Chapter 3.2

Mechanical ventilation with heat recovery

3.2 Mechanical ventilation with heat recovery

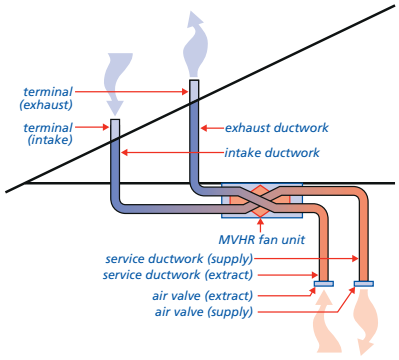
CONTENTS

SCOPE

This Chapter gives guidance on mechanical ventilation with heat recovery (MVHR) systems acceptable to NHBC.

DEFINITIONS FOR THIS CHAPTER

Mechanical ventilation with heat recovery (MVHR) systems will generally comprise the following components:



fan unit shown within the insulated part of the home

Air valve (extract and supply)
Wall or ceiling mounted fitting(s) used to balance the flow rate of air between rooms. Note: elsewhere, these may be referred to as grilles.

Exhaust ductwork
Ductwork that carries air from the fan unit and exhausts it to the external atmosphere.

Intake ductwork
Ductwork that carries air from the external atmosphere to the MVHR fan unit.

MVHR fan unit
Unit that contains the fan(s), heat exchanger and filter(s).

Service ductwork (extract and supply)
Ductwork that carries air between the air valves and the MVHR fan unit.

Terminal
Fitting(s) located on the outside of the building to terminate the end of the intake and exhaust ductwork.

DESIGN STANDARDS

3.2 – D1 Design shall meet the Technical Requirements

Design that follows the guidance below will be acceptable for MVHR systems.

STATUTORY REQUIREMENTS

3.2 – D2 Design shall comply with all relevant statutory requirements

Design should be in accordance with relevant building regulations and other statutory requirements.

Further guidance can be found in:

- Approved Document F
- the Domestic Ventilation Compliance Guide
- Section 3 of the Technical Handbooks
- the Domestic Ventilation Guide in Scotland
- the Technical Booklets in Northern Ireland.

SYSTEM DESIGN

3.2 – D3 MVHR systems shall be designed to ensure satisfactory in-service performance

Items to be taken into account include:

(a) systems
The MVHR system should be designed as a complete package, taking into account the performance of all components and materials to ensure they are compatible and that they meet the requirements of the design.

(b) location of the fan unit
The fan unit should be located to ensure satisfactory performance and appropriate access for maintenance.

Design should take account of:

- the manufacturer's recommendations for installing in the proposed location
- the system's satisfactory performance in the proposed location
- protection from the cold (see Clause D3(j))
- appropriate arrangements for access (see Clause D6).

(c) ventilation rates
The MVHR system should be designed to meet the ventilation rates set out in appropriate building regulations and standards (see Clause D2).

(d) type and position of air valves
The type of air valve should be selected for its location and function. Design should ensure that air valves are appropriately specified for:

- wall or ceiling location
- supply or extract function.

To create cross-ventilation within a room, low velocity air valves should be:

- positioned on the opposite side of the room from internal door openings
- not closer than 200mm to walls where located on a ceiling
- not more than 400mm from the ceiling where located on a wall.

Extracting air valves in kitchens should be a minimum of 600mm away from hobs when measured on plan.

Air valves should be positioned to take account of:

- the likely location of tall furniture
- the avoidance of draughts over beds and seating areas.

(e) position of terminals
To prevent cross-contamination, intake ductwork terminals should normally be separated from exhaust ductwork terminals and other potential sources of pollution by a minimum of 1m measured on plan. Increased separation distances may be required between the intake and any:

- soil and vent pipe terminal
- boiler flue outlet
- biomass or solid fuel chimney terminal.

(f) airflow
Systems should be designed to ensure even distribution of airflow, taking into account the resistance of the ductwork, including bends and fittings.

Airflow resistance within the system should be reduced by specifying suitable ducts, bends and terminals, and by ensuring the number of bends are minimised. The route of ductwork should be as direct as practicable.

The airflow resistance of terminals calculated in accordance with BS EN 13141-2 should be used in the design. The resistance of ductwork, including bends, should be calculated using data supplied by the duct manufacturer.

The MVHR fan unit should have suitable capacity to meet the performance requirements of the design, taking into account the airflow resistance of the system.

(g) ductwork
Ductwork should be of a rigid or semi-rigid material and be suitable for use in MVHR systems.

The design of ductwork fixings should be in accordance with the manufacturer's recommendations. Clips should be evenly spaced to ensure that the ductwork is securely held in position in accordance with Clause S4(b).

Joints in ductwork and between ductwork and other system components should be securely fixed and sealed with purpose-designed connections in accordance with the ductwork manufacturer's recommendations. Joints should be durable and air tight (see Clause M4(b)).

