Implementing fit for purpose FHS ventilation

Developed by the FHS Ventilation Implementation Group
Authors: David Adams, Tessa Hurstwyn, Ross Holleron (Future Homes Hub), Kelly Butler (IG Chair / BEAMA), Ian Mawditt (Fourwalls)

1. Executive Summary

Current issues

Research and on-site evidence from across the UK consistently show that ventilation systems in new homes are often not designed, installed, or commissioned in line with regulatory requirements, leading to poor performance. Common issues include poor design coordination, inadequate commissioning, limited installer competence, unclear maintenance responsibilities, and a lack of resident understanding. On-site practices often deviate from design intent, particularly where installers rely on custom and practice rather than verified specifications. Commissioning checklists can appear to reflect target values rather than measured performance, undermining indoor air quality (IAQ), occupant health, and long-term building durability.

Proposed changes

The proposed enhancements, in addition to the Part F 2025 consultation changes, focus on strengthening end-to-end delivery through:

- Clearer design accountability and improved documentation.
- Expansion of the proposed competent person scheme (proposed in Part F 2025 consultation) to cover design of NV with IE (natural ventilation with intermittent extract) and dMEV (decentralised mechanical extract ventilation) systems with a complementary design training module.
- Introduction of independent verification for a percentage of installations.
- Differentiated verification levels depending on whether the installer/ commissioner is a member of a competent person scheme.

See Appendix A for a Recommendations Summary

Addressing the issues

These changes target the delivery gap between regulation and real-world performance. Competent design and installation practices will be supported through clearer responsibilities and verified outputs. Verification introduces accountability and risk of discovery for poor practices, encouraging quality compliance. Feedback loops will ensure late-stage design or installation changes are properly reflected in documentation. Collectively, these measures will ensure that ventilation systems deliver the IAQ outcomes they are designed for, improving consistency, occupant health, and satisfaction.

Impact of changes

The proposed improvements will raise ventilation quality standards across the housing sector, with minimal additional cost (£5–£7.50 per home for verification). Developers will benefit from reduced post-completion issues and reputational risk, while occupants will experience healthier, more comfortable living environments. The changes bring England in line with best practices across Europe, closing the persistent performance gap. Over time, they will foster a more skilled, accountable supply chain and ensure ventilation systems support wider householder health, energy efficiency and net-zero goals.

Implementation

It is expected that these relatively minor enhancements can be implemented alongside / as part of the Part F 2025 introduction and in conjunction with a reinvigorated and upgraded ventilation competent person scheme.

2. Background and rationale

Ventilation is a critical part of a building that is rarely noticed until it doesn't work. Over the years, it has remained in the background in the design and construction of new homes and rarely afforded the required importance to ensure satisfactory performance. As homes become more airtight to meet carbon and energy targets, ventilation is no longer optional. It becomes essential. Without it, we risk undermining the very outcomes we are trying to achieve: health, comfort, and long-term building durability.

Although ventilation has long been included in Building Regulations, evidence and experience show that the systems installed are not always working as intended. Compliance may be demonstrated on paper, but that is no guarantee of performance in practice.

For householders, poor ventilation is difficult to detect until problems appear, such as condensation, mould, persistent odours, or a sense of stuffiness. For housebuilders, the consequences may be less visible but just as serious: increased complaints, reputational risk, and the cost of remedial work.

A consistent evidence base – a step change is required

The case for change is not based on theory. It rests on more than a decade of detailed studies showing how ventilation systems in a significant proportion of UK homes have underperformed in real conditions.

