Building Regulations 2008

DRAFT

Technical Guidance Document F

Ventilation

Contents

Introduction

This document has been published by the Minister for the Environment and Local Government under article 7 of the Building Regulations 1997. It provides guidance in relation to Part F of the Second Schedule to the Regulations as amended by the Building Regulations (Amendment) Regulations 2008. The document should be read in conjunction with the Building Regulations, 1997 and other documents published under these Regulations.

In general, Building Regulations apply to the construction of new buildings and to extensions and material alterations to buildings. In addition, certain parts of the Regulations apply to existing buildings where a material change of use takes place. Otherwise, Building Regulations do not apply to buildings constructed prior to 1 June, 1992.

Transitional Arrangements

In general, this document applies to works, or buildings in which a material change of use takes place, where the works or the change of use commence or takes place, as the case may be, on or after xx xxx 2008. Technical Guidance Document F - **Ventilation** dated 1997, also ceases to have effect from that date. However, the latter document may continue to be used in the case of buildings

- where the work or the change of use commence or takes place, as the case may be, on or before yy yyyy yyyy or
- where planning approval or permission has been applied for on or before yy yyyy, yyyy and substantial work has been completed by yy yyy, yyyy, or a notice pursuant to Part 8 of the Planning and Development Regulations 2001, has been published on or before yy yyyy, yyyy and substantial work has been completed by yy yyyy, yyyy.

"Substantial work has been completed" means that the structure of the external walls of the house or flat has been erected.

The Guidance

The materials, methods of construction, standards and other specifications (including technical specifications) which are referred to in this document are those which are likely to be suitable for the purposes of the Regulations. Where works are carried out in accordance with the guidance in this document, this will, prima facie, indicate compliance with Part F of the Second Schedule to the Building Regulations. However, the adoption of an approach other than that outlined in the guidance is not precluded provided that the relevant requirements of the Regulations are complied with. Those involved in the design and construction of a building may be required by the relevant building control authority to provide such evidence as is necessary to establish that the requirements of the Building Regulations are being complied with.

Existing Buildings

In the case of material alterations or change of use of existing buildings, the adoption without modification of the guidance in this document may not, in all circumstances, be appropriate. In particular, the adherence to guidance, including codes, standards or technical specifications, intended for application to new work may be unduly restrictive or impracticable. Buildings of architectural or historical interest are especially likely to give rise to such circumstances. In these situations, alternative approaches based on the principles contained in the document may be more relevant and should be considered. See also Paragraph 1.1.11 of this document.

Technical Specifications

Building Regulations are made for specific purposes, e.g. to provide, in relation to buildings, for the health, safety and welfare of persons, the conservation of energy and access for disabled persons. Technical specifications (including harmonised European Standards, European Technical Approvals, National Standards and Agrément Certificates) are relevant to the extent that they relate to these considerations. Any reference to a technical specification is a reference to so much of the specification as is relevant in the context in which it arises. Technical specifications may also address other aspects not covered by the Regulations. However, if this version of the technical specification is subsequently revised or updated by the issuing body, the new version may be used as a source of guidance provided that it continues to address the relevant requirements of the Regulations.

Ventilation

Materials and Workmanship

Under Part D of the Second Schedule to the Building Regulations, building work to which the Regulations apply must be carried out with proper materials and in a workmanlike manner. Guidance in relation to compliance with Part D is contained in Technical Guidance Document D.

Interpretation

In this document, a reference to a section, subsection, part, paragraph or diagram is, unless otherwise stated, a reference to a section, subsection, part, paragraph or diagram, as the case may be, of this document. A reference to another Technical Guidance Document is a reference to the latest edition of a document published by the Minister for the Environment and Local Government under article 7 of the Building Regulations, 1997.

Diagrams are used in this document to illustrate particular aspects of construction - they may not show all the details of construction.

Building Regulations - The Requirement

Part F of the Second Schedule to the Building Regulations 2002 is amended to read as follows:-.

Means of ventilation.	F 1	Buildings shall be provided with adequate means of ventilation capable of ensuring that the air quality inside the building is not a threat to the health of the people using the building. This shall be achieved by a) limiting the moisture content of the air within the building so that it does not contribute to condensation and mould growth, and b) limiting the concentration of harmful pollutants in the air within the building. Adequate provision shall be made for the removal of water vapour from kitchens, bathrooms and other areas where water vapour is generated, and for the removal of harmful pollutants from areas where they are produced in significant quantities.
Condensation in roofs.	F2	Adequate provision shall be made to prevent excessive condensation in a roof or in a roof void above an insulated ceiling.

This Technical Guidance Document is divided into two sections.

Section 1 relates to the requirement in F1.

Section 2 relates to the requirement in F2.

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1.1 GENERAL

1.1.1 Ventilation of a building involves the supply of fresh outside air and the removal of "stale" indoor air. It normally comprises a combination of purpose-provided ventilation and air infiltration. The purpose-provided ventilation may be provided by natural or mechanical means.

1.1.2 The means of ventilation should be capable of providing a satisfactory indoor air quality for human respiration in occupied areas of a building by

- Diluting pollutants, including odours, and water vapour to levels which do not pose direct or indirect health risk;
- Removing excess water vapour from areas where it is produced in significant quantities, such as kitchens, utility rooms, bathrooms and shower rooms so as to reduce the likelihood of creating conditions that support the growth of mould, harmful bacteria, pathogens and allergens;
- Removing harmful pollutants from areas where they are produced in significant quantities;
- Providing an adequate supply of fresh air for persons using an area in a building.

1.1.3 The means of ventilation used can have a significant effect on building energy use and can directly effect achievement of compliance with the requirements of Part L of the Building Regulations. It can also affect occupant comfort, e.g. through undesirable draughts or excessive air movement. The aim should be to provide adequate ventilation while limiting energy use and avoiding occupant discomfort. In general the limitation of uncontrolled air infiltration and the placing of increased reliance for ventilation on controllable purpose-provided ventilation should improve energy efficiency and provide for enhanced occupant comfort.

1.1.4 It is important to minimise the uncontrollable infiltration and supply sufficient purpose-provided ventilation. Air tightness measures to limit infiltration are covered in Part L of the Building Regulations. Technical Guidance Document F recommends methods of achieving sufficient purpose-provided ventilation allowing for a reasonably high level of air tightness.

1.1.5 Airborne pollutants include those that are released from materials and products used in construction, decoration and furnishing of a building, and those created as a result of the activities of the building occupants. Common pollutants in a dwelling are combustion products from unflued appliances (e.g. gas cookers) and chemical emissions from construction and consumer products. In an office building, body odour is the key pollutant but there are a number of other pollutant sources including building materials, furnsihing, printers and photocopiers. Where pollutants can be reduced at source through the use of low emission materials and products this will improve indoor air quality.

The main sources of water vapour within buildings are kitchens, bathrooms, shower rooms, swimming pools and similar recreational areas, and areas used for clothes washing and similar processes utilising considerable amounts of water. Unflued combustion appliances (e.g. gas cookers, unflued space heaters) can be significant sources.

1.1.6 Ventilation to achieve the objectives set out in Paragraph 1.1.2 may be achieved by natural ventilation, or through the supply or extraction of air by mechanical means, or by a combination of these methods. The guidance in this document is based on the following general strategy:

General ventilation to provide fresh air to the building and remove water vapour and other pollutants that are released throughout the building (e.g. by building materials, furnishings, the presence and activities of occupants). General ventilation provides nominal continuous air exchange. The ventilation rate may be reduced or discontinued when the building is not occupied.

Extract ventilation from rooms or spaces where most water vapour and/or pollutants are released, e.g. where activities such as cooking, bathing or photocopying take place. The purpose of extract ventilation is to minimize the spread of water vapour and/or pollutants to the rest of the building. Extract ventilation may be intermittent or continuous depending on the nature of the activities involved.

Purge ventilation applicable throughout the building to facilitate removal of high concentrations of pollutants or water vapour that may develop from time to time, e.g. from accumulations when extract ventilation not utilized, from occasional activities such as painting and decorating and from accidental occurrences and spillages.

1.1.7 The ventilation strategy adopted should ensure controllability so that the objectives set out in Paragraph 1.1.2 can be achieved without unreasonable waste of energy. In naturally ventilated buildings manually controlled background ventilators may be used. Background ventilators that respond to pressure differential across the ventilator and automatically reduce opening area to adjust ventilation flowrate may also be used.

1.1.8 Provision should be made for reasonable access to components and equipment installed as part of a ventilation system. The access is required to allow maintenance of the system, e.g. changing filters, cleaning ducts, replacing defective components.

1.1.9 Where a room or space contains a heat producing appliance, permanent ventilation may be required. See Technical Guidance Document J - Heat Producing Appliances.

Regard shall also be had to the requirements of Part B of the Building Regulations - Fire Safety - when dealing with the provision of ventilation and air inlet openings.

