Development & Planning Authority

Guernsey Technical Standard

Ventilation

The Building (Guernsey) Regulations, 2012

F

F1 Means of ventilation (building)

2012 edition
With May 2016 amendments

MAIN CHANGES MADE BY THE MAY 2016 AMENDMENTS

1. Text changes made to reflect the new structure of government post May 1st 2016. All references to Departments have been removed.

MAIN CHANGES MADE BY THE FEB 2013 AMENDMENTS

2. The general guidance on materials and workmanship and the Construction Products Directive has been edited to reflect the new EU Construction Products Regulation.

MAIN CHANGES IN THE 2012 EDITION

3. This Guernsey Technical Standard which takes effect on 1st July 2012 is issued under the Building (Guernsey) Regulations, 2012. From this date all previous editions of documents approved under the Building Regulations, 1992 i.e. (the UK Approved Document F 2006 edition) will no longer be valid except in relation to building work carried out in accordance with full plans deposited with the States of Guernsey Building Control before that date.
4. This document has been prepared from the UK's Approved Document F 2010 edition, therefore further changes from the previously approved guidance document include;
5. Fixed mechanical ventilation systems installed in non-domestic premises, where they can be tested and adjusted, must be commissioned.
6. Ventilation provisions have been increased for dwellings with a design air permeability tighter than or equal to 5m3/h.m2) at 50 Pa.
7. For passive stack ventilators, the stack diameter has been increased to 125mm for all room types. Use of passive stack ventilation in inner wet rooms has been clarified.
8. The guidance for ventilation when a kitchen or bathroom in an existing dwelling is refurbished has been clarified.
9. Reference is made to a new Domestic ventilation compliance guide. Whilst the guidance on testing and commissioning ventilation systems in dwellings is not relevant for the Island, the information previously given in Appendix D and E of the previously approved guidance, Approved Document F 2006 edition, can now be found in this new guide in section 2.

How this Guernsey Technical Standard F differs from the UK Approved Document F

10. In addition to the different legislative references reflecting Guernsey legislation, the main differences a non resident based applicant should note is the limitation on F1(2) Commissioning and testing that does not apply to dwellings.
11. The UK Building (Approved Inspectors, etc.) Regulations 2010 are not in force in Guernsey. Therefore approved inspectors are not recognised on the Island and all references have been removed.

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Introduction

What is a Guernsey Technical Standard?

This document has been approved and issued by the Development and Planning Authority to provide practical guidance on ways of complying with requirements F1 and regulation 11 of the Building (Guernsey) Regulations, 2012 (GSI 2012 No.11) . The Building (Guernsey) Regulations, 2012 are referred to throughout the remainder of this document as 'the Building Regulations'.

The intention of issuing Guernsey Technical Standards is to provide guidance about compliance with specific aspects of the Building Regulations in some of the more common building situations. They include examples of what, in ordinary circumstances, may be reasonable provision for compliance with the relevant requirement(s) of the Building Regulations to which they refer.

If guidance in a Guernsey Technical Standard is followed this may be relied upon as tending to show compliance with the requirement(s) covered by the guidance. Similarly a contravention of the standard may be relied upon as tending to establish a breach of the requirements. However, this is not conclusive, so simply following guidance does not guarantee compliance in an individual case or a failure to follow it meaning that there is necessarily a breach. It is also important to note that there may well be other ways of achieving compliance with the requirements. There is therefore no obligation to adopt any particular solution contained in this Guernsey Technical Standard if you would prefer to meet the relevant requirement in some other way. However, persons intending to carry out building work should always check with Building Control, that their proposals comply with Building Regulations.

The guidance contained in this Guernsey Technical Standard relates only to the particular requirements of the Building Regulations that the document addresses, (see 'Requirements' below). However, building work may be subject to more than one requirement of the Building Regulations and there may be an obligation to carry out work on a material change of use. In such cases the works will also have to comply with any other applicable requirements of the Building Regulations and work may need to be carried out which applies where a material change of use occurs.

This document is one of a series that has been approved and issued for the purpose of providing practical guidance with respect to the requirements of the Building Regulations in particular of regulations 6, 8 and 11 and Schedule 1.

At the back of this document is a list of all the documents that have been approved and issued for this purpose.

How to use this Guernsey Technical Standard

In this document the following conventions have been adopted to assist understanding and interpretation:

a. Texts shown against a yellow background are extracts from the Building Regulations, and set out the legal requirements that relate to compliance with the **means of ventilation** requirements of the Building Regulations. It should be remembered however that, as noted above, building works must comply with all the other applicable provisions of the Building Regulations.

b. Key terms are defined in annex B at the rear of this document.

c. Details of technical publications referred to in the text of this document will be presented in ***italics*** and repeated in standards referred to as an annex at the rear of this document. A reference to a publication is likely to be made for one of two main reasons. The publication may contain additional or more comprehensive technical detail, which it would be impractical to include in full in this Document but which is needed to fully explain ways of meeting the requirements; or it is a source of more general information. The reason for the reference will be indicated in each case. The reference will be to a specified edition of the document. The Guernsey Technical Standard may be amended from time to time to include new references or to refer to revised editions where this aids compliance.

Where you can get further help

If you require clarification of any of the technical guidance or other information set out in this Guernsey Technical Standard and the additional detailed technical references to which it directs you, there are a number of routes through which you can seek further assistance:

– The States of Guernsey website: **www.gov.gg/planning**

– If you are the person undertaking the building work you can seek advice from Building Control Surveyors to help ensure that, when carried out, your work will meet the requirements of the Building Regulations.

– Businesses registered with a competent person self-certification scheme may be able to get technical advice from their scheme operator. A full list of competent persons schemes are included as Schedule 3 of the Building Regulations.

– If your query is of a highly technical nature you may wish to seek the advice of a specialist, or industry technical body, in the area of concern.

Responsibility for compliance

It is important to remember that if you are the person (e.g. designer, builder, installer) carrying out building work to which any requirement of Building Regulations applies you have a responsibility to ensure that the work complies with any such requirement. The building owner or occupier will also have a responsibility for ensuring compliance with Building Regulation requirements and could be served with a compliance notice in cases of non-compliance or with a challenge notice in cases of suspected non-compliance.

General Guidance

Types of work covered by this Guernsey Technical Standard

Building work

Building work, as defined in regulation 5 of the Building (Guernsey) Regulations, 2012, includes the erection or extension of a building, the provision or extension of a controlled service or fitting, and the material alteration of a building or a controlled service or fitting. In addition, the Building Regulations may apply in cases where the purposes for which, or the manner or circumstances in which, a building or part of a building is used change in a way that constitutes a material change of use.

Under regulation 6 of the Building Regulations 2012, building work must be carried out in such a way that, on completion of work,

i. the work complies with the applicable Parts of Schedule 1 of the Building Regulations,

ii. in the case of an extension or material alteration of a building, or the provision, extension or material alteration of a controlled service or fitting, it complies with the applicable Parts of Schedule 1 to the Building Regulations and also does so as satisfactorily as it did before the work was carried out.

Work described in Part F concerns ventilation. Work associated with ventilation covered in these sections may be subject to other relevant Parts of the Building Regulations.

Material change of use

A material change of use occurs in specified circumstances in which a building, or part of a building that was previously used for one purpose will be used in future for another, or is converted to a building of another kind. Where there is a material change of use, the Building Regulations set requirements that must be met before the building can be used for its new purpose.

Regulation 7 of the Building (Guernsey) Regulations, 2012 specifies the following circumstances as material changes of use:

- a building is used as a dwelling where previously it was not,
- a building contains a flat where previously it did not,
- a building is used as an institution where previously it was not,
- a building is used as a public building where previously it was not,
- a building is not described in Classes I to V or VI of Schedule 2, where previously it was,
- a building contains a room for residential purposes where previously it did not,
- a building contains an office where previously it did not,
- a building is used as an hotel or guest house, where previously it was not,
- a building is an industrial building, where previously it was not,
- a building contains a shop, where previously it did not,
- a building is used for the sale of food or drink, to the public in the course of a business and for consumption in that building and where there is a maximum capacity of 15 or more persons seated or standing, where previously it was not so used,
- the building, which contains at least one room for residential purposes, contains a greater or lesser number of such rooms than it did previously,

– the building, which contains at least one dwelling, contains a greater or lesser number of dwellings than it did previously.

Part F will apply to all the material changes of use mentioned above. This means that whenever such changes occur the building must be brought up to the standards required by Part F.

Protected Buildings and Monuments

The types of building works covered by this Guernsey Technical Standard may include work on historic buildings. Historic buildings include:

a. a building appearing on the protected buildings listing

b. a building or other structure appearing on the protected monument listing

When exercising its functions under The Land Planning and Development Law, the States has duties under s30(1), 34, 35 and 38(1) of that Law, to secure so far as possible that monuments are protected and preserved, that the special characteristics of protected buildings are preserved and to pay special attention to the desirability of preserving and enhancing the character and appearance of a conservation area. Building Control will need to comply with these duties when considering any decisions in relation to such buildings or buildings in such areas.

Special considerations may apply if the building on which the work is to be carried out has special historic, architectural, traditional or other interest, and compliance with the **means of ventilation** requirements would unacceptably alter the fabric, character or appearance of the building or parts of it.

When undertaking work on or in connection with buildings with special historic, architectural, traditional or other interest, the aim should be to improve the **means of ventilation** where and to the extent that it is possible provided that the work does not prejudice the fabric, character or appearance of the host building or increase the long-term deterioration to the building's fabric or fittings.

In arriving at a balance between historic building conservation and the **means of ventilation** requirements advice should be sought from the historic building adviser.

Note: Any building which is a protected monument listed under Section 29 of The Land Planning and Development (Guernsey) Law 2005 is exempt from most Building Regulations requirements including those in Part E, (See regulation 13 and class V of Schedule 2 to the Building Regulations) unless the proposed works constitute a material change of use.

Notification of work

In almost all cases of new building work it will be necessary to notify Building Control in advance of any work starting. The exception to this: where work is carried out under a self-certification scheme listed in Schedule 3 or where works consist of emergency repairs.

Competent person self-certification schemes under Schedule 3

Under regulations 14(4), 17(4) and 19 of the Building Regulations it is not necessary to deposit plans or notify Building Control in advance of work which is covered by this Guernsey Technical Standard if that work is of a type set out in column 1 of Schedule 3 to the Regulations and is carried out by a person registered with a relevant self-certification (competent persons) scheme as set out in column 2 of that Schedule. In order to join such a scheme a person must demonstrate competence to carry out the type of work the scheme covers, and also the ability to comply with all relevant requirements in the Building Regulations. These schemes may change from time to time, or schemes may change name, or new schemes may be authorised under Schedule 3; the current list on the States's website should always be consulted. Full details of the schemes can be found on the individual scheme websites.

Where work is carried out by a person registered with a competent person scheme, regulation 19 of the Building Regulations requires that the occupier of the building be given, within 30 days of the completion of the work, a certificate confirming that the work complies with all applicable Building Regulation requirements. There is also a requirement that Building Control be given a notice that this has been done, or the certificate, again within 30 days of the completion of the work. These certificates and notices are usually made available through the scheme operator.

Building Control is authorised to accept these certificates as evidence of compliance with the requirements of the Building Regulations. However, inspection and enforcement powers remain unaffected, although they are normally used only in response to a complaint that work may not comply.

Exemptions

Schedule 2 to the Building Regulations sets out a number of classes of buildings which are exempt from majority of Building Regulations requirements including Part F.

Materials and workmanship

Any building work within the meaning of the Building Regulations should, in accordance with regulation 11, be carried out with proper materials and in a workmanlike manner.

You may show that you have complied with regulation 11 in a number of ways. These include the appropriate use of a product bearing CE marking in accordance with the Construction Products Regulation (305/2011/EU-CPR) as or a product complying with an appropriate technical specification (as defined in those Regulations), a British Standard or an alternative national technical specification of any state which is a contracting party to the European Economic Area which in use is equivalent, or a product covered by a national or European certificate issued by a European Technical Approval issuing body, and the conditions of use are in accordance with the terms of the certificate.

You will find further guidance in the Guernsey Technical Standard on materials and workmanship that provides practical guidance on regulation 11 on materials and workmanship.

Supplementary guidance

Building Control occasionally issues additional material to aid interpretation of the guidance in Guernsey Technical Standards. This material may be conveyed in official letters to relevant agents and/or posted on the States website accessed through: **www.gov.gg/planning**

Technical specifications

When a Guernsey Technical Standard makes reference to specific standards or documents, the relevant version of the standard is the one listed at the end of the publication. However, if this version of the standard has been revised or updated by the issuing standards body, the new version may be used as a source of guidance provided that it continues to address the relevant requirements of the Building Regulations.

Where it is proposed to work to an updated version of the standard instead of the version listed at the end of the publication, this should be discussed with Building Control in advance of any work starting on site.

The appropriate use of any product, which complies with a European Technical Approval as defined in the Construction Products Regulation, (305/2011/EU-CPR) as amended, repealed or replaced will meet the relevant requirements.

Independent schemes of certification and accreditation

Much of the guidance throughout this document is given in terms of performance.

Since the performance of a system, product, component or structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and accreditation of installers and maintenance firms will provide confidence in the appropriate standard of workmanship being provided.

Confidence that the required level of performance can be achieved will be demonstrated by the use of a system, material, product or structure which is provided under the arrangements of a product conformity certification scheme and an accreditation of installer scheme.

Third party accredited product conformity certification schemes not only provide a means of identifying materials and designs of systems, products and structures which have demonstrated that they reach the requisite performance, but additionally provide confidence that the systems, materials, products and structures are actually provided to the same specification or design as that tested or assessed.

Third party accreditation of installers of systems, materials, products and structures provides a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing the reliability of the anticipated performance.

Many certification bodies that approve such schemes are accredited by the **United Kingdom Accreditation Service**.

Certification of products, components, materials or structures under such schemes may be accepted as evidence of compliance with the relevant standard. Similarly the certification of installation or maintenance of products, components, materials and structures under such schemes as evidence of compliance with the relevant standard may be acceptable. Nonetheless Building Control will wish to establish in advance of the work, that any such scheme is adequate for the purpose of the Building Regulations.

Interaction with other legislation

This Guernsey Technical Standard makes reference to other legislation, including that listed below, the requirements of which may be applicable when carrying out building work. All references are to legislation as amended or repealed and replaced.

Note: All Laws, Ordinances and Statutory instruments can be accessed at;

www.guernseylegalresources.gg/

The Health and Safety at Work (General) (Guernsey) Ordinance, 1987 made under the Health and Safety at Work etc. (Guernsey) Law, 1979 and the Health, Safety and Welfare of Employees Law, 1950 applies to any workplace or part of a workplace. It applies to the common parts of flats and similar buildings if people such as cleaners, wardens and caretakers are employed to work in these common parts.

Mixed use development

In mixed use developments part of a building may be used as a dwelling while another part has a non-domestic use. In such cases, if the requirements of this Part of the Regulations for dwellings and non-domestic use differ, the requirements for non-domestic use should apply in any shared parts of the building.

The Requirement

This Guernsey Technical Standard deals with the following requirements from Part F of Schedule 1 of the Building Regulations.

Requirement	*Limits on application*
Means of ventilation **F1**(1). There must be adequate means of ventilation provided for people in the building. (2). Fixed systems for mechanical ventilation and any associated controls must be commissioned by testing and adjusting as necessary to secure that the objective referred to in sub-paragraph (1) is met.	Requirement F1 does not apply to a building or space within a building- (a) into which people do not normally go, (b) which is used solely for storage, or (c) which is a garage used solely in connection with a single family dwelling. Requirement F1(2) does not apply to dwellings

Guidance

Performance

The requirements of F1(1) will be met if a ventilation system is provided that, under normal conditions, is capable of limiting the accumulation of moisture, which could lead to mould growth, and pollutants originating within a building which would otherwise become a hazard to the health of the people in the building.

Introduction to provisions

F.1 In general terms, the requirement may be achieved by providing a ventilation system which:

a. extracts, before it is generally widespread, water vapour from areas where it is produced in significant quantities (e.g. kitchens, utility rooms and bathrooms);

b. extracts, before they are generally widespread, pollutants which are a hazard to health from areas where they are produced in significant quantities (e.g. rooms containing processes or activities which generate harmful contaminants);

c. rapidly dilutes, when necessary, pollutants and water vapour produced in habitable rooms, occupiable rooms and sanitary accommodation;

d. makes available over long periods a minimum supply of outdoor air for occupants and disperses, where necessary, residual pollutants and water vapour. Such ventilation should minimise draughts and, where necessary, should be reasonably secure and provide protection against rain penetration;

e. is designed, installed and commissioned to perform in a way which is not detrimental to the health of the people in the building; and

f. is installed to facilitate maintenance where necessary.

F.2 The guidance in this Guernsey Technical Standard has not been formulated to deal with the products of tobacco smoking.

F.3 Ventilation systems in buildings result in energy being used to heat fresh air taken in from outside and, in mechanical ventilation systems, to move air into, out of and/or around the building. Energy efficiency is dealt with under Part L of Schedule 1 and Regulation 20 of the Building Regulations but consideration should be given to mitigation of ventilation energy use, where applicable, by employing heat recovery devices, efficient types of fan motor and/or energy-saving control devices in the ventilation system.

Section 1 - General Provisions

Guidance

1.1 The purpose of this section is to outline briefly what ventilation in buildings is for and the philosophy behind the guidance for ventilation given in Guernsey Technical Standard F. More detail is given in some of the informative Annexes at the end of this Guernsey Technical Standard.

The purpose of ventilation

1.2 Ventilation is simply the removal of 'stale' indoor air from a building and its replacement with 'fresh' outside air. It is assumed within the Guernsey Technical Standard that the outside air is of reasonable quality.

Ventilation is required for one or more of the following purposes:

a. provision of outside air for breathing;

b. dilution and removal of airborne pollutants, including odours;

c. control of excess humidity (arising from water vapour in the indoor air);

d. provision of air for fuel-burning appliances (which is covered under Part J of the Building Regulations).

1.3 Ventilation may also provide a means to control thermal comfort but this is not controlled under the Building Regulations. Part L addresses minimising energy use due to the effects of solar gain in summer.

