

Approved Document F – Ventilation

Volume 1: dwellings

Consultation version – October 2019

This draft guidance accompanies the October 2019 consultation on the Future Homes Standard, Part L and Part F of the Building Regulations. The Government is seeking views on the standards for new dwellings, and the structure of the draft guidance. The standards for work to existing dwellings are not a subject of this consultation.

The approved documents

What is an approved document?

The Secretary of State has approved a series of documents that give practical guidance about how to meet the requirements of the Building Regulations 2010 for England. These approved documents give guidance on each of the technical parts of the regulations and on regulation 7. The approved documents provide guidance for common building situations.

It is the responsibility of those carrying out building work to meet the requirements of the Building Regulations 2010. Although it is ultimately for the courts to determine whether those requirements have been met, the approved documents provide practical guidance on potential ways to achieve compliance with the requirements of the regulations in England.

Although approved documents cover common building situations, compliance with the guidance set out in the approved documents does not provide a guarantee of compliance with the requirements of the regulations because the approved documents cannot cater for all circumstances, variations and innovations. Those with responsibility for meeting the requirements of the regulations will need to consider for themselves whether following the guidance in the approved documents is likely to meet those requirements in the particular circumstances of their case.

Note that there may be other ways to comply with the requirements than the method described in an approved document. If you prefer to meet a relevant requirement in some other way than described in an approved document, you should seek to agree this with the relevant building control body at an early stage.

Where the guidance in the approved document has been followed, a court or inspector will tend to find that there is no breach of the regulations. However, where the guidance in the approved document has not been followed, this may be relied upon as tending to establish breach of the regulations and, in such circumstances, the person carrying out building works should demonstrate that the requirements of the regulations have been complied with by some other acceptable means or method.

In addition to guidance, some approved documents include provisions that must be followed exactly, as required by regulations or where methods of test or calculation have been prescribed by the Secretary of State.

Each approved document relates only to the particular requirements of the Building Regulations 2010 that the document addresses. However, building work must also comply with all other applicable requirements of the Building Regulations 2010 and all other applicable legislation.

How to use this approved document

This document uses the following conventions.

- a. **Text against a green background** is an extract from the Building Regulations 2010 or the Building (Approved Inspectors etc.) Regulations 2010 (both as amended). These extracts set out the legal requirements of the regulations.
- b. **Key terms, printed in green**, are defined in Appendix A.
- c. References are made to appropriate standards or other documents, which can provide further useful guidance. When this approved document refers to a named standard or other reference document, the standard or reference has been clearly identified in this document. Standards are highlighted in **bold** throughout. The full name and version of the document referred to is listed in Appendix D (standards) or Appendix C (other documents). However, if the issuing

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body has revised or updated the listed version of the standard or document, you may use the new version as guidance if it continues to address the relevant requirements of the Building Regulations.

- d. Standards and technical approvals also address aspects of performance or matters that are not covered by the Building Regulations and may recommend higher standards than required by the Building Regulations. Nothing in this approved document precludes you from adopting higher standards.
- e. 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

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 building work being undertaken.

The Building Regulations

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

Regulation 3 of the Building Regulations defines 'building work'. Building work includes:

- a. the erection or extension of a building
- b. the provision or extension of a controlled service or fitting
- c. the material alteration of a building or a controlled service or fitting.

Regulation 4 of the Building Regulations states that building work should be carried out in such a way that, when work is complete:

- a. *For new buildings or work on a building that complied with the applicable requirements of the Building Regulations:* the building complies with the applicable requirements of the Building Regulations.
- b. *For work on an existing building that did not comply with the applicable requirements of the Building Regulations:*
 - (i) the work itself must comply with the applicable requirements of the Building Regulations
 - (ii) the building must be no more unsatisfactory in relation to the requirements than before the work was carried out.

Material change of use

Regulation 5 of the Building Regulations defines a 'material change of use' in which a building or part of a building that was previously used for one purpose will be used for another.

The Building Regulations set out requirements that must be met before a building can be used for a new purpose. To meet the requirements, the building may need to be upgraded in some way.

Materials and workmanship

In accordance with Regulation 7 of the Building Regulations, building work must be carried out in a workmanlike manner using adequate and proper materials. Guidance on materials and workmanship is given in Approved Document 7.

Energy efficiency requirements

Part 6 of the Building Regulations imposes additional specific requirements for energy efficiency.

If a building is extended or renovated, the energy efficiency of the existing building or part of it may need to be upgraded.

Notification of work

Most building work and material changes of use must be notified to a building control body unless one of the following applies.

- a. It is work that will be self-certified by a registered competent person or certified by a registered third party.
- b. It is work exempted from the need to notify by regulation 12(6A) of, or Schedule 4 to, the Building Regulations.

Responsibility for compliance

People who are responsible for building work (e.g. agent, designer, builder or installer) must ensure that the work complies with all applicable requirements of the Building Regulations. The building owner may also be responsible for ensuring that work complies with the Building Regulations. If building work does not comply with the Building Regulations, the building owner may be served with an enforcement notice.

Contents

Section 0: Introduction	8
Summary	8
Flexibility for historic and traditional buildings	9
Interactions with other parts of the Building Regulations	9
Interaction with Part B	9
Interaction with Part J	10
Interaction with Part L	10
Interaction with Parts K and M	10
Notification of work covered by the ventilation requirements	10
Competent person self-certification schemes	10
Emergency repairs	11
Minor works	11
Live-work units	11
Mixed use developments	11
Requirement F1(1): Means of ventilation	12
Section 1: Ventilation provision	13
General	13
Noise	13
Access for maintenance	14
The ventilation strategy in this Approved Document	14
Performance-based guidance	14
Equivalent area of ventilators	15
Extract ventilation	15
Whole dwelling ventilation	18
Purge ventilation	19
Performance testing	20
Control of ventilation	21
Ventilation systems for dwellings without basements	21
Ventilation systems for dwellings with basements	21
Ventilation of a habitable room through another room	22

Consultation version: not statutory guidance

System specific guidance ^[OBJ]	23
Natural ventilation with background ventilators and intermittent extract fans^[OBJ]	24
Continuous mechanical extract ventilation^[OBJ]	25
Continuous mechanical supply and extract ventilation ^[OBJ]	26
Installation of ventilation systems ^[OBJ]	27
Section 2: Minimising ingress of external pollution ^[OBJ]	28
Control of ventilation intakes ^[OBJ]	29
Location of exhaust outlets ^[OBJ]	29
Section 3: Work on existing buildings^[OBJ]	30
Requirement F1(2) and Regulations 39, 42 and 44 ^[OBJ]	31
Section 4: Testing and Commissioning ^[OBJ]	33
Air flow rate testing and commissioning of ventilation systems ^[OBJ]	33
Inspection requirements ^[OBJ]	33
Air flow rate testing ^[OBJ]	35
Providing information ^[OBJ]	36
Appendix A: Key Terms ^[OBJ]	37
Appendix B: Performance-based ventilation ^[OBJ]	40
Introduction ^[OBJ]	40
Performance criteria for dwellings ^[OBJ]	40
Assumptions used in applying performance criteria for dwellings in Section 1 ^[OBJ]	41
General ^[OBJ]	41
Extract ventilation ^[OBJ]	42
Whole dwelling ventilation ^[OBJ]	43
Basis of Table 1.3 – Whole dwelling ventilation rates ^[OBJ]	44
Purge ventilation ^[OBJ]	44
Appendix C: Completion checklist and commissioning sheet ^[OBJ]	46
<i>Checking design against measured air flow rates^[OBJ]</i>	46
<i>Demonstrating compliance^[OBJ]</i>	46
Part 1 – System details and declarations ^[OBJ]	47
Part 2a – Installation details ^[OBJ]	48
Part 3 – Commissioning details ^[OBJ]	49
Appendix D: Standards referred to ^[OBJ]	50
Appendix E: Documents referred to ^[OBJ]	51

Section 0: Introduction

Summary

0.1 This approved document gives guidance on how to comply with Part F of the Building Regulations. It contains the following sections:

Section 1: Means of ventilation

Section 2: Minimising ingress of external pollution

Section 3: Work in existing buildings

Section 4: Installation and commissioning

Application

0.2 The recommendations of this volume of this approved document apply to work in dwellings only.

Exemptions

0.3 The following classes of buildings are exempt from the Part F requirements:

a. *special buildings* – any of the following:

- i. buildings controlled under the Manufacture and Storage of Explosives Regulations 2005
- 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* – either of the following:

- detached buildings into which people do not normally go
- detached buildings into which people go only occasionally to inspect or maintain fixed plant, provided that the buildings are a specified distance from buildings into which people normally go, as defined in the Building Regulations 2010 Schedule II;

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) - provided that all of the following apply:

- i. no part of the building is used as a dwelling
- ii. the building is at least one and one-half times its height from a building containing sleeping accommodation

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iii. there is a fire exit not more than 30 metres distant from any point in the building.

