Code of Practice - Ventilation- Mechanical Extract Ventilation (MEV) + Mechanical Ventilation with Heat Recovery (MHVR)

Contractors Requirements & Competency

This section outlines the general Standards & Specifications that Contractors, products and installation methods must conform to. The installation of mechanical ventilation must be carried out by suitably qualified individuals in accordance with manufacturer's guidelines and industry best practice as a minimum.

Product Standard & Specification

All products must conform to the appropriate BS, EN or IS standard for that particular measure. As a minimum, the following Standards should be satisfied:

- COMMISSION DELEGATED REGULATION (EU) No 1254/2014 of 11 July 2014 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of residential ventilation units
- I.S. EN 13141-1:2004 Ventilation for buildings. Performance testing of components/products for residential ventilation. Externally and internally mounted air transfer devices.
- B.S. EN 13141-4:2011 Ventilation for buildings. Performance testing of components/products for residential ventilation. Fans used in residential ventilation systems.
- I.S. EN 13141-5:2004 Ventilation for buildings. Performance testing of components/products for residential ventilation. Cowls and roof outlet terminal devices.
- I.S. EN 13141-7:2011 Ventilation for buildings. Performance testing of components/products for residential ventilation. Performance testing of a mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for single-family dwellings.
- I.S. EN 13141-11:2015 Ventilation for Buildings - Performance Testing of Components/products for Residential Ventilation Part 11: Supply Ventilation Units
- I.S. 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
- I.S. 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

- I.S. EN ISO 9972:2015 - Thermal Performance of Buildings - Determination of Air Permeability of Domestic Buildings – (Single or Single & Multi) Fan Pressurization Method
- BS 8233:2014: Sound insulation and noise reduction for buildings Code of Practice.
- I.S. EN ISO 9972:2015 - Thermal Performance of Buildings - Determination of Air Permeability of Domestic Buildings – (Single or Single & Multi) Fan Pressurization Method
- Department of Environment, Community & Local Government document Installation and Commissioning of Ventilation Systems for Dwellings – Achieving Compliance with Part F 2009.

Building Regulations

- Building Regulations (Part B): The system must be suitable for incorporation onto structures so that it does not compromise the property's ability to resist internal fire spread within the structure and external fire spread.
- Building Regulations (Part C): When installed as per the system supplier's guidelines, the system should not affect the property's ability to resist weather and ground moisture.
- Building Regulations (Part D): When installed as per the system supplier's guidelines, the system should meet the Building Regulations requirements for materials and workmanship.
- Building Regulations (Part F): The insulation should also be suitable for use on a property and meet the ventilation requirements.
- Building Regulations (Part J): Correct installation should also satisfy the Building Regulations such that the installation does not increase the risk of the property catching fire through the use of a heat producing appliance.
- Building Regulations (Part L): The ventilation system shall conserve energy in keeping with the Building Regulations

The design and installation of the recommended works must not compromise the ventilation, air quality, humidity (and the potential for condensation) and quality of living environment in the home. Particular care must be given to the potential impact on the living environment in the home resulting from any measures installed under the Programme. It is the duty of the Contractor to prevent any detrimental changes to the living environment and to recommend to the Customer on any measures necessary to ensure that there is no detrimental change to the living environment as a result of the works. (See Section 5 on Ventilation)

Mechanical Extract Ventilation (MEV)

- Mechanical Extract Ventilation includes Demand Control Ventilation.
- A MEV system should be considered where it is intended to achieve relatively low air leakage rates, typically 5 $m^3/hr/m^2$ or less.
- Only MEV systems that are compliant with the Ecodesign Energy Labelling Directive with an SPI of no greater than 1.08 W/m3/h or included in SAP Appendix Q and that have a specific fan power (SFP) no greater than 0.3 W/(l/s) should be installed.

