

# RESIDENTIAL VENTILATION GUIDE

A GUIDE TO SPECIFYING AND INSTALLING RESIDENTIAL VENTILATION



# Create a healthier indoor environment with fast, effective ventilation

From a quiet, low energy fan to a whole house solution

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# Why we need to ventilate



## Airtight Homes

Modern dwellings are designed with increasingly reduced air infiltration rates, higher levels of insulation making them almost completely sealed. Consequently the air inside may become moist, stale and generally stuffy and unpleasant to breathe. As we spend nearly 70% of our time at home we should be looking after our indoor air quality and environment.



## Condensation

Dampness is a huge problem in the U.K. Damaging to both humans and to the fabric of buildings, condensation forms when the temperature of a surface (walls, mirror etc) is below the dew point of the surrounding air. This leads to streaming windows and walls and ultimately to mould.



## Carbon Emissions

Everyone is aware of the need to reduce our carbon footprint. Managing the carbon emissions from dwellings will be the cornerstone of our Building Regulations until we reach a carbon zero dwelling.



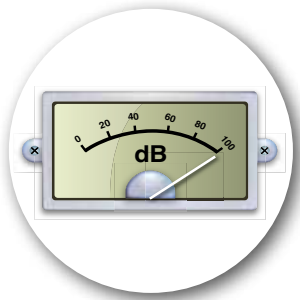
## Mould

Unchecked levels of moisture (condensation) and relative humidity combined with a suitable organic breeding place such as wood, carpet, wallpaper etc., will inevitably lead to mould growth. Mildew forms in wall cavities and crevices and microscopic mould spores may inhaled by humans triggering asthma, allergies and skin disorders so extraction of moist air is important when it occurs.



## Toxic Gases

A variety of noxious and toxic gases may collect within a dwelling if not properly ventilated. All this may have a serious effect on health and well being if not considered as part of a ventilation strategy.

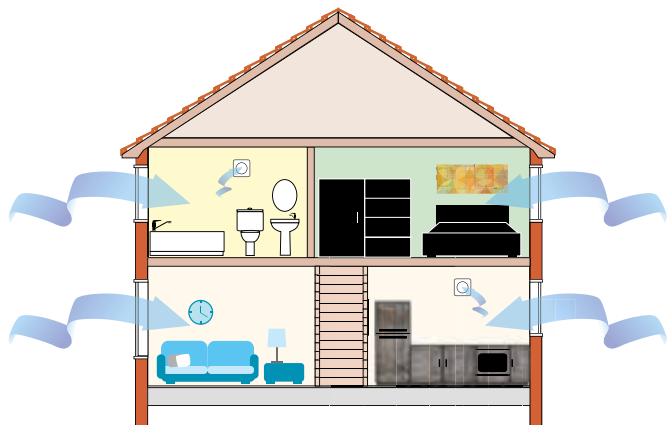


## Noise

Many people do not really stop and consider the constant level of sound we are subjected to on a daily basis, but noise is ever present. Often it is subliminal but never the less always present around us, affecting our nervous system and in extreme cases our well being. Specifying quieter running ventilation products and radial design duct work that reduces noise between rooms, contributes to a quieter indoor environment.

## The Concept of Extract Ventilation

In order to extract air from a wetroom using an extractor fan e.g. a toilet, en-suite, bathroom, utility room or kitchen, there needs to be a supply of air into that room. This normally takes the form of opening windows, trickle vents at the top of windows, undercutting of internal doors or air grilles in the case of rooms with no windows. One cannot extract air from a wetroom if there is not the facility of supply air into that room.



# Selecting the correct product

## What options are available?

The Building Regulations recommend four principle methods of residential ventilation. Airflow have been specialising in the most effective methods for many years. The following is an overview of the best options available.

An essential part of reducing carbon emissions is the need to develop and install more efficient appliances for more energy efficient dwellings to meet the relevant SAP ratings and provide lower specific fan power (SFP) ventilation products with longer life cycles.

## Intermittent Extract Fans (System 1)

Wall or ceiling mounted with a choice of controls, in axial, mixed axial/centrifugal and centrifugal impeller variants. Energy efficient, low watt, quieter running. All important elements in specifying and installing products to meet the Building Regulations.

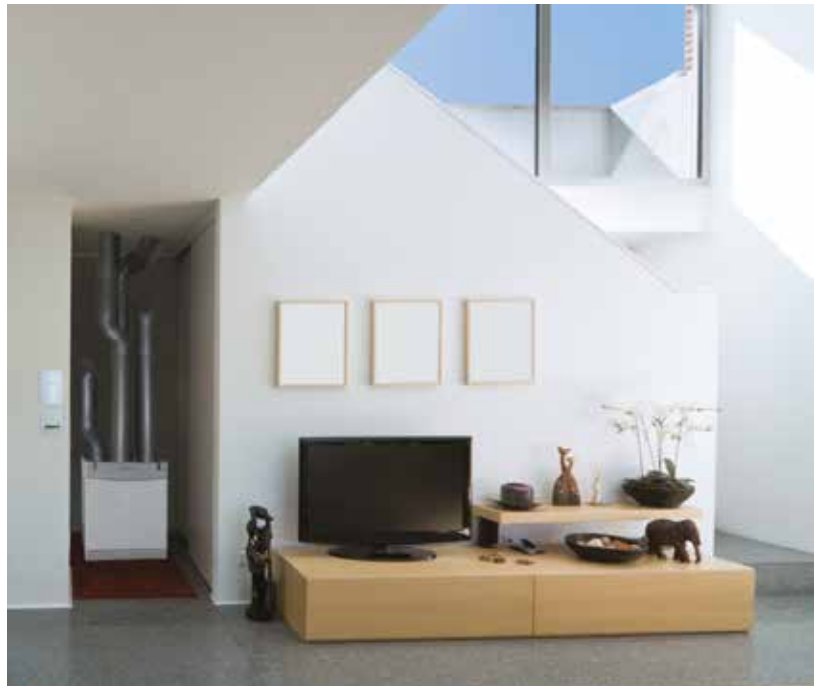


## Continuous Mechanical Extract Ventilation (MEV/dMEV) (System 3)

Continuously running at a trickle speed in either centralised (loft/cupboard installation) or decentralised (single fans mounted in wet rooms) locations, for quieter, constant extraction from wet rooms. Available with multiple trickle and boost speed choices.