- **Communities and Local Government (now MHCLG) (2009)**: Commissioned research to evaluate homes built to Part F 2006, this found that more than half of fans failed to meet extract targets and over 70% of homes had insufficient trickle ventilation. Pollutants such as carbon dioxide, formaldehyde and VOCs often exceeded health-based thresholds, particularly in flats and more airtight dwellings. The poor levels of compliance observed in this study led to the introduction of new Regulations for the testing and commissioning of mechanical systems in the 2010 edition of Approved Document F.
- **Zero Carbon Hub site study (2015)**: This study assessed 33 homes across six developments. It revealed serious issues at every stage of the process, from design to handover. Fan flow rates often reached only 40–50% of the required values, flexible ducting was used inappropriately, and residents frequently switched off systems due to noise. Even well-specified systems underperformed when delivered on site due to installation inadequacies.
- **MHCLG IAQ and Ventilation Study (2015/16[1])**: Based on homes built to Part F 2010 and the most comprehensive study of its kind in the UK, this research found that most homes built to Part F 2010 failed to provide sufficient ventilation. In naturally ventilated homes, 94% of master bedrooms had elevated levels of CO_2 overnight. Most systems were not commissioned adequately, and residents lacked understanding of how to operate them. Overall, more than 90% of the homes studied did not meet the minimum requirements of Part F. The findings were disappointing given the introduction of new testing and commissioning requirements in Part F 2010.
- **Evidence from Scotland** reinforces these findings. Studies[2] between 2012 and 2020 examined new energy-efficient homes and found that mechanical ventilation systems frequently failed to deliver adequate performance in practice. Elevated CO_2 levels were

[1] Published 2019

[2] Led by Sharpe T and, McGill G – University of Strathclyde

common, particularly in bedrooms, and installations were often undermined by poor coordination, limited commissioning, and noise-related occupant disengagement. These studies also highlighted a lack of routine maintenance and user understanding, illustrating the persistent gap between regulatory intent and lived experience, even in homes built to higher environmental standards.

These studies, conducted across different years and housing types, and anecdotal feedback since, all found the same thing. Ventilation is not consistently delivering the outcomes it should, despite the regulatory standards in place.

Responding through regulation – the role of Part F

In response, the 2021 update to Approved Document F introduced several important changes. These included:

- Linking ventilation rates directly to measured airtightness.
- Updating background ventilator guidance to better reflect whole-dwelling requirements.
- Simplifying the structure and language of the Approved Document, including making demonstrating compliance easier.

These changes were developed to be practical and proportionate, but implementation remains inconsistent. Anecdotal experience suggests the quality/ validity of information being provided on the ventilation checklist can be questionable, with the results simply reflecting the target values rather than actual measured performance. Many teams across the supply chain still lack familiarity with the new requirements, and commissioning is often inadequate. Guidance and skills support will help, but so too will clearer expectations around design and delivery.

The forthcoming **Part F 2025 proposals** aim to build on these reforms. Key themes include:

- **Design**: Setting limits on system resistance to help ensure better-performing ducting system installations
- **Commissioning**: Improving methods of commissioning of mechanical ventilation systems

These Part F 2025 proposals are not about adding new burdens. They are intended to help close the gap between what is designed and what is delivered. The goal is to improve consistency, protect occupants and reduce reputational risks for developers.

While these proposals represent an important step forward, they do not adequately address the commissioning quality issues by stopping short of requiring independent verification of system performance: a measure necessary to secure consistent outcomes.

Scotland's proposed 'Passivhaus-equivalent' standard places strong emphasis on ventilation as part of an integrated performance standard. Independent verification of commissioning, including airflow balancing and measured system performance, will be required at completion.

Learning from Europe

Across Europe, governments and industry have responded to similar challenges with targeted reforms, particularly around independent verification of ventilation design and commissioning. This has been the key difference between success and ongoing failure.

- In **Belgium**, a two-stage system was introduced. First, a ventilation design must be lodged before construction. Second, 10% of completed homes are independently and randomly inspected, with penalties for non-compliance. Since this change, compliance rates have improved dramatically: from around 20% to over 90% of homes tested.
- **France** introduced mandatory post-installation testing under its RE 2020 framework. Trained third-party testers verify actual flow rates, and results are uploaded to a national ventilation performance database. These changes followed longstanding concerns about low compliance and hidden failures in new homes.
- **Ireland** now requires independent commissioning of mechanical systems in airtight homes. Installers must be registered, and commissioning data must be submitted before energy performance certificates can be issued. Independent verification of the commissioned flow rates for mechanical systems must be provided.

These countries faced the same questions that England faces now. Their experience shows that improved outcomes do not require sweeping changes to technology or specification. They require assurance that systems are doing what they were designed to do. Independent verification and proportionate oversight were at the heart of this.

