

Approved Document F – Ventilation

Volume 2: buildings other than dwellings

Consultation version – January 2021

This draft guidance accompanies the January 2021 consultation on the Future Buildings Standard: Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for non-domestic buildings and dwellings; and overheating in new residential buildings. The government is seeking views on the standards for work to buildings other than dwellings, and the structure of the draft guidance.

Background

How is construction regulated in England?

The Manual to the Building Regulations gives an overview of the building regulatory system in England. You can access the most recent version of the manual [here](#).



Manual to the Building Regulations

A code of practice for use in England



How do you comply with the Building Regulations?

The Building Regulations are made under powers provided in the Building Act 1984. This applies in England and Wales. The majority of building projects are required to comply with them. They exist to ensure the health and safety of people in and around all types of buildings (i.e. domestic, commercial and industrial). They also provide for energy conservation, and access to and use of buildings.

The following is a high-level summary of the Building Regulations relevant to most types of building work. Where there is any doubt you should consult the full text of the regulations, available at www.legislation.gov.uk.

Building work

Building work is a legal term used to define the scope of the Building Regulations. For further information, see Volume 1 and paragraph A14 in Volume 2 of the **Manual to the Building Regulations**.

Material change of use

Building Regulations often apply when you change the use of a building, when it is a material change of use. This is discussed in paragraphs A14, A20 and Table A2 in Volume 2 of the **Manual to the Building Regulations**.

Materials and workmanship

Regulation 7 of the Building Regulations place requirements on materials and workmanship. Chapter 7 in Volume 1 and paragraphs F8 – F11 in Volume 2 of the **Manual to the Building Regulations** provides a summary of how to meet the regulations.

Independent third-party certification and accreditation

For information about Competent Persons Schemes, see Chapter 5 in Volume 1 and Chapter C in Volume 2 of the **Manual to the Building Regulations**.

Energy efficiency requirements

More information on energy efficiency requirements of the Building Regulations is given in paragraphs A12, A14 (f), A14 (g), A14 (h) A22, A23, B2 and F24 in Volume 2 of the **Manual to the Building Regulations**.

Notification of work

It is commonly necessary to notify a building control service of the work that you are to undertake. For further information on when to notify a building control service, see Chapter B in Volume 2 of the **Manual to the Building Regulations**.

Responsibility for compliance

Those responsible for carrying out building work (for example agents, designers, builders, installers and the building owner), must ensure that the work complies with all of the relevant requirements of the Building Regulations. For further information on this topic, see Chapter 7 in Volume 1 and paragraphs A26, B2 and F2 Volume 2 of the **Manual to the Building Regulations**.

How to use an approved document

The approved documents provide guidance to help you satisfy the Building Regulations in many common situations. Following the guidance in the approved documents does not guarantee compliance. It is important to understand, when carrying out building work, the need to meet all of the relevant requirements of the Building Regulations. For further information see Chapter 1 and Chapter 7 in Volume 1 and Chapter F in Volume 2 of the Manual to the Building Regulations.

In this consultation version of the Approved Document, technical differences to the Approved Document 2010 edition incorporating 2010 and 2013 amendments are generally **highlighted in yellow**, although editorial changes have been made to the whole document which may have changed the meaning of some guidance.

This text is subject to change before it becomes statutory guidance in 2021.

User requirements

The approved documents provide technical guidance. Users of the approved documents should have adequate knowledge and skills to understand and apply the guidance correctly to the

Consultation version: not statutory guidance

building work being undertaken. Users should also understand that following the approved documents does not guarantee compliance with the Building Regulations.

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Section 0: Introduction

Summary

- 0.1** This approved document is **Approved Document F, volume 2: Buildings other than dwellings**. It gives guidance on how to comply with Part F of Schedule 1 of the Building Regulations. For guidance on **dwellings**, use **Approved Document F, volume 1: Dwellings**.
- 0.2** This approved document contains the following sections:

Approved Document Section	Related Building Regulations requirements
Section 0: Introduction	N/A
Section 1: Ventilation provision	Requirement F1(1)
Section 2: Minimising the ingress of external pollutants	
Section 3: Work on existing buildings	
Section 4: Commissioning and providing Information	Requirement F1(2) and Regulations 39 and 44
Appendix A: Key terms	N/A
Appendix B: Performance-based ventilation	N/A
Appendix C: Standards referred to	N/A
Appendix D: Documents referred to	N/A

Application

- 0.3** The guidance in this volume of **Approved Document F** applies only to building other than **dwellings**. In a mixed-use building, this document should be consulted for building work in those parts of the building that are not **dwellings**.

NOTE: **Dwellings** are self-contained units. **Rooms for residential purposes** are not **dwellings**, and so this document applies to them. Buildings that contain only **rooms for residential purposes** are not **dwellings**, and this document applies to them.

Exemptions

- 0.4** The following classes of buildings are exempt from the Part F requirements.
- a. Special buildings – any of the following:
 - i. buildings controlled under the Explosives Regulations 2014.

- ii. buildings controlled under the Nuclear Installations Act 1965.
 - iii. buildings included in the schedule of monuments maintained under section 1 of the Ancient Monuments and Archaeological Areas Act 1979.
- b. Unoccupied buildings – provided that the buildings are a specified distance from buildings into which people normally go, as defined in the Building Regulations 2010 Schedule II, either of the following:
- i. detached buildings into which people do not normally go
 - ii. detached buildings into which people go only occasionally to inspect or maintain a fixed plant,
- c. Greenhouses - provided that the main purpose of the building is not retailing, packing or exhibiting.
- d. Agricultural buildings (as defined in the Building Regulations 2010 Schedule II). Agricultural buildings used mainly for retailing, packing or exhibiting are not exempt.
- e. Temporary buildings – buildings that are not intended to remain for more than 28 days
- f. Ancillary buildings – any of the following:
- i. buildings used for the disposal of buildings or building plots on site
 - ii. buildings on the site of construction or civil engineering works that both:
 - a. are for use only during the course of those works
 - b. contain no sleeping accommodation
 - iii. buildings on the site of mines and quarries that both:
 - a. do not contain dwellings
 - b. are not used as offices or showrooms.
- g. Small buildings – detached single-storey buildings with a maximum floor area of 30 m² that contain no sleeping accommodation, and that are either:
- i. constructed substantially of non-combustible material
 - ii. at least 1 metre from the boundary of their curtilage
- h. Very small buildings – detached buildings with a maximum floor area of 15 m² floor area that contain no sleeping accommodation
- i. Bomb shelters – detached buildings with a maximum floor area of 30 m² that are designed and intended to be used as shelters from nuclear, chemical or conventional weapons, and for no other purpose, provided the site of the excavation for the building is a minimum of 1 metre plus the depth of excavation from any other exposed structure.
- j. Conservatories and porches – extensions of buildings at ground level, with a maximum floor area of 30 m², for a:
- i. conservatory
 - ii. porch
 - iii. covered yard
 - iv. covered way
 - v. carport open on at least two sides.