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:

- constructed substantially of non-combustible material
- 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, and;

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.

Flexibility for historic and traditional buildings

[Note for consultation: This consultation does not include guidance for work on existing buildings]

Interactions with other parts of the Building Regulations

Interaction with Part B

0.4 The requirements of Part B apply if, for example, ducts pass through any of the following:

- i. a fire-resisting wall or floor
- ii. a fire compartment
- iii. a protected stairway.

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- 0.5** 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

- 0.6** 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.
- 0.7** 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

- 0.8** 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

- 0.9** 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.

Notification of work covered by the ventilation requirements

- 0.10** Notifiable ventilation work on a building should usually be notified to a **building control body** before the work starts. However, work may be notified after the it starts in any of the following situations:
- i. Where work will be carried out by a person registered with a competent person self-certification scheme (paragraphs 0.11 to 0.13)
 - ii. When the work is emergency repairs
 - iii. When the work is minor works

Competent person self-certification schemes

- 0.11** Where work is to be carried out by a person registered with a competent person scheme, it is not necessary to notify a **building control body** in advance.
- 0.12** If work is carried out by a person registered with a competent person scheme, both:
- i. The occupier of the building must be given a certificate to confirm that the work complies fully with all relevant requirements of the building regulations. This certificate must be provided within 30 days of the work being completed.
 - ii. The **building control body** must be given a notice of the work carried out, within 30 days of the work being completed.

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0.13 Building control bodies may accept notices and certificates from a person registered with a competent person scheme as evidence of compliance with the requirements of the Building Regulations. The local authority still retains inspection and enforcement powers in these circumstances.

NOTE: A list of competent person schemes and the types of work for which they are authorised is available at www.gov.uk/building-regulations-competent-person-schemes

Emergency repairs

[Note for consultation: This consultation does not include guidance for work on existing buildings]

Minor works

[Note for consultation: This consultation does not include guidance for work on existing buildings]

Live-work units

0.14 If a unit contains both living accommodation and space for commercial purposes that could be reverted to domestic use, the whole unit should be treated as a dwelling for the purposes of this Approved Document. This could be the case if, for example, 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.

Mixed use developments

0.15 When constructing a dwelling as part of a larger building that contains other types of accommodation (a mixed use development), this Approved Document (F, volume 1) should be used for guidance in relation to each individual dwelling. Approved Document F, volume 2 gives guidance for the non-dwelling parts of such buildings.

[Note for consultation: This consultation does not include guidance for non-dwellings]

Requirement F1(1): Means of ventilation

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

Requirement [regulations will be amended as necessary in line with the performance 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: 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.

Performance

In the Secretary of State's view, requirement F1(1) will be met if the dwelling is provided with a means of ventilation which:

- a. extracts water vapour and indoor air pollutants from areas where they are produced in significant quantities (e.g. kitchens, utility rooms and bathrooms) before they spread through the building – by following guidance for extract ventilation in paragraphs 1.17 to 1.21
- b. supplies a minimum level of outdoor air for occupants' health – by following guidance for whole dwelling ventilation in paragraphs 1.22 to 1.24
- c. rapidly dilutes indoor air pollutants and water vapour when necessary in habitable rooms; – by following guidance for purge ventilation in paragraphs 1.25 to 1.26.
- d. minimises the ingress of external air pollutants – by following guidance in Section 2.
- e. provides all of the following as far as reasonably practicable:
 - low levels of noise, by following guidance in paragraphs 1.5 to 1.7
 - is easy to maintain, by following guidance in paragraph 1.8
 - protection from rain
 - protection from cold draughts
 - does not significantly risk occupants' health

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 might 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 The building should provide the ventilation rates given in this section.

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 ventilation rates set out in this Approved Documents have 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 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:

- sizing and jointing ducts correctly
- ensuring that equipment is appropriately and securely fixed
- 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.

Access for maintenance

- 1.8 Reasonable access should be provided for maintaining ventilation systems. This should include all of the following:
- a. providing access to replace filters, fans and coils;
 - b. providing access points for cleaning duct work; and
 - c. providing access for the general maintenance of plant.

The ventilation strategy in this Approved Document

- 1.9 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).
- 1.10 Ventilation may be delivered through natural ventilation, mechanical ventilation or both.
- 1.11 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

- 1.12 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 Table 1.1, Table 1.2 and Table 1.3.
- 1.13 Ventilator sizes for the whole dwelling are also provided to help designers comply with Part F of the Building Regulations in common situations.
- 1.14 Some ventilation system designs can, in some circumstances, result in lower ventilation rates than stated in Table 1.1 and 1.2. For example, systems with **automatic controls**. Where lower ventilation rates are proposed, it should be demonstrated through independent verification by a suitably qualified person 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

- 1.15** The size of **background ventilators** (including trickle ventilators) is given in this Approved Document as an **equivalent area**, not free area. BS EN 13141-1 includes a method of measuring the **equivalent area** of **background ventilator** openings. This Approved Document expresses **equivalent area** in mm².
- 1.16** **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.

Extract ventilation

1.17 **Extract ventilation** to outside should be provided in all of the following spaces:

- **kitchens**
- **utility rooms**
- **bathrooms**
- **sanitary accommodation**

Extract ventilation can be intermittent or continuous.

- 1.18** Minimum **extract ventilation** rates for intermittent extract systems are specified in Table **1.1**. Minimum **extract ventilation** rates for continuous extract systems are specified in Table **1.2**.
- 1.19** Mechanical extract terminals and fans, not including cooker extract hoods, should be installed both:
- as high as is practicable in the room
 - a maximum of 400 mm below the ceiling.
- 1.20** Where a cooker hood is used to extract to the outside, the height of the extract hood above the hob surface should be either as specified in the manufacturer's instructions, or if unknown 650 mm to 750 mm.

Table 1.1 Minimum extract ventilation rates for intermittent extract systems

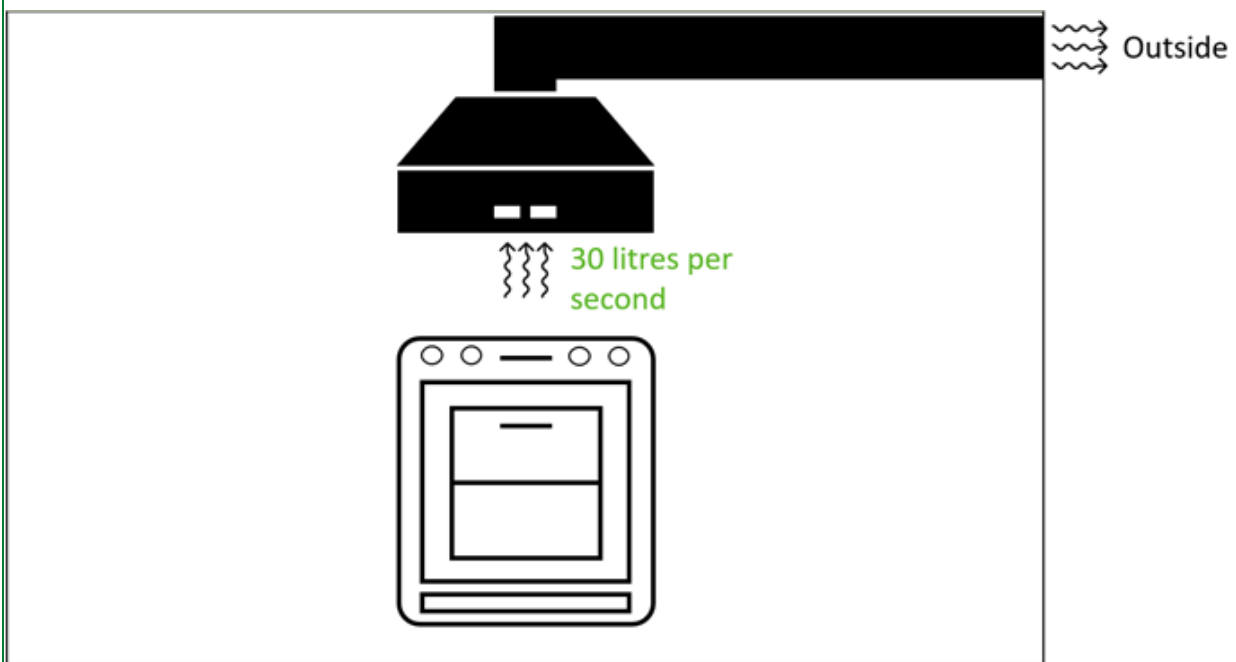
Room	Intermittent extract rate
Kitchen (cooker hood extracting to outside) ¹	30 litres per second
Kitchen (no cooker hood or cooker hood does not extract to outside) ²	60 litres per second
Utility room	30 litres per second
Bathroom	15 litres per second
Sanitary accommodation ³	6 litres per second

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Notes for Table 1.1:

1. See Diagram 1.
2. See Diagram 2.
3. As an alternative for sanitary accommodation, the purge ventilation guidance may be used.

