RISE | Retrofit information, support & expertise

PAS to Passivhaus: Comparing Retrofit Standards

Quick guide

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Introduction

As the UK moves toward its 2050 net zero target, retrofitting existing homes is a national priority. However, energy-efficient building - especially retrofit - carries risks. Poorly executed upgrades can lead to mould, condensation, and structural damage, affecting occupant health, comfort, and long-term durability.

To address these risks, **PAS 2035** provides a structured, risk-managed approach. It includes ventilation checks, moisture control, and post-installation evaluation, supported by whole-dwelling assessments that consider building condition, occupant behaviour, and measure interaction.

PAS 2035 operates within a wider compliance ecosystem, interacting with **Building Regulations**, **British Standards**, and other technical guidance. Within this landscape, **Passivhaus** and its retrofit counterpart **EnerPHit** offer a gold standard for performance and comfort. Alongside these, standards such as **RdSAP** (used for EPC assessments) and the **AECB's Carbonlite New Build and Retrofit Standards** offer alternative frameworks for improving building performance, each with varying levels of rigour and flexibility.

This quick guide explores:

- How **Passivhaus standards** from the Passivhaus Institute (PHI), including EnerPHit, align with and complement PAS 2035 in retrofit projects.
- The strengths and limitations of other standards such as **RdSAP** and **AECB Carbonlite**, offering a comparative view of retrofit compliance frameworks.

Why Passivhaus Matters in Retrofit

The **Passivhaus Trust** is a leading UK organisation committed to advancing the adoption of Passivhaus standards across both new build and retrofit sectors. Established to promote ultra-low energy buildings, the Trust provides technical guidance, training programmes, and advocacy to support the delivery of buildings that are comfortable, healthy, and affordable to run.

The Trust plays a central role in shaping best practice by working closely with architects, engineers, local authorities, and policymakers to embed Passivhaus standards into mainstream construction and retrofit strategies. It also maintains a growing library of UK-based case studies, demonstrating the real-world application and benefits of Passivhaus and EnerPHit standards.

Dr Sarah Price, a retrofit consultant, Passivhaus and AECB certifier, and technical author of **PAS 2035**, is currently collaborating with the Passivhaus Trust to raise awareness and improve retrofit quality. Her work focuses on closing the performance gap between predicted and actual building performance, which remains a persistent issue in UK retrofit projects.

Through her involvement, she aims to help more professionals and homeowners understand and adopt Passivhaus standards. We spoke to Sarah about this work and its applicability to retrofit, where quality assurance is critical and risks such as moisture, poor ventilation, and thermal bridging are more prevalent.

What is Passivhaus?

Passivhaus (or Passive House) is a rigorous voluntary standard for energy efficiency in buildings. Developed in Germany by the Passivhaus Institute in the early 1990s, it focuses on reducing the energy required for heating and cooling while improving indoor comfort and air quality.

A Passivhaus building is:

1. Extremely energy efficient, requiring minimal heating
2. Comfortable year-round, with stable indoor temperatures
3. Airtight and well-insulated, reducing drafts and thermal bridging
4. Equipped with mechanical ventilation with heat recovery (MVHR)
5. Designed to minimise the performance gap between predicted and actual energy use

Passivhaus buildings are modelled using the **Passivhaus Planning Package (PHPP)**, a detailed energy modelling tool that accounts for building geometry, insulation, airtightness, ventilation, and solar gains.

In the UK, the **Passivhaus Trust** provides guidance and promotes adoption. Notable UK examples of Passivhaus retrofit include:

- **Wilmcote House** in Portsmouth *(see figure 1)*
- **Erneley Close** in Manchester *(see figure 2)*
- **Lena Gardens** in London – a full Passivhaus project located in a conservation area, certified since 2008

Figure 1: Wilmcote House Residential Refurbishment. Source: ECD Architects.

Figure 2: Erneley Close EnerPHit Refurbishment. Source: Passivhaus Trust.

EnerPHit: Retrofit with Passivhaus Principles

Recognising the challenges of applying full Passivhaus standards to existing buildings, the **Passivhaus Institute** developed **EnerPHit**—a retrofit standard that balances ambition with practicality *(see figure 3)*.

EnerPHit can be achieved in a number of ways:

- **Component-based certification**: Individual elements (e.g., walls, windows, roof) must meet specific U-values. This allows for targeted upgrades without needing to meet all performance criteria at once. This flexibility is especially useful for complex buildings or constrained sites.
- **Step-by-step retrofit planning**: Improvements can be phased over time, making the process more affordable and manageable. This aligns well with the **Medium-Term Improvement Plan** required under **PAS 2035.**
- **Space heating demand targets**: If not using the component method, a space heating demand target of **<20 or 25 kWh/m²/year** is required, depending on where the project is in the UK. This can also be met using a step-by-step approach, or all in one go.

