Code of Practice for Investigation and Provision of Ventilation in Existing Dwellings

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CODE OF PRACTICE FOR INVESTIGATION AND PROVISION OF VENTILATION IN EXISTING DWELLINGS

1. INTRODUCTION

This Code of Practice is issued by the Property Care Association hereinafter referred to as 'the Association'. This Code is based on current "best practice" and aims to provide a concise and thorough guide to the investigation and control of water vapour levels in existing residential buildings.

The aim of this Code of Practice is to provide guidelines that set the principles and standards to which PCA members work, and should be read in conjunction with the Code of Practice for the Investigation and Control of Dampness in Buildings.

Different parts of the UK have different regulatory, compliance and guidance documents in relation to residential ventilation. It is impractical to cater for all parts of the UK in this Code of Practice. As the vast majority of the UK's existing housing stock is in England this Code of Practice is based around the various documents that apply in England in relation to the ventilation of buildings. The main ones being as follows:

- Approved Document B
- Approved Document F
- Approved Document J
- Approved Document L1B
- Approved Document P
- The Domestic Ventilation Compliance Guide
- The Domestic Building Services Compliance Guide

This Code of Practice is designed to be considered in conjunction with the aforementioned documents, not replace them.

For residential ventilation work in Scotland, Wales and Northern Ireland this Code of Practice will provide a good source of advice and information. It should however be noted that in all cases the requirements of the individual countries Building Regulations and/or any local building bylaws must be observed, and where necessary the advice of the Local Authority Building Body should be taken.

2. DEFINITIONS

For the purposes of this document, the definitions in BS 6100: Part 5 and Building Regulations Approved Document F apply with the following amendments/additions:

- **AFHR Fan -Alternate Flow with Heat Retention**
  An alternate flow heat retention fan for use in habitable rooms. The fan alternates between supply and extract modes. During extract mode, the fan retains heat and transfers a proportion of the heat to the air during supply mode.
- **Air permeability**
  A 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 of 50 Pascal.
- **Airtightness**
  A general descriptive term for the resistance of the building envelope to infiltration. The greater the airtightness, the lower the infiltration.
- **Automatic Control**

Where a ventilation device opens and closes or is switched on and off, or where its performance is adjusted by a mechanical or electronic controller i.e. humidistat.

- **Background Ventilator**
  A small ventilation opening designed to provide controllable whole building ventilation e.g. a window mounted trickle ventilator.
- **Background Ventilation**
  Term often used as an alternative to "whole building ventilation" and/or a term used to describe the continual low duty setting of a dMEV, MEV and MVHR systems.
- **BCB or Building Control Body**
  A local authority or an approved inspector.
- **Condensate**
  Liquid water produced by condensation.
- **Condensation**
  Process whereby water is deposited from air containing water vapour when its temperature drops to or below dewpoint.
- **Constant flow**
  A function of a ventilation unit that maintains a selected flow rate subject to its performance limitations.
- **Continuous operation**
  Where a mechanical ventilation device runs all the time e.g. a dMEV or MVHR system.
- **Dewpoint**
  Temperature at which 100% relative humidity is reached and air becomes saturated with water vapour.
- **dMEV Fan**
  A continuously operating "wet room" extract fan which operates at a low background rate with an occasional boost facility. These fans generally operate at much lower duties than intermittent extract fans and the pressures they need to develop to overcome ductwork systems are therefore much less. Consequently, they are significantly quieter in operation, with many operating at imperceptible noise levels.
- **Ductwork System**
  An assortment of components used to transfer air into and out of a building. These include rigid, semi-rigid, flexible, insulated, un-insulated lengths of ductwork, bends, t-pieces, connectors etc.
- **Extract ventilation**
  The removal of air from a room or space to outside. This may be achieved via passive stack ventilation or mechanical ventilation.
- **Fan Performance Curve**
  A graphical representation of a fans performance which will include as a minimum airflow and pressure developing characteristics as a minimum.
- **Habitable room**
  A room used for dwelling purposes which is not solely a kitchen, utility room, bathroom, cellar or toilet e.g. a bedroom or living room is a habitable room.
- **Hygroscopic**
  Readily taking up water vapour from the air.
- **Hygrothermal**
  Pertaining to the simultaneous movement of moisture and heat.

