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Approved Document F 2021 Editions

A guide to the changes

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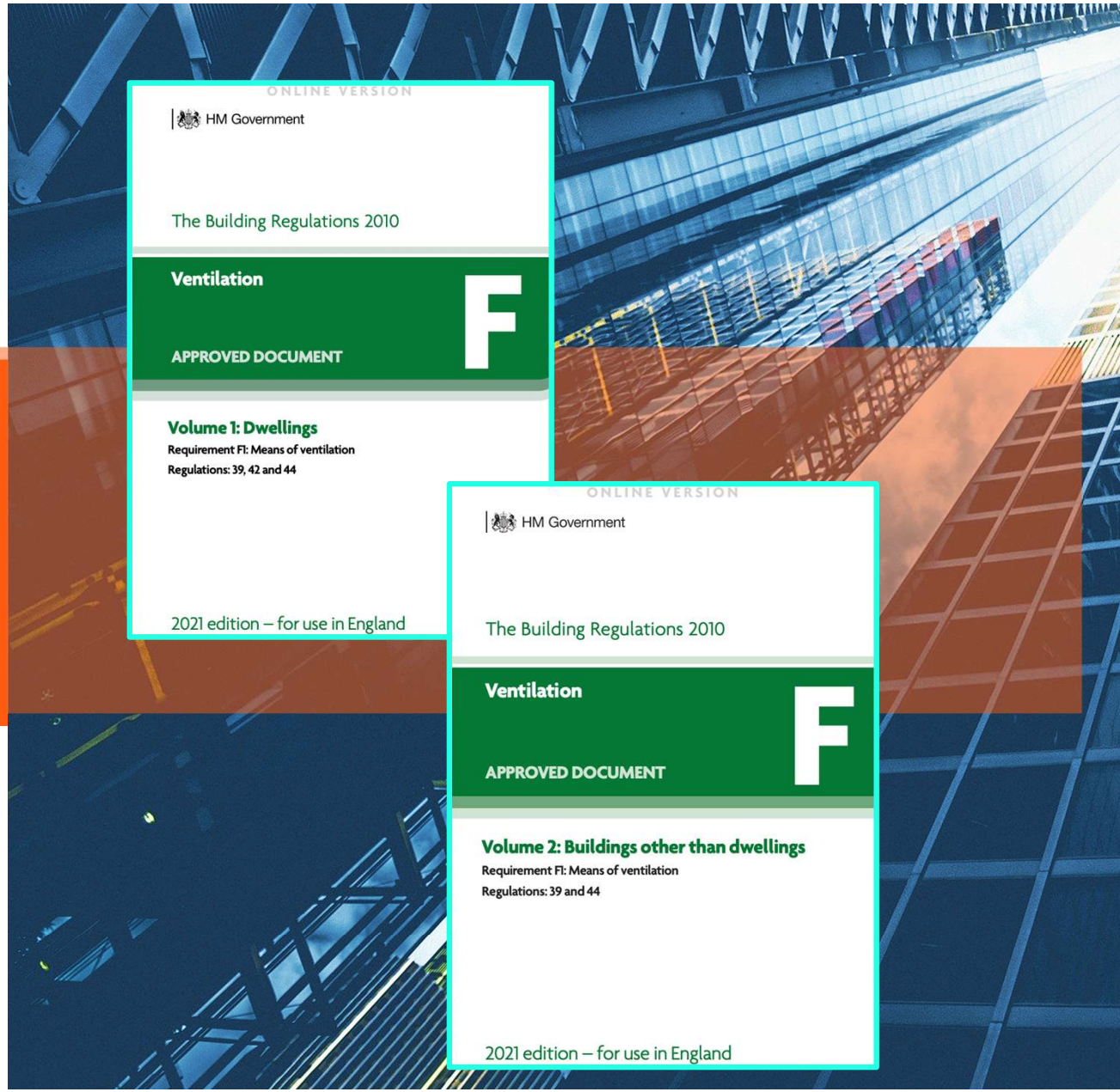

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What we will look at in this presentation

- Why there is a need for change
- When will this change be implemented
- The existing system options and the new system requirements
- How these systems work
- The performance rates they need to achieve
- Natural ventilation design options
- Common design faults and how to avoid them
- New requirements on works to existing buildings
- New testing and mandatory commissioning requirements

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- **Why is there a need for change ?**
- **New Dwellings** and also **existing buildings** are becoming evermore airtight
- Our existing housing stock of leaky buildings have relied heavily on *infiltration* to maintain a healthy air quality in the dwelling

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- **Why is there a need for change?**

The research findings.


Ministry of Housing,
Communities &
Local Government

Ventilation and Indoor Air Quality in New Homes

September 2019
Aecom Limited
Ministry of Housing, Communities and Local Government

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The primary aim of the study was to evaluate whether the ventilation provisions recommended in the 2010 edition of Approved Document F provide satisfactory indoor air quality in new homes.