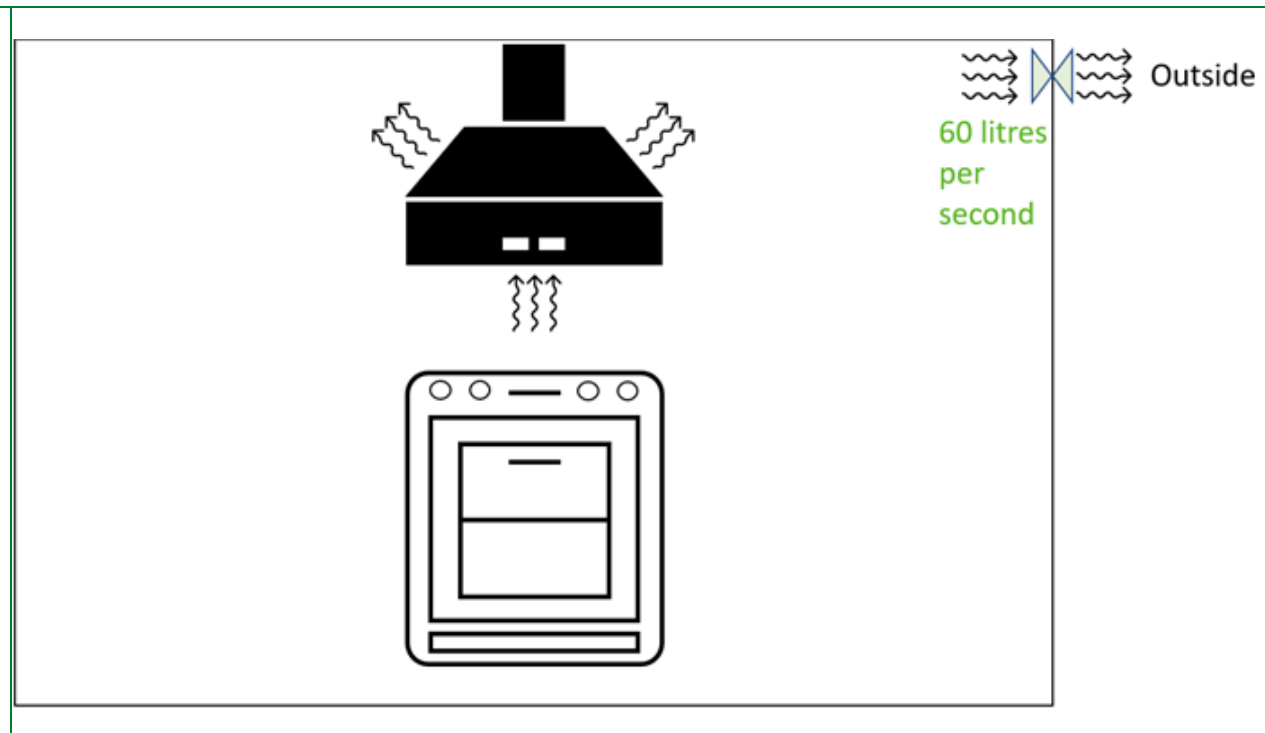
Diagram 1 – Minimum ventilation rate for kitchen extract where cooker hood extracts to outside¹



Notes:

1. The cooker hood should span at least the full width of the cooker.

Diagram 2 – Minimum ventilation rate for kitchen extract where cooker hood does not extract to outside¹



Notes:

1. This diagram includes a recirculating cooker hood for illustration. A recirculating cooker hood does not provide a means of ventilation. for the purposes of compliance with Part F

1.21 Minimum **extract ventilation** rates for continuous extract systems are specified in Table 1.2. A 'continuous' rate is given for the general operation of the fan, and a 'high' rate for use during periods when additional extract is required. Minimum **extract ventilation** rates for continuous extract systems are specified in Table 1.2.

Table 1.2 Minimum extract ventilation rates for continuous extract systems

Room	High rate	Continuous rate
Kitchen	13 litres per second	The sum of all extract ventilation in the dwelling on its continuous rate should be at least the whole dwelling ventilation rate given in Table 1.3
Utility room	8 litres per second	
Bathroom	8 litres per second	
Sanitary accommodation	6 litres per second	

Whole dwelling ventilation

1.22 Supply air for the dwelling should be delivered through either:

- Continuous supply fans
- Background ventilators (further guidance is given in Section 2)

1.23 The minimum whole dwelling ventilation rate for the supply of air to the habitable rooms in a dwelling should meet both of the criteria given in table 1.3 as follows.

- The minimum whole dwelling ventilation rate by number of bedrooms
- The minimum whole dwelling ventilation rate by floor area

Number of bedrooms	1	2	3	4	5
Minimum ventilation rate criterion 1 – by number of bedrooms	19	25	31	37	43
Minimum ventilation rate criterion 2 – by floor area	0.3 l/s per m ² of internal floor area				
Notes:					
<ol style="list-style-type: none"> 1. Where the dwelling has only one habitable room, a minimum ventilation rate of 13 litres per second should be used. 2. The minimum ventilation rate 0.3 litres per second per m² of internal floor area. (This includes all floors, e.g. for a two-storey building add the ground and first floor areas). 3. For each additional bedroom, add 6 litres per second to the values in Table 1.3. 					

1.24 To allow air to flow throughout the dwelling, internal doors should allow air to move within the dwelling by providing a minimum free area equivalent to a 10mm undercut in a 760mm wide door. Doors should be undercut either:

- If the floor finish is fitted: 10 mm above the floor finish
- If the finish is not fitted: 20 mm above the floor surface.

Purge ventilation

1.25 A system for **purge ventilation** is required in each **habitable room**. **Purge ventilation** should be capable of extracting a minimum of four air changes per hour per room directly to outside. **Purge ventilation** should be delivered through either:

- openings (e.g. windows or doors)
- a mechanical extract system.

Where purge ventilation in a **habitable room** is delivered through openings in that room, the minimum opening areas in Table 1.4 should be achieved. The values in Table 1.4 are based on BS5925:1991, which assumes all of the following:

- single-sided ventilation
- an urban environment
- a wind speed of 2.1 metres per second
- a temperature difference of 3°C between the air inside and outside of the building.

Depending on the dwelling design or the external climate, it may be possible in other circumstances to achieve 4 air changes per hour with smaller openings. If smaller openings than Table 1.4 are specified, expert advice should be sought.

Opening type	Minimum total area of openings
Hinged or pivot windows with an opening angle of 15 to 30 degrees	1/10 of floor area of room
External doors Opening sash windows Hinged or pivot windows with an opening angle of greater than or equal to 30 degrees	1/20 of floor area of room

1.26 Hinged or pivot windows with an opening angle of less than 15 degrees are not suitable for purge ventilation.

NOTE: The purge ventilation guidance in paragraphs 1.25 to 1.26 aims to achieve a minimum 4 air changes per hour.

Performance testing

1.27 The air flow resistance of all components should be considered when specifying ventilation systems. The complete assembly, as installed, should be designed to meet the performance requirements of this Approved Document. The performance of the separate components should be measured according to the relevant parts of BS EN 13141 and other relevant standards. The relevant test standards for common equipment types are given in Table 1.5.

Equipment type	Test standard
Intermittent extract fans	BS EN 13141-4
Cooker hoods	BS EN 13141-3
Background ventilators without humidity control	BS EN 13141-1 clauses 5.1 and 5.2 Background ventilators should meet the performance requirements for both: a. Air flow from outside to inside the dwelling b. Air flow from inside to outside
Continuous mechanical extract systems	BS EN 13141-6
Continuous supply and extract mechanical ventilation with heat recovery units	BS EN 13141-7
Single-room heat recovery ventilators	BS EN 13141-8. For internal and external leakage and for mixing, the unit should meet at least Class U4.