1.1.10 Noise generated by ventilation fans which may propagate through ducts and ductwork can disturb the occupants of a building and so discourage their use. Noise minimization should be considered through the specification of quieter products, the correct design of ductwork and fittings and installation and mounting of units to manufacturers instructions.

Application to Buildings of Architectural Heritage Interest

1.1.11 The application of the guidance in this document to existing buildings, including protected structures and proposed protected structures and other buildings that may be of architectural heritage interest, without consideration of the particular characteristics of the building, may be inappropriate.

Variation of the strategies proposed in this document may be acceptable to the local building control authority if it can be shown that it is necessary to do so in order to protect the structural and/or architectural heritage integrity of the particular building and having regard, in particular, to the likelihood of higher air permeability of older buildings.

For more guidance on appropriate measures see *"Planning Guidelines No. 9: Architectural Heritage Protection - Guidelines for Planning Authorities"* published by the Department of the Environment, Heritage and Local Government

Glossary

1.1.12 In this Document the following definitions apply

Air permeability: The average volume of air in cubic metres per hour that passes through one square metre of the building envelope when subject to an internal to external pressure difference of 50 Pascals when measured in accordance with the method defined IS EN 13829:2000 "*Thermal performance of buildings: determination of air permeability of buildings: fan pressurization method".*
It is a measure of the resistance of the building envelope to *air infiltration*.

Air infiltration: The exchange of air between outside a building and inside other than through openings provided by design (for ventilation, access and other purposes). Infiltration is caused by pressure difference effects of wind and/or stack effect and occurs through cracks, porosity of building elements and other unintentional openings in the building fabric.

Automatic control: Control of a ventilation device, (e.g. opening, switching on or adjusting performance) by mechanical or electronic means in response to a relevant external stimulus, (e.g. humidity, pollutant level, occupancy detection, pressure difference).

Background ventilator: A secure ventilation opening generally located in a wall or window for the purpose of provision of general ventilation, generally incorporating a controllable ventilation grill which can be fully closed.

Continuous operation: Operating all of the time that ventilation is required, e.g. a mechanical ventilation system as the principal means of general ventilation. The performance level, e.g. airflow rate, may be adjusted manually or mechanically during operation.

Equivalent area: The area of sharp-edged orifice through which air would pass at the same volume flow rate, as the opening or See Paragraph 1.1.13 regarding the *equivalent area* of *background ventilators* and the relationship between *equivalent area* and *free area* ventilation device under consideration, when the applied pressure difference is identical.

Extract ventilation: Designed provision for the removal of air from a room or space directly to outside. Extract ventilation may be provided by natural means (e.g. passive stack ventilation) or by mechanical means (e.g. by an extract fan).

Free area: The geometric open area of a ventilator**.**

General ventilation: Ventilation of rooms and spaces at a relatively low continuous rate to control pollutant and water vapour levels to acceptable levels generally and provide adequate levels of fresh outdoor air.

Habitable room: A room in a dwelling used for living or sleeping purposes but does not include a kitchen having a floor area of less than 6.5 m^2.

Intermittent operation: Operating when a particular need is identified. Intermittent operation may be in response to automatic control responding to a particular stimulus, or manual control when need identified by user.

Kitchen: means a room or part of a room used primarily for the preparation and cooking of food.

Manual control: Control of a ventilation device, e.g. opening, switching on or adjusting performance, by manual intervention of user, e.g. dwelling occupant.

Occupiable room: A room in a building other than a dwelling, occupied as an office, workroom, classroom, hotel bedroom or similar room but does not include a bathroom, sanitary accommodation, utility room or rooms or spaces used solely or principally for circulation, building services, plant or storage purposes**.**

Passive stack ventilation (PSV): A ventilation system using ducts from high level locations within rooms to terminals on or above the roof, which provides a flow of air by a combination of the natural stack effect, i.e. the movement of air due to the difference in temperature between inside and outside, and the effect of wind passing over the roof of the dwelling.

Permanent ventilator: A ventilator permanently fixed in the open position and not provided with a means of closure which eliminated airflow through the device.

Purge ventilation: Ventilation by means of a large adjustable ventilation opening or openings which will allow the movement of a substantial volume of air in a short time period e.g. an opening window or door, and with some part of the ventilation opening at least 1.75 m above the floor level [previously called “rapid ventilation”].

Stack effect: Airflow between inside and outside a building due to the pressure differential caused by differences in air density associated with indoor/outdoor air temperature differences.

Utility room: A room used for laundry purposes which contains a sink, washing machine, tumble drier or similar equipment and which is not entered solely from outside the building**.**

Ventilation: Supply and removal of air (by natural or mechanical means) to or from spaces in a building. Ventilation is provided through designed ventilation openings, other designed openings in a building and air infiltration.

Ventilation opening: Any means of permanent or controllable ventilation which -
- opens directly to the external air, and
- except in the case of a screen, fascia, baffle, etc., has a smallest dimension of at least 8 mm, but does not include a flue to a chimney.

Wet room: A room used for domestic activities, e.g. cooking, clothes washing, bathing, which, by their nature, are likely to give rise to significant production of water vapour. Typical wet rooms in dwellings are kitchens, utility rooms, bathrooms and sanitary facilities containing provision for showering or bathing.

Equivalent area and Free area

1.1.13 In this document, opening areas for background ventilators are specified in terms of *equivalent area.* The *equivalent area* of a ventilator is always less than the *free area* and is a better measure of the airflow performance of a ventilator. The more complex the airflow path through a ventilator, the greater the difference between *equivalent area* and *free area*. *Equivalent area* is measured in accordance with the method specified in IS EN 13141-1: 2004. Information on *equivalent area* of ventilation products, e.g. trickle ventilators, should be supplied by the product manufacturer. Where this information is not available, the free area may be used to assess compliance but the area of ventilator required should be increased by 25%.

1.2 DWELLINGS

1.2.1 General

1.2.1.1 In this Subsection guidance is given on approaches to meeting the ventilation objectives as set out in Subsection 1.1,

a) primarily natural ventilation with specific provision for extract ventilation (Subsection 1.2.2); and

b) primarily mechanical ventilation with heat recovery (Subsection 1.2.3).

In both cases provision for purge ventilation by openable windows or external doors is provided. *Diagrams 1 and 2* show the key characteristics of each approach.

Other approaces to ventilation provision may be adopted provided the requirements of Regulation F1 are met.

1.2.1.2 Provision should be made to facilitate transfer of air and cross ventilation between rooms, where required, e.g. a 10 mm gap should be provided under doors.

1.2.1.3 Mechanical extract terminals, passive stack extract vents and extract fans should be placed as high as practical and no greater than 400 mm below ceiling level. Cooker hoods should generally be located 650 mm to 750 mm above the hob surface unless otherwise recommended by manufacturers.

1.2.1.4 Where ducting is provided e.g. for passive stack ventilation or for ventilation supply or extract, in dwelling with a protected stairway, particular regard must be had to the requirements of Part B of the Building Regulations to avoid the possibility of smoke or fire spreading into the stairway.

1.2.1.5 Ceiling height is one of a number of factors which affect ventilation of habitable rooms. The suggested dimensions in *Diagram 3* are consistent with good room design, the use of standard materials and good building practice.

