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Installation and Commissioning of Ventilation Systems for Dwellings - Achieving Compliance with Part F 2019

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Corrections issued since publication

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Corr. No.	Amendments and Text affected
ACF (i)	**Table 1, 3.0 Ventilation air inlets and internal air transfer, page 8:** a. Background ventilation/air inlets should be provided to meet the minimum required area of ventilation specified by Section 1.2.4 of TGD F and should be compatible with the continuous mechanical extract ventilation system. is replaced with a. For any design air permeability, controllable background ventilators having a minimum equivalent area of 2,500 mm^2 should be fitted in each room, except wet rooms, from which air is extracted and should be compatible with the continuous mechanical extract ventilation system.

Contents

Acknowledgements

Section 1: Introduction

This guide provides detailed guidance for persons installing fixed ventilation systems in new and existing dwellings to help them comply with installation and commissioning requirements of the Building Regulations.

This guide is referenced in Technical Guidance Document F. It provides installation guidance for ventilation systems as defined by Technical Guidance Document F.

It is important to note that the guide covers a range of frequently occurring situations but is not exhaustive and alternative means of achieving compliance with the ventilation requirements in the Building Regulations may be possible.

This guide also references publications which include information on good practice for design and installation over and above the minimum regulatory provision.

The co-operation of the UK authorities (Department of Communities and Local Government) is gratefully acknowledged in allowing the use of the information in its publication "Domestic Ventilation Compliance Guide" for official use in Ireland.

1.1 Status of guide

Technical Guidance Documents are intended to provide practical guidance but they are not intended to be comprehensive. Consequently, there may be references in Technical Guidance Documents to other documents which will provide more detailed information and assistance on parts of the guidance. This guide is one of those documents. It provides more detailed information on the guidance about compliance with the installation and commissioning and provision of information in Technical Guidance Documents F and L which apply when installing fixed ventilation systems in new and existing dwellings.

Whilst the guidance in this document is for systems defined in Technical Guidance Document F, the installation and commissioning guidance given can also be considered good practice for other ventilation systems.

In addition to providing practical guidance on how the statutory requirements in the Building Regulations may be met, this guide also contains recommendations for an inspection checklist and for recording the equivalent area of background ventilators.

1.2 How to use this guide

Section 2 of the guide provides guidance on the installation and commissioning of mechanical extract ventilation systems. **Section 3** of the guide provides guidance on the installation and commissioning of mechanical ventilation systems with heat recovery. **Section 4** of the guide provides guidance on the installation and commissioning of natural ventilation systems. The purpose of the guide is to ensure that installations satisfactorily meet the design standards specified in TGD F and TGD L. This is to ensure adequate ventilation whilst minimising energy use and environmental problems such as noise and thermal discomfort.

The commissioning procedures define the method by which a system is checked and assessed before handover to the end user. Commissioning of natural ventilation openings is based on visual checks. For mechanical ventilation (both intermittent and continuous), airflow measurements are included as part of the commissioning process. Ventilation systems should be installed and commissioned by competent installers. Verification of these flowrates to the intended design flowrates should be carried out by independent third parties e.g. NSAI Certified or equivalent. The verification of flowrates by the independent third party should be included as part of the ancillary certificate issued for the dwelling ventilation system.

Supplementary information is in *italic font with a grey background.* It is intended to assist in understanding of the guidance or to direct readers to sources of additional information but it is not part of the guidance. In some cases, there are links to best practice guidance that goes beyond the minimum requirements.

Verification of the flowrates to the intended design flowrates and leakage of the ductwork should be carried out as specified in I.S. EN 14134: 2004: *Ventilation for buildings – Performance testing and installation checks of residential ventilation systems*, by independent third parties e.g. Irish National Accreditation Board (INAB), NSAI Certified or equivalent.

For the purpose of this guide, “natural ventilation systems” means those systems as described in Section 1.2.4 of TGD F. This includes those that employ intermittently used mechanical extract fans installed in wet rooms.

Section 5 details the information that should be left with the building owner on completion of the installation of the system. This information is to aid the user to correctly operate and maintain the system.

Section 6 contains an installation and commissioning checklist that should be completed for all systems. It requires specific visual and performance checks on the installation, and includes a section for commissioning and recording the airflow measurements for intermittent and continuous mechanical ventilation.

1.3 Key terms

Background Ventilator	A secure ventilation opening generally located in a wall or window for the purpose of provision of general ventilation, generally incorporating a controllable ventilation grill, which can be fully closed.
Mechanical Ventilation with Heat Recovery (MVHR)	A ventilation system that comprises central ducted supply and extract fans with air being supplied into the habitable rooms via a heat recovery unit.
Equivalent Area	The area of a single sharp-edged hole that passes the same air volume flow rate at the same applied pressure difference as the vent being tested.
Free Area	The geometric open area of a ventilator or terminal.
Intermittent Extract Fan	This is a mechanical fan which does not run all the time. It operates when a particular need is identified, e.g. when there is a particular need to remove pollutants or water vapour (e.g. during cooking or bathing). Intermittent operation may be in response to automatic control responding to a particular stimulus, or manual control when need identified by user.
Passive Stack Ventilation (PSV)	A ventilation system using ducts from high level locations within rooms to terminals on or above the roof, which provides a flow of air by a combination of the natural stack effect, i.e. the movement of air due to the difference in temperature between inside and outside, and the effect of wind passing over the roof of the dwelling.
Single Room Heat Recovery Ventilators (SRHRV)	Comprise local continuously running balanced decentralised supply and extract fans in a single or multiple room(s) with Heat Recovery.

For other terms used throughout this guide, reference should be made to the glossary section in Technical Guidance Document F.

Section 2: Continuous Mechanical Ventilation Systems

The information in Tables 1 and 2 provide guidance on installation and procedures for inspection, air flow measurement, and testing and commissioning of continuous mechanical extract ventilation (MEV) systems for dwellings. The guidance for the performance of continuous MEV systems is provided in Section 1.2.2 of TGD F.

Table 1: Mechanical Extract Ventilation installation requirement		
	Installation clauses	**Supplementary information**
1.0 Continuous extract fans: centralised **Continuous extract fans: decentralised**	**Manufacturer's details and specific instructions** a. The information provided in this Table sets out the minimum recommended procedures for typical MEV System installation. b. For further product-specific information, refer to the manufacturer's installation instructions.	
	Location of Fan unit a. The fan unit should be located in accordance with the manufacturer's instructions. b. The final location of the equipment should allow sufficient space to allow access for maintenance c. The fan unit should be installed to allow sufficient space for end of life replacement of the whole unit or key mechanical/electrical components. This should be achievable without the need to remove fixed structures or significant lengths of connected ductwork. d. The fan unit should be installed on a sound structure, which is stable and	*The location of the fan unit should be chosen to minimise overall duct run length, both from the internal extract terminals/grilles to the fan unit and from the fan unit to the external discharge terminal.* *Where a fan unit is installed in an unheated space, it may need to be insulated to minimise the risk of condensation in the fan unit.*

Table 1: Mechanical Extract Ventilation installation requirement		
	Installation clauses	**Supplementary information**
	level.	
2.0 Ductwork	**Duct Installation-general** a. Ducts should be sized to minimise pressure loss and noise generation. This is achieved by sizing ducts to limit the air velocity. Section 5 of Building Engineering Services Association Good Practice Guide to Low Energy Ventilation for Residential Buildings TR/35 provides guidance on sizing of residential ductwork. b. The routing of ducts should minimise overall duct length and minimise the number of bends required. It is particularly important to minimise bends in main ducts at high velocities. c. Ductwork should be insulated where it passes through unheated areas and voids e.g. attic spaces with the equivalent of at least 25mm of a material having a thermal conductivity of $\leq$0.04 W/m.K to reduce the possibility of condensation forming. Where a duct extends above roof level, the section above the roof should be insulated. d. Horizontal ducting including ducting in walls should be arranged to slope with a slight fall away from the fan to prevent backflow of moisture into the unit. e. Vertical ducting will require a condensate trap in order to prevent backflow of moisture into the unit. f. Where ducts pass through fire barriers, they must be appropriately fire stopped in accordance with Part B (Fire).	*Main ducts should be run at same size as fan spigot. Branch ducts can reduce in size whilst maintaining maximum velocity specifications. Rigid ducting is recommended in all locations with the exceptions of short lengths e.g. < 1m. in order to connect extract air grilles.*

Table 1: Mechanical Extract Ventilation installation requirement		
	Installation clauses	**Supplementary information**
	g. 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. h. Ducts should not be routed where they can be easily damaged e.g. attics spaces intended for storage. i. Rigid duct runs should be adequately supported. j. All duct connections should be sealed. Where ducts are installed against a solid structure this can be achieved by assembling and sealing ductwork prior to fixing.	*Joints must be properly made in accordance with the supplier's recommendations.*
3.0 Ventilation air inlets and internal air transfer	**Background ventilators** a. For any design air permeability, controllable background ventilators having a minimum equivalent area of 2,500 mm^2 should be fitted in each room, except wet rooms, from which air is extracted and should be compatible with the continuous mechanical extract ventilation system. b. Ensure that ventilation ducts are sealed to the air tightness barrier with appropriate tapes or sealants.	
4.0	**Air transfer** a. To ensure adequate air transfer, a gap, e.g. 10 mm, should be provided under internal doors.	

