Approved Document F – Ventilation

Volume 1: dwellings

Consultation version –November 2020

This draft guidance accompanies the November 2020 Stage 2A consultation on Part L and Part F of the Building Regulations. The Welsh Government is seeking views on the standards for existing dwellings, mitigating overheating in new dwellings, and amendments to non-domestic buildings. The Part L and F standards for work to new dwellings are not a subject of this consultation.

The approved documents

[In this Stage 2A consultation version of the Approved Document, we are consulting on the text associated with existing dwellings. Sections 3 and 4, and Appendix A, and D are the applicable sections that provide guidance in relation to existing dwellings. As this is a complete new replacement Approved Document, we have not highlighted the changes to Approved Document F (2010 edition) therefore, the whole of the applicable sections highlighted above in green should be read. The sections highlighted above may also reference paragraphs or tables within a non-highlighted section, which will then also need to be considered in the perspective of existing dwellings. Please note the text for new dwellings is still to be updated based on the stage 1 consultation response, and is not subject to this stage 2A consultation]

What is an approved document?

This Approved Document, which takes effect on ?? 2021, has been approved and issued by the Welsh Ministers to provide practical guidance on ways of complying with the ***ventilation requirements*** of the Building Regulations 2010 for Wales, as amended, which are referred to throughout the remainder of this document as 'the Building Regulations'. Approved documents give guidance on each of the technical parts of the regulations and on regulation 7.

Approved documents set out what, in ordinary circumstances, may be accepted as reasonable provision for compliance with the relevant requirements of the Building Regulations to which they refer. If you follow the guidance in an approved document, there will be a presumption of compliance with the requirements covered by the guidance. However, compliance is not guaranteed; for example, 'normal' guidance may not apply if the particular case is unusual in some way.

Note that there may be other ways to comply with the requirements – *there is no obligation to adopt any particular solution contained in an approved document.* If you prefer to meet a requirement in some other way than described in an approved document, you should discuss this with the relevant building control body.

Some approved documents include extracts from the Building Regulations 2010. The Building Regulations must be followed exactly.

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

How to use this approved document

This document uses the following conventions.

a. Text against a grey background is an extract from the Building Regulations 2010 or the Building (Approved Inspectors etc.) Regulations 2010 (both as amended). These extracts set out the legal requirements of the regulations.

b. Key terms, printed in blue, are defined in Appendix A.

c. When this approved document refers to a named standard or other document, the relevant version is listed in Appendix E (standards) or Appendix F (other documents).

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

d. Additional *commentary in italic* text appears after some numbered paragraphs. This commentary is intended to assist understanding of the immediately preceding paragraph or sub-paragraph, or to direct readers to sources of additional information, but is not part of the technical guidance itself.

NOTE: Standards and technical approvals may also address aspects of performance or matters that are not covered by the Building Regulations, or they may recommend higher standards than required by the Building Regulations.

Where you can get further help

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 can seek further help through a number of routes, some of which are listed below.

a. The Welsh Government website: https://gov.wales/building-regulations

b. *If you are the person undertaking the building work*: either from your local authority building control service or from an approved inspector

c. *If you are registered with a competent person scheme*: from the scheme operator

d. *If your query is highly technical*: from a specialist or an industry technical body for the relevant subject.

The Building Regulations

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

Building work

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

a. the erection or extension of a building

b. the provision or extension of a controlled service or fitting

c. the material alteration of a building or a controlled service or fitting.

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

a. *For new buildings or work on a building that complied with the applicable requirements of the Building Regulations*: the building complies with the applicable requirements of the Building Regulations.

b. *For work on an existing building that did not comply with the applicable requirements of the Building Regulations*:

   (i) the work itself must comply with the applicable requirements of the Building Regulations

   (ii) the building must be no more unsatisfactory in relation to the requirements than before the work was carried out.

Material change of use

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

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

Materials and workmanship

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

Energy efficiency requirements

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

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

Notification of work

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

a. It is work that will be self-certified by a registered competent person.

b. It is work exempted from the need to notify by regulation 12(6A) of, or Schedule 4 to, the Building Regulations.

Responsibility for compliance

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

Contents

Section 0: Introduction

Summary

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

Section 1: Ventilation provision for new dwellings

Section 2: Minimising ingress of external pollution

Section 3: Work in existing dwellings

Section 4: Installation and commissioning

Application

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

Exemptions

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

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

i. buildings controlled under the Manufacture and Storage of Explosives Regulations 2005

ii. buildings controlled under the Nuclear Installations Act 1965

iii. buildings included in the schedule of monuments maintained under section 1 of the Ancient Monuments and Archaeological Areas Act 1979;

b. *unoccupied buildings* – either of the following:

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

c. *greenhouses* - provided that the main purpose of the building is *not* retailing, packing or exhibiting;

d. *agricultural buildings* (as defined in the Building Regulations 2010 Schedule II) - provided that all of the following apply:

i. no part of the building is used as a dwelling

ii. the building is at least one and one-half times its height from a building containing sleeping accommodation

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

Agricultural buildings used mainly for retailing, packing or exhibiting are *not* exempt;

e. *temporary buildings* – buildings that are not intended to remain for more than 28 days;

f. *ancillary buildings* – any of the following:

i. buildings used for the disposal of buildings or building plots on site

ii. buildings on the site of construction or civil engineering works that both:
   a. are for use only during the course of those works
   b. contain no sleeping accommodation

iii. buildings on the site of mines and quarries that both:
   a. do not contain dwellings
   b. are not used as offices or showrooms;

g. *small buildings* – detached single-storey buildings with a maximum floor area of 30 m^2, that contain no sleeping accommodation, and that are either:

- constructed substantially of non-combustible material
- at least 1 metre from the boundary of their curtilage;

h. *very small buildings* – detached buildings with a maximum floor area of 15 m^2 floor area that contain no sleeping accommodation;

i. *bomb shelters* – detached buildings with a maximum floor area of 30 m^2 that are designed and intended to be used as shelters from nuclear, chemical or conventional weapons, and for no other purpose, provided the site of the excavation for the building is a minimum of 1 metre plus the depth of excavation from any other exposed structure, and;

j. *conservatories and porches* – extensions of buildings at ground level, with a maximum floor area of 30 m^2, for a:

i. conservatory
ii. porch
iii. covered yard
iv. covered way
v. carport open on at least two sides.

Flexibility for historic and traditional buildings

0.4 As mentioned above in paragraph 0.3a, buildings included in the schedule of monuments maintained under section 1 of the Ancient Monuments and Archaeological Areas Act 1979 are exempt from compliance with the requirements of the Building Regulations. There are other classes of buildings where special considerations may apply in deciding what is adequate provision for ***ventilation***:

(a) listed buildings;
(b) buildings in conservation areas;
(c) buildings which are of architectural and historical interest and which are referred to as a material consideration in a local authority's development plan or local development framework;
(d) buildings which are of architectural and historical interest within national parks, areas of outstanding natural beauty, registered historic parks and gardens, registered battlefields, the curtilages of scheduled ancient monuments, and world heritage sites; and
(e) buildings of traditional construction with permeable fabric that both absorbs

and readily allows the evaporation of moisture.

0.5 When undertaking work on or in connection with a building that falls within one of the classes listed above, the aim should be to provide adequate ***ventilation*** as far as is reasonable and practically possible. The work should not prejudice the character of the host building or increase the risk of long-term deterioration of the building fabric or fittings.
0.6 The guidance given by English Heritage[1] and in BS 7913 Principles of the conservation of historic buildings should be taken into account in determining appropriate ***ventilation*** strategies for building work in historic buildings.
0.7 In general, new extensions to historic or traditional dwellings should comply with the standards of ***ventilation*** as set out in this Approved Document. The only exception would be where there is a particular need to match the external appearance or character of the extension to that of the host building.
0.8 Particular issues relating to work in historic buildings that warrant sympathetic treatment and where advice from others could therefore be beneficial include:
(a) restoring the historic character of a building that has been subject to previous inappropriate alteration, e.g. replacement windows, doors and rooflights;
(b) rebuilding a former historic building (e.g. following a fire or filling a gap site in a terrace);
(c) making provision for the fabric of historic buildings to 'breathe' to control moisture and potential long-term decay problems.
0.9 In determining what is adequate ***ventilation*** in the circumstances, it is important that the ***BCB*** takes into account the advice of the local authority's conservation officer. The views of the conservation officer are particularly important where building work requires planning permission and/or listed building consent.