Diagram 1: Natural Ventilation with Mechanical Extract

Diagram 2: Continuous mechanical ventilation with heat recovery

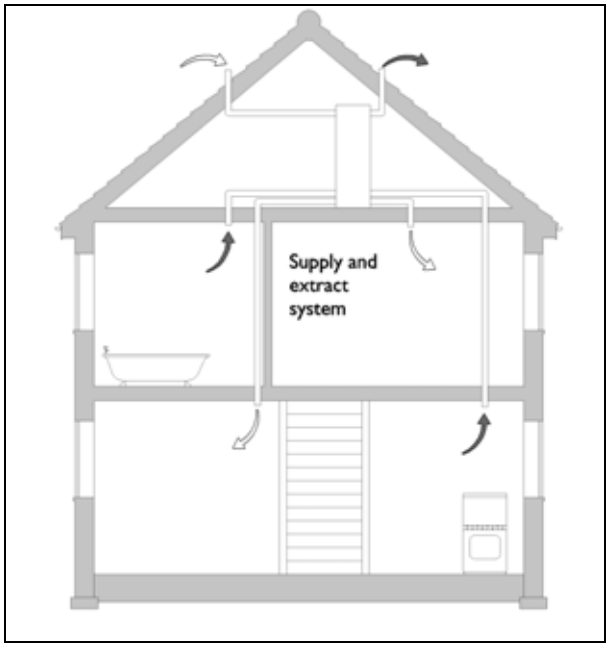


Diagram 3: Suggested Height of Habitable Rooms

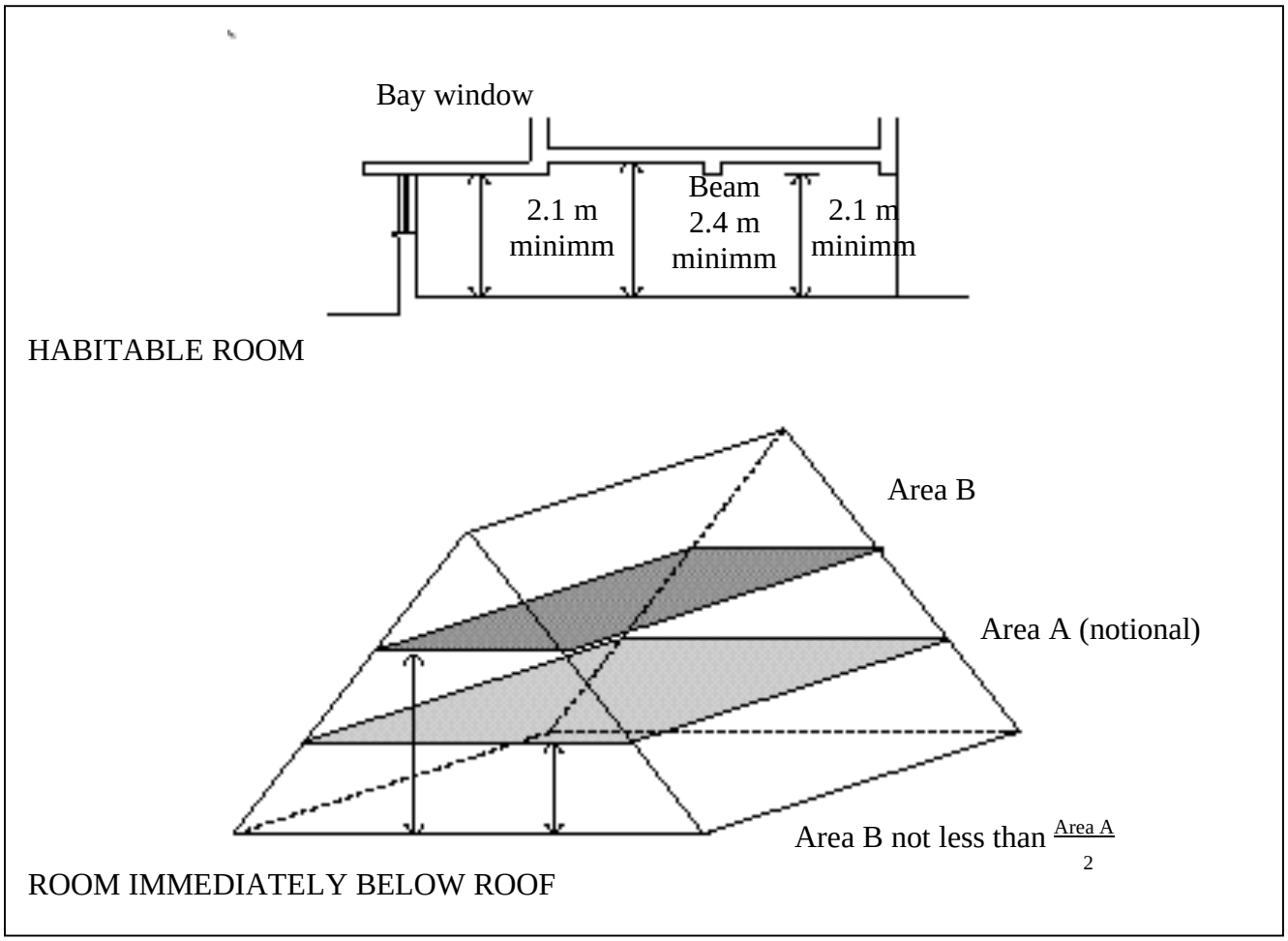


Table 1: Basic ventilation provision using background ventilators and specific provision for extract and purge ventilation			
Room or Space	**General Ventilation**	**Extract ventilation**	**Purge ventilation**
	Minimum equivalent area of background ventilator[a] (mm^2)	**Extract fan[b] - Minimum intermittent extract rate (L/s)**	**Opening window or external door - Minimum provision**
Habitable Room	*5000[c, d]*	-	*1/20 of room floor area*
Kitchen	*2500[c, d, e]*	*60l/s generally 30l/s if immediately adjacent to cooker (e.g. cooker-hood not recirculating)*	*Window opening section (no size requirement)[e]*
Utility Room	*2500[c, d, e]*	*30 l/s*	*Window opening section (no size requirement)[e]*
Bathroom	*2500[c, d, e]*	*15 l/s*	*Window opening section (no size requirement)[e]*
Sanitary Accommodation (no bath or shower)	*2500[c, d, e]*	*6 l/s[f]*	*Window opening section (no size requirement)[e]*

Notes:

a See paragraph 1.2.2.2 re total equivalent area for all background ventilators.

b. See paragraphs 1.2.2.6 and 1.2.2.7 re alternative of passive stack ventilation or continuous room ventilation with heat recovery.

c. The equivalent area of background ventilator should be increased by 50% where an infiltration rate of less than 7 m^3/m^2h at pressure difference of 50Pa is measured or assumed for the purposes of calculating energy use and CO_2 emissions using the DEAP methodology.

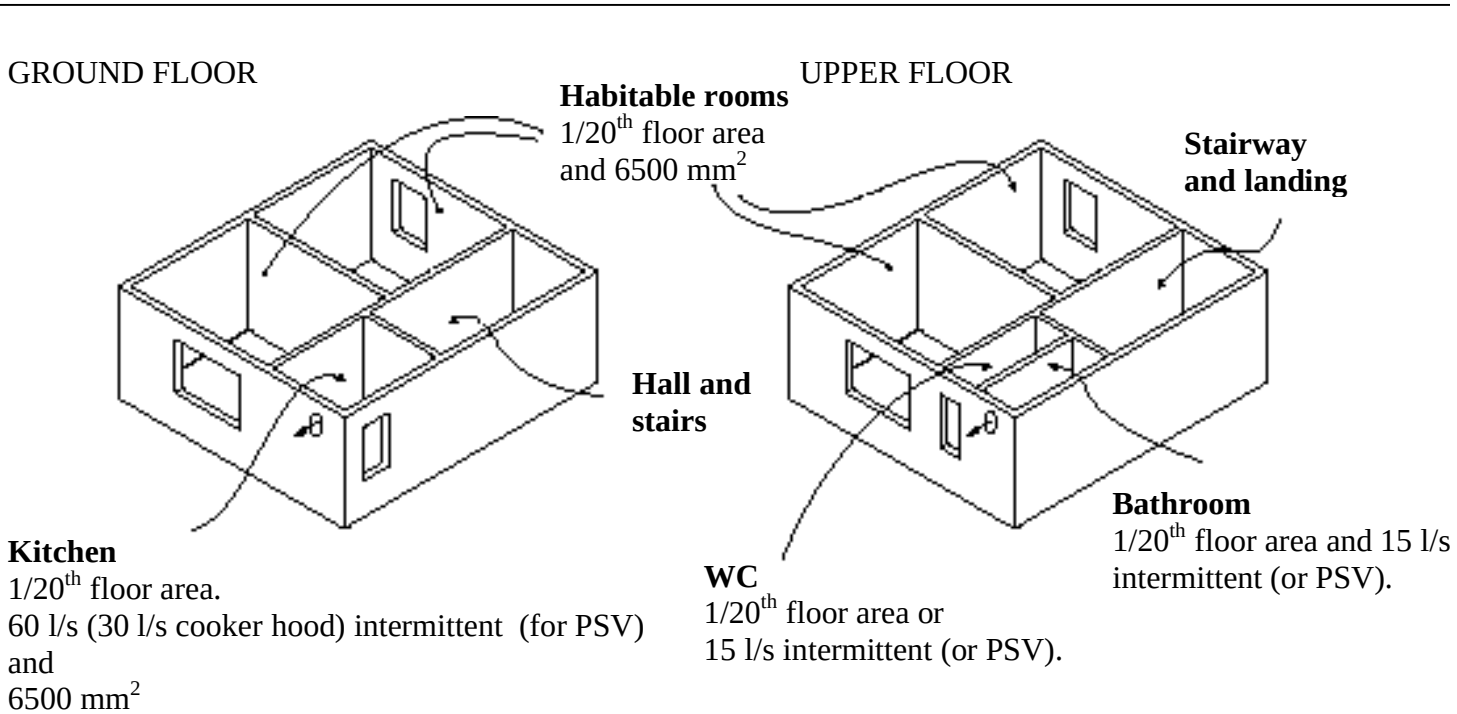
d. See paragraph 1.2.2.9 re the extent and location of background ventilation where there is only a single exposed façade and cross-ventilation is not possible.

e. See paragraph 1.2.2.3 re ventilation provision where the provision of background ventilation and purge ventilation is not possible, e.g. when there is no external wall.

f. As an alternative, the opening window section provided for purge ventilation may also be relied on for extract ventilation.

g. See paragraphs 1.2.2.11 to 1.2.2.13 re provision for ventilation of habitable rooms through other rooms or into courtyards.