Reasonable provision for historic and traditional buildings

- 0.5** The following types of buildings may not need to comply fully with the **ventilation** standards in this approved document.
- Those listed in accordance with section 1 of the Planning (Listed Buildings and Conservation Areas) Act 1990.
 - Those in a conservation area designated in accordance with section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990.
 - Other historic buildings that have a vapour permeable construction that both absorb and readily allows moisture to evaporate. These include: wattle and daub, cob, stone and constructions using lime render or mortar.
- 0.6** Work to a building in paragraph 0.5 should comply with the **ventilation** standards in this approved document to the extent that it is reasonably practicable. The work being done should not:
- unacceptably affect the significance of the listed building, conservation area or scheduled monument;
 - increase the risk of long-term deterioration of the building fabric or fittings.
- 0.7** New extensions to historic or traditional **buildings** should comply fully with the standards of **ventilation** in this approved document unless there is a need to match the external appearance or character of the extension to that of the host building.
- 0.8** The local authority's conservation officer should be consulted when doing work to a building in paragraph 0.5a or b.

Emergency repairs

- 0.9** For emergency repairs, if it is not practicable to notify the **building control body** in advance, the **building control body** should be notified at the earliest opportunity. If the installer is registered in a competent person scheme, see **Notification of Work** in this document.

Minor works

- 0.10** Minor works must comply with the relevant requirements of the Building Regulations, but do not need to be notified to the **building control body**.

For mechanical **ventilation** and air-conditioning systems, minor works include:

- replacing parts
- adding an output or control device where testing and adjusting the system would not affect its energy efficiency or would not be possible
- providing a self-contained mechanical ventilation or air-conditioning appliance given all of the following apply.
 - Any electrical work is exempt from a requirement to give advance notice to a **building control body**.
 - Testing and adjusting the system would not affect its energy efficiency or would not be possible.

- iii. The appliance is not installed in a room that contains an open-flued combustion appliance.

Live-work units

- 0.11** A unit that contains both living accommodation and space to be used for commercial purposes (e.g. as a workshop or office) should be treated as a **dwelling**, as long as the commercial part can revert to domestic use.
- 0.12** The commercial part of the building can revert to domestic use if all of the following apply.
- a. There is direct access between the commercial space and the living accommodation.
 - b. The commercial space and living accommodation are within the same **thermal envelope**.
 - c. The living accommodation occupies a substantial proportion of the total area of the unit. What constitutes a 'substantial proportion' should be assessed on a case-by-case basis.

NOTE: A large non-domestic building that contains a small flat for a manager is not treated as a **dwelling**. A **dwelling** that contains a room used as an office or utility space is still treated as a **dwelling**.

Mixed use developments

- 0.13** When constructing a **dwelling** as part of a larger building that contains other types of accommodation, often called a mixed-use development, refer to the two volumes of **Approved Document F** as follows.
- a. For guidance on each individual **dwelling**, follow **Approved Document F, volume 1: Dwellings**.
 - b. For guidance on the non-**dwelling** parts of the building, such a common area and the commercial or retail space, follow this Approved Document.

Selected key interactions with other parts of the Building Regulations

The approved documents set out what, in ordinary circumstances, may be accepted as one way to comply with the Building Regulations. It remains the responsibility of those designing or undertaking building work to assess, on a case-by-case basis, whether specific circumstances require additional or alternative measures to achieve compliance with the regulatory requirements. There are interactions between many of the requirements of the Building Regulations, here is guidance on some key interactions.

Interaction with Part B

- 0.14** The requirements of Part B apply if ducts pass through any of the following:
- a fire-resisting wall or floor
 - a fire compartment
 - a protected stairway.
- 0.15** This document gives guidance on window openings for **ventilation**. In addition, **Approved Document B** gives guidance on the size of escape windows. The larger of the window openings in **Approved Document B** or **F** should be applied in all cases.

Interaction with Part J

- 0.16** **Ventilation** fans might cause combustion gases to spill from open-flued appliances – combustion gases might fill the room instead of going up the flue or chimney. This can occur even if the combustion appliance and fan are in different rooms.
- 0.17** The guidance in **Approved Document J** should be followed when installing and testing **ventilation** appliances and combustion appliances must operate safely whether or not fans are running.

Interaction with Part L

- 0.18** Energy efficiency should be considered when specifying **ventilation** systems. Energy efficiency, including the control of **infiltration**, is dealt with under Part L of the Building Regulations.

Interaction with Parts K and M

- 0.19** Where **manual controls** are provided for a ventilation device, they should be within reasonable reach of the occupants, to comply with **Approved Documents K and M**.

Interaction with Part [X]

- 0.20** This document sets guidance for **purge ventilation** for the purposes of rapidly diluting indoor air pollutants and water vapour where necessary in habitable rooms in buildings other than **dwellings**. For domestic-type buildings, **[the regulation for overheating]** may require a higher standard than given in this document for **purge ventilation** to remove excess heat. In this case, the higher of the two standards should be followed.

Requirement F1(1): Means of ventilation

This Approved Document deals with the Requirements of Part F1(1) of Schedule 1 of the Building Regulations 2010.

Requirement [regulations will be amended as necessary in line with the intention sections below]	
Requirement	Limits on application
Means of ventilation F1(1). There shall be adequate means of ventilation provided for people in the building.	Requirement F1 does not apply to a building or space within a building: <ol style="list-style-type: none"> a. into which people do not normally go; or b. which is used solely for storage; or c. which is a garage used solely in connection with a single dwelling.

Intention

In the Secretary of State's view, requirement F1(1) is met if the building other than a dwelling is provided with a means of ventilation which achieves all of the following.

- a. extracts water vapour and indoor air pollutants from areas where they are produced in significant quantities before they spread through the building – by following guidance for extract ventilation in **Section 1** for the relevant building type.
- b. supplies a minimum level of outdoor air for occupant's health – by following guidance for whole building ventilation in **Section 1** for the relevant building type.
- c. rapidly dilutes indoor air pollutants and water vapour when necessary in occupiable rooms and sanitary accommodation – by following guidance for purge ventilation in **Section 1** for the relevant building type.
- d. For offices, monitors the indoor air quality – paragraph 1.39 – 1.41.
- e. Minimises the ingress of external pollutants – by following guidance in **Section 2**.
- f. provides all of the following as far as reasonably practicable:
 - i. low levels of noise, by following guidance in paragraphs 1.5 to 1.8;
 - ii. is easy to maintain, by following guidance in paragraph 1.9;
 - iii. protection from rain;
 - iv. protection from cold draughts;
 - v. does not significantly risk occupants' health.

In the Secretary of State's view, requirement F1(1) is met for work on an existing building other than a dwelling by following guidance in **Section 3**.

Section 1: Ventilation provision

General

1.1 The aim of Requirement F1(1) is to protect the health of occupants of the building by providing adequate **ventilation**. Without adequate **ventilation**, mould and internal air pollution may become hazardous to health.

NOTE: The guidance in this approved document is not designed to deal with the products of tobacco smoking or vaping.

1.2 This approved document sets out guidance for **ventilation** provision in the following types and uses of buildings and **occupiable rooms**:

- a. Specific types of **occupiable rooms** – follow paragraphs 1.27 to 1.28.
- b. Offices – follow paragraphs 1.29 to 1.46.
- c. Car parks – follow paragraphs 1.47-1.49.
- d. Building types other than offices or car parks– follow paragraph 1.50.