Interactions with other parts of the Building Regulations

The construction of new buildings, and building work to existing buildings, must satisfy all the technical requirements set out in the Building Regulations. When considering the incorporation of **ventilation** measures in dwellings, attention should also be paid in particular to the need to comply with Part B (fire safety), Part C (site preparation and resistance to contaminants and moisture), Part E (resistance to the passage of sound), Part L (conservation of fuel and power), Part J (combustion appliances and fuel storage systems), Part K (protection from falling, collision and impact), Part M (access to and use of buildings) and Part P (electrical safety), as well as Part F.

The adoption of any particular **ventilation** measure should not involve unacceptable technical risk with another technical requirement within the Building Regulations. Some examples of interaction with other technical requirements are given below.

Interaction with Part B

0.10 The requirements of Part B apply if ducts pass through any of the following:

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

0.11 This document gives guidance on window openings for ventilation. In addition, Approved Document B gives guidance on the size of escape windows. The larger of the window

[1] www.english-heritage.org.uk

0.12 openings in Approved Document B or F should be applied in all cases.

Interaction with Part J

0.13 Ventilation fans might cause combustion gases to spill from open-flued appliances – combustion gases might fill the room instead of going up the flue or chimney. This can occur even if the combustion appliance and fan are in different rooms.

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

Interaction with Part L

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

Interaction with Parts K and M

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

Notification of work covered by the ventilation requirements

0.17 Notifiable ventilation work on a building should usually be notified to a building control body before the work starts. However, work may be notified after it starts in any of the following situations:

i. Where work will be carried out by a person registered with a competent person self-certification scheme (paragraphs 0.16 to 0.18)
ii. When the work is emergency repairs (paragraph 0.19)
iii. When the work is minor works (paragraph 0.20)

Competent person self-certification schemes

0.18 Where work is to be carried out by a person registered with a competent person scheme, it is not necessary to notify a building control body in advance.

0.19 If work is carried out by a person registered with a competent person scheme, both:

i. The occupier of the building must be given a certificate to confirm that the work complies fully with all relevant requirements of the building regulations. This certificate must be provided within 30 days of the work being completed.

ii. The building control body must be given a notice of the work carried out, within 30 days of the work being completed.

0.20 Building control bodies may accept notices and certificates from a person registered with a competent person scheme as evidence of compliance with the requirements of the Building

Regulations. The local authority still retains inspection and enforcement powers in these circumstances.

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

Emergency repairs

0.21 For emergency repairs, if it is not practicable to notify the building control body in advance, the building control body should be notified at the earliest opportunity. If the installer is registered in a competent person scheme, the normal requirements in paragraphs 0.16 to 0.18 would apply.

Minor works

Where the work is of a minor nature as described in the schedule of non-notifiable work (Schedule 4 to the Building Regulations), the work must still comply with the relevant requirements but need not be notified to the ***BCB***. In relation to mechanical ***ventilation*** and air-conditioning systems such work includes:

- replacement of parts, or the addition of an output or control device where testing and adjusting is not possible or would not affect the system's energy efficiency;
- provision of a self-contained mechanical ***ventilation*** or air-conditioning appliance provided that any electrical work is exempt from a requirement to give advance notice to a ***BCB***, and testing and adjustment is not possible or would not affect its energy efficiency, and the appliance is not installed in a room containing an open-flued combustion appliance. Examples might be a cooker hood, a ***bathroom*** extract fan or a room air conditioning unit, which cannot be adjusted from their factory settings.

Live-work units

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

a. there is direct access between the commercial space and the living accommodation
b. the commercial space and living accommodation are within the same thermal envelope;
c. the living accommodation occupies a substantial proportion of the total area of the unit.

Mixed use developments

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

Requirement F1(1): Means of ventilation

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

Requirement [regulations will be amended as necessary in line with the performance sections below]	
Requirement	*Limits on application*
Means of ventilation **F1(1).** There shall be adequate means of ventilation provided for people in the building.	Requirement F1 does not apply to a building or space within a building: a. into which people do not normally go; or b. which is used solely for storage; or c. which is a garage used solely in connection with a single dwelling.

Performance

In the Welsh Minister's view, Requirement F1(1) will be met for a new dwelling if the dwelling is provided with a means of ventilation which:

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

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In the Welsh Minister's view, Requirement F1(1) is met for work on an existing dwelling by following guidance in Section 3.

Section 1: Ventilation provision for new dwellings

General

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

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

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

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

1.4 The ventilation rates set out in this Approved Document have been designed to meet the pollutant levels in Appendix B where the outside air is of reasonable quality. In areas where the outside air is not of reasonable quality, Section 3 provides guidance on limiting ingress of external air pollutants.

Noise

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

- sizing and jointing ducts correctly
- ensuring that equipment is appropriately and securely fixed
- selecting appropriate equipment, including following paragraph 1.6.

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

1.7 Account should be taken of outside noise when considering the suitability of opening windows for purge ventilation.

Access for maintenance

1.8 Reasonable access should be provided for maintaining ventilation systems. This should include all of the following:

a. providing access to replace filters, fans and coils;
b. providing access points for cleaning duct work; and
c. providing access for the general maintenance of plant.

The ventilation strategy in this Approved Document

1.9 The ventilation strategy in this Approved Document relies on a combination of all of the following:

- Extract ventilation from rooms where water vapour or pollutants are likely to be released, e.g. bathrooms and kitchens, to minimise their spread to the rest of the building. Ventilation fans may be either intermittent or continuous.
- Whole building ventilation to provide fresh air to the building and to dilute, disperse and remove water vapour and pollutants not removed by extract ventilation.
- Purge ventilation to remove high concentrations of pollutants and water vapour. Purge ventilation is intermittent and required only for pollutants produced by occasional activities (e.g. fumes from painting).

1.10 Ventilation may be delivered through natural ventilation, mechanical ventilation or both.

1.11 The ventilation systems in this Approved Document are examples of systems that comply with Part F of the Building Regulations. Other ventilation systems may be acceptable if they can be shown to meet an equivalent level of performance.

Performance-based guidance

1.12 Performance criteria for acceptable levels of moisture and pollutants are given in Appendix B. Air flow rates necessary to meet the performance criteria are given in Table 1.1, Table 1.2 and Table 1.3.

1.13 Ventilator sizes for the whole dwelling are also provided to help designers comply with Part F of the Building Regulations in common situations.

1.14 Some ventilation system designs can, in some circumstances, result in lower ventilation rates than stated in Table 1.1 and 1.2. For example, systems with automatic controls. Where lower ventilation rates are proposed, it should be demonstrated through independent verification by a suitably qualified person that the solution meets the performance standards in Appendix B. Where this is demonstrated, the design may be considered to meet the functional requirement.

Equivalent area of ventilators

1.15 The size of background ventilators (including trickle ventilators) is given in this Approved Document as an equivalent area, not free area. BS EN 13141-1 includes a method of

measuring the equivalent area of background ventilator openings. This Approved Document expresses equivalent area in mm^2.

1.16 Background ventilators should have the equivalent area marked where it will be easily visible from inside the dwelling when installed, to aid verification by Building Control Bodies.

Extract ventilation

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

- kitchens
- utility rooms
- bathrooms
- sanitary accommodation

Extract ventilation can be intermittent or continuous.

1.18 Minimum extract ventilation rates for intermittent extract systems are specified in Table 1.1.

Minimum extract ventilation rates for continuous extract systems are specified in Table 1.2.

1.19 Mechanical extract terminals and fans, not including cooker extract hoods, should be installed both:

- as high as is practicable in the room
- not more than 400 mm below the ceiling.

1.20 Where a cooker hood is used to extract to the outside, the height of the extract hood above the hob surface should be either as specified in the manufacturer's instructions, or if unknown 650 mm to 750 mm.