1.4 The airborne pollutants and water vapour mentioned in paragraph 1.2b and c above include those that are released from materials and products paragraph used in the construction, decoration and furnishing of a building, and as a result of the activities of the building's occupants.

1.5 The pollutant(s) of most importance will vary between building types (e.g. dwelling, office, factory), building uses (e.g. industrial process, shop, commercial kitchen), and even from room to room within a building (e.g. kitchen, shower room, conference room, photocopier room). Common pollutants in a dwelling are moisture and combustion products from unflued appliances (e.g. gas, oil or solid fuel cookers) and chemical emissions from construction and consumer products.

Note that the ventilation system capacity, if used appropriately, is usually sufficient to remove odours arising from normal occupant activities within a dwelling. In an office building, body odour is often the key pollutant, but there are a number of other pollutant sources including the building itself, furnishings, printers and photocopiers.

Types of ventilation

1.6 Buildings are ventilated through a combination of infiltration and purpose-provided ventilation:

a. Infiltration is the uncontrollable air exchange between the inside and outside of a building through a wide range of air leakage paths in the building structure.

b. Purpose-provided ventilation is the controllable air exchange between the inside and outside of a building by means of a range of natural and/or mechanical devices.

1.7 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 and its supporting Guernsey Technical Standards. Guernsey Technical Standard F recommends methods of achieving sufficient purpose-provided ventilation, allowing for a reasonably high level of airtightness.

1.8 For the purposes of Part F, a reasonably high level of airtightness means a level which is significantly tighter than the minimum target value recommended under Part L, because all new buildings are expected to better the target value to some degree. Through good design and execution, domestic and non-domestic buildings can currently achieve an air permeability down to around 2 to 4 $m^3/(h.m^2)$ of envelope area at 50 Pascal (Pa) pressure difference. Some buildings constructed are tighter than this. It can be anticipated that there will be a continual trend towards more airtight buildings due to drivers for higher energy efficiency and lower carbon emissions.

1.9 The ventilation provisions recommended for new dwellings in this Guernsey Technical Standard have been specified for two standard designs of air permeability:

a. In the default option, the guidance assumes zero air permeability and thus no infiltration. The building ventilation is reliant entirely on installed purpose-provided ventilation, thus ensuring sufficient ventilation for dwellings of all levels of air permeability. This option should be particularly suitable when intending to construct a more airtight dwelling, or where the person carrying out the building work does not have previous experience of closely matching design with as-constructed air permeability and may, as a consequence, achieve a significantly better performance than designed.

b. In the alternative option, the guidance assumes an infiltration of 0.15 air changes per hour (ach). The recommended purpose-provided ventilation is less as infiltration contributes to the total amount of ventilation. This option is most appropriate when designing to an air permeability leakier than 5 $m^3/(h.m^2)$ at 50 Pa, and it is expected from experience that the measured air permeability will be close to the design value and will not be better than 3 $m^3/(h.m^2)$ at 50 Pa.

   Paragraphs 2.8 to 2.10 provide further information.

The ventilation strategy adopted in Guernsey Technical Standard F

1.10 Guernsey Technical Standard F adopts the following strategy. (Systems which comply with the strategy are described in Sections 2 and 3.)

a. Extract ventilation from rooms where most water vapour and/or pollutants are released, e.g. due to activities such as cooking, bathing or photocopying. This is to minimise their spread to the rest of the building. This extract may be either intermittent or continuous.

b. Whole building/dwelling ventilation to provide fresh air to the building and to dilute and disperse residual water vapour and pollutants not dealt with by extract ventilation as well as removing water vapour and other pollutants which are released throughout the building (e.g. by building materials, furnishings, activities and the presence of occupants). Whole building/dwelling ventilation provides nominally continuous air exchange. The ventilation rate may be reduced or ceased when the building is not occupied. It may be necessary to purge the air when the building is re-occupied.

c. Purge ventilation throughout the building to aid removal of high concentrations of pollutants and water vapour released from occasional activities such as painting and decorating or accidental releases such as smoke from burnt food or spillage of water. Purge ventilation is intermittent, i.e. required only when such occasional activities occur. Purge ventilation provisions may also be used to improve thermal comfort, although this is not controlled under the Building Regulations.

1.11 This ventilation strategy can be delivered by a natural ventilation system or a mechanical ventilation system or a combination of both (i.e. 'mixed-mode' or 'hybrid' ventilation system). For mainly naturally ventilated buildings, it is common to use a combination of ventilators to achieve this strategy (e.g. for dwellings it is common to use intermittent extract fans for extract ventilation, trickle ventilators for whole dwelling ventilation and windows for purge ventilation). For mechanically ventilated or air-conditioned buildings, it is common for the same ventilators to provide both local extract and whole building / dwelling ventilation and, for buildings other than dwellings, to provide purge ventilation as well.

1.12 The ventilation systems and devices mentioned in this document are examples of those commonly in use at the time of writing. Other ventilation systems and devices, perhaps following a different strategy (e.g. positive input ventilation or supply air windows), may provide acceptable solutions, provided it can be demonstrated to Building Control (e.g. by use of a product or system covered by a national or European certificate issued by a European Technical Approval issuing body, provided the conditions of use are in accordance with the terms of the certificate) that they meet requirement F1. The assessment of the suitability of a ventilation system should take account of the design air permeability of the building, and the fact that the completed building may be 'tighter' than the design value because of variability in construction quality.

Control of ventilation

1.13 It is important that ventilation is controllable so that it can maintain reasonable indoor air quality and avoid waste of energy. These controls can be either manual (i.e. operated by the occupant) or automatic. Demand-controlled ventilation systems employ sensors to detect the level of occupancy, water vapour or other pollutants and adjust the ventilation rate accordingly in order to avoid over-ventilation and so reduce energy consumption.

1.14 Manually controlled trickle ventilators (the most common type of background ventilators) can be located over the window frames, in window frames, just above the glass or directly through the wall (see Diagram 5 in Key terms annex E). They are positioned typically 1.7 m above floor level to avoid discomfort due to cold draughts. These ventilators often incorporate a simple flap that allows users to shut off the ventilation – depending on external weather conditions. Trickle ventilators are intended to be normally left open in occupied rooms in dwellings. A window with a night latch position is not recommended because of the difficulty of measuring the equivalent area, the greater likelihood of draughts and the potential increased security risk in some locations.

1.15 In dwellings, humidity-controlled devices are available to regulate the humidity of the indoor air and, hence, minimise the risk of condensation and mould growth. These are best installed as part of an extract ventilator in moisture-generating rooms (e.g. kitchen or bathroom). Humidity control is not appropriate for sanitary accommodation, where the dominant pollutant is normally odour. Trickle ventilators are available which 'throttle down' the ventilation flow passage(s) according to the pressure difference across the ventilator to reduce draught risks during windy weather. Manufacturers should be consulted when selecting the correct type of pressure-controlled trickle ventilator.

1.16 Other types of automatic control may be suitable for regulating ventilation devices (e.g. trickle ventilators, ventilation fans, dampers and air terminal devices) in dwellings. In such cases, it is important that the device controls the ventilation air supply and/or extract according to the need for ventilation in the space to remove or dilute indoor pollutants and water vapour. Trickle ventilators with automatic controls should also have manual override, so that the occupant can close the ventilator to avoid draughts and fully open the ventilator to provide maximum air flow when required. For pressure-controlled trickle ventilators that are fully open at typical conditions (e.g. 1 Pa pressure difference), only a manual close option is recommended.

1.17 In buildings other than dwellings, more sophisticated automatic control systems are available. These may be based on sensors located within the building, e.g. occupancy sensors (using local passive infra-red detectors) or indoor carbon dioxide concentration sensors (using electronic carbon dioxide detectors) as an indicator of occupancy level and, therefore, body odour.

Performance-based guidance

1.18 This Guernsey Technical Standard focuses on performance-based guidance which suggests to the designer what level of ventilation should be sufficient, rather than how it should be achieved. Therefore, the designer has the freedom to use whatever ventilation provisions suit a particular building, including the use of innovative products and solutions, if it can be demonstrated that they meet the performance standard recommended in this Guernsey Technical Standard.

1.19 The actual performance criteria for acceptable levels of moisture and pollutants are given in Annex A. The air flow rates necessary to meet the performance criteria are given in the main guidance.

1.20 Simple guidance in the form of ventilator sizes for the whole dwelling is also provided to make it easier for designers to meet building regulations requirements in common situations.

Equivalent area of ventilators

1.21 Equivalent area is used in the Guernsey Technical Standard instead of free area for the sizing of background ventilators (including trickle ventilators) because it is a better measure of the air flow performance of a ventilator. Unlike equivalent area, free area is simply the physical size of the aperture of the ventilator but may not accurately reflect the air flow performance which the ventilator will achieve. The more complicated

and/or contorted the air flow passages in a ventilator, the less air will flow through it. So, two different ventilators with the same free area will not necessarily have the same air flow performance. A European Standard, *BS EN 13141-1:2004* (Clause 4), includes a method of measuring the equivalent area of background ventilator openings.

1.22 As equivalent area cannot be verified with a ruler, it will be difficult to demonstrate to Building Control that trickle ventilators and similar products have the correct equivalent area unless it is clearly marked on the product. For this reason, it is preferable to use ventilators which have the equivalent area (in mm^2 at 1 Pa pressure difference), or equivalent area per metre (where the equivalent area of the product varies according to length) marked on the product in an easily visible location from the inside of the dwelling when installed. Where it is not practical for the manufacturer to mark the ventilator because it can be used in conjunction with a range of other components, some form of temporary marking for the installed system should be acceptable to Building Control.

Ventilation effectiveness

1.23 Ventilation effectiveness is a measure of how well a ventilation system works in terms of delivering the supply air to the occupants of a building. If the supply air is mixed fully with the room air before it is breathed by the occupants, the ventilation effectiveness is 1. If the supply air is extracted from the room before it mixes with any room air, the ventilation effectiveness is 0. If the supply air reaches the occupant without mixing with any room air, the ventilation effectiveness tends towards infinity.

1.24 This is important as a system with a higher ventilation effectiveness achieves acceptable pollutant levels at the occupant's breathing zone for a lower air supply rate, and offers potentially significant energy savings. However, it has been decided not to make an allowance for any reduction of fresh air supply rates based on ventilation effectiveness in Guernsey Technical Standard F at this time. This is because ventilation effectiveness is dependent on the ventilation system design, its installation and the way in which occupants use the space. While it is possible to predict what the ventilation effectiveness of a system should be, there is currently insufficient knowledge of the actual ventilation effectiveness achieved in buildings to allow designers to guarantee performance and so avoid significant under-ventilation by reducing air supply rates. This is because ventilation effectiveness may be influenced by factors beyond the designer's control such as occupant usage (e.g. seating plan and use of computers within a space and whether the space is being heated or cooled by the ventilation air). In the designs shown in this Guernsey Technical Standard, it has been assumed that the ventilation effectiveness is 1.0. *CIBSE Guide A* provides further information on ventilation effectiveness.

Source control

1.25 A complementary strategy for achieving good indoor air quality is to reduce the release of water vapour and/or air pollutants into the indoor air, i.e. source control. Source control is not considered within the main guidance of the Guernsey Technical Standard owing to limited knowledge about the emission of pollutants from construction and consumer products used in buildings and the lack of suitable labelling schemes available. Some construction products such as glass, stone and ceramics are by their nature low emitters of air pollutants. Currently, some paints are labelled for their volatile organic compound (VOC) content, and some wood-based boards (*class E1, BS EN 13986:2004*) are available with low formaldehyde emission. This allows suitable products to be chosen when good indoor air quality is a priority, but at the present time it is not practical to make an allowance for use of these products in the ventilation requirements. Further information about control of emissions from construction products is available in *BRE Digest 464*.

1.26 Exposure to house dust mite (HDM) allergens can lead to allergic sensitisation and to exacerbation of allergic conditions. The moisture criteria needed to avoid HDM are more complex and demanding than those needed to avoid mould. The reduction of mite growth may be feasible in UK dwellings via appropriate ventilation, heating and moisture control as part of an integrated approach that involves the removal of existing mite allergens.

1.27 Useful information may be found in the *World Health Organisation (WHO) publication, House dust mites, Crowther D and Wilkinson T (2008),* which is included in Public health significance of urban pests, Bonnefoy X, Kampen H and Sweeney K, WHO Regional Office for Europe, available at: www.euro.who.int/document/e91435.pdf

1.28 Further information and suggested measures for source control are given in *Review of health and safety risk drivers (BD 2518)*, available at: www.communities.gov.uk/publications/planningandbuilding/reviewhealthsafety

Noise

1.29 The noise caused by ventilation systems is not controlled under the Building Regulations. However, such noise may be disturbing to the occupants of a building and it is recommended that measures be taken to minimise noise disturbance. For example, in noisy areas, in order to reduce noise entering the building through the ventilation system, it may be appropriate to use sound-attenuating ventilation products depending on the noise level and any planning conditions.

1.30 Noise from the ventilation system may also disturb people who are outside the building, so measures to minimise externally emitted noise should also be considered.

1.31 Noise generated by ventilation fans (which may travel through ducts) and noise from the fan unit may disturb the occupants of the building and so discourage their use. Therefore, the designer should consider minimising noise by careful design and the specification of quieter products.

1.32 To ensure good acoustic conditions, the average A-weighted sound pressure level in noise sensitive rooms, such as bedrooms and living rooms, should not exceed 30 dB $L_{Aeq,T}$ (see Note below). In less sensitive rooms, such as kitchens and bathrooms, a higher level would be acceptable, e.g. 35 dB $L_{Aeq,T}$. Noise from a continuously running mechanical ventilation system on its minimum low rate should not normally exceed these levels, and should preferably be lower in order to minimise the impact of the ventilation system.

1.33 The main issues to be addressed in minimising the noise impact of the ventilation system are the noise from the fan unit entering the ducts, and the attenuation provided by the ducts, bends and junctions and the characteristics of the room grill. The noise breaking out of the fan unit casing may also be significant in adjacent rooms. The characteristics of the room will also affect the noise level.

1.34 Methods for measuring the sound power level produced by the fan unit of decentralised extract, centralised extract, and balanced supply and extract with heat recovery systems are under development. When available, they should be read in conjunction with the appropriate parts of *BS EN 13141.*

Note:

1.35 The noise index $L_{Aeq,T}$ is used in *BS 8233:1999,* where T is the duration of the measurement. If the noise from the sound source is steady (e.g. fluctuating by up to 3 dB) a measuring time of 1 minute will be adequate and the $L_{Aeq,1\ min}$ level will be similar to the dB(A) level used elsewhere. If the noise from the sound source fluctuates more than this a longer measuring time (T) will be required.

Fire precautions

1.36 Where ducting passes through a fire-resisting wall/floor or fire compartment, the required measures to ensure compliance with Part B of the Building Regulations must be taken.

Modular and portable buildings

1.37 Buildings constructed from sub-assemblies that are delivered newly made or selected from stock should be treated no differently from any other new building and must comply with all the relevant requirements in Schedule 1 to the Building (Guernsey) Regulations, 2012 that were in force when they were manufactured.

Installation of ventilation systems

1.38 It is recommended that ventilation systems are installed in new and existing dwellings in accordance with the guidance in the *2010 edition of the Domestic ventilation compliance guide, available from www.planningportal.gov.uk/*. The guide is referenced at relevant points of this Guernsey Technical Standard – in Section 2, New dwellings, and in Section 4, **Work on existing buildings.**

1.39 Section 5 of the domestic ventilation compliance guide includes an installation checklist which should be completed by the system installer. It also includes an installation inspection sheet where the equivalent area of background ventilators should be recorded.

1.40 Installation guidance for buildings other than dwellings can be found in the references listed in Table 6.

Air flow rate testing and commissioning of ventilation systems

1.41 The Regulations require all non domestic mechanical ventilation systems to be commissioned (where they can be tested and adjusted);

1.42 For commissioning of non-domestic ventilation systems, the commissioning procedure is *CIBSE Code M, available from www.cibse.org.*

1.43 The commissioning of mechanical ventilation systems to provide adequate ventilation under Part F of the Building Regulations will need to be carried out with the commissioning of such systems to ensure that they use no more fuel and power than is reasonable in the circumstances under Part L of the Building Regulations.

1.44 In addition, guidance on commissioning ventilation ductwork is provided in the *HVCA guidance documents DW/144 Specification for sheet metal ductwork: low, medium and high pressure/velocity air systems, DW/154 Specification for plastics ductwork, and DW/143 Practical guide to ductwork leakage testing, all available from www.hvca.org.uk.*

Section 2 - New Dwellings

Introduction

2.1 This Guernsey Technical Standard shows three main ways of complying with the ventilation requirements of the Building Regulations:

a. providing the ventilation rates set out in paragraphs 2.4 to 2.7; or

b. following the system guidance set out:

for dwellings without basements in paragraphs 2.8 to 2.10. This guidance covers all levels of design air permeability. Alternative guidance is also provided for dwellings designed to an air permeability leakier than (>) 5 $m^3/(h.m^2)$ at 50 Pa where the developer from experience will not construct significantly more airtight dwellings (not better than 3 $m^3/(h.m^2)$ at 50 Pa); or for dwellings with basements in paragraphs 2.11 to 2.13; or

c. using other ventilation systems provided it can be demonstrated to Building Control that they satisfy the Requirement, e.g. by showing that they meet the moisture and air quality criteria set out in Annex A.

2.2 There should be reasonable access for maintenance. This should include access for the purpose of changing filters, replacing defective components and cleaning ductwork.

Note

2.3 Extract fans lower the pressure in a building, which can cause the spillage of combustion products from open-flued appliances (i.e. the combustion gases may fill the room instead of going up the flue or chimney). This can occur even if the appliance and the fan are in different rooms. Ceiling sweep fans produce air currents and hence local depressurisation, which can also cause the spillage of flue gases from open-flued gas appliances or from solid fuel open fires. In buildings where it is intended to install open-flued combustion appliances and extract fans, the combustion appliance should be able to operate safely whether or not the fans are running. A way of showing compliance in these circumstances would be to follow the guidance given in Guernsey Technical Standard J on both the installation of the appliances and tests to show that combustion appliances operate safely whether or not fans are running.