1.3 Other **ventilation** solutions may be used, provided it can be demonstrated to the **building control body** that they meet Requirement F1(1). For example, by showing the **building control body** that the **ventilation** solution meets the moisture and indoor air quality criteria in **Appendix B**.

1.4 The guidance set out in this approved document has been designed to meet the pollutant levels in **Appendix B** where the outside air is of reasonable quality. In areas where the outside air is not of reasonable quality, **Section 2** provides guidance on limiting the ingress of external air pollutants.

Noise

1.5 Mechanical **ventilation** systems, including both **continuous** and **intermittent mechanical ventilation** should be designed and installed to minimise noise. This includes all of the following:

- a. Sizing and jointing ducts adequately.
- b. Ensuring that equipment is appropriately and securely fixed, such as with resilient mountings, where structure-borne noise could be a problem.
- c. Selecting appropriate equipment, including following paragraph 1.6.

1.6 For mechanical **ventilation** systems, fan units should be appropriately sized so that fans operating in normal background **ventilation** mode are not unduly noisy. This might require fans to be sized so that they do not operate near the maximum capacity of the fan when operating in normal background **ventilation** mode.

1.7 Account should be taken of outside noise when considering the suitability of opening

windows for purge ventilation.

- 1.8** For buildings other than dwellings, acceptable levels of noise will depend on the type of building and the activities in each space. Acceptable noise levels may be determined by consulting with relevant industry standards or by seeking expert advice from a professional noise consultant. Noise testing is not required to demonstrate compliance with the functional requirements.

Access for maintenance

- 1.9** Reasonable access should be provided for maintaining ventilation systems, including all the following:
- Providing access to replace filters, fans and coils.
 - Providing access points for cleaning duct work.
 - Providing access for the general maintenance of plant.

The ventilation strategy in this approved document

- 1.10** The ventilation strategy in this approved document relies on a combination of all of the following:
- Extract ventilation** from rooms where water vapour or pollutants are likely to be released, e.g. bathrooms and kitchens, to minimise their spread to the rest of the building. Ventilation fans may be either intermittent or continuous.
 - Whole building ventilation** to provide fresh air to the building and to dilute, disperse and remove water vapour and pollutants not removed by extract ventilation.
 - Purge ventilation** to remove high concentrations of pollutants and water vapour. Purge ventilation is intermittent and required only for pollutants produced by occasional activities (e.g. fumes from painting).
- 1.11** Ventilation may be delivered through natural ventilation, mechanical ventilation or both.
- 1.12** Naturally ventilated buildings should follow additional guidance on ventilation in CIBSE's AM10:2005. Mixed mode buildings should follow additional guidance on ventilation in CIBSE's AM13:2000.
- 1.13** The ventilation systems in this approved document are examples of systems that comply with Part F of the Building Regulations. Other ventilation systems may be acceptable if they can be shown to meet an equivalent level of performance.

Performance-based guidance

- 1.14** Performance criteria for acceptable levels of moisture and pollutants are given in **Appendix B**. Air flow rates necessary to meet the performance criteria are given in this guidance or in the documents referred to.
- 1.15** Some ventilation systems can, in some circumstances, result in lower ventilation rates than stated in this guidance or in the documents referred to. For example, systems with

automatic controls. Where lower ventilation rates are proposed, it should be demonstrated by seeking expert advice that the solution meets the performance standards in Appendix B. Where this is demonstrated, the design may be considered to meet the functional requirement.

Equivalent area of ventilators

- 1.16** The size of background ventilators (including trickle ventilators) is given in this Approved Document as an equivalent area in mm², not a free area. BS EN 13141-1 includes a method of measuring the equivalent area of background ventilator openings.
- 1.17** Background ventilators should have the equivalent area marked where it will be easily visible from inside the dwelling when installed, to aid verification by building control bodies.

Installation of ventilation systems

- 1.18** Ventilation systems should be installed both:
- to comply with the guidance in paragraphs 1.19 to 1.26;
 - in a way that does not compromise the performance of the system in-use.
- 1.19** Rigid ducts should be used wherever possible. Where necessary, flexible ducts may be used for final connections, but their lengths should be kept under a maximum as given in paragraph 1.20. All flexible ductwork should meet the standards of BSRIA's BG 43/2013.
- 1.20** The maximum lengths of flexible duct should meet the following.
- Flexible duct connected to axial fans: maximum 1.5 metres.
 - Flexible duct connected to centrifugal fans:
 - for extract rates 6 to 30 litres per second: maximum 6 metres
 - for extract rates 31 to 60 litres per second: maximum 3 metres.
- 1.21** Any flexible ducts should be installed so that the full internal diameter is obtained, and flow resistance is minimised. This includes both:
- pulling the duct taut
 - ensuring that ductwork does not pass through orifices with a smaller diameter than the duct itself.
- 1.22** Ductwork installations should be designed and installed to minimize the overall pressure losses within the system through all the following.
- Minimising the overall length of duct.
 - Minimising the number of bends required.
 - Installing appropriately sized ducts for the air flow rate.
- 1.23** Each air terminal should have a free area of at least 90% of the free area of its associated duct.
- 1.24** Duct connections should be both mechanically secured and adequately sealed to prevent uncontrolled losses. For flexible ducting, rigid connectors and jubilee clips should be used

to ensure a good seal.

1.25 A visual inspection should be made by the installer to confirm that both:

- a. there are no obvious defects
- b. all packaging has been removed.

1.26 Mechanical ventilation systems must be commissioned in accordance with an approved procedure. See **Section 4** of this approved document.

Requirements for specific types of occupiable rooms

1.27 Ventilation systems in non-domestic environments may be required to disperse airborne contaminants, for example infectious agents being transmitted as aerosols. Ventilation systems, including natural ventilation, should be designed to provide a minimum of 15 litres per second per person of outdoor air in the following types of occupiable rooms.

- a. Rooms where singing, loud speech or aerobic exercise or other aerosol generating activities are likely to take place. These may include rooms, for example, in gymnasiums, indoor sports venues, dance studios, theatres, concert halls, public houses, nightclubs, assembly halls, as well as in other types of building.
- b. Rooms where members of the public are likely to gather in large numbers. These may include rooms, for example, in public buildings, hotels, shopping malls, gymnasiums, indoor sports venues, dance studios, theatres, concert halls, public houses, nightclubs or assembly halls as well as in other types of building.
- c. Rooms which are maintained at both low temperatures and low levels of humidity. These may include rooms used for chilled food processing and occupied cold stores.

1.28 Buildings containing rooms outlined in paragraph 1.27 should also meet the ventilation guidance relevant to the building type set out in paragraphs 1.29 to 1.50. If the ventilation guidance set out in 1.29 to 1.50 requires outdoor air rates greater than 15 litres per second per person in these rooms, the higher rate should be provided as a minimum.

Ventilation for Offices

Extract ventilation for offices

1.29 Extract ventilation should be provided in offices in all the following areas.

- a. Sanitary accommodation.
- b. Washrooms.
- c. Food and beverage preparation areas.
- d. Rooms that are designed to contain printers and photocopiers in substantial use (greater than 30 minutes per hour).