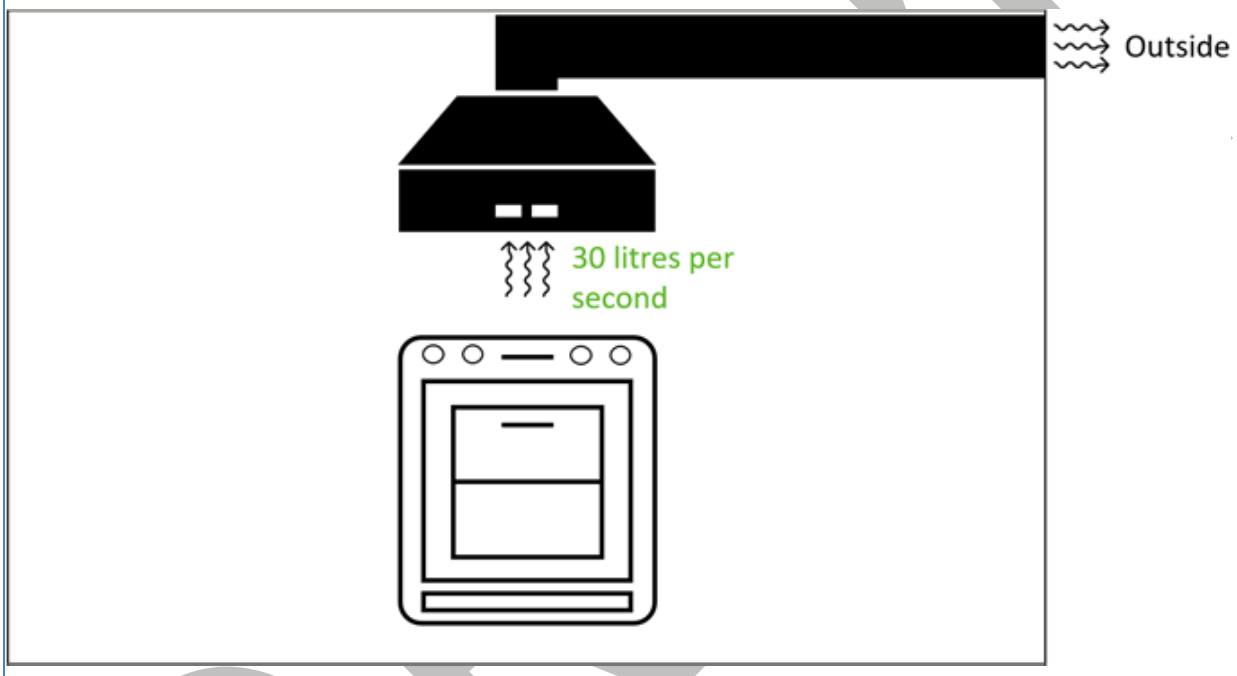
Table 1.1 Minimum extract ventilation rates for intermittent extract systems

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

Notes:

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

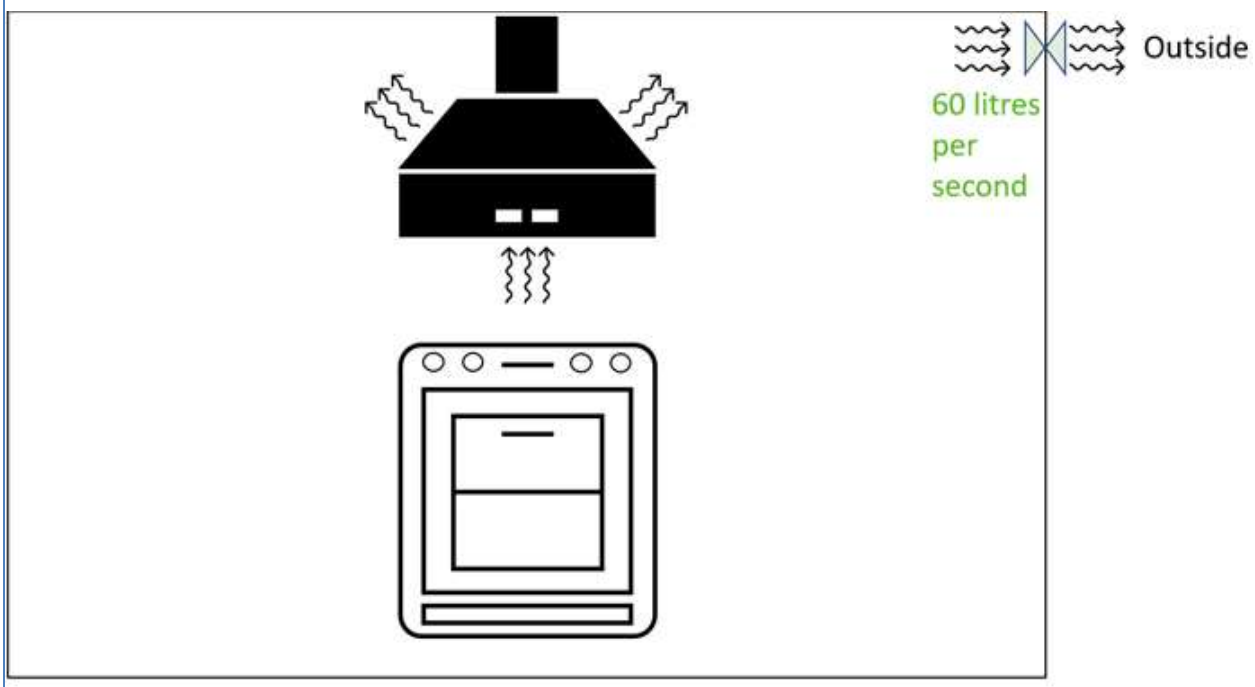
Diagram 1 – Minimum ventilation rate for kitchen extract where cooker hood extracts to outside[1]



Notes:

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

Diagram 2 – Minimum ventilation rate for kitchen extract where cooker hood does not extract to outside[1]



Notes:

1. This diagram includes a recirculating cooker hood for illustration. A recirculating cooker hood does not provide a means of ventilation

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

Table 1.2 Minimum extract ventilation rates for continuous extract systems

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

Whole dwelling ventilation

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

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

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

a. The minimum whole dwelling ventilation rate by number of bedrooms

b. The minimum whole dwelling ventilation rate by floor area

Table 1.3 Minimum whole dwelling ventilation rates[1,2]

Number of bedrooms	1	2	3	4	5
Minimum ventilation rate criterion 1 – by number of bedrooms	19	25	31	37	43
Minimum ventilation rate criterion 2 – by floor area	0.3 l/s per m^2 of internal floor area				

Notes:

1. Where the dwelling has only one habitable room, a minimum ventilation rate of 13 litres per second should be used.
2. The minimum ventilation rate 0.3 litres per second per m^2 of internal floor area. (This includes all floors, e.g. for a two-storey building add the ground and first floor areas.)
3. For each additional bedroom, add 6 litres per second to the values in Table 1.3.

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

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

Purge ventilation

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

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

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

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

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

Table 1.4 Purge ventilation openings

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

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

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

Performance testing

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

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 4.1 and 4.2 Background ventilators should meet the performance requirements for both: a. Air flow from outside to inside the dwelling b. Air flow from inside to outside
Continuous mechanical extract systems	BS EN 13141-6
Continuous supply and extract mechanical ventilation with heat recovery units	BS EN 13141-7
Single-room heat recovery ventilators	BS EN 13141-8. For internal and external leakage and for mixing, the unit should meet at least Class U4.

Control of ventilation

1.28 Ventilation should be controllable. Controls may be either manual (i.e. operated by the occupant) or automatic.

1.29 Trickle ventilators should be a minimum of 1.7m above floor level, to reduce cold draughts, but still be within easy reach of the occupant.

NOTE: Trickle ventilators are intended to normally be left open.

1.30 Continuously running fans should be set up to operate without occupant intervention, but may have manual or automatic controls to select the high rate. Any manual high rate controls should be provided locally to the spaces being served, e.g. bathrooms and kitchens. Automatic controls might include sensors for humidity, occupancy/usage and pollutant release.

1.31 Controls based on humidity sensors may be installed in moisture-generating rooms (e.g. kitchen or bathroom) but should not be used for sanitary accommodation, where odour is the main pollutant.