A key secondary aim was to establish the extent to which installed ventilation systems comply with the minimum ventilation provisions recommended in Approved Document F.

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The study highlighted issues around the ventilation of internal emissions of moisture, bio effluents (body odour) and volatile organic compounds

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- In total, 80 Homes were studied in the period from November 2015 to February 2016, this was across seven developments in England

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55 of the homes were naturally ventilated. These comprised of trickle ventilators throughout the homes to provide general background ventilation in combination with intermittent extract fans in kitchens, bathrooms and toilets for use during cooking, bathing etc

25 of the Homes had decentralised mechanical extract ventilation (dMEV) systems . These comprised of continuously- running extract fans located within the kitchen, bathrooms and toilets to provide general background ventilation, as well as trickle ventilators to aid the supply of air to the habitable rooms (eg Living rooms and Bedrooms) in the Homes

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- During the monitoring period, householders were requested to keep their trickle ventilators open and use their extract fans.
- Interviews were undertaken with residents to understand indoor pollutant sources, their ventilation behaviour and their perception of indoor air quality in their home.

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The survey findings

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Naturally ventilated homes: only 2 of the 55 homes visited met the guidance in ADF with regard to both trickle ventilation provision and intermittent extract fan air flow rates. In particular, **only 9 of the homes met the minimum extract fan air flow rates**.

- A number of fans tested provided less than half minimum extract fan flow rates.
- Only one half of the homes met the minimum trickle ventilator areas, with homes ranging from 60% below to 107% above the recommended area.

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- **Homes with continuous mechanical extract: O**nly one of the 25 Homes visited met the guidance published in ADF with respect to both continuous extract fan air flow rates and trickle ventilation provisions.
- The key reason for this is that, in nearly all cases, the extract fan flow rates were below those recommended. In normal mode (ie low rate) whole dwelling extract air flow rates ranged from 85% below to 8% above the recommended flow rate.
- Although trickle ventilators met the minimum free area requirements in all of the homes , two of the three developments sites which had dMEV had trickle ventilations installed in the same rooms as the extract fans . This is contrary to guidance to ADF and may reduce the ability of extract fans to draw air through the whole house.

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THE CONCLUSIONS

- *These levels of compliance may be seen as disappointing given that one of the key changes in the the Part F 2010 revisions was the introduction of a legal requirement for testing and commissioning of installed fans, and for the installer to notify the Building Control body of the commissioning and the air flow rates.*

- *It is further noted that the measured air exchanges rates in the study are significantly below that recommended in ADF. The poorer IAQ levels tended to be in the bedrooms.*

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When will the changes be implemented?

The existing 2010 arrangements will continue to apply where both of the following situations have been met:

Application is in and registered by the 15th June 2022

AND

- **The works are suitably commenced on site by the 15th June 2023**

*Note: it's on a plot by plot basis. ie Commencement of one plot on a development of multiple house **will not** keep the other plots under the old regulations*

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Interaction with other parts of the Building Regulations

Part B- Protected stairways ,and compartmentation.
Part J- Open flued appliance
Part L- Suitable ventilation system required to dovetail with the Part L design
Parts K and M- Suitable manual controls positions for occupants
Part O- Note overheating requirements may require a higher purge ventilation standard than Part F

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- The existing system options and the new system requirements
- How these systems work
- The performance rates they need to achieve

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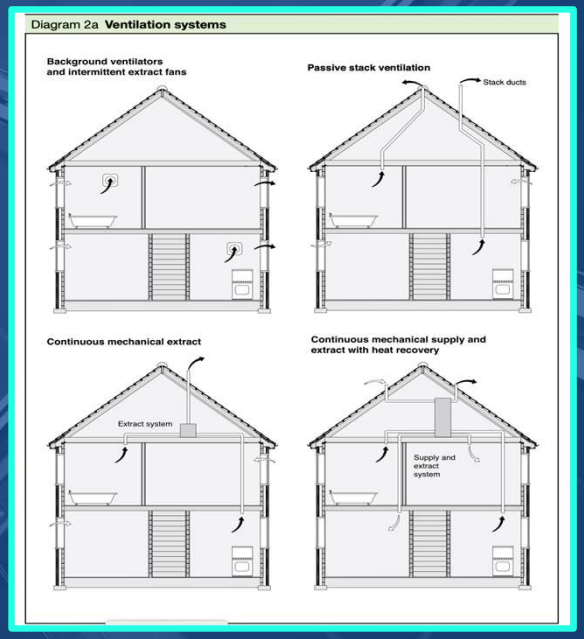
The Current System Provisions

System 1: Background ventilators and intermittent extract fans. Guidance on minimum provisions for ***extract*** and ***whole dwelling ventilation*** is set out in Table 5.2a. Note that it includes separate guidance for dwellings with habitable rooms having only a single exposed façade.

System 2: Passive stack ventilation (PSV). Guidance on minimum provisions for ***extract*** and ***whole dwelling ventilation*** is set out in Table 5.2b.