NOTE: Rooms that are designed to contain printers and photocopiers in substantial use (greater than 30 minutes per hour), should not be designed to be occupied.

1.30 For rooms designed to contain printers and photocopiers in substantial use (greater than 30 minutes per hour), both of the following should apply.

- a. The air extract rate should be 20 litres per second per machine during use.
- b. The whole building ventilation rate should also be met.

1.31 Sanitary accommodation should have an intermittent air extract rate of both of the following.

- a. 15 litres per second per shower or bath.
- b. 6 litres per second per WC pan or urinal.

Extract ventilators in sanitary accommodation should be capable of operating in a continuous mode if required.

1.32 Food and drink preparation areas should have an intermittent extract rate of either of the following.

- a. If the area is *only* for using a microwave and preparing drinks: 15 litres per second.
- b. If the area is for using a domestic-type hob or cooker, either:
 - i. if the extract ventilator is adjacent to the hob/cooker: 30 litres per second
 - ii. if the extract ventilator is remote from the hob/cooker: 60 litres per second.

NOTE: This guidance does not apply to commercial kitchens, which should follow the specific guidance in **Table 1.1**.

1.33 Specialist buildings and spaces such as sports centres should follow the guidance in **Table 1.1**.

1.34 For naturally ventilated offices which do not use mechanical ventilation, both of the following should apply.

- a. Extract ventilators should be located both:
 - i. as high as practicable;
 - ii. a maximum of 400 mm below the ceiling.
- b. Where used, passive stack ventilation terminals should be located in the ceiling.

Whole building ventilation rates for offices

1.35 Outdoor air should be supplied for **occupiable rooms** in offices at whichever will provide a higher total rate between:

- a. 10 litres per second per person
- b. 1 litre per second per m² floor area.

1.36 **Common spaces**, including rooms or spaces used solely or mainly for circulation such as corridors and lift lobbies, should be provided with either:

- a. natural ventilation by appropriately located ventilation opening(s) with a total opening area of at least 1/50th of the floor area of the **common space**;
- b. mechanical ventilation installed to provide a supply of outdoor air of 1 litre per second per m² of floor area.

1.37 If there are significant levels of pollutants other than body effluents/ odour, additional ventilation may be required. The calculation method provided in CIBSE's *Design Guide A* should be followed to determine the whole building ventilation rate.

1.38 Each office should have the means to increase the general ventilation rate of each **occupiable room** by 50% so that it can operate for long periods (e.g. months) at a higher ventilation rate. This may be beneficial to reduce the spread of airborne infection in offices in a period when airborne illness is prevalent.

Indoor air quality monitoring for offices

1.39 Each **occupiable room** should have a means of monitoring the performance of the ventilation system. This may be achieved through using CO₂ monitors or other means of measuring indoor air quality. This does not apply to either:

- a. rooms designed for fewer than 15 people
- b. large volume spaces, such as atria.

1.40 Where CO₂ monitors are used, they should meet all of the following:

- a. be mains operated
- b. include a visual indicator of CO₂ concentration
- c. be capable of logging data at no more than 15-minute intervals, and to store data for at least the previous 24-hour period
- d. any audible alarms should be able to be permanently deactivated
- e. be capable of recording and displaying readings in the range of at least 0 – 5000 parts per million.

1.41 Where CO₂ monitors are used, they should be located:

- a. at least 300mm away from any wall if ceiling mounted
- b. at least 150mm away from the ceiling if wall mounted
- c. away from obstructions such as furniture or fittings
- d. at least 500mm away from individual workstations, doors, windows or air vents.

Purge ventilation for offices

1.42 Each office should have the means to provide purge ventilation, to reduce pollutants before the office space is occupied, or after activities such as painting.

The purged air should both:

- a. be taken directly to outside
- b. *not* be re-circulated to any other part of the building.

1.43 Purge ventilation should be designed to provide at least 4 air changes per hour.

Controls for offices

1.44 Controls should be provided for ventilators so that the ventilation in each room can be adjusted. For mechanical ventilation either manual or automatic controls are acceptable.

1.45 For a room with no openable window, the extract ventilation should operate both:

- a. while the room is occupied
- b. for a minimum of 15 minutes after occupants have left the room.

Recirculation of air within ventilation systems in offices

1.46 Office buildings should have the ability to provide adequate outdoor air to all occupied spaces without recirculating air within spaces or between different spaces, rooms or zones, unless the ventilation system has an ultraviolet filter, HEPA filter or other germicidal filter.

NOTE: For some system types some recirculation is necessary or desirable in normal operation. Such systems should comply with paragraph 1.46 by either meeting the standards for filtration or by having the ability to switch to a full fresh air mode.

Ventilation of car parks

1.47 For car parks below ground level, enclosed car parks and multi-storey car parks, the ventilation rate should be designed, and equipment installed, to limit the carbon monoxide to both of the following.

- a. Average concentration: a maximum of 30 parts per million over an eight-hour period.
- b. Peak concentration, such as by ramps and exits: a maximum of 90 parts per million over a 15-minute period.

NOTE: Guidance on the ventilation of car parks to manage the risk of fire is given in **Approved Document B**.

1.48 As an alternative to paragraph 1.47 either of the following may be applied.

- a. If the car park is naturally ventilated, openings at each car parking level should comply with both of the following:
 - i. Have a minimum aggregate equivalent area of 1/20th of the floor area at that level.
 - ii. Have a minimum of 25% of the total equivalent area on each of two opposing walls.

- b. If a car park is mechanically ventilated, either of the following should apply.
 - i. Both:
 - a. permanent natural ventilation openings should have a minimum equivalent area of 1/40th of the floor area.
 - b. The provision of mechanical ventilation system should be capable of at least three air changes per hour (ach).
 - ii. For a car park not in a basement, the provision of a mechanical ventilation system should be capable of at least six air changes per hour (ach).

Provisions should be made for exits and ramps where cars queue inside the building with engines running to ensure a local ventilation rate of at least 10 air changes per hour (ach).

1.49 Further guidance can be found in all of the following.

- a. The Association of Petroleum and Explosives Administrations' *Code of practice for ground floor, multi-storey and underground car parks*.
- b. CIBSE's *Design Guide B*.
- c. Health and Safety Publication's *EH40, Occupational exposure limits for limiting concentration of exhaust pollutants*.
- d. ASHRAE's *ASHRAE Handbook—HVAC Applications, chapter 15 'Enclosed Vehicular Facilities'*.

Ventilation for buildings other than offices and car parks

1.50 Adequate means of ventilation in buildings other than offices and car parks may be demonstrated by meeting the relevant standards set out in Table 1.1.

NOTE: The guidance on installation of ventilation systems (paragraphs 1.18 to 1.26) and guidance for specific types of occupiable rooms (paragraphs 1.27 to 1.29) should also be met in buildings other than offices and car parks.

NOTE: For residential non-domestic buildings in scope of [the regulation for overheating (1)]. In order to demonstrate compliance with [the regulation for overheating (1)] it is likely that purge ventilation rates higher than those indicated in the guidance in table 1.1 will be required.

