

The Building Regulations 2010

Ventilation

APPROVED DOCUMENT



Volume 1: Dwellings

Requirement F1: Means of ventilation

Regulations: 39, 42 and 44

2021 edition – for use in England

2021 edition

This approved document supports Part F of Schedule 1 to the Building Regulations 2010.

This approved document takes effect on 15 June 2022 for use in England. It does not apply to work subject to a building notice, full plans application or initial notice submitted before that date, provided the work for each building is started before 15 June 2023. Full detail of the transitional arrangements can be found in Circular Letter 01/2021 published on gov.uk.

Introduction

What is an approved document?

Approved documents are approved by the Secretary of State and give practical guidance on common building situations about how to meet the requirements of the Building Regulations 2010 for England. Different approved documents give guidance on each of the technical parts of the regulations. These are all listed in the back of the approved documents. 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 are approved by the Secretary of State.

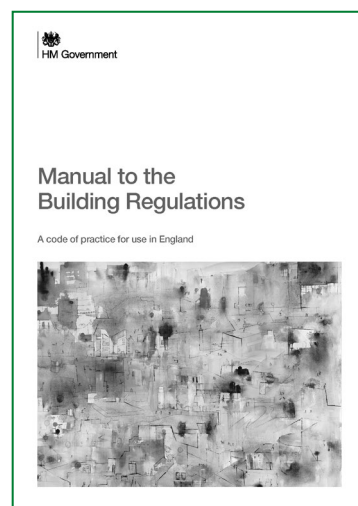
Each approved document covers the requirements of the Building Regulations 2010 relating to a different aspect of *building work*. *Building work* must also comply with all other applicable requirements of the Building Regulations 2010 and all other applicable legislation.

How is construction regulated in England?

Most *building work* being carried out in England must comply with the Building Regulations 2010. The Building Regulations are made under powers in the Building Act 1984.

Building Regulations protect the health and safety of people in and around buildings, they also provide for energy and water conservation and access to and use of buildings.

The *Manual to the Building Regulations* (references to this in the introduction are taken from the first edition) gives an overview of the building regulatory system in England. You can access the most recent version of the manual at: www.gov.uk/guidance/building-regulations-and-approved-documents-index.



How do you comply with the Building Regulations?

Building work must meet all relevant requirements of the Building Regulations. To comply with the Building Regulations, it is necessary both to follow the correct procedures and meet technical performance requirements.

The approved documents set out what, in ordinary circumstances, may be accepted as one way to comply with the Building Regulations. Note, however, that:

- Complying with the guidance in the approved documents does not guarantee that *building work* complies with the requirements of the regulations – the approved documents cannot cover all circumstances. Those responsible for *building work* must consider whether following the guidance in the approved documents is likely to meet the requirements in the particular circumstances of their case.
- There may be other ways to comply with the requirements than those described in an approved document. If those responsible for meeting the requirements prefer to meet a requirement in some other way than described in an approved document, they should seek to agree this with the relevant building control body at an early stage.

Those responsible for *building work* include agents, designers, builders, installers and the building owner. For further information, see Chapter 7 in Volume 1 and paragraphs A26, B2 and F2 in Volume 2 of the *Manual to the Building Regulations*.

The Building Regulations can be contravened by not following the correct procedures or not meeting the technical performance requirements. If the building owner or those responsible for the works contravene the Building Regulations, the local authority may prosecute them in the magistrates' court. For further information on enforcement and sanctions in the existing system, see Chapter B in Volume 2 of the *Manual to the Building Regulations*.

What do the Building Regulations cover?

'*Building work*' is a legal term for work covered by the Building Regulations. Where a building is not exempt, the Building Regulations apply to all types of *building work* as defined in regulation 3 of the Building Regulations. For further information, what constitutes *building work* is covered in Chapter A, Volume 2 of the *Manual to the Building Regulations*.

The Building Regulations contain sections dealing with definitions, procedures and the expected technical performance of *building work*. For example, the Building Regulations:

- a. define what types of building, plumbing and heating work is classed as *building work* in regulation 3 (for further information see paragraphs A14 to A16 in Volume 2 of the *Manual to the Building Regulations*).
- b. specify types of building that are exempt from the Building Regulations (for further information see Table A1 and paragraph A11 in Volume 2 of the *Manual to the Building Regulations*).
- c. set out the notification procedures to follow when undertaking *building work* (for further information see Figure 2.1 in Volume 1 of the *Manual to the Building Regulations*).
- d. set out the technical requirements (see Table 7.1 in Volume 1 of the *Manual to the Building Regulations*) with which the individual aspects of building design and construction must comply in the interests of the health and safety of building users, of energy efficiency (for further information see paragraphs A12(d)–(f), A14(f)–(h), A22, A23, B2(c) and F24 in Volume 2 of the *Manual to the Building Regulations*), and of access to and use of buildings.
- e. set out the standards for building materials and workmanship in carrying out *building work* (for further information see Chapter 7 in Volume 1, and paragraphs F8 to F11 in Volume 2 of the *Manual to the Building Regulations*).

When must a building control body be notified?

It is often necessary to notify a building control body of planned *building work*. To help ensure that work complies with the Building Regulations, those responsible for *building work* may need to use one of the two types of building control body listed below:

- a. a local authority building control body (for further information see Chapter B in Volume 2 of the *Manual to the Building Regulations*)
- b. an approved inspector (for further information see Chapter E in Volume 2 of the *Manual to the Building Regulations*).

If *building work* consists only of installing certain types of services or fittings (e.g. fuel-burning appliances or replacement windows) and the building owner employs an installer that is registered with a relevant competent person scheme designated in the regulations, a building control body does not need to be notified.

For further information about competent person schemes, see Chapter 5 in Volume 1 and Chapter C in Volume 2 of the *Manual to the Building Regulations*.

How to use this approved document

Each approved document contains:

- general guidance on the performance expected of materials and *building work* in order to comply with each of the requirements of the Building Regulations, and
- practical examples and solutions on how to achieve compliance for some of the more common building situations.

They may not provide appropriate guidance if the case is unusual in terms of its design, setting, use, scale or technology. Non-standard conditions may include any of the following:

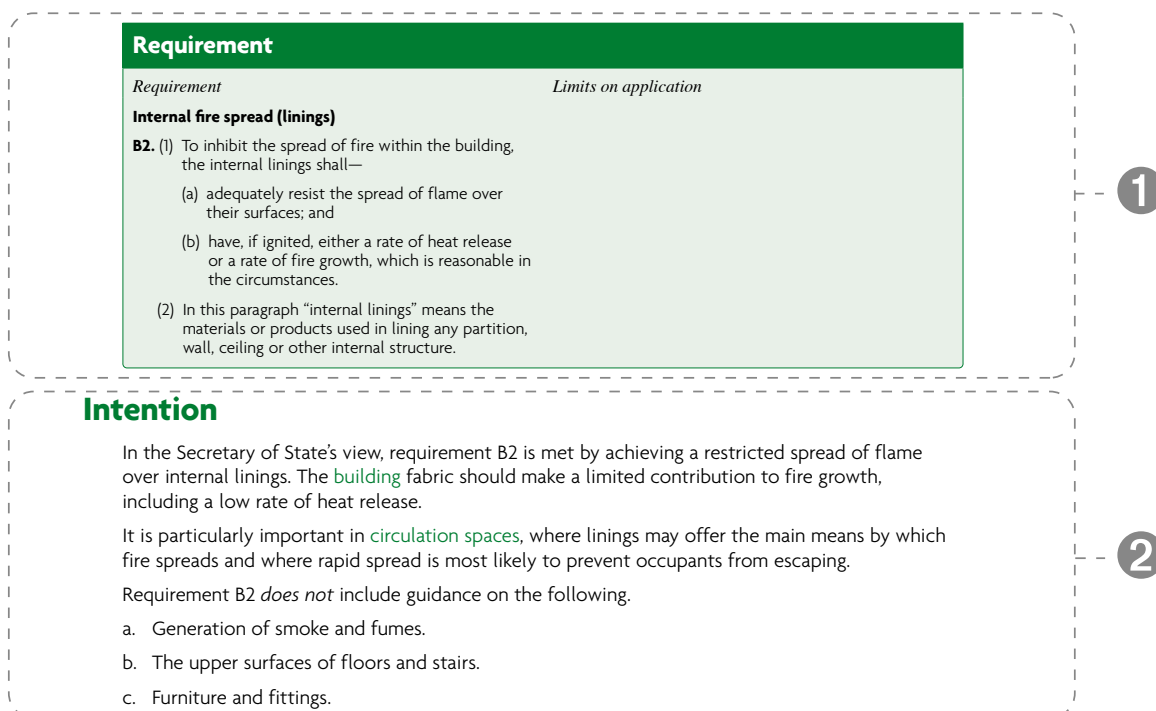
- difficult ground conditions
- buildings with unusual occupancies or high levels of complexity
- very large or very tall buildings
- large timber buildings
- some buildings that incorporate modern construction methods.

Anyone using the approved documents should have sufficient knowledge and skills to understand the guidance and correctly apply it to the *building work*. This is important because simply following the guidance does not guarantee that your *building work* will comply with the legal requirements of the Building Regulations. Each approved document contains legal requirements (which you must follow) and guidance (which you may or may not choose to follow). The text in a box with a green background at the beginning of each section of an approved document is taken from the Building Regulations. This text sets out the legal requirements.

The explanation which follows the legal requirements is guidance (see Diagram *i* below). The guidance then explains one or more ways to demonstrate how *building work* can be shown to comply with the legal requirements in common circumstances. The terms in **green lettering** in an approved document are key terms, listed and explained in the appendix to that approved document. Guidance in the approved documents addresses most, but not all, situations that building owners will face. Situations may arise that are not covered. You or your advisers will need to carefully consider whether following the guidance will mean that the requirements of the Building Regulations will be met.

B2**Requirement B2: Internal fire spread (linings)**

This section deals with the following requirement from Part B of Schedule 1 to the Building Regulations 2010.

**Key**

- 1 The law: extract from the Building Regulations 2010.
- 2 Statutory guidance.

Diagram *i* The relationship between regulations and guidance in the approved documents

For further information about the use of technical guidance, see Chapter 7 in Volume 1 and Chapter F in Volume 2 of the *Manual to the Building Regulations*.

Where to get further help

If you are unsure whether you have the knowledge and skills to apply the guidance correctly, or if you do not understand the technical guidance or other information in this approved document or the additional detailed technical references to which it directs you, you should seek further help. Some sources of help are listed below.

- a. Your building control body may be able to help in many cases.
- b. If you are registered with a competent person scheme, the scheme operator should be in a position to help.
- c. Suitably qualified and experienced construction professionals should also be engaged where necessary.

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Section 0: Introduction

Summary

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

Approved document section	Related Building Regulations requirements
Section 0: Introduction	n/a
Section 1: Ventilation provision	Requirement F1(1)
Section 2: Minimising the ingress of external pollutants	
Section 3: Work on existing dwellings	
Section 4: Commissioning and providing information	Requirement F1(2) and regulations 39, 42 and 44
Appendix A: Key terms	n/a
Appendix B: Performance-based ventilation	n/a
Appendix C: Completion checklist and commissioning sheet	n/a
Appendix D: Checklist for ventilation provision in existing dwellings	n/a
Appendix E: Standards referred to	n/a
Appendix F: Documents referred to	n/a

Application

- 0.3 The guidance in Approved Document F, Volume 1 applies only to **dwellings**.
For blocks of flats with **shared communal rooms**, Approved Document F, Volume 2: Buildings other than dwellings should be consulted.
NOTE: **Dwellings** are self-contained units. **Rooms for residential purposes** and buildings that contain only **rooms for residential purposes** are not **dwellings** and are covered by Approved Document F, Volume 2: Buildings other than dwellings.