System 3: Continuous mechanical extract (MEV). Guidance on minimum provisions for ***extract*** and ***whole dwelling ventilation*** is set out in Table 5.2c.

System 4: Continuous mechanical supply and extract with heat recovery (MVHR). Guidance on minimum provisions for ***extract*** and ***whole dwelling ventilation*** is set out in Table 5.2d.



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The new system requirements and these systems work?

Table 1.6 Types of ventilation system

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

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Acceptability for Natural Ventilation-must be less Airtight

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

a. A design air permeability higher than $5m^3/(h \cdot m^2)$ at 50Pa.

b. An as-built air permeability higher than $3m^3/(h \cdot m^2)$ at 50Pa.

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

a. Expert advice should be sought.

b. A continuous mechanical extract ventilation system should be installed by following the guidance in paragraphs 1.60 to 1.66.

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

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One of the following:

a. A design air permeability higher than $5m^3/(h \cdot m^2)$ at 50Pa.

b. An as-built air permeability higher than $3m^3/(h \cdot m^2)$ at 50Pa.

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Natural ventilation and intermittent extract fans - Acceptability and cost efficiency.

SAP DESIGN Air Leakage	Part L potential Build cost	ACTUAL Air Leakage test result	Actions needed
6	H	6	Not permitted. Retro Fit improvements as actual test result is higher than 5. See Part L backstop
6	H	5	No Action needed
6	H	4	No Action needed
6	H	3	Building actual test result needs to be at least 4
4	M	4	No Action needed
4	M	3	Building actual test result needs to be at least 4
3	Retro Part L upgrade works potentially H	4	Revise the AS BUILT SAP with increased measures as the building is leakier than intended
3	Retro Part L upgrade works potentially H	3	Building actual test result needs to be at least 4 AND Revise the AS BUILT SAP with increased measures as the building is leakier than intended in the Design calc

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Natural ventilation intermittent fans

Table 1.1 Minimum extract ventilation rates for intermittent extract systems

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

NOTES:

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

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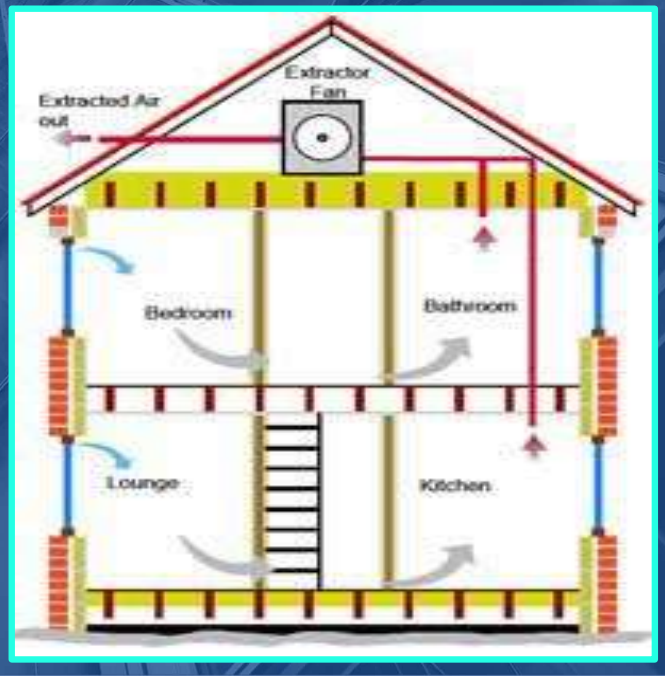
CMEV continuous ventilation



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Minimum extract rates for continuous ventilation

Table 1.2 Minimum extract ventilation rates for continuous extract systems[1]

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

NOTE:

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

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Minimum extract rates for continuous ventilation

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

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

NOTES:

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

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Common design faults - How to avoid them

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Mechanical Extract Design

- **Centrifugal type** fans for duct lengths over 1.5M in length.
- **Continuous extract system?-** Do not provide BV's in the extract rooms.
- **MVHR?-** Do not provide BV's
- **Rigid Ducts** where possible
- **BVs 4,000mm2** per each habitable room **in continuous extract systems**

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Mechanical Extract Design

- **Centrifugal type** fans for duct lengths over 1.5M in length.
- **Continuous extract system?-** Do not provide BV's in the extract rooms.
- **MVHR?-** Do not provide BV's
- **Rigid Ducts** where possible
- **BVs 4,000mm2** per each habitable room **in continuous extract systems**