Table 1.1 Ventilation for buildings other than offices

[Note for consultation: we are seeking alternative or additional references where these are currently used as standard practice]

Building / space / activity	Regulations and guidance (also see Appendices C and D)
Animal rooms	CIBSE Guide B:2016 Code of practice for the housing and care of animals used in scientific procedures (HMG,

Table 1.1 Ventilation for buildings other than offices

[Note for consultation: we are seeking alternative or additional references where these are currently used as standard practice]

Building / space / activity	Regulations and guidance (also see Appendices C and D)
	2014)
Building services plantrooms	<p>Provision for emergency ventilation to control dispersal of contaminating gas releases (e.g. refrigerant leak) is given in paragraphs 23 to 25 of HSE Guidance Note 202 <i>General Ventilation in the Workplace – Guidance for Employers</i>.</p> <p>BS 4434:1989 <i>Specification for safety aspects in the design, construction and installation of refrigeration appliances and systems</i></p> <p>Follow manufacturer’s guidance for adequate provision of air for service equipment.</p>
Catering and commercial kitchens	<p>HSE Catering Information Sheet No. 10, 2017: <i>Ventilation in catering kitchens</i></p> <p>HSE Information Sheet No. 11, 2000: <i>The main health and safety law applicable to catering</i></p> <p>BESA DW /172 (2018) <i>Specification for kitchen ventilation systems</i></p> <p>CIBSE Guide B:2016</p>
Cleanrooms	CIBSE Guide B:2016
Common spaces	<p>Either:</p> <p>a. natural ventilation by appropriately located ventilation opening(s) with a total opening area of at least 1/50th of the floor area of the common space</p> <p>b. mechanical ventilation installed to provide a supply of fresh air of 1 litre per second per m² of floor area</p>
Data centres	CIBSE Guide B:2016
Dealing rooms	CIBSE Guide B:2016
Factories and workshops	<p>Factories Act 1961</p> <p>Health and Safety at Work etc. Act 1974</p> <p>CIBSE Guide B:2016</p> <p>Note: Requirements are often exceeded by other criteria such as the ventilation requirements of the particular manufacturing process</p>

Table 1.1 Ventilation for buildings other than offices

[Note for consultation: we are seeking alternative or additional references where these are currently used as standard practice]

Building / space / activity	Regulations and guidance (also see Appendices C and D)
Farms	<p>The Welfare of Farmed Animals (England) Regulations SI 2007 No. 2078</p> <p>BS 5502:2003+A1:2013 <i>Buildings and Structures for Agriculture</i></p> <p>CIBSE AM10:2005 if naturally ventilated</p> <p>CIBSE AM13:2000 if mixed mode</p>
Healthcare buildings: non-surgical	<p>CIBSE Guide B:2016</p> <p>NHS Activity database</p> <p>Health Technical Memorandum (HTM) 03-01</p> <p>Health Building Notes (HBN) – various</p>
Hospitals	<p>CIBSE Guide B:2016</p> <p>NHS Activity database</p> <p>Health Technical Memorandum (HTM) 03-01</p> <p>Health Building Notes (HBN) – various</p>
Hotels	<p>CIBSE Guide B:2016</p>
Industrial ventilation	<p><i>Industrial ventilation</i>, 28th Edition, <i>Manual of recommended practice</i>, American Conference of Government Industrial Hygienists (2007)</p> <p>HSG258 Controlling airborne contaminants at work (third edition), HSE, 2017</p> <p>HS(G) 193 <i>COSHH essentials</i>, HSE, 2003</p>
Museums, libraries and art galleries	<p>PD 5454:2012 Guide for the storage and exhibition of archival materials</p>
Places of assembly	<p>CIBSE Guide B:2016</p>
Prison cells	<p>Certified Prisoner Accommodation PSI 17/2012</p>
Sanitary accommodation	<p>Same as for offices in paragraph 1.31: Sanitary accommodation should have an intermittent air extract rate of both of the following.</p> <p>a. 15 litres per second per shower or bath.</p>

Table 1.1 Ventilation for buildings other than offices

[Note for consultation: we are seeking alternative or additional references where these are currently used as standard practice]

Building / space / activity	Regulations and guidance (also see Appendices C and D)
	<p>b. 6 litres per second per WC pan or urinal.</p> <p>Extract ventilators in sanitary accommodation should be capable of operating in a continuous mode if required.</p>
Schools and education	<p>Ventilation provisions in schools should meet the guidance in Building Bulletin 101, <i>Ventilation of School Buildings</i> and in the Education (School Premises) Regulations.</p> <p>Building Bulletin 101 can also be used as a guide to the ventilation required in other educational buildings, such as further education establishments, where the accommodation is similar to that in schools, e.g. sixth form accommodation. However, the standards may not be appropriate for particular areas where more hazardous activities take place than are normally found in schools, e.g. some practical and vocational activities that require containment or fume extraction.</p> <p>Building Bulletin 101 can also be used for children’s centres and other early years settings, including day nurseries, playgroups, etc.</p>
Shops and general retail premises	CIBSE Guide B:2016
Supermarkets and food stores	CIBSE Guide B:2016
Sports centres and swimming pools	<p>CIBSE Guide B:2016</p> <p>Sport England – Sports Halls Design and Layouts: Updated and combined guidance (2012)</p>
Transportation buildings and facilities	CIBSE Guide B:2016

Section 2: Minimising the ingress of external pollutants

2.1 Ventilation systems should be designed to minimise the intake of external air pollutants following paragraphs 2.2 to 2.9 if either of the following apply:

- a. The location of the building exceeds limit values in Table 2.1. This may have been determined through an air quality assessment.
- b. The building is located near to any of the following sources of significant local pollution:
 - i. Road traffic, including traffic junctions and underground car parks.
 - ii. Combustion plant (such as heating appliances) running on conventional fuels, most commonly natural gas.
 - iii. Other combustion processes (for example, waste incineration, thermal oxidation abatement systems).
 - iv. Discharges from industrial processes.
 - v. Fugitive (i.e. not effectively controlled) discharges from industrial processes and other sources.
 - vi. Exhaust discharges from building ventilation systems.
 - vii. Construction and demolition sites, which are a source of particles and vaporous discharges.

Table 2.1 Limit Values from Schedule 2 of the Air Quality Standards Regulations 2010

Pollutant	Exposure Limit	Exposure Time
Carbon Monoxide	10 mg/m ³	8 hour average
Sulphur Dioxide	350 µg/m ³	1 hour average
	125 µg/m ³	1 day average
Nitrogen Dioxide	200 µg/m ³	1 hour average
	40 µg/m ³	1 year average
Benzene	5 µg/m ³	1 year average
Lead	0.5 µg/m ³	1 year average
PM 2.5	25 µg/m ³	1 year average
PM 10	50 µg/m ³	1 day average

	40 µg/m ³	1 year average
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NOTE: This section only gives guidance for typical situations. **Expert advice** may be needed for situations outside of this scope.

Control of ventilation intakes

2.2 Ventilation intakes should be located away from the direct impact of the sources of local pollution.

NOTE: CIBSE's *TM 64* and *TM 40* give further guidance.

2.3 Where urban traffic is a source of pollution, the air intakes for buildings next to busy urban roads should be both:

- as high as possible
- located on the less polluted side of the building.

