A Joint Position Statement from Ventilation System Suppliers & Supporters

Positive Input Ventilation (PIV) Systems, as referred to in PAS 2035:2019 by certain training providers, and in the BEIS Guide to Best Practice - Retrofit Internal Wall Insulation

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PCA Property Care ASSOCIATION

FETA

Content

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Positive Input Ventilation (PIV) Systems as referred to in PAS 2035:2019, by certain training providers & in BEIS Guide to Best Practice - Retrofit Internal Wall Insulation.

This paper is supported by the following organisations:

- By those members of the Residential Ventilation Association, part of HEVAC and FETA, who supply and/or manufacture PIV systems.
- By the majority of those BEAMA members who supply and/or manufacture PIV systems, and who are committed to providing suitable advice on the design, sizing, and position of such systems to comply with the requirements of PAS2035.
- By the Property Care Association, the leading trade association for the investigation and treatment of damp related defects in the UK.

1. Background

We have collectively produced this Position Paper to:

(a) Address what we consider are misunderstandings, inaccuracies, and unsubstantiated claims within PAS 2035:2019 regarding, and in relation to, PIV systems.

(b) Provide a response to the alternative opinion from certain training provider's views on PIV systems and written statement that a t*raining provider "does not recommend the use of PIV in retrofit projects, even though it is allowed by PAS 2035."*

(c) Challenge the BEIS Guidance document statement that *"Positive Input Ventilation (PIV) should not be installed with internal wall insulation. The risk of interstitial condensation between the wall and the IWI is increased when using a ventilation system such as PIV, that actively pushes warm, wet air into the building fabric."* this is not supported by any observed documentary evidence and is far too all-encompassing in relation to IWI and PIV.

(d) Provide re-assurance to specifiers and purchasers that a correctly applied, designed, installed, and commissioned PIV system remains a suitable means of providing adequate ventilation in the vast majority of existing UK homes regardless of whether or not they are subject to retrofit measures that will improve airtightness and/or insulation levels.

For the record, we do not in any way think that PIV systems are a residential ventilation panacea. We recognise that there are often better suited methods of ventilation for a home than a PIV system. We consider a PIV system just one of a number of methods that can be considered to adequately ventilate a dwelling and are equally enthusiastic about such other methods – when we think they are better suited to a particular application.

2. PIV systems and Interstitial Condensation

One of the most contentious issues regarding PIV systems relates to the level of positive pressure they can create within a dwelling and the perception that without suitable Background Ventilators this could lead to moisture laden air being forced into the fabric of the structure and result in interstitial condensation. To be fair to the training providers concede that this perceived risk *"…has not yet been properly evaluated by research."*

While it is true to say that there has been no detailed research done to establish if homes with PIV systems have suffered from interstitial condensation, this is most likely due to the fact that we are not aware of any UK home affected by interstitial condensation that can be attributed to the provision of a correctly applied, designed, supplied, installed, and commissioned PIV system. With PIV systems having been installed in over 1 million UK homes since the 1970's without any evidence of consequential interstitial condensation, it is not surprising that there has been little research to determine if they have ever caused interstitial condensation. Researchers rarely research problems where there is little or no evidence a problem exists to do research on.

In the published, recently reviewed, BS 5250:2021 – Management of moisture in buildings, this matter was reviewed and reference to Interstitial Condensation has been removed under 8.3.2 Mechanical supply ventilation systems.

The only detailed study of the effect of pressurisation by a PIV system in a UK home was carried out by the Building Research Establishment (BRE) as part of a wider study of PIV systems. An extract from their Information Paper IP 12/00 on the study, published in 2000 is shown below:

> ***"Pressurising effect of input ventilation***
>
> *The pressurising effect of the input ventilation fan measured in the airtight BRE test house was only 2.1 Pa. This is in reasonable agreement with the calculated value of 2.37 Pa based on airtightness and the input fan airflow rate. Pressure differences generated by stack effect and the wind outside are typically much greater than this."*

Another more recent BRE publication regarding the use of PIV systems for Radon gas control (Radon solutions in homes: Part 2 Positive house ventilation) has the following comment:

> *"Pressures generated using positive ventilation systems are small, typically between 0.2 Pa and 5.0 Pa. Occupants will not be aware of this pressure effect."*

BRE do not raise any concerns in the aforementioned publications regarding PIV systems increasing the risk of interstitial condensation.

Although not specifically related to PIV systems in homes, another more recent research project with a paper by Ferrantelli et al, published in the Journal of Building Physics in April 2019, titled "Positive pressure effect on moisture performance in a school building" concluded:

It would not be unreasonable to assume from the aforementioned, taking into account the fact that the moisture content of the air being dissipated through the structure with a PIV system will be much lower than without, that the technical risk of a PIV system causing interstitial condensation is very much lower than that of it being created by the much higher pressures created by stack and wind effects. Interstitial condensation dampness caused by wind and stack effect is rarely, if ever, mentioned as a possible concern, even with systems which rely on these driving forces to adequately ventilate a property i.e., Natural ventilation with background ventilators and intermittent extract fans and in part, Mechanical ventilation with heat recovery.