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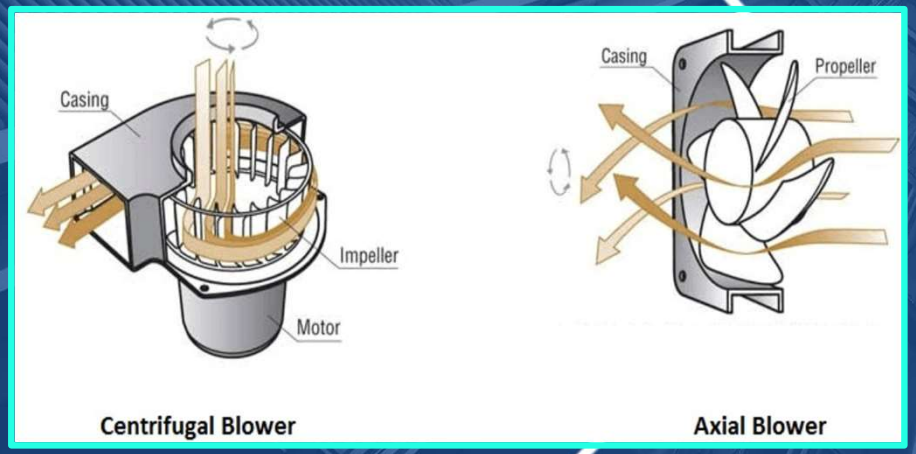
Extract performance 15lit/sec -Analysis by test



Fan Type	Axial	Centrifugal
Manufacturers declared rate	23	24
Practical results	**Axial**	**Centrifugal**
Measured Flow rate external wall fit	19	24
With rigid ductwork. Within 1.5m of final outlet	15	24
With rigid ductwork. Within 3m of final outlet and with external grill	**9**	24
Flexible ductwork pulled taught. Within 3m of final outlet	**10.8**	24
Flexible ductwork pulled taught. Within 3m of final outlet and with external grill	**8.4**	22

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Background Ventilation Design

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Background Ventilation Design

- Marked with equivalent area –*To be easy to read*
- Not in rooms that have continuous extract
- Open plan kitchen/lounge areas? *3 vents minimum*
- Total number required based on bedroom numbers –
- ***Minimum 4 for a 1 bed unit. Minimum 5 when more than 1 bed***
- 500mm away from any mechanical extract position
- Elevation opens onto a **busy road?-** Noise attenuation type
- **Single exposed elevation?-** *Vents at high and low level*
- **More than one exposed elevation for the unit**?-*balance the BV area to promote good cross flow.*
- No more acceptance of secure position fan lights with twin lock positions

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The Amount of Background ventilation

Table 1.7 Minimum equivalent area of background ventilators for natural ventilation[1]

Room	Minimum equivalent area of background ventilators for dwellings with multiple floors	Minimum equivalent area of background ventilators for single-storey dwellings
Habitable rooms[2][3]	8000mm²	10,000mm²
Kitchen[2][3]	8000mm²	10,000mm²
Utility room	No minimum	No minimum
Bathroom[4]	4000mm²	4000mm²
Sanitary accommodation	No minimum	No minimum

NOTES:

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

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Improvements to existing buildings

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The trigger for improvements

Table 3.1 Energy efficiency measures

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

NOTES:

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

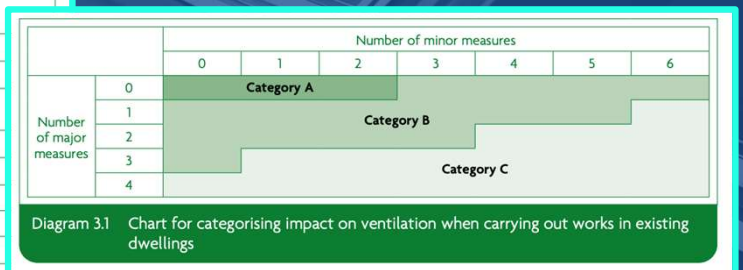

Diagram 3.1 Chart for categorising impact on ventilation when carrying out works in existing dwellings

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

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Upgrading Example

A semi detached 1950's built house undergoing the following works.

1. A Loft Conversion
2. Replacement of all the windows and
3. Removal of the chimney stack

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Upgrading

3.11 If the method in Diagram 3.1 results in the work being categorised as Category B, it is likely that the ventilation provision of the dwelling has been reduced below the requirements of F1(1). Further ventilation provision should be provided by one of the following means.

a. Natural ventilation, by following the system-specific guidance in paragraphs 1.47 to 1.59. It is assumed that any existing purpose-built ventilators are in working order and that the equivalent area has not been compromised.

b. Continuous mechanical extract ventilation, by following the system-specific guidance in paragraphs 1.60 to 1.66.

c. Mechanical ventilation with heat recovery, by following the system-specific guidance in paragraphs 1.67 to 1.73. To avoid unintended air pathways, existing background ventilators should be covered or sealed shut.

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Category B- Natural ventilation check and upgrade where there is a shortfall

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

Intermittent extract

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

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

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

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

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

Background ventilators

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

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

a. The risk of draughts.

b. Security issues.

c. The difficulty of measuring the equivalent area.

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

1.54 If an exposed façade is close to an area of sustained and loud noise (e.g. a main road), then a noise attenuating background ventilator should be fitted.

