Technical Note No. 32

VENTILATION

Introduction

It has been estimated that up to 90 per cent of our time is spent indoors. With the introduction of more airtight building construction, and modern lifestyles generating increased amounts of moisture and air pollution within both domestic and commercial buildings, ventilation has become more of a concern. Heating, smoking, cooking and sleeping are all sources of atmospheric pollutants and water vapour. It has been proven that adequate ventilation is essential for the well being and health of building occupants and to the fabric of the building itself. Correct ventilation of domestic and commercial buildings is therefore essential.

In domestic properties the building façade, especially the window element, provides the designer with the means of supplying ventilation to the building and its occupants. Commercial buildings generally benefit from an integrated approach that commonly incorporates some form of air handling plant together with air conditioning.

The level of ventilation required to each building type is covered within The Building Regulations 'Approved Document F' for England and Wales. Readers in Scotland should refer to the Building Standards (Scotland) Regulations for guidance on ventilation requirements, and readers in Northern Ireland should refer to 'Northern Ireland Building Regulations'.

It should be noted that buildings which house specialist activities such as schools, workspaces, hospitals plant rooms and smoking rooms will require specialist design to the standards listed within Section 2 of 'Approved Document F'.

Types of ventilation

The ventilation types identified in the Approved Documents are:

- Rapid ventilation (e.g. opening windows).
- Background ventilation.
- Extract ventilation
- Permanent ventilation

Definitions:

Rapid ventilation

Rapid ventilation is defined as "one or more ventilation openings with some part at high level (typically 1.75m above floor level) such as an opening window."

Background ventilation

Background ventilation is defined as a ventilation opening (or openings) e.g. trickle ventilators or airbricks, fitted with a 'hit-and-miss' type grille, and where appropriate a suitably designed opening window (acceptable for domestic applications). The ventilation openings should be reasonably secure, adjustable and located typically 1.75m above floor level so as to avoid discomfort to the occupants from cold draughts.

Extract ventilation

Mechanical extract ventilation operated manually and/or by sensor or controller. For the purposes of this technical note refer to the Building regulations 'Approved document F' for guidance on the design requirements for mechanical extract rates.

It should be noted that extract ventilation is a requirement of Approved document F for kitchens bathrooms and utility rooms even if natural ventilation is provided.

Passive Stack Ventilation systems are acceptable forms of extract ventilation provided that such a system is suitably designed and certified by an approved or recognised body.

Permanent ventilation

Permanent ventilation is that which is required to supply combustion air to all rooms containing a non-room sealed fuel-burning appliance.

Methods

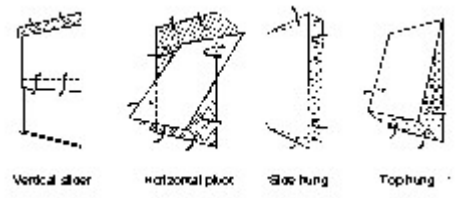
Rapid ventilation

The most obvious means of providing rapid controllable natural ventilation is via an openable window however there may be a conflict with security requirements especially on ground and lower floors.

Rapid ventilation requirements are set out within the 'Approved Document F', and usually require 1/20th of the floor area of the room to be an openable window, part of the ventilation opening must be at high level (typically 1.75m above the floor level). The 'Approved Document' also sets out which rooms require a rapid ventilation provision. Due regard must be paid to BS 8213 Part1: *Code of practice for safety in use and during cleaning of windows and doors,* when designing opening windows.

Attention is drawn to the need to avoid solar overheating as detailed in Approved document L 2000 with regard to the provision of opening windows in conservatories and other glazed constructions.

The effectiveness of the ventilation supplied by a window is directly linked to its style and proportions; deeper (taller) windows ventilate more effectively but can cause a nuisance due to draughts. Different types of window produce varying airflows into and out of the building.