Mechanical ventilation may be the most practical means of achieving this requirement.

Where modelling or monitoring data is required to assess risks, **expert advice** should be sought.

2.4 If practicable, ventilation intakes should not be located in courtyards and enclosed urban spaces where air pollutants are discharged. If this is unavoidable, intakes should be both:

- as far as possible from the source of pollutants
- in an open or well-ventilated area.

2.5 In areas where wind often comes from opposing directions (e.g. a valley location), the air intakes and outlets should point in opposite directions.

2.6 Where sources of pollution fluctuate with the time of day, such as urban road traffic, it may be acceptable, for time limited periods to either:

- reduce the flow of external air into ventilation intakes
- close ventilation intakes when the concentrations of external pollutants are highest.

In these circumstances, **expert advice** should be sought.

Location of exhaust outlets

2.7 Exhaust outlets should be located so that both:

- Re-entry of exhaust into a building, or entry into other nearby buildings, is minimised;
- There is no adverse effect on the surrounding area.

2.8 Where there is a prevailing wind direction, exhaust outlets should be downwind of intakes.

2.9 Exhaust outlets should not discharge into any of the following:

- courtyards
- enclosures
- architectural screens.

Consultation version: not statutory guidance

NOTE: Chapter 13 of the *McGraw Hill Indoor Air Quality Handbook* provides further guidance.

Section 3: Work on existing buildings

General

- 3.1** This approved document sets out guidance for ventilation provision in existing buildings where the Building Regulations applies.
- 3.2** Other **ventilation** solutions may be used, provided it can be demonstrated to the **building control body** that they meet Requirement F1(1), that there shall be adequate means of ventilation provided in the building. For example, by showing the **building control body** that the **ventilation** solution meets the moisture and indoor air quality criteria in **Appendix B**.
- 3.3** When building work is carried out on an existing building, both of the following should apply:
- The work should comply with the applicable requirements of the Building Regulations.
 - The rest of the building, including the provision of **ventilation**, should not be made less satisfactory than before the work was carried out.

NOTE: Ventilation through infiltration should be considered to be part of the ventilation provision of a building where it is providing advantageous ventilation. Reducing infiltration might reduce the indoor air quality of the building below the standards given in **Appendix B**.

- 3.4** When a building undergoes a **material change of use**, Part F of Schedule 1 of the Buildings Regulations applies to the building or part of the building that has been subject to the change of use. Guidance in **Section 1** should be followed.

NOTE: Ventilation equipment is considered to be a 'controlled service or fitting' and the provision or extension of such equipment in or in connection with a building is building work.

NOTE: Some building work does not need to be notified to the local authority. This is set out in Schedule 4 of the Building Regulations 2010.

- 3.5** If work is carried out which increases the energy efficiency of a building, it is likely that the airtightness will be increased and therefore the **ventilation** will need to be increased in order to maintain a healthy indoor environment. When carrying out work which is likely to increase the airtightness of the building, it should be demonstrated to the **building control body** that the work meets the requirements of Requirement F1(1), that there shall be adequate means of ventilation provided in the building. For domestic-type installation of common energy efficiency measures in existing buildings, **Approved Document F, Volume 1: Dwellings** contains guidance on meeting Part F of Schedule 1 of **the Building Regulations**.

Replacing windows

- 3.6** If the existing windows have **background ventilators**, the replacement windows should include **background ventilators**. The new **background ventilators** should both:

- a. *not* be smaller than the **background ventilators** in the original window
- b. be controllable either automatically or by the occupant.

If the size of the **background ventilators** in the existing window is not known, the ventilator sizes in paragraph 3.7 may be selected.

3.7 If the existing windows have no **background ventilators**, replacing windows is likely to increase the **airtightness** of the building. If ventilation is not provided via a **mechanical extract and supply ventilation** system, then increasing the airtightness of the building may reduce useful **ventilation** in the building. In these circumstances, it should be ensured that the **ventilation** provision in the building is no worse than it was before the work was carried out. This may be demonstrated in any of the following ways:

- a. Adopting the following **background ventilators** in the replacement windows equivalent to the following:
 - i. **occupiable rooms**:
 - a. for floor areas up to 10 m² – minimum 2500 mm² **equivalent area**
 - b. for floor areas greater than 10 m² – minimum 250 mm² **equivalent area** per m² of floor area
 - ii. **domestic-type kitchens** - minimum 8000 mm² **equivalent area**
 - iii. **bathrooms** and shower rooms - minimum 4000 mm² **equivalent area** per bath or shower
 - iv. **sanitary accommodation** (and/or washing facilities) – minimum 2000 mm² **equivalent area** per WC
- b. Other **ventilation** provisions provided they can be demonstrated to a **building control body** that they comply with the requirements of paragraph 3.3.

NOTE: If it is not technically feasible to adopt the minimum **equivalent areas** set out in paragraph 3.7, the **background ventilators** should adopt **equivalent areas** as close to the minimum value as is feasible.

Requirement F1(2) and Regulations 39 and 44

Requirement [regulations will be amended as necessary in line with the intention sections below]	
<i>Requirement</i>	<i>Limits on application</i>
<p>F1(2). Fixed systems for mechanical ventilation and any associated controls must be commissioned by testing and adjusting as necessary to secure that the objective referred to in sub-paragraph (1) is met.</p>	<p>Requirement F1 does not apply to a building or space within a building:</p> <ul style="list-style-type: none"> a. into which people do not normally go; or b. which is used solely for storage; or c. which is a garage used solely in connection with a single dwelling.
<p>Requirements in the Building Regulations 2010</p> <p>Information about ventilation</p> <p>39.—(1) This regulation applies where Part F1(1) of Schedule 1 imposes a requirement in relation to building work.</p> <p>(2) The person carrying out the work shall not later than five days after the work has been completed give sufficient information to the owner about the building’s ventilation system and its maintenance requirements so that the ventilation system can be operated in such a manner as to provide adequate means of ventilation.</p> <p>Commissioning</p> <p>44.—(1) This regulation applies to building work in relation to which paragraph F1(2) of Schedule 1 imposes a requirement, but does not apply to the provision or extension of any fixed system for mechanical ventilation or any associated controls where testing and adjustment is not possible.</p> <p>(2) This regulation applies to building work in relation to which paragraph L1(b) of Schedule 1 imposes a requirement, but does not apply to the provision or extension of any fixed building service where testing and adjustment is not possible or would not affect the energy efficiency of that fixed building service.</p> <p>(3) Where this regulation applies the person carrying out the work shall, for the purpose of complying with paragraph F1(2) or L1(b) of Schedule 1, give to the local authority a notice confirming that the fixed building services have been commissioned in accordance with a procedure approved by the Secretary of State.</p> <p>(4) The notice shall be given to the local authority –</p> <ul style="list-style-type: none"> (a) not later than the date on which the notice required by regulation 16(4) is required to be given; or (b) where the regulation does not apply, not more than 30 days after the completion of the work. 	

NOTE: Where the **building control body** is an approved inspector, see regulation 20 of the Building (Approved Inspectors etc.) Regulations 2010 (as amended).

Intention

In the Secretary of State's view, requirement F1(2) and regulation 44 are met if building work that involves installing a mechanical ventilation system follows paragraphs 4.1 to 4.3, to achieve all of the following.