Table 1a **Extract ventilation rates**

Room	Intermittent extract	Continuous extract	
	Minimum rate	Minimum high rate	Minimum low rate
Kitchen	30 l/s adjacent to hob; or 60 l/s elsewhere	13 l/s	Total extract rate should be at least the whole dwelling ventilation rate given in Table 1b
Utility room	30 l/s	8 l/s	
Bathroom	15 l/s	8 l/s	
Sanitary accommodation	6 l/s	6 l/s	

Table 1b **Whole dwelling ventilation rates**

	Number of bedrooms in dwelling				
	1	2	3	4	5
Whole dwelling ventilation rate [a, b] (l/s)	13	17	21	25	29

Notes:

a. In addition, the minimum ventilation rate should be not less than 0.3 l/s per m^2 of internal floor area. (This includes all floors, e.g. for a two-storey building add the ground and first floor areas.)

b. This is based on two occupants in the main bedroom and a single occupant in all other bedrooms. This should be used as the default value. If a greater level of occupancy is expected add 4 l/s per occupant.

Ventilation rates

2.4 The performance will be achieved by providing the air flow rates set out in paragraphs 2.5 to 2.7. The air flow rates specified are for the performance of the complete installation. The performance of the ventilation devices (and associated components such as ducting for fans) should be tested according to the Standards listed under 'Performance test methods' in Table 3. All natural and mechanical systems should be fully commissioned, and guidance is given in the *Domestic ventilation compliance guide, available from: www.planningportal.gov.uk/*

2.5 Extract ventilation to outside is required in each kitchen, utility room and bathroom and for sanitary accommodation. The extract can be either intermittent or continuously operating. The intermittent rate, and for continuous systems the minimum extract air flow rates at the highest and lowest settings, should be no less than specified in Table 1a.

2.6 The whole dwelling ventilation rate for the supply of air to the habitable rooms in a dwelling should be no less than specified in Table 1b.

2.7 Purge ventilation provision is required in each habitable room and should be capable of extracting a minimum of four air changes per hour (ach) per room directly to outside. Normally, openable windows or doors can provide this function (see Annex B), otherwise a mechanical extract system should be provided. In other rooms (e.g. kitchens and bathrooms) the mechanical or passive stack extract provisions should be sufficient, although passive stack ventilation will take longer to purge the room.

Ventilation systems for dwellings without basements

2.8 The performance required for dwellings without basements could be achieved by following Steps 1 and 2 below. Worked examples for each system are given in Annex C.

2.9 For each system, guidance is given for dwellings to cover all design air permeabilities. This guidance is therefore suitable for all dwellings and, for ventilation purposes, it is not necessary for the as-built permeability to be close to the design permeability.

2.10 In addition to this guidance, for each system alternative guidance is provided for dwellings with as-built air permeabilities leakier than (>) 3 $m^3/(h.m^2)$ at 50 Pa. It is recommended that this option is selected only if designing to an air permeability leakier than (>) 5 $m^3/(h.m^2)$ at 50 Pa and if the person carrying out the building work has previous experience of closely matching design with as-built air permeability levels. If the alternative guidance is followed, and it is subsequently found that either

a. the tested air permeability for that dwelling is tighter than or equal to (≤) 3 $m^3/(h.m^2)$ at 50 Pa, or

b. if the dwelling is not tested, but another dwelling of the same dwelling type tested under Regulation 26 is tighter than or equal to (≤) 3 $m^3/(h.m^2)$ at 50 Pa,

it may be necessary for Building Control to ask for more air permeability testing to be carried out to ensure all dwellings in the sample are provided with adequate ventilation.

Step 1: Select one of the following four ventilation systems (illustrated in Diagram 1a).

System 1: Background ventilators and intermittent extract fans. Guidance on minimum provisions for extract and whole dwelling ventilation is set out in Table 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 2b.

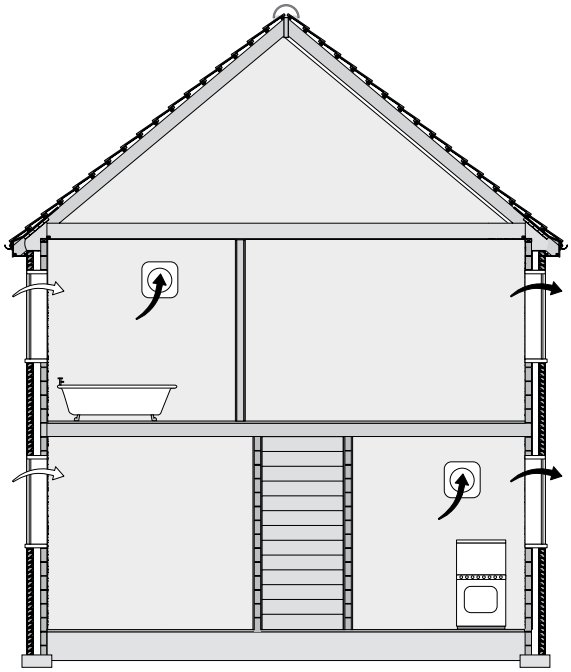
System 3: Continuous mechanical extract (MEV). Guidance on minimum provisions for extract and whole dwelling ventilation is set out in Table 2c.

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 2d.

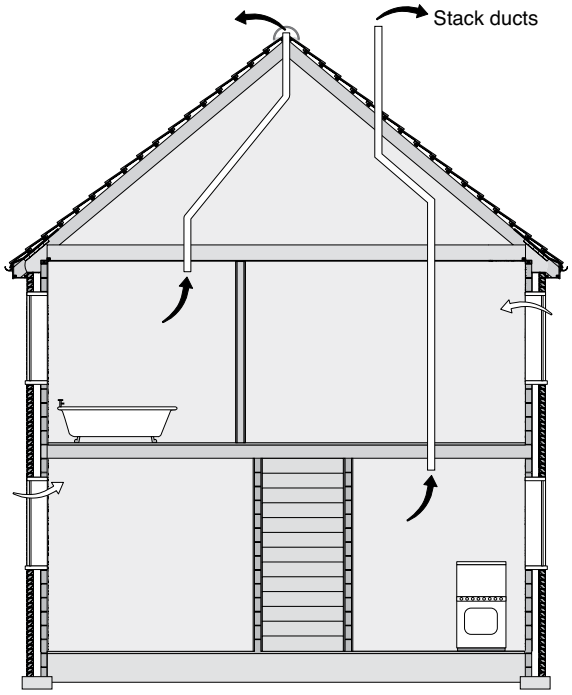
Step 2: See Table 3 for guidance on performance test methods for the products chosen.

Diagram 1a **Ventilation systems**

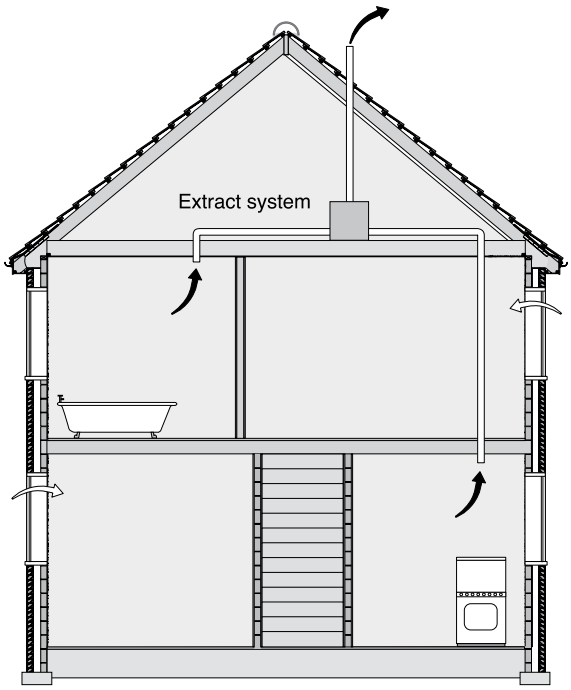
Background ventilators and intermittent extract fans



Passive stack ventilation



Continuous mechanical extract



Continuous mechanical supply and extract with heat recovery

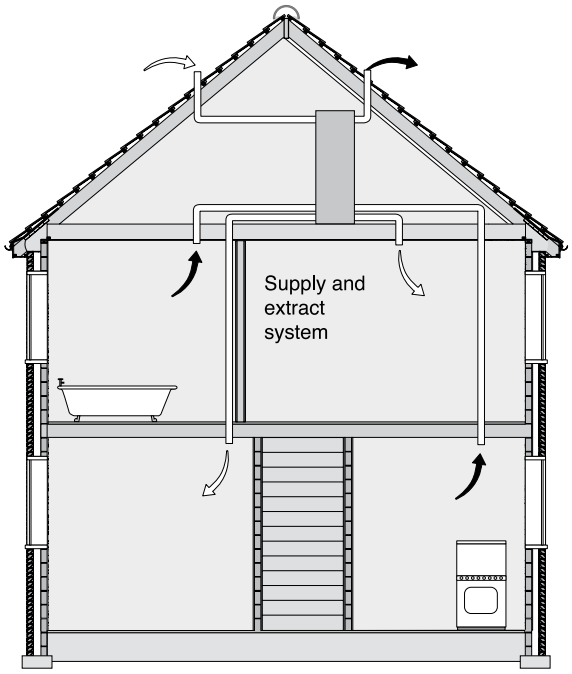


Diagram 1b **Single-sided ventilation**

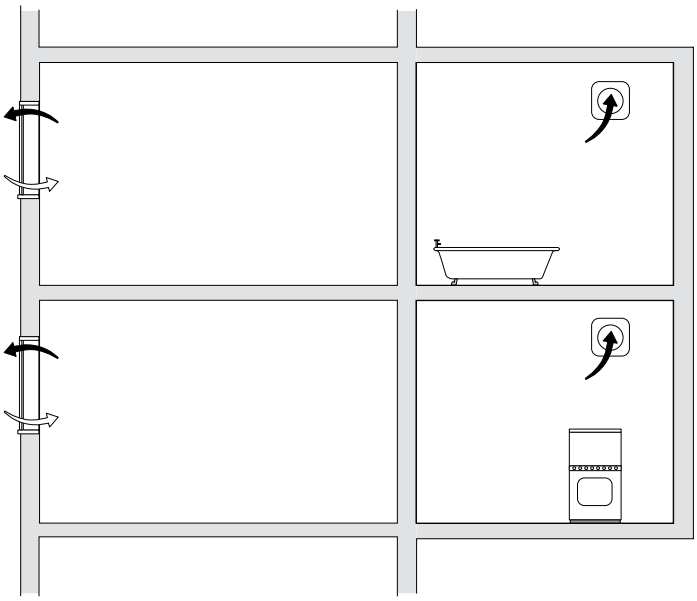


Table 2a **System 1 – Background ventilators and intermittent extract fans (for additional information see Table 3 and worked examples C1 and C5 in Annex C)**

Design of system 1

The background ventilators have been sized for the winter period. Additional ventilation may be required during warmer months and it has been assumed that the provisions for purge ventilation (e.g. openable windows) could be used.

Intermittent extract

Intermittent extract rates are given in Table 1a. For sanitary accommodation only, as an alternative, the purge ventilation provisions (windows) given in Annex B can be used where security is not an issue.

Instead of a conventional intermittent fan, a continuously running single room heat recovery ventilator could be used in wet rooms. It should use the minimum high rate given in Table 1a and 50% of this value as the minimum low rate. No background ventilator is required in the same room as the single room heat recovery ventilator. Furthermore, the total equivalent background ventilator area described in the tables below can be reduced by 2500 mm^2 for each room containing a single room heat recovery ventilator.

Location of intermittent extract fans

Intermittent extract fans should be installed in each wet room.

Cooker hoods should be 650 mm to 750 mm above the hob surface (or follow manufacturer instructions).

Intermittent extract fans other than cooker hoods should be installed as high as is practical and preferably less than 400 mm below the ceiling.

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

Table 2a System 1 – Background ventilators and intermittent extract fans (for additional information see Table 3 and worked examples C1 and C5 in Annex C)

Background ventilators (follow Steps 1 to 3 below)

Step 1: Determine the total equivalent ventilator area – See Table A below for a dwelling with any design air permeability. As an alternative, the guidance in Table 2b below may be followed for a dwelling designed to an air permeability leakier than (>) 5 $m^3/(h.m^2)$ at 50 Pa which recommends less ventilation provisions, but see the cautionary advice in paragraph 2.10.

Step 2: Follow (i) or (ii) as appropriate depending on the number of storeys:

(i) For multi-storey dwellings, and single-storey dwellings more than four storeys above ground level:

Use the total equivalent ventilator area from Step 1.

(ii) For single-storey dwellings up to and including the fourth storey above ground level:

Add a further 10000 mm^2 to the total equivalent ventilator area from Step 1, preferably shared between several rooms.

Step 3: For dwellings which have a single exposed façade, or at least 70% of the equivalent area is designed to be on the same façade, cross-ventilation is not possible, or is limited, and additional ventilation provisions are recommended. In this case background ventilators should be located at both high and low positions in the façade to provide enhanced single-sided ventilation. The total equivalent area as described in Steps 1 and 2 above should be provided at the high position (typically 1.7 m above floor level) for all dwelling types and all storey heights. In addition, ventilators having the same total equivalent area should be provided at least 1.0 m below the high ventilators as shown in Diagram 1b. Single-sided ventilation is most effective if the dwelling is designed so that the habitable rooms are on the exposed façade, and these rooms are no greater than 6 m in depth.

A – Total equivalent ventilator area [a] (mm^2) for a dwelling with any design air permeability.

Total floor area (m^2)	**Number of bedrooms [b]**				
	1	2	3	4	5
≤50	35000	40000	50000	60000	65000
51–60	35000	40000	50000	60000	65000
61–70	45000	45000	50000	60000	65000
71–80	50000	50000	50000	60000	65000
81–90	55000	60000	60000	60000	65000
91–100	65000	65000	65000	65000	65000
> 100	Add 7000 mm^2 for every additional 10 m^2 floor area				

B – Alternative guidance on total equivalent ventilator area [a] (mm^2) for a dwelling with a designed air permeability leakier than (>) 5 $m^3/(h.m^2)$ at 50 Pa.

Total floor area (m^2)	**Number of bedrooms [b]**				
	1	2	3	4	5
≤50	25000	35000	45000	45000	55000
51–60	25000	30000	40000	45000	55000
61–70	30000	30000	30000	45000	55000
71–80	35000	35000	35000	45000	55000
81–90	40000	40000	40000	45000	55000
91–100	45000	45000	45000	45000	55000
> 100	Add 5000 mm^2 for every additional 10 m^2 floor area				

Notes:

a. The equivalent area of a background ventilator should be determined at 1 Pa pressure difference, using the appropriate test method given in Table 3.

b. This is based on two occupants in the main bedroom and a single occupant in all other bedrooms. For a greater level of occupancy, assume a greater number of bedrooms (i.e. assume an extra bedroom per additional person). For more than five bedrooms, add an additional 10000 mm^2 per bedroom.

Table 2a System 1 – Background ventilators and intermittent extract fans (for additional information see Table 3 and worked examples C1 and C5 in Annex C)

Location of background ventilators

Background ventilators should be located to avoid draughts, e.g. typically 1.7 m above floor level (except in the single-sided case described above).

Background ventilators should be located in all rooms with external walls, with at least 5000 mm^2 equivalent area in each habitable room and 2500 mm^2 equivalent area in each wet room. If a habitable room has no external walls follow the guidance in paragraphs 2.14 to 2.16. If a wet room has no external walls follow the guidance for intermittent extract given for Purge ventilation and Controls below.

If the dwelling has more than one exposed façade, to maximise the air flow through the dwelling by encouraging cross-ventilation, it is best to locate similar equivalent areas of background ventilators on opposite (or adjacent) sides of the dwelling.

Purge ventilation

For each habitable room with:

external walls, see Annex B for window or external door (including patio door) sizing;

no external walls, see paragraphs 2.14 to 2.16.

There may be practical difficulties in achieving this (e.g. if unable to open a window due to excessive noise from outside).

For each wet room with:

external walls, install an openable window (no minimum size);

no external walls, the normal extract provisions will suffice, although it will take longer to purge the room.

As an alternative to the provisions given above for habitable and wet rooms, a mechanical fan extracting at 4 ach to outside could be used.

Devices used for purge ventilation should be manually controlled. The location of the devices is not critical for ventilation.

Air transfer

To ensure good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm^2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door. This should be achieved by making an undercut of 10 mm above the floor finish if the floor finish is fitted, or by a 20 mm undercut above the floorboards, or other surface, if the finish has not been fitted.

Controls

Intermittent extract

May be operated manually and/or automatically by a sensor (e.g. humidity, occupancy/usage, pollutant release). Humidity controls should not be used for sanitary accommodation as odour is the main pollutant.

In kitchens, any automatic control must provide sufficient flow during cooking with fossil fuel (e.g. gas) to avoid build-up of combustion products.

Any automatic control should have a manual override to allow the occupant to turn the extract on.

In a room with no openable window (i.e. an internal room) an intermittent extract fan should have a 15 minute overrun. In rooms with no natural light, the fans could be controlled by the operation of the main room light switch.

Background ventilators

May be either manually adjustable or automatically controlled (see paragraphs 1.13 to 1.15).

Manual controls

Where manual controls are provided, they should be within reasonable reach of the occupants. It is recommended that they are located in accordance with the guidance for Requirement N3 Safe opening and closing of windows etc., which is given in Guernsey Technical Standard N. Where reasonable, pull cords, operating rods or similar devices should be provided. Although Requirement N3 applies only to workplaces, for the purpose of this Guernsey Technical Standard it should also apply to dwellings.

Noise

Fans should be quiet so as not to discourage their use by occupants.

Table 2b System 2 – Passive stack ventilation (PSV) (for additional information see Table 3 and worked examples C2 and C6 in Annex C)

Design of system 2

The background ventilators have been sized for the winter period. Additional ventilation may be required during warmer months and it has been assumed that the provisions for purge ventilation (e.g. openable windows) could be used.

Ceiling extract grilles should have a free area of not less than the duct cross-sectional area (when in the fully open position if adjustable).

If a dwelling in which PSV is proposed is situated near a significantly taller building (i.e. more than 50% taller), it should be at least five times the difference in height away from the taller building (e.g. if the difference in height is 10 m, PSV should not be installed in a dwelling within 50 m of the taller building).

The roof terminal design should be as specified by the PSV manufacturer.