EnerPHit also supports:

- **Moisture risk management**, helping to protect building fabric and indoor air quality

Quality assurance through certification, ensuring that each stage of the retrofit meets high performance standards

This approach is particularly useful for homeowners, housing associations, and local authorities who want to improve energy performance without undertaking a full retrofit all at once.

Figure 3: Harpenden EnerPHit Plus before and after. Source: Passivhaus Trust.

Adoption, Barriers and Opportunities in the UK

Despite its benefits, **Passivhaus adoption in the UK remains limited**:

- Only 1% of new builds meet Passivhaus standards
- Fewer than six EnerPHit certified retrofits are completed annually (but there are more uncertified)
- Uptake is higher among those who can afford whole-house retrofits, but many are unaware of the step-by-step component method option

The most common barriers include:

- **Cost:** Full retrofits are expensive, and funding support is limited
- **Awareness:** Many homeowners, designers, and contractors are unfamiliar with Passivhaus principles or assume they're only for new builds
- **Local authority constraints:** Many aim only for EPC compliance, relying on PAS 2035 for quality assurance
- **Technical challenges:** Installing MVHR in high-rise buildings or homes with complex layouts can be difficult, but not impossible.

However, there are **clear opportunities** — especially in **medium or high-rise buildings** with favourable form factors that reduce heat loss. An external retrofit, sometimes known as 'wrapping' or a 'tea-cosy approach', can bring down costs, reduce disruption for occupants and can help manage quality on site.

There are opportunities for private and social landlords to reduce **maintenance and management costs** of their housing stock by implementing a Passivhaus or EnerPHit approach. Landlords of Passivhaus homes have also reported:

- Reduced call-outs from tenants,
- Fewer properties in rental arrears (due to very low energy bills),
- Reduced anti-social behaviour and
- A reduction in fuel poverty

As demand grows for **high-quality, low-energy retrofits**, Passivhaus and EnerPHit offer a robust framework for delivering long-term performance and comfort.

Comparing Standards

Passivhaus is not the only standard available for assessing and improving building performance. Other frameworks include:

AECB Carbonlite Building Standards: Developed by the Association for Environment Conscious Building, these offer more accessible alternatives to full Passivhaus:

- **AECB Carbonlite New Build:** A rigorous standard, closely aligned with the Passivhaus standard but with more flexibility.
- **AECB Carbonlite Retrofit:** A retrofit standard, closely aligned with the EnerPHit standard but with more flexibility.

RdSAP (Reduced Data SAP): Used to generate Energy Performance Certificates (EPCs) in the UK. While widely adopted, RdSAP is based on limited inputs and theoretical assumptions, making it less accurate than the Passivhaus Planning Package (PHPP), which models actual performance in detail.

PAS 2035: A process-led standard focused on managing retrofit risk and ensuring quality. It mandates a Medium-Term Improvement Plan, which aligns well with EnerPHit's step-by-step approach.

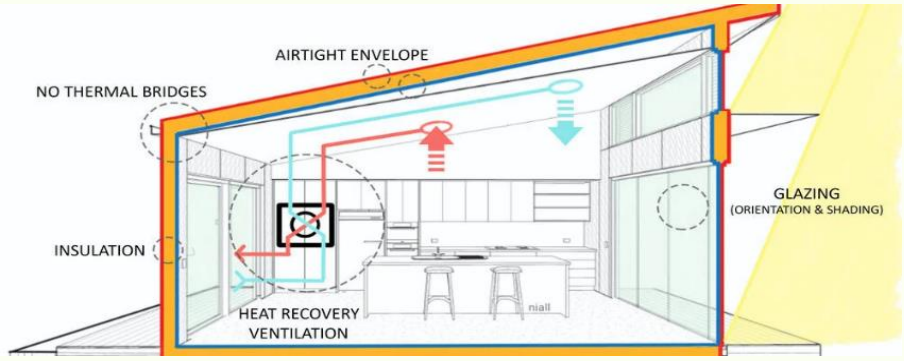

Figure 4: Passivhaus principles. Source: GAEA Architects.

What sets **Passivhaus** apart is its **performance-based focus** rather than compliance with prescriptive measures *(see figure 4)*. It emphasises:

- **Airtightness and thermal bridging:** Reducing heat loss through careful detailing and construction quality
- **Indoor air quality and moisture control:** Achieved through continuous ventilation and fabric-first design
- **Detailed modelling:** Using PHPP to predict actual energy demand, reducing the number of assumptions made
- **Third-party certification**: Using an independent and experienced Passivhaus Certifier ensures projects deliver what they are designed to and eliminates the performance gap.