(h) variation from the design
The installation should be in accordance with the design. The designer should confirm that any proposed variations from the design will maintain satisfactory performance of the system.

(i) control of condensation
Condensate can form where ducts pass though spaces outside of the insulated parts of the home (such as a roof void) or when ductwork carrying cold air passes through spaces within the insulated parts of the home. Ductwork should be insulated

to reduce the risk of condensation formation.

Where insulation is required to prevent condensation formation, it should be continuous and vapour resistant. This can be achieved by using either suitable pre-insulated ductwork or a proprietary insulation system with a thermal resistance equivalent to a minimum of 25mm of insulating material with a thermal conductivity of 0.04W/(m.K).

Type of duct	Ductwork continuously insulated	
	Ductwork located inside the insulated part of the home	Ductwork located outside of the insulated part of the home
Intake	Yes	Yes
Exhaust	Yes	Yes
Service (supply and extract)	No	Yes*

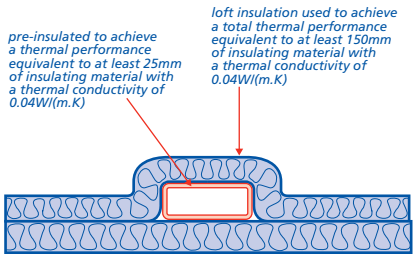
*Additional insulation should be provided in accordance with Clause D3(j)

Design should ensure that any condensate that forms within the duct can drain to a suitable outfall. Fan units should be located to enable connection of the condensate drain to the soil and waste system via a dry trap.

(j) protection from cold
Design should ensure that MVHR systems are protected from the effects of cold. Items to be taken into account include:

- the manufacturer's recommendations where any parts are located outside of the insulated part of the home
- insulation of ductwork and other system components
- condensation
- performance in relation to indoor air quality.

Where service ductwork is designed to be located outside of the insulated parts of the home, horizontal sections should be insulated to achieve a thermal resistance equivalent to at least 150mm of insulating material with a thermal conductivity of 0.04W/(m.K). This may be achieved by installing the service ductwork between the layers of horizontal insulation, and can take into account the continuous ductwork insulation described in Clause D3(i).



Condensate drains located outside the insulated part of the home should be insulated to prevent freezing.

To prevent damage to the components and ensure satisfactory operation, MVHR systems should be fitted with automatic frost protection.

(k) summer bypass
A summer bypass facility can reduce the heat recovery effect of the MVHR system during periods of warm weather. Where included, it should operate automatically and divert the airflow around the heat exchanger.

BUILDING INTEGRATION

3.2 – D4 Design of the MVHR system shall ensure compatibility with other building elements and not adversely affect the performance of the building or other services

Items to be taken into account include:

(a) compatibility with other building elements
Design of the system, including the route of ductwork, should take account of other building elements. Ductwork passing through structural elements should not adversely affect the structural or fire performance of the building.

Where design requires alterations to structural elements such as I-joists, this should only be carried out in accordance with the manufacturer's recommendations or be designed by an engineer in accordance with Technical Requirement R5.

(b) air transfer
Allowance should be made for air transfer within the dwelling. Where gaps between the underside of internal doors and the floor finish are used for air transfer, they should take account of the guidance given in Chapter 1.2 'A consistent approach to finishes'.

(c) fire
Design of the MVHR system, including ancillary components, should ensure that the fire requirements of the building are in accordance with relevant building regulations and standards. Items to be taken into account include:

- suitable detailing of components passing through other elements of the building
- the location and type of fire-stops to be used (see Clause M4(a))
- the method of providing air transfer
- the integrity of protected stairs and halls
- the integrity of walls and floors.

(d) weathertightness
Proprietary roof terminals should be used to ensure the weathertightness of the roof covering.

Reference should be made to Chapters 7.1 'Flat roofs and balconies' and 7.2 'Pitched roofs'.

(e) fixing MVHR fan units
Fan units should be fixed to parts of the building capable of taking their load.

Where fan units are supported by other elements of the building, such as roof trusses or joists, their design should take account of the additional load.

Where MVHR fan units are supported by framed structures, additional components may be required to provide a secure fixing point (see Clause S5). Fixings should be in accordance with manufacturer's recommendations.

(f) electrical service
The electrical service to MVHR fan units should incorporate a switched fused spur that allows the unit to be isolated.

NOISE

3.2 – D5 MVHR systems shall be designed to minimise disturbance caused by noise

Fan units should be sized to run at their optimum speed to provide suitable performance whilst taking noise into account. Specifying MVHR fan units that provide the designed airflow rates when running at less than full speed can reduce noise output.

Ductwork should be sized to allow air to pass freely without causing excessive noise disturbance. To reduce noise transfer along ductwork, a short length of flexible duct can be installed adjacent to air valves and fan units in accordance with Clause S4(a).