Size of passive stack ventilators

Room	Internal duct diameter (mm)	Internal cross-sectional area (mm^2)
Kitchen	125	12000
Utility room	125	12000
Bathroom	125	12000
Sanitary accommodation*	125	12000

*For sanitary accommodation only, as an alternative, the purge ventilation provisions (windows/doors) given in Annex B can be used where security is not an issue.

Location of PSV

For a dwelling with only a single exposed façade, the dwelling should be designed such that the habitable rooms are on the exposed façade so as to achieve cross-ventilation.

PSV extract terminals should be located in the ceiling or on a wall less than 400 mm below the ceiling.

Instead of PSV, an open-flued appliance may provide sufficient extract ventilation for the room in which it is located when in operation, and can be arranged to provide sufficient ventilation when not firing. For instance, the provisions would be adequate if: (a) the solid fuel open-flued appliance is a primary source of heating, cooking or hot water production; or (b) the open-flued appliance has a flue of free area at least equivalent to a 125 mm diameter duct and the appliance's combustion air inlet and dilution inlet are permanently open, i.e. there is a path with no control dampers which could block the flow, or the ventilation path can be left open when the appliance is not in use (see also paragraph 2.3).

Background ventilators (follow Steps 1 to 3 below)

Step 1: Determine the total equivalent ventilator area – See Table A below for a dwelling with any design air permeability. As an alternative, the guidance in Table B below may be followed for a dwelling with a designed air permeability leakier than (>) 5 $m^3/(h.m^2)$ at 50 Pa which recommends less ventilation provisions, but see the cautionary advice in paragraph 2.10.

Step 2: Make an allowance for the total air flow through all PSV units. As an approximation assume each PSV unit provides an equivalent area of 3000 mm^2.

Step 3: The actual equivalent ventilator area required for the dwelling is the value found in Steps 1 and 2.

In addition to this, the total equivalent area of the background ventilators must be at least equal to the total cross-sectional area of all the PSV ducts.

A – Total equivalent ventilator area [a] (mm^2) for a dwelling with any design air permeability.

Total floor area (m^2)	Number of bedrooms [b]				
	1	2	3	4	5
≤50	35000	40000	50000	60000	65000
51–60	35000	40000	50000	60000	65000
61–70	45000	45000	50000	60000	65000
71–80	50000	50000	50000	60000	65000
81–90	55000	60000	60000	60000	65000
91–100	65000	65000	65000	65000	65000
> 100	Add 7000 mm^2 for every additional 10 m^2 floor area				

Table 2b System 2 – Passive stack ventilation (PSV) (for additional information see Table 3 and worked examples C2 and C6 in Annex C)

B – Alternative guidance on total equivalent ventilator area [a] (mm^2) for a dwelling with a designed air permeability leakier than (>) 5 $m^3/(h.m^2)$ @ 50 Pa.

Total floor area (m^2)	Number of bedrooms [b]				
	1	2	3	4	5
≤50	25000	35000	45000	45000	55000
51–60	25000	30000	40000	45000	55000
61–70	30000	30000	30000	45000	55000
71–80	35000	35000	35000	45000	55000
81–90	40000	40000	40000	45000	55000
91–100	45000	45000	45000	45000	55000
> 100	Add 5000 mm^2 for every additional 10 m^2 floor area				

Notes:

a. The equivalent area of a background ventilator should be determined at 1 Pa pressure difference, using the appropriate test method given in Table 3.

b. This is based on two occupants in the main bedroom and a single occupant in all other bedrooms. For a greater level of occupancy, assume a greater number of bedrooms (i.e. assume an extra bedroom per additional person). For more than five bedrooms, add an additional 10000 mm^2 per bedroom.

Location of background ventilators

Background ventilators should be located in all rooms with external walls except the rooms where a PSV is located, but open-flued combustion appliances will still require an air supply as given in Guernsey Technical Standard J. There should be at least 5000 mm^2 equivalent area in each habitable room and 2500 mm^2 equivalent area in each wet room not containing a PSV.

If a habitable room has no external walls, follow the guidance in paragraphs 2.14 to 2.16.

Background ventilators should be located to avoid draughts, e.g. typically 1.7 m above floor level.

If the dwelling has more than one exposed façade, to maximise the air flow through the dwelling by encouraging cross ventilation, it is best to locate similar equivalent areas of background ventilators on opposite (or adjacent) sides of the dwelling.

Purge ventilation

For each habitable room with:

external walls, see Annex B for window or external door (including patio door) sizing;

no external walls, see paragraphs 2.14 to 2.16.

There may be practical difficulties in achieving this (e.g. if unable to open a window due to excessive noise from outside).

For each wet room with:

external walls, install an openable window (no minimum size);

no external walls – the PSV systems will be adequate, although it may take longer to purge the room.

As an alternative to the provisions given above for habitable and wet rooms, a mechanical fan extracting at 4 ach to outside could be used.

Devices used for purge ventilation should be manually controlled. The location of the devices is not critical for ventilation.

Air transfer

To ensure good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm^2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door. This should be achieved by making an undercut of 10 mm above the floor finish if the floor finish is fitted, or by a 20 mm undercut above the floorboards, or other surface, if the finish has not been fitted.

Controls

Should be set up to operate without occupant intervention. May have automatic controls (e.g. sensors for humidity, occupancy/usage, pollutant release). Humidity controls should not be used for sanitary accommodation as odour is the main pollutant.

In kitchens, any automatic control must provide sufficient flow during cooking with fossil fuel (e.g. gas) to avoid build-up of combustion products.

Ensure that the system always provides the minimum whole dwelling ventilation rate specified in Table 1b in the heating season.

Background ventilators

May be either manually adjustable or automatically controlled (see paragraphs 1.13 to 1.15).

Manual controls

Where manual controls are provided, they should be within reasonable reach of the occupants. It is recommended that they are located in accordance with the guidance for Requirement N3 Safe opening and closing of windows etc., which is given in Guernsey Technical Standard N. Where reasonable, pull cords, operating rods or similar devices should be provided. Although requirement N3 applies only to workplaces, for the purpose of this Guernsey Technical Standard it should also apply to dwellings.

Table 2c System 3 – Continuous mechanical extract (MEV) (for additional information see Table 3 and worked examples C3 and C7 in Annex C)

Design of continuous mechanical extract systems

System 3 has been sized for the winter period. Additional ventilation may be required during warmer months and it has been assumed that the provisions for purge ventilation (e.g. openable windows) could be used.

Step 1: Determine the whole dwelling ventilation rate from Table 1b.

(**Note:** no allowance is made for infiltration as the extract system lowers the pressure in the dwelling and all air flow through infiltration paths does not increase the overall ventilation rate.)

Step 2: Calculate the whole dwelling extract ventilation rate by summing the individual room rates for 'minimum high rate' from Table 1a.

(For sanitary accommodation only, as an alternative, the purge ventilation provisions given in Annex B can be used where security is not an issue. In this case the 'minimum high extract rate' for the sanitary accommodation should be omitted from the Step 2 calculation.)

Step 3: The required extract rates are as follows:

The maximum whole dwelling extract ventilation rate (i.e. the boost rate) should be at least the greater of Step 1 and Step 2. **Note** that the maximum individual room extract rates should be at least those given in Table 1a for minimum high rate.

The minimum whole dwelling extract ventilation rate should be at least the whole dwelling ventilation rate found in Step 1.

Note: This system could comprise either a central extract system or individual room fans (or a combination of both). To ensure that the system provides the intended ventilation rate, measures should be taken to minimise likely wind effects when any extract terminal is located on the prevailing windward façade. Possible solutions include ducting to another façade, use of constant volume flow rate units or, for central extract systems, follow more detailed guidance which has been prepared by the Energy Saving Trust (EST) and the Building Research Establishment (BRE) in conjunction with The Electric Heating and Ventilation Association (TEHVA) and the Residential Ventilation Association (RVA). This guidance, entitled Performance testing of products for residential ventilation should be read in conjunction with the appropriate parts of BS EN 13141 and is available at the SAP Appendix Q website www.sap-appendixq.org.uk/page.jsp?id=5

Note: if a single room heat recovery ventilator (SRHRV) is used to ventilate a habitable room, with ventilation of the rest of the dwelling provided by continuous mechanical extract, the air flow rates are determined as follows:

determine the whole dwelling ventilation rate from Table 1b;

calculate the room supply rate required for the SRHRV from: (Whole dwelling ventilation rate × Room volume)/(Total volume of all habitable rooms);

Undertake Steps 1 to 3 above for sizing the continuous mechanical extract for the rest of the dwelling. However, when performing Step 1, the supply rate specified for the SRHRV should be subtracted from the value given in Table 1b.

Background ventilators

For any design air permeability, controllable background ventilators having a minimum equivalent area of 2500 mm^2 should be fitted in each room, except wet rooms, from which air is extracted. As an alternative, where the designed air permeability is leakier than (>) 5 $m^3/(h.m^2)$ at 50 Pa background ventilators are not necessary, but see the cautionary advice in paragraph 2.10. Where this approach causes difficulties (e.g. on a noisy site) seek expert advice.

Where background ventilators are fitted:

they should be located to avoid draughts, e.g. typically 1.7 m above floor level;

fans and background ventilators fitted in the same room should be a minimum of 0.5 m apart;

background ventilators may be either manually adjustable or automatically controlled (see paragraphs 1.13 to 1.15).

Purge ventilation

For each habitable room with:

external walls, see Annex B for window or external door (including patio door) sizing;

no external walls, see paragraphs 2.14 to 2.16.

There may be practical difficulties in achieving this (e.g. if unable to open a window due to excessive noise from outside). In such situations, seek expert advice.

For each wet room with:

external walls, install an openable window (no minimum size);

no external walls, the normal extract provisions will suffice, although it will take longer to purge the room.

As an alternative to the provisions given above for habitable and wet rooms, a mechanical fan extracting at 4 ach to outside could be used.

Devices used for purge ventilation should be manually controlled. The location of the devices is not critical for purge ventilation.

Location of ventilation devices

Extract should be from each wet room.

Cooker hoods should be 650 mm to 750 mm above the hob surface (or follow manufacturer instructions).

Mechanical extract terminals and fans should be installed as high as is practicable and preferably less than 400 mm below the ceiling.

Where ducts etc. are provided in a dwelling with a protected stairway, precautions may be necessary to avoid the possibility of the system allowing smoke or fire to spread into the stairway. See Guernsey Technical Standard B.

Table 2c System 3 – Continuous mechanical extract (MEV) (for additional information see Table 3 and worked examples C3 and C7 in Annex C)

Air transfer

To ensure good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm^2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door. This should be achieved by making an undercut of 10 mm above the floor finish if the floor finish is fitted, or by a 20 mm undercut above the floorboards, or other surface, if the finish has not been fitted.

Controls

Should be set up to operate without occupant intervention, but may have manual or automatic controls to select the boost rate. Any manual boost controls should be provided locally to the spaces being served, e.g. bathrooms and kitchen, as provision of a single centrally located switch may result in fans being left in an inappropriate mode of operation. Automatic controls could include sensors for humidity, occupancy/usage and pollutant release. Humidity controls should not be used for sanitary accommodation as odour is the main pollutant.

In kitchens, any automatic control must provide sufficient flow during cooking with fossil fuel (e.g. gas) to avoid build-up of combustion products.

Ensure that the system always provides the minimum whole dwelling ventilation rate specified in Table 1b.

Where manual controls are provided, they should be within reasonable reach of the occupants. It is recommended that they are located in accordance with the guidance for Requirement N3 Safe opening and closing of windows etc., which is given in Guernsey Technical Standard N. Where reasonable, pull cords, operating rods or similar devices should be provided. Although Requirement N3 applies only to workplaces, for the purpose of this Guernsey Technical Standard it should also apply to dwellings.

Noise

Any continuously running fans should be quiet so as not to discourage their use by occupants. Guidance on noise is given in paragraphs 1.29 to 1.35.

Table 2d System 4 – Continuous mechanical supply and extract with heat recovery (MVHR) (for additional information see Table 3 and worked examples C4 and C8 in Annex C)

Design of MVHR systems

System 4 has been sized for the winter period. Additional ventilation may be required during warmer months and it has been assumed that the provisions for purge ventilation (e.g. openable windows) could be used.

Step 1: For any design air permeability, determine the whole dwelling ventilation supply rate from Table 1b.

As an alternative where the designed air permeability is intended to be leakier than (>) 5 $m^3/(h.m^2)$ at 50 Pa, allow for infiltration for all dwelling types by subtracting from the whole dwelling ventilation supply rate from Table 1b: 0.04 $l/(s.m^3)$ x gross internal volume of the dwelling heated space (m^3), but see the cautionary advice in 2.10.

Step 2: Calculate the whole dwelling extract ventilation rate by summing the individual room rates for 'minimum high rate' from Table 1a.

(For sanitary accommodation only, as an alternative, the purge ventilation provisions given in Annex B can be used where security is not an issue. In this case the 'minimum high extract rate' for sanitary accommodation should be omitted from the Step 2 calculation.)

Step 3: The required air flow rates are as follows:

The maximum whole dwelling extract ventilation rate (i.e. the boost rate) should be at least the greater of Step 1 and Step 2. Note that the maximum individual room extract rates should be at least those given in Table 1a for 'minimum high rate'.

The minimum whole dwelling supply ventilation rate should be at least the whole dwelling ventilation rate found in Step 1.

Purge ventilation

For each habitable room:

with external walls, see Annex B for window or external door (including patio door) sizing;

without external walls, see paragraphs 2.14 to 2.16.

There may be practical difficulties in achieving this (e.g. if unable to open a window due to excessive noise from outside). In such situations, seek expert advice.

For each wet room:

with external walls, install an openable window (no minimum size);

without external walls, the normal extract provisions will suffice, although it will take longer to purge the room.

As an alternative to the provisions given above for habitable and wet rooms, a mechanical fan extracting at 4 ach to outside could be used.

Devices used for purge ventilation should be manually controlled. The location of the purge devices is not critical for ventilation.

Table 2d System 4 – Continuous mechanical supply and extract with heat recovery (MVHR) (for additional information see Table 3 and worked examples C4 and C8 in Annex C)

Location of ventilation devices

Extract should be from each wet room. Air should normally be supplied to each habitable room. The total supply air flow should usually be distributed in proportion to the habitable room volumes. Recirculation by the system of moist air from the wet rooms to the habitable rooms should be avoided.

Cooker hoods should be 650 mm to 750 mm above the hob surface (or follow the manufacturer's instructions).

Mechanical extract terminals and fans should be installed as high as is practical and preferably less than 400 mm below the ceiling.

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

Where ducts etc. are provided in a dwelling with a protected stairway, precautions may be necessary to avoid the possibility of the system allowing smoke or fire to spread into the stairway. See Guernsey Technical Standard B.

Background ventilators are not required with System 4.

Air transfer

To ensure good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm^2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door. This should be achieved by making an undercut of 10 mm above the floor finish if the floor finish is fitted, or by a 20 mm undercut above the floorboards, or other surface, if the finish has not been fitted.

Controls

Should be set up to operate without occupant intervention, but may have manual or automatic controls to select the boost rate. Any manual boost controls should be provided locally to the spaces being served, e.g. bathrooms and kitchen, as provision of a single centrally located switch may result in fans being left in an inappropriate mode of operation. Automatic controls could include sensors for humidity, occupancy/usage and pollutant release. Humidity controls should not be used for sanitary accommodation as odour is the main pollutant.

In kitchens, any automatic control must provide sufficient flow during cooking with fossil fuel (e.g. gas) to avoid build-up of combustion products.

Ensure the system always provides the minimum whole dwelling ventilation rate specified in Table 1b.

Where manual controls are provided, they should be within reasonable reach of the occupants. It is recommended that they are located in accordance with the guidance for Requirement N3 Safe opening and closing of windows etc., which is given in Guernsey Technical Standard N. Where reasonable, pull cords, operating rods or similar devices should be provided. Although requirement N3 applies only to workplaces, for the purpose of this Guernsey Technical Standard it should also apply to dwellings.

Noise

All continuously running fans used should be quiet so as not to discourage their use by occupants. Guidance on noise is given in paragraphs 1.29 to 1.35.

Table 3 **Performance test methods**

The minimum performance requirements specified within Tables 2a to 2d should be measured using the test methods contained in relevant clauses of the following documents.

Intermittent extract fans

BS EN 13141-4 clause 4 Performance testing of aerodynamic characteristics. All sub-clauses are relevant.

Range hoods

BS EN 13141-3 clause 4 Performance testing of aerodynamic characteristics. All sub-clauses are relevant.

Background ventilators (non-RH controlled)

BS EN 13141-1 clause 4 Performance testing of aerodynamic characteristics. Only the following sub-clauses are relevant:
a. 4.1 Flow rate/pressure; and
b. 4.2 Non-reverse flow ability.

The performance requirements should normally be met for both air flow from outside to inside the dwelling and for inside to outside. To ensure that the installed performance of background ventilators is similar to the results achieved when they are tested to this Standard, background ventilators and associated components should be installed according to manufacturers' instructions. This also applies to non-RH controlled sound-attenuating background ventilators.

Passive stack ventilators

For the commissioning of passive stack systems follow the guidance in the Domestic ventilation compliance guide, available from: www.planningportal.gov.uk/

Continuous mechanical extract (MEV) systems

BS EN 13141-6 clause 4 Performance testing of aerodynamic characteristics. Also see Note 2 below.

Continuous supply and extract ventilation MVHR units

BS EN 13141-7 clause 6 Test methods. Also see Note 2 below.

Single room heat recovery ventilators

BS EN 13141-8 clause 6 Test methods. Only the following sub-clauses are relevant:

6.1 General; and

6.2 Performance testing of aerodynamic characteristics sub-clauses 6.2.1 Leakage and mixing and 6.2.2 Air flow.

For internal and external leakage and for mixing, the unit should meet at least Class U4 as given in clause 3.2 Classification.