Making it work in England - A reasonable next step

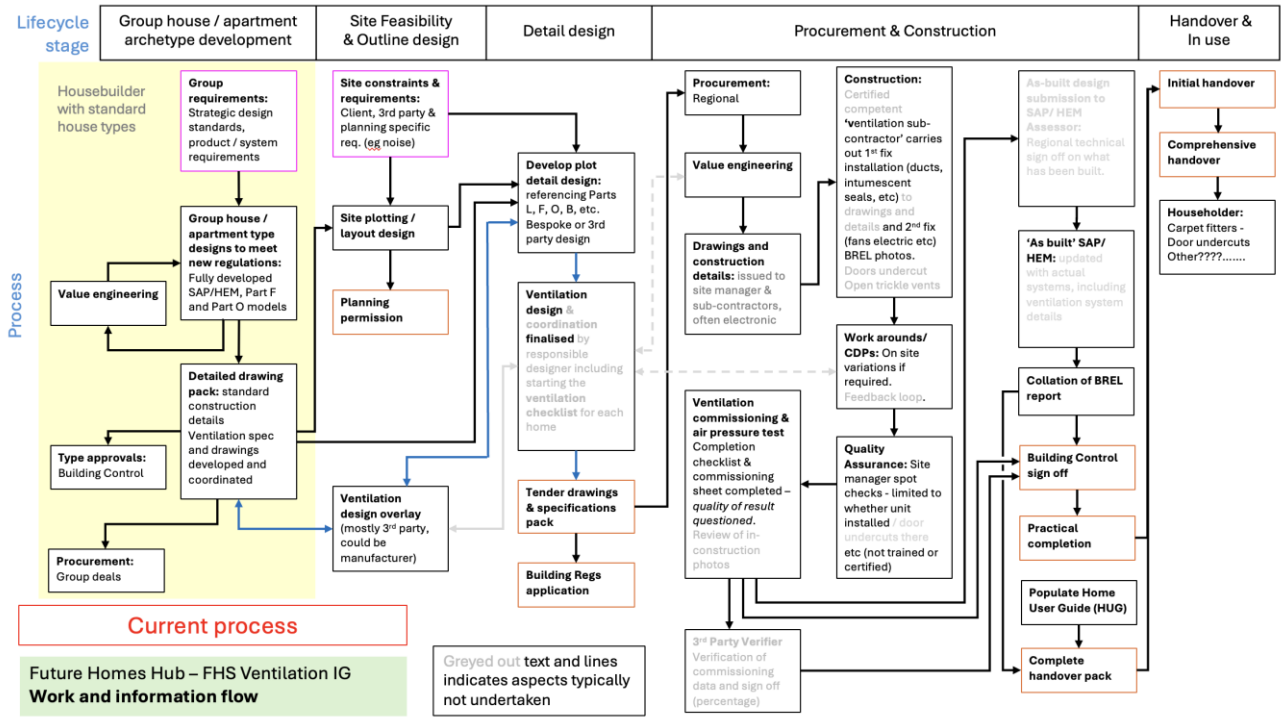
This paper presents recommendations for how the proposed Part F 2025 can be refined. Targeted enhancements that will significantly increase the potential for new homes to be healthy, comfortable and low risk for their occupants for years to come.

3. Current ventilation design, installation and commissioning practice

As UK homes become more airtight and therefore even more reliant on intended mechanical ventilation systems the risk of underperformance grows unless these systems are properly designed, installed, commissioned and maintained. The latest evidence suggests that:

- Coordination between ventilation systems and structural layouts is still weak on many sites
- Commissioning is often carried out by the installer, with limited or no third-party oversight
- Residents often do not understand how to use or maintain their systems
- Maintenance expectations are unclear or unfulfilled, particularly for filter changes in MVHR systems

As highlighted in the introductory section, this is not a technology but a delivery issue. To help identify key areas needing change, the current typical process for ventilation design, installation and commissioning is shown in the flow diagram (below). This broadly applies to housebuilders, with the yellow background showing the additional design-stage process for developers that use standard house types. The 'greyed out' text refers to the proposed fit-for-purpose process (see Section 4).



For larger developers:

Ventilation design is typically carried out at the standard house type detailed design stage with the developer receiving outline ventilation designs and specifications from a third party (often a manufacturer). These are integrated into the design pack for the house and a section of the Specification will set out the ventilation equipment specification, unit positioning, ductwork layout and required flow rates.

Developers will typically specify the ventilation unit manufacturer and product model. However, regional design teams are given some flexibility to modify system positioning if required eg for local planning requirements or for localised acoustic requirements. This process can then lead

to changes in the design and equipment delivered to site for installation. Anecdotally, during this and other value engineering led revisions, the feedback loop to the original designer may be missed and it is not clear if the site manager's drawing and specification packs are routinely updated to reflect the final design.