Table 1: Mechanical Extract Ventilation installation requirement		
	Installation clauses	**Supplementary information**
	b. Doors which are required to achieve a fire rating determined by Part B must achieve both the requirements of the fire door test certificate and the airflow requirements.	
5.0 Room extract air terminals/grilles	**Extract terminals/grilles** a. Extract terminals should be installed as per system design specification. b. Extract Terminals should installed in ceiling or as close to ceiling level as practical to ensure warm moist air is removed. c. Grilles, louvres or ductwork dampers should be installed to allow balancing of system. d. Terminals/grilles should have a facility to be locked in position once system balance has been achieved.	
6.0 Discharge Terminals	**Discharge terminals-roof and wall mounted** a. Proprietary terminals should be used. b. Ensure that the free area of the terminal opening is a minimum of 90% of free area of ducting used. c. The location of extract air discharge should avoid potential for recirculation	

Table 1: Mechanical Extract Ventilation installation requirement		
	Installation clauses	**Supplementary information**
	of extract air through ventilation air inlets.	
7.0 Controls	a. Clear instructions should be provided on MEV system isolators to state that MEV systems should be run continuously to ensure adequate indoor air quality and should not be switched off. b. Where sensors are duct mounted, their location should be clearly identified in handover information. c. There should be clear indication to the homeowner when the unit is in boost mode where applicable. d. Humidity control should not be used in sanitary accommodation where odour is the main pollutant.	

Table 2: Mechanical Extract Ventilation: inspection, testing and commissioning		
	Recommended Minimum requirements	**Supplementary information**
1.0 System overview	**Visual Inspections** Carry out the following checks and record the results in section 6: a. Obtain the system design flow rates for each extract terminal and confirmation from the system designer that the flow rates meet TGD F guidance. b. Confirm the system is installed as per Table 1. c. Confirm that the ductwork, fan and terminals are in good working condition with no visible or obvious defects or faults that will affect the system performance.	
	Initial start-up a. Is the airflow direction correct at each terminal? b. Is there any abnormal noise on start-up or when the system is running in normal background ventilation mode?	*Some fan units have a start-up diagnostic sequence that runs the fans at maximum speed for a period before reverting to normal operation – refer to the manufacturers operating instructions.*
2.0 Air flow balancing and measurement	**Air flow balancing** a. The system should be balanced to ensure that design airflow rates are achieved at each room terminal/grille. There are several combinations of room terminal/grille (hereafter referred to as terminal) and fan control that may be used in domestic systems; the fan manufacturer's instructions	

Table 2: Mechanical Extract Ventilation: inspection, testing and commissioning		
	Recommended Minimum requirements	**Supplementary information**
2.0 Air flow balancing and measurement *(continued)*	should be followed to achieve balancing. If specific details are not included the following steps should be taken: **1. Adjustable terminals and a fixed (stepped) speed fan.** The fan speed should be set to achieve the desired continuous flow rate. The index terminal flow rate is set to full open and all other terminals are adjusted to achieve the required flows at each terminal. If the total flow rate cannot be achieved through all the terminals then the fan speed should be increased. If all the terminals have to be closed significantly to achieve only the required airflow rate, then reduce the fan speed and rebalance the terminals. **2. Adjustable terminals and controllable speed fan.** The fan speed should be set approximately to achieve the desired continuous flow rate. The index terminal flow rate is set with the terminal fully open and all other terminals are adjusted to achieve the required flows at each terminal. If the index terminal has to be closed to achieve only the required air flow rate, then reduce the fan speed and rebalance the terminals. **3. Fixed terminals with flow adjustment by duct damper or similar device at the fan unit.** As bullet point 1. or 2. above depending on the type of fan speed control. **4. Adjustable terminals and fixed volume flow fan.** The fan speed should be set to achieve the desired continuous flow rate. The index terminal flow rate is set with the terminal full open and all other terminals are adjusted to achieve the required flows at each terminal. Adjustment of the terminals achieves balancing only; total flow rate is governed by the fan control setting. Great care should be taken not to	*The index terminal/grille can be assumed to be the furthest from the fan unit.*

Table 2: Mechanical Extract Ventilation: inspection, testing and commissioning		
	Recommended Minimum requirements	**Supplementary information**
	close the terminals too far as the fan unit will always maintain a constant volumetric flow rate; closing the terminals will only require the fan to work harder to achieve a given air flow rate. 5. **Fixed terminals with automatic flow adjustment at the fan unit.** The fan speed should be set to achieve the desired continuous flow rate. The flows are balanced by automatic devices located within the fan unit, no adjustment can be made.	
2.0 Air flow balancing and measurement *(continued)*	**Air flow measurements** a. Ensure all internal and external doors and windows are closed, including rooms in which measurements are being carried out. b. Airflow measurements should be performed using a calibrated airflow device with proprietary hood attachment and results recorded in litres per second (l/s). Reference should be made to design airflow rates. c. Record the airflow rate at each room terminal onto the commissioning sheet in Section 6, along with the design airflow rate for each terminal. Measurements should be taken at both maximum/Boost rate and minimum/trickle rate fan speeds. d. It is recommended that a calibrated vane anemometer or similar device be used to balance and measure the airflow rates at each room terminal. The instrument will require a hood to be attached to allow it to cover the terminal. e. The instrument should be calibrated annually and be capable of achieving	*Refer to BSRIA BG 46/2015 "Domestic Ventilation Systems – A Guide to measuring airflow rates" that provides several methods for the measurement of airflow rates: Table 4 provides airflow measurement methods for different types of ventilation system.* *Calibration of measurement equipment should be undertaken annually by returning the instrument to an INAB accredited calibration centre.*

Table 2: Mechanical Extract Ventilation: inspection, testing and commissioning		
	Recommended Minimum requirements	**Supplementary information**
	an accuracy of ± 5%.	
3.0 Controls	**Installation** a. Ensure all local controls have been installed following the manufacturer's instructions. b. Ensure all local controls are adequately labelled, indicating their function clearly. c. If sensors have been installed separately from the fan unit ensure installation follows the manufacturer's instructions. d. Where control of the fan is automated, the controls should be configured to minimise the occurrence of hunting.	*If hunting (the continual increase and decrease of the fan speed) does occur, occupants may seek to modify the control of the system or turn it off altogether to remove the noise nuisance.*
	Testing operation a. As far as practical, the correct operation of each control function should be tested.	

Section 3: Mechanical Ventilation with Heat Recovery (MVHR)

3.1 Mechanical Ventilation with heat recovery – centralised and single room

The information provided in Tables 3 and 4 gives guidance on the installation and commissioning of continuous mechanical balanced ventilation with heat recovery (MVHR) systems for dwellings. The relevant design guidance is given in TGD F, in particular, paragraph 1.2.3. The guidance is suitable for centralised or decentralised ventilation systems with heat recovery.

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
1.0 Continuous supply and extract with heat recovery – centralised	**Manufacturer's details and specific instructions** 1. The information provided in this Table sets out the minimum recommended procedures for typical MVHR System installations. 2. For further product-specific information, refer to the manufacturer's installation instructions.	
	Location of fan unit a. The fan unit should be located as specified by the system designer. b. Fan units should be installed to allow sufficient space to undertake routine maintenance of filters and heat exchanger block as appropriate. c. Fan units should be installed to allow sufficient space for replacement at end of its operational life – whole unit or of key mechanical/electrical components. This should be achievable without need to remove fixed structures or remove significant lengths of connected ductwork. d. The fan unit should be installed on a suitable sound structure, which is stable and level. e. 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. f. Condensate drain(s) should be installed from the fan unit to an appropriate drain location. The condensate pipe should be installed to have a minimum 5˚ fall from the fan unit.	*The location of the fan unit should minimise overall duct run length, both from the internal terminals/grilles to the fan unit and from the fan unit to the external discharge terminal.* *Refer to the manufacturer's specification for appropriate environmental conditions. Unconditioned spaces, e.g. lofts, may become very hot in summer, which may have implications for both mechanical and electronic component life.* *The fan unit spigot arrangement may dictate the location and orientation of installation to ensure optimum performance refer to the manufacturer's instructions.* *If a fan unit is to be installed in an unheated space, it may require external insulation fitting to minimise the potential of condensation forming within the fan unit casing.* *The rate of condensate forming may be up to several litres per day and therefore the appropriateness of the drain location should consider this.*