- a. All fixed mechanical ventilation systems for which testing and adjustment is possible are tested and commissioned.
- b. Commissioning results show that systems are operating as required to achieve adequate ventilation, including achieving the flowrates specified in this approved document.
- c. Commissioning results show that controls are operating as required to achieve adequate ventilation.
- d. The person carrying out the work gives notice to the building control body and building owner that commissioning has been carried out in accordance with the procedure given in this document.

In the Secretary of State's view, when building work is carried out that affects ventilation, regulation 39 is met if the installer provides clear and simple written guidance for the building owner on how to operate and maintain their ventilation system, as per paragraphs 4.4 to 4.9.

Section 4: Commissioning and providing information

Commissioning of ventilation systems

- 4.1 Mechanical **ventilation** systems must be commissioned to provide adequate **ventilation**. A commissioning notice must be given to the **building control body**.
- 4.2 Commissioning should be carried out in accordance with **CIBSE's Commissioning Code M**.
- 4.3 **Ventilation** ductwork commissioning should take account of guidance in BESA's *DW/144* for metal ductwork, *DW/154* for plastic ductwork and *DW/143* for ductwork leakage testing.

NOTE: When mechanical **ventilation** is commissioned, the use of fuel and power should also be considered in accordance with Part L of the Building Regulations (L1(b) of Schedule 1). Installers may provide notice of commissioning to cover Part F (F1(2) of Schedule 1) and Part L in the same document.

Providing information

- 4.4 Sufficient information about the **ventilation** system and its maintenance requirements must be given to the building owner so that the system can be operated effectively. This should include both design flow rates and maintenance requirements. **The information should be provided in a clear manner, for a non-technical audience.**
- 4.5 For new and existing buildings other than **dwelling**s, information should be provided in a new or existing building log book. The log book should follow the guidance in CIBSE's *TM31*. Guidance on building log books is given in **Approved Document L, volume 2: conservation of fuel and power in buildings other than dwellings**.
- 4.6 **A copy of the completed commissioning sheet should be provided to the owner of the building.**
- 4.7 **The operation and maintenance information should contain specific instructions for the end user on how and when to use the **ventilation** system, including information on the intended use of available fan settings. Information should also be provided to suggest when, and how, the system components should be cleaned and maintained.**
- 4.8 **The following information should be provided where relevant:**
 - a. **manufacturer's contact details**
 - b. **that **background ventilators** allow fresh air into the home and should be left open**
 - c. **location of and setting of **automatic controls** (e.g. humidity and timer controls)**
 - d. **location and use of on/off and high rate settings for mechanical **ventilation** system**
 - e. **how to adjust extract air terminals on vertical passive stack ducts**

- f. how cleaning and maintenance should be carried out, including replacing filters
- g. location of filters, if not installed within the fan unit. If no filters are installed on extract terminals, describe how to access ducts for cleaning, how to undertake cleaning and at what interval
- h. the location of sensors and how to recalibrate them
- i. design flow rates
- j. use of and interpretation of results from CO₂ or other air quality monitoring sensors.

4.9 The operation and maintenance information should also contain relevant manufacturers' literature, including, where relevant:

- a. components specification
- b. installation guidance
- c. operating instructions
- d. maintenance schedules
- e. guarantees
- f. registration card
- g. spare part lists
- h. means of obtaining spare parts.

Appendix A: Key Terms

The definitions below are for this document only, and are not intended to be applied in other circumstances. Fuller definitions of the various terms are given in the relevant British Standards listed in **Appendix C**.

Air permeability is the physical property used to measure the **airtightness** of the building fabric. It is defined as air leakage rate per hour per square metre of envelope area at a test reference pressure differential across the building envelope of 50 Pascals. The **design air permeability** is the target value set at the design stage.

Airtightness describes the resistance of the building envelope to **infiltration** with ventilators closed. The greater the **airtightness** at a given pressure difference across the envelope, the lower the **infiltration**.

Automatic control is where a **ventilation** device is adjusted by a mechanical or electronic controller that responds to a relevant stimulus. That stimulus usually relates to the humidity of the air in a room, pollutant levels, occupancy of the space or pressure difference across the device.

Background ventilator is a small **ventilation opening** designed to provide controllable **whole building ventilation**.

Bathroom is a room containing a bath or shower and, in addition, can also include **sanitary accommodation**.

Building Control Body is a local authority or an approved inspector.

Common space is a space where large numbers of people are expected to gather (e.g. a shopping mall or foyer of a cinema or theatre) or which is used mainly for circulation (e.g. a corridor or lift lobby in an office building).

Continuous operation is when a mechanical **ventilation** device runs all the time, e.g. mechanical **extract ventilation** (MEV) and **mechanical supply and extract ventilation**. The air flow rate provided by mechanical **ventilation** need not be constant but may be varied, under either **manual** or **automatic control**, in response to the demand for removal of pollutants or water vapour.

Controlled Service or fitting

Dwelling means self-contained unit, including a house or a flat, designed to be used separately to accommodate a single household.

Equivalent area is a measure of the aerodynamic performance of a ventilator. It is the area of a sharp-edged circular orifice through which air would pass at the same volume flow rate, under an identical applied pressure difference, as through the opening under consideration.

Expert advice is advice from a suitably qualified competent person. Examples from the ventilation industry include a chartered or professional engineer, a building services specialist, a specialist ventilation manufacturer or members of professional trade bodies.

Free area is the geometric open area of a ventilator.

Habitable room is a room used for dwelling purposes but which is not solely a kitchen, utility room, bathroom, cellar or sanitary accommodation.

Infiltration is the uncontrolled exchange of air between inside a building and outside, through cracks, porosity and other unintentional openings in a building, caused by pressure difference effects of the wind and/or stack effect.

Intermittent operation is when a mechanical ventilator does not run all the time, usually running only when there is a particular need to remove pollutants or water vapour (e.g. during cooking or bathing). Intermittent operation may be under either manual control or automatic control.

Manual control is where a ventilation device is opened and closed, or switched on and off, or its performance is adjusted by the occupants of a room or building (see automatic control).

Mechanical extract ventilation is mechanically driven ventilation that continuously extracts indoor air and discharges it to outside.

Mechanical supply and extract ventilation is any is mechanically driven ventilation that both continuously supplies outdoor air to the inside of the dwelling and continuously extracts indoor air and discharges it to outside. This includes decentralised supply and extract ventilation, and Mechanical ventilation with heat recovery (MVHR).

Mechanical ventilation with heat recovery (MVHR) is a mechanical supply and extract system that includes a heat recovery mechanism.

Natural ventilation is ventilation provided by thermal, wind or diffusion effects through doors, windows or other intentional openings without the use of mechanically driven equipment. For the purposes of this approved document, natural ventilation refers to a ventilation strategy using background ventilators and intermittent extract ventilation.

Occupiable room is a room in a building other than a dwelling that is occupied by people, such as an office, workroom, classroom or hotel bedroom. The following are not occupiable rooms: bathrooms, sanitary accommodation, utility rooms or rooms or spaces used solely or mainly for circulation, building services plant or storage purposes.