Control of ventilation

- 1.28** Ventilation should be controllable. Controls may be either **manual** (i.e. operated by the occupant) or **automatic**.
- 1.29** Trickle ventilators should be a minimum of 1.7m above floor level, to reduce cold draughts, but still be within easy reach of the occupant.
- NOTE:** Trickle ventilators are intended to normally be left open.
- 1.30** Continuously running fans should be set up to operate without occupant intervention, but may have **manual** or **automatic controls** to select the high rate. Any **manual** high rate controls should be provided locally to the spaces being served, e.g. bathrooms and kitchens. **Automatic controls** might include sensors for humidity, occupancy/usage and pollutant release.
- 1.31** Controls based on humidity sensors may be installed in moisture-generating rooms (e.g. kitchen or **bathroom**) but should not be used for **sanitary accommodation**, where odour is the main pollutant.
- 1.32** Other types of **automatic control** might be suitable. Where present, **automatic controls** should operate according to the need for ventilation in the space. Trickle ventilators with automatic controls should also have manual override.
- NOTE:** Where a combustion appliance is installed, any automatic controls must also ensure that ventilation provided meets the requirements of Part J.

Ventilation systems for dwellings without basements

- 1.33** In addition to paragraphs 1.12 and 1.33, the performance required for ventilation systems for dwellings without **basements** would be achieved by following paragraphs **1.34 to 1.36**.

Ventilation systems for dwellings with basements

- 1.34** A dwelling that includes a **basement** connected to the rest of the dwelling by a large **permanent opening** (e.g. an open stairway) may be treated as a multi-storey dwelling, and the guidance in this document may be followed for dwellings without **basements**.
- Note:** If a **basement** has only one exposed façade, the guidance for **natural ventilation** given in this Approved Document would not be appropriate. In such cases, specialist advice should be sought.

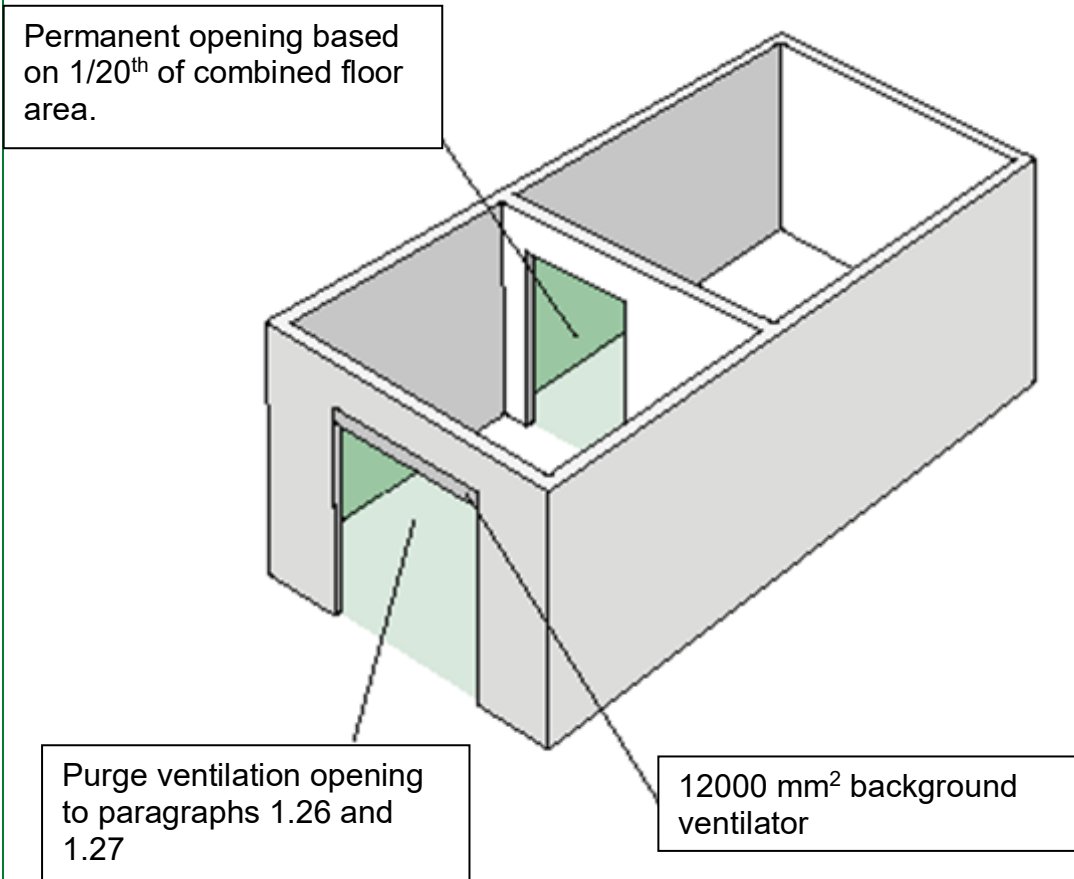
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- 1.35** A dwelling that includes a **basement** not connected to the rest of the dwelling above ground by a large **permanent opening** should be considered as follows:
- The part of the dwelling above ground should be considered separately.
 - The **basement** should be treated separately as a single-storey dwelling above ground level.
 - If the **basement** has no bedrooms, assume it has one bedroom to determine the ventilation required for the purposes of meeting the ventilation standards.
- 1.36** A dwelling that comprises only a **basement** should be treated as a single-storey dwelling above ground level. In such circumstances, the guidance for dwellings without **basements** should be followed. The guidance on natural ventilation, however, is not appropriate for a dwelling that comprises only a basement.

Ventilation of a habitable room through another room

- 1.37** If a **habitable room** does not contain openable windows (i.e. an internal room), the requirement for adequate ventilation can be met using paragraphs 1.38 and 1.39 if the room is ventilated through either:
- another **habitable room**
 - a **conservatory**
- 1.38** The **habitable room** or **conservatory** should have openings to outside to provide both:
- purge ventilation** with a minimum total area given in paragraphs **1.26 and 1.27** based on the combined floor area of the **habitable rooms** (or the **habitable room** and the **conservatory**)
 - background ventilation** of at least **12,000mm²** equivalent area
- 1.39** Between the two rooms there should be a permanent opening with a minimum area of 1/20th of the combined floor area of the two rooms. See Diagram 3.

Diagram 3 – Two habitable rooms treated as one room for ventilation purposes



System specific guidance

1.40 Paragraphs 1.41 to 1.75 give guidance for the following types of ventilation system:

- **Natural ventilation** with background ventilators and intermittent extract (paragraphs 1.41 to 1.51)
- Continuous **mechanical extract** (paragraphs 1.52 to 1.69)
- Continuous **mechanical supply and extract** (paragraphs 1.60 to 1.75)

Natural ventilation with background ventilators and intermittent extract fans

NOTE: The guidance for natural ventilation is only suitable for less airtight dwellings. For the design, sizing and positioning of ventilators to provide effective ventilation using natural ventilation for highly-airtight dwellings expert advice should be sought.

Intermittent extract

- 1.41 Intermittent extract fans should be fitted in all wet rooms. For kitchens, utility rooms, bathrooms and sanitary accommodation, the extract rates given in Table 1.1 can be met using an intermittent extract fan.
- 1.42 If a wet room has no external walls, the intermittent extract fan should extract at four air changes per hour to provide the purge ventilation given in paragraphs 1.25 and 1.26.
- 1.43 For sanitary accommodation, as an alternative, extract rates can be met using windows by following the purge ventilation guidance in paragraphs 1.25 and 1.26.
- 1.44 Any automatic controls (e.g. humidity control) for intermittent extract should have a manual override to allow the occupant to turn the extract ventilation on or off.
- 1.45 In a room with no openable window, an intermittent extract fan should be provided with controls which continue to operate the fan for a minimum of 15 minutes after the room is vacated.

Background ventilators

- 1.46 All rooms with external walls should have background ventilators. If a habitable room has no external walls, paragraphs 1.37 to 1.39 should be followed.

NOTE: A window with a night latch position is not adequate for background ventilation, due to:

- the risk of draughts
- security issues
- the difficulty of measuring equivalent area.

- 1.47 If the dwelling has more than one exposed façade, the area of background ventilators on each façade should be similar, to allow cross-ventilation.