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
1.0 Continuous supply and extract with heat recovery – centralised **(continued)**	g. The condensate drain(s) should be adequately secured and where passing through an unheated space must be adequately insulated to prevent freezing. **Additional note for decentralised SRHRV systems** a. Supply and Extract terminals should be installed to avoid short-circuiting of airflows.	
	Preparation for installation a. Holes of a suitable dimension through the fabric of the building will be required for the installation of the intake and exhaust air ducts. These holes may need a slight downward angle towards the outside to prevent water ingress. b. Intake and exhaust terminals should be so spaced as to avoid short-circuiting and in exposed locations, it is recommended that they are located on the same façade to reduce the effects of wind pressure. c. Where ductwork penetrates a building's air barrier, the continuity of the barrier must be maintained. The nature of the barrier and ease of achieving an effective seal should be considered before holes are drilled. d. Ducting placed in or passing through unheated voids or loft spaces should be insulated to reduce the possibility of condensation forming. e. For ceiling mounted fans or terminals/grilles, the holes should be cut to the	

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
1.0 Continuous supply and extract with heat recovery – centralised **(continued)**	minimum required size such that the fan/grille spigot fits snug into the hole. f. Note that ceiling terminals may be required to have a fire rating to maintain the integrity of a floor in the case of fire, DHPLG circular BC 07/2018 "Fire Safety Issues relating to Timber Internal Floors" provides further guidance. g. It is important to consider the planning and installation of ductwork in co-ordination with other trade activities and installations, such that routes are designed without compromise to the required ventilation airflow rates.	
	Installation The fan unit should be installed using the manufacturer's supplied or recommended fixing brackets.	*Acoustic/anti-vibration isolation may be required. This will depend on the nature of the mounting structure; refer to the manufacturer's instructions.*
2.0 Ductwork	**Duct installation – General notes** a. Ducts should be sized to minimise pressure loss and noise generation. This is achieved by sizing of the ducts to limit the air velocity. Section 5 of Building Engineering Services Association Good Practice Guide to Low Energy Ventilation for Residential Buildings TR/35 provides guidance on sizing of residential ductwork. b. 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. c. The need for privacy (acoustic separation) between rooms should be considered when planning duct layout.	*The duct size and type specified by the system designer should always be used to minimise pressure loss and noise generation. Main ducts should be run at the same size as the fan unit spigot. Duct size should then be reduced for branch ducts.* *A radial layout may achieve acoustic separation more effectively than a branched layout.* *The performance of the ventilation system relies on efficient air distribution and it is vital that duct installation is not left until the last moment when the only means of overcoming obstructions is to install flexible ducts where rigid ducts had been specified.*

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
	d. Where room air extract terminals/grilles are not fitted with filters, consideration should be given for the need to access ducts for cleaning. e. Ducting should be insulated where it passes through unheated areas and voids (e.g. loft spaces) with the equivalent of at least 25 mm of a material having a thermal conductivity of ≤0.04 W/mK to reduce the possibility of condensation forming. Where a duct extends externally above roof level the section above the roof should be insulated or a condensate trap should be fitted just below roof level. f. Heat loss can occur through the intake and exhaust ducts, consequently their length should be minimised. 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 fully sealed vapour barrier outside the insulation to prevent condensation occurring within the insulation material. g. Horizontal ducting, including ducting in walls, should be arranged to slope slightly downwards away from the fan to prevent backflow of any moisture into the product. h. Vertical ducting will require a condensate trap in order to prevent backflow of any moisture into the product. i. Perforated insulated flexi duct, used to minimise airborne acoustic transmission, should not be used between the fan unit and external discharge terminal to prevent condensation occurring within the insulation material.	

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
	j. Where ductwork penetrates a building's air barrier, identify on building drawings and ensure that continuity of the barrier is maintained. k. 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.	
2.0 Ductwork	**Installation of ducts – rigid** a. 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. b. Connection of components should not result in significant airflow resistance. Components should be proprietary and fit easily together without distortion. c. Rigid duct runs must be adequately supported.	*Distortion of rectangular duct may result in significant reduction of the free internal area of the duct, increasing the flow resistance and making sealing more difficult.*
2.0 Ductwork	**Installation of ducts – flexible** a. 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, crushing the duct and restricting or preventing all air flow through the duct. b. Flexible duct should be pulled taught to ensure that the full internal diameter is obtained and flow resistance minimised. This is considered to	*It is suggested that flexible ducts should be supported at intervals not exceeding 600 mm.*

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
2.0 Ductwork (continued)	have been achieved if the duct is extended to 90% of its maximum length. c. Flexible ductwork should be supported at suitable intervals to minimise sagging. d. Bends in flexible duct should have a minimum inside radius equal to the diameter of the duct – see Diagram 1. If tighter bends are required, rigid bends should be used.	
	Duct connections a. All duct connections require sealing. 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. b. Where access to ducts will not be possible after construction is complete, i.e. ductwork within floor and wall voids, consideration should be given to permanent connection and sealing with an appropriate non-hardening sealant. 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.	*Joints must be properly made with appropriate materials in accordance with the supplier's recommendations.*
3.0 Internal ventilation air transfer	**Air transfer** a. To ensure good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door.	

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
	b. Ensure that the air transfer provision is unrestricted after floor finishes have been laid (e.g. carpets should not encroach). This should be achieved by making an undercut of 10 mm above the floor finish if the floor finish is fitted, or by an additional amount above the subfloor where the finish has not been fitted. **Additional notes for decentralised SRHRV systems** a. In decentralised SRHRV systems, a single ventilation unit, or a series of interlinked units may serve one or more rooms. These units (or combinations of units) have balanced supply and extract airflow rates. However, it is recommended that the provisions of 3a and 3b be maintained to minimise any imbalance of flows within rooms or spaces served by different units.	
4.0 Room supply and extract air terminals	**Supply and extract terminals/grilles – General notes** a. All room air extract terminals should be installed as detailed by the system designer. b. Room air extract terminals should be installed as close to ceiling level as practical, to ensure warm moist air is removed from each space. c. Room supply air terminals should be designed to discharge air away from walls or other fixed obstructions in order to provide even distribution of fresh air and avoid draughts. d. In open plan areas where both supply and extract terminals may be installed, e.g. kitchen-diners, the terminals should be adequately separated to ensure short-circuiting is minimised.	

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
	e. 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.	
	Fixed terminals – grilles or louvers a. 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.	
	Adjustable terminals/grilles a. Ensure each terminal/grille can be locked in its commissioned position once system balance has been achieved. It is vital for the correct operation of the system that the system remains balanced in its commissioned state.	
5.0 External supply and discharge terminals	**Supply and discharge terminals – roof and wall mounted** a. Proprietary terminals should be used. b. Ensure that the free area of the terminal opening is a minimum of 90% of the free area of the ducting being used. c. The location of the external discharge terminal should ensure that the potential for recirculation of extract air through the supply air terminal is minimised.	*It is recommended that the supply and extract air terminals are separated by a minimum of 500 mm horizontally if placed on the same façade of a building, or alternatively, refer to the manufacturer's installation instructions*
6.0 Controls	**Controls – General notes** a. Continuous ventilation systems should not allow the occupier to turn off	*Installation of alternative sensors may result in control functions not performing correctly.*

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
6.0 Controls (continued)	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. b. Where sensors are not pre-installed within the fan unit, or additional optional sensors can be installed, only the sensors specified by the manufacturer of the fan unit should be installed. c. If sensors are duct mounted, their location should be noted and provisions for access for maintenance or replacement made. d. If control of the fan speed is undertaken manually, the operation of the fan in boost mode should be made obvious to occupants. This will minimise the likelihood of it being left in this mode unnecessarily. Time-limited switches can also be used to achieve this. e. Humidity control should not be the only control used in sanitary accommodation, as odour is the main pollutant. **Controls – Location and configuration** a. Installation of manual controls for the system must meet the requirements of Part M of the Building Regulations. b. Installation of room sensors should follow the manufacturer's guidance on positioning. c. Where boost control of the fan speed is undertaken manually, additional	

Table 3: MVHR installation requirements		
	Installation clauses	**Supplementary information**
	switching should be provided locally to the spaces most in need of the boosted ventilation rate, i.e. bathrooms and kitchen. Provision of a single centrally located switch is insufficient and will result in fans being left in inappropriate modes of operation. d. Control indicators should indicate to the occupant that the system is operating correctly and if a fault has occurred. Control indicators should be in a visible location to the occupant and not in a remote location such as in the attic or above the ceiling.	
7.0 Decentralised SRHRV systems	**Ventilation of whole building** a. Some SRHRV systems provide balanced ventilation for a single room, or a part of a building only. Where these are used, the ventilation of all spaces should meet the requirements of the Building Regulations.	