Note 1. For all ventilation devices (e.g. extract fan, cooker hood), fitting ducting, intake/exhaust terminals, filters, etc. will impose an additional resistance to the air flow. Where appropriate this should be allowed for when specifying ventilation system components because, for example, a fan that meets the appropriate requirements when tested on its own may fail to meet the requirement when it is installed and fitted with ducting etc. In such cases, the performance of the separate components should be measured according to the relevant parts of BS EN 13141 and other relevant standards. The complete assembly, as installed, should be designed to meet the performance requirement by following good practice such as is given in the Domestic ventilation compliance guide, available from: www.planningportal.gov.uk/

Note 2. Detailed guidance on the tests to be undertaken has been prepared by the Energy Saving Trust (EST) and the Building Research Establishment (BRE) in conjunction with The Electric Heating and Ventilation Association (TEHVA) and the Residential Ventilation Association (RVA). This guidance, entitled Performance testing of products for residential ventilation, should be read in conjunction with the appropriate parts of BS EN 13141 and is available at the SAP Appendix Q website: www.sap-appendixq.org.uk/page.jsp?id=5

Ventilation systems for basements

2.11 For a dwelling which includes a basement that is connected to the rest of the dwelling above ground by a large permanent opening (e.g. an open stairway), the whole dwelling including the basement should be ventilated in accordance with paragraph 2.8 (for dwellings without basements) and treated as a multi-storey dwelling. If the basement has only a single exposed façade, while the rest of the dwelling above ground has more than one exposed façade, ventilation systems 3 and 4 are preferred, following the guidance in paragraph 2.8. If systems 1 or 2 are to be used, seek expert advice.

2.12 For a dwelling which includes a basement that is not connected to the rest of the dwelling above ground by a large permanent opening:

a. the part of the dwelling above ground should be considered separately and ventilated in accordance with paragraph 2.8. If the part of the dwelling above ground has no bedrooms, assume it has one bedroom for the purpose of determining ventilation provisions; and

b. the basement should be treated separately as a single-storey dwelling above ground level in accordance with paragraph 2.8. If the basement has no bedrooms, assume it has one bedroom for the purpose of determining ventilation provisions. The guidance on natural ventilation given in the Guernsey Technical Standard may not be appropriate for this situation and expert advice should be sought.

2.13 A dwelling which comprises only a basement should be treated as a single-storey dwelling above ground level in accordance with paragraph 2.8. The guidance on natural ventilation given in the Guernsey Technical Standard may not be appropriate for this situation and expert advice should be sought.

Ventilation of a habitable room through another room or a conservatory

2.14 In a habitable room not containing openable windows (i.e. an internal room) the requirement will be met if the room is ventilated either through another habitable room (see paragraph 2.15) or through a conservatory (see paragraph 2.16).

2.15 A habitable room not containing openable windows may be ventilated through another habitable room (see Diagram 2) if:

a. there is, from the habitable rooms to outside, provision for both:

   i. purge ventilation, one or more ventilation openings, with a total area given in Diagram 3 based on at least the combined floor area of the habitable rooms; and

   ii. background ventilation of at least 8000 mm^2 equivalent area; and

b. there is an area of permanent opening between the two rooms as given in Diagram 2 based on at least the combined floor area of the habitable rooms.

2.16 A habitable room not containing openable windows may be ventilated through a conservatory (see Diagram 3) if:

a. there is, from the conservatory to outside, provision for both:

   i. purge ventilation, one or more ventilation openings, with a total area given in Diagram 4 based on at least the combined floor area of the habitable room and conservatory; and

   ii. background ventilation, a ventilation opening (or openings) of at least 8000 mm^2 equivalent area; and

b. there are openings (which must be closable) between the habitable room and the conservatory for:

   i. purge ventilation equivalent to paragraph 2.15a(i) above; and

   ii. background ventilation equivalent to paragraph 2.15a(ii) above which should be located typically at least 1.7 m above floor level and need not be within the door frame.

Diagram 2 **Two habitable rooms treated as a single room for ventilation purposes**

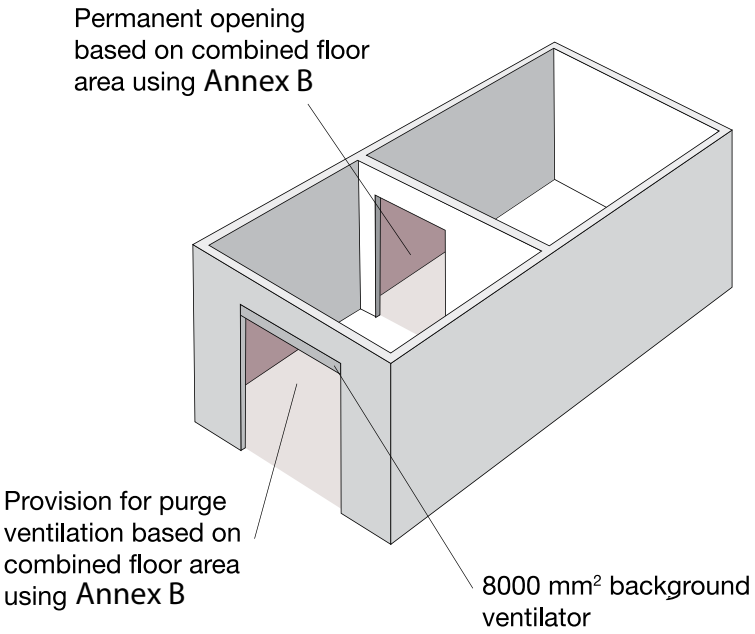
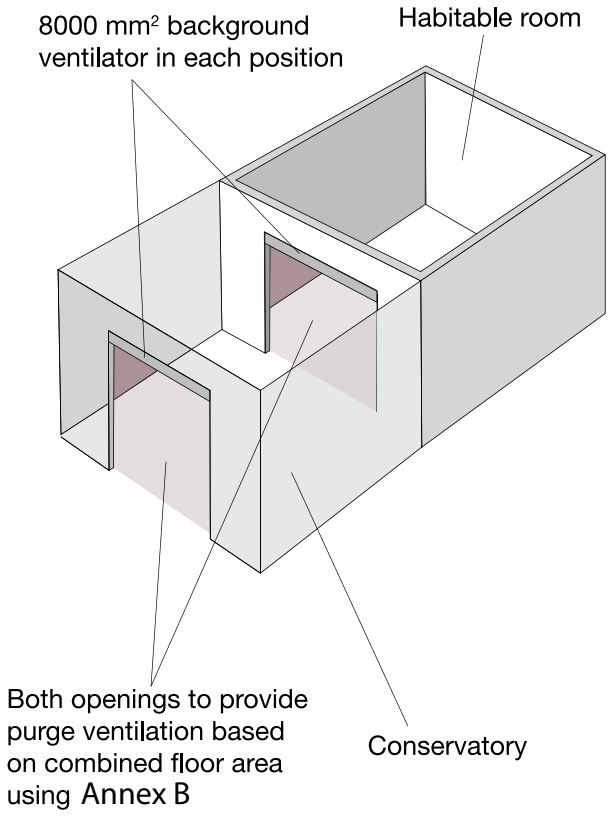


Diagram 3 **A habitable room ventilated through a conservatory**



Section 3 - New buildings other than dwellings

Introduction

3.1 This Guernsey Technical Standard sets out guidance for the following range of building types and uses:

a. offices – paragraphs 3.9 to 3.17;

b. car parks – paragraphs 3.19 to 3.22;

c. other building types – paragraph 3.18.

3.2 The ventilation provisions will not necessarily meet cooling needs. Guidance on limiting solar gains in summer to control overheating is considered in Guernsey Technical Standard L2 Conservation of fuel and power in buildings other than dwellings.

3.3 Provision should be made to protect the fresh air supplies from contaminants hazardous to health. Guidance on the siting of air inlets is provided in Annex D.

3.4 Guidance on design measures to avoid legionella contamination, including design features not related to the ventilation of the building, is given in the *HSE document Legionnaires' disease: the control of legionella bacteria in water systems (see paragraphs 79 to 144)*. Further guidance may be found in *CIBSE TM13 Minimising the risk of Legionnaires' disease and in BSRIA Application Guides AG19/2000, AG20/2000 and AG21/2000.*

3.5 Guidance on recirculated air in air-conditioning and mechanical ventilation systems is given in *UK's HSE document L24 Workplace health, safety and welfare, Approved Code of Practice and guidance (paragraph 32).*

Access for maintenance

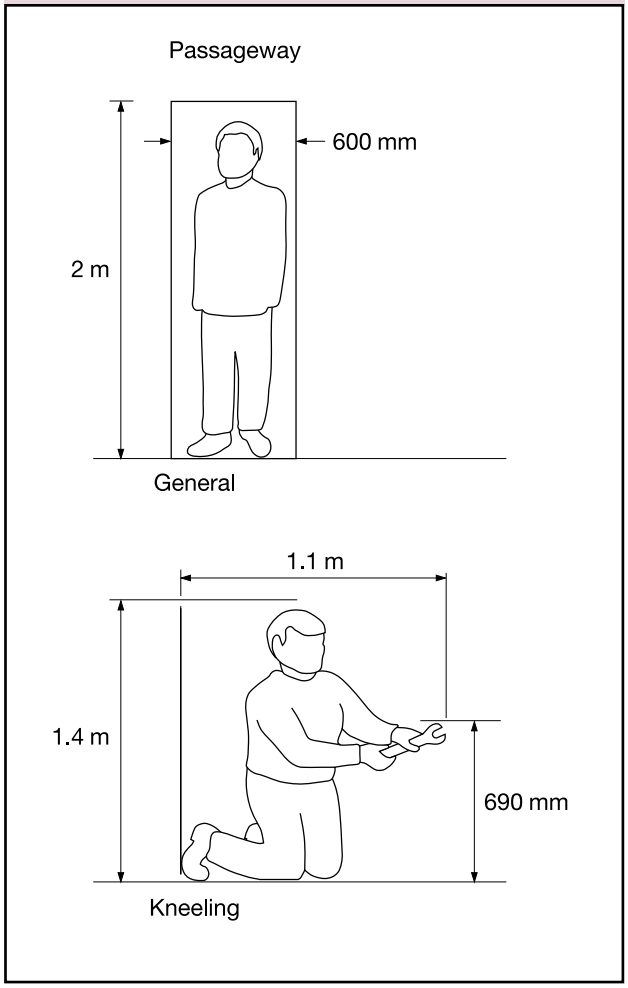
3.6 Reasonable provision would be to include:

a. access for the purpose of replacing filters, fans and coils; and

b. provision of access points for cleaning duct work.

3.7 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 600 mm space is provided where access is required between plant and 1100 mm where space for routine cleaning is required (see Diagram 4). These figures are the minimum necessary and additional space may be needed for opening of access doors, withdrawal of filters, etc. Further guidance for more complex situations can be found in *Defence Works Functional Standard, Design & Maintenance Guide 08: Space requirements for plant access operation and maintenance*. Further guidance for the cleaning of ducts is provided by *CIBSE Ventilation hygiene toolkit and HVCA TR/19 – Guide to good practice – Internal cleanliness of ventilation systems.*

Diagram 4 **Spaces for access**



Offices

Introduction to provisions

3.8 This Guernsey Technical Standard shows four ways of complying with the ventilation requirements of the Building Regulations:

a. providing a ventilation system which meets the air flow rates set out in paragraphs 3.9 to 3.13; or

b. following the system guidance set out in paragraphs 3.14 and 3.15; or

c. using the alternative approaches set out in paragraph 3.16; or

d. using other ventilation systems, provided it can be demonstrated to Building Control that they satisfy the Requirement, e.g. by showing that they meet the moisture and air quality criteria set out in Annex A.

Table 4a **Extract ventilation rates**

Room	Extract rate
Rooms containing printers and photocopiers in substantial use (greater than 30 minutes per hour)	Air extract rate of 20 l/s per machine during use. Note that, if the operators are in the room continuously, use the greater of the extract and whole building ventilation rates
Office sanitary accommodation and washrooms	Intermittent air extract rate of: 15 l/s per shower/bath 6 l/s per WC/urinal
Food and beverage preparation areas (not commercial kitchens)	Intermittent air extract rate of: 15 l/s with microwave and beverages only 30 l/s adjacent to the hob with cooker(s) 60 l/s elsewhere with cooker(s) All to operate while food and beverage preparation is in progress
Specialist buildings/spaces (e.g. commercial kitchens, sports centres)	See Table 6

Table 4b **Whole building ventilation rate for air supply to offices**

	Air supply rate
Total outdoor air supply rate for offices (no smoking and no significant pollutant sources)	10 l/s per person

Table 5a **Ventilation for offices with natural air supply – ventilation provisions**

Extract
Extract rates as per paragraph 4.10

Whole building ventilation
See CIBSE Application Manual AM 10: Natural ventilation in non-domestic buildings.

Purge ventilation
See CIBSE Application Manual AM 10: Natural ventilation in non-domestic buildings.

Notes:

1. PSV can be used as an alternative to a mechanical extract fan for office sanitary, washroom and food preparation areas.
2. When an open-flued appliance is provided in a building with mechanical extract, the spillage of flue gases could occur. The open-flued appliance needs to operate safely whether or not the fan is running, and further guidance is provided in BS 5440-1 which applies for up to 70 kW appliance input.

Table 5b **Ventilation for offices with natural air supply – location of ventilators in rooms**

Extract
Extract ventilators should be located as high as practicable and preferably less than 400 mm below the ceiling. This will tend to remove pollutants from the breathing zone of the occupants as well as increase the effectiveness of extracting buoyant pollutants and water vapour.
For PSV, extract terminals should be located in the ceiling of the room.
Whole building ventilation
See CIBSE Application Manual AM 10: Natural ventilation in non-domestic buildings.
Purge ventilation
See CIBSE Application Manual AM 10: Natural ventilation in non-domestic buildings.

Ventilation rates

3.9 The performance will be achieved by ventilation which provides the air flow rates set out in paragraphs 3.10 to 3.13. The air flow rates specified are for the installed performance.

3.10 Extract to outside is required in all office sanitary accommodation, washrooms and 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 flow rates should be no less than those specified in Table 4a.

3.11 The whole building ventilation rate for the supply of air to the offices should be no less than that specified in Table 4b.

3.12 Purge ventilation provision is required in each office. The total ventilation should be sufficient to reduce pollutants to an acceptable level before the space is occupied. The purged air should be taken directly to outside and should not be re-circulated to any other part of the building.

3.13 The outdoor air supply rates in Table 4b for offices are 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.*

Natural ventilation of rooms

3.14 The air flow rates specified in Tables 4a and 4b can be provided by a mainly natural ventilation system by following the guidance in Tables 5a, 5b and 5c. A wide range of natural ventilation systems for providing whole building ventilation is given in *CIBSE Application Manual AM 10: Natural ventilation in non-domestic buildings.*

Mechanical ventilation of rooms

3.15 The requirement will be satisfied by following:

a. the air flow rates set out in paragraphs 3.9 to 3.13; and

b. the location guidance in Table 5b for extract ventilation; and

c. the control guidance in Table 5c for extract ventilation.

Alternative approaches

3.16 As an alternative to paragraphs 3.9 to 3.13 the requirement will be satisfied by following the relevant recommendations of:

a. *CIBSE Application Manual AM 13: 2000: Mixed mode ventilation;*

b. *CIBSE Guide A and CIBSE Guide B*.

Ventilation of other types of building

3.17 The requirement will be satisfied by following the appropriate design guidance for the other buildings given in Table 6. In addition to the guidance documents listed, it should be noted that the Health and Safety at Work etc. (Guernsey) Law, 1979 and the Health, Safety and Welfare of Employees Law, 1950 applies to any workplace or part of a workplace. A short guide, *INDG244*, is available from the UK's HSE and at: www.hse.gov.uk/pubns/indg244.pdf.

Table 5c **Ventilation for offices with natural air supply – controls for ventilators in rooms**

Extract

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 overrun.

For PSV, either operated manually and/or automatically by a sensor or controller.

Whole building ventilation

See CIBSE Application Manual AM 10: Natural ventilation in non-domestic buildings.

Purge ventilation

See CIBSE Application Manual AM 10: Natural ventilation in non-domestic buildings.

Accessible controls

Readily accessible override controls should be provided for the occupants.

Table 6: **Ventilation of other buildings and spaces**

Building/space/activity	**Regulations and guidance (also see Section 8)**
Animal husbandry	BS 5502:2003 Buildings and Structures for Agriculture See also CIBSE Guide B:2005, Section 2.3.24.1, and CIBSE AM10:2005 if naturally ventilated
Assembly halls	CIBSE Guide B:2005, Section 2.3.3, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Atria	CIBSE Guide B:2005, Section 2.3.4, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Broadcasting studios	CIBSE Guide B:2005, Section 2.3.5
Building services plant rooms	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 202 General Ventilation in the Workplace – Guidance for Employers. Other guidance is in BS 4434:1989 Specification for safety aspects in the design, construction and installation of refrigeration appliances and systems
Call centres	CIBSE Guide B:2005, Section 2.3.24.2 and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Catering (inc. commercial kitchens)	UK 's HSE Catering Information Sheet No. 10, 2000: Ventilation of kitchens in catering establishments UK's HSE Information Sheet No. 11, 2000: The main health and safety law applicable to catering See also CIBSE Guide B:2005, Section 2.3.6, and HVCA DW /172 Specification for kitchen ventilation systems
Cleanrooms	CIBSE Guide B:2005, Section 2.3.7
Common spaces	The following provisions apply to common spaces where large numbers of people are expected to gather, such as shopping malls and foyers. They do not apply to common spaces used solely or principally for circulation. Either: a. natural ventilation by appropriately located ventilation opening(s) with a total opening area of at least 1/50th of the floor area of the common space; or b. mechanical ventilation installed to provide a supply of fresh air of 1 l/s per m^2 of floor area
Communal residential buildings	EST, Energy Efficiency Best Practice in Housing, Good Practice Guide GPG 192: Designing energy efficient multi-residential buildings See also CIBSE Guide B:2005, Section 2.3.8, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Computer rooms	CIBSE Guide B:2005, Section 2.3.9, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Darkrooms (photographic)	CIBSE Guide B:2005, Section 2.3.24.4
Dealing rooms	CIBSE Guide B:2005, Section 2.3.24.5 and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode

Table 6: **Ventilation of other buildings and spaces**

Building/space/activity	**Regulations and guidance (also see Section 8)**
Factories and warehouses	Health and Safety at Work etc. (Guernsey) Law, 1979 and the Health, Safety and Welfare of Employees Law, 1950 See also CIBSE Guide B:2005, Section 2.3.11, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode. Requirements are often exceeded by other criteria such as the ventilation requirements of the particular manufacturing process
High-rise (non-domestic buildings)	CIBSE Guide B:2005, Section 2.3.12, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Horticulture	CIBSE Guide B:2005, Section 2.3.24.6, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Hospitals and healthcare buildings	NHS Activity database Health Technical Memorandum (HTM) 03 Health Building Notes (HBN) – various CIBSE Guide B:2005, Section 2.3.13, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Hotels	CIBSE Guide B:2005, Section 2.3.14, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Industrial ventilation	Industrial ventilation, 24th Edition, Manual of recommended practice, American Conference of Government Industrial Hygienists HS(G) 37 An introduction to local exhaust ventilation HS(G) 54 Maintenance, examination and testing of local exhaust ventilation HS(G) 193 COSHH essentials
Laboratories	CIBSE Guide B:2005, Section 2.3.16
Museums, libraries and art galleries	BS 5454:2000 CIBSE Guide B:2005, Section 2.3.17, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Plant rooms	CIBSE Guide B:2005, Section 2.3.18
Prison cells	Refer to National Offender Management Service (NOMS). Home Office, NOMS Property, Technical Services, Room 401, Abell House, John Islip St., London SW1P 4LH
Sanitary accommodation	Same as for offices in Table 6.1a
Schools and educational buildings	Ventilation provisions in schools can be made in accordance with the guidance in Building Bulletin 101, Ventilation of School Buildings (see www.teachernet.gov.uk/iaq). 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 found 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 requiring containment or fume extraction. The Building Bulletin can also be used for children's centres and other early years settings, including day nurseries, playgroups, etc.
Shops and retail premises	CIBSE Guide B:2005, Section 2.3.20, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Sports centres (inc. swimming pools)	CIBSE Guide B:2005, Section 2.3.21
Standards rooms	CIBSE Guide B:2005, Section 2.3.24.7
Transportation buildings and facilities	CIBSE Guide B:2005, Section 2.3.23 and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode

Ventilation of car parks

3.18 The requirement will be satisfied for car parks below ground level, for enclosed-type car parks and for multi-storey car parks if the mean predicted pollutant levels are calculated, the ventilation rate is designed and equipment is installed to limit the carbon monoxide to:

a. an average concentration of not more than 30 parts per million over an eight hour period; and

b. peak concentrations, such as by ramps and exits, of not more than 90 parts per million for periods not exceeding 15 minutes.