Passive stack ventilation (PSV) is a ventilation system using ducts from terminals in the ceiling of rooms to terminals on the roof that extract air to outside by a combination of the natural stack effect and the pressure effects of wind passing over the roof of the building.

Purge ventilation is manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute pollutants and/or water vapour. Purge ventilation may be provided by natural means (e.g. an openable window) or mechanical means (e.g. a fan).

Purpose-provided ventilation is that part of the ventilation of a building provided by ventilation devices designed into the building (e.g. background ventilators, PSV, extract fans,

mechanical **ventilation** or air-conditioning systems).

Sanitary accommodation is a space containing one or more water closets or urinals. **Sanitary accommodation** containing one or more cubicles counts as one space if there is free circulation of air throughout the space.

Stack effect is the pressure differential between inside and outside a building, caused by differences in the density of the air due to an indoor/outdoor temperature difference.

Surface water activity is a measure of the availability of water to micro-organisms. Surface water activity is determined from the ratio of the vapour pressure of the water in the substrate to the vapour pressure of pure water at the same temperature and pressure. This ratio, in steady-state conditions, is numerically equal to the equilibrium relative humidity of the air, except that the latter is commonly expressed as a percentage.

Thermal envelope is the combination of **thermal elements** of a building which enclose a particular conditioned indoor space or groups of indoor spaces.

Utility room is a room containing a sink or other feature or equipment that may reasonably be expected to produce significant quantities of water vapour.

Ventilation is the supply and removal of air (by natural and/or mechanical means) to and from a space or spaces in a building. It normally comprises a combination of **purpose-provided ventilation** and **infiltration**.

Ventilation opening is any means of **purpose-provided ventilation** (whether permanent or closable) that opens directly to external air, such as the openable parts of a window, a louvre or a **background ventilator**. It also includes any door that opens directly to external air.

Whole building ventilation (general ventilation) is nominally **continuous ventilation** of rooms or spaces at a relatively low rate to dilute and remove pollutants and water vapour not removed by **extract ventilation**, **purge ventilation** or **infiltration**, as well as to supply outdoor air into the building.

Appendix B: Performance-based ventilation

Introduction

- B.1** This Appendix sets out the levels of moisture and other pollutants that the provisions in this approved document are designed to control. The provisions are designed to control all of the following:
- Bio-effluents as described in paragraph B.2 (a)
 - Moisture levels as described in paragraph B.2 (b)
 - Indoor air pollutants as described in paragraph B.2 (d)

NOTE: the guidance in this approved document may not be adequate to address pollutants from flueless combustion space heaters. This approved document does not directly address contamination from outdoor sources.

NOTE: A strategy for achieving good indoor air quality includes reducing the release of water vapour and air pollutants. This approved document does not provide guidance on this strategy.

Performance criteria for buildings other than dwellings

- B.2** The main guidance within this document has focused on offices. For this, the main criteria have been:
- A supply rate, in the absence of tobacco smoking or other excessive pollutants, of 10 litres per second per person. This will also satisfy the requirement of 8 litres per second per person needed to control higher levels of bio-effluents.
 - There should be no visible mould on external walls, windows, rooflights and doors in a properly heated building with typical moisture generation.
 - Mould growth can occur whether the building is occupied or unoccupied, so the surface water activity (as set out in Table B.2) should be met at all times, regardless of occupancy. The other pollutants listed in Table B.1 are only of concern when the building is occupied.
 - The performance criteria for indoor air pollutants are given in Table B.1.

Table B.1 Indoor air pollutants guidance values¹

Pollutant	Exposure limit	Exposure time	Guidance
Carbon monoxide	100 mg/m ³	15 minute average	WHO, 2010

Consultation version: not statutory guidance

	30 mg/m ³	1 hour average	WHO, 2010
	35 mg/m ³ (occupational exposure)	8 hours average	HSE, 2003
Nitrogen dioxide (NO ₂)	200 µg/m ³	1 hour average	WHO, 2010
	40 µg/m ³ (21 ppb)	1 year average	WHO, 2010
Formaldehyde	100 µg/m ³	30 minute average	WHO, 2010
	10 µg/m ³	1 year average	PHE, 2019
TVOC ¹	300 µg/m ³	8 hour average	ECA, 1992 / WHO, 2010
Ozone	100 µg/m ³		Department of the Environment, 1994b

Notes:

1. Total volatile organic compound (TVOC) metric is representative of all airborne indoor air VOC concentrations and should not be used as a direct indicator of health. The simplified metric is used as an indicator for ventilation control strategies. As an alternative to the TVOC limit, individual VOC limits may be used where justified according to paragraph B.3.
2. The designer and builder may choose source control as the optimal strategy of reducing VOC levels in buildings. However, the ventilation requirements must still be met.

B.3 As an alternative to using TVOC, the individual VOCs may be used, where supported by robust independent evidence. Public Health England's *Indoor Air Quality Guidelines for selected Volatile Organic Compounds (VOCs) in the UK* should be used. Testing against these metrics is likely to be more complex than testing against TVOC.

[Note for consultation: The consultation is seeking views on what limits could be used as an alternative to TVOC, based on available evidence and publications]

Where the Health and Safety Executive gives guidance for specific situations, it should be followed in preference to the guidance given here.

Assumptions used in applying performance criteria for offices in Section 1

General

B.4 For the purposes of this approved document, the moisture criterion for offices will be met if the **surface water activity** in a room does not exceed the values given in Table B.2 during the heating season.

Table B.2 Surface water activity	
Moving average period	Surface water activity
1 month	75%
1 week	85%
1 day	95%

Extract ventilation

B.5 Office equipment can emit pollutants including ozone and organic compounds. For example, a study by Black and Wortham (1999)¹ suggests the following emission rates for laser printers and dry paper copiers assuming 30 minutes use in an hour:

- a. 25 mg/h for TVOCs
- b. 3 mg/h for ozone.

To meet the performance criteria for these pollutants requires an extract rate of 20 litres per second per machine during use.

B.6 For **sanitary accommodation**, the extract rates used for **dwellings** have been applied.

B.7 For food and beverage preparation areas, the extract rates used for **dwellings** have been applied.

¹ Black M S and Wortham A W (1999). Emissions from office equipment. Proceedings of the 8th International Conference on Indoor Air Quality and Climate, Indoor Air 99, Edinburgh 8–13 August 1999, Vol. 2, pp 455–459.

Appendix C: Standards referred to

BS 4434 Specification for safety aspects in the design, construction and installation of refrigeration appliances and systems [1989]**BS 5502** Buildings and structures for agriculture [2003]. Various relevant parts including: Part 33: Guide to the control of odour pollution [1991 + AMD 10014] and Part 52: Code of practice for design of alarm systems, emergency ventilation and smoke ventilation for livestock housing [1991 + AMD 10014].

PD 5454:2012 Guide for the storage and exhibition of archival materials.

Appendix D: Documents referred to

Legislation

Ancient Monuments and Archaeological Areas Act 1979, Chapter 46

Education (School Premises) Regulations.

Explosives Regulations 2014.

Factories Act 1961, Chapter 34.

Health and Safety at Work etc. Act 1974

Nuclear Installations Act 1965, Chapter 57

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