1.55 If fans and background ventilators are fitted in the same room, they should be at least 500mm apart.

1.56 The minimum total area of background ventilators in each room should follow the guidance in Table 1.7.

1.57 The total number of ventilators installed in the dwelling's habitable rooms and kitchens should be at least the following.

a. Four ventilators if the dwelling has one bedroom.

b. Five ventilators if the dwelling has more than one bedroom.

1.58 If the dwelling has a kitchen and living room which are not separate rooms, at least three ventilators of the same area as for other habitable rooms in Table 1.7 should be provided in the open-plan space.

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Upgrading- Category C

3.12 If the method in Diagram 3.1 results in the work being categorised as Category C, it is likely that the ventilation provision of the dwelling has been reduced *significantly* below the requirements of F1(1). Further ventilation should be provided by one of the following means.

a. Natural ventilation, by following expert advice for the design, sizing and positioning of ventilators to ensure adequate ventilation provision.

b. Continuous mechanical extract ventilation, by following the system-specific guidance in paragraphs 1.60 to 1.66.

c. Mechanical ventilation with heat recovery, by following the system-specific guidance in paragraphs 1.67 to 1.73. To avoid unintended air pathways, existing background ventilators should be covered or sealed shut.

3.13 Appendix D provides a checklist for determining the ventilation provision in an existing dwelling. It may be used before energy efficiency measures are carried out to establish whether an existing dwelling complies with the requirement for adequate means of ventilation.

Existing dwelling building works that have triggered Category B or C improvements: Checklist provided.

If the answer to any of the questions is NO then improvements will be required.

Table D1 Checklist for ventilation provision in existing dwellings

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

NOTES:

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

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Upgrading

Replacing windows

Existing windows with background ventilators

3.14 If the existing windows have background ventilators, the replacement windows should include background ventilators. The new background ventilators should comply with both of the following conditions.

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 3.15 may be applied.

Existing windows without background ventilators

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

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Upgrading

a. Incorporating background ventilators in the replacement windows equivalent to the following.
   i. Habitable rooms – minimum 8000mm^2 equivalent area.
   ii. Kitchen – minimum 8000mm^2 equivalent area.
   iii. Bathroom (with or without a toilet) – minimum 4000mm^2 equivalent area.
b. If the dwelling will have continuous mechanical extract ventilation, installing background ventilators in any replacement windows which are not in wet rooms, with a minimum equivalent area of 4000mm^2 in each habitable room.
c. Other ventilation provisions, if it can be demonstrated to a building control body that they comply with the requirements of paragraph 3.2.

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

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Example – Natural ventilation existing system

Changes falls into Category B?
Natural ventilation improvements paras 1.47 to 1.51 to be followed.

Changes fall into Category C?
Natural ventilation specialist involvement required.

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Firming up of the commissioning

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REG 39
Information about ventilation system type and how to operate
Details to be passed to the owner.

REG 41
Mechanical ventilation air flow rate testing-New Dwellings
Details and results within 5 days of completion to BCB.

REG 44
Commissioning
Details within 5 days of completion to BCB.

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Part 1 – System details and declarations

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

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

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

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Part 2a – Installation details

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

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

NOTE:

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Part 2b – Inspection of installation

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

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

NOTE:

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

Part 3 – Commissioning details

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

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

3.2 Air flow measurements – intermittent extract fans only		
Fan reference (from section 1.2 above)	Measured extract rate (l/s)	Design extract rate (l/s) Refer to Table 1.1[1]
Extract fan 1		
Extract fan 2		
Extract fan 3		
Extract fan 4		

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

3.3 Air flow measurements (extract) – continuous mechanical extract ventilation and mechanical ventilation with heat recovery only				
Room reference (location of terminals)	Measured air flow – high rate (l/s)	Design air flow – high rate (l/s) Refer to Table 1.2	Measured air flow – continuous rate (l/s)	Design air flow – continuous rate (l/s) Refer to Table 1.3
Kitchen				
Bathroom				
En suite				
Utility				
Other				
Other				
Other				

3.4 Air flow measurements (supply) – mechanical ventilation with heat recovery only				
Room reference (location of terminals)	Measured air flow – high rate (l/s)	Design air flow – high rate (l/s) Refer to Table 1.2	Measured air flow – continuous rate (l/s)	Design air flow – continuous rate (l/s) Refer to Table 1.3
Living room 1				
Living room 2				
Dining room				
Bedroom 1				
Bedroom 2				
Bedroom 3				
Bedroom 4				
Bedroom 5				
Study				
Other				

3.5 Commissioning engineer's declaration	
Engineer's signature	
Registration number (if applicable)	
Date of commissioning	

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

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Volume 2- Buildings Other than Dwellings SCOPE

Scope includes communal rooms in blocks of flats and rooms for residential purposes (but not self contained flats)

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Very much the same general simple design principles as vol 1.