## Mechanical Ventilation with Heat Recovery (MVHR) (System 4)

Continuously running from a centralised location. This system extracts moist, stale air from wet rooms in a dwelling, and supplies fresh, filtered air which is warmed in a heat exchanger by the outgoing waste air. Filtered air, with recycled heat is supplied to living rooms within the dwelling. Airflow supply a range of SAP Appendix Q eligible and Passive House approved units for exceptional efficiency.



## Hygienic, Zero Leakage Ducting

There is not much point in investing in energy efficient ventilation products if the benefits are lost from a poorly designed duct system. Choose a radial system to reduce the places where dust and spores can gather. Insist on a hygienic system with a coated, anti-static bore tube that connects each room individually avoiding the spread of noise between rooms.



# Selecting the correct product

## Installed performance

It is not sufficient to fit just any fan. It is important that the fan performs efficiently by extracting the minimum flow rate as required by the latest Building Regulations. The number of bends and the length of duct attached to the fan will create resistance to flow that must be overcome to ensure adequate extraction. This is known as installed performance.

Fans should be positioned to give an optimum flow of air through the whole room and to avoid pockets of residual air. The location of planned or existing door and window openings must be considered as well as sources of odours, stale air or condensation. Undercutting of all internal doors or fitting of grilles to allow air into the room is essential, particularly with internal rooms which have no windows and tightly sealed doors.

Fans should be mounted as high as possible, well away from primary heat sources such as gas water heaters, boilers and ovens.

## Domestic Ventilation Compliance Guide

The 2010 Building Regulations introduced a “Good Practice” installation guide for fan installation, inspecting and commissioning in new and existing dwellings. Consider this document as part of your specification. Don't forget a fan can only extract air if there is air coming in to replace it.

## What Type of Fan

Having considered the application of the ventilation required, it is important to select the correct type of fan to ensure that the requirement is truly met. However, you should first consider which type of fan will best suit the application to provide quiet efficient ventilation.



**Axial Fans** are ideal for through the wall and window applications. Providing high performance with a slim profile, they are suitable for use with flexible ducting up to a maximum 1.5m length.



**Mixed Flow Fans** combine the convenience of a slim axial fan with the performance of a small centrifugal making them ideal for slightly longer duct runs than axial fans.



**Centrifugal Fans** are quiet, powerful and suitable for wall and ceiling applications. They work very efficiently against system resistance making them the perfect choice for ducted installations.

## Where to install

IEE regulations specify the installation of fans within bathrooms and showers by identifying a series of zones. IEE regulations must be adhered to for all electrical installations. Fans must be installed in accordance with the latest IEE Wiring Regulations 17th Edition (BS7671:2008) A2:2013. Part 7 (Special Locations).

**Zone 0:** The Interior of the bath or a shower tray NO Fan can be fitted.

**Zone 1:** The external edge of the bath or a shower tray, extending up to 2.25m from the bathroom floor, or to the extended height of a shower head attached to a flexible hose (which ever is the higher).

**Zone 2:** Extends beyond Zone 1, by 600mm to each side and has the same height constraints as Zone 1.

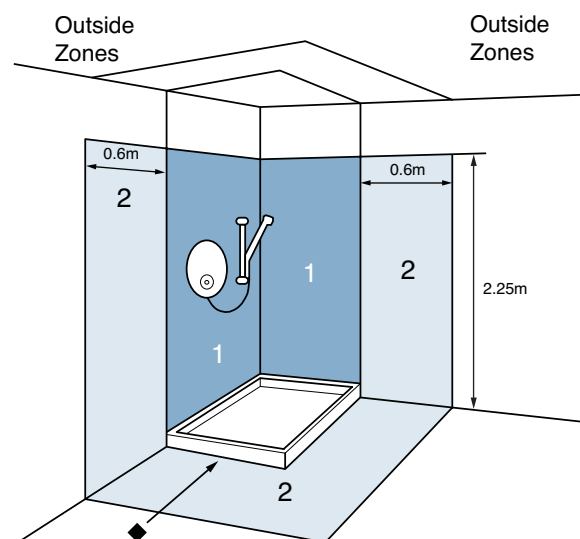
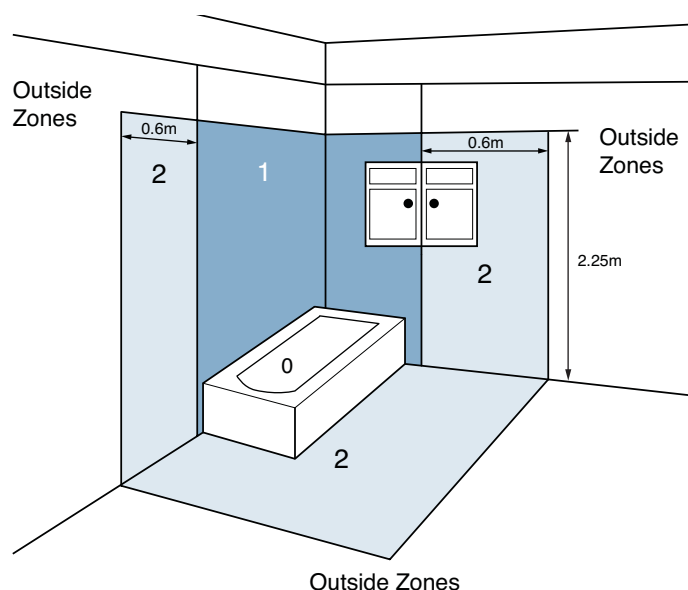
**Fans:** When installed in zone 1 or 2 must be at least IPX4 (splash proof)

Additionally fans in zone 1 must be SELV or IPX5 (jet spray proof)

All fans should be protected electrically by a 30mA RCD.



## Zones of en-suite / bathroom



# Good Practice Delivers Performance

## Fan Installation Guidance

Axial Fans are designed for simple installations and are generally suitable for wall, window mounting or with short (up to 1.5 metres) duct runs and no more than two bends for flows of up to 30 L/sec and one bend for over 30 L/sec.

Centrifugal fans are designed to generate the pressure required to perform in longer and more complex duct installations, however their use should be limited to duct runs of 6 metres for airflows between 0-30 L/sec and 3 metres for airflows between 31-60 L/sec.