The dwelling drawing pack can easily consist of 100+ drawings in total and the detailed specification can run to 100+ pages, covering all aspect of the build. Some developers split the information packs up for specific trades and work packages. However, it is unclear how well this detail is referred to by the ventilation installer on site. The risk is, especially for homes with intermittent extract fans and decentralised MEV, that the installers use 'custom and practice' to determine the equipment installation, whilst making sure to match the exterior positioning of vents as per the elevation drawings. Should drawings not be referenced, there is a risk that ductwork routes don't follow the design and performance is impacted. Should work-arounds on site be required it is unclear if there is feedback to the designer and calculations checked and drawing packs updated with necessary changes.

For smaller and micro developers:

For smaller house builders the 'design' for intermittent extract and decentralised MEV is typically carried out by the installer as part of the installation process. Design tends to be based on 'custom and practice' or using information provided from the supply chain. Installers may have been on an installation training course, but these do not cover ventilation design, and the installer is almost certainly not part of a competent person scheme.

Where centralised ventilation systems are installed, these are more likely to be designed and installed by specialist ventilation companies.

For all:

Ventilation installation is generally added to the electrical sub-contractor's package of works, unless very specific circumstances such as a PassivHaus construction where a specialist sub-contractor may be used. The electrician installing the ventilation may, or may not, be ventilation trained/ competent and is almost certainly not part of a competency scheme.

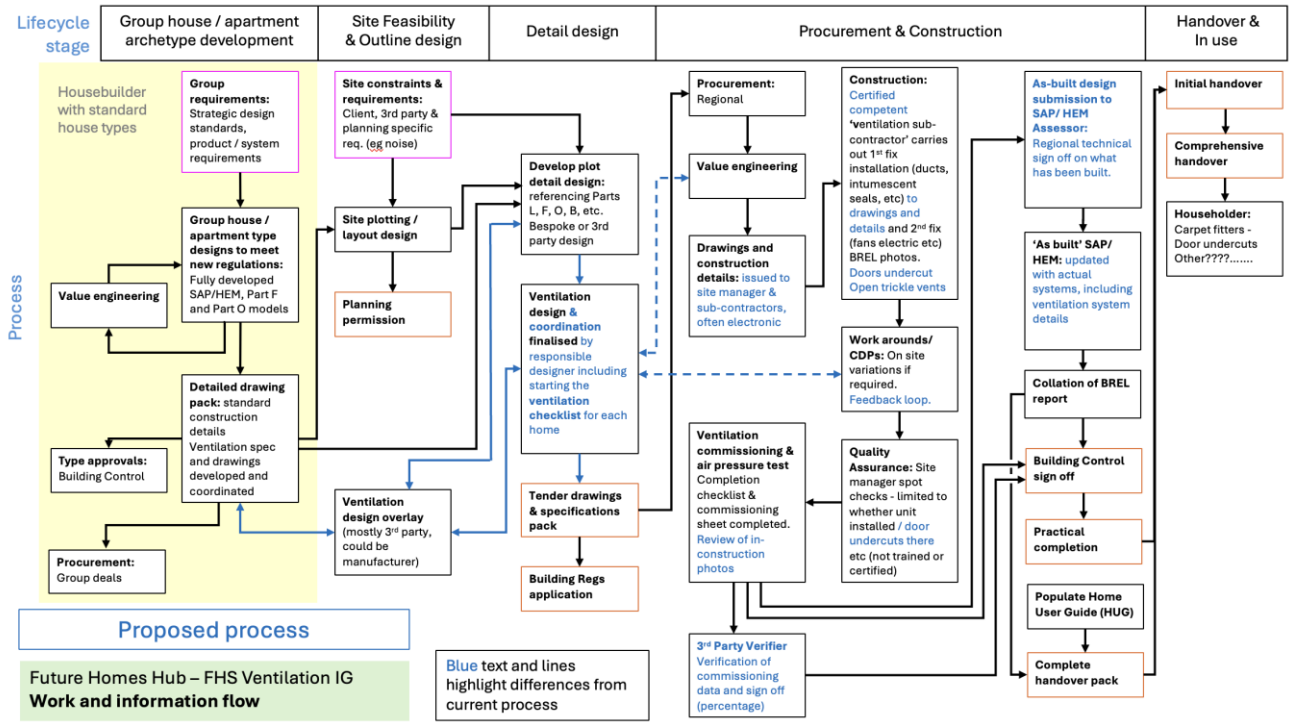
Anecdotally, QA checks by the site manager are limited to whether a fan has been installed in a given room. It is more common for larger developers to organise MVHR manufactures to provide onsite hand-holding for installations at the start of a development. The risk of knowledge loss due to changes in site teams remains a challenge for site managers.