Table 4: MVHR commissioning		
	Minimum commissioning requirements	**Supplementary information**
1.0 System overview	**Visual inspections** The following points should be observed and recorded in Section 6: a. System installation complies with the installation clauses given in Table 3. b. System is installed in accordance with design criteria. c. All ductwork and terminals are in good condition with no obvious defects that will be hazardous or affect the system performance.	
	Initial start-up a. Check that airflow direction is correct at each room terminal, supply and extract. b. Check for any abnormal noises on start-up or when the system is running in normal background ventilation mode.	*Some fan units have a start-up diagnostic sequence that runs the fans at maximum speed for a period before reverting to normal operation - refer to the manufacturer's operating instructions.*
2.0 Air flow balancing and measurement	**Air flow balancing** a. The system should be balanced to ensure that design airflow rates are achieved at each room terminal/grille. There are several combinations of room terminal/grille (hereafter referred to as terminal) and fan control that may be used in domestic systems; the fan manufacturer's instructions should be followed to achieve balancing. If specific details are not included the following steps should be: **1. Adjustable terminals and a fixed (stepped) speed fan.** The fan speed should be set to achieve the desired continuous flow rate. The index terminal flow rate is set to full open and all other	*The index terminal/grille can be assumed to be the furthest from the fan unit.*

Table 4: MVHR commissioning		
	Minimum commissioning requirements	**Supplementary information**
2.0 **Air flow balancing and measurement** **(continued)**	terminals are adjusted to achieve the required flows at each terminal. If the total flow rate cannot be achieved through all the terminals then the fan speed should be increased. If all the terminals have to be closed significantly to achieve only the required airflow rate, then reduce the fan speed and rebalance the terminals. **2. Adjustable terminals and controllable speed fan.** The fan speed should be set approximately to achieve the desired continuous flow rate. The index terminal flow rate is set with the terminal fully open and all other terminals are adjusted to achieve the required flows at each terminal. If the index terminal has to be closed to achieve only the required air flow rate, then reduce the fan speed and rebalance the terminals. **3. Fixed terminals with flow adjustment by duct damper or similar device at the fan unit.** As bullet point 1. or 2. above depending on the type of fan speed control. **4. Adjustable terminals and fixed volume flow fan.** The fan speed should be set to achieve the desired continuous flow rate. The index terminal flow rate is set with the terminal full open and all other terminals are adjusted to achieve the required flows at each terminal. Adjustment of the terminals achieves balancing only; total flow rate is governed by the fan control setting. Great care should be taken not to close the terminals too far as the fan unit will always maintain a constant volumetric flow rate; closing the terminals will only require the fan to work harder to achieve a given air flow rate.	

Table 4: MVHR commissioning		
	Minimum commissioning requirements	**Supplementary information**
	5. Fixed terminals with automatic flow adjustment at the fan unit. The fan speed should be set to achieve the desired continuous flow rate. The flows are balanced by automatic devices located within the fan unit, no adjustment can be made.	
2.0 Air flow balancing and measurement (continued)	**Air flow measurements** a. Ensure all internal and external doors and windows are closed, including rooms in which measurements are being carried out. b. Airflow measurements should be performed using a calibrated airflow device with proprietary hood attachment and results recorded in litres per second (l/s). Reference should be made to design airflow rates. c. Record the airflow rate at each room terminal onto the commissioning sheet in Section 6, along with the design airflow rate for each terminal. Measurements should be taken at both maximum rate and minimum rate fan speeds. d. It is recommended that a vane anemometer or similar device be used to balance and measure the airflow rates at each room terminal. The instrument will require a hood to be attached to allow it to cover the terminal. e. The instrument should be calibrated annually and be capable of achieving an accuracy of ± 5%.	*Refer to BSRIA BG 46/2015 "Domestic Ventilation Systems – A Guide to measuring airflow rates" that provides several methods for the measurement of airflow rates.* *Calibration of measurement equipment should be undertaken annually by returning the instrument to an INAB accredited calibration centre.*

Table 4: MVHR commissioning		
	Minimum commissioning requirements	**Supplementary information**
	Additional notes for decentralised SRHRV a. The supply and extract configuration of some fan units may prevent measurement of the airflow rates. In such cases, if the manufacturer's installation instructions have been followed the airflow rates specified for that product must be assumed to have been achieved.	
3.0 Controls	**Installation** a. Ensure all local controls have been installed following the manufacturer's instructions. b. Ensure all local controls are adequately labelled, indicating their function clearly. c. If sensors have been installed separately from the fan unit ensure installation follows the manufacturer's instructions. d. Where control of the fan is automated, the controls should be configured to minimise the occurrence of hunting. e. If manual control of, for example, heat exchanger by-pass is provided, clear and detailed instructions should be made available to the occupier.	*If hunting (the continual increase and decrease of the fan speed) does occur, occupants may seek to modify the control of the system or turn it off altogether to remove the noise nuisance. Where there is a risk of overheating, it is recommended that the system allow for a bypass of the heat recovery function.*
	Testing operation a. As far as practical, the correct operation of each control function should be tested.	

Section 4: Natural ventilation systems

4.1 Background ventilators and intermittent extract fans

The information provided in Tables 5 and 6 gives guidance on the installation and commissioning of systems comprising background ventilators and intermittent extract fans for dwellings. The relevant design guidance is given in TGD F, in particular, paragraph 1.2.4

4.2 Passive stack ventilation

The information provided in Tables 7 and 8 gives guidance on the installation and commissioning of passive stack systems for dwellings. The relevant design guidance is given in TGD F, in particular, paragraph 1.2.4.9.

Table 5: Natural Ventilation with extract installation requirements		
	Installation clauses	**Supplementary information**
1.0 Intermittent extract fans (including cooker hoods)	**Manufacturer's details and specific instructions** a. The information provided in this Table sets out the minimum recommended procedures for typical background ventilators with intermittent fan installations. b. For further product-specific information, refer to the manufacturer's installation instructions.	

Table 5: Natural Ventilation with extract installation requirements		
	Installation clauses	**Supplementary information**
1.0 Intermittent extract fans (including cooker hoods)	**Preparation** a. Ensure final location of equipment offers sufficient space to allow access for maintenance. b. For through-wall units, bore a hole of a suitable dimension through the fabric of the building for the installation of the duct. The hole should have a slight downward angle towards the outside to prevent water ingress. c. For ceiling mounted fans/terminals, the holes should be cut to the minimum required size such that the fan/grille spigot fits snugly into the hole. d. Where ductwork penetrates a building's air barrier, the continuity of the barrier must be maintained. The nature of the barrier and ease of achieving an effective seal should be considered before holes are drilled. e. It is important to consider the planning and installation of ductwork in co-ordination with other trade activities and installations, such that routes are designed without compromise to the required ventilation airflow rates.	

Table 5: Natural Ventilation with extract installation requirements		
	Installation clauses	**Supplementary information**
1.0 Intermittent extract fans (including cooker hoods) (continued)	**Installation – through wall** a. The duct sleeve connecting the fan outlet to the terminal/grille should be at least the same diameter as the fan outlet. b. The duct sleeve should be rigid. In situations where this is not possible, flexible ductwork may be used providing extract ventilation rates are not compromised. Flexible ductwork should be pulled taut. c. The installed duct sleeve should be sealed to the external and internal wall to maintain air tightness. This is of particular importance for cavity walls. d. Ensure that there are no obstructions in the duct prior to fitting the fan.	
	Installation – through window a. Check suitability of window and obtain suitable window mounting kit from manufacturer for proposed fan unit.	*For window mounted fans: do not plan to install in opening lights.* *4 mm minimum advisable glass thickness, but seek specialist advice from glazier for mounting suitability.*