Exemptions

- 0.4 Certain types of building are exempt from the Part F requirements of the Building Regulations. These are outlined in paragraphs A7 to A13 of the *Manual to the Building Regulations*.

Historic and traditional buildings

- 0.5 Work to the following types of **dwellings** may not need to comply fully with the **ventilation** standards in this approved document.
 - a. Those listed in accordance with section 1 of the Planning (Listed Buildings and Conservation Areas) Act 1990.

- b. Those in a conservation area designated in accordance with section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990.
 - c. Other historic buildings with a vapour-permeable construction that both absorbs moisture and readily allows moisture to evaporate. These include those built with wattle and daub, cob or stone and constructions using lime render or mortar.
- 0.6** Work to a building in paragraph 0.5 should comply with the **ventilation** standards in this approved document where reasonably practicable. The work should not result in either of the following outcomes.
- a. Unacceptably affect the significance of the listed building, conservation area or scheduled monument.
 - b. Increase the risk of long-term deterioration of the building fabric or fittings.
- 0.7** New extensions to historic and traditional **dwelling**s should comply with all **ventilation** standards in this approved document unless there is a need to match the external appearance or character of the extension to that of the host building.
- 0.8** The local authority's conservation officer should be consulted when undertaking work to a building in paragraphs 0.5a or 0.5b.

Emergency repairs

- 0.9** For emergency repairs, if it is not possible to notify the **building control body** in advance, the **building control body** should be notified as soon as possible. If the installer is registered with a competent person scheme, see Chapter 5 in Volume 1 and Chapter C in Volume 2 of the *Manual to the Building Regulations*.

Minor works

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

For mechanical **ventilation** and air-conditioning systems, minor works include any of the following.

- a. Replacing parts.
- b. Adding an output or control device if testing and adjusting the system would not affect its energy efficiency or would not be possible.
- c. Providing a self-contained mechanical **ventilation** or air-conditioning appliance when all the following apply.
 - i. Any electrical work is exempt from a requirement to give advance notice to a **building control body**.
 - ii. Testing and adjusting the system would not affect its energy efficiency or would not be possible.
 - iii. The appliance is not installed in a room that contains an open-flued combustion appliance.

Live/work units

- 0.11** A unit that contains both living accommodation and space for commercial purposes (e.g. for a workshop or office) should be treated as a **dwelling** if the commercial part can be reverted to domestic use.

- 0.12** The commercial part of the building can be reverted to domestic use if all of the following apply.
- There is direct access between the commercial space and the living accommodation.
 - The commercial space and living accommodation are within the same **thermal envelope**.
 - The living accommodation comprises a substantial proportion of the total area of the unit. What constitutes a 'substantial proportion' should be assessed on a case-by-case basis by the **building control body**.

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

Mixed-use developments

- 0.13** When constructing a **dwelling** as part of a larger building that contains other types of accommodation, sometimes called a mixed-use development, refer to the two volumes of Approved Document F as follows.
- For guidance on each individual **dwelling**, use this approved document: Approved Document F, Volume 1: Dwellings.
 - For guidance on the non-**dwelling** parts of the building, such as **shared communal rooms** and commercial or retail space, use Approved Document F, Volume 2: Buildings other than dwellings.

Selected key interactions with other parts of the Building Regulations

- 0.14** The approved documents set out what, in ordinary circumstances, may be accepted as one way to comply with the Building Regulations. Those designing or undertaking building work remain responsible for assessing, on a case-by-case basis, whether specific circumstances require additional or alternative measures to comply with the regulatory requirements. There are interactions between many of the requirements of the Building Regulations. Guidance on some key interactions is given below.

Interaction with Part B

- 0.15** The requirements of Part B apply if, for example, ducts pass through any of the following.
- A fire resisting structure.
 - A fire compartment.
 - A protected stairway.

0.16 This approved 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 specified in Approved Document B or Approved Document F should be applied in all cases.

Interaction with Part J

0.17 **Ventilation** fans might cause combustion gases to spill from open-flued appliances. These combustion gases might fill the room instead of going up the flue or chimney, even if the combustion appliance and fan are in separate rooms.

0.18 The guidance in Approved Document J should be followed when installing and testing **ventilation** appliances. Combustion appliances must operate safely whether or not fans are running.

Interaction with Part L

0.19 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 Part K and Part M

0.20 **Manual controls**, where provided for a **ventilation** device, should be within reasonable reach of the occupants. Follow the guidance in Approved Documents K and M.

Interaction with Part O

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

Requirement F1(1): Means of ventilation

This section deals with the requirements of Part F1(1) of Schedule 1 to the Building Regulations 2010.

Requirement	
<p><i>Requirement</i></p> <p>Means of ventilation</p> <p>F1. (1) There shall be adequate means of ventilation provided for people in the building.</p>	<p><i>Limits on application</i></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; b. which is used solely for storage; or c. which is a garage used solely in connection with a single dwelling.

Intention

In the Secretary of State's view, requirement F1(1) is met if the **dwelling** has a means of **ventilation** that achieves all of the following.

- 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, following the guidance on **extract ventilation** in paragraphs 1.17 to 1.22.
- b. Supplies a minimum level of outdoor air for occupants' health, following the guidance for **whole dwelling ventilation** in paragraphs 1.23 to 1.25.
- c. Rapidly dilutes indoor air pollutants, and disperses water vapour when necessary in **habitable rooms**, following the guidance for **purge ventilation** in paragraphs 1.26 to 1.31.
- d. Minimises the entry of external air pollutants, following the guidance in Section 2.
- e. Achieves all of the following, as far as is reasonably practicable.
 - i. Produces low levels of noise, following the guidance in paragraphs 1.5 to 1.7.
 - ii. Offers easy access for maintenance, following the guidance in paragraph 1.8.
 - iii. Provides protection from cold draughts.

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

Section 1: Ventilation provision

General

1.1 The aim of requirement F1(1) is to protect the health of occupants of the building by providing adequate **ventilation**. Without adequate **ventilation**, mould and internal air pollution 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, if it can be shown to the **building control body** that they satisfy requirement F1(1).

1.4 The **ventilation** rates set out in this approved document have been designed to meet the indoor pollutant levels in Appendix B where the outside air is of reasonable quality. In areas where the outside air is not of reasonable quality, Section 2 provides guidance on limiting the entry 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 doing all of the following.

- a. Correctly sizing and jointing ducts.
- b. Ensuring that equipment is appropriately and securely fixed, such as using resilient mountings where noise carried by the structure of the building could be a problem.
- c. Selecting appropriate equipment, including following paragraph 1.6.

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

1.7 Account should be taken of outside noise when considering whether openable windows are appropriate for **purge ventilation**.

NOTE: Although there is no requirement to undertake noise testing, achieving the levels in the following guidance would ensure good acoustic conditions. The average A-weighted sound pressure level for a ventilator operating under normal conditions and not at boost rates should not exceed both of the following.

- a. 30dB $L_{Aeq,T}^*$ for noise-sensitive rooms (e.g. bedrooms and living rooms) when a continuous mechanical **ventilation** system is running on its minimum low rate.
- b. 45dB $L_{Aeq,T}^*$ in less noise-sensitive rooms (e.g. kitchens and **bathrooms**) when a **continuous operation** system is running at the minimum high rate or an **intermittent operation** system is running.

* The noise index $L_{Aeq,T}$ is used in **BS 8233**, where T is the duration of the measurement. If the noise from the sound source is steady (i.e. fluctuating by up to 3dB), a measuring time of 1 minute will be adequate and the $L_{Aeq,1min}$ level will be similar to the dB(A) level used elsewhere. If the noise from the sound source fluctuates more than this, a longer measuring time (T) may be required, but the higher portion of the fluctuating level should be considered, and the sound may attract more attention due to the changes in level.

NOTE: Methods for measuring the sound power level produced by the fan unit of decentralised **extract ventilation**, centralised **extract ventilation** and balanced **mechanical ventilation with heat recovery** systems are described in **BS EN 13141**.

Access for maintenance

- 1.8** Reasonable access should be provided for maintaining **ventilation** systems, including all of the following.
- Providing access to replace filters, fans and coils.
 - Providing access points for cleaning ductwork.
 - Providing access for the general maintenance of the 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 operation** or **continuous operation**.
 - Whole dwelling 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 used intermittently 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 a combination of 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 equal level of performance.

Performance-based guidance

- 1.12** Performance criteria for acceptable levels of moisture and pollutants are given in Appendix B. **Ventilation** rates designed to meet the performance criteria are given in Tables 1.1 to 1.3.
- 1.13** Ventilator sizes for the whole **dwelling** are also provided in Table 1.7 to help designers comply with Part F of the Building Regulations in common situations.
- 1.14** Some **ventilation** system designs can, in certain circumstances, result in lower **ventilation** rates than those stated in Table 1.1 and Table 1.2 (e.g. systems with **automatic controls**). Where lower **ventilation** rates are proposed, **expert advice** should be obtained to demonstrate that the solution meets the performance standards in Appendix B.

Equivalent area of ventilators

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

Extract ventilation

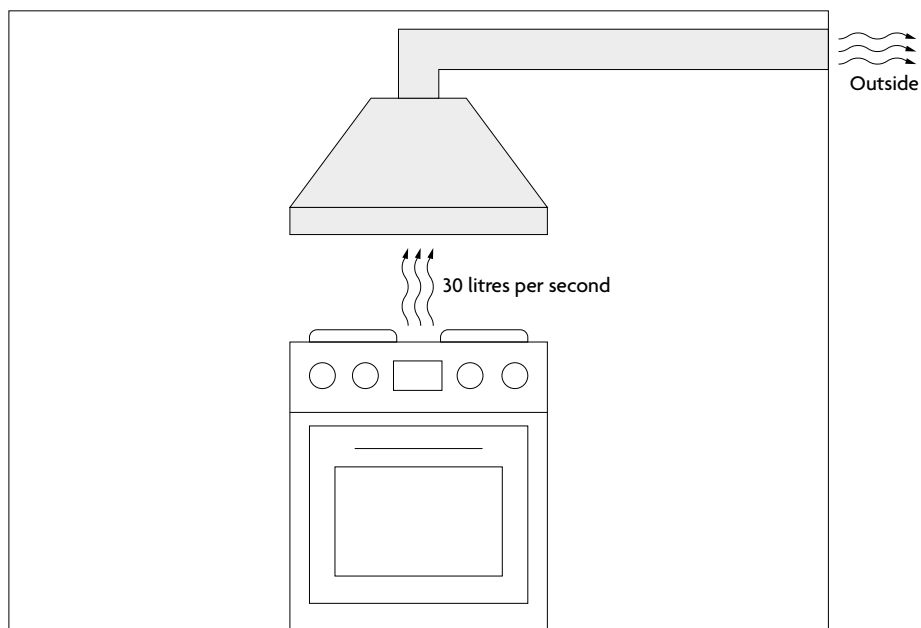
- 1.17** Extract ventilation to the outside should be provided in all of the following spaces.
- Kitchens.
 - Utility rooms.
 - Bathrooms.
 - Sanitary accommodation.
- 1.18** Extract ventilation can be intermittent or continuous.
- 1.19** Minimum extract ventilation rates in litres per second (l/s) for intermittent operation extract systems are given in Table 1.1. Minimum extract ventilation rates for continuous operation extract systems are given in Table 1.2.
- 1.20** Extract ventilation terminals and fans, not including cooker extract hoods, should be installed to comply with both of the following conditions.
- As high as is practicable in the room.
 - A maximum of 400mm below the ceiling.
- 1.21** 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 no specification is available, between 650mm and 750mm.