Background ventilation

Background ventilation can be provided by means of:

- Trickle ventilators within windows
- Airbricks with hit-and-miss grilles
- Windows with suitably designed hardware

Approved document F details the individual requirements for background ventilation for rooms and these are tabulated below for rooms containing windows, i.e. those located on an external wall:

Domestic buildings

Habitable rooms	8000mm^2
Kitchen	4000mm^2
Utility room	4000mm^2
Bathroom	4000mm^2
Sanitary accommodation (separate from bathroom)	4000mm^2

An acceptable alternative is to provide an average of 6000mm^2 per room with a minimum of 4000mm^2 in each room.

Non-domestic buildings

Occupiable room up to 10m^2	4000mm^2
Occupiable room over10m^2	400mm^2 per m^2
Kitchen (domestic type)	4000mm^2
Bathroom, shower room	4000mm^2 per bath/shower
Sanitary accommodation	4000mm^2 per WC

Rooms that are not situated on external walls or rooms that gain ventilation via another habitable room have a different requirement for ventilation; these are explained in 'Approved document F'

Trickle ventilators within windows

There are three principle methods of providing ventilators within windows:

- Through the frame or sash
- Through a purpose-designed extension to the window head
- Glazed into the frame above the glass

Other factors may need careful consideration when deciding which trickle vents to use, such as:

- Acoustic performance (sound attenuation)
- Operation
- Humidity

- Aesthetic

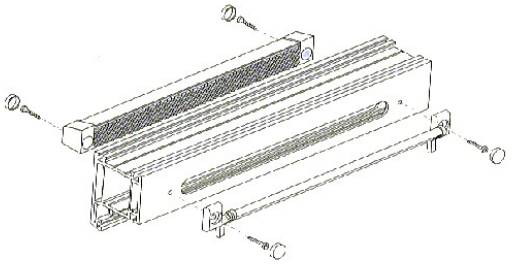
Trickle ventilators may need to be provided in locations that are subject to high levels of noise pollution e.g. adjacent to busy roads or rail tracks. Ventilators can be supplied which attenuate the noise however these tend to be larger than standard ventilators due to the requirement for a sound-absorbing acoustic material. This type of ventilator is able to provide up to 48dB sound reduction, but may provide less.

Most trickle vent manufacturers produce ventilators that can be operated by remote means, i.e. cords or rigid rods. These are especially useful in locations where physically reaching the vent is difficult, such as over sinks, or for use when people have medical conditions that prevent them using the conventional operating methods.

Trickle ventilators are available that monitor the humidity within the air. They open and close accordingly the relative humidity within each room. Requiring no electrical supply, this type of ventilator is perceived to be more energy efficient and is particularly useful in kitchen and bathroom applications where humidity can fluctuate widely.

It should be borne in mind when specifying ventilators that BS 6375: Part 1 1989 *Classification of weathertightness* states that there is no requirement to record the flow of air through a controlled ventilator when closed, however some manufacturers have carried out weather testing. It is therefore incumbent upon the designer to ensure that the specified product performs satisfactorily.

Through the frame or sash



Through the frame ventilators are manufactured in both aluminium and plastic and are usually comprised of two major parts, an external grille or hood and an internal section that houses the controllable element of the vent, usually a sleeve section is also available. Most internal sections are designed to deflect the airflow upwards to avoid discomfort to the building occupants and to discourage them from blocking the vents.

This type of ventilator is applied over a routered slot within the window framing element and clips or screws into place; many are now fitted with seals to help reduce air infiltration when they are closed.

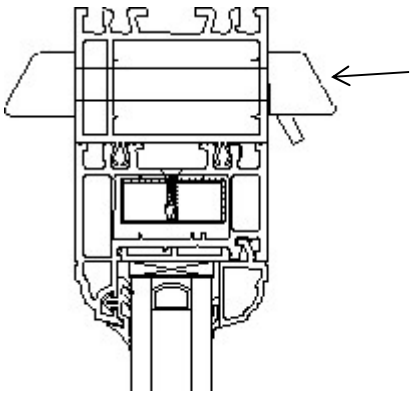
In all cases the system must contain an integral insect screen.

If used in PVC-U windows, trickle ventilators that pass through the frame or sash member may need to be sleeved if the frame is reinforced in order to prevent condensation forming on the steel/aluminium reinforcing and causing corrosion problems. If however the reinforcement is cut back to accommodate the ventilator the strength of the framing member may be compromised and the window performance impaired.