3.19 **Note** that Guernsey Technical Standard B also includes provisions for the ventilation of car parks for the purpose of fire risk management.

Alternative approaches for ventilation of car parks

3.20 As an alternative to paragraph 3.18, the following guidance would satisfy the requirement:

a. 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.

b. Mechanically ventilated car parks

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

And:

ii. 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).

3.21 Further guidance can be found in Code of practice for ground floor, multi-storey and underground car parks published by the *Association for Petroleum and Explosives Administration (www.apea.org.uk); CIBSE Guide B:2005, Section 2.3.23.3; and the UK's Health and Safety Publication EH40: Occupational exposure limits for limiting concentration of exhaust pollutants.* Fire safety issues are considered in Guernsey Technical Standard B.

Section 4 - Work on existing buildings

Introduction

4.1 When building work is carried out on an existing building, the work should comply with the applicable requirements of Schedule 1 to the Building Regulations, and the rest of the building should not be made less satisfactory in relation to the requirements than before the work was carried out (see regulations 5 and 6 of the Building Regulations). Further, when a building undergoes a material change of use, as defined in regulation 7 of the Building Regulations (see page 8), Part F applies to the building or that part of the building which has been subject to the change of use, in accordance with regulation 8. Therefore, the guidance in other sections of this Guernsey Technical Standard may be applicable.

4.2 Windows. The Building Regulations requires that, when windows in an existing building are replaced, the replacement work should comply with the applicable requirements of Schedule 1, i.e. Parts L and N. In addition, the building work once completed should not have a worse level of compliance with other applicable requirements of Schedule 1 than before commencement of the work. Other applicable requirements of Schedule 1 may include Parts B and J.

4.3 Where the original windows were fitted with trickle ventilators the replacement windows should include them and they should be sized as set out in paragraph 4.6.

4.4 Where the original windows were not fitted with trickle ventilators and the room is not ventilated adequately by other installed provisions, it would be good practice to fit trickle ventilators (or an equivalent means of ventilation) to help with control of condensation and improve indoor air quality. Ventilation devices should be fitted with accessible controls.

See *A guide to trickle ventilators at www.ggf.org.uk*

4.5 When windows are replaced as part of the work connected with a material change of use, Sections 2 and 3 of this Guernsey Technical Standard apply.

4.6 In all cases where trickle ventilators (or an equivalent means of ventilation) are to be fitted, the new ventilation opening should not be smaller than was originally provided, and it should be controllable. Where there was no ventilation opening, or where the size of the original ventilation opening is not known, the following minimum sizes should be adopted.

Dwellings:

a. habitable rooms – 5000 mm^2 equivalent area

b. kitchen, utility room and bathroom (with or without WC) – 2500 mm^2 equivalent area.

Buildings other than dwellings:

a. occupiable rooms: for floor areas up to 10 m^2 – 2500 mm^2 equivalent area; greater than 10 m^2 – at the rate of 250 mm^2 equivalent area per m^2 of floor area

b. kitchens (domestic type) – 2500 mm^2 equivalent area

c. bathrooms and shower rooms – 2500 mm^2 equivalent area per bath or shower

d. sanitary accommodation (and/or washing facilities) – 2500 mm^2 equivalent area per WC.

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

4.7 The requirements will be met by following the guidance in paragraphs 4.8 to 4.10.

4.8 The general ventilation rate for the additional room and, if necessary, adjoining rooms could be achieved by one of the following options.

a. Background ventilators could be used as follows:

   i. if the additional room is connected to an existing habitable room which now has no windows opening to outside, the guidance in paragraph 2.15 should be followed; or

ii. if the additional room is connected to an existing habitable room which still has windows opening to outside but with a total background ventilator equivalent area less than 5000 mm^2, the guidance in paragraph 2.15 should be followed; or

iii. if the additional room is connected to an existing habitable room which still has windows opening to outside and with a total background ventilator equivalent area of at least 5000 mm^2, there should be background ventilators of at least 8000 mm^2 equivalent area between the two rooms and background ventilators of at least 8000 mm^2 equivalent area between the additional room and outside.

b. A single room heat recovery ventilator could be used to ventilate the additional habitable room. The supply rate to that room should be determined as follows. First, determine the whole building ventilation rate from Table 1b. Second, calculate the room supply rate required from:

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

4.9 For purge ventilation, follow the guidance given in Table 2a.

4.10 Guidance on location and controls is also given in Table 2a and guidance on performance testing standards is given in Table 3.

Addition of a wet room to an existing dwelling

4.11 The requirements for the additional wet room will be met by following the guidance in paragraphs 4.12 to 4.15.

4.12 Whole building and extract ventilation can be provided by:

a. intermittent extract, as given in Table 2a, and a background ventilator of at least 2500 mm^2 equivalent area; or

b. single room heat recovery ventilator, as given in Table 2a; or

c. passive stack ventilator, as given in Table 2b; or

d. continuous extract fan, as given in Table 2c.

4.13 To ensure good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm^2 in the internal door between the wet room and the existing dwelling. This is equivalent to an undercut of 10 mm for a standard 760 mm width door. This should be achieved by making an undercut of 10 mm above the floor finish if the floor finish is fitted, or by a 20 mm undercut above the floorboards, or other surface, if the finish has not been fitted.

4.14 For purge ventilation, follow the guidance for the appropriate system given in Tables 2a to 2c.

4.15 Guidance on location and controls is given in Tables 2a to 2c and guidance on performance standards is given in Table 3.

Addition of a conservatory to an existing building

4.16 The guidance applies to conservatories with a floor area over 30 m^2.

4.17 The requirements will be met by following the guidance in paragraphs 4.18 to 4.20.

4.18 The general ventilation rate for the conservatory and, if necessary, adjoining rooms could be achieved by the use of background ventilators. Follow the guidance in paragraph 2.16 whatever the ventilation provisions in the existing room adjacent to the conservatory.

4.19 For purge ventilation, follow the guidance given in Table 2a.

4.20 Guidance on location and controls is also given in Tables 2a and guidance on performance standards is given in Table 3.

Refurbishing a kitchen or bathroom in an existing dwelling

4.21 If any of the work being carried out in the kitchen or bathroom of an existing building is 'building work', as defined in regulation 5 of the Building Regulations, the Regulations require that you comply with the appropriate requirements of the Regulations, and in doing so you do not make compliance with other requirements of the Regulations, including ventilation, worse than before.

The definition of 'building work' in regulation 5 of the Building Regulations includes a range of building activities in existing buildings, and includes all work on controlled services.

If you carry out any 'building work', and there is an existing extract fan or passive stack ventilator (or cooker hood extracting to outside in the kitchen), you should retain or replace it. However, if there is no existing ventilation system you need not provide one. Replacing an extract fan or cooker hood with a similar type, and using the existing cabling, need not be notified to Building Control.

If a combustion appliance is installed, Guernsey Technical Standard J: Heat producing appliances and fuel storage systems should be consulted. It is available on the States of Guernsey web site www.gov.gg.

Annex A - Performance based ventilation

Introduction

As specified in the section 1, this Guernsey Technical Standard recommends ventilation provisions to control both moisture and pollutants in buildings. In order to do this, acceptable levels of moisture and other pollutants need to be defined. This Annex sets out the levels of moisture and other pollutants that the provisions in this Guernsey Technical Standard are designed to control.

Note that the guidance within this Guernsey Technical Standard may not be adequate to address pollutants from flueless combustion space heaters or from occasional, occupant-controlled events such as painting, smoking, cleaning or other high-polluting events. It does not address the airborne spread of infection or contamination from outdoor sources. While many of these considerations could be important factors in achieving acceptable indoor air quality, solutions are not ready for inclusion in this guidance, and indeed indoor air quality may be better controlled at source (e.g. avoidance, isolation or use of lower emitting products).

Performance criteria for dwellings

The performance criterion for moisture is as follows:

- There should be no visible mould on external walls in a properly heated dwelling with typical moisture generation.

The principal performance criteria used for other indoor air pollutants are as follows.

Exposure to the following levels of nitrogen dioxide (NO_2) should not be exceeded:

- 288 µg/m^3 (150 ppb) – 1 hour average (DOH, 2004)
- 40 µg/m^3 (20 ppb) – long-term average (DOH, 2004).

Exposure to the following levels of carbon monoxide should not be exceeded:

- 100 mg/m^3 (90 ppm) – 15 minute averaging time (DOH, 2004)
- 60 mg/m^3 (50 ppm) – 30 minute averaging time (DOH, 2004)
- 30 mg/m^3 (25 ppm) – 1 hour averaging time (DOH, 2004)
- 10 mg/m^3 (10 ppm) – 8 hours averaging time (DOH, 2004).

Exposure to total volatile organic compound (TVOC) levels should not exceed 300 µg/m^3 averaged over 8 hours (ECA, 1992).

Control of bio-effluents (body odours) for adapted individuals (reduction in perception due to being exposed to the environment for a period of time) will be achieved by an air supply rate of 3.5 l/s/person (ASHRAE, 2003).

Mould growth can occur whether the dwelling is occupied or unoccupied, so the performance criteria for moisture (as set out in Table 8) should be met at all times, regardless of occupancy. The other pollutants listed above are harmful to the occupants only when the dwelling is occupied.

Assumptions used in applying performance criteria for dwellings in Section 2

General

- For the default option in which the design air permeability can be any value, dwellings with ventilation System 1 or 2 are assumed to have an infiltration of 0.05 ach (air changes per hour); and dwellings with ventilation System 3 or 4 are assumed to have no infiltration.
- For the alternative option in which the design air permeability is >5 m^3/(h.m^2) at 50 Pa, dwellings with ventilation System 1, 2 or 4 are assumed to have an infiltration of 0.15 ach, and dwellings with ventilation System 3 are assumed to have negligible infiltration, as discussed in Table 2c.
- The ventilation effectiveness is 1.0.
- For the purpose of this Guernsey Technical Standard, for all dwellings (new, and existing where Part F applies), the moisture criterion is likely to be met if the moving average surface water activity of the internal surfaces of external walls is always less than the value

noted in Table 7 during the heating season, evaluated over each of the stated averaging periods. Table 7 is the primary basis for demonstrating compliance with the moisture criterion.

Table 7 **Surface water activity**

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

As a guide, for new dwellings, for the purpose of this Guernsey Technical Standard, the moisture criteria in Table 7 are likely to be met if the moving average relative humidity (RH) in a room is always less than the value given in Table 8 during the heating season, evaluated over each of the stated averaging periods.

Table 8 **Indoor air relative humidity**

Moving average period	Room air relative humidity
1 month	65%
1 week	75%
1 day	85%

The performance criterion for moisture (given above) is the same as that used in the 2006 edition of the UK's Approved Document F. However, research carried out since 2006 (Altamirano-Medina et al, 2009) has indicated that the values of relative humidity needed to satisfy the criterion could be expressed in a different and more practical way as shown in Table 8. These RH values may, in general, be slightly less onerous than those used in the 2006 edition. This may not be true in all cases and so the ventilation rates necessary to satisfy the criterion have not been changed.

Extract ventilation

- The principal pollutant to be removed by extract ventilation is moisture. The source rates were taken from *BS 5250:2002* Table B.1.
- For intermittent extract:
  - Historically, a ventilation rate of 60 l/s has been specified in the kitchen for the removal of moisture and there is no strong justification to amend it. The ventilation rate removes moisture generated at a production rate of 2000 g/h. A reduced ventilation rate of 30 l/s is used for a cooker hood, owing to the greater ventilation effectiveness.
  - Historically, a ventilation rate of 15 l/s has been specified in the bathroom for the removal of moisture and there is no strong justification to amend it. The ventilation rate removes moisture generated at a production rate of 400 g/h.
  - In the utility room, it is assumed that the ventilation rate required is 50% of that in the kitchen.
  - In WCs, the main pollutant is odour. Historically, a ventilation rate of 6 l/s has been specified and there is no strong justification to amend it.
- For continuous extract:
  - No reason has been found to change the extract rates, so the rates used in Table 5.1a are the same as used in the 2006 edition of the UK's Approved Document F.

Whole dwelling ventilation

- The principal pollutant to be removed by whole dwelling ventilation is moisture. The source rates were taken from *BS 5250:2002 Table B.1*.
- It was assumed that local extract removes 100% of the moisture generated in the bathroom and 50% of the moisture generated in the kitchen.
- The rates given in Table 1b are the same as in the 2006 edition.

- The calculations were based on winter weather conditions. During warmer spring and autumn periods, the moisture removal capacity of the outdoor air will be less (i.e. the outdoor air on being heated to the internal temperature within the dwelling will have a higher relative humidity in the spring and autumn periods) and additional ventilation may be required. The provisions for purge ventilation (e.g. windows) may be used for this purpose.
- There are other pollutants which must also be adequately controlled. These are particularly important in homes of low occupant density where moisture production is low for the size of the property. Levels of volatile organic compounds were monitored in a BRE study of UK homes (Dimitroulopoulou et al, 2005). From these data, the total source production rate of volatile organic compounds was determined to be 300 µg/h per m^2 of floor area. To meet the performance criterion of 300 µg/m^3, it requires a minimum whole dwelling ventilation rate of 0.3 l/s per m^2 of internal floor area.

Purge ventilation

- A value of 4 ach has been selected as:
  - it provides a purge ventilation rate an order of magnitude above whole building ventilation;
  - it is similar to the ventilation rate provided by windows in the 1995 edition of the UK's Approved Document F. The calculation assumes single-sided ventilation for a dwelling in an urban environment and an internal/external temperature difference of 3°C.

Basis of Table2 – Whole dwelling ventilation rates

- In determining the ventilation rates, the air supply rates in Table1b have been used.
- For dwellings having an air permeability of > 5 $m^3/(h.m^2)$ at 50 Pa, the air supply rate has been reduced by 0.15 ach to allow for infiltration.
- To determine the equivalent areas, the standard air flow equation has been used as below:

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

Where:

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

Q = the air supply rate (l/s)

C_d = the discharge coefficient, taken as 0.61

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

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

Note that the total actual equivalent area required (A_T) is double that derived from the equation above, which provides the equivalent area only for air supplied to the dwelling. A similar equivalent area is required for air to exit the dwelling. The total equivalent area determined in this way is given in the guidance for Systems 1 and 2. Note that in determining these pressure differences, a meteorological wind speed of 4 m/s at 10 m height was taken (based on BS 5925:1991) and an internal/external temperature difference of 15°C.

Performance criteria for buildings other than dwellings

The main guidance within this document has focused on offices. For this, the main criteria have been:

- A supply rate, in the absence of tobacco smoking or other excessive pollutants, of 10 l/s/person, based upon surveys which indicate that below this level the incidence of health effects becomes increasingly significant. This will also satisfy the requirement of 8 l/s/person needed to control bio-effluents for unadapted individuals.
- There should be no visible mould on external walls in a properly heated building with typical moisture generation.
- Exposure to the following levels of nitrogen dioxide (NO_2) should not be exceeded:
  - 288 µg/m^3 (150 ppb) – 1 hour average (Department of the Environment, 1996)
  - 40 µg/m^3 (21 ppb) – annual mean (WHO, 2005).

- Exposure to the following levels of carbon monoxide should not be exceeded:
  - 100 mg/m^3 (90 ppm) – 15 minute averaging time (WHO, 2000)
  - 60 mg/m^3 (50 ppm) – 30 minute averaging time (WHO, 2000)
  - 30 mg/m^3 (25 ppm) – 1 hour averaging time (WHO, 2000)
  - 10 mg/m^3 (10 ppm) – 8 hours averaging time (Department of the Environment, 1994a).
- Exposure to the following levels of carbon monoxide for occupational exposure should not be exceeded:
  - 35 mg/m^3 (30 ppm) – 8 hours averaging time (HSE, 2003).
- Exposure to total volatile organic compound (TVOC) levels should not exceed 300 µg/m^3 averaged over 8 hours (ECA, 1992).
- Ozone levels should not exceed 100 µg/m^3 (Department of the Environment, 1994b).