Table 1.1 Minimum extract ventilation rates for intermittent extract systems

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

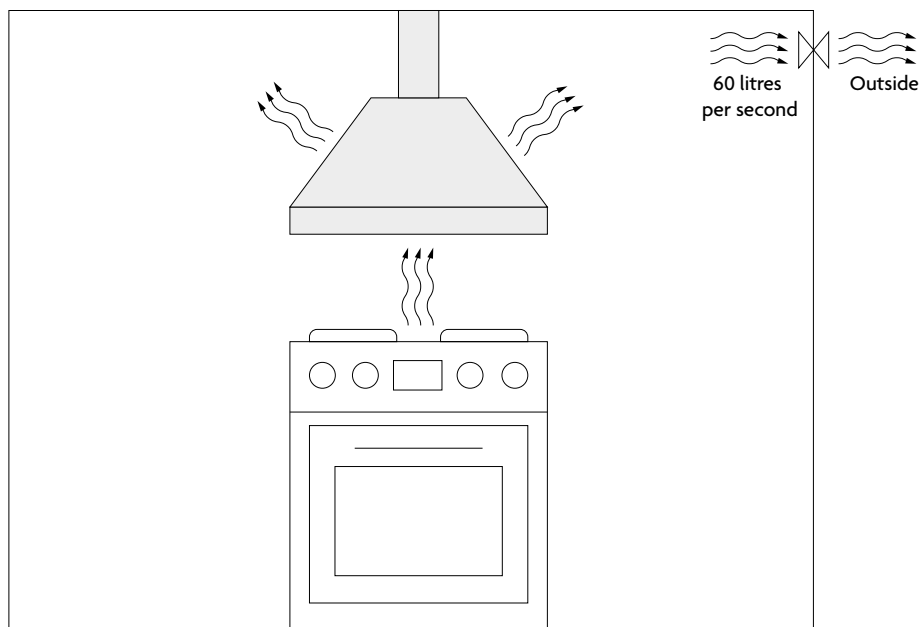
NOTES:

- See Diagram 1.1.
- See Diagram 1.2.
- As an alternative for sanitary accommodation, the purge ventilation guidance may be used.



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

Diagram 1.1 Minimum kitchen extract ventilation rate in cases where a cooker hood extracts to the outside⁽¹⁾



NOTE:
1. The diagram includes a recirculating cooker hood for illustration. A recirculating cooker hood on its own does not provide a means of ventilation that complies with Part F of the Building Regulations.

Diagram 1.2 Minimum ventilation rate for kitchen extract where a cooker hood does not extract to the outside⁽¹⁾

1.22 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 when additional extraction is required.

Table 1.2 Minimum extract ventilation rates for continuous extract systems⁽¹⁾

Room	High rate (l/s)	Continuous rate
Kitchen	13	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	
Bathroom	8	
Sanitary accommodation	6	

NOTE:

1. If the continuous rate of ventilation provided in a room is equal to or higher than the minimum high rate specified in the table, no extra ventilation is needed.

Whole dwelling ventilation

1.23 Supply air for the **dwelling** should be delivered through one of the following means.

- a. Continuous supply fans.
- b. **Background ventilators**.

1.24 The minimum **whole dwelling ventilation** rate for the supply of air to the **habitable rooms** in a **dwelling** should meet both of the following conditions.

- a. A minimum rate of 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-floor and first-floor areas).
- b. A minimum rate determined by the number of bedrooms, as specified in Table 1.3.

Table 1.3 Minimum whole dwelling ventilation rates determined by the number of bedrooms

Number of bedrooms ⁽¹⁾⁽²⁾	Minimum ventilation rate by number of bedrooms (l/s)
1	19
2	25
3	31
4	37
5	43

NOTES:

1. If the dwelling only has one habitable room, a minimum ventilation rate of 13l/s should be used.
2. For each additional bedroom, add 6l/s to the values in Table 1.3.

1.25 Internal doors should allow air to flow through the **dwelling** by providing a minimum **free area** equivalent to a 10mm undercut in a 760mm wide door. Doors should be undercut to achieve one of the following.

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

Purge ventilation

- 1.26** A system for **purge ventilation** should be provided in each **habitable room**.
- 1.27** **Purge ventilation** should be capable of extracting at least four air changes per hour per room directly to the outside.
- NOTE:** In order to demonstrate compliance with Part O of the Building Regulations it is likely that higher **purge ventilation** rates than those given in paragraph 1.29 will be required.
- 1.28** **Purge ventilation** should be delivered through one of the following means.
- Openings (e.g. windows or doors).
 - A mechanical **extract ventilation** system.
- 1.29** Where **purge ventilation** is delivered through openings in a **habitable room**, the minimum opening areas in Table 1.4 should be achieved. The values in Table 1.4 are based on **BS 5925**, which assumes all of the following.
- Single-sided **ventilation**.
 - An urban environment.
 - A wind speed of 2.1 metres per second (m/s).
 - A temperature difference of 3°C between the air inside and outside the building.
- 1.30** Depending on the **dwelling** design or the external climate, it may be possible in certain circumstances to achieve four air changes per hour with smaller openings. If smaller openings than those given in Table 1.4 are specified, **expert advice** should be sought to ensure that the design complies with requirement F1(1).

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

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

Performance testing

- 1.32** 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 standards 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.

Table 1.5 Performance testing standards

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 standards for both of the following: a. air flow from outside to inside the dwelling b. air flow from inside the dwelling to outside
Continuous mechanical extract ventilation systems	BS EN 13141-6
Mechanical ventilation with heat recovery	BS EN 13141-7 BS EN 13141-8 – for internal and external leakage and for mixing, the unit should meet at least Class U4 of the standard

Control of ventilation

- 1.33** Ventilation should be controllable. Controls may be either manual (i.e. operated by the occupant) or automatic.
- 1.34** Background ventilators should be at least 1700mm above floor level, to reduce cold draughts, but still be easy for the occupant to reach.
- NOTE:** Background ventilators are intended to normally be left open.
- 1.35** Continuously running fans should be set up to operate without occupant intervention but may have manual or automatic controls for selecting the high rate of operation. 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.
- 1.36** 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.
- 1.37** Other types of automatic controls might be suitable. Where present, automatic controls should operate according to the need for ventilation in the space. Background ventilators with automatic controls should also have manual override.
- NOTE:** Where a combustion appliance is installed, any automatic controls must also ensure that the ventilation provided meets the requirements of Part J of the Building Regulations.

Ventilation systems for dwellings with basements

- 1.38** In addition to paragraphs 1.12 to 1.37, the performance required for ventilation systems for dwellings with basements would be achieved by following the guidance in paragraphs 1.39 to 1.41.
- 1.39** A dwelling that includes a basement connected to the above ground parts of the dwelling by a large permanent opening (e.g. an open stairway), may be treated as a multi-storey dwelling when following the guidance in this approved document 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, expert advice should be sought.

- 1.40** A **dwelling** with a **basement** that is not connected to the rest of the **dwelling** above ground level by a large **permanent opening** should be considered as follows.
- The part of the **dwelling** above ground level should be considered separately.
 - The **basement** should be treated separately as a single-storey **dwelling** above ground level.
 - If the **basement** has no bedrooms, it should be treated as having one bedroom when calculating the **ventilation** required for the purposes of meeting the **ventilation** standards.
- 1.41** A **dwelling** that is *only* a **basement** should be treated as a single-storey **dwelling** above ground level. In such circumstances, the guidance for **dwelling**s without **basements** should be followed. The guidance on **natural ventilation**, however, is not appropriate for a **dwelling** that is only a **basement**.

Ventilation of a habitable room through another room

- 1.42** If a **habitable room** does not contain windows that can be opened (e.g. an internal room), the requirement to provide adequate **ventilation** can be met using paragraphs 1.43 and 1.44. This guidance can be used if the room is ventilated through either of the following.
- Another **habitable room**.
 - A conservatory.
- 1.43** The **habitable room** or conservatory should have openings to the outside to provide both of the following.
- Purge ventilation** with a minimum total area given in paragraph 1.29, based on the combined floor area of the **habitable rooms** (or the **habitable room** and the conservatory).
 - Background **ventilation** of at least 10,000mm² **equivalent area**.
- 1.44** Between the two rooms there should be a **permanent opening** with a minimum area of 1/20 of the combined floor area of the two rooms (see Diagram 1.3).

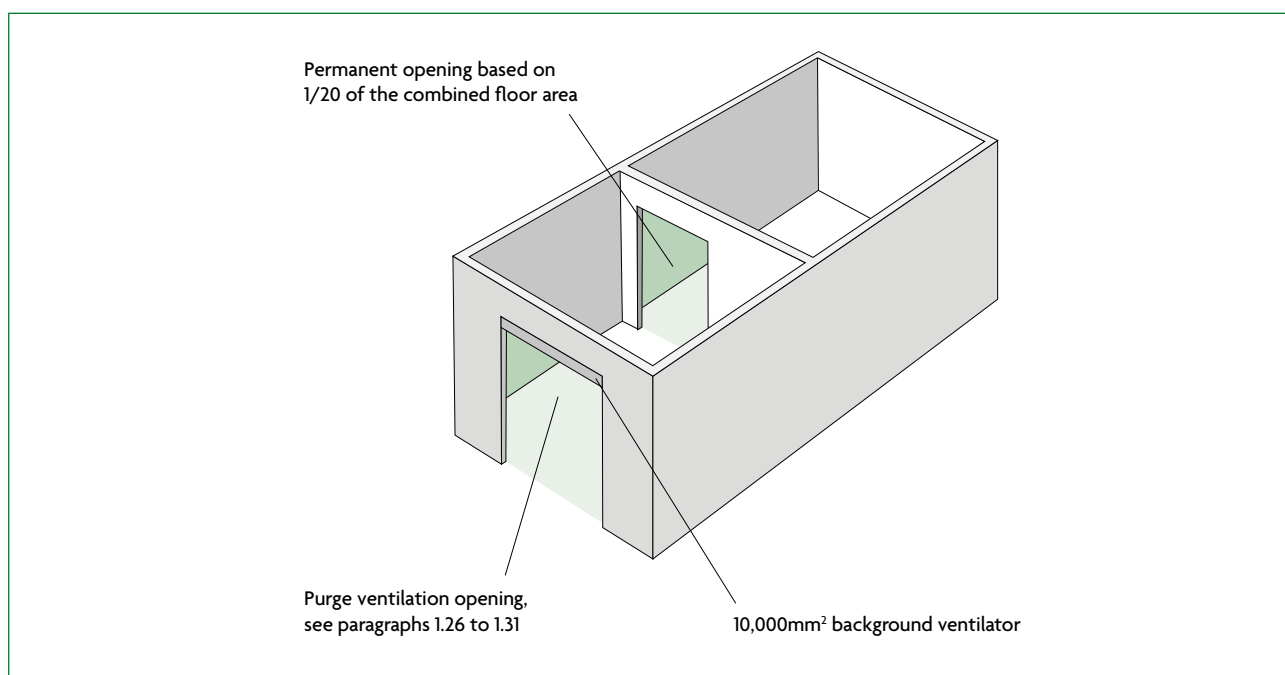


Diagram 1.3 Two habitable rooms treated as one room for ventilation purposes

System-specific guidance

1.45 Paragraphs 1.46 to 1.73 give guidance for the types of ventilation system listed in Table 1.6.

Table 1.6 Types of ventilation system

System type	Dwellings covered by the guidance
Natural ventilation (paragraphs 1.47 to 1.59)	Less airtight dwellings
Continuous mechanical extract ventilation (paragraphs 1.60 to 1.66)	All dwellings
Mechanical ventilation with heat recovery (paragraphs 1.67 to 1.73)	All dwellings

NOTE: For situations outside the scope of Table 1.6, expert advice should be sought for the design, sizing and position of ventilators to provide effective ventilation.