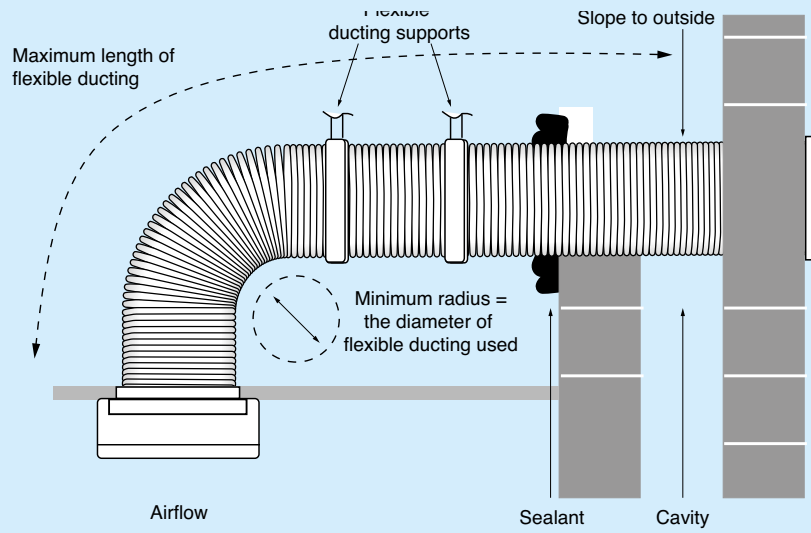
To reduce risk of restricted airflow when installing fans with flexible duct, please follow the guidance below:

- The inner radius of any bend should be greater or equal to the diameter of the ducting being used.
- If the radius is reduced, the resistance of the bend will increase and the volume of air being extracted will decrease (see “Do” diagram).
- Ensure flexible ducting is installed without peaks or troughs (see “Don’t” diagram).
- External terminations i.e. grilles must have at least 90% equivalent free area of the ductwork being used.
- To avoid the backflow of condensation into the fan in vertical ceiling installations, it is required by the Building Regulations to fit a condensation trap to the vertical outlet duct of the fan.

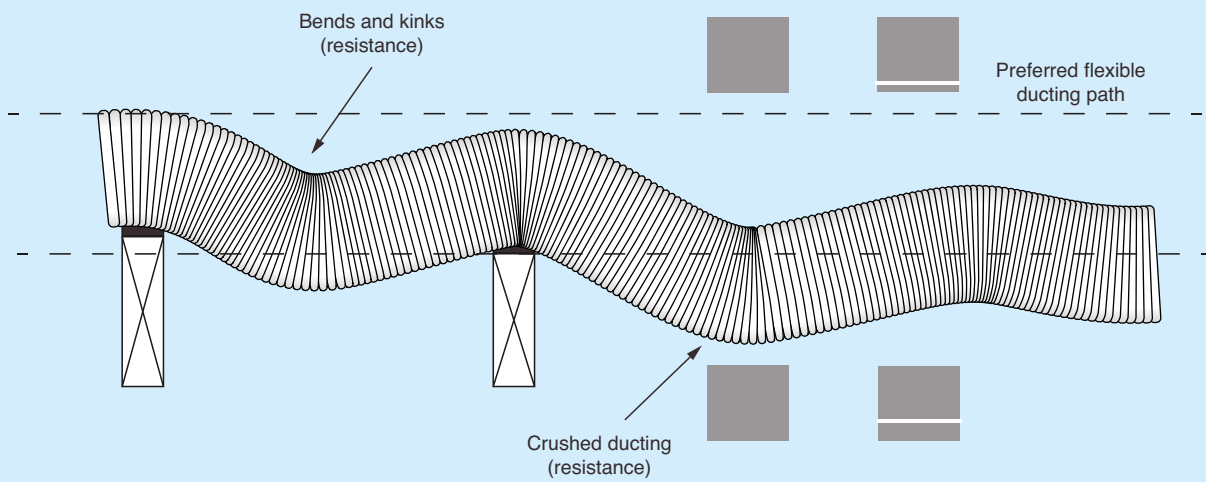


## Duct Installations

✓ **Do**



✗ **Don't**



# Building Regulations for Ventilation

## Delivering Improvement

It all started in London when the first “Building Act” came into force forbidding thatched roofs inside the city limits. By the time of the Great Fire of London in 1666, many thatched buildings still remained, spreading the fire. Shortly after the first “inspected” building code was introduced.

Fast forward to the “1984 Building Act” and the first appearance of a dedicated ventilation regulation. In 1991 they became the “Building Regulations” with further revisions in 2000, 2006 and 2010.

## Building Regulations England and Wales

References to Approved Document F1 with credentials in 2010, Means of Ventilation for England and Wales.

**Visit: [www.planningportal.gov.uk/buildingregulations](http://www.planningportal.gov.uk/buildingregulations)**

Please note that other documents apply specifying ventilation in Scotland, Northern Ireland and the Republic of Ireland.

## Scotland

Refer to the Scottish Building Standards, technical handbook 2013 edition for domestic and non-domestic applications, Standard 3.14

**Visit: [www.scotland.gov.uk](http://www.scotland.gov.uk)**

## Northern Ireland

Refer to the Building Regulations (Northern Ireland) 2012, Part K.

**Visit: [www.dfpni.gov.uk](http://www.dfpni.gov.uk)**

## Republic of Ireland

Building Regulations, Technical Guidance Document F:2009 Ventilation.