- **Infiltration**
  The uncontrolled exchange of air between inside and outside of a building through cracks and other unintentional openings caused by wind pressure and/or stack effect.
- **Intermittent Extract Fan**
  An extract fan designed for occasional use to complement the whole building ventilation typically provided by background ventilators e.g. trickle ventilators. Careful consideration needs to be given to the ductwork system attached to these fans due to the high pressure drops associated with the high flow rates they provide. These fans should not be fitted in a home unless there are sufficient background ventilators installed, and the designer can be certain they will be used appropriately.
- **Interstitial condensation**
  Condensation which occurs within an element of the building fabric.
- **MEV unit.**
  A centrally mounted, continuous mechanical extract ventilation system which is typically connected to a number of "wet rooms" via a system of ductwork and discharges air to atmosphere via a single external terminal.
- **MVHR – Mechanical Ventilation with Heat Recovery**
  A whole home mechanical ventilation system with heat recovery. Designed to work continuously by extracting air from "wet rooms" and supplying air to the "habitable rooms" of a property. A proportion of the heat from the extract air is transferred to the supply air via a heat exchanger. These systems negate the need for purpose provided background ventilation e.g. trickle ventilators.
- **Performance enhancing ventilation unit**
  A ventilation unit installed in a room to provide enhanced ventilation to that specific room and/or the main ventilation system serving the home. Examples may include:
    - A continuously operating extract fan installed in an internal bathroom where a Positive Input Ventilation system is installed.
    - A continuously operating extract fan installed in a "wet room" that is not directly accessible from the main hallway where a PIV is installed.
    - An alternate flow with heat retention fan installed in a bedroom seriously affected with condensation dampness, to provide enhanced ventilation in that room.
- **PIV – Positive Input Ventilation**
  A ventilation system which supplies filtered ventilation air to a property, usually via the central hallway or above the stairwell.
- **PSV – Passive Stack Ventilation**
  A ventilation system using ducts from terminals in the ceiling of rooms to terminals on the roof that extract hat extract air to the outside by a combination of the natural stack effect and pressure effects of wind passing over the roof of the building.
- **Purge Ventilation**
  Is the manually controlled ventilation of rooms and spaces at a relatively high rate to rapidly dilute pollutants and/or water vapour e.g. an openable window.
- **Purpose provided ventilation**
  Part of the ventilation of a dwelling that is provided by ventilation devices that have been designed into the dwelling e.g. via background ventilators or extract fans.
- **Relative humidity**
  The amount of water vapour contained within a given volume of air compared with the maximum amount that could be contained at the same temperature (usually expressed as %RH).

- **SRHRV – Single room heat recovery ventilation**
  A single room mechanical ventilation system with heat recovery. Designed to work by simultaneously supplying and extracting air in “wet rooms”. A proportion of the heat from the extract air is transferred to the supply air via a heat exchanger. These systems only negate the need for purpose provided background ventilation e.g. trickle ventilators in the rooms they serve.
- **Thermal bridge**
  Part of a construction with thermal resistance significantly lower than that of the surrounding construction e.g. a window lintel.
- **Vapour**
  Substance in its gaseous phase.
- **Ventilated cavity**
  Volume of air with openings to the outside air so placed as to promote the through passage of air.
- **Ventilation**
  The supply and removal of air by natural or mechanical means to and from a space or spaces within a building. It normally comprises a combination of purpose provided ventilation and infiltration.
- **Water vapour**
  Water in its gaseous phase, also known as humidity.
- **Wet room**
  A room used for activities that give rise to significant production of airborne moisture e.g. a kitchen, bathroom, w.c. or utility room.
- **Whole Building Ventilation**
  The continuous ventilation of rooms or spaces at a relatively low rate to dilute and remove pollutants and water vapour not removed by the operation of extract ventilation, purge ventilation or infiltration. For a home, this is referred to as whole dwelling ventilation.

3. HEALTH AND SAFETY

General Measures:

3.1 The Health and Safety at Work etc. Act 1974 (and its subsequent amendments)

The Health & Safety at Work etc. Act 1974 and its subsequent amendments requires every employer to be responsible, in so far as is reasonably practicable, for the provision of a safe working environment, appropriate safety equipment and instruction, training and information on the safe use of plant, equipment and materials necessary for the job.

Employees in turn have an obligation to make proper use of the safety equipment provided and to act upon the information and training given to ensure their own safety and that of others who may be affected by their acts or omissions.

3.2 Guidance on Safe Practice

The peripatetic nature of investigating and undertaking most remedial works (i.e. working alone on variable site locations) should be considered when making risk assessments.

3.3 Obligations to other persons, the environment and other properties at risk

Where deemed appropriate neighbours/owners of adjoining or nearby properties must be notified direct if it is considered there may be a potential nuisance and/or hazard to health from work being carried out.

Information should include the type of hazard (e.g. flammability), method of application (and any potential risks there from) and some recommendations on precautions to be taken before, during or after remedial works (including details of adequate ventilation and minimum property re-entry times).

3.4 Electrical Precautions

The installation and commission of electrical fan and extractor units should be in accordance with Part P of the Building Regulations.