NOTE: As defined in Appendix A, less airtight dwellings are dwellings which have one of the following.

- A design air permeability higher than $5\text{m}^3/(\text{h}\cdot\text{m}^2)$ at 50Pa.
- An as-built air permeability higher than $3\text{m}^3/(\text{h}\cdot\text{m}^2)$ at 50Pa.

1.46 Where a dwelling has natural ventilation and a measured air permeability that differs from the design air permeability, so that it is defined as a highly airtight dwelling, one of the following applies.

- Expert advice should be sought.
- A continuous mechanical extract ventilation system should be installed by following the guidance in paragraphs 1.60 to 1.66.

NOTE: Continuous mechanical extract ventilation systems are available as decentralised options. An intermittent extract fan may be replaced with a decentralised continuous mechanical extract ventilation system fan.

Natural ventilation with background ventilators and intermittent extract fans (guidance suitable only for less airtight dwellings)

Intermittent extract

1.47 Intermittent extract fans should be fitted in all wet rooms. For kitchens, utility rooms, bathrooms and sanitary accommodation, the extract rates in Table 1.1 can be met using an intermittent extract fan.

1.48 If a wet room has no external walls, the intermittent extract fan should extract at four air changes per hour to meet the purge ventilation standards in paragraphs 1.26 to 1.31.

1.49 For sanitary accommodation, extract rates can be met using windows by following the purge ventilation guidance in paragraphs 1.26 to 1.31.

1.50 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.

1.51 In a room with no openable window, an intermittent extract fan should be provided with controls which continue to operate the fan for at least 15 minutes after the room is vacated.

Background ventilators

1.52 All rooms with external walls should have background ventilators. If a habitable room has no external walls, paragraphs 1.42 to 1.44 should be followed.

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

- a. The risk of draughts.
- b. Security issues.
- c. The difficulty of measuring the equivalent area.

- 1.53** If the dwelling has more than one exposed façade, the area of background ventilators on each façade should be similar, to allow cross-ventilation.
- 1.54** If an exposed façade is close to an area of sustained and loud noise (e.g. a main road), then a noise attenuating background ventilator should be fitted.
- 1.55** If fans and background ventilators are fitted in the same room, they should be at least 500mm apart.
- 1.56** The minimum total area of background ventilators in each room should follow the guidance in Table 1.7.
- 1.57** The total number of ventilators installed in the dwelling's habitable rooms and kitchens should be at least the following.
 - a. Four ventilators if the dwelling has one bedroom.
 - b. Five ventilators if the dwelling has more than one bedroom.
- 1.58** If the dwelling has a kitchen and living room which are not separate rooms, at least three ventilators of the same area as for other habitable rooms in Table 1.7 should be provided in the open-plan space.

Table 1.7 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
Habitable rooms ⁽²⁾⁽³⁾	8000mm ²	10,000mm ²
Kitchen ⁽²⁾⁽³⁾	8000mm ²	10,000mm ²
Utility room	No minimum	No minimum
Bathroom ⁽⁴⁾	4000mm ²	4000mm ²
Sanitary accommodation	No minimum	No minimum

NOTES:

1. The use of this table is not appropriate in any of the following situations and expert advice should be sought.
 - If the dwelling has only one exposed façade.
 - If the dwelling has at least 70% of its openings on the same façade.
 - If a kitchen has no windows or external façade through which a ventilator can be installed.
2. Where a kitchen and living room accommodation are not separate rooms (i.e. open plan), no fewer than three ventilators of the same equivalent area as for other habitable rooms should be provided within the open-plan space.
3. The total number of ventilators installed in a dwelling's habitable rooms and kitchens should be no fewer than five, except in one-bedroom properties, where there should be no fewer than four.
4. If a bathroom has no window or external façade through which a ventilator can be installed, the minimum equivalent area specified should be added to the ventilator sizes specified in other rooms.

Purge ventilation

1.59 For **purge ventilation**, follow paragraphs 1.26 to 1.31.

Continuous mechanical extract ventilation

1.60 A **continuous mechanical extract ventilation** system could consist of one of the following.

- a. A central extract system.
- b. Individual room extract fans.
- c. A combination of a central extract system and individual room extract fans.

1.61 If an exhaust air terminal is located on a façade that is exposed to the prevailing wind, measures should be taken to minimise likely wind effects. Solutions could include the following.

- a. Ducting to another façade.
- b. Use of constant volume flow rate units.
- c. Seeking **expert advice**.

Ventilation rates

1.62 The total combined rate of **continuous mechanical extract ventilation** in the **dwelling** should be at least the **whole dwelling ventilation** rate in Table 1.3.

1.63 Each **wet room** should have a minimum **continuous mechanical extract ventilation** high rate as given in Table 1.2.

Background ventilators for continuous mechanical extract ventilation

1.64 Where **continuous mechanical extract ventilation** is used, **background ventilators** should satisfy all of the following conditions.

- a. Not be in **wet rooms**.
- b. Provide a minimum **equivalent area** of 4000mm² for each **habitable room** in the **dwelling**.
- c. Provide a minimum total number of ventilators that is the same as the number of bedrooms plus two ventilators (i.e. a one-bedroom **dwelling** should have three **background ventilators**, a two-bedroom **dwelling** should have four **background ventilators**, etc.).

1.65 If a **habitable room** has no external walls, paragraphs 1.42 to 1.44 should be followed.

Purge ventilation

1.66 For **purge ventilation**, follow paragraphs 1.26 to 1.31.

Mechanical ventilation with heat recovery

Ventilation rates

1.67 For **dwelling**s using **mechanical ventilation with heat recovery**, each **habitable room** should have mechanical supply **ventilation**. The total supply air flow should be distributed proportionately to the volume of each **habitable room**.

1.68 Mechanical supply terminals should be located and directed to avoid draughts.

1.69 The minimum total continuous rate of **mechanical ventilation with heat recovery** is the **whole dwelling ventilation** rate in Table 1.3.

- 1.70** For dwellings using mechanical ventilation with heat recovery, each wet room should have a minimum continuous mechanical extract ventilation high rate as given in Table 1.2.
- 1.71** Mechanical ventilation with heat recovery systems should be designed to avoid the moist air from the wet rooms recirculating to the habitable rooms.

Background ventilators

- 1.72** To avoid unintended air pathways, background ventilators should not be installed with mechanical ventilation with heat recovery.

Purge ventilation

- 1.73** For purge ventilation follow paragraphs 1.26 to 1.31.

NOTE: The efficiency of mechanical ventilation with heat recovery systems should improve as the dwelling becomes more airtight.

Installation of ventilation systems

- 1.74** Ventilation systems should be installed to meet both of the following conditions.
- Comply with the guidance in this approved document.
 - Not compromise the performance of the system.
- 1.75** Adequate space should be available for access to maintain ventilation equipment.
- 1.76** Rigid ducts should be used wherever possible.
- 1.77** Flexible ductwork, where installed, should meet all of the following conditions.
- Only used for final connections.
 - Lengths should be a maximum of 1.5m.
 - Meet the standards of BSRIA's BG 43/2013.
- 1.78** Any flexible ducts should be installed so that the full internal diameter is maintained and flow resistance is minimised. This is achieved by taking both of the following actions.
- Pulling the duct taut.
 - Ensuring that ductwork does not pass through orifices with a smaller diameter than the duct itself.
- 1.79** Ductwork installations should be designed and installed to minimise the overall pressure losses within the system by taking all of the following steps.
- Minimising the overall length of duct.
 - Minimising the number of bends required.
 - Installing appropriately sized ducts for the air flow rate.
- 1.80** Each air terminal should have a free area of at least 90% of the free area of its associated duct.

- 1.81** Duct connections should be both mechanically secured and adequately sealed to prevent leaks. Rigid connectors and jubilee clips should be used for flexible ducting to ensure a good seal.
- 1.82** The installer should make a visual inspection to confirm both of the following.
- a. There are no obvious defects.
 - b. All packaging has been removed.
- 1.83** 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 4 of this approved document.

Section 2: Minimising the ingress of external pollutants

- 2.1 **Ventilation** systems should be designed to minimise the intake of external air pollutants following paragraphs 2.2 to 2.9 if either of the following applies.
- a. The pollutant values in the location of the **dwelling** exceed any of the limits in Table 2.1. This may have been determined through an air quality assessment. Where modelling or monitoring data is required, **expert advice** should be sought.
 - b. The **dwelling** is located near to any of the following sources of significant local pollution.
 - i. Road traffic, including traffic junctions and underground car parks.
 - ii. Combustion plant (such as heating appliances) running on conventional fuels, most commonly natural gas.
 - iii. Other combustion processes (for example, waste incineration, thermal oxidation abatement systems).
 - iv. Discharges from industrial processes.
 - v. Fugitive (i.e. not effectively controlled) discharges from industrial processes and other sources.
 - vi. Exhaust discharges from building **ventilation** systems.
 - vii. Construction and demolition sites, which are a source of particles and vaporous discharges.
 - viii. Other significant sources of local air pollution which may be detrimental to health.

Table 2.1 Limit values from Schedule 2 to the Air Quality Standards Regulations 2010

Pollutant	Exposure limit	Exposure time
Carbon monoxide	10mg/m ³	8-hour average
Sulphur dioxide	350µg/m ³	1-hour average
	125µg/m ³	1-day average
Nitrogen dioxide	200µg/m ³	1-hour average
	40µg/m ³	1-year average
Benzene	5µg/m ³	1-year average
Lead	0.5µg/m ³	1-year average
PM _{2.5}	25µg/m ³	1-year average
PM ₁₀	50µg/m ³	1-day average
	40µg/m ³	1-year average

NOTE: This section only gives guidance for typical situations. **Expert advice** may also be able to provide additional guidance on the suitability of other technologies to minimise the intake of external air pollutants, including filtration.

Control of ventilation intakes

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

NOTE: CIBSE's TM64 and TM40 give further guidance.

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

- a. As high as possible.
- b. Located on the less polluted side of the building.

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

2.4 If practicable, ventilation intakes should not be located in courtyards or enclosed urban spaces where air pollutants are discharged. If this is unavoidable, intakes should be located to meet both of the following conditions.