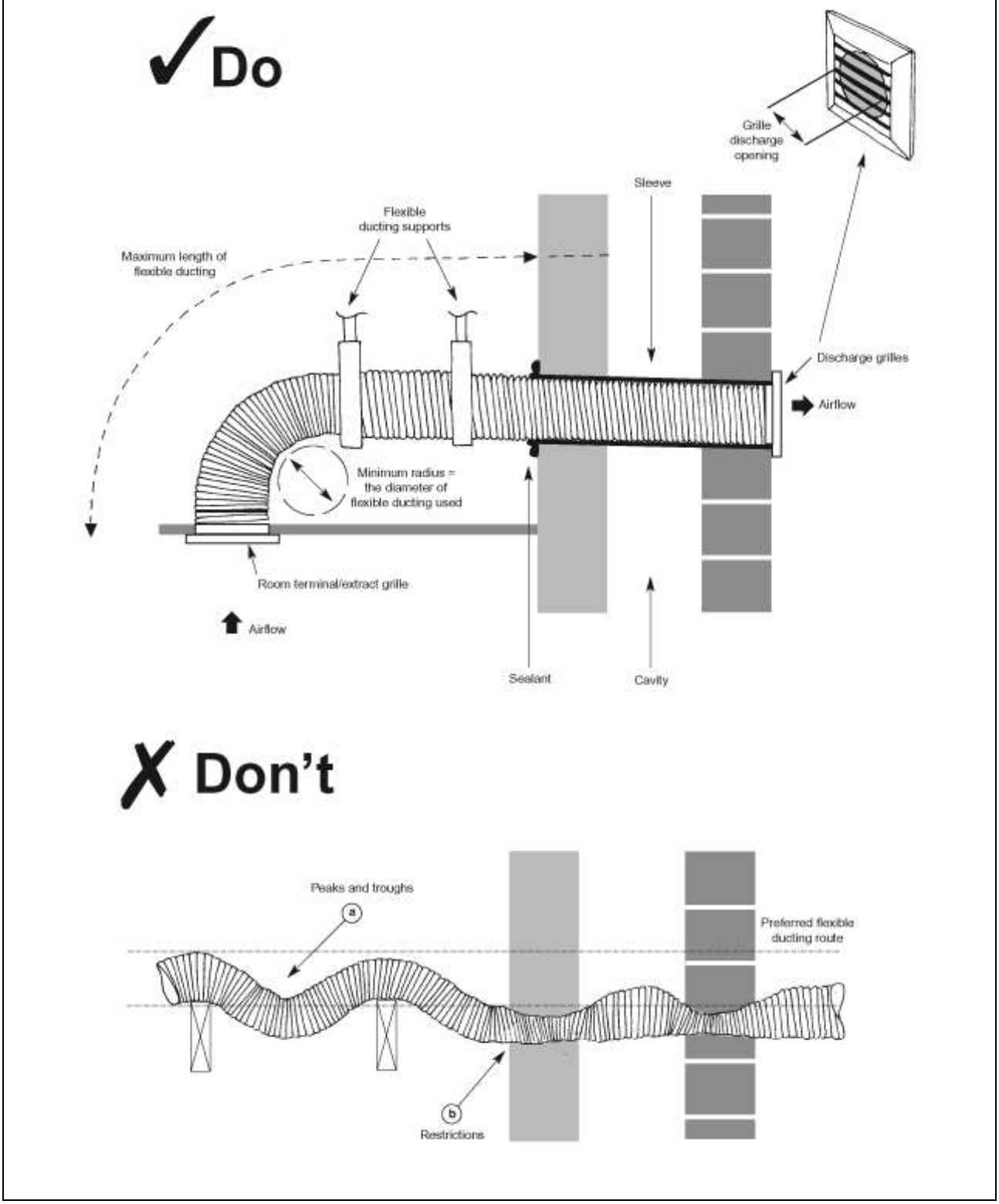
Table 5: Natural Ventilation with extract installation requirements		
	Installation clauses	**Supplementary information**
1.0 Intermittent extract fans (including cooker hoods) (continued)	**Installation – ducted** a. Rigid ducts, rectangular or circular, should be used wherever possible. Circular ducts offer least resistance. Where necessary, flexible ducts may be used, but their lengths should be kept to a minimum, connecting to rigid ductwork at the earliest opportunity. b. For flexible duct connected to axial fans the length is limited to 1.5 metres; for centrifugal fans the length limit is 6 metres (for extract rates 6 to 30 l/s), and 3 metres (for extract rates 31 to 60 l/s). c. The number of bends is limited to two for up to 30 l/s, and reduces to one bend for higher extract rates. d. Flexible duct should be pulled taught to ensure that the full internal diameter is obtained and flow resistance minimised. This is considered to have been achieved if the duct is extended to 90% of its maximum length. e. Ducting should be insulated where it passes through unheated areas and voids (e.g. loft spaces) with the equivalent of at least 25 mm of a material having a thermal conductivity of ≤0.04 W/mK to reduce the possibility of condensation forming.	*Exceptions to duct limits will be accepted providing evidence from the manufacturer is available that confirms that the specified performance will not be affected.* *For in-line fans, refer to manufacturer's data.* *For duct installations, see Diagram 1.* *Where possible, connect straight lengths of ductwork to fan spigot.*

Table 5: Natural Ventilation with extract installation requirements		
	Installation clauses	**Supplementary information**
1.0 Intermittent extract fans (including cooker hoods) (continued)	f. Horizontal ducting, including ducting in walls, should be arranged to slope slightly downwards away from the fan to prevent backflow of any moisture into the product. g. Vertical ducting will require a condensate trap in order to prevent backflow of any moisture into the product. Follow manufacturer's recommendations in these instances. h. Where ducting passes through a fire-stopping wall or fire compartment, the required measures to ensure compliance with Part B of the Building Regulations should be taken.	
1.0 Intermittent extract fans (including cooker hoods) (continued)	**Cooker hoods** a. Cooker hoods should be installed so that access is easy for changing and cleaning of the filter/filters.	*Re-circulating cooker hoods do not provide extract ventilation and therefore do not provide extract ventilation in a kitchen for the purposes of Part F. To provide extract ventilation in a kitchen for the purposes of Part F, an extract fan to outside should be provided with an installed capacity of at least 60 l/s.*

Table 5: Natural Ventilation with extract installation requirements		
	Installation clauses	**Supplementary information**
2.0 Ventilation air inlets and discharge terminals/grilles	**Background ventilators** a. Background ventilators should be provided to meet the minimum required equivalent area of ventilation specified by paragraph 1.2.2.1 and paragraph 1.2.2.2 of TGD F. b. For wall mounted background ventilators make an opening in wall in accordance with manufacturer's instructions for the size required. Ensure that there are no obstructions in the opening. c. Install the wall or window ventilator product in accordance with manufacturer's instructions. d. Ensure that wall or window ventilator products are sealed to their surrounds using a proprietary sealant as recommended by the manufacturer.	*Background ventilators fitted in windows are usually installed during manufacture. Close co-ordination between supplier and installer is recommended to ensure correct location of ventilators.* *Background ventilators installed in walls may require a proprietary wind cowl to reduce wind noise and prevent over ventilation.*
	Discharge terminals – roof and wall mounted a. Only proprietary terminals should be used. b. Ensure that the free area of the terminal/grille opening is a minimum of 90% of the free area of the ducting being used.	

Table 5: Natural Ventilation with extract installation requirements		
	Installation clauses	**Supplementary information**
3.0 Miscellaneous	**Air transfer** a. To ensure good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door. b. Ensure that the air transfer provision is unrestricted after floor finishes have been laid (e.g. carpets should not encroach). This should be achieved by making an undercut of 10 mm above the floor finish if the floor finish is fitted, or by a 20 mm undercut above the floorboards, or other surface, if the finish has not been fitted.	
4.0 Controls	**General** a. Refer to paragraph 1.2.2.3 and paragraph 1.2.2.5 of TGD F. b. Ensure that a local manual override control is provided for any extract fan operated by automatic controls.	*Humidity controls should not be used for sanitary accommodation where odour is the main pollutant.*

Diagram 1



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).

Table 6: Natural Ventilation with extract ventilation commissioning		
	Minimum commissioning requirements	**Supplementary information**
1.0 Intermittent extract fans (including cooker hoods)	**Visual inspections** The following points should be observed and recorded in Section 6: a. System installation complies with the installation clauses given in Table 1. b. Number of extract points and terminals satisfy Table 1 in TGD F. c. All equipment is in good condition with no obvious defects that will be hazardous or affect the system performance.	
	Functional checks a. Temporary protection and packaging should be removed from all products. b. Check fan operates correctly when activated by manual control (e.g. light switch), or automatic control (e.g. PIR). c. Ensure fan switches off after controls are de-activated and, in the case of run-on timers, that these are set to a minimum of 15 minutes.	*Unless timer control is graduated in minutes, run-on timers should be checked against a timed test and adjusted if run time is less than 15 minutes.*
	Airflow measurements a. Ensure that all intended background ventilators or other air transfer devices are open. b. Ensure all internal and external doors and windows are closed, including room in which measurement is being carried out. c. Airflow measurements should be performed using a calibrated airflow	*The recommended method is the use of a vane anemometer, or similar, placed in a hood which covers the terminal to measure the extract airflow rate.* *Calibration of measurement equipment should be undertaken annually by returning the instrument to an INAB accredited calibration centre.*

Table 6: Natural Ventilation with extract ventilation commissioning		
	Minimum commissioning requirements	**Supplementary information**
	device with proprietary hood attachment and results recorded in litres per second (l/s). Reference should be made to Table 3 and paragraph 1.2.4.1 of TGD F for design airflow rates. d. Record the extract airflow for each extract fan onto commissioning sheet (see Section 6). e. The instrument should be calibrated annually and be capable of achieving an accuracy of ± 5%.	
2.0 Background ventilators	**Visual inspections** The following points should be observed and recorded in Section 6: a. Correct equivalent area and location of air inlets satisfy Table 3 in TGD F. b. Remove any temporary protection and packaging from all background ventilators, and check functionality (i.e. do shutters open/close correctly). c. Ensure that an adequate seal has been provided between ventilator product and wall/window frame.	*The equivalent area should be displayed on the air inlet product.*

Table 6: Natural Ventilation with extract ventilation commissioning *(continued)*		
	Minimum commissioning requirements	**Supplementary information**
2.0 Background ventilators	**Visual inspections** The following points should be observed and recorded in Section 6: d. Correct equivalent area and location of air inlets satisfy Table 1 in TGD F. e. Remove any temporary protection and packaging from all background ventilators, and check functionality (i.e. do shutters open/close correctly). f. Ensure that an adequate seal has been provided between ventilator product and wall/window frame.	*The equivalent area should be displayed on the air inlet product.*