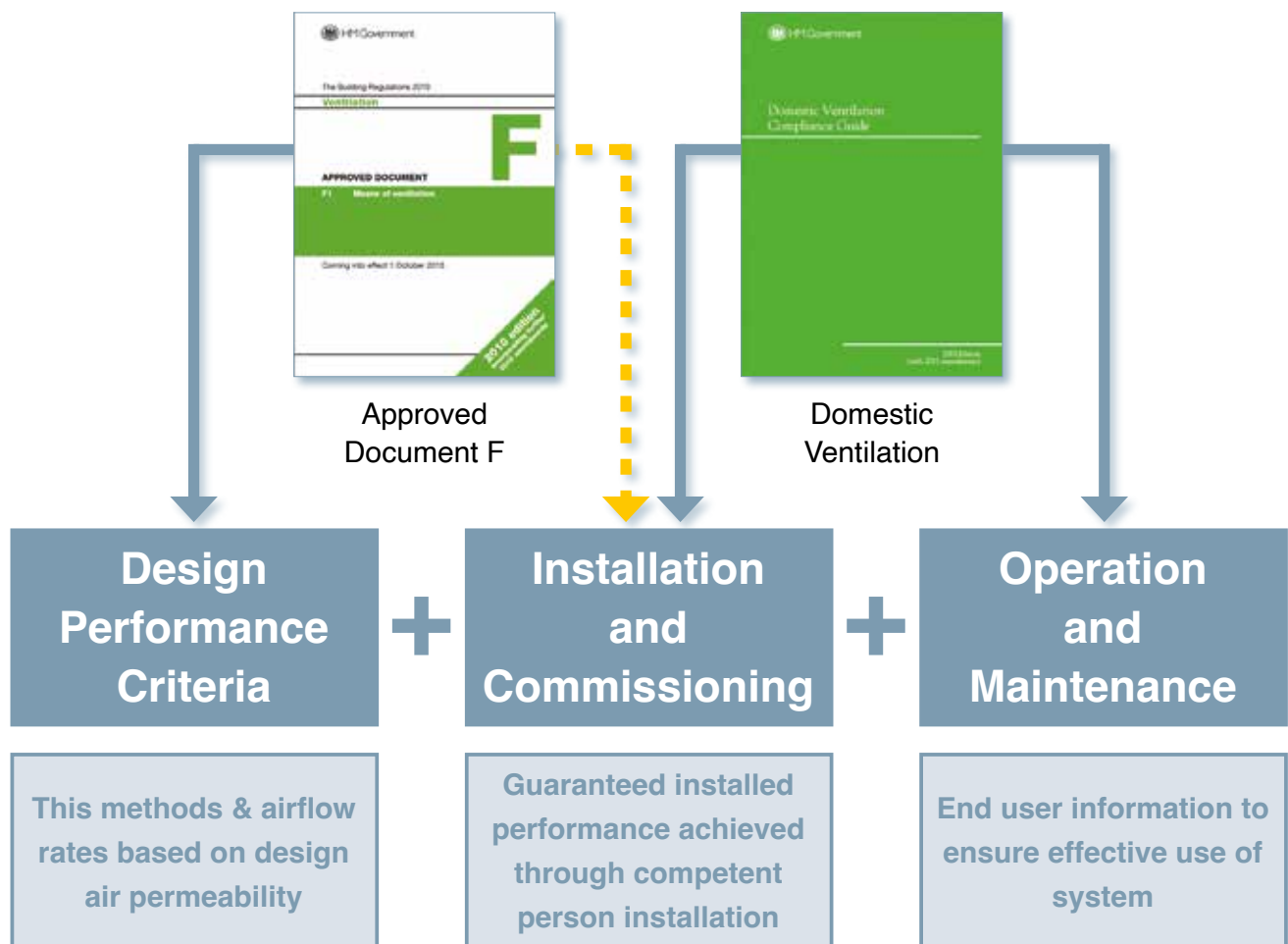
**Visit: [www.environ.ie](http://www.environ.ie)**



# Building Regulations for Ventilation

## Approved Documents

There are a range of Approved Documents (Building Regulations) covering many aspects of building construction and installation processes. Approved Document F1, Means of Ventilation 2010 provides specific details of the requirements to provide a minimum standard of ventilation in a dwelling required to be signed off by Building Control following “Notifiable Work”.



Accompanying the approved document there is a Domestic Ventilation Compliance Guide which provides detailed guidance for persons installing fixed building services in new and existing domestic dwellings to help them comply with building regulations. It covers work on both new systems and replacement systems, identifying the difference requirements where these exist.

# Building Regulations for Ventilation

## System 1 – Intermittent Fans

### Approved Document F1 Means of Ventilation

- Mechanical Intermittent Extract Fans located in all wet rooms including bathroom, kitchen, utility and wc
- Replacement air enters the building via background ventilators in all rooms, usually in the form of window vents
- The requirements for background ventilation are influenced by the size of the dwelling, the number of bedrooms and the air permeability of the dwelling

Room	Extract Rate (min)
Kitchen	30 L/sec (adj. to hob) 60 L/sec (elsewhere)
Utility	30 L/sec
Bathroom	15 L/sec
Sanitary	6 L/sec

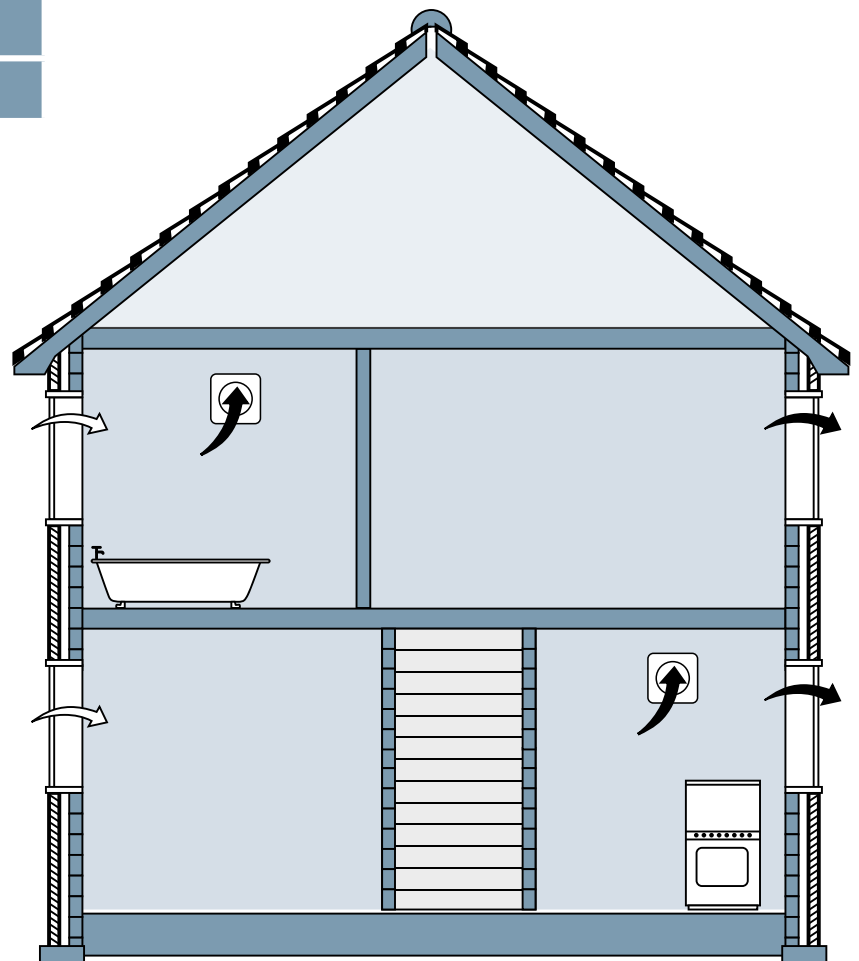
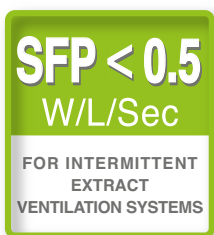


For larger bathrooms, bathrooms with power showers or rainforest showers considerably more extraction may be needed to reach customer expectations.