All electrical equipment should comply with the current edition of the IEE Regulations. Items should be properly maintained at all times and handled with care to avoid damage. Portable electrical tools and equipment should be subject to in-service inspections and testing (Portable Appliance Inspections - PAT testing).

Electrical circuits and installations must be properly and adequately safeguarded.

4. TRAINING

All staff must have received training commensurate with their duties.

The Construction Skills Certification Scheme (CSCS) enables every competent technician, who may not have an NVQ, to be registered with a CSCS card. The CSCS card also provides evidence that the technician holds a valid CSCS Health and Safety Awareness Training Certificate.

NOTE: General advice on training is available from the Association.

5. THEORY OF AIR QUALITY AND ATMOSPHERIC MOISTURE

To ensure the health and comfort of the occupants, all dwellings need a constant supply of fresh air. The amount of fresh air required will be dependent on the dwelling and the number and lifestyle of occupants within it. An appropriate supply of fresh air is also important to control condensation, pollutants, and to ensure the safe and efficient operation of some combustion appliances i.e. gas fires etc.

5.1 Condensation

Air normally contains water vapour in varying quantities and its capacity to do so is related to temperature. The warmer the air the greater the capacity to hold moisture. The amount of moisture in the air is usually expressed as Relative Humidity (RH), which is a percentage of the maximum amount of moisture vapour the air has the capacity to hold at a given temperature.

Air is saturated when it cannot contain any more water vapour at the existing temperature; under these conditions it is said to have reached a relative humidity of 100%.

If the temperature of the air falls until saturation point occurs, the air is at a critical temperature at which it cannot hold any more water - this temperature is known as the dew point. At this temperature it will result in water vapour being forced to condense out as liquid water.

Vapour pressure dictates the direction of movement of atmospheric moisture vapour, and movement occurs from areas of high vapour pressure to low. Vapour pressure is governed by the amount of moisture in the air, with warmer air capable of holding more moisture and exerting a higher pressure.

Problems associated with high levels of relative humidity in the internal environment such as condensation and mould growth are becoming increasingly commonplace.

The drive to reduce energy use and increase thermal performance in dwellings has, in part, been achieved by the control of drafts and the controlled release of moisture through the fabric of the building. This in some situations has resulted in properties that are incapable of managing atmospheric moisture during periods of high moisture production. It therefore follows that the planned management of atmospheric moisture through forced or passive ventilation must be designed around the use and occupation style of the dwelling.

5.2 Mould

BS5250: 2011 states: "*As a guide if the average humidity within a room stays above 70% for several days, the relative humidity at external wall surfaces will be above 80%, which is high enough to support the germination and growth of moulds.*"

This is considerably less than the 100% relative humidity that is required for surface condensation to occur. The presence of liquid water is not required for mould growth. With a suitable substrate and adequately high relative humidity levels, mould spores will germinate and growth will occur.

The main requirement for the development and growth of mould is a source of moisture. However, food, oxygen and temperature are also important. The susceptibility of material to mould growth will vary.

6. INSPECTIONS

6.1 General

Inspections should not normally exceed the instructions received from the client. However, a note should be made of any other relevant problems/defects which are observed, and these should be reported in writing (if deemed appropriate) under separate cover.

6.1.1 Inspections should only be undertaken by person's or surveyors that have been adequately trained in the identification of all forms of dampness and their causes, and are competent to specify the correct rectification measures when defects are discovered. They must have a good working knowledge of all types of building construction. One such standard of training and competence that is recognised is the level achieved by passing the Certificated Remedial Treatment Surveyor (CSRT) examinations.

6.1.2 Survey and reporting should clearly distinguish between forms of dampness that can affect properties, and how the lack of effective ventilation can aggravate these issues. Surveyors therefore must be capable of identifying the types and causes of dampness and specifying the appropriate remedial measures.

6.1.3 The surveyor should be adequately equipped. Adequate equipment normally includes portable ladder (with safety provision for peripatetic working), floor lifting tools, torch, mirror, moisture meter, hygrometer, surface thermometer, air flow meter (anemometer), digital camera and notebook.

Additional surveying aids may be required in accordance with the company's practice and any special features of individual surveys. Further information is available in the Domestic Ventilation Compliance Guide.

6.1.4 The surveyor must have and use appropriate personal protective equipment identified in the risk assessment carried out under the Management of Health and Safety at Work Regulations 1992 and, if necessary, under the COSHH regulations.

6.1.5 Special consideration should be given to properties that have listed status and/or are in a conservation area. Special permissions may be required from the local conservation office in the event that the building needs alteration or other aesthetic or structural changes as a result of installation. This would include the siting of extract vents.