Table 7: Passive stack ventilation installation requirements		
	Installation clauses	**Supplementary information**
1.0 Ductwork preparation and installation	**Manufacturer's details and specific instructions** a. The information provided in this Table sets out the minimum recommended procedures for typical passive stack ventilation installations. b. For further product-specific information, refer to the manufacturer's installation instructions. c. Internal duct diameters and/or cross sectional areas should be adequate to meet the ventilation requirements of paragraph 1.2.4.1.	
	Preparation a. Ducting routes and offsets should be planned such that their final installation is in accordance with the illustrated guidance given in Diagrams 2 and 3. b. Separate ducts should be taken from the ceilings of the kitchen, bathroom, utility room or WC to separate terminals on the roof. Do not use common outlet terminals or branched ducts. c. Where ductwork penetrates a building's air barrier, the continuity of the barrier must be maintained. The nature of the barrier and ease of achieving an effective seal should be considered before holes are drilled. d. It is important to consider the planning and installation of ductwork in co-ordination with other trade activities and installations, such that routes are designed without compromise to the required ventilation airflow rates.	*Ideally, all ducts should be installed as near vertical as site constraints allow.* *Both rigid ducting and flexible ducting are suitable for PSV systems and have similar resistance to airflow at typical PSV system airflow rates.*

Table 7: Passive stack ventilation installation requirements		
	Installation clauses	**Supplementary information**
1.0 Ductwork preparation and installation (continued)	**Installation** a. Carefully measure the length of duct to be used such that it is just sufficient to fit between the ceiling terminal and the outlet terminal. Flexible ducting should be fully extended but not taut, allowing approximately 300 mm extra to make smooth bends in an offset system. b. Ducting should be properly supported along its length to ensure that the duct can run straight without distortion or sagging and that there are no kinks at any bends or the connections to ceiling terminals and outlet terminals. Flexible ducting generally requires more support than rigid ducting. c. In the roof space, the duct should be secured to a wooden strut that is securely fixed at both ends. A flexible duct should be allowed to curve gently at each end of the strut to attach to the ceiling terminal and roof outlet terminal. d. A rigid duct should be used for system stability for the part of a PSV system which is outside, above the roof slope. It should project down into the roof space far enough to allow firm support. e. Ensure that the duct is securely fixed to the roof outlet terminal so that it cannot sag or become detached. f. Ducting should be insulated where it passes through unheated areas and voids (e.g. loft spaces) with the equivalent of at least 25 mm of a material having a thermal conductivity of ≤0.04 W/mK to reduce the possibility of condensation forming.	

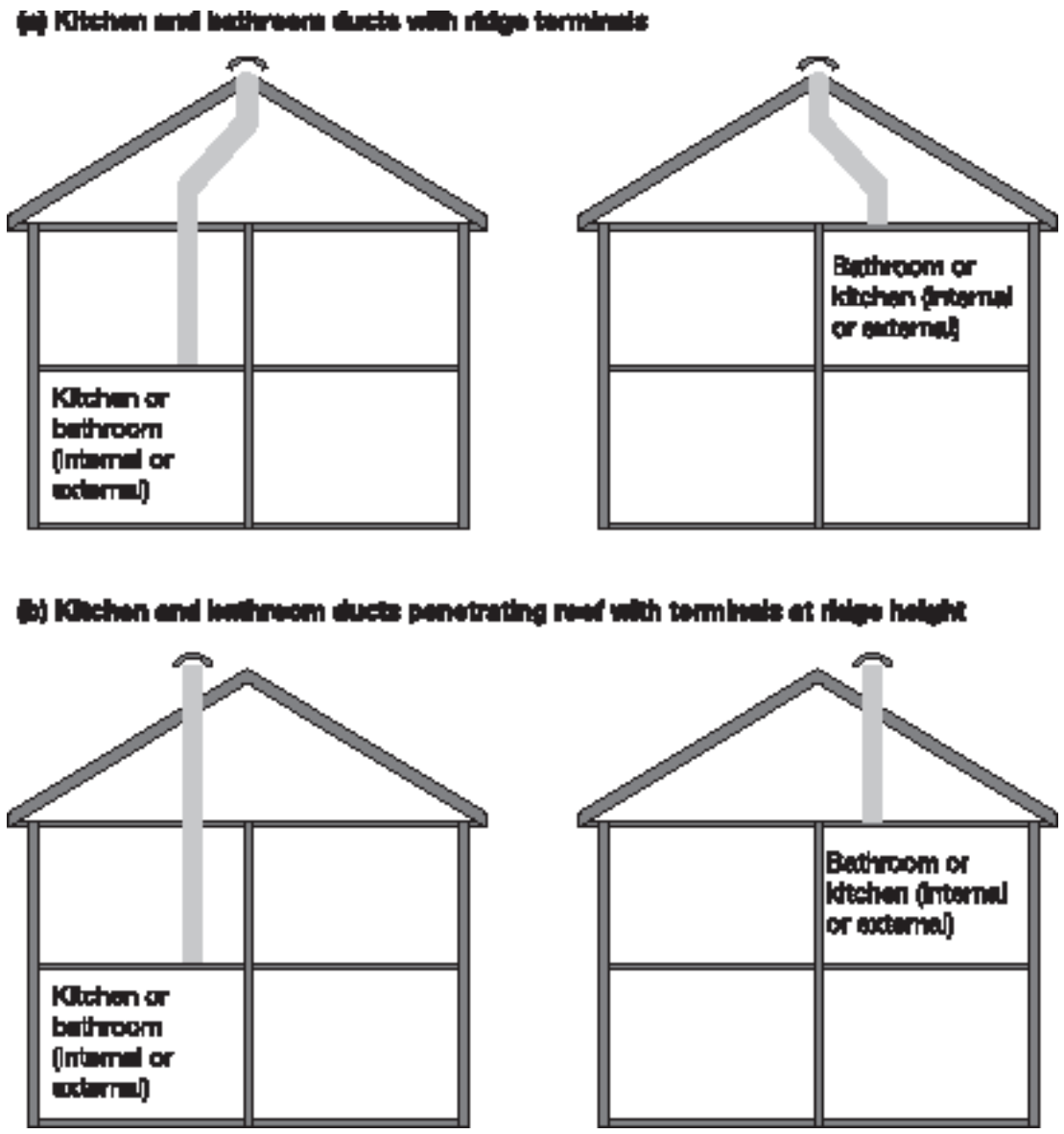
Table 7: Passive stack ventilation installation requirements		
	Installation clauses	**Supplementary information**
	g. Where a duct extends externally above roof level the section above the roof should be insulated or a condensate trap should be fitted just below roof level.	
2.0 Ventilation air inlets and discharge terminals	**Background ventilators** a. Background ventilators should be provided to meet the minimum required equivalent area of ventilation specified by Table 3 and paragraph 1.2.4.1 of TGD F. b. For wall mounted background ventilators make an opening in wall in accordance with manufacturer's instructions for the size required. Ensure that there are no obstructions in the opening. c. Install the wall or window ventilator product in accordance with manufacturer's instructions. d. Ensure that wall or window ventilator products are sealed to their surrounds using a proprietary sealant as recommended by the manufacturer.	*Background ventilators fitted in windows are usually installed during manufacture. Close co-ordination between supplier and installer is recommended to ensure correct location of ventilators.* *Background ventilators installed in walls may require a proprietary wind cowl to reduce wind noise and prevent over ventilation.*
	Extract terminals – wall and ceiling mounted a. PSV extract terminals should be located in the ceiling or on a wall less than 400 mm below the ceiling. b. The extract terminal should have a free area of not less than the duct cross-sectional area. If a conversion fitting is required to connect the duct to the terminal then the duct cross-sectional area should be maintained	*In non-sanitary accommodation, humidity controlled terminals may be used to increase the airflow during periods of increased humidity and reduce the airflow during periods of low humidity. Humidity controls should not be used for sanitary accommodation where odour is the main pollutant.*

Table 7: Passive stack ventilation installation requirements		
	Installation clauses	**Supplementary information**
	(or exceeded) throughout the conversion fitting so as not to restrict the flow.	
2.0 Ventilation air inlets and discharge terminals (continued)	**Discharge terminals** a. Proprietary products should be used that are compatible with the PSV duct system that has been installed. b. The roof terminal should not allow ingress of large insects or birds and should be designed so that rain is not likely to enter the duct and run down into the dwelling. c. The terminal should also be designed such that any condensation forming inside it cannot run down into the dwelling but will run off externally onto the roof. d. A tile ventilator used to terminate a PSV system on the roof slope should be positioned no more than 0.5 m from the roof ridge. If the duct penetrates the roof more than 0.5 m from the ridge, it should extend above the roof slope to at least ridge height.	*Refer to Diagram 2 for further details.*
3.0 Miscellaneous	**Air transfer** a. To ensure good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door. b. Ensure that the air transfer provision is unrestricted after floor finishes have been laid (e.g. carpets should not encroach). This should be achieved	

Table 7: Passive stack ventilation installation requirements		
	Installation clauses	**Supplementary information**
	by making an undercut of 10 mm above the floor finish if the floor finish is fitted, or by a 20 mm undercut above the floorboards, or other surface, if the finish has not been fitted.	