Diagram 4: Ventilation of a typical dwelling



1.2.2 Natural Ventilation with Provision for Extract Ventilation

1.2.2.1 *Table 1* and *Diagram 4* summarise the provisions for general extract and purge ventilation appropriate for various spaces within a dwelling when natural ventilation is chosen as the primary means of ventilation.

1.2.2.2 In general, the minimum total equivalent area of background ventilators providing general ventilation should be 30,000 mm^2 with an additional 5000 mm^2.for each additional 10 m2 floor area above the first 50m^2 of floor area measured. For single storey dwellings situated at ground level or on any storey up to four storeys, an additional 5000 mm2 per dwelling should be provided. (See also paragraph 1.2.2.6).
As noted in Paragraph 1.1.13, the areas specified should be increased by 25% where free area of ventilators is used instead of equivalent area.

1.2.2.3 For wet rooms, e.g. kitchens, utility rooms, bathrooms or rooms with sanitary facilities (without bath), where mechanical extract ventilation is provided and there is no provision for general ventilation by means of controllable background ventilator and no provision for purge ventilation by means of an openable window, the mechanical extract ventilation should include an automatic 15 minute overrun (after switchoff). In the case of a kitchen, utility room or bathroom without WC, control by humidistat is acceptable as an alternative to 15 minute overrun.

Background ventilators
1.2.2.4 Typical types and locations of background ventilators are illustrated in *Diagram 5*.
Background ventilators should be located, as far as possible, so as to avoid draughts, e.g. more than 1.7 m above floor level.

1.2.2.5 Purge ventilation
Windows
For a hinged or pivot window that opens 30º or more, or for sliding sash windows, the height x width of the opening part should be at least 1/20 of the floor area of the room.

If the room contains more than one openable window, the areas of all the opening parts may be added to achieve the required proportion of the floor area. The required proportion of the floor area is determined by the opening

External doors (including patio doors)
For an external door, the height x width of the opening part should be at least 1/20 of the floor area of the room.
• If the room contains more than one external door, the areas of all the opening parts may be added to achieve at least 1/20 of the floor area of the room.
• If the room contains a combination of at least one external door and at least one openable window, the areas of all the opening parts may be added to achieve at least 1/20 of the floor area of the room.

Mechanical Extract Fans
Mechanical extract fans should be chosen to achieve the specified airflow rate having regard to location, length and type of ducting and size and type of discharge grille. Axial fans are normally only suitable for use with short length of through-the-wall ducting of the same size as the fan outlet. For bathrooms, axial fans may be acceptable for use with flexible ducting up to 1.5m long and two 90˚ bends. Centrifugal fans can generally be used with flexible ducting of up to 3m and one 90˚ bend for extract rates of 60l/s (e.g. from kitchen) and up to 6 m for extract rates of 15 l/s with two 90˚ bends (e.g. from bathrooms).

1.2.2.6 Some guidance to good practice in relation to ducting for fans is illustrated in *Diagram 6*. In all cases, the appropriateness of a particular fan for a particular use should be verified by reference to manufacturers data. The aerodynamic performance of extract fans should be established using the test methods specified in IS EN 13141-4. For cooker hoods the test methods are specified in IS EN 13141-5:2004.
Further good practice with regards to installing duct work is as follows:

• Fans and ducting placed in or passing through unheated voids or loft spaces should be insulated to reduce the possibility of condensation forming.
• Where a duct rises vertically it may be necessary to fit a condensation trap in order to prevent backflow of any moisture into the product.
• Horizontal ducting, including ducting in walls, should be arranged to slope slightly downwards away from the fan to prevent backflow of any moisture into the product.
• All duct runs should be straight, with as few bends and kinks as possible to minimise system resistance.
• Where ducting passes through a fire-stopping wall or fire compartment, the required measures to ensure compliance with Part B of the Building Regulations must be taken.
• All flexible ducting should be pulled taut to minimise system resistance.
Care should be taken when positioning the ducting to ensure that it cannot be damaged through occupier use of the space in which it is installed.
• Ensure flexible ducting is installed without peaks or troughs (see Diagram 6)

• Ensure that the circular profile of flexible duct is maintained throughout the full length of the duct run. Where the flexible ducting passes through a smaller gap and the flexible duct is deformed, the resistance will increase, leading to loss of extracted air volume (see *Diagram* 6).

1.2.2.7 For indoor ventilation systems it is important to ensure that intake air is not contaminated. For static discharges such as parking, loading bays and stack discharges ventilation intakes need to be placed away from the direct impact of short-range pollution sources especially if the sources are within a few metres of the building. Some guidance is given in CIBSE TM21.For buildings positioned directly adjacent to urban roads air intakes should be as high as possible and away from the direct influence of the source so as to minimise the ingress of traffic pollutants. There will be exceptions to this simple guide and these risks may need to be assessed by modelling. In such case it is recommended that expert advice is sought.

Diagram 5: Typical background ventilators

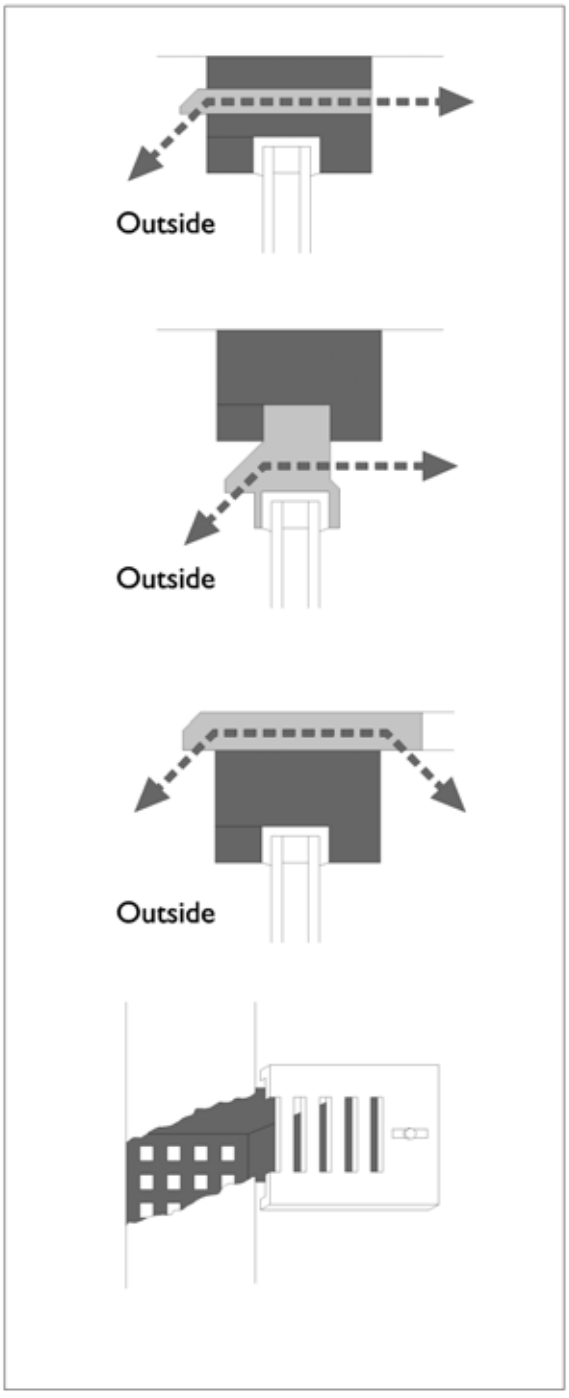
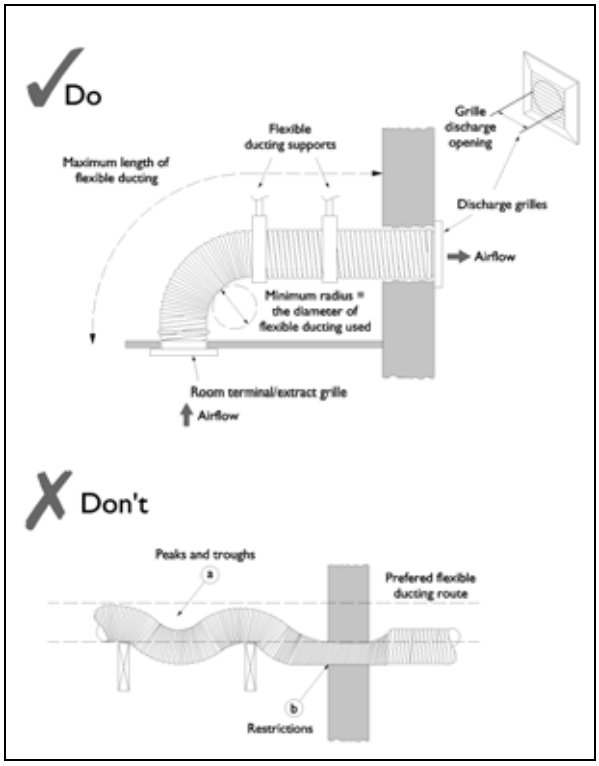


Diagram 6: Ducting to Extract Fans



Alternatives to mechanical extract

1.2.2.8 In general, passive stack ventilation (PSV) may be used instead of mechanical extract in any location where an extract fan is specified in *Table 1*. Passive stack ventilation should be designed and installed in accordance with BRE IP 13/94 and, for kitchens and utility rooms, incorporate an automatic humidity sensitive ventilation inlet control grille (see also paragraph 1.2.2.9).