6.1.6 Site Notes:
Irrespective of the scope of the inspection, adequate site notes (preferably including plans and a photographic record) are of prime importance and should be retained. Where appropriate, the following should be recorded: -

- The type and age of the property i.e. bungalow, semi-detached and age of any extensions and type of roof covering (i.e. slate, double roman concrete tiles)
- Building Fabric and condition
- The number of rooms within the property including all wet rooms (wet room definition being a room that can create moisture i.e. it has a tap or toilet)
- The size of the rooms including ceiling heights
- Total internal floor area
- Existing heating system
- All existing ventilation equipment including air bricks and trickle vents
- Where insulation is fitted (i.e. roof space, walls, ceilings)
- External wall construction
- Areas of dampness or mould growth
- The extent of deterioration and the repairs required as assessed at the time of the inspection.
- Occupation, including number of occupants and pattern of occupancy.
- Sources of moisture production
- Information on ambient temperature, relative humidity, and surface temperature of external walls.

6.2 Surveying Practice (includes investigation procedure & inspection process)

6.2.1 General
When inspecting a structure to determine whether there is a ventilation problem, it is essential to consider the possible presence of other sources of dampness [See 6.1.2]. Even if the instructions given are limited to the detection of atmospheric dampness, other problems should be highlighted if they are present and reasonably obvious to a specialist surveyor.

Consideration should be given to a property where occupation levels may change after your survey has been carried out, such as a pre-purchase survey. For example, a 4 bedroomed house currently occupied by 2 people may subsequently be occupied by a family of 6.

Visual observations both externally and internally are important and may provide much of the information needed to arrive at a preliminary diagnosis. Nevertheless, a full understanding of the distribution of dampness in a structure will normally require the use of various moisture measuring techniques. Surveyors should be familiar with the use of such equipment and interpretation of results there from; in particular, the fact that electrical moisture meters give only qualitative readings in masonry. These readings may be affected by salts.

6.2.2 External

Note should be taken of any factors which are likely to lead to water ingress or reduced thermal properties of the building fabric.

Examples may include cracking in masonry walls, defective rainwater goods, damaged roof coverings, poor pointing or defective render, vegetation, shrubs, blocked drains, obstructed air bricks, inappropriate ground levels or design details that restrict drainage or ventilation.

The type and number of airbricks should be noted, both for venting the void beneath a suspended timber ground floor and also where present at higher levels to provide ventilation in rooms. These should be marked on a plan where necessary and reviewed to determine the necessity for additional airbricks. Checks should be made to ensure air bricks are not compromised by internal alterations or retrofit insulation.

6.2.3 Internal

Note should be taken of all obvious factors attributable to a ventilation problem and marked on the site plan. Examples of this may include mould growth to walls (external walls and window and door reveals are more common areas), water staining on windows & window sills, condensate (i.e. free water) on windows and walls, mould growth to the backs of and inside furniture, particularly where placed adjacent to external walls, damp patches of plaster that cannot be attributed to other forms of dampness particularly where they change size and appearance in line with the weather.

6.2.4 Key Observations

Key information from the internal survey is as follows;

- Room sizes including heights
- Number of bedrooms
- Number of occupants (including occasional occupiers & pets)
- Type of ventilation already fitted and whether they are intermittent operation or continuous duty.
- Type of internal doors i.e. fire doors or standard
- The size of the gap between the bottom of the door and the floor covering
- Where gas fires or other open flued appliances are situated
- Number of wet rooms within the property (Kitchen, Bathrooms, en suites, utility rooms)
- Wet rooms with no opening windows

6.2.5 Occupant Engagement
Note should be taken wherever possible of the occupant's lifestyle including how often they use any provided ventilation equipment, whether they open windows on a regular basis and how they use the heating system within the property, and any notable moisture producing activities. It should be noted if windows are open at the time of the inspection as this may impair the findings.

6.3 Inspection & Specification Considerations
During the inspection, there is specific information that is required to ensure that a suitable ventilation strategy can be specified, these are;

6.3.1 Occupation
The amount of people and pets occupying a property has a direct impact on how much moisture is produced and as such should be considered as critical information when determining the correct ventilation strategy for that property.

6.3.2 Heating
The type and use of heating system in a property will also have a direct impact on how a property reacts to moisture production.

6.3.3 Thermal Performance
Thermal performance of the building will determine the amount of energy that is needed to provide comfortable living conditions for the occupants. Older buildings that have poorer thermal performance, such as uninsulated solid walls and floors, will generally have greater temperature differentials between external walls and the air they contain. This can, in some circumstances, result in increased relative humidity at the interface between the two, and potentially lead to mould growth and condensation. Where buildings have been subject to retrofit insulation or other measures to improve the thermal performance of construction elements, this differential should have been reduced.