With timber windows, the frames should be pressure treated after all the machining has been carried out. If the vents are being fitted into pre-treated timber frames then adequate preservative must be applied to the machined area in order to prevent decay.

Some aluminium systems companies recommend that cut aluminium faces should be treated with a compatible surface treatment or air drying paint. Such consideration must be given to sites in coastal locations or those subject to other aggressive environments.

Through purpose designed head section or head extension profile

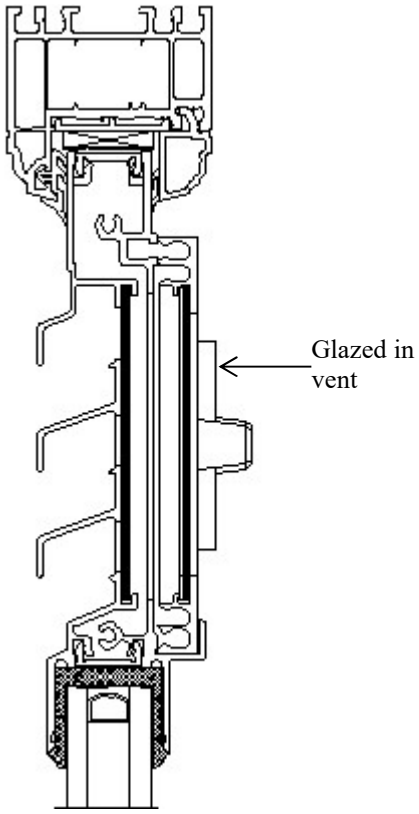


The ventilators used in this method are the same as those used in through frame. However this method of applying a trickle ventilator is generally more favoured by the manufacturer especially when using PVC-U as it does not require the fabricator to carry out any additional operations within the window manufacturing process and a separate production line is usually set up producing head vent sections. The completed head vent sections are then fixed to the finished window.

A further benefit of this method is that the head sections are generally purpose designed and afford the ventilation opening a degree of protection against severe weather and can offer an aesthetically pleasing detail.

Purpose made sections usually make provision for internal building finishes allowing for dry lining etc. without impairing the ventilation function.

Glazed-in ventilators



Sometimes called over glass ventilators these ventilators sit on top of the sealed unit and are glazed into the frame along with the sealed unit.

They are available for a range of standard double glazed sealed unit thicknesses and for single glazing. Glazed-in ventilators are constructed in both aluminium and PVC-U. Those which are constructed of aluminium should incorporate a thermal break. Recent developments have seen the introduction of vents that close positively with wind pressure and improve the weather performance.

Care should be taken when detailing this type of ventilator to ensure that the passing action of the window sashes is not impaired should it be required.

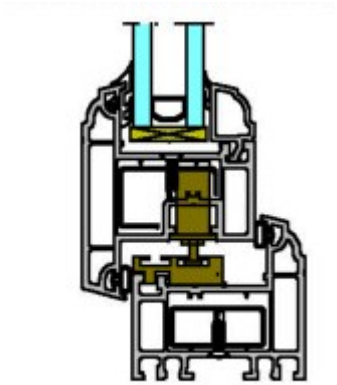
This type of ventilator can be more noticeable by virtue that it physically increases the sight lines, and can lead to unaligned edges, but sensible positioning can alleviate this problem.

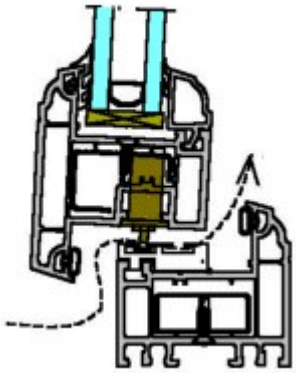
Air bricks with hit and miss grilles

Usually provided within the façade of the building this method uses proprietary airbricks on the outside of the building, and a controllable hit and miss grille on the inside of the building. This form of providing ventilation is however usually more expensive owing to the construction costs of lintels and cavity trays, etc.