Still has specific design guidance for **offices** and **car parks** and a reference to second tier documents for other purpose groups

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Table 1.1 Ventilation for buildings other than offices and car parks

Building/space/activity	Regulations and guidance (also see CIBSE's Guide A and Appendices D and E)
Animal rooms	CIBSE Guide B2 *Ventilation and Ductwork* (2016) *Code of Practice for the Housing and Care of Animals Bred, Supplied or Used for Scientific Purposes* (Home Office, 2014)
Building services plant rooms	Dangerous Substances and Explosive Atmospheres Regulations 2002 Provision for emergency ventilation to control dispersal of contaminating gas releases (e.g. refrigerant leak) is given in paragraphs 23 to 25 of HSE Guidance Note HSG 202 *General Ventilation in the Workplace – Guidance for Employers*. **BS EN 378-3** *Refrigerating systems and heat pumps. Safety and environmental requirements – Installation site and personal protection* Follow manufacturers' guidance for adequate provision of air for service equipment.
Catering and commercial kitchens	HSE Catering Information Sheet No. 10: *Ventilation in catering kitchens* (2017) BESA DW 172 *Specification for Kitchen Ventilation Systems* (2018) CIBSE Guide B2 *Ventilation and Ductwork* (2016)
Cleanrooms	CIBSE Guide B2 *Ventilation and Ductwork* (2016)
Common spaces[1]	Either: a. natural ventilation by appropriately located ventilation opening(s) with a total opening area of at least 1/50 of the floor area of the common space b. mechanical ventilation installed to provide a supply of fresh air of 0.5 litres per second per m^2 of floor area.
Data centres	CIBSE Guide B2 *Ventilation and Ductwork* (2016)
Dealing rooms	CIBSE Guide B2 *Ventilation and Ductwork* (2016)
Factories and workshops	Control of Substances Hazardous to Health (COSHH) Regulations 2002 Factories Act 1961 Health and Safety at Work etc. Act 1974 BESA TR 40 *Guide to Good Practice for Local Exhaust Ventilation* (2020) CIBSE Guide B2 *Ventilation and Ductwork* (2016) **NOTE:** Requirements are often exceeded by other criteria, such as the ventilation requirements of the particular manufacturing process.
Farms	Welfare of Farmed Animals (England) Regulations 2007 **BS 5502** *Buildings and structures for agriculture*
Gymnasiums	Sport England Design Guidance Note: *Fitness and Exercise Spaces* (2008)
Healthcare buildings: non-surgical	CIBSE Guide B2 *Ventilation and Ductwork* (2016) NHS Activity DataBase Health Technical Memorandum (HTM) 03-01 (Department of Health) Health Building Notes (HBN) – various (Department of Health)
Hospitals	CIBSE Guide B2 *Ventilation and Ductwork* (2016) NHS Activity DataBase Health Technical Memorandum (HTM) 03-01 (Department of Health) Health Building Notes (HBN) – various (Department of Health)
Hotels	CIBSE Guide B2 *Ventilation and Ductwork* (2016)

Second tier document design for other buildings

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Table 1.1 Continued

Building/space/activity	Regulations and guidance (also see CIBSE's Guide A and Appendices D and E)
Industrial ventilation	*Industrial Ventilation: A Manual of Recommended Practice for Design* (American Conference of Government Industrial Hygienists, 2019) *Industrial Ventilation: A Manual of Recommended Practice for Operation and Maintenance* (American Conference of Government Industrial Hygienists, 2020) HSG 258 *Controlling Airborne Contaminants at Work* (HSE, 2017)
Museums, libraries and art galleries	**BS 4971** *Conservation and care of archive and library collections* **BS EN 16893** *Conservation of Cultural Heritage. Specifications for location, construction and modification of buildings or rooms intended for the storage or use of heritage collections*
Places of assembly	CIBSE Guide B2 *Ventilation and Ductwork* (2016)
Prison cells	PSI 17/2012 *Certified Prisoner Accommodation* (Ministry of Justice, 2012)
Sanitary accommodation	Same as for offices in paragraph 1.26: sanitary accommodation should have an intermittent air extract rate of both of the following. a. 15 litres per second per shower or bath. b. 6 litres per second per WC pan or urinal. Extract ventilators in sanitary accommodation should be capable of continuous operation if required.
Schools and education	Education (School Premises) Regulations 1999 Building Bulletin 101 *Guidelines on Ventilation, Thermal Comfort and Indoor Air Quality in Schools* (ESFA, 2018) Building Bulletin 101 can also be used as a guide to the ventilation required in other educational buildings, such as further education establishments, where the accommodation is similar to that in schools, e.g. sixth form accommodation. However, the standards may not be appropriate for particular areas where more hazardous activities take place than are normally found in schools, e.g. some practical and vocational activities that require containment or fume extraction. Building Bulletin 101 can also be used for children's centres and other early years settings, including day nurseries, playgroups, etc.
Shops and general retail premises	CIBSE Guide B2 *Ventilation and Ductwork* (2016)
Sports centres and swimming pools	CIBSE Guide B2 *Ventilation and Ductwork* (2016) Sport England *Sports Halls Design and Layouts: Updated and Combined Guidance* (2012)
Supermarkets and food stores	CIBSE Guide B2 *Ventilation and Ductwork* (2016)
Transportation buildings and facilities	CIBSE Guide B2 *Ventilation and Ductwork* (2016)