- a. As far as possible from the source of pollutants.
- b. In an open or well-ventilated area.

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

2.6 Where sources of pollution vary with the time of day, such as urban road traffic, it may be acceptable, for time-limited periods, to take one of the following actions.

- a. Reduce the flow of external air into ventilation intakes.
- b. Close ventilation intakes when the concentrations of external pollutants are highest.

NOTE: In these circumstances, expert advice should be sought.

Location of exhaust outlets

2.7 Exhaust outlets should be located so that both of the following are achieved.

- a. Re-entry of exhaust air into a building, or entry into nearby buildings, is minimised.
- b. There is no harmful effect on the surrounding area.

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

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

- a. Courtyards.
- b. Enclosures.
- c. Architectural screens.

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

Section 3: Work on existing dwellings

General

- 3.1** When building work in an existing **dwelling** includes work on **ventilation**, for example:
- adding a **habitable room**
 - adding a **wet room**
 - replacing part of the **ventilation** system, including extract fans
- the work should meet the relevant standards in this approved document.
- 3.2** When other building work is carried out that will affect the **ventilation** of the existing **dwelling**, for example:
- replacing a window or door
 - doing energy efficiency work
- the **ventilation** of the **dwelling** should either:
- meet the standards in the relevant approved document
 - not be less satisfactory than before the work was carried out.
- NOTE:** **Ventilation** through **infiltration** should be considered to be part of the **ventilation** provision of a **dwelling**. Reducing **infiltration** might reduce the indoor air quality of the **dwelling** below the standards given in Appendix B.
- 3.3** For common types of work, the requirements of paragraphs 3.1 and 3.2 may be demonstrated by following the guidance detailed below.
- For installing energy efficiency measures excluding window replacement, paragraphs 3.6 to 3.13.
 - For installing energy efficiency measures including window replacement, paragraphs 3.6 to 3.13 and 3.14 to 3.16.
 - For replacing windows only, paragraphs 3.14 to 3.16.
 - For the addition of a **habitable room**, paragraphs 3.17 to 3.20.
 - For the addition of a conservatory, paragraphs 3.21 to 3.24.
 - For the addition of a **wet room**, paragraphs 3.25 to 3.29.
 - For refurbishing a kitchen or **bathroom**, paragraphs 3.30 to 3.32.
 - For work done to improve the **ventilation** of the **dwelling** that was not triggered by the building work in (a) to (g), Section 1 should be followed.
- 3.4** Other **ventilation** solutions than those detailed here may be used, as long as it can be demonstrated to a **building control body** that they comply with the requirements of paragraphs 3.1 and 3.2.

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

NOTE: **Ventilation** equipment is considered to be a ‘controlled service or fitting’ and providing or extending this equipment in or in connection with a building is considered to be building work.

NOTE: Some building work does not need to be notified to the local authority. Details of such work are set out in the *Manual to the Building Regulations*.

Installing energy efficiency measures

- 3.6** Many existing **dwellings** are ventilated through **infiltration** rather than purposeful **ventilation**. Energy efficiency measures carried out on existing **dwellings** might reduce **infiltration** and cause the **dwelling** to become under-ventilated.

Building work should not reduce the **ventilation** provision of the **dwelling** unless it can be demonstrated that the **ventilation** provision after the work is carried out meets the minimum standards of requirement F1(1).

- 3.7** When carrying out energy efficiency measures to an existing **dwelling**, an assessment should determine what, if any, additional **ventilation** provision is needed, based on the estimated impact of the work. The assessment should be carried out by one of the following means.
- Applying the simplified method in paragraphs 3.8 to 3.13.
 - Seeking **expert advice**, which may include carrying out an **air permeability** test that follows the procedures given in Approved Document L, Volume 1: Dwellings.

NOTE: Following **BSI PAS 2035** is considered to be an adequate means of demonstrating compliance with paragraph 3.6.

Simplified method

NOTE: The simplified method set out in paragraphs 3.8 to 3.13 is designed to apply to an existing **dwelling** that is assumed to have adequate means of **ventilation** through a combination of **purpose-provided ventilation** and **infiltration**. If the property differs significantly from this assumption, the requirements of paragraph 3.6 must still be met. This should be demonstrated through seeking **expert advice** or using another suitable method.

- 3.8** When carrying out energy efficiency measures on an existing **dwelling**, Table 3.1 should be used to calculate the number of major and minor energy efficiency measures involved. This calculation should include all of the following.
- Energy efficiency measures fitted since the original **dwelling** was constructed, to consider accumulation of measures.
 - Energy efficiency measures planned.

NOTE: Where specific energy efficiency measures are not included in Table 3.1, the most similar category should be chosen instead.

- 3.9** Diagram 3.1 should then be used to determine the category that the works result in.

Table 3.1 Energy efficiency measures

	Category of measure
Roof insulation	
a. Renewing loft insulation, including effective edge sealing at junctions and penetrations	Minor
b. Loft conversions or works that include changing a cold loft (insulation at ceiling level) to a warm loft (insulation at roof level)	Minor
Wall insulation	
c. Installing cavity wall insulation to any external wall	Minor
d. Installing external or internal wall insulation to less than or equal to 50% of the external wall area	Minor
e. Installing external or internal wall insulation to more than 50% of the external wall area	Major
Replacement of windows and doors⁽¹⁾	
f. Replacing less than or equal to 30% of the total existing windows or door units	Minor
g. Replacing more than 30% of the total existing windows or door units	Major
Draught-proofing (other than openings)⁽²⁾	
h. Replacing a loft hatch with a sealed/insulated unit	Minor
i. Sealing around structural or service penetrations through walls, floors or ceiling/roof	Minor
j. Sealing and/or insulating a suspended ground floor	Major
k. Removing chimney or providing another means of sealing over chimney, internally or externally	Major

NOTES:

1. If the energy efficiency works involve only replacing windows, then the guidance in paragraphs 3.14 to 3.16 may be followed as an alternative means of demonstrating compliance.
2. Draught-proofing measures might not, on their own, constitute building work. This work may be controllable under the Building Regulations if carried out as part of other building work.

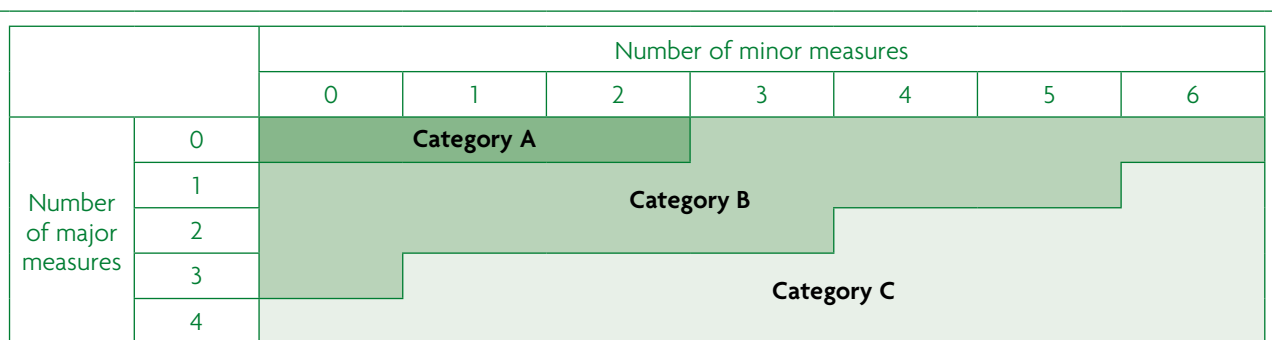


Diagram 3.1 Chart for categorising impact on ventilation when carrying out works in existing dwellings

3.10 If the method in Diagram 3.1 results in the work being categorised as Category A, it is likely that the energy efficiency measures have *not* reduced the ventilation provision of the dwelling below the requirements of F1(1) so no further ventilation provision is necessary.

- 3.11** If the method in Diagram 3.1 results in the work being categorised as Category B, it is likely that the **ventilation** provision of the **dwelling** has been reduced below the requirements of F1(1). Further **ventilation** provision should be provided by one of the following means.
- Natural ventilation**, by following the system-specific guidance in paragraphs 1.47 to 1.59. It is assumed that any existing purpose-built ventilators are in working order and that the **equivalent area** has not been compromised.
 - Continuous mechanical extract ventilation**, by following the system-specific guidance in paragraphs 1.60 to 1.66.
 - Mechanical ventilation with heat recovery**, by following the system-specific guidance in paragraphs 1.67 to 1.73. To avoid unintended air pathways, existing **background ventilators** should be covered or sealed shut.
- 3.12** If the method in Diagram 3.1 results in the work being categorised as Category C, it is likely that the **ventilation** provision of the **dwelling** has been reduced *significantly* below the requirements of F1(1). Further **ventilation** should be provided by one of the following means.
- Natural ventilation**, by following **expert advice** for the design, sizing and positioning of ventilators to ensure adequate **ventilation** provision.
 - Continuous mechanical extract ventilation**, by following the system-specific guidance in paragraphs 1.60 to 1.66.
 - Mechanical ventilation with heat recovery**, by following the system-specific guidance in paragraphs 1.67 to 1.73. To avoid unintended air pathways, existing **background ventilators** should be covered or sealed shut.
- 3.13** Appendix D provides a checklist for determining the **ventilation** provision in an existing **dwelling**. It may be used before energy efficiency measures are carried out to establish whether an existing **dwelling** complies with the requirement for adequate means of **ventilation**.

Replacing windows

Existing windows with background ventilators

- 3.14** If the existing windows have **background ventilators**, the replacement windows should include **background ventilators**. The new **background ventilators** should comply with both of the following conditions.
- Not be smaller than the **background ventilators** in the original window.
 - Be controllable either automatically or by the occupant.

If the size of the **background ventilators** in the existing window is not known, the ventilator sizes in paragraph 3.15 may be applied.

Existing windows without background ventilators

- 3.15** Replacing the windows is likely to increase the **airtightness** of the **dwelling**. If **ventilation** is not provided via a **mechanical ventilation with heat recovery** system, then increasing the **airtightness** of the building may reduce beneficial **ventilation** in the building. In these circumstances, it is necessary to ensure that the **ventilation** provision in the **dwelling** is no worse than it was before the work was carried out. This may be demonstrated in any of the following ways.

- a. Incorporating **background ventilators** in the replacement windows equivalent to the following.
 - i. **Habitable rooms** – minimum 8000mm² **equivalent area**.
 - ii. **Kitchen** – minimum 8000mm² **equivalent area**.
 - iii. **Bathroom** (with or without a toilet) – minimum 4000mm² **equivalent area**.
- b. If the **dwelling** will have **continuous mechanical extract ventilation**, installing **background ventilators** in any replacement windows which are not in **wet rooms**, with a minimum **equivalent area** of 4000mm² in each **habitable room**.
- c. Other **ventilation** provisions, if it can be demonstrated to a **building control body** that they comply with the requirements of paragraph 3.2.

NOTE: If it is not technically feasible to adopt the minimum **equivalent areas** set out in paragraph 3.15, the **background ventilators** should have **equivalent areas** as close to the minimum value as is feasible.

3.16 When windows are replaced as part of the work connected with a **material change of use**, Section 1 of this approved document should be followed in addition to paragraphs 3.14 and 3.15.