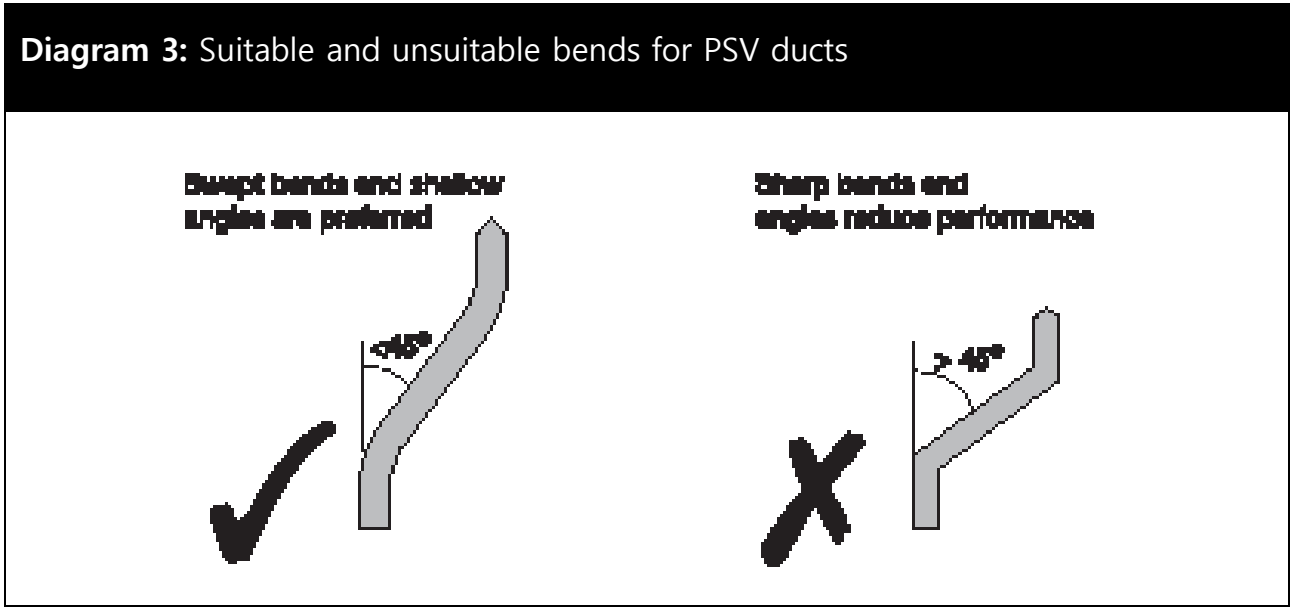
Table 8: Passive stack ventilation commissioning (inspection only)		
	Minimum commissioning requirements	**Supplementary information**
1.0 Ductwork and terminals	**Visual inspections** The following points should be observed and recorded in Section 6: a. System installation complies with the installation clauses given in Table 3. b. Number and size of terminal points provide equivalent extraction to that provided by mechanical extract fans as provided by guidance on Design of PSV Systems in BRE IP 13/94. c. All ductwork and terminals are in good condition with no obvious defects that will be hazardous or affect the system performance.	
2.0 Background ventilators	**Visual inspections** The following points should be observed and recorded: a. Correct size, number, orientation and location of air inlets to provide adequate ventilation as BRE IP 13/94. b. Remove any temporary protection and packaging from all background ventilators, and check functionality (i.e. do shutters open/close correctly). c. Ensure that an adequate seal has been provided between ventilator product and wall/window frame.	*The equivalent area should be displayed on the background ventilator product.*

Diagram 2: Suitable layouts for PSV systems



The layouts shown in Diagram 2 are considered to be suitable for the majority of dwellings of up to four storeys. Placing the outlet terminal at the ridge of the roof (Diagram 2(a)) is the preferred option for reducing the adverse effects of wind gusts and certain wind directions. A tile ventilator may be used to terminate a PSV system on the roof slope but the terminal should be positioned no more than 0.5 m from the roof ridge. If the duct penetrates the roof more than 0.5 m from the ridge, it should extend above the roof slope to at least ridge height to ensure that the duct terminal is in the negative pressure region above the roof (Diagram 2(b)).

Diagram 3: Suitable and unsuitable bends for PSV ducts



Ducts should use no more than one offset (i.e. no more than two bends) and these should be of the “swept” rather than “sharp” type to minimize flow resistance. Offsets at an angle should be no more than 45° to the vertical (Diagram 3).

Section 5: System completion and handover

This section outlines the minimum information to be handed over to the end user immediately after the ventilation system has been installed and commissioned.

5.1 Documentation to be handed over to the end user

Operation and maintenance manual

The operation and maintenance information for the ventilation system should be included in the Safety Plan to be handed over to the building owner on completion and should contain specific instructions for the end user on how and when to use the ventilation system, including information on the intended use of available fan settings. Information should also be provided to suggest when the system components should be cleaned and maintained.

The following information should be provided where relevant:

- Manufacturer's contact details;
- Design specification:
    - Description of the design strategy (e.g. natural, cMEV, MVHR)
    - Type of controls (if any) and intended mode(s) of operation (e.g. continuous or intermittent running of fans)
    - Design air volume flow rates for the system as a whole and for individual air terminals (or equivalent information for natural ventilation; e.g. equivalent areas of ventilators)
- 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 and boost settings for mechanical ventilation system
- Location of operational status indicator in mechanical ventilation systems;
- Instructions on how cleaning and maintenance should be carried out, including replacement filters and the minimum frequency for filter replacement;
- Location of filters if not installed within the fan unit. (If no filters installed on extract terminals – how are ducts accessed for cleaning and recommendations for how cleaning is undertaken and interval);
- Location and method of clearance of any condensate drains provided.
- Recalibration or checking of sensors and their location.

The operation and maintenance manual should also contain relevant manufacturers' literature which was supplied with the system or with individual components of the system. This might include components specifications, installation guidance, operating instructions, maintenance schedules, guarantees, registration card, spare part lists, means of obtaining spare parts, etc.

Completion checklist and commissioning sheet

The three-part sheet detailed in Section 6 should be signed, completed, and included in the operation and maintenance manual.

Section 6: Completion checklist and commissioning sheet

This installation completion checklist and commissioning sheet is divided into three distinct parts:

Part 1 contains the particulars of the system, installation address and installer‘s details.

Part 2.a should be completed by the installer for all systems, and functions as an installation checklist.

Part 2.b is a visual inspection, or pre-commissioning checklist, and should be completed by the competent installer/commissioning technician for all systems.

Part 3 should be completed by the competent installer/commissioning technician for all systems that employ fan units, including intermittent extract fans, and requires airflow measurements to be recorded.

Part 4 is for completion by an independent third party certification body and should be made available to support ventilation system certificate.

The three parts should be completed in full, and a copy should form part of the operation and maintenance manual.

Checking design against measured airflow rates

For ventilation systems cMEV, MVHR and natural ventilation systems, the measured airflow rates should be recorded on Part 3: *Commissioning details*, as part of the commissioning procedures given in Tables 2, 4 and 6. The measured values will need to be compared with their respective design values. Compliance with the design will be met if the measured rates for each are equal to, or greater than the design value. If any measured value is less than the design value, adjustment should be made to correct the system and all airflows re-measured until they meet the design values.

Instrument calibration

Measurement of airflows should be performed using equipment that has been calibrated at an INAB accredited calibration center. Calibration should be performed annually for each airflow measurement device used to record final airflow rates in Part 3. The Building Control Authority (BCA) may request copies of calibration certificates. These should be provided under Section 11(5) of the Building Control Act 1990.

Demonstrating compliance

All four parts should be completed, with the relevant Parts 2 and 3 signed by a person who is suitably qualified and responsible for the installation and for the commissioning of the system that has been installed.

The four-part form needs to be completed for each installation address, and a copy should be included as part of the handover documentation to the owner of the dwelling.

Part 1 – System details and declarations

1.1 Installation Address Details	
Dwelling name/number	
Street	
Locality	
Town	
County	
Eircode	
MPRN	
1.2 Installation Details	
System classification*	System .....
Enter System as defined in Sections 1.2.2, 1.2.3 and 1.2.4 of TGD F 2019	
Manufacturer	
Model numbers	
Serial number (where available)	
Location of fan units	1.
	2.
	3.
	4.
	5.
1.3 Installers Details	
Name	
Company	
Address Line 1	
Address Line 2	
Telephone Number	
Eircode	
1.4 Commissioning Technicians/Engineers Details (if different to 1.3)	
Technician/Engineer's Name	
Company	
Address Line 1	
Address Line 2	
Telephone Number	

Eircode	
1.5 Third Party Certifying Technicians/Engineers Details	
Technician/Engineer's Name	
Company	
Address Line 1	
Address Line 2	
Telephone Number	
Eircode	

**Note. If a system has been installed that is not defined by TGD F, further installation checks and commissioning procedures may be required. Seek particular guidance from the manufacturer for these systems.*

Part 2.a – Installation details

2.a.1 Installation Checklist – General (all Systems)	**Tick as appropriate**	
Has the system been installed in accordance with manufacturer's requirements?	Yes	No
Have relevant system installation clauses been followed as detailed in Tables 1, 3, and 5 as applicable?	Yes	No
If any deviation from Tables 1, 3 and 5, these should be detailed here.		
Description of installed controls (e.g. timer, central control, humidistat, PIR, etc.).		
Location of manual/override controls.		