It is important therefore that retrofit insulation is continuous and is designed to minimise cold bridges and avoid temperature differentials between different areas of the building. Lack of continuity and creation of colder sections may result in localised mould growth.

6.4 Basic equipment used in investigations – use and limitations

Commonly used surveying equipment for ventilation surveys is as follows:

6.4.1 Electrical Resistance Moisture Meter
A hand-held device that measures the resistance between two metal pins, or via a scanner pad. An electronic moisture meter has the advantage of not requiring destructive testing but it must be recognised that electrical moisture meters will produce only qualitative and comparative readings in masonry. Quantitative estimates can ONLY be made using gravimetric or chemical methods. The limitations of an electronic moisture meter must be understood by the surveyor.

Moisture meters cannot differentiate between dampness from one source and that from another. It is therefore necessary to consider all potential causes of dampness before arriving at a conclusion. Further information on correct use of moisture meters is available within PCA guidance note DP1 'The use of Moisture Meters'.

6.4.2 Digital Hygrometers

An instrument used for measuring relative humidity. Most modern hygrometers will typically provide additional information such as ambient temperature and dew point temperature.

NOTE It is essential that all electronic measuring instruments such as thermo-hygrometers are allowed to reach equilibrium with their surroundings before readings are taken.

Hygrometer

6.4.3 Thermometers

A surveyor should have the means to test ambient temperature and the temperature of wall surfaces. A surface thermometer can be utilised to find variations in wall temperature and determine potential cold bridges and areas which may be more prone to problems associated with high relative humidity.

The thermometer should also be used in conjunction with a hygrometer to establish if certain surfaces are below dew point to establish if condensation is occurring.

Infrared surface thermometer

6.4.4 Anemometers (also known as air flow meter)

An instrument for measuring air flow, to establish the efficiency of a ventilation system.

6.4.5 Data Logging

The use of the equipment previously detailed will provide a snap shot of the condition inside the building at the time of the inspection. However, rarely is the surveyor allowed to survey a building at the times when condensation is most likely to occur, i.e. early morning when temperatures are at their lowest.

In addition, humidity levels within a building can fluctuate significantly throughout the day. To overcome this, long-term monitoring is required and data loggers can be left in situ over a period of time and build up a long-term picture of temperature and relative humidity within the building.

Digital Data Logger

6.4.6 Thermal Imaging

Thermal imaging provides a visual aid to temperature differential based on infrared radiation and can be a useful tool in the surveyors arsenal. Thermal imaging can be particularly useful to determine areas of missing insulation in areas such as cavity wall or in inaccessible roof voids, or to help identify cold bridges.

It is important to note that thermal imaging will only show temperature differential and will not show moisture.

7. REPORTS AND SPECIFICATIONS

Following the inspection, a report should be submitted to the client describing accurately the conditions discovered at the time of the inspection. The report must clearly state all areas to which access was restricted or could not be gained.

The report MUST highlight the consequences of dampness in buildings.

8. RECOMMENDATIONS AND SOLUTIONS

8.1 General

As part of the reporting process it is usual to recommend a ventilation strategy that will provide 'adequate' ventilation to the property. This should be in accordance with the latest version of Approved Documents F and L1B.*excludes listed buildings.

> Note: Approved Document F provides guidance on the minimum levels of ventilation in relation to the size and occupancy levels of the building. Older properties and those with non-standard layouts may require additional ventilation strategies that are not dictated in approved Document F. The Domestic Ventilation Compliance Guide should also be considered in conjunction with Approved Document F.

> Note: Approved Document L1B provides guidance on commissioning and minimum energy efficiency requirements in relation to residential ventilation. The Domestic Building Services Guide, which contains maximum specific fan powers for various ventilation systems along with minimum heat exchange efficiency for systems incorporating heat recovery, should also be considered in conjunction with Approved Document L1B.

8.1.1 There are various means of operating ventilation equipment, from a simple manually operated pull cord to separate sensors that measure Relative Humidity and CO_2 and boost automatically

> Note: Additional background ventilation such as trickle vents, air bricks and passive air brick ventilators may be required to ensure that adequate air exchange can be provided so that optimum performance can be achieved. This is particularly relevant for properties with a non-standard layout

8.2 Specification & Selection of systems:

There are 4 main ventilation strategies prescribed in Approved Document F (means of ventilation) which are described below. Common to all ventilation strategies are the following:

Air transfer

To ensure good air transfer throughout the building, there should be an undercut of minimum area 7600mm in all internal doors above the floor finish. This is the equivalent to a 10mm undercut on a standard 760mm door. If this cannot be achieved i.e. a fire door, it is recommended that specialist advice is sought.