- Where continuous extract ventilation is proposed, the minimum ventilation rate provided should be in accordance with S.R. 54:2014[1].
- The sizing of appropriate ductwork should be in strict accordance with the size and type of ductwork that formed part of the SAP Appendix Q testing of the ventilation unit. Note the specification of ductwork in SAP Appendix Q is currently categorised as: 'Flexible duct', 'Rigid duct' or 'No duct'. Where a semi rigid duct is proposed it must conform with SAP Appendix Q requirements and listed as complying with 'Specification requirements applicable to the utilisation of Rigid duct performance data within the Standard Assessment Procedure (SAP) for dwellings with Semi-Rigid duct systems fitted to balanced whole-house mechanical ventilation systems'.
- Where an open-flued heat-producing appliance is located in a dwelling that also contains mechanical extraction, it should be installed and commissioned in accordance with Building Regulations (Part J) and S.R. 54:2014.
- Background ventilation: A continuously running MEV system partially depressurises the dwelling. To allow for sufficient replacement air, each habitable room should be fitted with background equivalent ventilation area of at least 3,125 mm^2, as per S.R. 54:2014. Equivalent area is measured in accordance with the method specified in IS EN 13141-1: 2004. Background ventilation should not be installed in a wet room. Care should be taken to ensure adequate cross ventilation is provided throughout the dwelling.
- Purge ventilation for habitable rooms and wet rooms should be provided in accordance with S.R. 54:2014. In wet rooms the MEV system is acceptable as purge ventilation where the room does not have an external wall, although it may take longer for the MEV system (even at boost level of flow rate) to purge the room in question. For rooms only containing a WC, an opening window is adequate for the purposes of purge ventilation. Where there is no window in the WC, the MEV system should provide extraction at the rate provided for in S.R. 54:2014.

Mechanical Ventilation with Heat Recovery (MVHR)

- A MEV system should be considered where it is intended to achieve relatively low air leakage rates, typically 5 $m^3/hr/m^2$ or less.
- Only MVHR systems are compliant with the Ecodesign Energy Labelling Directive with an SPI of no greater than 2.88 W/m3/h or included in SAP Appendix Q and that have a specific fan power (SFP) no greater than 0.8 W/(l/s) with a minimum Heat Recovery Efficiency of 85% should be installed.
- The MVHR system should be capable of an extract rate from each wet room at least equal to that specified in S.R. 54: 2014. It is not recommended to connect cooker hoods to Mechanical Ventilation with Heat Recovery systems. Where cooker hoods are connected, the Building Regulations (Part B and Part F) and the guidance under fire precautions in BRE Digest 398 "Continuous mechanical ventilation in dwellings" should be followed.
- Where continuous extract ventilation is proposed, the minimum ventilation rate provided should be in accordance with S.R. 54:2014.
- The sizing of appropriate ductwork should be in strict accordance with the size and type of ductwork that formed part of the SAP Appendix Q testing of the ventilation unit. Note the specification of ductwork in SAP Appendix Q is currently categorised as: 'Flexible duct', 'Rigid

[1] S.R. 54:2014 Code of Practice: Methodology for the energy efficient retrofit of existing dwellings

duct' or 'No duct', where a semi rigid duct is proposed it must conform with SAP Appendix Q requirements and listed as complying with 'Specification requirements applicable to the utilisation of Rigid duct performance data within the Standard Assessment Procedure (SAP) for dwellings with Semi-Rigid duct systems fitted to balanced whole-house mechanical ventilation systems'

- Open flued combustion appliances are not recommended in dwellings fitted with Mechanical Ventilation with Heat Recovery where the system might interfere with the operation of the appliance and combustion, in accordance with Building Regulations (Part J). All extract points should be treated as if they were extract fans. Further guidance is available in BRE 398 "Continuous Mechanical Ventilation in Dwellings". It is recommended that a spillage test be carried out before and after installation of the ventilation system, with the appropriate spillage test procedure, in accordance with Building Regulations (Part J)
- The minimum capacity of a Mechanical Ventilation with Heat Recovery system should be based on the calculated general ventilation rate, adjusted to allow for air infiltration due to permeability of the building fabric, as per S.R. 54:2014.