#### Domestic Building Services Compliance Guide 2013 edition

Referred to in the 2013 edition of Approved Document L1A and the amended version of L1B, Conservation of Fuel and Power.

Mechanical ventilation systems should be designed to minimise electric fan power. The specific fan power (SFP) should not be worse than:

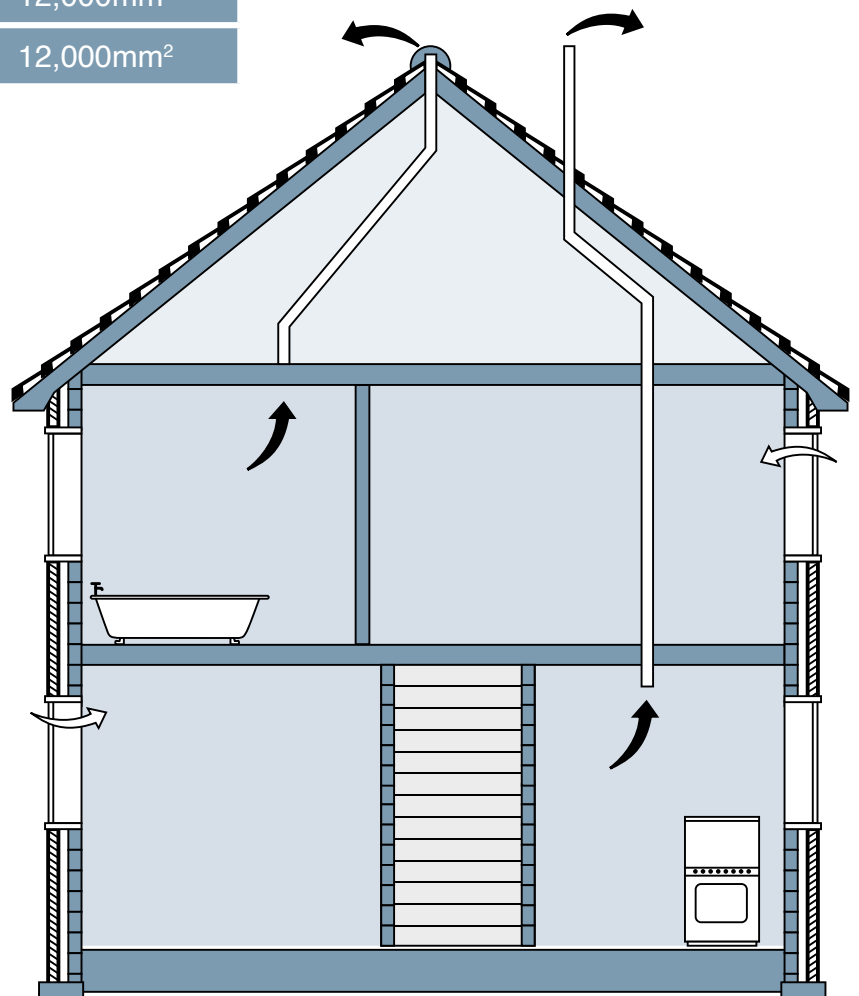


## System 2 – Passive Stack Ventilation

### Approved Document F1 Means of Ventilation

- A Passive Stack Ventilation System provides continuous ventilation
- The driving force being the “stack effect” and the “wind effect” - warm air rises, and wind passing over the outlet helps to draw the air out of the building
- Background ventilation is required to dry rooms only
- Separate ducts from each wet room

Room	Internal duct diameter	Internal x sectional area
Kitchen	125mm	12,000mm <sup>2</sup>
Utility	125mm	12,000mm <sup>2</sup>
Bathroom	125mm	12,000mm <sup>2</sup>
Sanitary	125mm	12,000mm <sup>2</sup>



# Building Regulations for Ventilation

## System 3 – Central/De-Centralised Mechanical Ventilation

### Approved Document F1 Means of Ventilation

- Extracts continuously from all wet rooms at a low level and boosts to extract pollutants at higher levels when required
- Control/boost by manual switches or automatically via sensors – humidity/ CO<sub>2</sub>/ motion/ other sensors
- Sited remotely in a loft space or cupboard and ducted via rigid or semi-rigid duct to the outside air using most economical route
- Replacement air enters the building via background ventilators located in all dry rooms

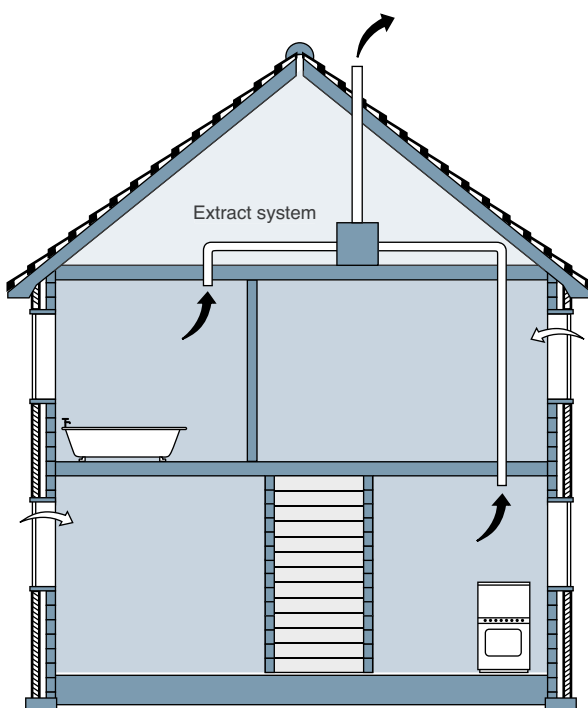
Room	Continuous Extract Rate (min)
Kitchen	13 L/sec
Utility	8 L/sec
Bathroom	8 L/sec
Sanitary	6 L/sec

Domestic Building Services Compliance Guide 2013 edition

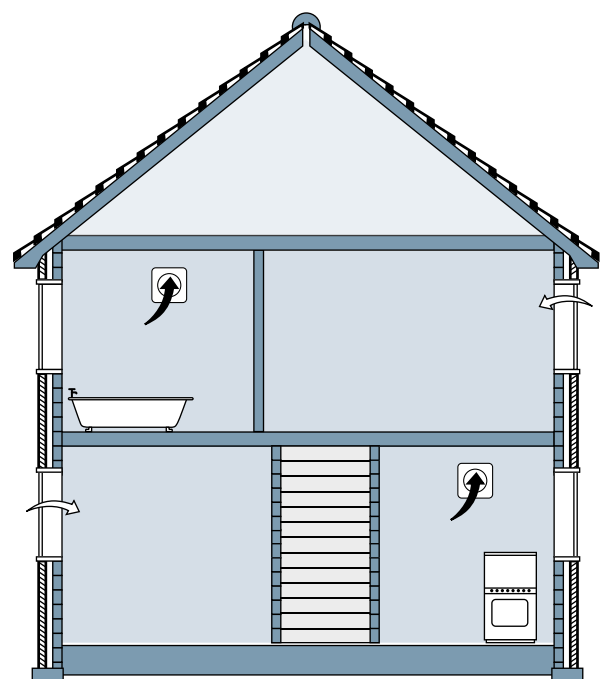
Referred to in the 2013 edition of Approved Document L1A and the amended version of L1B, Conservation of Fuel and Power.