Addition of a habitable room (not including a conservatory) to an existing dwelling

3.17 The requirement for adequate **ventilation** can be met if **background ventilators** are used as follows.

- a. If the additional room is connected to an existing **habitable room** which now has no windows opening to the outside, paragraphs 1.42 to 1.44 should be followed
- b. If the additional room is connected to an existing **habitable room** that still has windows opening to the outside, the following conditions apply.
 - i. If the **existing habitable room** has a total **background ventilator equivalent area** of less than 5000mm², paragraphs 1.42 to 1.44 should be followed.
 - ii. If the existing **habitable room** has a total **background ventilator equivalent area** of at least 5000mm², both of the following should be provided.
 - **Background ventilators** of at least 12,000mm² **equivalent area** between the two rooms.
 - **Background ventilators** of at least 12,000mm² **equivalent area** between the additional room and the outside.

3.18 As an alternative to paragraph 3.17, to ventilate the additional **habitable room**, one of the following methods could be used.

- a. A single-room **heat recovery** ventilator. The supply rate to the additional room should be determined as follows.
 - i. Establish the **whole dwelling ventilation** rate from Table 1.3.
 - ii. Calculate the room supply rate required from the following equation.

$$\frac{(\text{whole dwelling ventilation rate} \times \text{Room volume})}{(\text{Total volume of all habitable rooms})}$$

- b. If the **dwelling** already has mechanical **ventilation**, the centralised system could be extended into the additional room.
- 3.19** For **purge ventilation** in a new **habitable room** in a **dwelling**, paragraphs 1.26 to 1.31 should be followed.
- 3.20** For a new **habitable room** in a **dwelling**, **ventilation** location should follow paragraphs 1.9 to 1.31, performance testing should follow paragraph 1.32 and controls should follow paragraphs 1.33 to 1.37.

Addition of a conservatory to an existing building

- 3.21** The guidance in this section applies to conservatories with a floor area that exceeds 30m². Conservatories with a floor area that does not exceed 30m² are exempt from the Part F requirements.
- 3.22** The general **ventilation** rate for a new conservatory and, if necessary, adjoining rooms could be achieved using **background ventilators**. The guidance in paragraphs 1.42 to 1.44 should be followed regardless of the **ventilation** provisions in the existing room adjacent to the conservatory.
- 3.23** For **purge ventilation** in a new conservatory, paragraphs 1.26 to 1.31 should be followed.
- 3.24** For a new conservatory, performance testing should follow paragraph 1.32 and controls should follow paragraphs 1.33 to 1.37.

Addition of a wet room to an existing dwelling

- 3.25** When a **wet room** is added to an existing **dwelling**, **whole dwelling ventilation** should be extended and **extract ventilation** should be provided by one of the following means.
- Intermittent extract, as specified in Table 1.1, and a **background ventilator** of at least 5000mm² **equivalent area**.
 - Continuous extract, as specified in Table 1.2.
 - Single-room **heat recovery** ventilator, as detailed in paragraph 3.26.
- 3.26** If a continuously running single-room **heat recovery** ventilator is used in a **wet room**, it should use the minimum high rate given in Table 1.2 and 50% of this value as the continuous rate. A **background ventilator** is not required in the same room as the single-room **heat recovery** ventilator.
- 3.27** Internal doors should allow air to move within the **dwelling** by providing a **free area** equivalent to a 10mm undercut in a 760mm wide door. Doors should be undercut to achieve one of the following.
- If the floor finish is fitted: 10mm above the floor finish.
 - If the floor finish is not fitted: 20mm above the floor surface.
- 3.28** For **purge ventilation** in a new **wet room**, paragraphs 1.26 to 1.31 apply.
- 3.29** For a new **wet room**, **ventilation** location should follow paragraphs 1.9 to 1.31, performance testing should follow paragraph 1.32 and controls should follow paragraphs 1.33 to 1.37.

Refurbishing a kitchen or bathroom in an existing dwelling

NOTE: If a combustion appliance is installed in a kitchen or bathroom where building work is carried out, Part J of the Building Regulations must be considered.

- 3.30** Where building work is carried out in a kitchen or bathroom, any existing fans (including cooker hoods, where they extract to the outside) should be retained or replaced. Appropriate checks should be made to determine whether any retained ventilation devices are working correctly.
- 3.31** If there is no ventilation system in the original room, it is not necessary to provide one in the refurbished room. However, additional ventilation may be necessary if refurbishment work is likely to make the building less compliant with the ventilation requirements of the Building Regulations than it was before the work was carried out. The guidance in paragraphs 3.6 to 3.13 should be followed for refurbishment that includes energy efficiency measures and paragraphs 3.14 to 3.16 should be followed for window replacements.
- 3.32** If an extractor fan or cooker hood is replaced and it uses the existing cabling, this does not need to be notified to a building control body (see section 1(a) of Schedule 4 to the Building Regulations).

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

This section deals with the requirements of Part F1(2) of Schedule 1 and regulations 39, 42 and 44 of the Building Regulations 2010.

Requirement	
<i>Requirement</i>	<i>Limits on application</i>
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.	Requirement F1 does not apply to a building or space within a building: <ol style="list-style-type: none">into which people do not normally go;which is used solely for storage; orwhich is a garage used solely in connection with a single dwelling.

Regulations

Information about ventilation

- 39.** (1) This regulation applies where paragraph F1(1) of Schedule 1 imposes a requirement in relation to building work.
- (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.

Mechanical ventilation air flow rate testing

- 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.
- (2) The person carrying out the work shall, for the purpose of ensuring compliance with paragraph F1(1) of Schedule 1—
- (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.
- (3) The notice referred to in paragraph (2)(b) shall—
- (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.

Commissioning

- 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.
- (2) This regulation also 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.
- (3) Where this regulation applies the person carrying out the work shall, for the purpose of ensuring compliance 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.
- (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 that regulation does not apply, not more than 30 days after completion of the work.

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

Intention

In the Secretary of State's view, requirement F1(2) and regulation 44 are met if building work that involves installing a mechanical **ventilation** system, for a new or an existing **dwelling**, follows the guidance in paragraphs 4.1 to 4.12 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 flow rates 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** that commissioning has been carried out following the procedure given in this document.

In the Secretary of State's view, when building work that affects **ventilation** is carried out, the requirements of regulation 39 are met if the installer provides clear and simple written guidance for the building owner on how to operate and maintain the **ventilation** system. The written guidance should be as described in the following paragraphs.

- a. For new **dwellings**, paragraphs 4.13 to 4.19.
- b. In existing **dwellings**, paragraphs 4.13 to 4.17 and 4.20.

In the Secretary of State's view, when a new **dwelling** is created by building work, the requirements of regulation 42 are met if the installer complies with both of the following.

- a. Measures and records the mechanical **ventilation** flow rates by following the guidance in paragraphs 4.9 and 4.10.
- b. Gives notice of **ventilation** flow rates to the **building control body** not later than five days after the final test.

Section 4: Commissioning and providing information

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:** Paragraphs 4.1 and 4.2 apply to 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 Part 3 of the example sheet given 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 standards

- 4.4** Ventilation systems should be inspected and tested in accordance with paragraphs 4.5 to 4.12.

Background ventilators and intermittent extract ventilation

- 4.5** For background ventilators, all of the following measures should be undertaken and the results recorded using the checklist in Appendix C.
- The minimum equivalent area for background ventilators from Table 1.7 should be identified and recorded.
 - The actual equivalent area and location of installed background ventilators should be recorded.
 - Checks should be made to determine that the background ventilator controls work and that they open and close correctly.
 - The quality of the installation of the ventilator product should be checked to ensure it is correctly mounted within the wall or window aperture.
- 4.6** For intermittent extract fans, the installer should carry out checks to establish the following.
- That the fans operate correctly.
 - That the fans respond correctly to the controls provided with the installation.
 - That any run-on timers are set to at least 15 minutes.

Ducted systems

- 4.7** For all ductwork and terminals, the following checks should be made and the results recorded in the checklist in Appendix C.
- a. That the system has been installed to achieve both of the following.
 - i. The design criteria.
 - ii. A standard that will not reduce its performance.
 - b. That the number, size and location of the air terminals provide effective air distribution in the space.
 - c. That all ductwork and terminals are in good condition with no obvious defects that will affect the performance of the system.
 - d. That the air flow direction is correct at each room terminal.
 - e. That there are no abnormal noises from the **ventilation** system, including in all of the following situations.
 - 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 ventilation** or **mechanical ventilation with heat recovery**, the system should be balanced to achieve design air flow rates at each room terminal. The fan manufacturer's instructions should be followed when balancing the system. If specific details are not available from the manufacturer, the relevant set of instructions from sub-paragraphs (a) to (e) below should be followed.
- a. For adjustable terminals with a fixed (stepped) speed fan, the following apply.
 - 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 fully 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 set to a significantly closed position to achieve 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, the following apply.
 - i. The fan should be set at a speed that will approximately 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 set to a significantly closed position to achieve 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 a similar device at the fan unit, the guidance in sub-paragraphs (a) or (b) above should be followed, depending on the type of fan speed control.

- d. For adjustable terminals with a fixed-volume flow fan, the following apply.
 - 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 fully open and all other terminals should be adjusted to achieve the required flow rates at each terminal.

NOTE: Adjusting the terminals only balances the flow. 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 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.
- a. **Intermittent extract** fans.
 - b. Cooker hoods.
 - c. Continuous extract fans and/or terminals.
 - d. Continuous supply fans and/or terminals.
- 4.10** A calibrated air flow device with a proprietary hood should be used to measure the air flow rates at each room terminal following the procedure detailed below.
- a. The design air flow rates should be determined in accordance with Table 1.2.
 - b. Both of the following should be confirmed.
 - i. All intended **background ventilators** or other air transfer devices are open.
 - ii. All internal and external doors and windows are closed.
 - c. Air flow measurements should be performed using an air flow device that complies with all of the following.
 - i. Has a proprietary hood attachment.
 - ii. Has an accuracy of $\pm 5\%$.
 - iii. Has been calibrated within the last 12 months at a calibration centre accredited by the United Kingdom Accreditation Service (UKAS).
 - d. The air flow for each extract/supply fan or terminal should be recorded in litres per second (l/s) on the commissioning sheet (see Part 3 of Appendix C).
- NOTE:** In exceptional circumstances, the configuration of some fan units may prevent air flow rates from being measured. If so, evidence should be provided to assure the **building control body** that the flow rate can be determined by following the manufacturer's guidance.

Controls

- 4.11** The correct operation of each control function should be tested where it is practical. **Ventilation** controls should be inspected to ensure that the following have been achieved.
- All local controls have been installed in accordance with the manufacturer's instructions.
 - All local controls are adequately labelled to clearly indicate their function.
 - If sensors have been installed separately from the fan unit, that the manufacturer's installation instructions were followed.
 - Where control of the fan is automated, that the controls are configured to ensure that **automatic controls** do not disturb occupants; for example, by sudden changes in fan speed.
- 4.12** If **manual controls** are provided, clear and detailed instructions should be given to the occupier as part of the information package described in paragraphs 4.13 to 4.17.