Installation Standard & Specification

a. It is essential that the original design is undertaken by a competent designer in accordance with manufacturers' guidance and established good practice.

b. Ventilation systems must be installed in accordance with:

- Department of Environment, Community & Local Government[2] document entitled *Installation and Commissioning of Ventilation Systems for Dwellings – Achieving Compliance with Part F 2009*.
- Manufacturer's guidelines
- S.R. 54:2014 Code of Practice: Methodology for the energy efficient retrofit of existing dwellings
- Industry best practice
- The Electro-Technical Council of Ireland Limited (ETCI) National Wiring Rules for Electrical Installations, Fourth Edition ET101:2008

c. The suitability of connection of a continuous fan system to a cooker hood must follow the manufacturer's guidance.

d. To ensure cross-ventilation, i.e. good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm^2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door.

e. In order to meet extract requirements, the system may require a higher extract or boost capacity depending on the number of wet rooms (kitchens, bathrooms, utility room, etc.). The extract rate to be provided for each wet room is specified in S.R. 54.

f. Ventilation systems shall be designed to minimise disturbance caused by noise. Fan units should be sized to run at their optimum speed and to provide suitable performance while minimising noise.

g. Location of fan unit

[2] Now under the Department of Housing, Planning, Community and Local Government

- The fan unit should be located as specified by the system designer.
- Fan units should be installed to allow sufficient space to undertake routine maintenance on filters and heat exchanger block as appropriate and for replacement of the whole unit or key components at the end of its operational life.
- The fan unit should be installed on a suitable structure, which is stable and level. Locating the unit in an upper floor cupboard (insulated for sound proofing) should be considered.
- If the fan unit is not pre-insulated, insulation should be added to minimise the potential of condensation forming within, or on, the fan unit casing and should not create a fire risk.
- A condensate drain should be installed from the fan unit to an appropriate drain location and should be adequately secured. The condensate pipe should be installed to have a minimum 5-degree fall from the fan unit. The condensate drain must also be adequately insulated to prevent freezing where passing through an unheated space.

h. Installation of ducts

- Where ducts pass through fire barriers, they must be appropriately fire stopped in accordance with the requirements of Part B (Fire Safety) of the Building Regulations.
- Ducts should be sized to minimise pressure loss and noise generation. This is achieved by sizing of the ducts to limit the air velocity.
- A hole of a suitable dimension through the fabric of the building will be required for the installation of the duct. The hole will need a slight downward angle towards the outside to prevent water ingress.
- Where ductwork penetrates a building's air barrier, the continuity of the barrier must be maintained.
- The routing of ducts should aim to minimise overall duct length and minimise the number of bends required. It is particularly important to minimise bends in main ducts operating at higher air velocities.
- Where room air extract terminals/grilles are not fitted with filters, access to ducts for cleaning should be provided, where possible.
- Ducting should be insulated where it passes through unheated areas and voids (e.g. loft spaces), with material that has a U-value of 1.6 W/m2K, to reduce the possibility of condensation forming. Ducting extending externally above roof level should be insulated or a condensate trap should be fitted just below roof level.
- Ducts within the building's heated envelope carrying cold air between the external supply/discharge terminals and the fan unit should be insulated and wrapped additionally with a vapour barrier outside the insulation to prevent condensation occurring within the insulation material.
- Horizontal ducting, including ducting in walls, should slope slightly downwards away from the fan to prevent backflow of any moisture into the product. Vertical ducting will require a condensate trap in order to prevent backflow of any moisture into the product.
- Perforated insulated flexi duct should not be used between the fan unit and external discharge terminal to prevent condensation occurring within the insulation material.
- Ducts should not be installed where they can be damaged, for example run across open loft areas where they may be stood on or have items placed on them, breaking seals and possibly crushing the duct.

- Connection of components should not result in significant airflow resistance. Components should be proprietary and fit easily together without distortion.
- Rigid duct runs must be adequately supported. Flexible ductwork should be supported at suitable intervals to minimise sagging. It is especially important to support ductwork at the connections to the inlet terminal or onto the ventilation unit. Clips and supports for ductwork should be spaced at regular, equal distances and in accordance with the ductwork
- Flexible duct should be pulled taught to ensure that the full internal diameter is obtained and flow resistance minimised. There should be no peaks and/or troughs in flexible ductwork.
- Bends in flexible duct should have a minimum inside radius equal to the diameter of the duct. If tighter bends are required, rigid bends should be used.
- It is recommended that ductwork be boxed in such that the ductwork is still accessible to carry out any works.