1.32 Other types of automatic control might be suitable. Where present, automatic controls should operate according to the need for ventilation in the space. Trickle ventilators with automatic controls should also have manual override.

NOTE: Where a combustion appliance is installed, any automatic controls must also ensure that ventilation provided meets the requirements of Part J.

Ventilation systems for dwellings without basements

1.33 The performance required for ventilation systems for dwellings without basements would be achieved by following paragraphs 1.34 to 1.36.

Ventilation systems for dwellings with basements

1.34 A dwelling that includes a basement connected to the rest of the dwelling by a large permanent opening (e.g. an open stairway) may be treated as a multi-storey dwelling, and the guidance in this document may be followed for dwellings without basements**.**

Note: If a basement has only one exposed façade, the guidance for natural ventilation given in this Approved Document would not be appropriate. In such cases, specialist advice should be sought.

1.35 A dwelling that includes a basement not connected to the rest of the dwelling above ground by a large permanent opening should be considered as follows:

a. The part of the dwelling above ground should be considered separately. For the purposes of meeting the ventilation standards, it should be assumed to have at least one bedroom.

b. The basement should be treated separately as a single-storey dwelling above ground level.

c. If the basement has no bedrooms, assume it has one bedroom to determine the ventilation required for the purposes of meeting the ventilation standards.

1.36 A dwelling that comprises only a basement should be treated as a single-storey dwelling above ground level. In such circumstances, the guidance for dwellings without basements should be followed. The guidance on natural ventilation, however, is not appropriate for a dwelling that comprises only a basement.

Ventilation of a habitable room through another room

1.37 If a habitable room does not contain openable windows (i.e. an internal room), the requirement for adequate ventilation can be met using paragraphs 1.38 and 1.39 if the room

is ventilated through either:

- another habitable room
- a conservatory

1.38 The habitable room or conservatory should have openings to outside to provide both:

i. purge ventilation with a minimum total area given in paragraphs 1.25 and 1.26 based on the combined floor area of the habitable rooms (or the habitable room and the conservatory)

ii. background ventilation of at least 12,000mm^2 equivalent area

1.39 Between the two rooms there should be a permanent opening with a minimum area of 1/20th of the combined floor area of the two rooms. See Diagram 3.

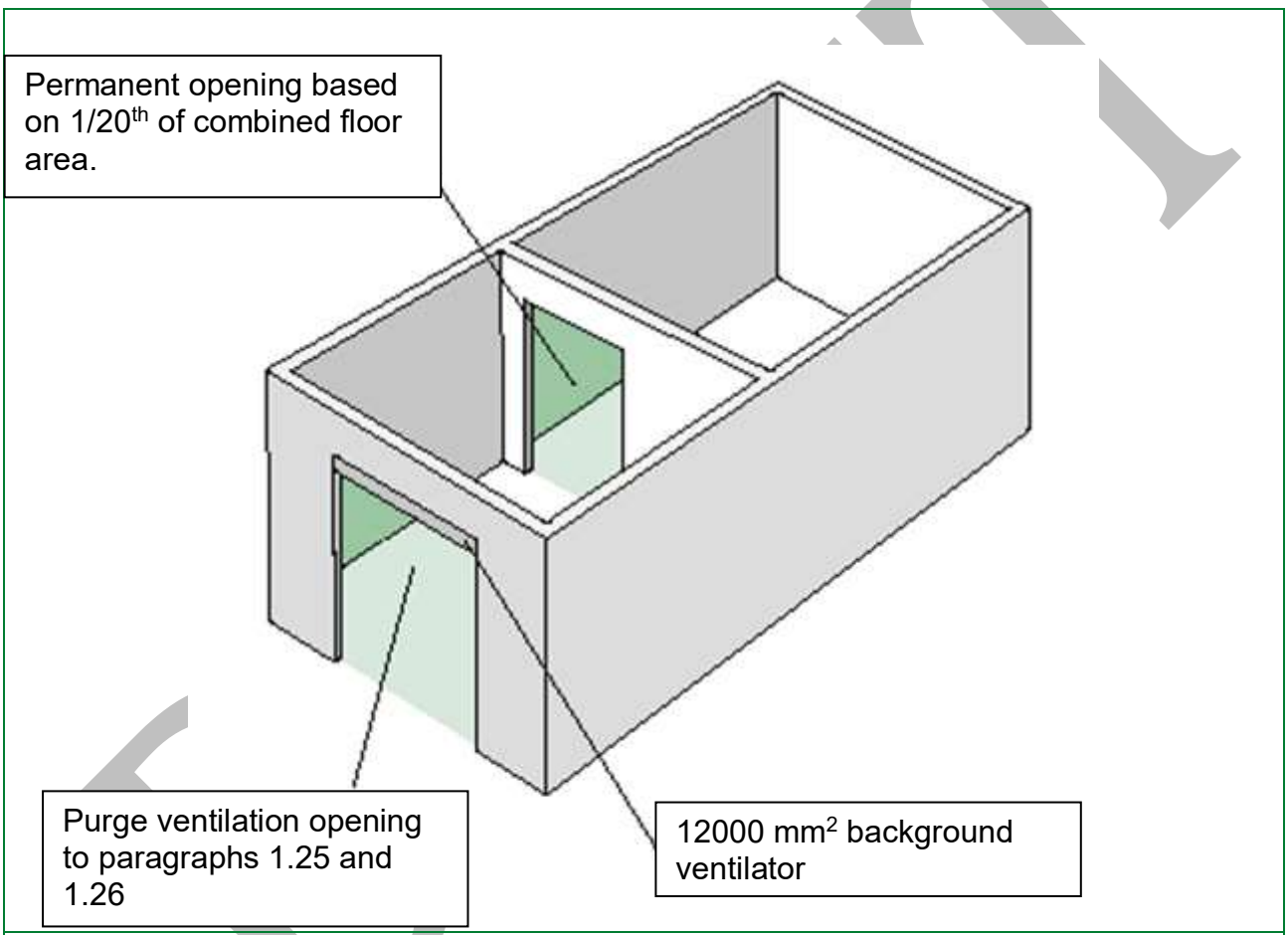


Diagram 3. Two habitable rooms treated as one room for ventilation purposes

System specific guidance

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

- Natural ventilation with background ventilators and intermittent extract (paragraphs 1.41 to 1.51)

- Continuous mechanical extract (paragraphs 1.52 to 1.59)
- Continuous mechanical supply and extract (paragraphs 1.60 to 1.66)

Natural ventilation with background ventilators and intermittent extract fans

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

Intermittent extract

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

1.42 If a wet room has no external walls, the intermittent extract fan should extract at four air changes per hour to provide the purge ventilation given in paragraphs 1.25 and 1.26.

1.43 For sanitary accommodation, as an alternative, extract rates can be met using windows by following the purge ventilation guidance in paragraphs 1.25 and 1.26.

1.44 Any automatic controls (e.g. humidity control) for intermittent extract should have a manual override to allow the occupant to turn the extract ventilation on or off.

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

Background ventilators

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

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

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

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

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

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

Table 2.1 Minimum equivalent area of background ventilators for natural ventilation[1]

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

Notes:

1 The use of this table is not appropriate where the dwelling has a single exposed façade. For such situations, expert advice should be sought.

2 The guidance for flats is also applicable to any dwelling which is only one storey, such as a bungalow.

3 In situations where any bathroom has no window or external façade through which a ventilator can be installed, then the minimum equivalent area for the kitchen ventilator should be 12,000mm^2.

In situations where the kitchen has no windows or external façade through which a ventilator can be installed, the use of this table is not appropriate and expert advice should be sought.

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

Purge ventilation

1.51 For purge ventilation follow paragraphs 1.26 to 1.27.

Continuous mechanical extract ventilation

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

1.52 A continuous mechanical extract ventilation system could comprise one of the following:
a. a central extract system
b. individual room extract fans
c. a combination of both a central extract system and individual room extract fans.

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

Ventilation rates

1.54 The total combined continuous rate of mechanical extract ventilation in the dwelling should be a minimum of the whole dwelling ventilation rate in Table 1.3.