NOTE:

1. Common spaces are as defined in Appendix A.

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Minimising the ingress of external pollutants is expanded upon

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Toughening up on the commissioning certification in much the same way as Volume 1

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Indoor air quality monitoring

Monitoring of carbon dioxide levels- Types of Building it applies to.

Indoor air quality monitoring

1.21 In new buildings, the following types of occupiable room, unless they are rooms of the size described in paragraph 1.22, should have a means of monitoring the indoor air quality. This may be achieved using CO_2 monitors or other means of measuring indoor air quality.

a. Occupiable rooms in offices.

b. Occupiable rooms where singing, loud speech or aerobic exercise or other aerosol generating activities are likely to take place. These may include rooms, for example, in gymnasiums, other indoor sports venues, dance studios, theatres, concert halls, public houses, nightclubs, places of assembly, as well as in other types of building.

c. Occupiable rooms where members of the public are likely to gather. These may include rooms, for example, in public buildings, hotels, gymnasiums, indoor sports venues, dance studios, theatres, concert halls, public houses, nightclubs, places of assembly, as well as in other types of building.

d. Occupiable rooms which are maintained at both low temperatures and low levels of humidity. These may include rooms used for chilled food processing and occupied cold stores.

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Indoor air quality monitoring.

Relevant building size limitations

1.22 The guidance in paragraph 1.21 does not apply to the following sizes of room.

a. Small spaces up to 125m^3 volume, or 50m^2 floor area.

b. Large spaces over 800m^3 in volume, or 320m^2 floor area.

1.23 Where CO_2 monitors are used, they should meet all of the following.

a. Be non-dispersive infrared (NDIR) type CO_2 monitors.

b. Be mains powered.

c. Be placed at breathing height and away from windows, doors or ventilation openings where practicable.

d. Be placed at least 500mm from people where practicable.

NOTE: Additional details on CO_2 monitoring for indoor air quality can be found in Appendix C.

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Indoor air quality monitoring

Appendix C gives guidance on design type and use

Appendix C: CO_2 monitoring

NOTE: The guidance in this appendix is based on the Scientific Advisory Group for Emergencies (SAGE) EMG/SPI-B advisory group paper *Application of CO_2 monitoring as an approach to managing ventilation to mitigate SARS-CoV-2 transmission.*

People exhale carbon dioxide (CO_2) when they breathe out. If there is a build-up of CO_2 in an area it can indicate that ventilation needs to be improved.

Checking levels of CO_2 using a monitor can help to identify areas that are poorly ventilated.

Types of CO_2 monitor to use

Many different types of CO_2 monitor are available. The most appropriate portable devices for use in the workplace are non-dispersive infrared (NDIR) CO_2 monitors.

How to use a CO_2 monitor

The level of CO_2 in the air will vary within an indoor space. It is best to place CO_2 monitors at head height and away from windows, doors or air supply openings.

Monitors that are positioned too close to people may give a misleadingly high reading due to the CO_2 in exhaled breath. Monitors should therefore be positioned at least 500mm away from room occupants.

Measured levels of CO_2 within a space can vary throughout the day due to changes in number of occupants, activities being performed or ventilation rates in the space. The opening and closing of doors and windows can also have an effect.

The amount of CO_2 in the air is measured in parts per million (ppm). If measurements in an occupied space seem very low (far below 400ppm) or very high (over 1500ppm), it is possible that the monitor is not in a suitable location. The monitor may need to be moved to another position within the space, to get a more accurate reading.

Instantaneous or 'snapshot' CO_2 readings can be misleading, so several measurements should be taken throughout the day. The frequency of measurements should be sufficient to ensure that changes in the use of the room or space throughout the day are represented in the readings. Levels of CO_2 may also vary throughout the year, as outdoor temperatures, and therefore behaviour relating to opening windows and doors, change.

How to get the most accurate readings

a. Check that monitors are within the recommended calibration period.

b. Follow the manufacturer's instructions, including allowing the appropriate warm-up time for the device to stabilise

c. Know how to use the monitor correctly, including the time needed to provide a reading.

d. Take measurements at key times throughout the working day.

e. Record CO_2 readings, number of occupants, the type of ventilation in use at the time and the date. These will help you use the CO_2 records to decide if an area is poorly ventilated.

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Indoor air quality monitoring

Appendix C gives design guidance on how to make sure its effective

How the measurements can help you take action

CO_2 measurements should be used as a broad guide to ventilation within a space, rather than treated as 'safe thresholds'.