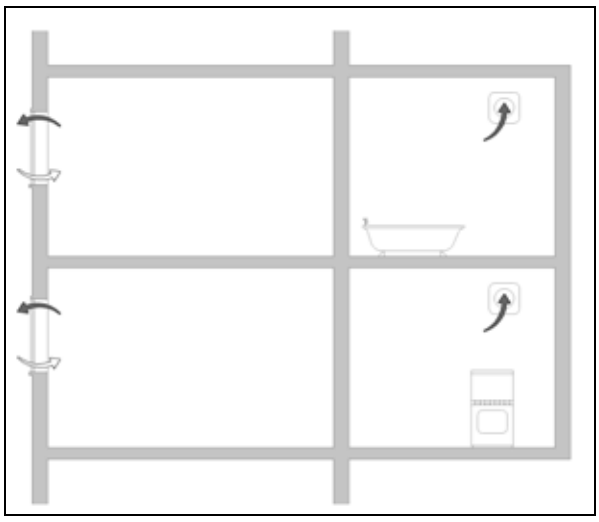
1.2.2.9 A continuously operating single room heat recovery ventilator may also be used in any location where a mechanical extract fan is specified in *Table 1*. Such a ventilator should have a minimum high rate of extraction equivalent to the extract rate specified in *Table 1* and a minimum low rate equivalent to 50% of this rate. This ventilator provides general ventilation and extract ventilation and neither a background ventilator nor an extract fan is required. For each single room heat recovery ventilator provided the total equivalent area of the background ventilators for the dwelling (see paragraph 1.2.2.2) can be reduced by 2500mm^2.

1.2.2.10 Where a kitchen or utility room contains an open-flued appliance
a) which is the main source of space heating or hot water heating for the dwelling, or
b) which has a flue with a free area of at least the equivalent of a 125mm diameter duct, and both flue and air inlets are permanently open, i.e. with no control dampers, additional provision for extract ventilation e.g. by means of mechanical extract ventilation or passive stack ventilation, should not be necessary.

Single sided ventilation

1.2.2.11 The guidance given in *Table 1* relates to dwellings where a reasonable degree of cross ventilation is possible and background ventilators are located on opposite or adjacent sides. For a dwelling with a single exposed façade, e.g. an apartment with only one exposed side, natural ventilation may be provided by the use of high and low level background ventilators. The area of high level ventilators should be as set out in *Table 1* with an equivalent area of low level ventilators installed. There should be a difference in level of at least 1 metre between high and low level ventilators. Alternatively cross ventilation may be provided by the use of passive stack ventilators in wet rooms located away from the single exposed façade of the dwelling. *Diagram 7* summarises the type of provision appropriate when cross ventilation is not possible.

Diagram 7 Single sided ventilation



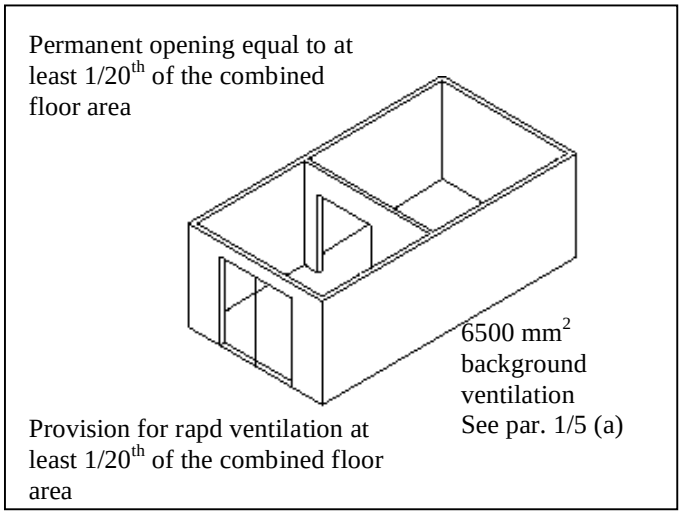
Extract fans and open-flued appliances

1.2.2.12 Where both open flued combustion appliances (including open fires) and extract fans are installed in the same dwelling, it should be verified that the combustion appliance can operate effectively and safely whether or not the fans are running. A. reduced rates of extraction may be appropriate in these circumstances. Reference should be made to BRE Information Paper 1P 7/94 *Spillage of flue gases from solid-fuel combustion appliances* and BRE Information Paper IP 21/92, *Spillage of flue gases from open-flued combustion appliances*. See also additional guidance in TGD J.

Ventilation of Habitable Rooms through other rooms and spaces

1.2.2.13 Two habitable rooms may be treated as a single room for ventilation purposes if there is an area of permanent opening between them equal to at least 1/20th of the combined floor areas (see *Diagram 8*).

Diagram 8:Two rooms treated as a single room for ventilation purposes



1.2.2.14 A habitable room may be ventilated through an adjoining space (see *Diagram 9*) if -

a) the adjoining space is a conservatory or similar space, and

b) there is an opening (which may be closeable) between the room and the space, with an area not less than 1/20th of the combined floor area of the room and space, and

c) provision is made for-

(i) background ventilation to the space, and

(ii) one or more permanent openings for ventilation purposes between the room and the space consisting of a wall or window ventilator, each having an equivalent area not less than 5000 mm^2 and located so as to avoid undue drafts, and

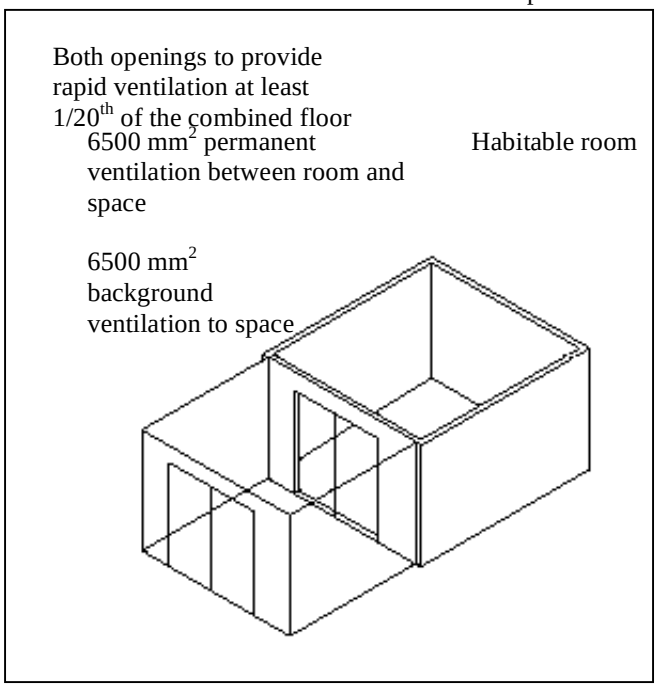
(d) provision is made for purge ventilation to the space with a total area not less that 1/20th of the combined floor area of the room and space, and

(e) the space is not connected to another room which has no alternative means of natural ventilation other than through the space, and

provision is made for mechanical extract or passive stack ventilation if the room contains a kitchen and

(f) provision is made for mechanical extract or passive stack ventilation if the room contains a kitchen.

Diagram 9:A habitable room ventilated through an adjoining space.