For the record, we also have a great deal of experience of these Systems and are not aware of interstitial condensation being attributed to any of these systems either, when properly installed.

3. PAS 2035:2019

We would like to make clear that PIV is an accepted and acknowledged method of ventilation under PAS2035. PAS2035 does include a note stating that with the use of PIV there is a risk of interstitial condensation. We have seen no evidence of the validity of this claim.

PIV systems have evolved and improved in performance over decades, having a proven efficacy in doing so. It is estimated that well over 1 million PIV units have been installed in the UK, often in place of ventilation systems more positively referenced in PAS 2035:2019 which have failed to perform as expected. Many readers of PAS 2035:2019, with real life experience of PIV systems and their benefits, do not recognise the comments it makes regarding it and indeed question its validity as an accurate reference document in relation to PIV systems.

The information regarding PIV systems within PAS 2035:2019 is also being used as a basis for training by certain organisations, who have associates that were involved in the development of PAS 2035, to publish that they do not *recommend the use of PIV in retrofit projects, even though it is allowed by PAS 2035* thus adding additional conditions which override PAS 2035, despite the claim that the course is in lockstep with PAS 2035:2019.

The recently published BEIS IWI guidance document published in September 2021 has added to the problem in relation to the claim that PIV with Internal Wall Insulation causes Interstitial Condensation. This is at odds with BEIS research published in March 2021 in relation to IWI, that highlighted Interstitial Condensation but made no link to ventilation systems.

The information in PAS 2035:2019, the training being provided by certain training providers and the BEIS guidance document are already having a negative impact on PIV in the market and could have a negative impact on jobs given the high volumes for the product.

We also think that the negativity towards PIV will result in many home occupants being denied the benefits that have been enjoyed by millions over the past 5 decades.

"Guidance Document: Positive Input Ventilation (PIV) Systems" produced by the Property Care Association (PCA), which provides generic guidance on the correct application, design, installation, and commissioning of PIV systems in existing homes, is a useful guidance document focused on PIV. It is now in its third edition with its fourth edition currently under consideration and is a good source of guidance for the application and installation of PIV.

4. How does a correctly applied, designed, installed, and commissioned PIV system actually work?

It appears to us that there is a perception by the authors of PAS2035:2019, certain training providers and the authors of the BEIS guidance document that PIV systems work in a combination of two ways:

1. By creating a positive pressure within a dwelling with the intention of pushing warm, moist, stale air through the structural gaps and/or Background Ventilators if fitted, in all rooms.
   It is worth noting here that PAS 2035:2019 refers to Background Ventilators being required for a PIV system in all *"…living spaces and bedrooms."* while certain training providers refer to them being installed in *"…all rooms, including wet rooms."*

2. By trying to contain and then push out moisture laden air within Wet Rooms to outside from the Wet Rooms.

A very important point to make here is that no reference is made at all in PAS2035:2019 or by certain training providers to PIV system enhancement extract fans in Wet Rooms.

Enhancement extract fans are sometimes required to optimise the performance of a PIV unit. This is well known by those who specialise in PIV systems. More information on PIV system enhancement extract fans follows.

PIV systems actually work by continually diluting, displacing, and replacing indoor air with filtered, lower moisture content external air. A properly designed and installed PIV system will effectively mix the indoor air with external air throughout a dwelling and gently change the air in a home on a controlled and continuous basis. The continuously diluted internal air has a resulting lower moisture content and therefore dew point, and the whole dwelling ventilation rate it provides, which should be calculated in a way consistent with all other ventilation systems, also helps control other non-moisture related indoor air pollutants.

Air will naturally move from areas of high vapour pressure to low vapour pressure and PIV systems are designed to take advantage of this natural phenomenon, not work against it. When moisture laden air leaves a wet room, via open doors or door undercuts, it will mix with the drier air being delivered centrally to the dwelling by the PIV unit, have its moisture content reduced by dilution and drive down the average dew point of the air within the dwelling.

As stated earlier in this document, the installation of a PIV unit on its own, with or without Background Ventilators, is not always sufficient to provide sufficient ventilation in a dwelling. Depending on the layout of the dwelling, there may be a need for PIV system enhancement extract fans to be installed in some wet rooms as well to optimise performance and provide adequate ventilation.