Outdoor levels are around 400ppm. A consistent indoor CO_2 value of less than 800ppm is likely to indicate that a space is well ventilated.

An average CO_2 concentration of 1500ppm over the period when a space is occupied is an indicator of poor ventilation. Action should be taken to improve ventilation if CO_2 readings are consistently higher than 1500ppm.

However, in locations where continuous talking or singing takes place, or there are high levels of physical activity (such as dancing, playing sport or exercising), providing ventilation sufficient to keep CO_2 levels below 800ppm is recommended.

Where CO_2 monitors will be less effective

CO_2 monitors may not be suitable for use in areas that rely on air-cleaning units because these remove contaminants from the air but do not remove CO_2.

In large, open spaces and spaces with high ceilings, such as food production halls or warehouses, air may not be fully mixed and the measurements made by CO_2 monitors may not be representative.

CO_2 monitors are of limited use in less populated areas.

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Thank you for listening

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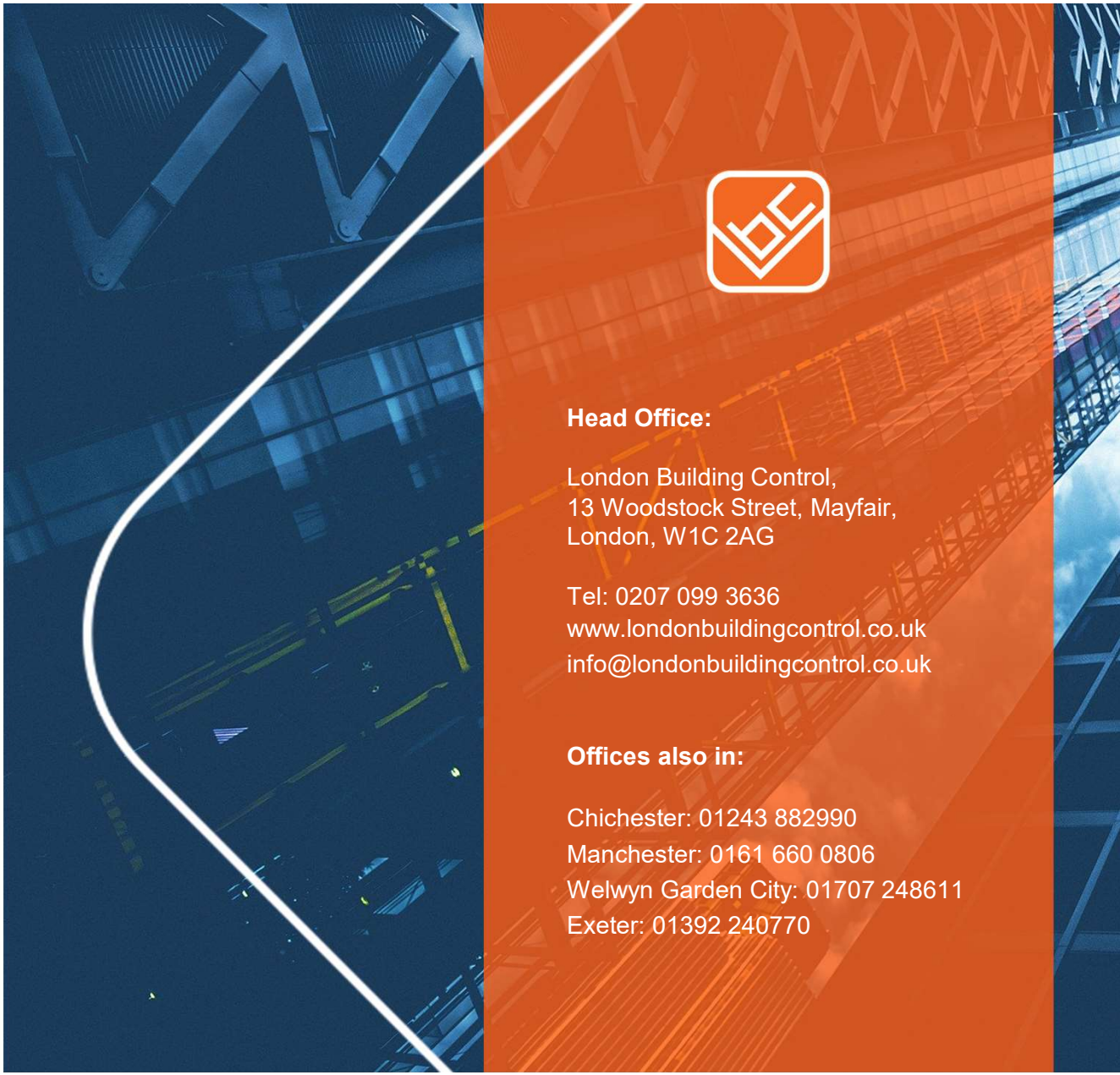

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