i. Duct connections

- All duct connections require sealing to ensure the connections are airtight. Where ducts are installed against a solid structure this can be difficult to achieve. In such locations preassembly of duct sections should be considered. This will require that connections are permanent to ensure the seal is maintained during installation. It is recommended to carry out leak testing on connections.
- Ducting should be adequately clamped to the inlet and outlet terminals to avoid detachment, which would result in warm, moist air being discharged into the space.
- All duct connections should be fully sealed to ensure no leakage of air can occur.
- Where access to ducts will not be possible after construction is complete, i.e. ductwork within floor and wall voids, permanent connection and sealing with an appropriate non-hardening sealant should be applied.
- Connection of lengths of flexible duct must use a rigid connector and jubilee clips or similar to ensure a long-term seal is achieved. Connections of lengths of flexible duct should not be taped-only

j. Supply and extract terminals/grilles

- All room air extract terminals should be installed as detailed by the system designer.
- Room air extract terminals should be installed as close to ceiling level as practical, to ensure warm moist air is removed from each space.
- Room supply air terminals must not be located adjacent to walls, unless designed to discharge air away from the wall, as this may result in down draughts.
- It is recommended that the supply and extract air terminals are separated by a minimum of 300 mm horizontally if placed on the same façade of a building or per the manufacturer's instructions.
- The number and location of terminals installed in a space should ensure effective air distribution and ensure that air noise is not a nuisance when the system is operating at boost airflow rates.
- If the supply and extract air terminals are fixed, ensure that effective balancing of the system can be achieved. If this is not provided within the fan unit then dampers should be installed within the duct system to allow balancing when the system is commissioned.

- If terminals/grilles are adjustable, ensure each terminal/grille can be locked in its commissioned position once the system has been balanced.

k. Supply and discharge terminals – roof and wall mounted

- Proprietary terminals should be used.
- Ensure that the free area[3] of the terminal opening is a minimum of 90% of the free area of the ducting being used.
- The location of the external discharge terminal should ensure that the potential for recirculation of extract air through the supply air terminal is minimised.

l. Controls

- Controls for ventilation systems should be suitable for continuous operation and should provide an indication to the occupant that the system is operating correctly or if there is a fault/maintenance required.
- Continuous ventilation systems should not allow the occupier to turn off the fan other than at the local isolator. Provision of an on/off function will result in the fans being operated intermittently and the required continuous airflow ventilation rates not being achieved.
- Where sensors are not integrated within the fan unit, only sensors specified by the manufacturer of the fan unit should be installed.
- If sensors are duct mounted, their location should be noted and provisions for access for maintenance or replacement made.
- If control of the fan speed is undertaken manually, the operation of the fan in boost mode should be made obvious to minimise the likelihood of it being left in this mode unnecessarily.
- In humidity controlled systems, controls should be provided which allow for either manual or automatic switching to boost whenever a wet room is in use. Automatic controls should be set to switch to boost when relative humidity within the wet room reaches 70 %, and that the boost remains on until the relative humidity reduces to 50 %.
- Installation of manual controls for the system must meet the requirements of Part M of the Building Regulations.
- Installation of room sensors should follow the manufacturer's guidance on positioning and in accordance with ETCI guidance.
- Where control of the fan speed is undertaken manually, switching should be provided locally to each of the spaces being served, e.g. bathrooms, kitchen, utility room, etc. Provision of a single centrally located switch is insufficient and will result in fans being left in inappropriate modes of operation.

m. Handover and Commissioning

- The installer must make good, to the satisfaction of the Customer, any accidental damage sustained by a property where this is a direct result of their work or installation.
- Following installation, the ventilation system must be commissioned to verify that the installed system achieves the designed level of ventilation.

[3] As per Building Regulations (Part F), 'free area' is the geometric open area of a ventilator.