The sub-contractor will provide a completed ventilation commissioning checklist, which is copied to Building Control, and forms a key piece of evidence in the completion sign-off of the home. Anecdotally, the quality/ validity of the information being provided on the ventilation checklist can be questionable, with the results simply reflecting the target values rather than actual measured performance. The number of air flow measurement devices calibrated each year is far less than the number of installations would suggest are needed (12-monthly calibration of equipment is required under Part F 2021).

As referenced in the Introduction, studies have shown the quality of installations are very variable and the level of confidence in the efficacy of the performance testing is low. Building control are provided with the ventilation checklist but have no way of knowing the quality/ validity of the information provided and there is only very low likelihood of poor practice being identified.

4. Fit for purpose ventilation design, installation and commissioning practice

The 'fit for purpose' process flow, shown below, integrates the Part F 2025 proposals and aims to rectify the remaining weaknesses of current practice including by: clarifying design responsibility, ensuring feedback loops and including a percentage of independent validation checking to provide risk of discovery for poor practice.



In essence, it seeks to ensure that processes currently described in regulation and guidance are undertaken in practice delivering the intended indoor air quality outcomes for occupants.

The key elements of the proposal are included in the Implementation Plan in section 5. In short:

- a ventilation design, carried out by a competent designer.
- procurement of the correct equipment (or a feedback loop to the designer to verify any changes).
- Installation and commissioning by a suitably competent person with appropriate on-site checking processes in place.
- Recording of commissioned flow rates, etc (as per Part F) and production of the ventilation commissioning checklist.
- Percentage verification of ventilation air flow and system performance

Essential to driving good practice through the supply-and-delivery chain is the introduction of a verification process, as adopted across Europe and, on a percentage basis which would verify the basic system elements, air flow and system performance measurements (also, by necessity the presence of the necessary design and installation information). The proportion would be lower for installations carried out by a registered competent person relative to those that rely on Building Control sign off. By introducing a likelihood of poor practice being discovered, subcontractors that correctly design, install and commission can flourish and those that do not either improve or exit the market.

5. Implementation plan – key elements

Typical ventilation systems:

- Natural ventilation with Intermittent extract (NV with IE)

  A passive system using background ventilators (trickle vents) for fresh air supply and door undercuts providing room to room air transfer, combined with intermittent extract fans in wet rooms to remove peak moisture and pollutants.

- Decentralised mechanical extract ventilation (dMEV)

  Continuous extract fans installed in individual wet rooms, running at a low background rate with boost capability. This de-centralised strategy requires minimal ductwork. Replacement air is drawn in through background ventilators (trickle vents) in habitable rooms and door undercuts or transfer grilles providing room to room air transfer.

- Centralised mechanical extract ventilation (cMEV)

  A continuous extract system using a central fan and ductwork to remove air from wet rooms, with replacement air drawn in through background ventilators (trickle vents) in habitable rooms and door undercuts or transfer grilles providing room to room air transfer.

- Mechanical ventilation with heat recovery (MVHR)

  A balanced system that supplies and extracts air mechanically via ductwork. Heat is transferred from outgoing to incoming air to reduce ventilation heat losses. Where extraction points are located in wet rooms only (typical), room to room air transfer is provided via grilles or door undercuts.

Design

NV with IE & dMEV systems:

Either: Designed by a competent installer who is registered with a competent person scheme (with the design element of the ventilation system training and competence expanded beyond the current 'principles' to include detailed design) with input from manufacturers and the housebuilder (as appropriate). Ventilation design responsibility being held by the competent installer,

Or: Designed by a housebuilders design team with input from ventilation equipment manufacturers. Ventilation design responsibility being held by the housebuilder. Manufacturers may offer an indemnified design service to the housebuilder (noting this would be for a specific design / parts list / drawing and any alterations that are not approved would invalidate the indemnity)

cMEV & MVHR systems:

Designed by a competent specialist designer (who may also be the ultimate installer) with technical input from manufacturers and design coordination by the housebuilder design team.