Mechanical ventilation systems should be designed to minimise electric fan power. The specific fan power (SFP) should not be worse than:

**SFP < 0.7**  
W/L/Sec  
FOR CONTINUOUS EXTRACT VENTILATION SYSTEMS



Centralised Ventilation



De-Centralised Ventilation

## System 4 – Continuous Mechanical Supply and Extract with Heat Recovery

### Approved Document F1 Means of Ventilation

- Supplies and extracts air continuously at a low rate and incorporates a boost facility to extract pollutants and supply fresh outdoor air at a higher rate as required
- Control/ boost by manual switches or automatically via sensors – humidity/ CO<sub>2</sub>/ motion/ other sensors
- Sited in a cupboard or insulated loft and ducted via rigid duct to the outside air
- Replacement air is dealt with by balanced supply/extract

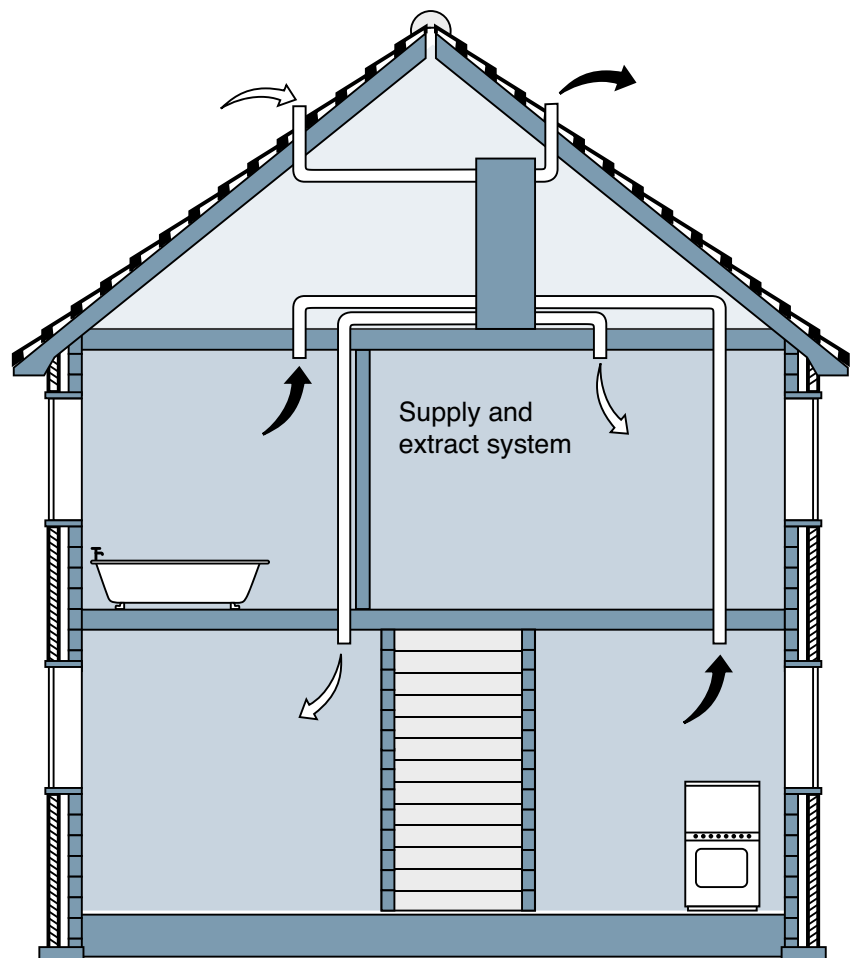
Room	Intermittent Extract Rate (min)
Kitchen	13 L/sec
Utility	8 L/sec
Bathroom	8 L/sec
Sanitary	6 L/sec

Domestic Building Services  
Compliance Guide 2013 edition

Referred to in the 2013 edition of Approved Document L1A and the amended version of L1B, Conservation of Fuel and Power.  
Mechanical ventilation systems should be designed to minimise electric fan power. The specific fan power (SFP) should not be worse than:



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# A Whole House Solution

## What is ventilation with Heat Recovery?

It is a process of continuously preheating incoming cool supply air by warming it with the outgoing exhaust air?

Warm air is not simply exhausted but transfers most of its heat to supply air in a highly efficient heat recovery exchanger.

At no time do the airstreams mix as the heat radiates through plates of the exchanger.

## Supply air

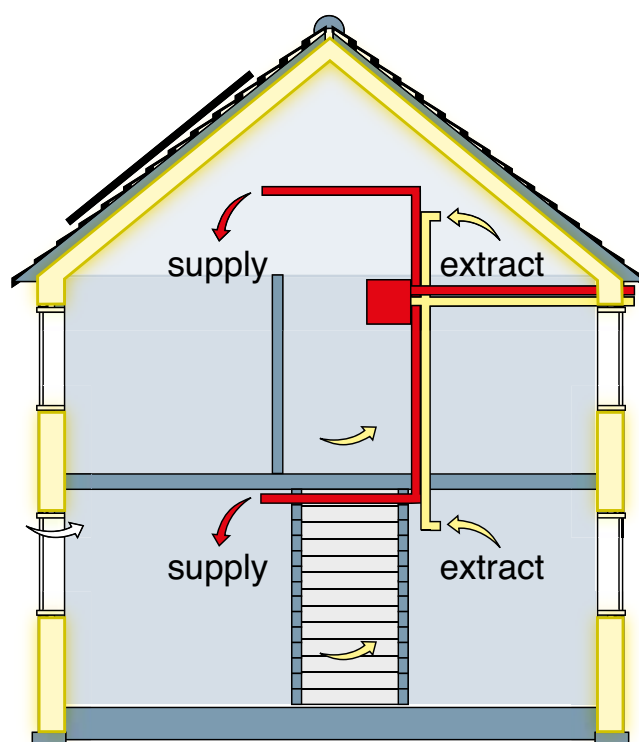
Fresh air is fed directly from outside into the ventilation system through a filter.