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

Background ventilators for continuous mechanical extract ventilation

1.56 Where continuous mechanical extract ventilation is used, background ventilators should both:
a. not be in wet rooms
b. provide minimum equivalent area of 5,000 mm^2 for each habitable room in the dwelling

1.57 If a habitable room has no external walls, paragraphs 1.37 to 1.39 should be followed.

1.58 Fans and background ventilators in the same room should be a minimum of 0.5 m apart.

Purge ventilation

1.59 For purge ventilation follow paragraphs 1.26 to 1.27.

Continuous mechanical supply and extract ventilation

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

Ventilation rates

1.60 For dwellings using mechanical supply and extract ventilation, each habitable room should have mechanical supply ventilation. The total supply air flow should be distributed proportionately to the volume of each habitable room.

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

1.62 The minimum total continuous rate of mechanical supply and extract ventilation is the whole dwelling ventilation rate in Table 1.3.

1.63 For dwellings using mechanical supply and extract ventilation, each wet room should have a minimum mechanical extract ventilation high rate as given in Table 1.2.

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

Background ventilators

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

Purge ventilation

1.66 For purge ventilation follow paragraphs 1.25 to 1.26.

Installation of ventilation systems

1.67 Ventilation systems should be installed in a way that does not compromise the performance of the system in-use.

1.68 Adequate space should be available for access to maintain ventilation equipment.

1.69 Rigid ducts should be used wherever possible. Where flexible ductwork is installed this should only be used for final connections and their lengths should be kept to a minimum as given in paragraph 1.70. All flexible ductwork should meet the standards of BSRIA BG 43/2013.

1.70 Any flexible ducts should be installed so that the full internal diameter is obtained and flow resistance is minimised. This includes both:

- pulling the duct taut
- ensuring that ductwork does not pass through orifices with a smaller diameter than the duct itself.

1.71 Ductwork installations should be designed and installed to minimize the overall pressure losses within the system through all the following.

- minimising the overall length of duct
- minimising the number of bends required.
- installing appropriately sized ducts for the air flow rate

1.72 Each air terminal should have a free area of at least 90% of the free area of its associated duct.

1.73 Duct connections should be both mechanically secured and adequately sealed to prevent uncontrolled losses. For flexible ducting, rigid connectors and jubilee clips should be used to ensure a good seal.

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

- There are no obvious defects
- All packaging has been removed.

1.75 Mechanical ventilation systems must be commissioned in accordance with an approved procedure. **Appendix C** of this Approved Document includes a completion checklist and commissioning sheet, which the system installer should complete to demonstrate compliance. See **Section 5**.

Section 2: Minimising ingress of external pollution

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

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

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

- carbon monoxide, CO
- nitrogen dioxide, NO_2
- sulphur dioxide, SO_2
- ozone, O_3
- particles ($PM_{2.5}$-PM_{10})
- benzene
- 1,3-butadiene
- polycylic aromatic hydrocarbons (PAHs)
- ammonia
- lead.
- nitrogen oxides, NOx

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

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

Control of ventilation intakes

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

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

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

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

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

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

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

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

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

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

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

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

In these circumstances, specialist advice should be sought.

Location of exhaust outlets

2.10 Exhaust outlets should be located so that both:

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

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

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

- courtyards
- enclosures
- architectural screens.

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

Section 3: Work on existing dwellings

General

3.1 When building work is carried out on an existing dwelling, both of the following should apply:

a. The work should comply with the applicable requirements of the Building Regulations.
b. the building, including the provision of ventilation, should not be made less satisfactory than before the work was carried out.

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

3.2 For common types of work, the requirements of paragraph 3.1 may be demonstrated through the following:

a. For installing energy efficiency measures, paragraphs 3.5 to 3.12
b. For replacing windows only, paragraphs 3.13 to 3.15
c. For addition of a habitable room, paragraphs 3.16 to 3.19
d. For addition of a conservatory, paragraphs 3.20 to 3.23
e. For addition of a wet room, paragraphs 3.24 to 3.28
f. For refurbishing a kitchen or bathroom, paragraphs 3.29 to 3.31

NOTE: For window replacements carried out at the same time as other energy efficiency measures, follow paragraphs 3.5 to 3.12.

3.3 Other ventilation solutions may be used, provided it can be demonstrated to a building control body that they comply with the requirements of paragraph 3.1.

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

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

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

Installing energy efficiency measures

3.5 Many existing buildings are ventilated through infiltration rather than purposeful ventilation. Energy efficiency measures carried out on existing buildings 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 in the dwelling after the work is carried out is equal to the minimum standards of F1(1).

3.6 To demonstrate compliance with **paragraph 3.5** an assessment should be carried out to determine what, if any, additional ventilation provision is required based on the estimated impact of the work. The assessment should be carried out by either of the following.

a. *Simplified method*: paragraphs 3.7 to 3.12 and the chart in Diagram 3.1 should be followed.
b. Expert advice should be sought, which may include carrying out an air permeability test. The air permeability test should follow the procedures given in **Approved Document L: volume 1,** and results copied to the Building Control Body. A test does not need to be lodged for the purposes of Part F compliance.

NOTE: Although it may go beyond the requirements of **paragraph 3.5**, compliance with **PAS 2035** is considered to be an adequate means of demonstrating compliance with **paragraph 3.5**.

Simplified Method

NOTE: The simplified method set out in paragraphs 3.7 to 3.12 is designed to apply to an existing dwelling, assumed to have adequate means of ventilation through a combination of purpose provided ventilation and advantageous infiltration.

If the property is significantly different from this, the requirements of paragraph 3.5 must still be met, which should be demonstrated through seeking expert advice or another suitable method.

3.7 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. This calculation should include all of the following:

a. energy efficiency measures fitted since the original dwelling was constructed, to consider accumulation of measures
b. energy efficiency measures planned.

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

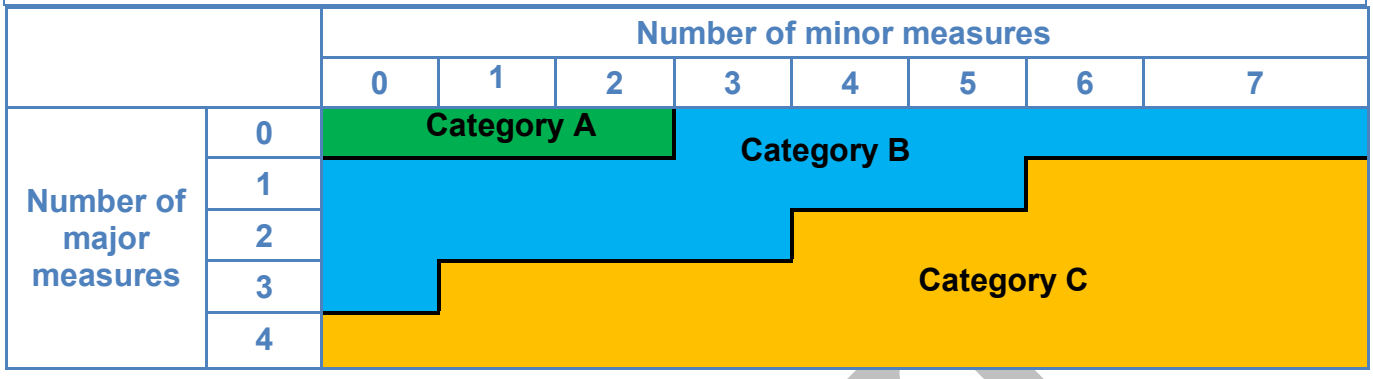
3.8 The total number of minor and major measures should then be used in the chart in **Diagram 3.1** to determine what Category the works result in.

Table 3.1. Energy Efficiency Measures	Category of measure
Roof Insulation	
a. Renewing loft insulation, including careful 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. Cavity wall insulation to any external wall façade	Minor
d. External or Internal wall insulation to less than or equal to 50% of the external wall area	Minor
e. External or Internal wall insulation to greater than 50% of the external area	**Major**
Replacement of windows and doors [2]	
f. Replacement of less than or equal to 30% of the total existing windows or door units (when carried out with any other minor or major measure)	Minor
g. Replacement of greater than 30% of the total existing windows or door units (when carried out with any other minor or major measure)	**Major**
Draught-proofing (other than openings)[1]	
h. Replacement of loft hatch with a sealed/insulated unit	Minor
i. Sealing around structural or service penetration through walls, floors or ceiling/roof	Minor
j. Sealing and/or insulating suspended ground floor	**Major**
k. Removal of chimney or other means of sealing over chimney, internally or externally	**Major**

1 Draught-proofing measures might not, on their own, constitute building work. Such work may be controllable under the Building Regulations if carried out as part of other building work.