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1.48 If fans and background ventilators are fitted in the same room, they should be a minimum of 0.5 m apart.

1.49 The minimum total area of background ventilators in each habitable room should be as Table 2.1.

Table 2.1 Minimum equivalent area of background ventilators for natural ventilation ¹		
Room	Minimum equivalent area of background ventilators for dwellings with multiple floors	Minimum equivalent area of background ventilators for single-storey dwellings (e.g. flats) ²
Habitable rooms	10,000mm ²	12,000mm ²
Kitchen ^{3,4}	5,000mm ²	8,000mm ²
Bathroom	5,000mm ²	5,000mm ²
Sanitary accommodation	No minimum	No minimum

Notes:

- 1 The use of this table is not appropriate where the dwelling has a single exposed façade. For such situations, expert advice should be sought.
- 2 The guidance for flats is also applicable to any dwelling which is only one storey, such as a bungalow.
- 3 In situations where any bathroom has no window or external façade through which a ventilator can be installed, then the minimum equivalent area for the kitchen ventilator should be 12,000mm².
- 4 In situations where the kitchen has no windows or external façade through which a ventilator can be installed, the use of this table is not appropriate and expert advice should be sought.

1.50 If the dwelling has at least 70% of its openings on the same façade, the guidance for natural ventilation is not appropriate, and specialist advice should be sought.

Purge ventilation

1.51 For purge ventilation follow paragraphs 1.26 to 1.27.

Continuous mechanical extract ventilation

NOTE: The guidance for mechanical extract ventilation is suitable for highly-airtight dwellings only. For the design, sizing and positioning of ventilators to provide effective ventilation using mechanical extract for less airtight dwellings expert advice should be sought.

1.52 A continuous mechanical extract ventilation system could comprise one of the following:

- a central extract system
- individual room extract fans

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c. a combination of both a central extract system and individual room extract fans.

- 1.53 If an exhaust air terminal is on the façade exposed to the prevailing wind, measures should be taken to minimise likely wind effects. Solutions could include:
- ducting to another façade
 - use of constant volume flow rate units
 - seeking expert advice.

Ventilation rates

- 1.54 The total combined continuous rate of mechanical extract ventilation in the dwelling should be a minimum of the whole dwelling ventilation rate in Table 1.3.
- 1.55 Each wet room should have a minimum mechanical extract ventilation high rate as given in Table 1.2.

Background ventilators for continuous mechanical extract ventilation

- 1.56 Where continuous mechanical extract ventilation is used, background ventilators should both:
- not be in wet rooms
 - provide minimum equivalent area of 5,000 mm² for each habitable room in the dwelling
- 1.57 If a habitable room has no external walls, paragraphs 1.37 to 1.39 should be followed.
- 1.58 Fans and background ventilators in the same room should be a minimum of 0.5 m apart.

Purge ventilation

- 1.59 For purge ventilation follow paragraphs 1.26 to 1.27.

Continuous mechanical supply and extract ventilation

NOTE: The guidance for mechanical supply and extract ventilation is suitable for any level of airtightness.

Ventilation rates

- 1.60 For dwellings using mechanical supply and extract ventilation, each habitable room should have mechanical supply ventilation. The total supply air flow should be distributed proportionately to the volume of each habitable room.
- 1.61 Mechanical supply terminals should be located and directed to avoid draughts.
- 1.62 The minimum total continuous rate of mechanical supply and extract ventilation is the whole dwelling ventilation rate in Table 1.3.
- 1.63 For dwellings using mechanical supply and extract ventilation, each wet room should have a minimum mechanical extract ventilation high rate as given in Table 1.2.

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- 1.64 Mechanical supply and extract ventilation systems should be designed to avoid the recirculation of moist air from the wet rooms to the habitable rooms.

Background ventilators

- 1.65 To avoid unintended air pathways, background ventilators should not be installed with mechanical extract and supply ventilation

Purge ventilation

- 1.66 For purge ventilation follow paragraphs 1.25 to 1.26.

Installation of ventilation systems

- 1.67 Ventilation systems should be installed in a way that does not compromise the performance of the system in-use.
- 1.68 Adequate space should be available for access to maintain ventilation equipment.
- 1.69 Rigid ducts should be used wherever possible. Where flexible ductwork is installed this should only be used for final connections and their lengths should be kept to a minimum as given in paragraph 1.70. All flexible ductwork should meet the standards of BSRIA BG 43/2013.
- 1.70 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.
- 1.71 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
- 1.72 Each air terminal should have a free area of at least 90% of the free area of its associated duct.
- 1.73 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.
- 1.74 A visual inspection should be made by the installer to confirm that both:
- There are no obvious defects
 - All packaging has been removed.
- 1.75 Mechanical ventilation systems must be commissioned in accordance with an approved procedure. Appendix C of this Approved Document includes a completion checklist and commissioning sheet, which the system installer should complete to demonstrate compliance. See Section 5.

Section 2: Minimising ingress of external pollution

2.1 Ventilation in buildings located near to significant local pollution sources should be designed to minimise the intake of external air pollutants. Particular attention should be given to the guidance in this section in locations where the Air Quality Standards Regulations 2010 Schedule 2 limit values are exceeded.

Note: This section gives guidance for typical situations. Expert advice may need to be sought.

2.2 Typical urban pollutants that should be considered include all of the following:

- carbon monoxide, CO
- nitrogen dioxide, NO₂
- sulphur dioxide, SO₂
- ozone, O₃
- particles (PM_{2.5}-PM₁₀)
- benzene
- 1,3-butadiene
- polycyclic aromatic hydrocarbons (PAHs)
- ammonia
- lead.
- nitrogen oxides, NO_x

2.3 Typical sources of pollution around the dwelling include the following:

- road traffic, including traffic junctions and underground car parks
- combustion plant (such as heating appliances) running on conventional fuels, most commonly natural gas
- other combustion processes (for example, waste incineration, thermal oxidation abatement systems)
- discharges from industrial processes
- fugitive (i.e. not effectively controlled) discharges from industrial processes and other sources
- exhaust discharges from building ventilation systems
- construction and demolition sites, which are a source of particles and vapourous discharges.

Control of ventilation intakes

2.4 For a building located near to significant local pollution sources, the guidance in paragraphs 2.5 to 2.9 should be followed.

2.5 Where there are local sources of pollution, such as parking areas and adjacent building exhausts, ventilation intakes should be located away from the direct impact of the sources of pollution.

NOTE: CIBSE Technical Memorandum **TM21** gives further guidance.

2.6 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.

2.7 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.

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

2.9 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, specialist advice should be sought.

Location of exhaust outlets

2.10 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.

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

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

- courtyards
- enclosures
- architectural screens.

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

Section 3: Work on existing buildings

[Note for consultation: This consultation does not include guidance for work on existing buildings]

Requirement F1(2) and Regulations 39, 42 and 44

Requirement [regulations will be amended as necessary in line with the performance 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>Mechanical ventilation air flow rate testing</p> <p>42.—(1) This regulation applies where paragraph F1(1) of Schedule 1 imposes a requirement in relation to the creation of a new dwelling by building work.</p> <p>(2) The person carrying out the work shall, for the purpose of ensuring compliance with paragraph F1(1) of Schedule 1—</p> <ul style="list-style-type: none"> (a) ensure that testing of the mechanical ventilation air flow rate is carried out in accordance with a procedure approved by the Secretary of State; and (b) give notice of the results of the testing to the local authority. <p>(3) The notice referred to in paragraph (2)(b) shall—</p> <ul style="list-style-type: none"> (a) record the results and the data upon which they are based in a manner approved by the Secretary of State; and (b) be given to the local authority not later than five days after the final test is carried out. <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>	

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(4) The notice shall be given to the local authority –

(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).

Performance

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 4.11** 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 4.12 to 4.16**

In the Secretary of State's view, when a new dwelling is created by building work, regulation 42 is met if the installer complies with all of the following and

- a. Measures and records the mechanical ventilation flowrates by following **paragraph 4.9**
- b. Gives notice of ventilation flowrates to the **building control body** not later than five days after the final test.

Section 4: Testing and Commissioning

Air flow rate testing and 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** Air flow rates for mechanical ventilation in new dwellings must be measured. A notice **of the measured** air flow rates must be given to the **building control body**.
- Note:** this includes intermittent extract as well as continuous mechanical ventilation systems.
- 4.3** The person responsible for commissioning should complete air flow measurement test and commissioning sheets including, as a minimum, all information in the example sheet in Appendix C.
- 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.