- Commissioning must be completed in accordance with the Installation and Commissioning of Ventilation Systems for Dwellings – Achieving Compliance with Part F 2009 and should include the following as a minimum:
    - Check that air flow direction is correct at each supply and extract terminal.
    - The system should be balanced to ensure that design airflow rates are achieved at each room terminal/grille.
        - Ensure all internal and external doors and windows are closed, including rooms in which measurements are being carried out.
        - Air flow measurements should be performed using a calibrated airflow device with proprietary hood attachment and results recorded in litres per second (l/s).
        - Record the airflow rate at each room terminal onto the commissioning sheet along with the design airflow rate for each terminal. Measurements should be taken at both maximum rate and minimum rate fan speeds.
        - The instrument should be calibrated annually and be capable of achieving an accuracy of ± 5%. Measurement of air flows should be performed using equipment that has been calibrated at an INAB accredited calibration centre.
    - Upon completion of the installation, MVHR systems should be protected from dust during the retrofit of the dwelling. The system should be switched off and dust covers applied to air valves.
    - Prior to completion of the home, the system should:
        - be checked to ensure it is clear from dirt and dust that may have accumulated during construction. This includes all including ductwork and filters.
        - be commissioned to confirm performance
        - be adjusted by using the air valves and controls to achieve the correct balancing and airflow rates
        - have air valves locked in position after correct commissioning and balancing.
    - Any changes from the design should be referred back to the designer and noted in the commissioning documentation.
- A digital copy of the commissioning documentation should be maintained.
- An operation and maintenance manual should be provided to the end user once the system has been fully installed and commissioned. The instructions in the manual should be presented in a way that is clear and easy to understand and relate directly to the installed system. The following information should be provided where relevant:
    - Manufacturer's and installer contact details;
    - Use of air inlets for background ventilation;
    - Location of and setting automatic controls (e.g. humidity and timer controls);
    - Location and use of on/off settings for mechanical ventilation system;
    - Adjustable extract air terminals on vertical PSV ducts;
    - Instructions on how cleaning and maintenance should be carried out;
    - Location of filters if not installed within the fan unit. (If no filters installed on extract terminals, information on how ducts are accessed for replacement/cleaning and recommendations for how cleaning is to be undertaken);
    - Recalibration or checking of sensors and their location;

- The commissioning sheet and completion certificate, as described in Installation and Commissioning of Ventilation Systems for Dwellings – Achieving Compliance with Part F 2009, should be appended to the operation and maintenance manual.

Important guidance note for Electrical works associated with the Deep Retrofit Pilot Programme

- All electrical works under the Deep Retrofit Pilot Programme must be carried out by a suitable qualified professional and be in full compliance with current ETCI rules.
- Earthing and Bonding must be in accordance with ETCI 101:2008 Chapter 54 (544 Equipotential bonding conductors) and Annex 63B (Guidelines for certification for alterations to existing installations).
- In order to comply with ETCI rules the following note from ETCI 101:2008 Annex 63B must be taken into consideration:

  As referred to in Annex 63B "Before commencing new work, the installer should assess the existing installation to ensure that it will not impair the safety of the proposed new work, and likewise the new work will not impair the safety of the existing installation. Should the installer become aware of any defect in any part of the installation that would impair the safety of the new work, the client must be informed in writing thereof. No new work should commence until these defects have been made good."
- If the earthing/bonding is less than 6mm^2 then the ventilation installer must either (a) issue an 'Electrical safety notice to the home owner' (signed by the installer) to notify them that their current wiring installation is not to current ETCI rules and work cannot commence on the installation until the wiring has been rectified to current ETCI rules or, (b) the bonding must be rectified to current ETCI rules by a competent suitably qualified person.
- Work may commence on a ventilation system with earthing/bonding of 6mm^2 and above however:

  Heating system with earthing/bonding of less than 10mm^2 the ventilation installer must issue an 'Electrical safety notice to the homeowner' to notify them that their current wiring installation is not to current ETCI rules.
- Where bonding arrangements are found not to be in accordance with the current ETCI National Rules then the consumer shall be informed in writing of the situation and advised to have the electrical installation checked and rectified by a competent person. In such circumstances, the 'Electrical safety notice to the home owner' can be issued to a homeowner when an electrical installation is not to current ETCI regulations. The 'Electrical safety notice to the home owner' can be downloaded from the following link: http://www.seai.ie/Grants/Better_energy_homes/contractor/Newsletter/Electrical_safety_notice_to_the_home_owner.pdf

Additional Guidance

- Good Practice Guide 268, Energy efficient ventilation in dwellings – a guide for specifiers (Energy Saving Trust)