The heat taken from the extracted air is used to warm the fresh incoming filtered air in the exchanger. This then flows through ducting. To the habitable rooms.

## Extract air

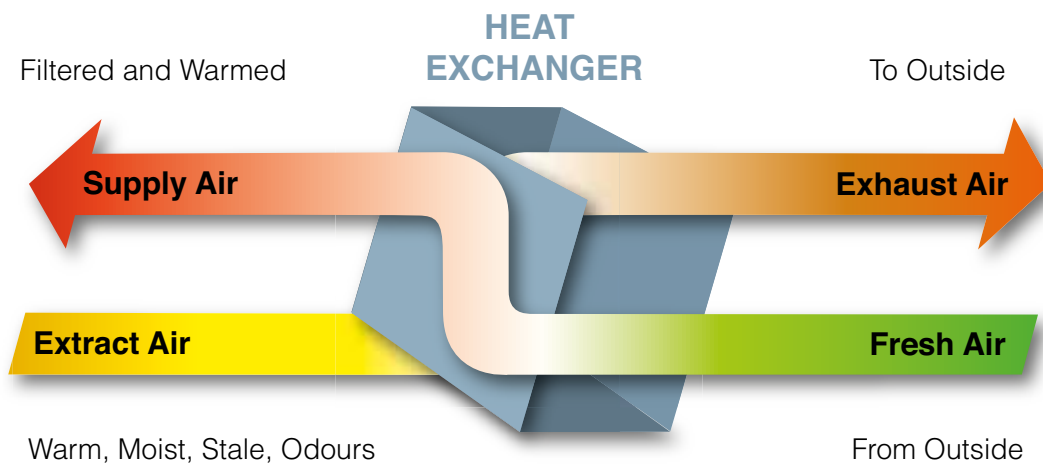
Stale air is contaminated with humidity, toxins and smells extracted from the kitchen and other wet rooms.

Extract valves in toilets and wet room areas, such as the bathroom, en-suite, utility and kitchen allow a constant or demand oriented air flow volume to be extracted.



Ventilation system with  
heat recovery

## How Does MVHR Work?



## Why bother with MVHR?

Reduce carbon emissions

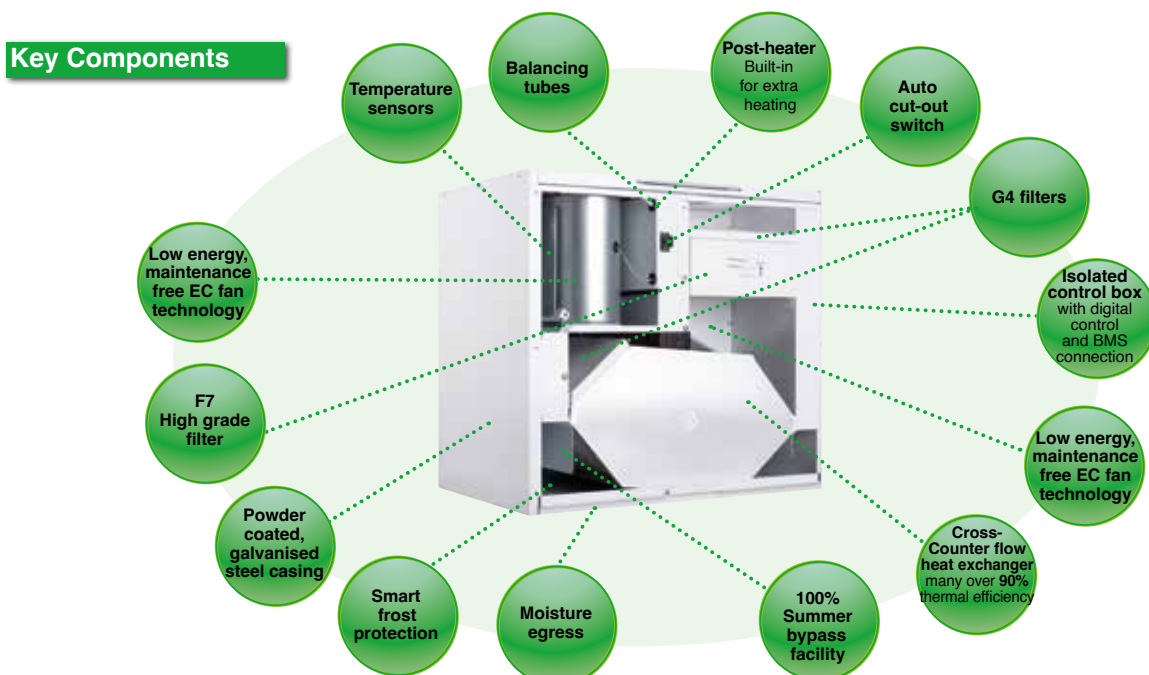
Government policy to conserve heat and power is leading to higher levels of insulation and air tightness in residential dwellings and commercial buildings.

The resulting poor indoor climate can lead to health problems for occupants and visitors alike and long term damaging effects to the fabric of a building.

Fresh, warmed, filtered air is the answer!

In healthy home thousands of litres of fresh air is needed every day to compensate for the moisture generated by each individual person, and also through cooking, washing and bathing.

Mechanical Ventilation with Heat recovery (MVHR) provides the perfect solution.



# A Whole House Solution

## Semi Rigid Ducting

### Fast, Flexible and Zero Leakage

“Semi rigid ducting performance data is now recognised by the UK Government as an input for Standard Assessment Procedure (SAP) calculations via Appendix Q”.



### The Problem - Poor installation

It makes no sense to invest in energy efficient products to improve indoor air quality if the benefits to be gained are lost through leakage from a poor quality and badly fitted ductwork system.