Operating and maintenance instructions

- 4.13** Sufficient information about the **ventilation** system and its maintenance requirements must be given to the building owner to allow the system to 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.
- 4.14** A copy of the completed commissioning sheet in Appendix C should be given to the owner of the **dwelling**.
- 4.15** 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 uses for the available fan settings. Information should also be provided to suggest when, and how, the system components should be cleaned and maintained.
- 4.16** The following information should be provided where relevant.
- Manufacturer's contact details.
 - That **background ventilators** allow fresh air into the home and should be left open.
 - The location of **automatic controls** and how to set them.
 - The location of **manual controls** for the on/off and high rate settings for a mechanical **ventilation** system and how to use them.
 - How cleaning and maintenance of the system and its components should be carried out. This includes the location and specification of filters and how to assess when to replace filters.
 - How to access ducts for cleaning, how to undertake cleaning of plant and ducts and the intervals at which cleaning should be undertaken.
 - The location of sensors and how to recalibrate them.
 - Design flow rates.

- 4.17** The operation and maintenance information should also contain relevant manufacturers' literature, including the following, where relevant.
- Component specifications.
 - Installation guidance.
 - Operating instructions.
 - Maintenance schedules.
 - Guarantees.
 - Registration card.
 - Spare parts lists.
 - Instructions for obtaining spare parts.

Home User Guide for new dwellings

- 4.18** A Home User Guide should be provided for a new **dwelling** as described in Section 9 of Approved Document L, Volume 1: Dwellings. It should contain a section on 'Ventilation' that provides non-technical advice on the **ventilation** systems provided within the new **dwelling**.
- 4.19** The Home User Guide is in addition to the operating and maintenance instructions. It is intended to be a non-technical overview for the occupiers, and should include some basic details on the operation and maintenance of the system. The operating and maintenance instructions provide further details as required.

NOTE: Information about overheating and the conservation of fuel and power are required under different regulations and guidance is given in Approved Documents O (Overheating) and L (Conservation of fuel and power). Where the system provides more than one function, the owner should be informed of each separate function.

Additional information for work in existing dwellings

- 4.20** When new **ventilation** is installed in an existing **dwelling**, information about it should be provided to the building owner in accordance with paragraphs 4.13 to 4.17.

Example text on the purpose of **ventilation** and the standards for existing **dwellings** can be viewed at <https://www.gov.uk/government/publications/home-user-guide-template>. However, there is no requirement to follow the layout, format or text used in the example.

Appendix A: Key terms

Except for the items marked * (which are from the Building Regulations 2010), these definitions apply only to Approved Document F, Volume 1: Dwellings.

Air permeability The measure of airtightness of the building fabric. It is defined as the air leakage rate per hour per m² of envelope area at the test reference pressure differential of 50Pa or 4Pa.

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

Automatic controls A system whereby 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 A small ventilation opening designed to provide controllable whole dwelling ventilation.

Basement (in relation to a dwelling) 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, in that a cellar is used only for storage, heating plant or purposes other than habitation.

Bathroom A room that contains a bath or shower and which can also include sanitary accommodation.

Building control body A local authority or an approved inspector.

Continuous mechanical extract ventilation

Mechanically driven ventilation that continuously extracts indoor air and discharges it to the outside.

Continuous operation Uninterrupted running of a mechanical ventilation device, such as continuous mechanical extract ventilation or mechanical ventilation with heat recovery. 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 the removal of pollutants or water vapour.

Dwelling A self-contained unit designed to accommodate a single household.

Equivalent area A measure of the aerodynamic performance of a ventilator. It is the area of a sharp-edged circular orifice through which air would pass at the same volume flow rate, under an identical applied pressure difference, as through the opening under consideration. The equivalent area of a background ventilator is determined at 1Pa pressure difference in accordance with Table 1.7.

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

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

Free area The geometric open area of a ventilator.

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

Heat recovery Applied to mechanical supply and extract systems or a single room ventilator, extract air is passed over a heat exchanger and the recovered heat is put into the supply air.

Highly airtight dwellings Dwellings that achieve one of the following.

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

Infiltration The uncontrolled exchange of air between the inside and outside of a building, through gaps and cracks.

Intermittent operation 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 or automatic control.

Less airtight dwellings Those dwellings that are not highly airtight dwellings.

Manual controls A system whereby 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 controls).

***Material change of use** Defined in regulation 5 as: Where there is a change in the purposes for which or the circumstances in which a building is used, so that after that change:

- a. the building is used as a dwelling, where previously it was not;
- b. the building contains a flat, where previously it did not;
- c. the building is used as an hotel or a boarding house, where previously it was not;
- d. the building is used as an institution, where previously it was not;
- e. the building is used as a public building, where previously it was not;

- f. the building is not a building described in classes 1 to 6 in Schedule 2, where previously it was;
- g. the building, which contains at least one dwelling, contains a greater or lesser number of dwellings than it did previously;
- h. the building contains a room for residential purposes, where previously it did not;
- i. the building, which contains at least one room for residential purposes, contains a greater or lesser number of such rooms than it did previously;
- j. the building is used as a shop, where it previously was not; or
- k. the building is a building described in regulation 7(4)(a), where previously it was not.

Mechanical ventilation with heat recovery A mechanically driven ventilation system that both continuously supplies outdoor air to the inside of the dwelling and continuously extracts indoor air and discharges it to the outside. For the purposes of this approved document, the guidance for mechanical ventilation with heat recovery applies to centralised or decentralised supply and extract systems, with or without heat recovery.

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

Permanent opening An opening between rooms or floors that has no means of closing it, e.g. an open stairwell or two rooms that have been joined by removing part of a wall.

Purge ventilation Manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute pollutants and/or disperse 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 That part of the ventilation of a building provided by ventilation devices designed into the building (e.g. background ventilators, extract fans, mechanical ventilation or air-conditioning systems).

***Room for residential purposes** Defined in regulation 2(1) as a room, or a suite of rooms, which is not a dwelling-house or a flat and which is used by one or more persons to live and sleep and includes a room in a hostel, an hotel, a boarding house, a hall of residence or a residential home, but does not include a room in a hospital, or other similar establishment, used for patient accommodation.

Sanitary accommodation A space containing one or more flush toilets (WCs) or urinals. Sanitary accommodation containing one or more cubicles counts as one space if there is free circulation of air throughout the space.

Shared communal rooms Rooms in buildings containing dwellings, which provide facilities for the residents. For example, a laundry room, occupied lobby or gym. This does not include areas used solely or principally for circulation in buildings containing dwellings, including corridors or lift lobbies.

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

Thermal envelope The combination of thermal elements of a building which enclose a particular conditioned indoor space or group of indoor spaces.

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

Ventilation 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.

Wet room 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 dwelling ventilation (general ventilation) 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 dwelling.

Appendix B: Performance-based ventilation

Introduction

- B1** 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 B2.
 - Indoor air pollutants, as described in paragraph B4.
 - Bio-effluents, as described in paragraph B6.

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

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

Performance criteria for dwellings

- B2** The performance criterion for moisture is that there should be no visible mould on the inner surfaces of the external walls of a properly heated **dwelling** with typical moisture generation.
- B3** Mould can grow whether the **dwelling** is occupied or unoccupied, so the performance criterion for humidity (given in Table B3) should be met at all times, regardless of whether there are occupants. The other pollutants listed in Table B1 are only of concern when the **dwelling** is occupied.
- NOTE:** The moisture criteria to avoid house dust mite allergens are more complex and demanding than those to avoid mould. This approved document does not give guidance on the control of house dust mite allergens.
- B4** The performance criteria for indoor air pollutants are given in Table B1. These are based on the World Health Organization's *Guidelines for Indoor Air Quality: Selected Pollutants* (2010) and Public Health England's *Indoor Air Quality Guidelines for Selected Volatile Organic Compounds (VOCs) in the UK* (2019).

Table B1 Indoor air pollutants guidance values⁽¹⁾⁽²⁾

Pollutant	Exposure limit	Exposure time
Carbon monoxide (CO)	100mg/m ³	15-minute average
	30mg/m ³	1-hour average
	10mg/m ³	8-hour average
Nitrogen dioxide (NO ₂)	200µg/m ³	1-hour average
	40µg/m ³	1-year average
Formaldehyde (CH ₂ O)	100µg/m ³	30-minute average
	10µg/m ³	1-year average
TVOC ⁽³⁾	300µg/m ³	8-hour average

NOTES:

1. No safe levels can be recommended for benzene or trichloroethylene so they have not been considered in the definition of ventilation rates in dwellings. The best strategy for reducing their concentration indoors may be to control them at source.
2. Even if the designer and builder choose to reduce volatile organic compound (VOC) levels in dwellings by controlling them at source, the ventilation requirements must still be met.
3. The 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 the purpose of ventilation control strategies. As an alternative to the TVOC limit, individual VOC limits may be used where justified in accordance with the guidance in paragraph B5.

- B5** As an alternative to using TVOC, the individual VOCs may be applied where their use is supported by robust independent evidence. Public Health England's *Indoor Air Quality Guidelines for Selected Volatile Organic Compounds (VOCs) in the UK* should be used. Testing against these metrics is likely to be more complex than testing against TVOC.
- B6** 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**).

Assumptions used in applying performance criteria for dwellings in Section 1

General

- B7** Where the guidance for **less airtight dwellings** is followed, **dwellings** are assumed to have an **infiltration** rate of 0.15 air changes per hour.
- B8** Where the guidance for **highly airtight dwellings** is followed, **dwellings** are assumed to have an **infiltration** rate of 0 air changes per hour.
- B9** **Ventilation** effectiveness is assumed to be 1.0 – that is, it is assumed that supply air is fully mixed with room air.

CIBSE's Guide A *Environmental Design* provides further information on **ventilation** effectiveness.

B10 For the purposes of this approved document, for all **dwelling**s (both new and existing, where Part F applies), the moisture criteria are 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 B2, evaluated over each moving average period.

Table B2 Surface water activity

Moving average period	Surface water activity
1 month	0.75
1 week	0.85
1 day	0.95

B11 For new **dwelling**s, for the purposes of this approved document, the moisture criteria in Table B2 is 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 B3, evaluated over each moving average period.

Table B3 Indoor air relative humidity

Moving average period	Indoor air relative humidity (%)
1 month	65
1 week	75
1 day	85

Appendix C: Completion checklist and commissioning sheet

- C1** This installation and commissioning checklist is divided into three parts, as follows.
- 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 air flow rates against measured air flow rates

- C2** Measured air flow rates for all fans should be recorded on Part 3: Commissioning details, as part of the commissioning procedures given in Section 4 of this approved document.
- The measured values should be compared with their respective design values to determine the following.
- If the measured rate for each fan is equal to or greater than the design value, then the system meets the design standard.
 - If any measured value is lower than the design value, an adjustment should be made to correct the system. All air flows should then be remeasured. If necessary, further adjustments should be made until all air flows match their design values.

Demonstrating compliance

- C3** All three parts of the installation and commissioning checklist should be completed.
- The relevant sections 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.
- C4** 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 has been correctly installed, inspected and commissioned.

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	
Town	
County	
Postcode	
1.2 System details	
System classification*	
<i>Enter 'natural ventilation', 'mechanical extract ventilation' or 'as defined by Approved Document F'.</i>	
Manufacturer	
Model numbers	
Serial number (where available)	
Location of fan units	1.
	2.
	3.
	4.
	5.
	6.
	7.
1.3 Installation engineer's details	
Engineer's name	
Company	
Address line 1	
Address line 2	
Postcode	
Telephone number	
1.4 Commissioning engineer's details (if different to 1.3)	
Engineer's name	
Company	
Address line 1	
Address line 2	
Postcode	
Telephone number	
Email address	

*NOTE: If a system has been installed that is not defined in Approved Document F, further installation checks and commissioning procedures may be required. Seek guidance from the manufacturer for such systems.