The following is an extract from the Property Care Association (PCA) best practice guide on PIV systems, referenced earlier, regarding such extract fans:

> *"7. ENHANCEMENT EXTRACT FANS*
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> *The installation of a PIV unit alone will help tackle a condensation dampness problem and improve indoor air quality in any home. Like any ventilation system it is not however a panacea and occasionally the addition of continuously running enhancement extract fans in "Wet Rooms" such as kitchens, utility rooms, bathrooms, en-suites, and WCs may be necessary to optimise performance.*

The installation of an enhancement extract fan is highly recommended in the following Wet Rooms:

1. *Any Wet Room which does not have an openable window or door to outside.*

2. *Any Wet Room where the air from a PIV unit or units would have to pass through another Wet Room to get to it.*

3. *Any Wet Room where the air from a PIV unit or units would have to pass through it to get to any "Habitable Room".*

Enhancement extract fans should be set to a background airflow setting of 4-6 l/s and should also be capable of the following boost rates:

Kitchens – 13 l/s.
Utility rooms, bathrooms, and en-suites – 8 l/s.
WCs – 6 l/s.

If there is an existing intermittent extract fan installed in any of the aforementioned Wet Rooms, it is highly recommended that it is replaced with an enhancement one as above. If there is an existing continuously running extract fan it is highly recommended that its airflow settings are adjusted to those above.

Other extract fans in other Wet Rooms are unlikely to have an adverse effect on a PIV system, however, it important to note that the total background airflow of all continuously running extract fans should not exceed 40% of the Normal Airflow Mode setting of the PIV unit."

It is worth noting here that the incorporation of PIV system enhancement extract fans will reduce the already very low pressure that a PIV unit on its own would create.

We acknowledge that PIV systems require the same "Purge Ventilation" measures as all other ventilation systems. Like all other systems we also understand that appropriate internal air transfer measures such as sufficient undercuts below internal doors are essential. Indeed, the requirement for these measures are detailed within the PCA's best practice guide.

5. PIV systems and Background Ventilators

With a PIV system, air must be able to exit the dwelling with the minimum of resistance to airflow.

For details about when and how background ventilators should be used reference should be made to Approved Document F, 2021 and manufacturer's product technical certificates, which are available from the manufacturer or National/European Technical Approved Body.

6. Guidance to those considering installing a PIV system in an existing dwelling

We would not support the installation of a Positive Input Ventilation system in any dwelling which already has a Mechanical Ventilation with Heat Recovery (MVHR) system installed, even if the existing system installed was assessed as inadequate. In such situations we would recommend that the existing MVHR system is repaired, modified, or adjusted to provide adequate ventilation, and if this is not possible, be replaced by an MVHR system which will.

Where existing ventilation is assessed as inadequate, and there are no insulation or airtightness measures proposed, we are satisfied that a Positive Input Ventilation system applied, designed, installed and commissioned in line with the Property Care Association's "Guidance Document: Positive Input Ventilation (PIV) Systems" will provide adequate ventilation to a dwelling, provided PIV enhancement extract fans are installed in Wet Rooms, when they are required, as detailed in the PCA document.

Where insulation and/or airtightness measures are proposed and a ventilation upgrade is required, we are satisfied that a Positive Input Ventilation (PIV) system applied, designed, installed and commissioned in line with the Property Care Association's "Guidance Document: Positive Input Ventilation (PIV) Systems" will provide adequate ventilation to a dwelling, provided PIV enhancement extract fans are installed in Wet Rooms, when they are required, as detailed in the PCA document, along with an appropriately sized background ventilator in each room without a PIV enhancement extract fan, if required to prevent internal air pressures exceeding those which would normally occur through stack and wind effects.

We acknowledge that installing a PIV system in a home with certain types of Internal Wall Insulation (IWI) will require careful consideration. With that in mind, we would recommend the use of an appropriately sized, background ventilator in each room (without a PIV enhancement extract fan).

If concerns persist in relation to the pressurisation effect of a PIV system in a home, consideration could be given to a basic, quick, post commissioning check being carried out.

In the case of a loft mounted PIV unit this would involve measuring the supply air flow rate with all windows and external doors closed, internal doors open and the loft hatch open, and then again with the loft hatch closed.

For wall mounted PIV units (normally installed in single storey apartments) this would involve measuring the supply air flow rate with all windows and external doors opened slightly and internal doors open, and then again with all windows and external doors closed. If there is no significant reduction in the supply airflow rate, then this would suggest that the resistance to airflow of the structure and the pressurisation effect of the PIV system are negligible. If there is a significant reduction in airflow, appropriately sized, background ventilators could be retrofitted in each room without a PIV enhancement extract fan. With any such check, care should be taken to ensure external wind loads do not affect the results.

We are of the view that the risk of any PIV system causing interstitial condensation in a dwelling, provided it is installed in line with the aforementioned considerations, to be no more than and arguably less than that of any method of ventilation in a dwelling that relies on stack and wind effects to function.

In summary, we are of the firm view, which is supported by technical and anecdotal evidence, that a correctly applied, designed, installed, and commissioned PIV system remains an ideal method of providing adequate ventilation in UK dwellings regardless of whether or not they are being subjected subject to retrofit insulation and/or airtightness improvement measures.