### The Solution - Semi Rigid Ducting

- Round and flat oval small bore flexible pipe, typically 75mm diameter
- Interchangeable ducting with identical hydraulic performance
- SAP Appendix Q eligible (unjointed system)
- Radial design goes directly to each room
- Considerable savings on installation time
- Easy to fit through I-joint, metal web and concrete screeds
- Pulls through narrow gaps and down cavity walls quickly and easily
- Limits noise transmission between rooms
- High crushability, typically up to 10 kN/m<sup>2</sup>
- Low resistance pipe compared to flexible ducting

## Advantages

### Hygiene

- Increasingly airtight homes need better ventilation
- Anti-static coating prevents dust build up
- Smooth bore for easy cleaning
- Corrosion and abrasion resistant
- Inspection door in distribution boxes for system cleaning

### System

- Push to seal fittings ensure Zero Leakage
- Virtually maintenance free
- Flexible tube gives freedom of design
- Very low noise transmission between rooms



# Glossary

## Air

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A gas comprising the following constituents (when dry):

78.09% nitrogen

20.95% oxygen

0.93% argon

0.03% carbon dioxide

Air density

The ratio of the mass of a given amount of air to the volume which this amount occupies (ie lb/ft<sup>3</sup> or kg/m<sup>3</sup>).

Secondary air

Room air entrained and set in motion by air discharge from a grille

## BCO

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A Building Control Officer or Building Inspector who ensures that Building Regulations are followed during construction and signs off the project.

## Bernoulli's theorem

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This says that the total energy per unit mass along any one stream line in a moving fluid is constant, and that the states in which that energy exists (pressure, kinetic or potential) are related and convertible.

## CPD

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Continuing Professional Development. The on-going learning process whereby professionals maintain, update and increase the knowledge and skills in their chosen career.

## Competent Person

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An individual who has completed a nationally recognised training scheme allowing them to "self certify" that their work complies with the Building Regulations.

## dMEV

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Decentralised Mechanical Extract Ventilation. A method of continuous ventilation of a dwelling using extractor fans in wet rooms. An allowable solution under system 3 of Approved Document F.

## Dynamic loss

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The energy lost when an airstream travelling at a known velocity is forced to make a sudden change in direction or velocity.

## EC Motor

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An electronically commutated motor running on DC voltage from an AC input. Avoiding the use of a transformer the motor incorporates voltage change resulting in a less bulky and more energy efficient performance.

## Energy

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Potential energy

The energy of a fluid or body due to its position (or height).

Kinetic energy

This energy which a fluid or body possesses by virtue of its motion.

## Fan

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Axial

A rotating propeller type device where the air is moved in the same direction as the inlet and outlet of the fan. Providing high air flow in a slim profile they are ideal for through the wall installation. Suitable for short lengths of ducting only.

Mixed Flow

A hybrid combination of an axial and centrifugal fan impeller where the air is moved in the same direction as the inlet and outlet of the fan. Provides higher pressure development than an axial fan so suitable for short to medium lengths of ducting.

Centrifugal

Quiet and powerful and suitable for wall, ceiling and ducted installations. Similar in design to a hamster wheel they work efficiently against system resistance making them perfect for longer duct runs.

## Fan Curve

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The fundamental performance of a fan or blower with the X axis expressed in pressure and the Y axis expressed in volume flow.

## Grille

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A system of fixed or adjustable vanes covering an opening through which air is discharged.

Return grille

A grille covering an opening through which air is withdrawn from the conditioned space.

## Heat Exchanger

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A device designed to efficiently transfer heat from one air stream to another, as in MVHR. At no time does the warm and colder air mix but a Metal or Polypropylene core may be used to transfer heat at different temperatures.

## IEEE

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Institute of Electrical and Electronic Engineers

## Inlet device

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A shaped air intake with pressure tapings that can be calibrated and used to measure air flow rate (e.g. bellmouthed or conical inlets).

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## IP Rating

Ingress protection rating. The degree of protection afforded by a casing against the ingress of solid objects and liquids. Designated by IPXX

The first figure is for solid objects rated from 0 (no protection) to 6 (total protection).

The second figure is for Liquid from 0 (no protection) to 9 (protection against long periods of immersion under pressure).

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## MEV

Mechanical Extract Ventilation. A description usually applied to a continuous operating central extract system as defined in System 3 of Approved Document F.

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## MVHR

Mechanical Ventilation with Heat Recovery. Equipment to regain warmth from otherwise waste extract air and supply to living spaces providing warm, filtered fresh air.

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## Notifiable Work

Activities which require compliance with the Building Regulations, approval by Building Control.

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## Passive House

A term referring to a very high standard of energy efficiency in a buildings design and construction. Typically a dwelling would have an air tightness level better than 1.5 m<sup>3</sup>/hr/m<sup>2</sup>

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## Pressure

Air pressure

The force per unit area imposed on the surface of a solid body by gaseous air.

Absolute pressure

Pressure relative to a perfect vacuum.

Barometric pressure

The local ambient air pressure.

Differential pressure

The difference between pressures measured at two points or levels in a system.

Static pressure

The difference between the absolute pressure at a point in an air stream or a pressurised chamber and the absolute pressure at ambient temperature. This is positive when the pressure at that point is above ambient pressure, and negative when below. It acts equally in all directions and is independent of velocity.

Velocity pressure

The increase in pressure produced by bringing a moving airstream to rest (as measured by a pitot static tube). It is equal to the product of air density and the square of the velocity divided by 2, and is sometimes known as the velocity head or dynamic pressure.

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## Relative humidity

The relative humidity of an air/water vapour mixture is the ratio of the vapour pressure existing to the saturated vapour pressure for the same dry-bulb temperature, expressed as a percentage (%RH).

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## SAP

Standard Assessment Procedure. An assessment of the energy efficiency and carbon index of a new dwelling. SAP energy ratings are part of the Building Regulations.

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## SELV

Safety Extra Low Voltage fans use a 12 or 24 volt electrical supply which means that they can be safely installed within a zone 1 area specified by the IEE Wiring Regulations.

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## Specific Fan Power (SFP)

The efficiency of a fan may be described by a numerical value calculated by dividing the operating watts (w) by the air flow rate in L/sec at that power. The value is not fixed and will vary with the fluctuating duty/air flow of the fan. ie: A fan operating at 10 watts with an air flow rate of 25 l/sec would have an SFP 0.4 w/L/sec.

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## 'U' Value

A measure of the thermal performance of a building envelope. The higher the value the worse the thermal efficiency.

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## WEEE

Waste Electrical and Electronic Equipment directive.

\*Note: For guidance only. E&OE

# Air Flow Solutions



## Always Innovating

Our constant search for new and better ways to save energy, improve the indoor environment and provide you with high quality, reliable and easy to use products that contribute to a low carbon future continues.

**visit: [airflow.com](http://airflow.com)**

for the latest, products, data sheets, application advice and information

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**Technical Support : 01494 560950**



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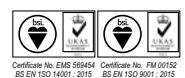
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