Purge ventilation
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 and doors can provide this function. Where this cannot be achieved i.e. a basement with no openable windows, it is recommended that specialist advice is sought.

8.2.1 System 1 – Background ventilators and intermittent extract fans.
The system typically consists of intermittent extract fans installed in wet rooms (i.e. kitchen, bathroom, utility room, en-suites) and background/trickle ventilators located in rooms with external walls. The fans can operate manually or automatically and are designed to work only when there is a need to remove pollutants or water vapour (e.g. during cooking or bathing). As a result there is a high reliance on occupants using the background/trickle ventilators to ensure this system performs adequately, and due to the high volumes of air these extract fans are required to move, they can be perceived as noisy by users.

8.2.2 System 2 - Passive Stack Ventilation (PSV).
The system consists of extract terminals installed in wet rooms connected to vertical 125mm diameter ducts that rise up through a building to atmosphere and background/trickle ventilators located in all rooms with external walls except rooms where a PSV is located. A PSV system is a natural ventilation system and is therefore driven by the forces of wind and temperature.

Applying this ventilation strategy to an existing dwelling could be problematical as the property design/layout may not match the design requirements of the PSV system.

8.2.3 System 3 - Continuous mechanical extract (MEV or dMEV).
An MEV is a centrally mounted, continuous mechanical extract system which is typically connected to a number of "wet rooms" via a system of ductwork and discharges air to atmosphere via a single external terminal/ exhaust.

A dMEV is a continuously operating "wet room" extract fan which operates at a low background rate with an occasional boost facility.

In an existing home both systems are less reliant on purpose provided background/trickle ventilators as the low volumes of air they move can usually be replaced by the higher natural infiltration rates associated with older properties. This, coupled with the fact that continuous mechanical ventilation has a good track record of helping problems associated with poor ventilation, means that these systems are becoming increasingly popular.

8.2.4 System 4 - MVHR – Mechanical Ventilation Heat Recovery
An MVHR system is a centrally mounted "whole home ventilation system" that extracts air from the "wet rooms" of a property and simultaneously supplies air to the "habitable rooms" via a system of ductwork. A proportion of the heat from the extracted air passes over to the supply air via an internal heat exchanger.

Due to the fact that ductwork is required to be provided to every room in the home, applying this method of ventilation to an existing home can prove costly and impractical. It could also be argued that this method of ventilation is less efficient in an existing home due to the higher levels of natural infiltration, and the lower levels of insulation associated with existing homes when compared to a typical new build home.

8.3 Alternative approach

There are also other ventilation strategies that are not prescribed within Approved Document F that can be ideal for existing buildings. These include;

8.3.1 Positive input ventilation (PIV)

PIV systems supply filtered ventilation air to a property, usually via the central hallway or above the stairwell. These systems work on a continuous basis and most have a number of settings meaning the ventilation rates can be matched exactly to the requirements of the individual home.

Both wall and loft mounted PIV systems can recover heat that exists at ceiling level in a home, and both require significantly less maintenance than other forms of ventilation.

Some people can experience a drop in temperature in the central hallway/landing area during times when the outside air is particularly cold. To overcome this, some PIV systems come with heaters to temper the incoming air. Others have intelligent control strategies.

8.3.2 Alternate flow fans with heat retention

These fans are typically installed in “habitable rooms” where problems associated with poor ventilation exist. They work by extracting and supplying ventilation air to the room on an alternate but continuous basis. When ventilation air is being extracted from a room, an integral heat exchanger retains a proportion of its heat which is then provided back to the room when the fan is in supply mode.

These fans are not suitable for “wet rooms”.

These fans can be commissioned to suit the size of the room as they have a number of speed settings. Optional control switches are also available for these systems.

8.3.3 Single room heat recovery (also known as decentralized heat recovery fans).

These are generally installed directly through the wall to atmosphere and consist of two fans (extract and supply) either side of a cross flow heat exchanger. Extracted, vapour laden air passing through the heat exchanger deposits heat which tempers the cooler incoming air. The combination of extraction and supply creates controlled air change for humidity control and air movement which prevents the formation of stagnant air pockets and causes evaporation of surface moisture.

As the description suggests, single room ventilation with heat recovery should be considered as a solution where only an isolated area of a building is affected, or as part of a retro fit system with ducted MVHR.

8.4 Practicalities of installation

Before considering a specific ventilation strategy for a building, consideration should be given to the following;

8.4.1 Type, age, layout & size of the building (also known as optimum design criteria)

Existing buildings and particularly older properties (pre-1930) can be laid out in many ways and as such some ventilation strategies will be less effective than others.