2 If the energy efficiency works involve replacing one or more windows, then the guidance in paragraphs 3.13 to 3.15 should additionally be followed.

Diagram 3.1 – Chart for ventilation when carrying out works in existing dwellings



3.9 If using the method in Diagram 3.1 results in the work being categorised in a **Category A,** it is likely that the energy efficiency measures have *not* reduced ventilation provision of the dwelling below the requirements of F1(1) and no further ventilation is required. If the applied energy efficiency measures in **Category A** include replacing one or more windows, then paragraphs 3.13 to 3.15 should be followed.

3.10 If using the method in Diagram 3.1 results in the work being categorised in a **Category B,** it is likely that the ventilation provision of the dwelling has been reduced below the requirements of F1(1). Further ventilation provision is necessary through one of the following.

a. For natural ventilation, the dwelling should meet the system specific guidance in **paragraphs 1.41 to 1.51**. It is assumed any existing purpose-built ventilators are in working order and the equivalent area has not been compromised.
b. Either:
    i. For continuous mechanical extract ventilation, follow the system specific guidance in **paragraphs 1.52 to 1.59**
    ii. For continuous mechanical supply and extract ventilation, follow system specific guidance in **paragraphs 1.60 to 1.66**. To avoid unintended air pathways, existing background ventilators should be covered or sealed shut.

3.11 If using the method in Diagram 3.1 results in the work being categorised in a **Category C,** it is likely that the ventilation provision of the dwelling has been reduced *significantly* below the requirements of F1(1). Further ventilation provision is necessary through one of the following.

a. For natural ventilation, follow expert advice for the design, sizing and positioning of ventilators to ensure adequate ventilation provision.

b. Either:
    i. For continuous mechanical extract ventilation, follow the system specific guidance in paragraphs 1.52 to 1.59
    ii. For continuous mechanical supply and extract ventilation, follow system specific guidance in paragraphs 1.60 to 1.66. To avoid unintended air pathways, existing background ventilators should be covered or sealed shut.

3.12 The checklist in **Appendix D** may aid in checking the ventilation provision in an existing dwelling. It may be used before energy efficiency measures are carried out to help determine compliance with **paragraph 3.5**.

Replacing windows

3.13 If an existing window has one or more background ventilators, the replacement window should include background ventilators. The new background ventilators should both:

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

If the size of the background ventilators in the existing window is not known, the ventilator sizes in paragraph 3.14 may be selected.

3.14 If an existing window has no background ventilators, a replacement window is likely to increase the airtightness of the dwelling. In these circumstances, it should be ensured that the ventilation provision in the dwelling is no worse than it was before it was carried out. This may be demonstrated in any of the following ways:

a. Adopting the following background ventilators in the replacement window equivalent to the following:
    - habitable rooms – minimum 8,000 mm² equivalent area
    - kitchen – minimum 8,000 mm² equivalent area
    - bathroom (with or without a toilet) – minimum 4000 mm² equivalent area.
b. If the dwelling will have continuous mechanical extract ventilation, install background ventilators for any replacement windows which are not in wet rooms, with a minimum equivalent area of 4,000 mm² in each habitable room.
c. If the dwelling will have continuous mechanical supply and extract ventilation, background ventilators should not be installed.
d. Other ventilation provisions, provided it can be demonstrated to a building control body that they comply with the requirements of paragraph 3.1.

3.15 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 3.13 to 3.14.

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

3.16 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 outside, paragraphs 1.37 to 1.39 should be followed

b. if the additional room is connected to an existing habitable room that still has windows opening to outside:

   i. if the existing habitable room has a total background ventilator equivalent area of less than 5000 mm^2, paragraphs 1.37 to 1.39 should be followed

   ii. if the existing habitable room has a total background ventilator equivalent area of at least 5000 mm^2, there should be both:

      i. background ventilators of at least 10,000 mm^2 equivalent area between the two rooms and;

      ii. background ventilators of at least 10,000 mm^2 equivalent area between the additional room and outside.

3.17 As an alternative to paragraph 3.16, to ventilate the additional habitable room, a single-room heat recovery ventilator could be used. The supply rate to that room should be determined as follows:

First, determine the whole building ventilation rate from Table 1.3.

Second, calculate the room supply rate required from:

$$\frac{\text{(Whole building ventilation rate x Room volume)}}{\text{(Total volume of all habitable rooms)}}$$

3.18 For purge ventilation in a new habitable room in a dwelling, paragraphs 1.25 to 1.26 should be followed.

3.19 For a new habitable room in a dwelling, ventilation location should follow paragraphs 1.17-1.26, performance testing should follow paragraph 1.27 and controls should follow paragraphs 1.28 to 1.32.

Addition of a conservatory to an existing building

3.20 The guidance in this section applies to conservatories with a minimum floor area of 30 m^2.

3.21 The general ventilation rate for a new conservatory and, if necessary, adjoining rooms could be achieved using background ventilators. Follow paragraphs 1.37 to 1.39 whatever the ventilation provisions are in the existing room adjacent to the conservatory.

3.22 For purge ventilation in a new conservatory, follow paragraphs 1.25 to 1.26.

3.23 For a new conservatory, ventilation location should follow paragraphs 1.17 to 1.26, performance testing should follow paragraph 1.27 and controls should follow paragraphs 1.28 to 1.32.

Addition of a wet room to an existing dwelling

3.24 When a wet room is added to an existing dwelling, whole building ventilation should be extended, and extract ventilation should be provided through *any* of the following:

a. Intermittent extract, as given in Table 1.1, and a background ventilator of at least 5000 mm^2 equivalent area
b. Continuous extract fan, as given in Table 1.2
c. Single-room heat recovery ventilator, as given in paragraph 3.25.

3.25 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. No background ventilator is required in the same room as the single room heat recovery ventilators.

3.26 For any ventilation strategy, 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 either:

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

3.27 For purge ventilation in a new wet room, follow paragraphs 1.25 to 1.26.

3.28 For a new wet room, ventilation location should follow paragraphs 1.17 to 1.26, performance testing should follow paragraph 1.27 and controls should follow paragraphs 1.28 to 1.32.

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*.

3.29 Where building work is carried out in a kitchen or bathroom, any existing fans (including cooker hoods, where they extract to outside) or passive stack ventilators should be retained or replaced. Appropriate checks should be made to determine whether existing ventilation devices retained are functional and working correctly.

3.30 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.

3.31 If an extract fan or cooker hood is replaced with a similar type, and using the existing cabling, this need not be notified to a building control body.

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

[Regulations will be amended as necessary in line with the performance sections below]

Requirement	
Requirement	*Limits on application*
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: a. into which people do not normally go; or b. which is used solely for storage; or c. which is a garage used solely in connection with a single dwelling.

Requirements in the Building Regulations 2010

Information about ventilation

39.—(1) This regulation applies where Part 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 **[regulations will be amended as necessary in line with the intention sections below]**

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 *or notifiable building work within an existing dwelling*.

(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 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 complying with paragraph F1(2) or L1(b) of Schedule 1, give to the local authority a notice confirming that the fixed building services have been commissioned in accordance with a procedure approved by the Secretary of State.

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

(a) not later than the date on which the notice required by regulation 16(4) is required to be given; or

(b) where the regulation does not apply, not more than 30 days after the completion of the work.

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

Performance

In the Welsh Minister's view, requirement F1(2) and Regulation 44 are met if building work (on new or existing dwellings) that involves installing a mechanical ventilation system follows **paragraphs 4.1 to 4.11** to achieve all of the following.

a. All fixed mechanical ventilation systems (including intermittent extract fans and cooker hoods) 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.
c. Commissioning results show that controls are operating as required to achieve adequate ventilation.
d. The person carrying out the work gives notice to the building control body and that commissioning has been carried out in accordance with the procedure given in this document.