Ventilating to a Court

1.2.2.15 Where a building contains a court and a ventilation opening serving a habitable room in a dwelling faces a wall nearer than 15 m, the following minimum distances should be maintained:

(a) if there is a wall on each side of the opening (forming a closed court) (see *Diagram 10a*), then the vertical distance from the top of the opening to the top of the wall containing the opening, D_t, should be less than twice the horizontal distance from the opening to the facing wall, D_f, or

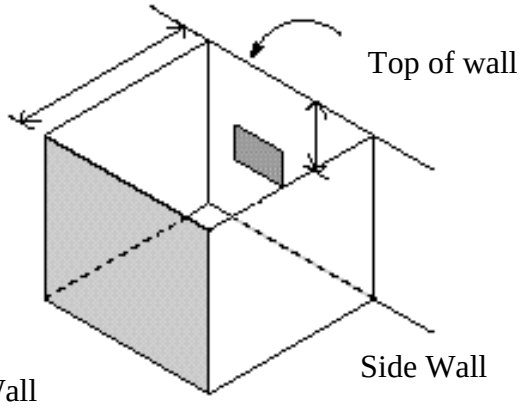
(b) if there is a wall on only one side of the opening (forming an open court) (see *Diagram 10b*), and if the length of the facing wall, D_l, is more than twice the horizontal distance from the opening to the facing wall, D_f, then either -

(i) the vertical distance from the top of the opening to the top of the wall containing the opening, D_t, or

(ii) the horizontal distance from the side of the opening to the open side of the court, D_s,

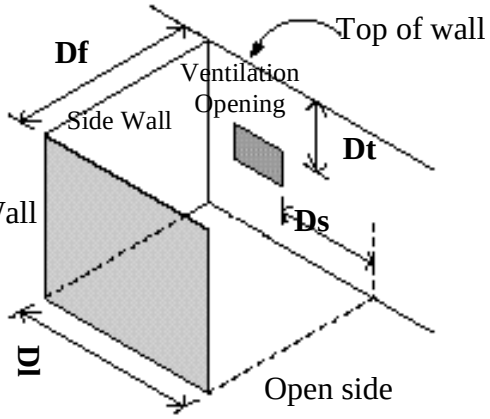
should be less than twice the horizontal distance from the opening to the facing wall, D_f.

Diagram 10: Ventilation of a habitable room to an enclosed court



Dt should be less than twice **Df**

A. CLOSED COURT



If **Dl** is more than **2Df**.

Dt should be less than twice **Df**

or

Ds should be less than twic **Df**

B. OPEN COURT

1.2.3 Mechanical Ventilation with Heat Recovery (MVHR)

1.2.3.1 An MVHR system should be capable of providing adequate general ventilation at all times and of meeting requirements for extract ventilation that may need to be met from time to time.

Sizing

1.2.3.2 The minimum capacity of an MVHR system should be based on the calculated general ventilation rate, adjusted to allow for air infiltration due to permeability of the building fabric. The calculated general ventilation rate is determined as the greater of

a) 5 l/s plus 4 l/s per person, e.g. 25 l/s for a five person dwelling, or

b) 0.3 l/s per m^2 internal floor area, e.g. 30 l/s for a 100 m^2 dwelling.

The adjustment to the calculated general ventilation rate to allow for air infiltration is derived as follows:

0.04V (l/s), for dwellings of more than 1 storey; and

0.06V (l/s), for single storey dwellings;

where V is the gross internal volume of the dwelling in m^3.

The adjustment is applied by deduction from the calculated general ventilation rate to give the minimum capacity of the MVHR system.

1.2.3.3 In order to meet extract requirements, the system may require a higher extract or boost capacity depending on the number of wet rooms (kitchens, bathrooms, etc.). The extract rate to be provided for each wet room is specified in *Table 2*. The required overall extract rate is calculated by adding together the relevant individual extract rates specified in the Table. If the result proves higher than the calculated minimum capacity, the system should be capable of meeting the higher extract rate or boost capacity.

Table 2: MVHR Systems: Minimum extract rates

Wet rooms	Minimum extract rate (l/s)
Kitchen	13
Utility room	8
Bathroom	8
Sanitary accommodation (no bath or shower)	6[1]

Notes:

1. As an alternative an opening window provided for purge ventilation may be relied on for extract

1.2.3.4 An MVHR system should normally provide air supply to each habitable room with extract from wet rooms. The system should be capable of an extract rate from each wet room at least equal to that specified in *Table 2*.

1.2.3.5 Facility for purge ventilation should be provided where the general and extract ventilation is provided by an MVHR system. Purge ventilation provision should be as set out in *Table 1* for natural ventilation.

1.2.3.6 MVHR systems should achieve a leakage classification of Class 2 or better as defined in IS EN 13141-7 when tested in accordance with the procedure specified in that standard. Detailed guidance on the relevant test procedure is contained in **"***Performance testing of products for residential ventilation - Central mechanical supply and exhaust ventilation system packages with heat recovery used in a single dwelling*" which is the approved procedure for DEAP.

1.2.3.7 It is important that the occupier of a home understands the importance of the use and operation of a mechanical extract system or Mechanical Ventilation System with Heat Recovery. It is essential that these units are run continuously and operated and maintained in accordance with manufacturers instructions.
Further information on installation, operation and maintenance of these systems is given in GPG 268 *Energy efficient ventilation in dwellings – a guide for specifiers,* available from SEI.

1.2.3.8 Controls for Mechanical Extract systems and Mechanical Heat Recovery Ventilation systems should be suitable for continuous operation and should provide indication to the occupant that the system is operating correctly. Controls should also indicate if a fault has occurred on system or if maintenance is required.

BUILDINGS OTHER THAN DWELLINGS

General

1.3.1.1 In this subsection guidance is given on approaches to meeting the ventilation objectives as set out in Subsection 1.1 for:

a. Offices in paragraphs 1.3.2.1 to 1.3.2.10
b. Car parks in paragraph 1.3.3.1

For other buildings guidance can be found in CIBSE guide B2 and other relevant guidance documents.

1.3.1.2 Other means of ventilation other than those specified in this document may be used provided the requirements of Regulation F1 are met.

1.3.1.3 Certain types of buildings such as offices, shops, factories, etc. may be subject to specific legislative requirements. The relevant legislation should be consulted.

1.3.1.4 Specific requirements of the Safety, Health and Welfare at Work (General Application) Regulations 2007 Part 2, Chapter 1, Section 6 should be consulted with this guidance.

Design of ventilation systems

1.3.1.5 Extract to outside should be provided in all office sanitary accommodation, washrooms and in food and beverage preparation areas. In addition printers and photocopiers in substantial use (greater than 30 minutes per hour) should be located in a separate room (to avoid any pollutants entering the occupied space) and extract provision installed. The extract rates should be no less than that specified in *Table 3*.

1.3.1.6 A general ventilation rate of 10L/s per occupant for buildings is appropriate where there are no significant pollutant levels. This rate is based on controlling body odours with low levels of other pollutants. Where there are significant levels of other pollutants, adequate outdoor air supply can be achieved by following the calculation method provided in CIBSE Guide A.

1.3.1.7 Purge ventilation should be sufficient to reduce pollutants to an acceptable level before a space is occupied. The purged air should be taken directly to outside and should not be recirculated to any other part of the building.

1.3.1.8 Where a kitchen, bathroom, sanitary accommodation or photocopier room is an internal room, it shall have mechanical extract ventilation to extract air at a rate of not less than that given in *Table 2*, and a permanently open air inlet having a clear opening area of at least 9000 mm^2.

1.3.1.9 Provision should be made to protect the fresh air supplies from contaminants injurious to health. Air inlets for ventilation systems should not be sited where they may draw in excessively contaminated air (for example, close to a flue, an exhaust ventilation system outlet, an evaporative cooling tower or an area in which vehicles manoeuvre).

1.3.1.10 To avoid legionnella contamination cooling towers should be positioned as far away as possible from air conditioning and ventilation inlets, opening windows and occupied areas, taking note of the prevailing wind direction and the wind distribution over neighbouring buildings. Further guidance may be found in CIBSE TM13: *Minimising the risk of Legionnaires' disease*.

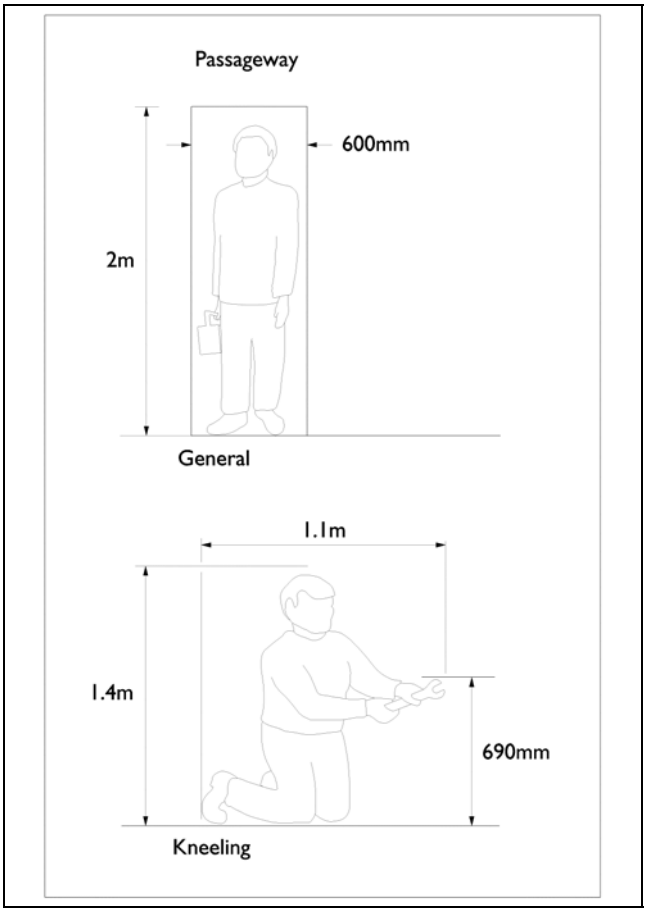
1.3.1.11 Where a forced ventilation system is used it shall be maintained in working order and any breakdown will be indicated by a control system if necessary for the safety and health of employees.