8.4.2 Occupancy level and moisture production.

Occupancy levels have a direct impact on the amount of moisture being produced within a property. For example, the ventilation strategy for 2 elderly people living in a 3 bedroom house will be different for a family of 2 adults and 3 children living in the same house.

Note: Pets, in particular fish tanks, should be considered when making assumptions on occupancy level.

8.4.3 Gas Spillage

Extract fans (particularly intermittent) lower the pressure in a building, which can cause the spillage of combustion products from open-flued appliances. This can include (but is not restricted to) log burning stoves, range type cookers, central and water heating boilers, room heaters and coal fires. When specifying a ventilation strategy for a building consideration must be given to the guidance in Approved Document J.

The consequences of gas spillage can be extremely harmful to the health of the occupants, and should be considered when designing a ventilation system.

8.4.4 Fire Precautions

Where ducting or air transfer grilles pass through or penetrate a fire resisting wall, floor or fire compartment, the required measures to ensure compliance with Approved Document B of the building regulations must be taken, otherwise fire/ smoke can pass through a fire wall via the ducting or grill.

8.4.5 Occupancy Engagement

Careful consideration should be given to occupancy engagement at the design stage. You can design the best system for the property but if the occupier does not use it the system will not function as intended. Some ventilation systems such as intermittent extract fans are heavily reliant on occupancy engagement and as such may not be suitable for all occupants.

8.4.6 Asbestos Containing Materials (ACM's)

Where the fabric of a building will be disturbed by the installation of ventilation equipment, ducting or grilles, a risk assessment shall be carried out in accordance with the requirements of the Control of Asbestos Regulations 2012 and any actions recommended carried out. Artex is one of the most common asbestos containing materials that may be disturbed.

8.4.7 Ground Gases

In areas where ground gases, including Radon are present, then the advice of an appropriate specialist should be sought before designing a system.

A well ventilated building will assist in improving overall indoor air quality and in all but exceptional instances, is unlikely to exacerbate problems with ground gas ingress.

8.5 System Installation

All electrical equipment should be installed strictly in accordance with the manufacturers instructions, relevant building regulations and guidance documents by a competent and suitably trained person. In particular, the recommendations and guidance given in the Domestic Ventilation Compliance Guide 2010 (As amended) should be observed for all installations.

8.5.1 External Grilles
The use of flapped external grilles for any type of ventilation system should be avoided. Integral flyscreens should be avoided also as these can impose significant resistance with air flow which in turn will reduce the efficacy of the ventilation unit.

When installing a wall mounted PIV unit the external grille should be a minimum of 1.5 metres away from a boiler flu (or similar appliance) and if possible you should try and situate the unit on a different elevation to where the boiler is fitted. This prevents flue cases being drawn back into the building.

Consideration should be given when installing ventilation equipment whether external access for drilling a core hole and fitting the external vent will cause access difficulties; such as high rise flats or a 3 storey building.

When installing extractor fans the external grille should be a minimum of 300mm from a gas fired boiler flu and 400mm from an oil-fired heating boiler. The recommendation is to work on a minimum of 500mm distance from any boiler flu.

8.5.2 Fan siting
Wherever possible, extractor fans should be fitted diagonally opposite to the entrance door of the room in which the fan is fitted. This is to ensure that the make up air entering the room is drawn across the maximum area of the room.

Where a wall mounted PIV unit is fitted within a building, the unit should always be fitted as close as possible to the external wall where it draws air from to ensure that the inlet pipe is as short as possible. If any of the inlet pipe is exposed to the internal environment it must always be insulated otherwise there is a real risk of condensation forming on this cold section of pipe.

8.5.3 Ducting
When installing ducting in an unheated void such as a roof space the ducting should always be insulated. This reduces the chance of moisture in the extracted air condensating in the duct before it is expelled to outside air.

The use of flexible ducting should always be kept to an absolute minimum and should not be installed on duct runs greater than 1m. Flexible ducting causes airflow resistance and affects fan performance.

8.5.4 Windowless Bathrooms

We would not recommend installing intermittent extractor fans to bathrooms that do not have an opening window as the chances of moisture laden air migrating to different areas of the property and causing mould / condensation related issues elsewhere will be exponentially higher.

8.5.5 Extractor hoods in kitchens
Where an externally vented extractor hood is fitted and you are considering a System 3 (MEV/ dMEV) type installation it is acceptable to install a separate fan to the kitchen to provide separate background ventilation.

8.6 System commissioning

8.6.1 It is a requirement under the building regulations that all fixed ventilation systems that can be tested and adjusted, shall be commissioned and a commissioning notice given to the Building Control body.

8.6.2 Ventilation equipment should be tested and commissioned once all the specified system has been completed i.e. ductwork and grilles.