Note that the guidance within this Guernsey Technical Standard may not be adequate to address pollutants from occasional, occupant-controlled events such as painting, smoking, cleaning or other high-polluting events. While these could be important factors in achieving acceptable indoor air quality, solutions are not ready for inclusion in this guidance, and indeed they may be better controlled at source (e.g. avoidance, isolation or use of lower emitting products).

Mould growth can occur whether the building is occupied or unoccupied, so the performance criteria for moisture (as set-out in Table 7) should be met at all times, regardless of occupancy. The other pollutants listed above are harmful to the occupants only when the building is occupied.

Assumptions used in applying performance criteria for offices

General

- The office has an air permeability of 3 m^3/(h.m^2) at 50 Pa.
- At this level of air permeability, in large buildings (low ratio of surface area to volume contained), infiltration can be assumed to be negligible compared with the purpose-provided ventilation.
- The ventilation effectiveness is 0.9 (for Table 4b).
- For the purposes of this Guernsey Technical Standard, the moisture criterion will be met if the surface water activity in a room does not exceed the values given in Table 7 during the heating season.

Extract ventilation

- Office equipment can emit pollutants including ozone and organic compounds. For example, a study by Black and Wortham (1999) suggests the following emission rates for laser printers and dry paper copiers assuming 30 minutes use in an hour:
  - 25 mg/h for TVOCs
  - 3 mg/h for ozone.

To meet the performance criteria for these pollutants requires an extract rate of 20 l/s per machine during use.

- For sanitary accommodation, the extract rates used for dwellings have been applied.
- For food and beverage preparation areas, the extract rates used for dwellings have been applied.

Whole building ventilation

- A number of studies have investigated ventilation and health in offices (principally sick building syndrome). Although there is no clear threshold ventilation rate below which health suddenly worsens, a number of sources have identified 10 l/s/p as a significant level. This can probably be traced back to an analysis of experimental studies of office buildings by Mendell (1993). Hence the recommendation

within the Guernsey Technical Standard is for 10 l/s/p for buildings with no smoking and no significant pollutant sources.

- Increasing the ventilation rate above 10 l/s/p may improve health (results unclear), but there are diminishing returns (i.e. the improvement in health per l/s/p increase in ventilation rate becomes smaller as the ventilation rate increases). This suggests that there is little advantage in increasing the whole building ventilation rate above 10 l/s/p. Increased ventilation has a cost in economic and environmental terms. Having set a ventilation rate of 10 l/s/p, if further improvements in indoor air quality are necessary, alternative approaches should be considered first, e.g. use of low-emission materials.

Purge ventilation

- There are normally more options for the removal of high concentrations of pollutants from office spaces than for dwellings (e.g. leaving rooms unoccupied until acceptable pollutant levels are achieved). Hence, general guidance has been provided rather than specifying any ventilation rate(s).

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Annex B - Purge Ventilation

Introduction

Adequate purge ventilation may be achieved by the use of openable windows and/or external doors. This Annex provides details of necessary window and door sizes. The diagrams highlight the window dimensions of importance.

Windows

- For a hinged or pivot window that opens 30º or more or for parallel sliding windows (e.g. vertical sliding sash windows), the height x width of the opening part should be at least 1/20th of the floor area of the room.
- For a hinged or pivot window that opens between 15º and 30º, the height x width of the opening part should be at least 1/10th of the floor area of the room.
- If the window opens less than 15º it is not suitable for providing purge ventilation and other arrangements should be made.
- 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 angle of the largest window in the room.
- **Note** that Guernsey Technical Standard B includes provisions for the size of escape windows. The larger of the provisions in Guernsey Technical Standard B or F should apply in all cases.

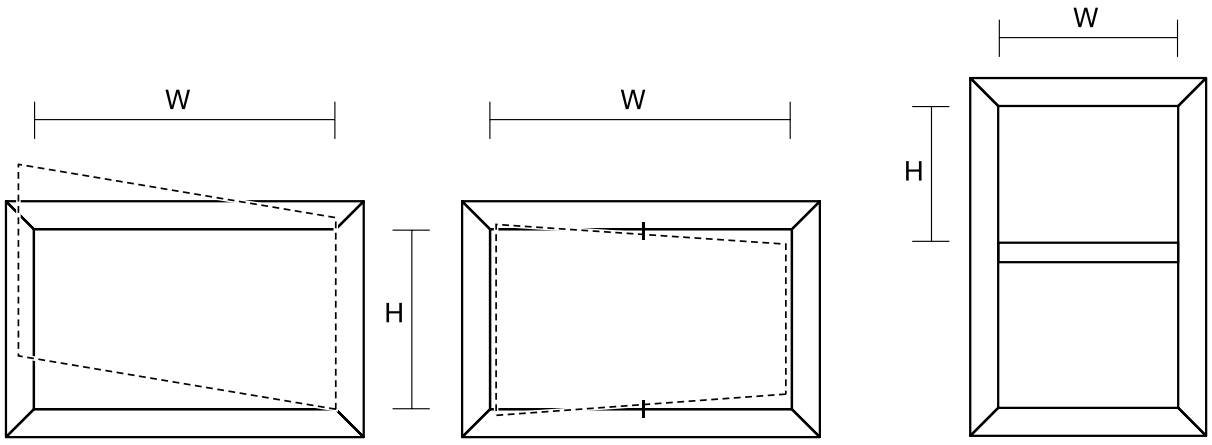
External doors (including patio doors)

- For an external door, the height x width of the opening part should be at least 1/20th 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 1/20th 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 1/20th 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 1/20th of the floor area of the room.

Window dimensions

Window opening area = H x W

(H and W are the dimensions of the open area)



(a) Side hinged (b) Centre pivot (about vertical axis) (c) Sash window

Further information

The aim of this guidance is to achieve a purge ventilation rate of 4 ach.

- It provides a purge ventilation rate of an order of magnitude above the whole building ventilation rate.
- It is similar to the purge ventilation rate provided by windows historically in ADF.

The guidance contained within this Annex is a simplification of guidance in BS5925:1991 (AMD 8930, 1995) Code of practice for ventilation principles and designing for natural ventilation. This Annex has assumed single-sided ventilation for dwellings in an urban environment (local wind speed of 2.1m/s) and a summer-time internal/ external temperature difference of 3°C. It has considered and simplified variations in air flow rates caused by factors including window type and window height.

This design guidance should deliver 4 ach in most cases. Depending on the dwelling design or the external climate, it may be possible to achieve this ventilation rate through a smaller window opening area. BS5925 provides a good starting point for determining the window openings required. It may be beneficial to also seek expert advice.

Annex C - Example calculations for ventilation sizing for dwellings

Introduction

This Annex provides example calculations for each ventilation system set out in paragraph 2.10. A ground-floor flat and a semi-detached house have been considered for each system type. Thus there are eight examples as follows.

Ground-floor flat:

Example C1 – Background ventilators and intermittent extract fans

Example C2 – Passive stack ventilation

Example C3 – Continuous mechanical extract

Example C4 – Continuous mechanical supply and extract

Semi-detached house:

Example C5 – Background ventilators and intermittent extract fans

Example C6 – Passive stack ventilation

Example C7 – Continuous mechanical extract

Example C8 – Continuous mechanical supply and extract

It has been assumed that the intended measured air permeability is > 5 $m^3/(h.m^2)$ in examples C1, C2, C5 and C6, and the design air permeability is ≤ 3 $m^3/(h.m^2)$ in the other examples.

Details of ground-floor flat

Description

The flat contains the following rooms:

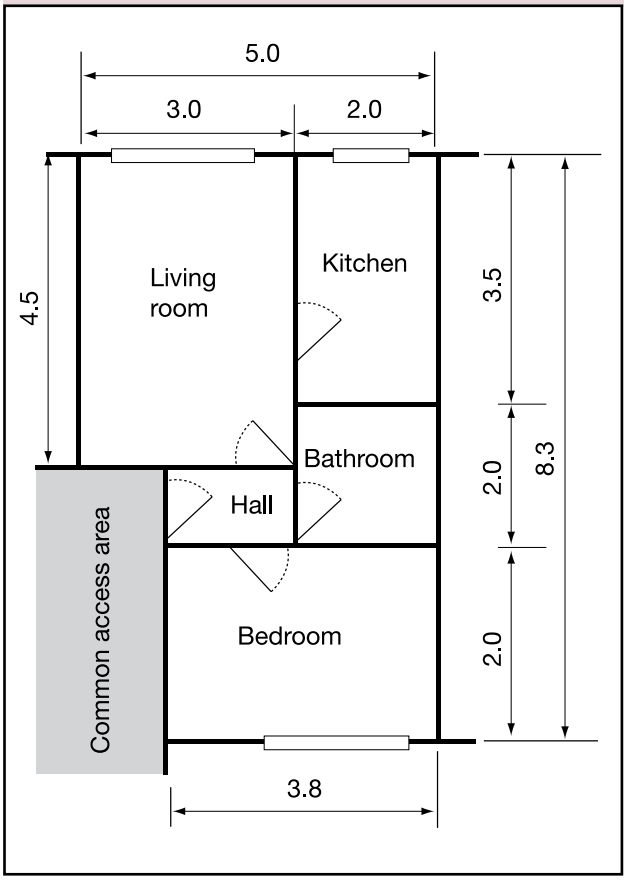
- kitchen
- combined living/dining room
- one double bedroom
- internal bathroom containing WC, and in addition
- all rooms have an external wall except for the bathroom.

The floor plan is given in Diagram 5.

Assumptions:

- cooker hood adjacent to cooker hob
- gross internal volume of the heated space of 83 m^3
- total floor area of 36 m^2
- two-person occupancy and
- side-hinged windows 1.0 m high and openable to 60°.

Diagram 9 **Ground floor flat plan example**



Example C1 Background ventilators and intermittent extract fans (this is based on Table2a)

Intermittent extract

Room	Intermittent extract rate
Kitchen	30 l/s (adjacent to hob)
Bathroom	15 l/s

Background ventilators

- For a single-storey ground-floor dwelling of 36 m^2 floor area, Table 2a shows that the equivalent background ventilator area is 35000 mm^2 (this includes the additional 10000 mm^2 as we are considering a single-storey building).
- To maximise the air flow through the dwelling by encouraging cross ventilation, it is best to locate similar equivalent areas of background ventilators on opposite sides of the dwelling.

Purge ventilation

- Calculate the percentage window opening area (percentage of floor area) for each room having an external wall.
- Using Annex B with an opening angle of 60° gives: 1/20th of the floor area.
- Therefore, for a living room of 13.5 m^2 floor area there should be a window opening area of at least 0.68 m^2. This calculation should be carried out for all habitable rooms.

Example C2 Passive stack ventilation (this is based on Table2b)

Choose appropriate passive stack ventilation provision

Room	Internal duct diameter (mm)	Internal cross-sectional area (mm^2)
Kitchen	125	12000
Bathroom	100	12000

Background ventilators
Calculate the total equivalent area of ventilators required for a dwelling as follows:

Step 1: for a single-storey ground-floor dwelling of 36 m^2 floor area, Table 2b shows that the equivalent background ventilator area is 35000 mm^2 (this includes the additional 10000 mm^2 as we are considering a single-storey building).

Step 2: for a PSV in both the kitchen and bathroom, an allowance of 6000 mm^2 can be made.

Step 3: 35000 – 6000 = 29000 mm^2.

- In addition, the equivalent area must be at least the total cross-sectional area of the ducts (24000 mm^2), which it is. It should be distributed with similar areas on opposite sides of the dwelling (but not in the kitchen and bathroom).

Purge ventilation

- Calculate the percentage window opening area (percentage of floor area) for each room having an external wall.
- Using Annex B with an opening angle of 60° gives: 1/20th of the floor area.
- Therefore, for a living room of 13.5 m^2 floor area there should be a window opening area of at least 0.68 m^2. This calculation should be carried out for all habitable rooms.

Example C3 **Continuous mechanical extract (this is based on Table2c)**

Continuous extract
Step 1: Whole dwelling ventilation rate is 13 l/s from Table1b.

Step 2: Whole dwelling extract ventilation rate is 21 l/s (from Table 1a assuming extract in kitchen and bathroom).

Step 3: Maximum whole dwelling extract rate (i.e. the boost rate) should be at least 21 l/s (with a minimum of 13 l/s in the kitchen and 8 l/s in the bathroom).

The minimum whole dwelling extract rate should be at least 13 l/s (spread between the kitchen and bathroom).

Background ventilators

As the design air permeability is ≤ 3 $m^3/(h.m^2)$ background ventilators of at least 2500 mm^2 equivalent area should be located in the living room and bedroom.

Purge ventilation

Calculate the percentage window opening area (percentage of floor area) for each room having an external wall.

Using Annex B with an opening angle of 60° gives: 1/20 of the floor area.

Therefore, for a living room of 13.5 m^2 floor area there should be a window opening area of at least 0.68 m^2. This calculation should be carried out for all habitable rooms.

Example C4 **Continuous mechanical supply and extract with heat recovery (this is based on Table 2d)**

Continuous supply and extract
Step 1: Whole dwelling supply ventilation rate is 13 l/s from Table 1b.

Step 2: Whole dwelling extract ventilation rate is 21 l/s (from Table 1a assuming extract in kitchen and bathroom).

Step 3: Maximum whole dwelling extract rate (i.e. the boost rate) should be at least 21 l/s (with 13 l/s extract in the kitchen and 8 l/s extract in the bathroom).

The minimum whole dwelling supply rate should be at least 13 l/s.

Purge ventilation
Calculate the percentage window opening area (percentage of floor area) for each room having an external wall.

Using Annex B with an opening angle of 60° gives: 1/20th of the floor area.

Therefore, for a living room of 13.5 m^2 floor area there should be a window opening area of at least 0.68 m^2. This calculation should be carried out for all habitable rooms.

Details of semi-detached house

Description

The semi-detached house contains the following rooms:

- entrance hall/stairway
- kitchen
- dining room
- living room
- three bedrooms
- bathroom containing WC, and in addition
- all rooms have an external wall.

The floor plans are given in Diagrams 6 and 7.

Assumptions

- cooker hood adjacent to cooker hob
- gross internal volume of the heated space of 210 m^3
- total floor area of 84 m^2
- four-person occupancy
- side-hinged windows 1.0 m high and openable to a fixed position of 20^0.

Diagram 6 **Semi-detached house ground-floor plan example**

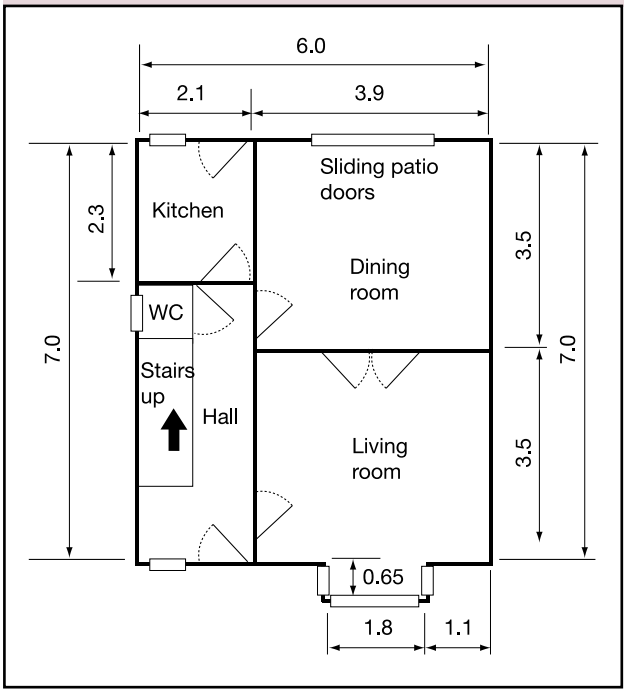
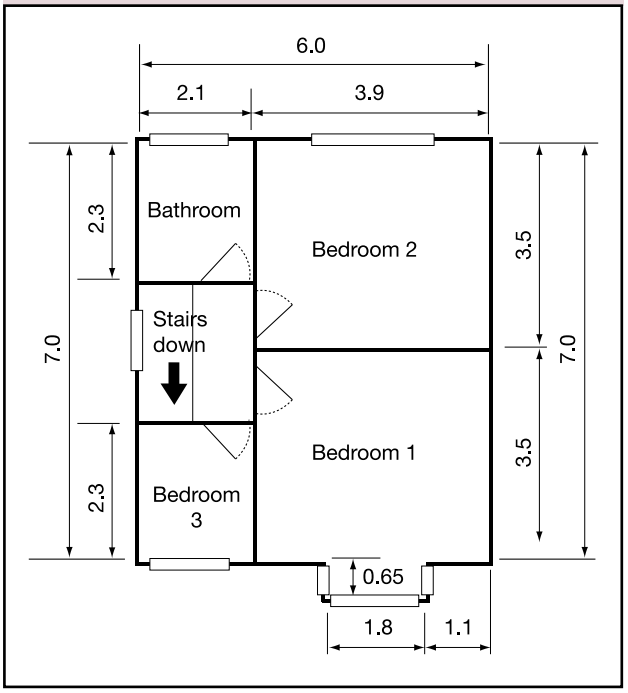


Diagram 7 **Semi-detached house first-floor plan example**



Example C5 Background ventilators and intermittent extract fans (this is based on Table 2a)

Intermittent extract

Room	Intermittent extract rate
Kitchen	30 l/s (adjacent to hob)
Bathroom	15 l/s

Background ventilators

- For a two-storey semi-detached house of 84 m^2 floor area, Table 2a shows that the equivalent background ventilator area is 40000 mm^2.
- To maximise the air flow through the dwelling by encouraging cross-ventilation, it is best to locate similar equivalent areas of background ventilators on opposite sides of the dwelling.

Purge ventilation

- Calculate the percentage window opening area (percentage of floor area) for each room having an external wall.
- Using Annex B with an opening angle of 20° gives: 1/10th of the floor area.
- Therefore, for a living room of 14.8 m^2 floor area there should be a window opening area of at least 1.48 m^2. This calculation should be carried out for all habitable rooms.

Example C6 Passive stack ventilation (this is based on Table 2b)

Choose appropriate passive stack ventilation provision

Room	Internal duct diameter (mm)	Internal cross-sectional area (mm^2)
Kitchen	125	12000
Bathroom	125	12000

Background ventilators
Calculate the total equivalent area of ventilators required for a dwelling as follows:

Step 1: for a two-storey semi-detached house of 84 m^2 floor area, Table 2a shows that the equivalent background ventilator area is 40000 mm^2.