Design responsibility: specialist designer (noting this would be for a specific design / parts list / drawing and any alterations not approved would invalidate the indemnity).

Outputs: A meaningfully complete system design including: ventilation calculations, ventilation flowrates, whole house ventilation rate[3], component list, ventilation design drawings, ventilation checklist etc

New:

- Ventilation detail design (for NV with IE and dMEV systems) included in installer training
- NV with EV and dMEV ventilation design function included in competent person scheme
- Ventilation checklist originated by, and naming, the ventilation designer

Procurement of ventilation design services

NV with IE & dMEV systems:

Either: Procure competent installer to undertake the design who is registered with a competent person scheme. This would almost always be part of a design-install-commission package of work.

Or: If design to be carried out by housebuilders design team, ensure that they have the relevant competencies.

Or: Procure competent specialist designer (with appropriate professional qualifications / credentials) to undertake the design.

cMEV & MVHR systems:

Procure competent specialist designer (with appropriate professional qualifications / credentials) to undertake the design.

New:

- If the design of NV with IE and dMEV is being carried out by the installer then they should be part of the competent person scheme

Installation

NV with IE & dMEV systems:

Installed by a suitably competent installer of ventilation systems based on their design or that provided by the housebuilder design coordinator.

cMEV & MVHR systems:

Installed by a suitably competent installer based on the design provided by the housebuilders design coordinator.

Notes:

- Competent installer trained in the installation of all ventilation systems part of competent persons scheme [Part F 2025 proposed]
- Full pack of design information (location / routing, component lists, required flow rates, ventilation checklist) made readily available to the installer on site.

New:

- Implementation of Part F 2025 proposals

[3] See also Appendix A

Commissioning

All systems:

Commissioned and balanced by a competent person, which may be the installer, who is registered with a competent person scheme [Part F 2021 formal guidance]

Checks and visual inspections should be performed such as: background ventilators (eg window trickle vents), door undercuts, ductwork installation, unit fixing, electrical connection, system balancing and calibration. [Part F 2021 and Part F 2025 formal guidance]

Air flow (and system performance of centralised systems) should be measured as per Part F 2025 commissioning procedures.

To check that the ventilation system will meet the whole dwelling ventilation requirements during the commissioning, the whole dwelling rate should be calculated using the actual airflows measured. This confirms this important factor has been delivered whilst also reinforcing the importance of measuring the actual airflow by utilising the results in a meaningful way (see Appendix B for more context).

Systems should be commissioned so that at completion the system and its controls are left in the intended working order and can operate efficiently and effectively.

Outputs:

- Air flow and system performance measured data
- Valid completion checklist and commissioning sheet
- Confirming equipment installed matches the design parts list
- Calculated whole dwelling ventilation using measured airflows

New:

- Implementation of Part F 2025 proposals

Procurement of ventilation installer / commissioner

All systems:

Procure suitably competent installer / commissioner and ensure all design information, including the ventilation checklist, is provided to them in an easily accessible format that is specific to ventilation and not a small part of an all-encompassing design and specification pack.

Detail design information to include: exact manufacturer, product model(s), ductwork type and route, individual fan flow rates per room, position of outlets within the room, external elevations, ventilation checklist etc. (as appropriate).

Note: The commissioner is often the installer, but not necessarily so.

New:

- Ventilation specific information packs should always be provided if the design is not being undertaken by the installer
- Ventilation installers should be part of a competent person scheme

Procurement of ventilation system equipment

All systems:

Equipment should be procured as per the design specification (with any subsequent changes agreed with the designer)

Verification

All systems:

A representative sample of installations verified for the presence of the necessary design, installation information and confirmation of the air flow and system performance measurements undertaken during commissioning.

To be carried out by an independent registered verifier that is a member of a ventilation verification competency scheme which would be developed by industry (as per the SMETERS competent person scheme). Verification should be randomly selected at a meaningful rate (>10%) and triggered after the commissioning is complete and the commissioner has left site (to ensure all installations/ commissioning is undertaken at risk of verification).

This ventilation verification could be undertaken alongside the air permeability or acoustic tests by the same test engineer.