Inspection requirements

- 4.4** Ventilation systems should be inspected and tested in accordance with paragraphs **4.5 to 4.11**.

Background ventilators and intermittent extract

- 4.5** For **background ventilators**, the following should be observed and recorded using the checklist in Appendix C:
- Identify and record minimum equivalent area for background ventilators from Table **2.1**.
 - Record actual equivalent area and location of installed background ventilators.
 - Check whether **background ventilator** controls work and that they open and close correctly.
 - Check the quality of the installation of the ventilator product to ensure it is correctly mounted within the wall or window aperture
- 4.6** For **intermittent extract** fans, the installer should:
- Check that the fan operates correctly.
 - Check that the fan or fans respond correctly to the controls provided with the installation
 - Check that any run-on timers are set to at least 15 minutes.

Ducted systems

- 4.7** For all ductwork and terminals, the following should be observed and recorded in the checklist in Appendix C:
- Check that the system has been installed both:
 - in accordance with the design criteria
 - to a standard that will not adversely affect its performance.
 - Number and size of air terminals satisfy Table **1.4**.

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- c. All ductwork and terminals are in good condition with no obvious defects that will affect the performance of the system.
- d. Air flow direction is correct at each room terminal
- e. There are no abnormal noises from the ventilation system, including all of the following
 - i. On start-up
 - ii. When running in background ventilation mode
 - iii. When running at the high rate

4.8 For continuous mechanical ventilation systems, such as continuous **mechanical extract** or continuous mechanical supply and extract systems, the system should be balanced to achieve design air flow rates at each room terminal. The fan manufacturer's instructions should be followed to balance the system. If specific details are not included, the relevant set of instructions from list a-e in this paragraph should be followed:

- a. For adjustable terminals with a fixed (stepped) speed fan:
 - i. The fan speed should be set to achieve the desired continuous flow rate.
 - ii. The index terminal flow rate should be set to full open and all other terminals should be adjusted to achieve the required flows at each terminal.
 - iii. If the total flow rate cannot be achieved through all the terminals, then the fan speed should be increased.
 - iv. If all the terminals have to be closed significantly to achieve only the required air flow rate, then the fan speed should be reduced and the terminals rebalanced.
- b. For adjustable terminals with a controllable speed fan:
 - i. The fan speed should be set approximately to achieve the desired continuous flow rate.
 - ii. The index terminal flow rate should be set with the terminal fully open and all other terminals should be adjusted to achieve the required flows at each terminal.
 - iii. If the index terminal has to be closed to achieve only the required air flow rate, then the fan speed should be reduced and the terminals rebalanced.
- c. For fixed terminals with flow adjustment by duct damper or similar device at the fan unit, follow a. or b. above, depending on the type of fan speed control.
- d. For adjustable terminals with a fixed volume flow fan:
 - i. The fan speed should be set to achieve the desired continuous flow rate.
 - ii. The index terminal flow rate should be set with the terminal full open, and all other terminals should be adjusted to achieve the required flows at each terminal.
 - iii. **NOTE:** Adjusting the terminals achieves balancing only. Total flow rate is governed by the fan control setting. Care should be taken not to close the terminals too far, because the fan unit will always maintain a constant volumetric flow rate. Closing the terminals will only require the fan to work harder to achieve a given air flow rate.
- e. For fixed terminals with automatic flow adjustment at the fan unit, the fan speed should be set to achieve the desired continuous flow rate. The flows are balanced by automatic devices within the fan unit, so cannot be adjusted.

Air flow rate testing

4.9 The air flow rate of all mechanical ventilation fans should be tested. This includes any of the following:

- Intermittent extract fans
- Cooker hoods
- Continuous extract fans and/or terminals
- Continuous supply fans and/or terminals

A calibrated air flow device with proprietary hood should be used to measure the air flow rates at each room terminal. The following procedure should be followed:

- a. The design airflow rates should be determined in accordance with Table 1.2.
- b. It should be ensured that both:
 - all intended background ventilators or other air transfer devices are open.
 - all internal and external doors and windows are closed.
- c. Airflow measurements should be performed using an airflow device that:
 - has a proprietary hood attachment.
 - has an accuracy of $\pm 5\%$.
 - has been calibrated within the last 12 months at a UKAS accredited calibration centre.
- d. The airflow for each extract/supply fan or terminal should be recorded in litres per second (l/s) on the commissioning sheet (see **Appendix C**).

NOTE: In exceptional circumstances, the configuration of some fan units may prevent air flow rates being measured. In those circumstances, evidence should be provided to BCB to give assurance that the flow-rate can be determined by following manufacturer's guidance.

Controls

4.10 The correct operation of each control function should be tested as far as practical. Ventilation controls should be inspected to ensure the following:

- a. All local controls have been installed following the manufacturer's instructions.
- b. All local controls are adequately labelled to indicate their function clearly.
- c. If sensors have been installed separately from the fan unit, the manufacturer's installation instructions were followed.
- d. Where control of the fan is automated, the controls are configured to ensure that automatic controls are not disturbing to occupants, for example, rapid changes in fan speed.

4.11 If manual controls are provided, clear and detailed instructions should be provided to the occupier as part of the information package in paragraphs 4.12 to 4.16.

Providing information

- 4.12** Sufficient information about the ventilation system and its maintenance requirements must be given to owners 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.**
- 4.13** **A copy of the completed commissioning sheet in Appendix C should be provided to the owner of the dwelling.**
- 4.14** 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.
- 4.15** 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
- 4.16** The operation and maintenance information should also contain relevant manufacturers' literature, including, where relevant:
- a. components specifications
 - 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 D.

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**. See Diagram 1.

Basement (in relation to dwellings) is a dwelling or a usable part of a dwelling (i.e. a **habitable room**), that is partly or entirely below ground level. Note that a **cellar** is distinct from a basement

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.

Cellar is a part of a dwelling that is partly or entirely below ground level, and is used only for storage, heating plant or purposes other than habitation. Note that a **basement** is distinct from a cellar.

Closable opening is a **ventilation opening** that may be opened and closed under either **manual** or **automatic control**.

Common space is a space where large numbers of people are expected to gather, such as a shopping mall or foyer of a cinema or theatre. For the purposes of this Approved Document, a space used solely or mainly for circulation (e.g. a corridor or lift lobby in an office building or blocks of flats) is not a **common space**.

Continuous operation is when a mechanical ventilation device runs all the time, e.g. mechanical **extract ventilation** (MEV) and mechanical ventilation with heat recovery (MVHR). 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.

Equivalent area is a measure of the aerodynamic performance of a ventilator. It is the area of

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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. The equivalent area of a background ventilator is determined at 1 Pa pressure difference in accordance with Table 1.5.

Extract ventilation is the removal of air directly from a space or spaces to outside. **Extract ventilation** may be by natural means (e.g. by **passive stack ventilation**) or by mechanical means (e.g. by an extract fan or central system).

Free area is the geometric open area of a ventilator.

Gross internal volume is the total internal volume of the heated space, including the volume of all furniture, internal walls, internal floors, etc.

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

Highly airtight dwellings are those with either:

- a. a design air permeability lower than $5 \text{ m}^3/(\text{h}\cdot\text{m}^2)$ at 50 Pa
- b. an as-built air permeability of lower than $3 \text{ m}^3/(\text{h}\cdot\text{m}^2)$ at 50 Pa.

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**.

Less airtight dwellings are those which are not **highly airtight dwellings**.

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

Mechanical supply and extract 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.

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.

NOTE: In this Approved Document, natural ventilation is used in reference to a ventilation provision which also includes intermittent extract fans

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.

Permanent opening is a **ventilation opening** that is permanently fixed in the open position.

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**, extract fans,

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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.

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.

Wet room is a room used for domestic activities (such as cooking, clothes washing and bathing) that produce significant amounts of airborne moisture, e.g. a kitchen, **utility room** or **bathroom**. For the purposes of Part F of the Building Regulations, **sanitary accommodation** is also regarded as a **wet room**.

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. For an individual dwelling, this is referred to as '**whole dwelling ventilation**'.

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:

- Moisture levels as described in paragraph B.2
- Indoor air pollutants as described in paragraph B.4
- Bio-effluents as described in paragraph B.6

NOTE 1: the guidance in this Approved Document may not be adequate to address pollutants from flueless combustion space heaters or from occasional, occupant-controlled events such as painting, cleaning or other high-polluting events. This Approved Document does not address the airborne spread of infection, and does not directly address contamination from outdoor sources.