9. POST INSTALLATION SERVICING & TESTING

9.1 In order to maintain an adequate level of efficiency for any ventilation system, periodic maintenance will be essential and must be undertaken in accordance with the manufacturers recommendations. Original manufacturer filters and spares should always be used.

9.2 Where testing of an existing system is required for instances such as litigation, reference should be made to BSRIA guide BG46 / 2015 for additional information

9.3 You should notify the building owner / occupier in writing of the future maintenance and servicing requirements of the equipment you have installed; including an indication of future costs and the work required.

10. OTHER SOURCES OF INFORMATION

This Code of Practice should be read in conjunction with;

British Standards

From: BSI Publications, Linford Wood, Milton Keynes MK14 6LE)

- BS 5250:2011 – Code of practice for control of condensation in buildings
- BS 6100: 2009 Part 5-Glossary of Building & Civil Engineering Terms
- BS 8102:2009- Code of Practice for Protection of Structures against water from the ground.
- BS EN ISO 9000-Quality Management and Quality Assurance Standards.
- BS EN 13141-1:2004 - Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 1: Externally and internally mounted air transfer devices
- BS EN 13141-2:2010 - Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 2: Exhaust and supply air terminal devices
- BS EN 13141-3:2004 - Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 3: Range hoods for residential use
- BS EN 13141-4:2011 - Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 4: Fans used in residential ventilation systems
- BS EN 13141-6:2014 - Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 6: Exhaust ventilation system packages used in a single dwelling
- BS EN 13141-7:2010 - Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 7: Performance testing of a mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for single family dwellings
- BS EN 13141-8:2014 - Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 8: Performance testing of un-ducted mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for a single room
- BS EN 13141-9:2008 - Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 9: Externally mounted humidity controlled air transfer device

- BS EN 13141-10:2010 - Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 10: Humidity controlled extract air transfer devices
- BS EN ISO 13788:2012 - Hygrothermal performance of building components and building elements – Internal surface temperature to avoid critical surface humidity and interstitial condensation – Calculation methods
- BS EN ISO 13789:2007 - Thermal performance of buildings – Transmission and ventilation heat transfer coefficients – Calculation method
- BS EN 15026:2007 - Hygrothermal performance of building components and building elements – Assessment of moisture transfer by numerical simulation

BRE

From: BRE Bookshop, BRE, Garston, Watford WD2 7JR

- Digest 139. Controlling moulds and lichens. Garston: BRE.
- Digest 369 – Interstitial Condensation.
- Digest 398. Continuous mechanical ventilation in dwellings: design, installation and operation. Garston: BRE.
- Good Practice Guide 174, Limiting thermal bridging in new dwellings. London: TSO.
- Good Practice Guide 183, Limiting thermal bridging in existing dwellings. London: TSO.
- GR5 Diagnosing the causes of dampness
- Report 262. Thermal insulation: avoiding risks. Garston: BRE.
- Report 466 - Understanding Dampness – effect, diagnosis, and remedies. Garston: BRE
- IP 1/06. Assessing the effect of thermal bridging at junctions and around openings. Garston: BRE. March 2006.
- IP 5/06. Modelling condensation and airflow in pitched roofs. Garston: BRE. April 2006.
- IP 13/94. Passive stack ventilation systems: design and installation. Garston: BRE. July 1994.
- IP 19/88 – House Inspection for Dampness.

Property Care Association (Downloadable from www.property-care.org)

- Certificated Surveyor in Remedial Treatment (CSRT) – Examination syllabus
- Certificated Surveyor in Structural Waterproofing (CSSW) – Examination syllabus

Other publications

- Approved Document B Means of Escape
- Approved Document F Ventilation. Applicable in England and Wales.
- Approved Document J Gas Spillage
- Approved Document L1B Conservation of Fuel & Power
- Approved Document P Electrical Safety
- BSRIA Guide BG46/ 2015
- CIBSE Guide B. Heating, Ventilating, Air Conditioning and Refrigeration. Available from the Chartered Institution of Building Services Engineers, Delta House, 222 Balham High Road, London SW12 9BS.
- Domestic Ventilation Compliance Guide

- Energy Saving Trust. GPG 268 – Energy efficient ventilation in dwellings – a guide for specifiers. 2006.
- HM Government - Domestic Building Services Compliance Guide
- Technical Handbooks. Applicable in Scotland. Available online from Scottish Building Standards at http://www.sbsa.gov.uk.
- Technical Booklet K Ventilation. Applicable in Northern Ireland. Available online at www.buildingregulationsni.gov.uk.

11. LEGISLATION

The following legislation is referred to in this code:

The Health and Safety at Work etc Act 1974

Employers should satisfy themselves that they have knowledge of the duties placed on them by all relevant legislation.

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