In the Welsh Minister's view, when building work is carried out that affects ventilation, Regulations 39 is met if the installer provides clear and simple written guidance for the building owner on how to operate and maintain their ventilation system, as per **paragraphs 4.12 to 4.16**

In the Welsh Minister's view, when building work is carried out to a new or existing dwelling , Regulation 42 is met if the installer complies with all of the following and

a. Ensures the flowrates comply with the flowrates specified in this approved document, including measures and records the mechanical ventilation flowrates by following **paragraph 4.9**
b. Gives notice of ventilation flowrates to the building control body not later than five days after the final test.

Section 4: Testing and Commissioning

Air flow rate testing and commissioning of ventilation systems

4.1 Mechanical ventilation systems must be commissioned to provide adequate ventilation. A commissioning notice must be given to the building control body.

4.2 Air flow rates for mechanical ventilation systems must be measured. A notice of the measured air flow rates must be given to the building control body.

4.3 The person responsible for commissioning should complete air flow measurement test and commissioning sheets including, as a minimum, all information in the example sheet in Appendix C.

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

Inspection requirements

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

Background ventilators and intermittent extract

4.5 For background ventilators, the following should be observed and recorded using the checklist in Appendix C:

a. Identify and record minimum equivalent area for background ventilators from Table 2.1.
b. Record actual equivalent area and location of installed background ventilators.
c. Check whether background ventilator controls work and that they open and close correctly.
d. Check the quality of the installation of the ventilator product to ensure it is correctly mounted within the wall or window aperture.

4.6 For intermittent extract fans, the installer should:

a. Check that the fan operates correctly.
b. Check that the fan or fans respond correctly to the controls provided with the installation.
c. Check that any run-on timers are set to at least 15 minutes.

Ducted systems

4.7 For all ductwork and terminals, the following should be observed and recorded in the checklist in Appendix C:

a. Check that the system has been installed both:
   - in accordance with the design criteria
   - to a standard that will not adversely affect its performance.
b. Number and size of air terminals satisfy Table 1.4.
c. All ductwork and terminals are in good condition with no obvious defects that will affect the performance of the system.
d. Air flow direction is correct at each room terminal.
e. There are no abnormal noises from the ventilation system, including all of the following

i. On start-up
ii. When running in background ventilation mode
iii. When running at the high rate

Commissioning

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

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

Air flowrate testing

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

- Intermittent extract fans

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

Air flow rates should be measured at each room terminal. The following procedure should be followed:

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

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

Where the fan/terminal is too big for the testing hood, this is not typically an exceptional circumstance - larger hoods are available for all domestic fans, except kitchen hood. If a kitchen hood cannot be measured in the way described, this is not typically an exceptional circumstance - an alternative is to measure on the outside on the exhaust terminal.
Examples of exceptional circumstances are:

a. *Kitchen hoods for above ground flats, where exhaust terminal is not accessible. If same hood/design on upper flats as ground (which has been measured) then this should be sufficient to demonstrate upper floor are fine.*
b. *Fan sited above non-removable building component, e.g. shower partition.*

Controls

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

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

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

Providing information

4.12 Sufficient information about the ventilation system and its maintenance requirements must be given to owners so that the system can be operated effectively. This should include both design flow rates, maintenance requirements. The information should be provided in a clear manner, for a non-technical audience.

4.13 A copy of the completed commissioning sheet in **Appendix C** should be provided to the owner of the dwelling.

4.14 The operation and maintenance manual should contain specific instructions for the end user on how and when to use the ventilation system, including information on the intended use of available fan settings. Information should also be provided to suggest when, and how, the system components should be cleaned and maintained.

4.15 The following information should be provided where relevant:

a. manufacturer's contact details;
b. that background ventilators allow fresh air into the home and should be left open;
c. location of and setting of automatic controls (e.g. humidity and timer controls);
d. location and use of on/off and high rate settings for mechanical ventilation system;
e. how to adjust extract air terminals on vertical passive stack ducts;
f. how cleaning and maintenance should be carried out, including replacing filters;
g. location of filters, if not installed within the fan unit. If no filters are installed on extract terminals, describe how to access ducts for cleaning, how to undertake cleaning and at what interval;
h. the location of sensors and how to recalibrate them.
i. design flow rates

4.16 The operation and maintenance manual should also contain relevant manufacturers' literature, including, where relevant:

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

Appendix A: Key Terms

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

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

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

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

Background ventilator is a small ***ventilation opening*** designed to provide controllable ***whole building ventilation***. See Diagram 1.

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

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

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

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

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

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

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

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

accordance with Table 1.5.

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

Free area is the geometric open area of a ventilator.

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

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

Highly airtight buildings are those with either:

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

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

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

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

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

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

Mechanical supply and extract is mechanically driven ventilation that both continuously supplies outdoor air to the inside of the dwelling and continuously extracts indoor air and discharges it to outside. This may include a heat recovery as part of a system to reclaim heat from the extract air to condition the supply air, such as mechanical ventilation with heat recovery (MVHR).

Natural ventilation is ventilation provided by thermal, wind or diffusion effects through doors, windows or other intentional openings without the use of mechanically driven equipment.

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

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

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

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

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

mechanical ventilation or air-conditioning systems).

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

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

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

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

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

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

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

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

Appendix B: Performance-based ventilation

Introduction

B.1 This Appendix sets out the levels of moisture and other pollutants that the provisions in this Approved Document are designed to control. The provisions are designed to control all of the following:

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

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

NOTE 2: A strategy for achieving good indoor air quality includes reducing the release of water vapour and air pollutants. This Approved Document does not provide guidance on this strategy.

Performance criteria for dwellings

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

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

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

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

Table B.1 Indoor air pollutants guidance values[1]

Pollutant	Exposure limit	Exposure time
Carbon monoxide	100 mg/m^3	15 minute average
	30 mg/m^3	1 hour average
Nitrogen dioxide (NO_2)	200 µg/m^3	1 hour average
	40 µg/m^3	1 year average
Formaldehyde	100 µg/m^3	30 minute average
TVOC[2]	300 µg/m^3	8 hour average

Notes:

1. There are no safe levels that can be recommended for benzene and trichloroethylene and as such they have not been considered for defining ventilation rates in dwellings. Source control may be the optimal strategy for reducing their concentration indoors.

2. Total volatile organic compound (TVOC) metric is representative of all airborne indoor air VOC concentrations and should not be used as a direct indicator of health. The simplified metric is used as an indicator for ventilation control strategies. As an alternative to the TVOC limit, individual VOC limits may be used where justified according to paragraph B.5.

3. The designer and builder may choose source control as the optimal strategy of reducing VOC levels in buildings. However, the ventilation requirements must still be met.

B.5 As an alternative to using TVOC, the individual VOCs may be used, where supported by robust independent evidence. Testing against these metrics is likely to be more complex than testing against TVOC. [**Note for consultation:** We are currently analysing the views from consultation stage 1 on what limits could be used as an alternative to TVOC, based on available evidence and publications]

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

Assumptions used in applying performance criteria for dwellings in Section 1

General

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

B.8 Where the guidance suitable for any level of airtightness is followed, dwellings are assumed to have no ***infiltration***.

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

CIBSE Guide A provides further information on ventilation effectiveness.

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

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

Table B.3 Surface water activity

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

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

Table B.4 Indoor air relative humidity water activity

Moving average period	Surface water activity
1 month	65%
1 week	75%
1 day	85%

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

Extract ventilation

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

B.14 For intermittent extract:

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

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

- A ventilation rate of 15 l/s is specified for removing moisture from ***bathrooms*** at a production rate of 400 g/h.

- A ventilation rate of 30 l/s is specified for removing moisture generated in utility rooms

at a production rate of 1000 g/h.

– In WCs, a ventilation rate of 6 l/s has been specified to remove odours.

B.15 For continuous extract:

– The rates used in Table 1.2 are the same as used in the 2006 and 2010 editions of Approved Document F.

Whole dwelling ventilation

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

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

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

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

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

A minimum ***whole dwelling ventilation*** rate of 0.3 l/s per m^2 of internal floor area is specified to remove volatile organic compounds at a production rate of 300 µg/h per m^2 of floor area.