NOTE 2: 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 dwellings

B.2 The performance criterion for moisture is that there should be no visible mould on external walls in a properly heated dwelling with typical moisture generation.

B.3 Mould can grow whether the dwelling is occupied or unoccupied, so the performance criterion for moisture (as in Table B.3) should be met at all times, regardless of occupancy. The other pollutants listed in Table B.1 are only of concern when the dwelling is occupied.

Note: that the moisture criteria to meet to avoid house dust mite allergens are more complex and demanding than that to meet to avoid mould. This document does not give guidance on the control of house dust mite allergens.

B.4 The performance criteria for indoor air pollutants are given in Table B.1. These are based on World Health Organisation (2010) guidance.

Table B.1 Indoor air pollutants guidance values ¹			
Pollutant		Exposure limit	Exposure time
Carbon monoxide		100 mg/m ³	15 minute average
		30 mg/m ³	1 hour average
Nitrogen dioxide (NO ₂)		200 µg/m ³	1 hour average
		40 µg/m ³	1 year average
Formaldehyde		100 µg/m ³	30 minute average
TVOC ²		300 µg/m ³	8 hour average

Notes:

1. There are no safe levels that can be recommended for benzene and trichloroethylene and as such they have not been considered for defining ventilation rates in dwellings. Source control may be the optimal strategy for reducing their concentration indoors.
2. 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.5.
3. 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.5 As an alternative to using TVOC, the individual VOCs may be used, where supported by robust independent evidence. 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]**

B.6 Control of bio-effluents (body odours) for people who have been exposed to the environment for a period of time will be achieved by an air supply rate of **4 litres per second per person (BS EN 16798-1:2019)**.

Assumptions used in applying performance criteria for dwellings in Section 1

General

B.7 Where the guidance for less airtight buildings is followed, dwellings are assumed to have an infiltration rate of **0.15 air changes per hour**.

B.8 Where the guidance for highly airtight buildings is followed, dwellings are assumed to have **no infiltration**.

B.9 Ventilation effectiveness is assumed to be 1.0 – that is, it is assumed that supply air is fully mixed with room air.

CIBSE Guide A provides further information on ventilation effectiveness.

Consultation version: not statutory guidance

B.10 For the purpose of this Approved Document, for all dwellings (new, and existing where Part F applies), the moisture criterion is likely to be met if, during the colder months of the year, the moving average **surface water activity** of the internal surfaces of external walls is always less than the value in Table B.3, evaluated over each moving average period.

Table B.3 is the primary basis for demonstrating compliance with the moisture criterion.

Table B.3 Surface water activity	
Moving average period	Surface water activity
1 month	0.75
1 week	0.85
1 day	0.95

B.11 For new dwellings, for the purpose of this Approved Document, the moisture criteria in Table B.3 are likely to be met if, during the colder months of the year the moving average relative humidity in a room is always less than the value given in Table B.4, evaluated over each moving average period.

Table B.4 Indoor air relative humidity water activity	
Moving average period	Surface water activity
1 month	65%
1 week	75%
1 day	85%

B.12 Table B.3 is used in the 2006 edition of Building Regulations Part F and Table B.4 is based on further research (Altamirano-Medina et al, 2009).

Extract ventilation

B.13 The main pollutant to be removed by **extract ventilation** is moisture. The moisture generation rates are taken from BS 5250:2011+A1:2016 Table D.4.

Consultation version: not statutory guidance

B.14 For intermittent extract:

- A ventilation rate of 60 l/s is specified for removing moisture generated in kitchens at a production rate of 2000 g/h.

A reduced ventilation rate of 30 l/s is used for a cooker hood, because of the greater ventilation effectiveness.

- A ventilation rate of 15 l/s is specified for removing moisture from **bathrooms** at a production rate of 400 g/h.
- A ventilation rate of 30 l/s is specified for removing moisture generated in utility rooms at a production rate of 1000 g/h.
- In WCs, a ventilation rate of 6 l/s has been specified to remove odours.

B.15 For continuous extract:

- The rates used in Table 2.1 are the same as used in the 2006 and 2010 editions of Approved Document F.

Whole dwelling ventilation

B.16 The **whole dwelling ventilation** rates in Table 1.3 are specified for removing moisture at the generation rates given in BS 5250:2011+A1:2016 Table D.4.

B.17 It is assumed that local extract removes the following percentages of moisture:

- moisture generated in the **bathroom**: 100%
- moisture generated in the kitchen: 50%.

B.18 The **whole dwelling ventilation** rate is based on winter weather conditions. During warmer spring and autumn periods, the moisture removal capacity of the outdoor air is less, and additional ventilation may be required. **Purge ventilation** (e.g. windows) may be used for this purpose.

B.19 Pollutants other than moisture must also be adequately controlled.

A minimum **whole dwelling ventilation** rate of 0.3 l/s per m² of internal floor area is specified to remove volatile organic compounds at a production rate of 300 µg/h per m² of floor area.

Consultation version: not statutory guidance

Basis of Table 1.3 – Whole dwelling ventilation rates

- B.20** To determine the ventilation rates, the air supply rates in Table 1.3 have been used.
- B.21** For **less airtight buildings**, the air supply rate is reduced by 0.15 air changes per hour to allow for **infiltration**.
- B.22** To determine the **equivalent areas**, the standard air flow equation has been used, as below:

$$A = 1000 \cdot (Q/C_d) \cdot (\rho / (2 \cdot \Delta P))^{0.5}$$

Where:

A = the **background ventilator equivalent area** (mm²)

Q = the air supply rate (l/s)

C_d = the discharge coefficient, taken as 0.61

ρ = the air density (kg/m³), taken as 1.2

ΔP = the pressure across the opening, which is taken as 0.6 Pa for single-storey dwellings and 1.0 Pa for multi-storey dwellings.

NOTE 1: the total actual **equivalent area** required (A_T) is double that derived from the equation above. The equation above provides the **equivalent area** only for air supplied to the dwelling. A similar **equivalent area** is required for air to exit the dwelling.

The total **equivalent area** determined in this way is given in the guidance for Systems 1 and 2

NOTE 2: when determining the difference between the indoor and outdoor pressure, both of the following were assumed:

- a wind speed of 4 m/s at 10 m above ground level (based on BS 5925:1991)
- an internal/external temperature difference of 15°C.

Purge ventilation

- B.23** A value of 4 air changes per hour has been selected because it provides a **purge ventilation** rate an order of magnitude above **whole building ventilation** assuming both:
- single-sided ventilation for a dwelling in an urban environment
 - an internal/external temperature difference of 3°C.

References

Altamirano-Medina H., Mumovic D., Davies M., Ridley I. and Oreszczyn T., (2009). *Guidelines to avoid mould growth in buildings*, Advanced Buildings Energy Research, 3, pp 221–236.

ASHRAE. Handbook 2007: HVAC applications.

BS 5250:2011+A1:2016 *Code of practice for the control of condensation in buildings*. BSI.

BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*, BSI.

BS EN 16798-1:2019 *Energy performance of buildings. Ventilation for buildings. Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics. Module M1-6*, BSI.

Department of the Environment (1994a). *Expert panel on air quality standards: Carbon monoxide*. London, HMSO.

www.defra.gov.uk/environment/airquality/panels/aqs/publications/index.htm.

Department of the Environment (1994b). *Expert panel on air quality standards: Ozone*. London, HMSO.

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Department of Health (2004). Committee on the Medical Effects of Air Pollutants. *Guidance on the effects on health of indoor air pollutants*.

Dimitroulopoulou C, Crump D, Coward S K D, Brown V, Squire R, Mann H, White M, Pierce B and Ross D (2005). *Ventilation, air tightness and indoor air quality in new homes*. Report BR 477. BRE bookshop.

ECA (1992). European Concerted Action on indoor air and its impact on man: *Guidelines for ventilation requirements in buildings*. Working Group Report No. 11. EUR 14449 EN. Commission of the European Communities, Luxembourg.

HSE (2003). *Occupational exposure limits 2002*, plus supplement 2003. HSE Books.

Ross D I and Wilde D (1999). *Continuous monitoring of nitrogen dioxide and carbon monoxide levels in UK homes*. Proceedings of the 8th International Conference on Indoor Air Quality and Climate, Indoor Air 99, Edinburgh 8-13 August 1999, Vol. 3, pp 147–152.

WHO (2010). *Guidelines for indoor air quality*. World Health Organisation, Geneva.

WHO (2005). *Air quality guidelines – global update*. World Health Organization, Geneva.