Step 2: for a PSV in both the kitchen and bathroom, an allowance of 6000 mm^2 can be made.

Step 3: 40000 – 6000 = 34000 mm^2.

- In addition, the equivalent area must be at least the total cross-sectional area of the ducts (24000 mm^2), which it is. It should be distributed with similar areas on opposite sides of the dwelling (but not in the kitchen and bathroom).

Purge ventilation

- Calculate the percentage window opening area (percentage of floor area) for each room having an external wall.
- Using Annex B with an opening angle of 20° gives: 1/10th of the floor area.
- Therefore, for a living room of 14.8 m^2 floor area there should be a window opening area of at least 1.48 m^2. This calculation should be carried out for all habitable rooms.

Example C7 Continuous mechanical extract (this is based on Table 2c)

Continuous extract

Step 1: Whole dwelling ventilation rate from the list in Table 1b is 21 l/s.

- However, minimum whole dwelling ventilation rate = 0.3 x floor area = 0.3 x 84 = 25 l/s.
- Hence, whole dwelling ventilation rate is 25 l/s.

Step 2: Whole dwelling extract rate is 21 l/s (from Table 1a assuming extract in kitchen and bathroom).

Step 3: In this case the required whole dwelling ventilation rate is greater than the whole dwelling extract ventilation rate, and only a minimum whole dwelling extract ventilation rate of 25 l/s is required (with at least 13 l/s in the kitchen and 8 l/s in the bathroom).

Background ventilators

- As the design air permeability is ≤ 3 $m^3/(h.m^2)$ background ventilators of at least 2500 mm^2 equivalent area should be located in the living room, dining room and each bedroom.

Purge ventilation

- Calculate the percentage window opening area (percentage of floor area) for each room having an external wall.
- Using Annex B with an opening angle of 15° gives: 1/10th of the floor area.
- Therefore, for a living room of 14.8 m^2 floor area there should be a window opening area of at least 1.48 m^2. This calculation should be carried out for all habitable rooms.

Example C8 Continuous mechanical supply and extract with heat recovery (this is based on Table 2d)

Step 1: Calculate the whole dwelling supply ventilation rate:

- Whole dwelling ventilation supply rate for the dwelling from the list in Table 1b is 21 l/s.
- However, minimum air supply rate = 0.3 x floor area = 0.3 x 84 = 25 l/s.
- Hence, whole dwelling supply ventilation rate is 25 l/s.

Step 2: Calculate the whole dwelling extract ventilation rate:

- Whole dwelling extract ventilation rate is 21 l/s (from Table 1a assuming extract in kitchen and bathroom).

Step 3: Maximum whole dwelling extract ventilation rate (i.e. the boost rate) should be at least 25 l/s (with at least 13 l/s extract in the kitchen and 8 l/s extract in the bathroom).

- The minimum whole dwelling supply ventilation rate should be at least 25 l/s.

Purge ventilation

- Calculate the percentage window opening area (percentage of floor area) for each room having an external wall.
- Using Annex B with an opening angle of 20° gives: 1/10th of the floor area.
- Therefore, for a living room of 14.8 m^2 floor area there should be a window opening area of at least 1.48 m^2. This calculation should be carried out for all habitable rooms.

Annex D - Minimising ingress of external pollution into buildings in urban areas

Typical urban pollutants that need to be considered include those covered by the UK Air Quality Strategy (www.defra.gov.uk/environment/airquality/strategy/index.htm (2007)). These are:

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

Although nitrogen oxide, NO, is not included in the UK Air Quality Strategy, it is a normal constituent of combustion discharges and in many cases (for example, from gas-fired plant) the largest polluting emitter. Therefore, it also needs to be taken into account.

Typical pollution emission sources that need to be considered include:

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

In urban areas, buildings are exposed simultaneously to a large number of individual pollution sources from varying upwind distances (long range, intermediate range and short range) and heights and also over different timescales. The relationship between these and their proportionate contribution under different circumstances governs pollutant concentrations over the building shell and also internally.

Internal contamination of buildings from outdoor pollution sources therefore depends upon the pollutant sources, the physical characteristics of the building and its relation to its surroundings, the ventilation strategy employed and the location of the air intake. Whatever type of ventilation system is used, it is important to ensure that the intake air is not contaminated. This is especially important in air quality management areas where, by definition, pollution levels of at least one pollutant are already close to the air quality standards. Simplified guidance on ventilation intake placement for minimising ingress of pollutants may be summarised, as in Table 9.

Control of ventilation intakes

For pollutant sources such as urban road traffic, whose concentration fluctuates with the time of day, reducing the flow of external air or closing ventilation intakes during peak periods of high external pollutant concentrations, for example during rush hours, for up to an hour may be an option.

Air intakes located on a less polluted side of the building may then be used for fresh air, or air may be fully recirculated within the building. Alternatively, the building may be used as a ‘fresh air’ reservoir to supply air during these short periods. The use of atria as a source of ‘fresh air’ for this purpose may be an option.

However, care must be taken since, for example, reducing the inflow of external air will also reduce the outflow of internal air, resulting in a build-up of internally generated pollutants that need to be removed. Most modern buildings have low ceiling heights and therefore the concept of a substantial ‘fresh air’ reservoir available within the building may not apply. Further details of this principle with examples may be found in Liddament (2000).

Table 9 **Guidance on ventilation intake placement for minimising ingress of pollutants**

Pollutant source	Recommendation
Local static sources Parking areas Welding areas Loading bays Adjacent building exhausts 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
Urban traffic	Air intakes for buildings positioned directly adjacent to urban roads 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 measured by modelling. In such cases, it is recommended that expert advice is sought For buildings located one or two streets away, the placement of intakes is less critical
Building features/layout: Courtyards Street canyons (i.e. a canyon formed in a street between two rows of tall buildings)	Intakes should not be located in these spaces where there are air pollutant discharges. This includes emission discharges from building ventilation system exhausts If air intakes are to be located in these spaces, they should be positioned as far as possible from the source in an open or well-ventilated area. In addition, steps should be taken to reduce the polluted source, e.g. parking and loading should be avoided as pollutants can accumulate in enclosed regions such as courtyards
Multiple sources	Where there are a large number of local sources, the combined effect of these around the façade of the building should be measured. The façade experiencing the lowest concentration of the pollutants would be an obvious choice for locating ventilation intakes but this will require expert assistance such as numerical and wind tunnel modelling. In general, however, it is recommended that air intakes be positioned as far away as possible from the source and at a location where air is free to move around the intake
Weather factors	In areas where predominant wind comes from opposing directions (e.g. a valley location) the air intakes and outlets should point in opposite directions In complex urban layouts, complex wind flows are likely to occur. In these cases, expert advice should be sought

Location of exhaust outlets

The location of exhausts is as important as the location of air intakes. These should be located such that re-entry to a building, or ingestion into other nearby buildings, is minimised (for both natural and mechanical intakes) and such that there is no adverse effect on the surrounding area. Guidance on outlet placement may be summarised as follows:

- Exhausts should be located downstream of intakes where there is a prevailing wind direction
- Exhausts should not discharge into courtyards, enclosures or architectural screens as pollutants tend to build up in such spaces and do not disperse very readily
- It is recommended that stacks should discharge vertically upwards and at high level to clear surrounding buildings and so that downwash does not occur
- Where possible, pollutants from stacks should be grouped together and discharged vertically upwards. The increased volume will provide greater momentum and increased plume height. This is common practice where there are a number of fume cupboard discharges; greater plume height dispersion can be achieved by adding the general ventilation exhaust.

References

CIBSE (1999). CIBSE Technical Memorandum TM21, Minimising pollution at air intakes.
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Liddament MW (2000) Chapter 13: 'Ventilation strategies', Indoor Air Quality Handbook. McGraw-Hill

The following are key terms used in this document:

Air permeability is the physical property used to measure the airtightness of the building fabric. It is defined as air leakage rate per hour per square metre of envelope area at a test reference pressure differential across the building envelope of 50 Pascal (50 N/m^2). The design air permeability is the target value set at the design stage.

Airtightness is a general descriptive term for the resistance of the building envelope to infiltration with ventilators closed. The greater the airtightness at a given pressure difference across the envelope, the lower the infiltration.

Automatic control is where a ventilation device is opened and closed or switched on and off or its performance is adjusted by a mechanical or electronic controller which responds to a relevant stimulus. That stimulus is usually related to the humidity of the air in a room, pollutant levels (e.g. carbon dioxide concentration in a room), occupancy of the space (e.g. using a passive infra-red motion detector) or pressure difference across the device (e.g. due to the wind outside).

Background ventilator is a small ventilation opening designed to provide controllable whole building ventilation. See Diagram 8.

Basement (in relation to dwellings) is a dwelling, or a usable part of a dwelling (i.e. a habitable room), that is situated partly or entirely below ground level. Note that a cellar is distinct from a basement in that it is used only for storage, heating plant or purposes other than habitation.

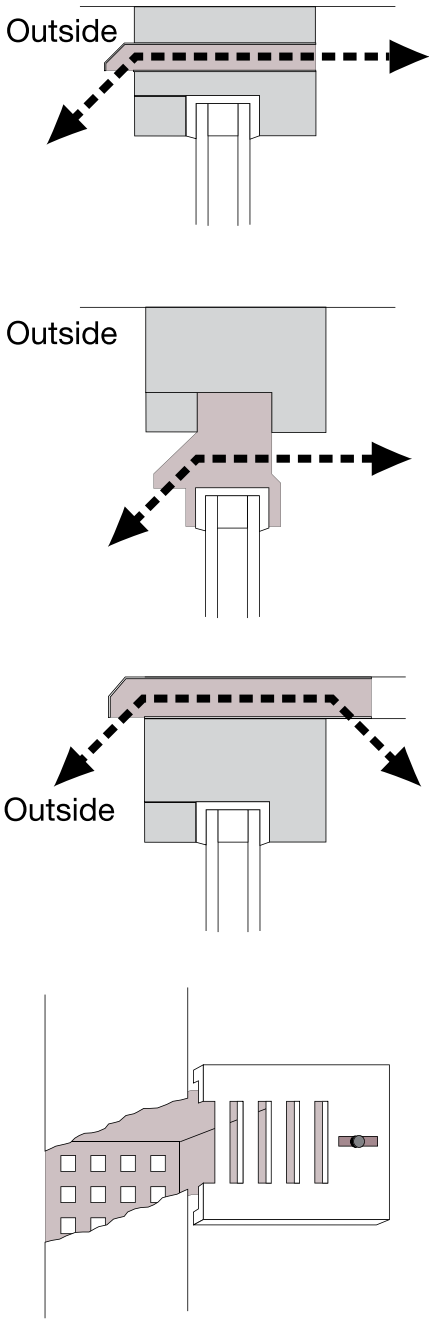
Bathroom is a room containing a bath or shower and, in addition, can also include sanitary accommodation.

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

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

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

Diagram 8 **Provisions for background ventilation**



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

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

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

Free area is the geometric open area of a ventilator.

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

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

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

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

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

Occupiable room is a room in a building other than a dwelling that is occupied by people, such as an office, workroom, classroom or hotel bedroom, but not 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) is a ventilation system using ducts from terminals in the ceiling of rooms to terminals on the roof that extract air to outside by a combination of the natural stack effect and the pressure effects of wind passing over the roof of the building.

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

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

Purpose-provided ventilation is that part of the ventilation of a building provided by ventilation devices designed into the building (e.g. via background ventilators, PSV, extract fans, mechanical ventilation or air-conditioning systems).

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

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

Surface water activity is a measure of the availability of water to micro-organisms, and is determined from the ratio of the vapour pressure of the water in the substrate to that of pure water at the same temperature and pressure. This ratio is, in steady-state conditions, numerically equal to the equilibrium relative humidity of the air, except that the latter is commonly expressed as a percentage (from IEA Annex 14 source book, 1991).

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

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

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

Wet room is a room used for domestic activities (such as cooking, clothes washing and bathing) which give rise to significant production of airborne moisture, e.g. a kitchen, utility room or bathroom. For the purposes of Part F, sanitary accommodation is also regarded as a wet room.

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

Annex F - Standards and other documents referred to

Standards

BS EN 378-3:2008 Refrigerating systems and heat pumps. Safety and environmental requirements. Installation site and personal protection.

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

BS 5502:2003 Buildings and structures for agriculture. Various relevant parts including: Part 33:1991 Guide to the control of odour pollution, AMD 10014 1998. Part 52:1991 Code of practice for design of alarm systems, emergency ventilation and smoke ventilation for livestock housing, AMD 10014 1998.

BS 5454:2000 Recommendations for the storage and exhibition of archival documents.

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

BS 7913:1998 Principles of the conservation of historic buildings.

BS EN 13141-1:2004 Ventilation for buildings. Performance testing of components/products for residential ventilation. Externally and internally mounted air transfer devices.

BS EN 13141-3:2004 Ventilation for buildings. Performance testing of components/products for residential ventilation. Range hoods for residential use.

BS EN 13141-4:2004 Ventilation for buildings. Performance testing of components/products for residential ventilation. Fans used in residential ventilation systems.

BS EN 13141-6:2004 Ventilation for buildings. Performance testing of components/products for residential ventilation. Exhaust ventilation system packages used in a single dwelling.

BS EN 13141-7:2004 Ventilation for buildings. Performance testing of components/products for residential ventilation. Performance testing of a mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for single family dwellings.

BS EN 13141-8:2006 Ventilation for buildings. Performance testing of components/products for residential ventilation. Performance testing of unducted mechanical supply and exhaust ventilation units [including heat recovery] for mechanical ventilation systems intended for a single room.

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

Other publications

American Conference of Government Industrial Hygienists (ACGIH) Industrial ventilation 26th Edition, Manual of recommended practice. Available from: www.acgih.org/store

BRE

BRE Digest 464, Part 1: VOC emissions from building products. Sources, testing and emission data, 2002. ISBN 978 1 86081 546 1.

BRE Digest 464, Part 2: VOC emissions from building products. Control, evaluation and labelling schemes, 2002. ISBN 978 1 86081 547 8.

BSRIA

Ventilation hygiene toolkit:
BSRIA Facilities Management Specification 1 Guidance to the standard specification for ventilation hygiene, 2002. ISBN 978 0 86022 454 9.

Chartered Institution of Building Services Engineers (CIBSE)

Applications Manual AM10: Natural ventilation in non-domestic buildings, 2005.
ISBN 978 1 80328 756 0.

Applications Manual AM13: Mixed mode ventilation, 2000. ISBN 978 1 90328 701 4.

CIBSE Guide A: Environmental design, 2006. ISBN 978 1 90328 766 8.

CIBSE Guide B: Heating, ventilating, air conditioning and refrigeration, 2005.
ISBN 978 1 90328 758 3.

TM13: Minimising the risk of Legionnaires' disease, 2002. ISBN 978 1 90328 723 1.

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CIBSE TM26 Hygienic maintenance of office ventilation ductwork, 2000.
ISBN 978 1 90328 711 8.

Defence Estates

Defence Works Functional Standard, Design and Maintenance Guide 08: Space requirements for plant access operation and maintenance, 1996. ISBN 978 1 11772 785 4. Available from: www.defence-estates.mod.uk/publications/dmg/dmg_08.pdf

UK's Department for Children, Schools and Families (DCSF);

Building Bulletin 101, Ventilation of school buildings, 2006. ISBN 978 0 11271 164 3. See: www.teachernet.gov.uk/iaq

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HTM 03; Part A – Ventilation in healthcare premises: Design and validation, 2007.

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Good Practice Guide 192. Designing energy efficient multi-residential buildings, 1997. Available from: www.est.org.uk/bestpractice/index.cfm (archived).

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HSE Catering Information Sheet No 10, Ventilation of kitchens in catering establishments, 2007. Available from: www.hsebooks.com.

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HVCA

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HVCA DW/143 A practical guide to ductwork leakage testing, 2000. ISBN: 978 0 90378 330 9.

HVCA DW/172 Specification for kitchen ventilation systems, 2005
ISBN 978 0 90378 329 3.

HVCA TR/19 Guide to good practice. Internal cleanliness of ventilation systems, 2005.
ISBN 978 0 90378 335 4.Legislation

GUERNSEY TECHNICAL STANDARDS

The following documents have been approved and issued by the Development and Planning Authority for the purpose of providing practical guidance with respect to the requirements of the Building Regulations

Guernsey Technical Standard A: Structure, 2012 edition with May 2016 amendments.

Guernsey Technical Standard B: Fire Safety - Volume 1 - Dwellinghouses, 2012 edition with May 2016 amendments.

Guernsey Technical Standard B: Fire Safety - Volume 2 - Buildings other than dwellinghouses, 2012 edition with May 2016 amendments.

Guernsey Technical Standard C: Site preparation and resistance to contaminants and moisture 2012 edition with May 2016 amendments.

Guernsey Technical Standard D: Toxic substances 2012 edition with May 2016 amendments.

Guernsey Technical Standard E: Resistance to the passage of sound, 2012 edition with May 2016 amendments.

Guernsey Technical Standard F: Ventilation, 2012 edition with May 2016 amendments.

Guernsey Technical Standard G: Health, hygiene and water efficiency, 2012 edition with May 2016 amendments.

Guernsey Technical Standard H: Drainage and waste disposal, 2012 edition with May 2016 amendments.

Guernsey Technical Standard J: Heat producing appliances and fuel storage systems, 2012 edition with May 2016 amendments.

Guernsey Technical Standard K: Safe means of access and egress, 2012 edition with May 2016 amendments.

Guernsey Technical Standard L1: Conservation of fuel and power – Dwellings, 2012 edition with May 2016 amendments.

Guernsey Technical Standard L2: Conservation of fuel and power – Buildings other than dwellings, 2012 edition with May 2016 amendments.

Guernsey Technical Standard M: Access to and use of buildings, 2012 edition with May 2016 amendments.

Guernsey Technical Standard N: Glazing - Materials and protection, 2012 edition with May 2016 amendments.

Guernsey Technical Standard P: Roads - Layout design and construction, 2012 edition with May 2016 amendments.

Guernsey Technical Standard Regulation 11: Materials and Workmanship, 2012 edition with May 2016 amendments.

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