Other items to be taken into account include:

- noise between habitable rooms
- external noise
- location of the MVHR fan unit
- the type of mountings used to secure the MVHR fan unit.

ACCESS AND CONTROLS

3.2 – D6 Design shall ensure that the fan unit and associated controls are easily accessed to enable routine servicing

Items to be taken into account include:

(a) fan units within the insulated parts of the home
Where fan units and associated controls are located within the insulated parts of the home, access should not be obstructed by shelving, equipment, services or other elements of the building. Access panels should be located and sized to enable routine servicing to be carried out.

(b) fan units outside of the insulated parts of the home
Where fan units are located outside of the insulated parts of the home, the controls, including visual indicators for servicing and operation mode, should be visible from within the insulated parts of the home, and a suitable means for safe access to the fan unit to carry out routine servicing should be provided.

Provision for access should include a suitable walkway from the access hatch and a working platform 1m^2 immediately adjacent to the MVHR fan unit. The walkway and platform should be designed to ensure that the continuity of any insulation is maintained. The supporting structure should be designed to take account of the additional load.

(c) indication and controls
MVHR systems should include visual indicators for maintenance, servicing and operation mode, and these should be visible and not obscured from view. Control devices should clearly indicate the mode the fan unit is in (e.g. boost, summer bypass, frost protection) and be simple to use.

Where operational controls for a boost function are provided, they should be located in or adjacent to the wet room, WC or kitchen that they serve. The boost function should switch off automatically.

(d) cleaning
To maintain operating performance, extract service ductwork and air valves should either be fitted with filters or ductwork should be accessible for cleaning.

(e) user information
Information about the system and its operation should be provided to the end user (see Clause S7).

PROVISION OF INFORMATION

3.2 – D7 Designs and specifications shall be produced in a clearly understandable format and include all relevant information

Drawings and specifications for each design should be provided to the installer and be available on site. Where appropriate, the information should include the:

- location of all ductwork runs, the fan unit and controls
- type and size of duct
- direction of fall for 'horizontal' ductwork
- type and spacing of clips and fixings
- positions and type of terminals
- type and location of ancillary components, including those used for fire safety and acoustic purposes
- designed airflow-balancing figures for the system.

MATERIALS STANDARDS

3.2 – M1 All materials shall:
(a) meet the Technical Requirements
(b) take account of the design

Materials that comply with the design and the guidance below will generally be acceptable for MVHR systems.

Further guidance for the selection of materials can be found in Technical Requirement R3 (see Chapter 1.1 'Introduction and Technical Requirements').

SYSTEMS

3.2 – M2 Materials and components used as part of a system shall be compatible

Materials and components for MVHR installations should be specified by the designer to form a complete system. The designer should ensure that components are compatible and will provide suitable performance. Particular consideration should be given where components from different manufacturers are specified on the same system.

DUCTWORK, INSULATION AND ANCILLARIES

3.2 – M3 Ductwork and insulation shall provide satisfactory performance

Materials used for ductwork and insulation should be suitable for the intended purpose and provide satisfactory performance for the life of the system.

Items to be taken into account include:

(a) ductwork
Rigid or semi-rigid ductwork should be suitable for use in MVHR systems.

Clips used for securing ductwork should be those recommended by the manufacturer.

Bends, connections and junctions should be formed using proprietary components that are part of the ductwork system.

(b) insulation
Insulation should be inert, durable and not be adversely affected by moisture vapour, and should also be suitable for use with the ductwork system.

3.2 – M4 Ancillary components shall be specified to provide satisfactory performance

Items to be taken into account include:

(a) fire stopping
Proprietary fire components should be suitably tested and specified to take account of the test conditions. Appropriate standards include:

- BS 476 Fire tests on building materials and structures (relevant parts)
- BS EN 1365-2 Fire resistance tests for loadbearing elements. Floors and roofs
- BS EN 1366-3 Fire resistance tests for service installations. Penetration seals

(b) jointing ductwork
The method and materials used for jointing ductwork should be specified by the duct manufacturer to ensure a durable and airtight seal. Other issues to be taken into account include:

- thermal movement
- moisture
- temperature
- compatibility with the duct material.

(c) air valves and terminals
Air valves and terminals should be specified to be suitable for their location and function, and the velocity of the system. Airflow resistance should be calculated in accordance with BS EN 13141-2 Ventilation for buildings. Performance testing of components/products for residential ventilation. Exhaust and supply air terminal devices.

Adjustable air valves should be lockable, to prevent building users from altering them.

Terminals should be designed to prevent the entry of birds and animals.

SITEWORK STANDARDS

3.2 – S1 All sitework shall:
(a) meet the Technical Requirements
(b) take account of the design
(c) follow established good practice and workmanship

Sitework that complies with the design and the guidance below will generally be acceptable for MVHR installations.