Appendix C: Completion checklist and commissioning sheet

C.1 This installation and commissioning checklist is divided into three parts:

- **Part 1** contains the particulars of the system, installation address and installer's details.
- **Part 2a** functions as an installation checklist.
- **Part 2b** is a visual inspection, or pre-commissioning, checklist.
- **Part 3** is for recording air flow measurements from fans.

Checking design against measured air flow rates

C.2 Measured air flow rates for all fans should be recorded on Part 3: Commissioning details, as part of the commissioning procedures given in Section 3 of this Approved Document. The measured values should be compared with their respective design values. Either:

- If the measured rate for each fan is equal to or greater than the design value: the design is complied with.
- If any measured value is less than the design value: adjustment should be made to correct the system. All air flows should then be re-measured. If necessary, further adjustments should be made until air flows meet the design values.

Demonstrating compliance

C.4 All three parts of the installation and commissioning checklist should be completed. The relevant parts of Parts 2 and 3 should be signed by a person who is both competent to install the system and responsible for installing and commissioning the system.

C.5 The three-part form should be completed for each installation address. A copy should be submitted to the **building control body** as evidence that the system is correctly installed, and has been correctly inspected and commissioned.

Consultation version: not statutory guidance

Part 1 – System details and declarations

The installer should complete this section and include details of the commissioning engineer.

1.1 Installation Address Details	
Dwelling name/number	
Street	
Locality	
Town	
County	
Post Code	
1.2 Installation Details	
System classification*	System
Enter natural ventilation, mechanical extract ventilation or mechanical extract and supply ventilation as defined by Approved Document F	
Manufacturer	
Model numbers	
Serial number (where available)	
Location of fan units	1. _____
	2. _____
	3. _____
	4. _____
	5. _____
1.3 Installation Engineer's Details	
Engineer's Name	
Company	
Address Line 1	
Address Line 2	
Telephone Number	
Post Code	
1.4 Commissioning Engineer's Details (if different to 1.3)	
Engineer's Name	
Company	
Address Line 1	
Address Line 2	
Telephone Number	
Post Code	

*Note. If a system has been installed that is not defined by Systems 1 to 4 in Approved Document F, further installation checks and commissioning procedures may be required. Seek guidance from the manufacturer for these systems.

Consultation version: not statutory guidance

Part 2a – Installation details

The installer should complete this section before commissioning is carried out.

2.1	Installation Checklist – General (all Systems)	Tick as appropriate	
	Has the system been installed in accordance with manufacturer's requirements?	Yes	No
	Have paragraphs 1.15 to 1.78 of Approved Document F volume 1 been followed (if relevant)?	Yes	No
	If there are any deviations from paragraphs 1.15 to 1.75 of Approved Document F volume 1, these should be detailed here.		
	Description of installed controls (e.g. timer, central control, humidistat, occupancy sensor, thermal bypass if applicable , etc)		
	Location of manual / override controls		
2.2	Installation Engineer's Declaration		
	Engineer's Signature		
	Registration Number (if applicable)		
	Date of Inspection		

Part 2b – Inspection of installation

The commissioning engineer should complete this section before completing Part 3.

2.3a	Visual Inspections – General (all Systems)		
	Total installed equivalent area of background ventilators in dwelling?		mm²
	Total floor area of dwelling?		m²
	Does the total installed equivalent ventilator area meet the requirements given in Table 2.1 or paragraph 1.56, as appropriate, in Approved Document F volume 1?	Yes	No
	Have all background ventilators been left in the open position?	Yes	No
	Have the correct number and location of extract fans/terminals been installed that satisfy Table 1.1 or Table 1.2 as appropriate in ADF?	Yes	No
	Is the installation complete, with no obvious defects?	Yes	No
	Do all internal doors have sufficient undercut to allow air transfer between rooms (e.g 10 mm over and above final floor finish)?	Yes	No
	Has all protection/packaging been removed (including background ventilators), such that system is fully functional?	Yes	No
	For ducted systems, has the ductwork been installed so that air resistance and leakage is kept to a minimum?	Yes	No
	Has the entire system been installed so that there is sufficient access for routine maintenance and to repair/replace components?	Yes	No
2.3b	Visual Inspections – General (Systems 3 and 4 only)		
	Have appropriate air terminal devices been installed to allow system balance?	Yes	No
	Has the heat recovery unit (mechanical supply and extract ventilation) and all ductwork been effectively insulated where installed in unheated spaces?	Yes	No
	Condensate connection is complete and condensate drains to an appropriate location (mechanical supply and extract ventilation only)?	Yes	No
2.3c	Other Inspections – General (Systems 1, 3 and 4 only)		
	Upon initial start-up, was there any abnormal sound or vibration, or unusual smell?	Yes	No

Consultation version: not statutory guidance

Part 3 – Commissioning details

The commissioning engineer should complete this section after completing Part 2b.

3.1 Commissioning Equipment				
Schedule of air flow measurement equipment used (model and serial)			Date of last UKAS calibration	
1.				
2.				
3.				
3.2 Air Flow Measurements – Intermittent extract fans only				
Fan reference (as 1.2)	Measured Extract Rate (l/s)	Design Extract Rate (l/s) Refer to Table 1.1 in ADF		
Extract Fan 1.				
Extract Fan 2.				
Extract Fan 3.				
Extract Fan 4.				
<i>For cooker hoods, only the highest setting needs to be recorded.</i>				
3.3 Air Flow Measurements (Extract) – Mechanical extract ventilation and mechanical supply and extract ventilation only				
Room reference (location of terminals)	Measured Air Flow High Rate (l/s)	Design Air Flow High Rate (l/s) Refer to Table 1.2 in ADF	Measured Air Flow Continuous rate (l/s)	Design Air Flow Continuous Rate (l/s) Refer to Table 1.3 in ADF
Kitchen.				
Bathroom				
En Suite				
Utility				
Other...				
Other...				
Other...				
3.4 Air Flow Measurements (Supply) – Mechanical supply and extract ventilation only				
Room reference (location of terminals)	Measured Air Flow High Rate (l/s)	Design Air Flow High Rate (l/s) Refer to Table 1.2 in ADF	Measured Air Flow Continuous Rate (l/s)	Design Air Flow Continuous Rate (l/s) Refer to Table 1.3 in ADF
Living Room 1				
Living Room 2 (if present)				
Dining Room				
Bedroom 1				
Bedroom 2				
Bedroom 3				
Bedroom 4				
Bedroom 5				
Study				
Other...				
3.5 Commissioning Engineer's Declaration				
Engineer's Signature				
Registration Number (if applicable)				
Date of Commissioning				

Appendix D: Standards referred to

BSI PD CR 1752:1999 *Ventilation for buildings – design criteria for the indoor environment.*

BS 5925:1991 *Code of practice for ventilation principles and designing for natural ventilation.* AMD 8930 1995.

BS 7913:2013 *Guide to the conservation of historic buildings*

BS EN 13141-1:2019 *Ventilation for buildings. Performance testing of components/products for residential ventilation. Externally and internally mounted air transfer devices.*

BS EN 13141-3:2017 *Ventilation for buildings. Performance testing of components/products for residential ventilation. Range hoods for residential use.*

BS EN 13141-4:2011 *Ventilation for buildings. Performance testing of components/products for residential ventilation. Fans used in residential ventilation systems.*

BS EN 13141-6:2014 *Ventilation for buildings. Performance testing of components/products for residential ventilation. Exhaust ventilation system packages used in a single dwelling.*

BS EN 13141-7:2010 *Ventilation for buildings. Performance testing of components/products for residential ventilation. Performance testing of a mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for single family dwellings.*

BS EN 13141-8:2014 *Ventilation for buildings. Performance testing of components/products for residential ventilation. Performance testing of unducted mechanical supply and exhaust ventilation units [including heat recovery] for mechanical ventilation systems intended for a single room.*

BS EN 13986:2004+A1:2015 *Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking.*

Appendix E: Documents referred to

Chartered Institution of Building Services Engineers (CIBSE)

CIBSE Guide A: *Environmental design*, 2016. ISBN 978 1 90328 766 8.

Health and Safety Executive (HSE)

HSG 193. *COSHH Essentials*.

L24 Workplace (Health, Safety and Welfare) Regulations 1992. *Approved Code of Practice and guidance*, 2001. ISBN 978 0 71760 413 5.

International Energy Agency (IEA)

Energy conservation in buildings and community systems. Annex 14: Condensation and energy. Volume 1: Source book (IEA) [1991]