1.3.1.12 Where an open flued combustion appliance is installed in a building with mechanical extract, the spillage of flue gases could occur. Reduced rates of extraction may be appropriate in these circumstances. It should be verified that the combustion appliance can operate effectively and safely whether or not the fans are running. Reference should be made to BRE Information Paper IP 7/94 *Spillage of flue gases from slid fuel combustion appliances* and BRE Information paper IP 21/92, *Spillage of flue gases from open-flued combustion appliances.* See also additional guidance in TGD J.

1.3.1.13 Reasonable provision for access for maintenance in ventilation systems would be to include:
i. Access for the purpose of replacing filters, fans and coils;and
ii. Provision of access points for cleaning ductwork.

Further guidance on access is given in CIBSE Guide B "Heating, ventilation, air conditioning and refrigeration" Appendix 3.A2

Diagram 11: Basic Access Space Requirements



1.3.1.14 In a central plant room adequate space should be provided as necessary for the maintenance of the plant. Where no special provision is required, the requirement could be satisfied if 600mm space is provided where access is required between plant and 1100mm where space for routine cleaning is required (see *Diagram 5*). These figures are the minimum necessary and additional space may be needed for opening of access doors withdrawal of filters etc.

Commissioning

1.3.1.15 Where ventilation and air-conditioning systems are installed to serve floor areas in excess of 200m^2 and the relevant provisions in paragraphs 1.3.2.1 to 1.3.3.1 have been undertaken, the requirement will be satisfied if the building control body is provided with confirmation that the mechanical ventilation systems have been commissioned and tested to demonstrate that they are operating effectively for the purpose of ventilation. A way of demonstrating compliance with the requirements would be to present test reports and commissioning certificates which certify that commissioning and testing have been carried out in accordance with the CIBSE commissioning codes and that the systems perform in accordance with the specification.

Ventilation of Offices

1.3.2.1 Adequate provision for ventilation rates as described can be achieved through the use of:

i. Primarily natural ventilation with specific provision for extract ventilation.
ii. Primarily mechanical ventilation.
iii. Air conditioning systems supplying fresh air mixed with recirculated air.

Natural ventilation with extract ventilation

1.3.2.2 For single-sided offices of depths of less than 6m and cross ventilated offices of depth less than 12m will be satisfied by following the ventilation rates set out in *Table 3*.

1.3.2.3 For other office buildings adequate provision using natural ventilation may be achieved by following the guidance on the design of natural ventilation systems in CIBSE Application manual AM10: *Natural ventilation in non-domestic buildings*

1.3.2.4 Extract ventilators should be located as high as possible and preferably less than 400mm below the ceiling.

1.3.2.5 Extract fans can be controlled either manually or automatically. For a room with no openable window (i.e. an internal room), the extract should have a 15 minute over-run. Readily accessible over-ride controls should be provided for the occupants.

1.3.2.6 Passive Stack Ventilation (PSV) may be used instead of mechanical extract where appropriate. It should be either operated manually and/or automatically by a sensor or controller. Readily accessible over-ride controls should be provided for the occupants.
AM10: *Natural ventilation in non-domestic buildings*

1.3.2.7 Passive stack ventilator extract terminals should be located in the ceiling of the room

Alternative approaches

1.3.2.8 Ventilation by means other than natural ventilation can meet the requirement by following the relevant recommendations of: CIBSE Application Manual AM13: 2000:*Mixed Mode Ventilation, CIBSE* Guide A and CIBSE Guide

Table 3: **Basic ventilation provision using background ventilators and specific provision for extract and purge ventilation**			
Room or Space	**General ventilation[h]**	**Extract ventilation[a][b][c]** (d)	**Purge ventilation[l]**
	Minimum equivalent area of background ventilator (mm^2)[e]	**Extract fan-Minimum intermittent extract rate (L/s)**	**Opening window or external door-minimum provision**
Occupiable room	(i) Floor area up to 10 m2 – 5000 mm^2 Floor area over 10 m2 – 500 mm^2/m^2 floor area	—	1/20 of floor area
Food and beverage preparation areas. (not commercial kitchens)[f]	(i) Floor area up to 10m^2 - 5000mm^2 (ii) Floor area over 10 m2 – 500 mm^2/m^2 floor area	Intermittent air extract rate of: 30L/s above a hob with cooker(s) [g] 60L/s elsewhere with cooker(s) All to operate while food and beverage preparation is in progress	1/20 of floor area
Office Sanitary accommodation (and/or washing facilities)	(i) Floor area up to 10m^2 - 5000mm^2 (ii) Floor area over 10 m2 – 500 mm^2/m^2 floor area	Intermittent extract rate of 15 litres/second per bath/shower 6 litres/second per WC/Urinal	1/20 of floor area
Rooms containing printers and photocopiers in substantial use (greater than 30 minutes per hour)	(i) Floor area up to 10m^2 - 5000mm^2 (ii) Floor area over 10 m2 – 500 mm^2/m^2 floor area	Air extract rate of 20L/s per machine during use. Note that if the operators are in the room continuously, use the greater of the extract and general ventilation rates.	1/20 of floor area

a. Where an open-flued appliance is provided in a building with mechanical extract ventilation, the spillage of flue gases could occur.
b. The open-flued appliance needs to be able to operate safely whether or not the fan is running and guidance is provided in par. 1.3.1.12.
c. PSV may also be used to achieve this extract rate.
d. Extract rate is for installed performance
e. See paragraph 1.2.2.2 re total equivalent area for all background ventilators
f. Further Guidance on the ventilation required for commercial kitchens are given in CIBSE Guide B 2.3.6. Table B2.3 and B2.
g. Incorporated within a cooker hood.
h. For further guidance see CIBSE Application Manual AM10: 2005 *Natural ventilation in non-domestic buildings* and *CIBSE Guide B 2.5.3*

For general ventilation openings should be adjustable and located (typically 1.7m above floor level) so as to avoid discomfort due to cold draughts.

Ventilation of car parks

1.3.3.1 The requirement will be satisfied for car parks below ground level, enclosed type car parks and multi-storey car parks if there is:

i. **Naturally ventilated car parks.**
The provision of well distributed permanent natural ventilation e.g. Openings at each car parking level with an aggregate equivalent area equal to at least 1/20th of the floor area at that level, of which at least 25% should be on each of two opposing walls

ii. **Mechanically ventilated car parks**
Either:
   a) The provision of both permanent natural ventilation openings of equivalent area not less than 1/40th of the floor area and a mechanical ventilation system capable of at least three air changes per hour (ach); or

   b) For basement car parks, the provision of a mechanical ventilation system capable of at least six air changes per hour (ach).

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

Further guidance can be found in CIBSE Guide B2
For fire safety refer to TGD B

Alternative approaches
The requirement will be satisfied for car parks below ground level, enclosed type car parks and multi-storey car parks if the mean predicted pollutant levels are calculated and the ventilation rate designed and equipment installed to limit the concentration of carbon monoxide to not more than 30 parts per million averaged over an 8 hour period and peak concentrations such as by ramps and exits, not more than 90 parts per million for periods not exceeding 15 minutes.

Section 2
Condensation in Roofs

Condensation in roofs. F2 Adequate provision shall be made to prevent excessive condensation in a roof or in a roof void above an insulated ceiling.

General

2.1 Condensation in a roof and in the spaces above insulated ceilings should be limited so that, under normal conditions

(a) the thermal performance of the insulating materials, and

(b) the structural performance of the roof construction

will not be substantially and permanently reduced.

2.2 The traditional method of limiting condensation in roof spaces is through the provision of adequate ventilation for cavities or attic spaces on the cold side of the roof insulation. Alternatively, where such cavities or spaces are absent, an effective vapour barrier is provided on the warm side of the insulation so that vapour from the building cannot permeate the insulation. Paragraphs 2.3 to 2.19 give some guidance on good practice in relation to non-complex buildings of normal design and construction, where the primary mechanism for achieving the limitation of condensation is the ventilation of roof voids or cavities. Effective limitation of condensation can also be achieved by other means including the use of vapour permeable or breathable roofing membranes. Where such methods are used, regard should be had to the requirements of Part D of the Building Regulations with regard to the use of proper materials and the guidance given in the Technical Guidance Document to Part D in that regard.