Basis of Table 1.3 – Whole dwelling ventilation rates

B.20 To determine the ventilation rates, the air supply rates in Table 1.3 have been used.

B.21 For **less airtight buildings**, the air supply rate is reduced by 0.15 air changes per hour to allow for ***infiltration***.

B.22 To determine the ***equivalent areas***, the standard air flow equation has been used, as below:

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

Where:

A = the ***background ventilator equivalent area*** (mm^2)

Q = the air supply rate (l/s)

C_d = the discharge coefficient, taken as 0.61

ρ = the air density (kg/m^3), taken as 1.2

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

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

dwelling.

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

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

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

Purge ventilation

B.23 A value of 4 air changes per hour has been selected because it provides a ***purge ventilation*** rate an order of magnitude above ***whole building ventilation*** assuming both:

- single-sided ventilation for a dwelling in an urban environment
- an internal/external temperature difference of 3°C.

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Appendix C: Completion checklist and commissioning sheet

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

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

Checking design against measured air flow rates

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

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

Demonstrating compliance

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

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

Part 1 – System details and declarations

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

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

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

Part 2a – Installation details

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

2.1	*Installation Checklist – General (all Systems)*	*Tick as appropriate*	
Has the system been installed in accordance with manufacturer's requirements?		**Yes**	**No**
Have paragraphs 1.71 to 1.79 of Approved Document F volume 1 been followed (if relevant)?		**Yes**	**No**
If there are any deviations from paragraphs 1.17 to 1.79 of Approved Document F volume 1, these should be detailed here.			
Description of installed controls (e.g. timer, central control, humidistat, occupancy sensor, thermal bypass if applicable, etc)			
Location of manual / override controls			

2.2	*Installation Engineer's Declaration*
Engineer's Signature	
Registration Number (if applicable)	
Date of Inspection	

Part 2b – Inspection of installation

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

2.3a	*Visual Inspections – General (all Systems)*		
Total installed equivalent area of background ventilators in dwelling?			**mm²**
Total floor area of dwelling?			**m²**
Does the total installed equivalent ventilator area meet the requirements given in Table 2.1 or paragraph 1.60, as appropriate, in Approved Document F volume 1?		**Yes**	**No**
Have all background ventilators been left in the open position?		**Yes**	**No**
Have the correct number and location of extract fans/terminals been installed that satisfy Table 1.1 or Table 1.2 as appropriate in ADF?		**Yes**	**No**
Is the installation complete, with no obvious defects?		**Yes**	**No**
Do all internal doors have sufficient undercut to allow air transfer between rooms (e.g 10 mm over and above final floor finish)?		**Yes**	**No**
Has all protection/packaging been removed (including background ventilators), such that system is fully functional?		**Yes**	**No**
For ducted systems, has the ductwork been installed so that air resistance and leakage is kept to a minimum?		**Yes**	**No**
Has the entire system been installed so that there is sufficient access for routine maintenance and to repair/replace components?		**Yes**	**No**
2.3b	***Visual Inspections – General (Systems 3 and 4 only)***		
Have appropriate air terminal devices been installed to allow system balance?		**Yes**	**No**
Has the heat recovery unit (mechanical supply and extract ventilation) and all ductwork been effectively insulated where installed in unheated spaces?		**Yes**	**No**
Condensate connection is complete and condensate drains to an appropriate location (mechanical supply and extract ventilation only)?		**Yes**	**No**
2.3c	***Other Inspections – General (Systems 1, 3 and 4 only)***		
Upon initial start-up, was there any abnormal sound or vibration, or unusual smell?		**Yes**	**No**

Part 3 – Commissioning details

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

3.1 Commissioning Equipment		
Schedule of air flow measurement equipment used (model and serial)		Date of last UKAS calibration
1.		
2.		
3.		

3.2 Air Flow Measurements – Intermittent extract fans only		
Fan reference (as 1.2)	Measured Extract Rate (l/s)	Design Extract Rate (l/s) Refer to Table 1.1 in ADF
Extract Fan 1.		
Extract Fan 2.		
Extract Fan 3.		
Extract Fan 4.		
Extract Fan 5.		

For cooker hoods, only the highest setting needs to be recorded.

3.3 Air Flow Measurements (Extract) – Mechanical extract ventilation and mechanical supply and extract ventilation only				
Room reference (location of terminals)	Measured Air Flow High Rate (l/s)	Design Air Flow High Rate (l/s) Refer to Table 1.2 in ADF	Measured Air Flow Continuous rate (l/s)	Design Air Flow Continuous Rate (l/s) Refer to Table 1.3 in ADF
Kitchen.				
Bathroom				
En Suite				
Utility				
Other...				
Other...				
Other...				

3.4 Air Flow Measurements (Supply) – Mechanical supply and extract ventilation only				
Room reference (location of terminals)	Measured Air Flow High Rate (l/s)	Design Air Flow High Rate (l/s) Refer to Table 1.2 in ADF	Measured Air Flow Continuous Rate (l/s)	Design Air Flow Continuous Rate (l/s) Refer to Table 1.3 in ADF
Living Room 1				
Living Room 2 (if present)				
Dining Room				
Bedroom 1				
Bedroom 2				
Bedroom 3				
Bedroom 4				
Bedroom 5				
Study				
Other...				

3.5 Commissioning Engineer's Declaration	
Engineer's Signature	

Registration Number (if applicable)	
Date of Commissioning	

Appendix D: Checklist for ventilation provision in existing dwellings

The relevant section of this checklist should be selected, depending on the chosen ventilation strategy. If any questions are answered 'No', further ventilation provisions should be installed, as described in paragraphs 3.10 to 3.11[1].

Natural Ventilation		
Does each habitable room include a background ventilator(s) that satisfy paragraph 1.29 and the minimum equivalent area in Table 2.1?	Yes	No
Are all background ventilators in working order? Can they be closed and opened fully?	Yes	No
Are there intermittent extract fans in all wet rooms that satisfy Table 1.1?	Yes	No
Does the location of fans satisfy paragraph 1.19?	Yes	No
Does each room have a system for purge ventilation (e.g. windows) that satisfy paragraphs 1.25 and 1.26?	Yes	No
Do openings in that room satisfy the minimum opening areas in Table 1.4?	Yes	No
Do all internal doors have sufficient undercut to allow air transfer between rooms as detailed in paragraph 1.24 (e.g. 10 mm above floor finish)?	Yes	No
Continuous mechanical extract ventilation		
This may comprise a central, individual room extract fans or both.		
Does the total combined continuous rate of mechanical extract ventilation satisfy Table 1.3?	Yes	No
Does each wet room minimum mechanical extract ventilation high rate satisfy Table 1.2?	Yes	No
Confirm there are *no* background ventilators in wet rooms?	Yes	No
Do habitable rooms have background ventilators having a minimum equivalent area of 4,000 mm^2?	Yes	No
Does each room have a system for purge ventilation (e.g. windows) that satisfy paragraphs 1.25 and 1.26?	Yes	No
Do openings in that room satisfy the minimum opening areas in Table 1.4?	Yes	No
Do all internal doors have sufficient undercut to allow air transfer between rooms as detailed in paragraph 1.24 (e.g. 10 mm above floor finish)?	Yes	No
Continuous mechanical supply and extract ventilation		
Does each habitable room have mechanical supply ventilation?	Yes	No
Does the total continuous rate of mechanical supply and extract ventilation satisfy Table 1.3?	Yes	No
Does each wet room minimum mechanical extract ventilation high rate satisfy 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) that satisfy paragraphs 1.25 and 1.26? Do openings in that room satisfy the minimum opening areas in Table 1.4?	Yes Yes	No No
Do all internal doors have sufficient undercut to allow air transfer between rooms as detailed in paragraph 1.24 (e.g. 10 mm above floor finish)?	Yes	No

Note:

1. A visual check for mould or condensation should be made. If either are present, additional ventilation provisions should be considered or specialist advice sought.

Appendix E: Standards referred to

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

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

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

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

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

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

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

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

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

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

Appendix F: Documents referred to

Chartered Institution of Building Services Engineers (CIBSE)

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

Health and Safety Executive (HSE)

HSG 193. *COSHH Essentials*.

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

International Energy Agency (IEA)

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