Purpose-designed window hardware

It is also possible to provide background ventilation using window hardware that has been designed to offer two opening positions. This is usually achieved on casement windows by fitting strikers which have two positions for the espagnolettes or shoot bolts, sometimes called nightvents. Windows fitted with cockspur handles may also have purpose-designed handles but these are becoming obsolete due to the aesthetic considerations of such large handles.





Providing background ventilation by this method is usually confined to windows above ground floor because of the risk to security. Locking handles may be used but this can conflict with the need to provide escape in the event of a fire, see Building Regulations, 'Approved Document B' *B1 means of warning and escape.*

Colour

The human eye can detect small colour differences therefore whichever of the above methods is employed, the specifier must satisfy himself/herself that the colour and finish of the ventilators is suitably matched to the window system.

Extract ventilation

The required volumes for extract ventilation are set out in the Building Regulations, 'Approved Document F', and the requirements for domestic buildings are tabulated below. Extract ventilation is commonly provided by electrically operated ducted fans with manual and automatic switching which ensure that polluted air is extracted. Care must be exercised when using extract fans and non-room sealed appliances to avoid the spilling of combustion fumes into the room.

There is an option to provide passive stack ventilation (PSV). PSV is a ventilation system using ducts from the ceiling of rooms to terminals on the roof which operate by a combination of the natural stack effect, i.e. the movement of air due to the difference in temperature between inside and outside, and the effect of air movement over the roof.

Habitable room	**no requirement**
Kitchen	
adjacent to hob	30 litres/sec
elsewhere	60 litres/sec or by PSV
Utility	30 litres/sec or by PSV
Bathroom	15 litres/sec or by PSV

Permanent ventilation

Some fuel burning appliances require ventilators that supply combustion air; these ventilators must be permanently open. They must comply with BS 5440: Part 2: *1989 Specification for the installation of ventilation for Gas Appliances.* This Standard ensures that there is a constant and suitable supply of combustion air to appliances and prevents the build up of potentially lethal carbon monoxide.

Permanent air vents should be sited at high level, or adjacent to appliances.

Permanent ventilation can be supplied using through frame or glazed in methods as well as via permanently open airbricks.

These ventilators must be provided in addition to the requirements for background ventilation

Ventilation of non domestic buildings

As mentioned previously most new non-domestic buildings benefit from an integrated approach to ventilation that commonly incorporates mechanical air handling equipment together with air conditioning, however recent trends towards sustainability are promoting natural ventilation in large buildings. The Building Regulations set out the requirements for ventilation. It is however practical to provide small non domestic buildings with ventilation through the principles detailed in the approved documents

The design of natural ventilation for large non-domestic buildings is a very complex matter. Natural ventilation can be defined as ventilation driven by the natural forces of wind and temperature. It should not be confused with infiltration which is the uncontrolled entry of outside air through gaps and cracks in the external fabric of the building.

When designing such a ventilation system building size, form, local topography, location and orientation have to be taken into account, this is best carried out with the aid of a specialist engineer.

Further information may be found in BS 5925: 1991 *Code of Practice for ventilation principles and designing for natural ventilation*.

CIBSE Application Manual AM10: 1997 *Natural ventilation in non-domestic buildings*

Further reading

BS 5925: 1991 *Code of Practice for ventilation principles and designing for natural ventilation*.

BS 5720: 1979 *Code of practice for mechanical ventilation and air conditioning in buildings*.

BS 5250: 1989 *Code of practice for the control of condensation in buildings.*

BRE Digest 398 *Continuous mechanical ventilation in dwellings: design, installation and operation.*

BSRIA *Making Natural Ventilation Work. (GN 7/2000)*

BS 5440: Part 2: 2000 *Specifications for installation of ventilation for gas appliances.*

BS 8213: Part 1: 1991 *Code of practice for safety in use and during cleaning of windows and doors.*

BRE guide to air quality in urban areas from Centre for Safety and health.

CIBSE Application Manual AM10 :1997 *Natural ventilation in non-domestic buildings.*

NHBC Technical Standards section 6.7

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