INSTALLERS

3.2 – S2 MVHR systems shall be installed by suitably qualified installers

MVHR systems should be installed by operatives who:

- are familiar with the system being installed
- can demonstrate that they have a suitable level of knowledge for installing domestic MVHR systems.

Operatives should have successfully completed an appropriate training course such as that offered by BPEC, or other suitable course acceptable to NHBC.

COMPLIANCE WITH THE DESIGN

3.2 – S3 MVHR systems shall be installed in accordance with the design

Installations, including materials, components and layouts, should follow the design. Proposed variations from the design should be referred back to the designer for approval.

The detailed design and specification should be available on site.

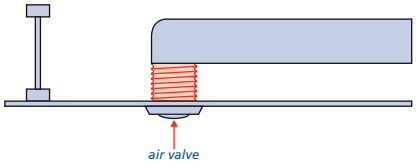
3.2 – S4 Ductwork shall be installed to ensure satisfactory in-service performance

Items to be taken into account include:

(a) type of duct
Ducts used for MVHR systems should be rigid or semi-rigid, have a round or rectangular section, and be suitable for the intended purpose.

Flexible duct should be:

- not more than 300mm in length
- located adjacent to fan units or air valves
- not used to form bends.



(b) fixing
Ductwork should be securely installed in a neat and workmanlike manner. Parallel ductwork runs should be positioned to maintain a reasonably even gap.

To prevent condensate collecting, horizontal ductwork should have a slight fall to a suitable outfall in accordance with the design, and be installed to a true line to avoid localised dips that could collect condensation.

Where ductwork passes through an external wall, it should be positioned to slope slightly outwards to prevent water entering the building.

Clips should be spaced at equal distances and no more than 750mm apart, or in accordance with the ductwork manufacturer's recommendations.

Ductwork should not be in direct contact with other surfaces, such as plasterboard ceilings, that may transfer noise to the dwelling.

(c) jointing
Joints in ductwork, and between ductwork and other system components, should be securely fixed and sealed with purpose-designed connections, in accordance with ductwork manufacturer's recommendations. Joints should be durable and air tight (see Clause M4(b)).

Where tapes and sealants are used, they should be suitable for the intended purpose and be those recommended by the ductwork manufacturer. Tape should be installed in a neat and workmanlike manner, surfaces should be dry and free from grease and dust before applying. Sealants should be applied to ensure that any excess material does not extrude to the inside of the duct.

(d) insulation of ductwork
Insulation should be installed in a neat and workmanlike manner to ensure that there are no gaps.

Proprietary duct insulation systems, including pre-insulated ducts, should be installed in accordance with the manufacturer's recommendations. Where a vapour control layer is incorporated, the joints should be sealed using appropriate tapes or sealants as recommended by the manufacturer.

3.2 – S5 MVHR fan units shall be installed in accordance with the design

MVHR fan units should be located, orientated and fixed in accordance with the design, using the clips, brackets and fixings recommended by the manufacturer. Fan units should be located and fixed to a part of the building capable of satisfactorily taking the load. Where MVHR fan units are supported by framed structures, additional components, such as noggings, may be required to provide a secure fixing.

COMMISSIONING AND BALANCING

3.2 – S6 MVHR systems shall be commissioned to ensure performance is in accordance with the design

The system, including ductwork and filters, should be checked to ensure it is clear from dirt and dust that may have accumulated during construction.

The MVHR system should be commissioned to confirm performance is in accordance with the design.

The installation should be adjusted by using the air valves and system controls to achieve the correct balancing and airflow rates.

Where the system cannot be balanced using the air valves and system controls, the complete system should be checked to ensure that it complies with the design. Any changes from the design should be referred back to the designer.

Adjusting the fan speed above the designed output may result in noise disturbance, and should be avoided.

Air valves should be locked in position after the system has been correctly balanced and commissioned.

A copy of the commissioning certificate should be made available to NHBC upon request.

HANDOVER REQUIREMENTS

3.2 – S7 Clear information, including user instructions, shall be provided to the end user.

The pack of information provided to the end user by the house builder should be in a format intended for a non-technical user and include:

- user instructions for the system and its controls
- a description of the system, including the location of components, and an easy-to-follow description of how it works
- details of the necessary routine maintenance to be expected, e.g. changing/cleaning the filters
- the method of cleaning the ductwork (where required)
- guidance for the use of summer bypass and boost settings (where installed)
- contact details of the manufacturer or distributor
- details of the installed system, including part numbers for consumables
- the commissioning certificate
- details of any maintenance and servicing agreements.

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NHBC
NHBC House, Davy Avenue, Knowlhill, Milton Keynes MK5 8FP
Tel: 0844 633 1000 Fax: 0844 633 0022 www.nhbc.co.uk

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