2.3 Roofs where the moisture from the building can permeate the insulation, e.g. cold deck roofs, should be ventilated in accordance with paragraphs 2.10 to 2.13 or in accordance with paragraphs 2.14 to 2.18 depending on the roof type and slope.

2.4 In addition to ensuring adequate ventilation, transfer of water vapour to cold roof voids should be limited as far as practicable. Care should be taken to seal around all penetrations of pipes, ducts, wiring, etc., through the ceilings, including provision of an effective seal to the attic access hatch.

Use of a vapour control layer at ceiling level, on the warm side of the insulation, will assist in limiting vapour transfer, but cannot be relied on as an alternative to ventilation. In particular, a vapour control layer should be used where the roof pitch is less than 15°, or where the shape of the roof is such that there is difficulty in ensuring adequate ventilation, e.g. room-in-the-roof.

For the purposes of health and safety, it may not always be necessary to provide ventilation to small roofs such as those over porches and bay windows.

2.5 Roofs where the moisture from the building cannot permeate the insulation e.g. warm deck roofs or inverted roofs, need not be ventilated.

2.6 Guidance is given for pitched roofs with a pitch greater than 15° in paragraphs 2.10 to 2.13. Guidance is given for flat roofs and pitched roofs with a pitch less than 15° in paragraphs 2.14 to 2. 19. However, if the ceiling of a room follows the pitch of the roof, ventilation should be provided as if it were a flat roof, irrespective of the slope of the roof.

2.7 Although a part of a roof which has a pitch of 70° or more may be insulated as though it were a wall (see Technical Guidance Document L), Requirement F2 applies to roofs of any pitch.

2.8 Ventilation openings may be continuous or distributed along the full length of the eaves and may be fitted with a screen, fascia, baffle, etc.

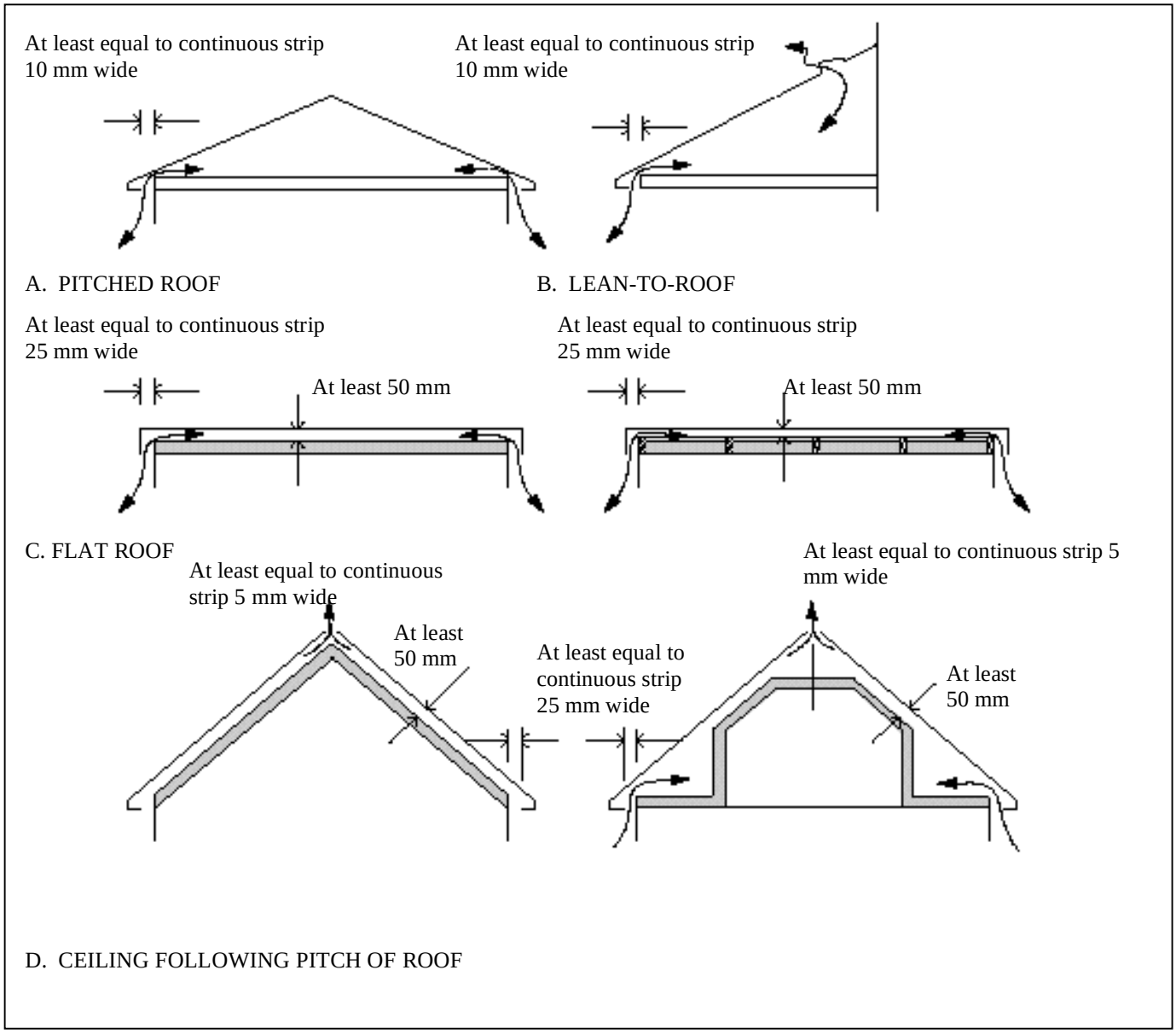
2.9 Further guidance in relation to condensation in roofs is contained in BS 5250 : 2002 : Code of practice for control of condensation in buildings. Additional guidance is given in the BRE publication "Thermal Insulation - avoiding risks".

Roofs with a pitch of 15° or more (Pitched Roofs)

2.10 If the ceiling follows the pitch of the roof, see paragraphs 2.14 to 2.19.

2.11 Pitched roof spaces should have ventilation openings at eaves level to promote cross-ventilation.

Diagram 12: Ventilating Roof Voids



These openings should have an area on opposite sides at least equal to continuous ventilation running the full length of the eaves and 10 mm wide (see *Diagram 12(a)*).

2.12 Purpose-made components are available to ensure that quilt or loose fill insulation will not or loose fill insulation will not obstruct the flow of air where the insulation and the roof meet.

2.13 A pitched roof which has a single slope and abuts a wall should have ventilation openings at eaves level and at high level. The ventilation at high level may be arranged at the junction of the roof and the wall or through the roof covering. If it is through the roof covering, it should be placed as high as practicable. The area at high level should be at least equal to continuous ventilation running the full length of the junction and 5 mm wide (see *Diagram 12 (b)*). **Roofs with a pitch of less than 15° and roofs of any pitch where the ceiling follows the pitch of the roof** continuous ventilation running the full length of the eaves and 25 mm wide (see *Diagram 12(c)*).

2.15 Roofs with a span exceeding 10 m, or with a plain shape other than a simple rectangle, may require its ventilation to be increased to 0.6% of the roof area.

2.16 The void should have a free air space of at least 50 mm between the roof deck and the insulation. Where joists run at right angles to the flow of air, a suitable air space may be formed by using counter battens.

2.17 Where the insulation follows the pitch of the roof, ventilation at the ridge, at least equal to continuous ventilation running the length of the ridge and 5 mm wide, is also needed (see *Diagram 12(d)*).

2.18 Where the edges of the roof abut a wall or other obstruction in such a way that free air paths cannot be formed to promote cross ventilation, or the movement of air outside any ventilation openings would be restricted, an alternative form of roof construction should be adopted (see par. 2.5).

2.19 A vapour control layer on the warm side of the insulation should generally be installed in the case of flat roof and roofs with a pitch of 15° or less.

Standards and other references

Standards

IS EN 13141-1: 2004

IS EN 13141-4:2004

IS EN 13141-7:2004

BS 5250 : 2002 Code of practice for control of condensation in buildings

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

Other references

Building Research Establishment, IP 21/92 “Spillage of flue gases from open-flued combustion appliances”

Building Research Establishment, IP 7/94 “Spillage of flue gases from solid-fuel combustion appliances”

Building Research Establishment, IP 13/94 “Passive stack ventilation systems: design and installation”

Building Research Establishment, BR 262 "Thermal Insulation - avoiding risks"

Building research Establishment, Performance testing

CIBSE Guide A

CIBSE Guide B2: Ventilation and Air Conditioning, 2001

CIBSE Application Manual 10

CIBSE Application Manual 13

CIBSE Technical Memorandum 13

DOEHLG, Planning Guidelines

HSE Safety and health at Work

Sustainable Energy Ireland, DEAP Manual

Other Useful references