Part 2a – Installation details

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

2a.1 Installation checklist – general (all systems)		Tick as appropriate	
Has the system been installed in accordance with the manufacturer's requirements?		Yes	No
Have paragraphs 1.12 to 1.83 ⁽¹⁾ been followed (if relevant)?		Yes	No
If there are any deviations from paragraphs 1.12 to 1.83, give details here			
Description of installed controls (e.g. timer, central control, humidistat, occupancy sensor, thermal bypass, if applicable, etc.)			
Location of manual/override controls			
2a.2 Installation engineer's declaration			
Engineer's signature			
Registration number (if applicable)			
Date of inspection			

NOTE:

1. All references to tables and paragraphs are to Approved Document F, Volume 1: Dwellings.

Part 2b – Inspection of installation

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

2b.1 Visual inspections – general (all systems)		
What is the total installed equivalent area of background ventilators in the dwelling?		mm ²
What is the total floor area of the dwelling?		m ²
Does the total installed equivalent ventilator area meet the standards detailed in Table 1.7 or paragraph 1.57 ⁽¹⁾ , as appropriate?	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 to satisfy the standards in Table 1.1 or Table 1.2, as appropriate?	Yes	No
Is the installation complete, with no obvious defects?	Yes	No
Do all internal doors have enough undercut to allow air transfer between rooms as detailed in paragraph 1.25 (i.e. 10mm above the floor finish or 20mm above the floor surface)?	Yes	No
Has all protection/packaging been removed (including from background ventilators), so that the system is fully functional?	Yes	No
Are systems clean internally and externally?	Yes	No
Has the entire system been installed to allow access for routine maintenance and to repair/replace components?	Yes	No
2b.2 Visual inspections – general (continuous mechanical extract ventilation and mechanical ventilation with heat recovery systems only)		
Have appropriate air terminal devices been installed to allow system balance?	Yes	No
Have the heat recovery unit and all ductwork been effectively insulated and sealed for all heated and unheated spaces?	Yes	No
Is the condensate connection complete and does the condensate drain to an appropriate location (mechanical ventilation with heat recovery only)?	Yes	No
Are filters installed?	Yes	No
For ducted systems, has the ductwork been installed so that air resistance and leakage is kept to a minimum?	Yes	No
2b.3 Other inspections – general (all systems)		
At initial start-up, was there any abnormal sound or vibration, or unusual smell?	Yes	No
During continuous operation, was there any excessive noise?	Yes	No

NOTE:

1. All references to tables and paragraphs are to Approved Document F, Volume 1: Dwellings.

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 number)			Date of last UKAS calibration	
1.				
2.				
3.				
3.2 Air flow measurements – intermittent extract fans only				
Fan reference (from section 1.2 above)		Measured extract rate (l/s)		Design extract rate (l/s) Refer to Table 1.1 ⁽¹⁾
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) – continuous mechanical extract ventilation and mechanical ventilation with heat recovery 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	Measured air flow – continuous rate (l/s)	Design air flow – continuous rate (l/s) Refer to Table 1.3
Kitchen				
Bathroom				
En suite				
Utility				
Other				
Other				
Other				
3.4 Air flow measurements (supply) – mechanical ventilation with heat recovery 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	Measured air flow – continuous rate (l/s)	Design air flow – continuous rate (l/s) Refer to Table 1.3
Living room 1				
Living room 2				
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				

NOTE:

1. All references to tables and paragraphs are to Approved Document F, Volume 1: Dwellings.

Appendix D: Checklist for ventilation provision in existing dwellings

- D1** The checklist in Table D1 may be used when installing energy efficiency measures in an existing dwelling, following paragraphs 3.6 to 3.13.
- D2** The checklist provides an aid to determining the ventilation provision in an existing dwelling. It may be used before energy efficiency measures are implemented to help establish compliance with the minimum standards of requirement F1(1) as described in paragraph 3.6. The relevant section of this checklist should be selected depending on the ventilation strategy selected. If the answer to any question is 'No', further ventilation provisions may need to be installed, as described in paragraphs 3.11 and 3.12.

NOTE: Although it may go beyond the standards of paragraph 3.6, following the checklist in Table D1 is considered to be an adequate means of demonstrating compliance with the minimum standards of requirement F1(1) as described in paragraph 3.6.

Table D1 Checklist for ventilation provision in existing dwellings**Natural ventilation⁽¹⁾**

What is the total equivalent area of background ventilators currently in dwelling?		mm ²
Does each habitable room satisfy the minimum equivalent area standards in Table 1.7 ⁽²⁾ ?	Yes	No
Have all background ventilators been left in the open position?	Yes	No
Are fans and background ventilators in the same room at least 0.5m apart?	Yes	No
Are there working intermittent extract fans in all wet rooms?	Yes	No
Is there the correct number of intermittent extract fans to satisfy the standards in Table 1.1?	Yes	No
Does the location of fans satisfy the standards in paragraph 1.20?	Yes	No
Do all automatic controls have a manual override?	Yes	No
Does each room have a system for purge ventilation (e.g. windows)?	Yes	No
Do the openings in the rooms satisfy the minimum opening area standards in Table 1.4?	Yes	No
Do all internal doors have sufficient undercut to allow air transfer between rooms as detailed in paragraph 1.25 (i.e. 10mm above the floor finish or 20mm above the floor surface)?	Yes	No
Continuous mechanical extract ventilation⁽¹⁾		
Does the system have a central extract fan, individual room extract fans, or both?	Yes	No
Does the total combined continuous rate of mechanical extract ventilation satisfy the standards in Table 1.3?	Yes	No
Does each minimum mechanical extract ventilation high rate satisfy the standards in Table 1.2?	Yes	No
Is it certain that there are <i>no</i> background ventilators in wet rooms?	Yes	No
Do all habitable rooms have a minimum equivalent area of 5000mm ² ?	Yes	No
Does each room have a system for purge ventilation (e.g. windows)?	Yes	No
Do the openings in the rooms satisfy the minimum opening area standards in Table 1.4?	Yes	No
Do all internal doors have sufficient undercut to allow air transfer between rooms as detailed in paragraph 1.25 (i.e. 10mm above the floor finish or 20mm above the floor surface)?	Yes	No
Mechanical ventilation with heat recovery⁽¹⁾		
Does each habitable room have mechanical supply ventilation?	Yes	No
Does the total continuous rate of mechanical ventilation with heat recovery satisfy the standards in Table 1.3?	Yes	No
Does each minimum mechanical extract ventilation high rate satisfy the standards in Table 1.2?	Yes	No
Have all background ventilators been removed or sealed shut?	Yes	No
Does each room have a system for purge ventilation (e.g. windows)?	Yes	No
Do the openings in the rooms satisfy the minimum opening area standards in Table 1.4?	Yes	No
Do all internal doors have sufficient undercut to allow air transfer between rooms as detailed in paragraph 1.25 (i.e. 10mm above the floor finish or 20mm above the floor surface)?	Yes	No

NOTES:

1. Make a visual check for mould or condensation. If either are present, install additional ventilation provisions or seek specialist advice.
2. All references to tables and paragraphs are to Approved Document F, Volume 1: Dwellings.

Appendix E: Standards referred to

BS 5925 Code of practice for ventilation principles and designing for natural ventilation [1991]

BS 8233 Guidance on sound insulation and noise reduction for buildings [2014]

BS EN 13141 Ventilation for buildings. Performance testing of components/products for residential ventilation

BS EN 13141-1 Externally and internally mounted air transfer devices [2019]

BS EN 13141-3 Range hoods for residential use without fan [2017]

BS EN 13141-4 Aerodynamic, electrical power and acoustic performance of unidirectional ventilation units [2021]

BS EN 13141-6 Exhaust ventilation system packages used in a single dwelling [2014]

BS EN 13141-7 Performance testing of ducted mechanical supply and exhaust ventilation units (including heat recovery) [2021]

BS EN 13141-8 Performance testing of un-ducted mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for a single room [2014]

BS EN 16798-1 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 [2019]

BSI PAS 2035 Retrofitting dwellings for improved energy efficiency: specification and guidance [2019]

Appendix F: Documents referred to

Legislation

(available via www.legislation.gov.uk)

Air Quality Standards Regulations 2010, SI 2010/1001

Ancient Monuments and Archaeological Areas Act 1979, c. 46

Building (Approved Inspectors etc.) Regulations 2010, SI 2010/2215

Explosives Regulations 2014, SI 2014/1638

Nuclear Installations Act 1965, c. 57

Planning (Listed Buildings and Conservation Areas) Act 1990, c. 9

Other documents

BSRIA

(www.bsria.com)

BG 43 *Flexible Ductwork: A Guide to Specification, Procurement, Installation and Maintenance* [2013]

Chartered Institution of Building Services Engineers (CIBSE)

(www.cibse.org)

Guide A *Environmental Design* [2015]

TM40 *Health and Wellbeing in Building Services* [2020]

TM64 *Operational Performance: Indoor Air Quality – Emissions Sources and Mitigation Measures* [2020]

McGraw-Hill Education

(www.mheducation.com)

John Spengler, John McCarthy and Jonathan Samet, *Indoor Air Quality Handbook* [2001]

Ministry of Housing, Communities and Local Government (MHCLG)

Manual to the Building Regulations: A Code of Practice for Use in England [2020]

Public Health England (PHE)

(www.gov.uk/phe)

Indoor Air Quality Guidelines for Selected Volatile Organic Compounds (VOCs) in the UK [2019]

World Health Organization (WHO)

(www.who.int)

WHO Guidelines for Indoor Air Quality: Selected Pollutants [2010]

List of Approved Documents

The following documents have been published to give guidance on how to meet the Building Regulations. You can find the date of the edition approved by the Secretary of State at www.gov.uk.

Approved Document A

Structure

Approved Document B

Fire safety

Volume 1: Dwellings

Approved Document B

Fire safety

Volume 2: Buildings other than dwellings

Approved Document C

Site preparation and resistance to contaminants and moisture

Approved Document D

Toxic substances

Approved Document E

Resistance to the passage of sound

Approved Document F

Ventilation

Volume 1: Dwellings

Approved Document F

Ventilation

Volume 2: Buildings other than dwellings

Approved Document G

Sanitation, hot water safety and water efficiency

Approved Document H

Drainage and waste disposal

Approved Document J

Combustion appliances and fuel storage systems

Approved Document K

Protection from falling, collision and impact

Approved Document L

Conservation of fuel and power

Volume 1: Dwellings

Approved Document L

Conservation of fuel and power

Volume 2: Buildings other than dwellings

Approved Document M

Access to and use of buildings

Volume 1: Dwellings

Approved Document M

Access to and use of buildings

Volume 2: Buildings other than dwellings

Approved Document O

Overheating

Approved Document P

Electrical safety – Dwellings

Approved Document Q

Security – Dwellings

Approved Document R

Physical infrastructure for high-speed electronic communications networks

Approved Document S

Infrastructure for the charging of electric vehicles

Approved Document 7

Materials and workmanship

The Building Regulations 2010, Approved Documents are available from:

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