Estimated cost for NV with IE & dMEV systems circa £50 - £75 per home (including national registration) which, at a ratio of 10% would be a cost uplift of £5 - £7.50 per dwelling built[4].

Outputs:

- Verifiers air flow and system performance measured data compared with required design rates and cross referenced with commissioning data to an appropriate tolerance.
- Results sent to Housebuilder, Building Control and to Competent Person scheme (as appropriate)
- Should a discrepancy beyond a threshold be identified, meaningful sanction applied to commissioning engineer (possibly in the form of increased verification rate associated with their work and rapidly leading to a suspension then loss of registration).

New:

- Percentage verification as a requirement both within competent person schemes and via BCB requirements
- Suggested verification rate of 10% of installations if installer/ commissioner is part of a competent person scheme.
- If installer/ commissioner is not part of a competent person scheme they should be subject to a higher percentage of verification (eg greater than 30%) to reflect the increased risk due to lack of competent person scheme oversight.

[4] Marginal cost, assuming undertaken at the same time and by the same person undertaking the air pressure or noise transmission tests.

Appendix A - Recommendations summary

	Recommendations	Reasoning
1	Implementation of Part F 2025 consultation proposals	To increase professionalisation within the industry
2	Ventilation detailed design (for NV with IE and dMEV systems) included in installer training	Smaller builders, in particular, are relying on the installer to undertake design yet the current training and competency scheme provision does not extend to detail design.
3	Expansion of the competent person scheme proposed in Part F 2025 consultation to cover design of NV with IE and dMEV systems	To ensure that installers undertaking ventilation design are competent and maintain their competency.
4	If the design of NV with IE and dMEV is being carried out by the installer, then they should be part of the competent person scheme	
5	Meaningfully complete ventilation system design to be defined	To ensure consistency and provide a basis for the Verifier to check documentation
6	Meaningfully complete ventilation system design to be provided to the installer as part of a ventilation specific design information pack	To ensure that the actual design detail is provided to the installer undertaking the works.
7	Add to the ventilation checklist the name and company of the ventilation designer	To raise the importance of the design process and drive accountability
8	At commissioning, the whole dwelling ventilation rate should be calculated using the actual airflows measured	For the commissioner to make immediate use of the measured ventilation rates thereby reinforcing their importance
9	Introduction of independent (3rd party) verification: of design data being available; that equipment installed matches the design; that commissioning results are valid; etc.	To introduce a risk of discovery should design, installation or commissioning be inadequate.
9a	Verification rate of 10% of installations if installer/ commissioner is part of a competent person scheme.	
9b	Verification rate of greater than 30% of installations if installer/ commissioner is not part of a competent person scheme.	To reflect the increased risk due to lack of competent person scheme oversight and encourage membership of a competent person scheme.
9c	Should a discrepancy beyond a threshold be identified, meaningful sanction applied to commissioning engineer (possibly in the form of increased verification rate associated with their work and rapidly leading to a suspension then loss of registration).	To build a culture of quality by recognising good work, holding poor performers accountable, and excluding those who repeatedly fail to meet standards.
9d	Data entry into national database	To allow ongoing monitoring of performance at a national level
10	Introduction of an industry-led ventilation verification competent persons scheme	To allow efficient and cost effective implementation of verification by allowing integration with existing testing arrangements (such as air pressure or noise tests)

Appendix B

Whole dwelling ventilation rate calculation

Good ventilation design starts with getting the basics right. As a minimum, systems must deliver the whole dwelling ventilation rate set out in Approved Document F: the continuous background rate that ensures adequate air exchange across the entire home. However, in current practice, there is a disconnect between the design and commissioning stages, where systems are set up to meet the individual extract rates for wet rooms (e.g. 13 l/s for kitchens or 8 l/s for bathrooms). These figures are important, but they are only part of the story. In many cases, the background ventilation requirement for the dwelling as a whole can be higher than the sum of the individual wet room rates, and failing to account for this can result in persistent under-ventilation.

To support good outcomes, there should be a clear design-stage check to confirm that the system will meet the whole dwelling ventilation requirement. This is typically based on the number of bedrooms, as set out in Approved Document F. Addressing this at the design stage (i.e. prior to installation or commissioning) helps to ensure systems are properly sized and capable of delivering the intended performance in practice.