2.a.2 Installer's Declaration	
Installer's Signature	
Registration Number (if applicable)	
Date of Inspection	

Part 2.b – Inspection of installation

This section should be completed by the commissioning technician prior to completing Part 3.

2.b.1 Verification - Background Ventilators – Natural Ventilation with Provision for Extract Ventilation		
Background ventilators (as per Part 1 1.2), and/or Section 1.2 of TGD to Part H. Note: Part J ventilators should not have closable vents.	Location	Number of vents [equivalent area mm^2]
	Total equivalent area	

2.b.2 Visual Inspections – General (all Systems)		
Total installed equivalent area of background ventilators in dwelling?		**mm^2**
Total floor area of dwelling?		**m^2**
Does the total installed equivalent ventilator area meet the requirements given in Section 1.2 of TGD F?	**Yes**	**No**
Have all background ventilators been left in the open position?	**Yes**	**No**
Have the correct number and location of extract fans/terminals been installed that satisfy relevant Table of Tables 1, 2 and 3 of TGD F?	**Yes**	**No**
Is the installation complete with no obvious defects present?	**Yes**	**No**
Do all internal doors have sufficient undercut to allow air transfer between rooms (i.e. 10 mm over and above final floor finish)?	**Yes**	**No**
Has all protection/packaging been removed (including background ventilators) such that system is fully functional?	**Yes**	**No**
For ducted systems, has the ductwork installation been installed in such manner that air resistance and leakage is kept to a minimum?	**Yes**	**No**
Are the correct number and size of background ventilators provided that satisfy TGD F?	**Yes**	**No**
Has the entire system been installed such that there is sufficient access for routine maintenance and repair/replacement of components?	**Yes**	**No**

2.b.3 Visual Inspections – General (Continuous MEV & MVHR)		
Have appropriate air terminal devices been installed to allow system balance?	**Yes**	**No**
Has the heat recovery unit (MVHR System only) and all ductwork been effectively insulated where installed in unheated spaces?	**Yes**	**No**
Condensate connection is complete and drains to an appropriate location - MVHR Systems only?	**Yes**	**No**
2.b.4 Other Inspections – General (All systems with Fans)		
Upon initial start-up, was any abnormal sound or vibration experienced, or unusual smells detected?	**Yes**	**No**

Part 3 – Commissioning details

3.1 Commissioning Equipment		
Schedule of air flow measurement equipment used, (model and serial)		Date of last INAB calibration
1.		
2.		
3.		

3.2 Air Flow Measurements – Natural Ventilation with Provision for Intermittent Extract Ventilation		
Extract Fan reference (as per Part 1 1.2)	Measured Extract Rate (l/s)	Design Extract Rate (l/s) Refer to TGD F (Table 3)
Extract Fan 1.		
Extract Fan 2.		
Extract Fan 3.		
Extract Fan 4.		
Extract Fan 5.		
Extract Fan 6.		

For kitchen extract canopies/hoods, only the highest setting needs to be recorded.

3.3 Air Flow Measurements (Extract) – MEV & MVHR				
Room reference (location of terminals)	Measured Air Flow Maximum/Boost Rate (l/s)	Design Air Flow Maximum/Boost Rate (l/s) Refer to TGD F (paragraph 1.2.2 & 1.2.3)	Measured Air Flow Minimum/Trickle Rate (l/s)	Design Air Flow Minimum/trickle Rate (l/s) Refer to TGD F (paragraph 1.2.2 & 1.2.3)
Kitchen				
Bathroom				
En Suite				
Utility				
Other...				
Other...				
Other...				

3.4.a Air Flow Measurements (Supply) – MVHR without recirculation				
Room reference (location of terminals)	Measured Air Flow Maximum/Boost Rate (l/s)	Design Air Flow Maximum/Boost Rate (l/s) Refer to TGD F (paragraph 1.2.3)	Measured Air Flow Minimum/Trickle Rate (l/s)	Design Air Flow Minimum/Trickle Rate (l/s) Refer to TGD F
Living Room 1				
Living Room 2 (if present)				
Dining Room				
Bedroom 1				
Bedroom 2				
Bedroom 3				
Bedroom 4				
Bedroom 5				
Study				
Other...				

3.4.b Air Flow Measurements (Supply) – MVHR with Recirculated air				
Room reference (location of terminals)	Measured Air Flow Minimum/Trickle Rate (l/s)	Design Air Flow Minimum/Trickle Rate (l/s) (from manufacturer, to supply fresh air and heating)	Measured Air Flow Maximum/Boost Rate (l/s)	Design Air Flow Maximum/Boost Rate (l/s) (from manufacturer, to supply fresh air and heating)
Living Room 1				
Living Room 2 (if present)				
Dining Room				
Bedroom 1				
Bedroom 2				

Bedroom 3				
Bedroom 4				
Bedroom 5				
Study				
Other...				

3.4.c Third Party Certification - Balance check		
	Yes	No
Is the overall supply air flow rate greater than but no greater than 15% of overall extract air flow rate?		

3.5 Commissioning - MEV & MVHR		
Have controls been set up in accordance with manufacturer's instructions?	Yes	No
Have all distribution grilles been locked to prevent unauthorised adjustment?	Yes	No
Have Ductwork joints been properly made in accordance with the supplier’s recommendations?	Yes	No

3.6 Commissioning Declaration by Installing Technician/Engineer	
Signature	
Date of Commissioning	
Competent person scheme name and registration no. (if available)	

Part 4 - Verification of Airflows by Third Party Certification Tester

4.1.a Third Party Certification - Documents handover to the customer		
	Yes	No
Confirm availability of operation and maintenance document, handover document for client		
Incl. type of ventilation system		
Incl. type of controls		
Incl. design air volume flow rates		

4.1.b Third Party Certification - Components check		
	Yes	No
Is the system safe to operate?		
Is there adequate access and free space to the system for the purposes of operation and maintenance?		
Has the system been left in reasonably clean condition?		
Are all components in good condition?		

4.2 Third Party Certification Flow Rate Tester Equipment		
Schedule of air flow measurement equipment used, (model and serial)		Date of last INAB calibration
1.		
2.		
3.		

4.3.a Verification - Background Ventilators – Natural Ventilation with Provision for Extract Ventilation		
Background ventilators (as per Part 1 1.2), and/or Section 1.2 of TGD to Part H Note: Part J ventilators should not have closable vents.	Location	Number of vents [equivalent area mm^2]
	Total equivalent area	

4.3.b Verification - Air Flow Measurements – Natural Ventilation with Provision for Intermittent Extract Ventilation		
Fan reference (as 1.2)	Measured Extract Rate (l/s)	Design Extract Rate (l/s) Refer to TGD F (Table 3)
Extract Fan 1.		
Extract Fan 2.		
Extract Fan 3.		
Extract Fan 4.		
Extract Fan 5.		
For kitchen extract canopies (cooker hoods), only the highest setting needs to be recorded.		

4.4.a Verification - Air Flow Measurements (Extract) – MEV & MVH				
Room reference (location of terminals)	Measured Air Flow Maximum/Boost Rate (l/s)	Design Air Flow Maximum/Boost Rate (l/s) Refer to TGD F (paragraph 1.2.2 & 1.2.3)	Measured Air Flow Minimum/Trickle Rate (l/s)	Design Air Flow Minimum/Trickle Rate (l/s) Refer to TGD F (paragraph 1.2.2 & 1.2.3)
Kitchen				
Bathroom				
En Suite				
Utility				
Other...				
Other...				
Other...				
TOTAL				

4.4.b Verification - Air Flow Measurements (Supply) – MVHR without recirculation				
Room reference (location of terminals)	Measured Air Flow Minimum Rate (l/s)	Design Air Flow Rate (l/s) Refer to TGD F (paragraph 1.2.3)	Measured Air Flow Boost Rate (l/s)	Design Air Flow Boost Rate (l/s) Refer to TGD F (paragraph 1.2.3)
Living Room 1				
Living Room 2 (if present)				
Dining Room				
Bedroom 1				
Bedroom 2				
Bedroom 3				
Study				
Other...				
TOTAL				

4.4.c Verification - Air Flow Measurements (Supply) – MVHR with Recirculated air				
Room reference (location of terminals)	Measured Air Flow Minimum/Trickle Rate (l/s)	Design Air Flow Minimum/Trickle Rate (l/s) (from manufacturer, to supply fresh air and heating)	Measured Air Flow Maximum/Boost Rate (l/s)	Design Air Flow Maximum/Boost Rate (l/s) (from manufacturer, to supply fresh air and heating)
Living Room 1				
Living Room 2 (if present)				
Dining Room				
Bedroom 1				
Bedroom 2				
Bedroom 3				
Study				
Other...				

4.4.d Third Party Certification - Balance check		
	Yes	No
Is the overall supply air flow rate greater than the overall extract airflow rate but no greater than 15% of overall extract airflow rate?		

4.6 Verification Declaration by Validation Technician/Engineer	
Signature	
Date of Commissioning	
Third Party Certification scheme name and registration no.	

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