EnerPHit, the retrofit version of Passivhaus, supports **step-by-step certification** via the **component or space-heating demand method**, allowing phased upgrades over time. This makes it especially useful for homeowners and social landlords who want to improve performance gradually while maintaining a clear path to certification.

Integrating Passivhaus with PAS 2035

PAS 2035 is the UK's official retrofit standard for government-funded projects. It introduces a structured, whole-house approach to retrofit and defines key roles, including:

- Retrofit Assessor
- Retrofit Designer

- Retrofit Coordinator
- Retrofit Installer
- Retrofit Evaluator

It also mandates:

- Whole-dwelling assessment
- Medium-term improvement planning
- Moisture risk management
- Ventilation checks

EnerPHit aligns well with PAS 2035 in several important ways:

1. The step-by-step EnerPHit plan mirrors the Medium-Term Improvement Plan in PAS 2035, allowing for phased upgrades that are both manageable and strategic.
2. Both frameworks prioritise moisture risk management, helping to prevent issues like damp, mould, and structural degradation.
3. PHPP (Passivhaus Planning Package) modelling can be used in place of SAP, offering more accurate and detailed predictions of energy performance, especially in complex or non-standard buildings.

By integrating **Passivhaus** into PAS 2035-compliant projects, retrofitters can significantly improve outcomes in a way that compliments the aims of PAS 2035. This includes reducing the **performance gap** between predicted and actual energy use, improving **indoor air quality**, and avoiding **unintended consequences** such as mould growth, condensation, and **energy rebound effects** — where energy savings are offset by increased usage due to improved comfort.

This combined approach supports a higher standard of retrofit, delivering long-term benefits for occupants, building fabric, and the environment.

Step-by-Step Retrofit and Quality Assurance

One of the most powerful aspects of EnerPHit is its support for **step-by-step retrofit**. This allows:

- Homeowners to spread costs over time
- Retrofitters to plan upgrades logically and efficiently *(see figure 5)*
- Certification to be achieved incrementally

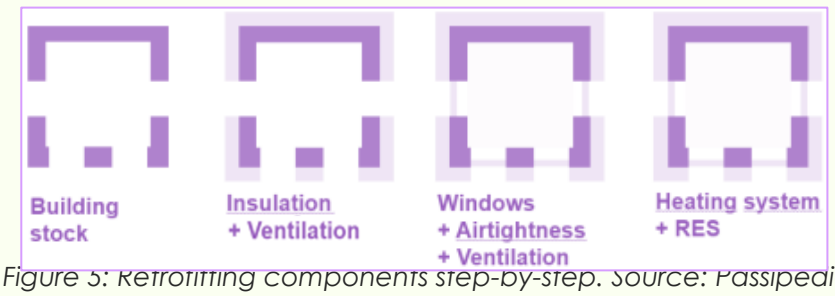

Figure 5: Retrofitting components step-by-step. Source: Passipedia.

Key principles include:

- **Component or space heating demand certification**: Each element (e.g., windows, insulation, airtightness) meets specific performance targets, or the whole building meets a space heating demand target.
- **Quality assurance:** Independent third-party certification ensures that work meets rigorous standards.
- **Excellent ventilation**: Balanced MVHR system means reduced moisture and better indoor air quality.
- **No cold spots**: Internal surface temperatures must meet minimum standards to improve comfort and reduce the risk of surface condensation & mould.
- **Airtightness**: Excellent airtightness improves comfort, reduces noise pollution, protects the building fabric from moisture and ensures excellent workmanship throughout.

EnerPHit emphasises that **quality lies in the details**. Simply adding insulation is not enough. Even small gaps or overlooked junctions can lead to significant energy loss or moisture issues.

The use of trained professionals and detailed planning tools like **PHPP** helps ensure that each measure contributes effectively to the overall retrofit strategy.

Training and Certification

To deliver high-quality **Passivhaus** or **EnerPHit** retrofits, professionals need appropriate training and a clear understanding of the standard's technical requirements. A range of certified courses are available for:

- **Passivhaus designers and consultants**: Responsible for energy modelling, and ensuring compliance with performance targets, and Integrating Passivhaus principles into architectural and technical design *(see figure 6.)*
- **Passivhaus tradesperson:** Trained to deliver airtightness, insulation, and detailing to Passivhaus standards.
- **Passivhaus certifiers**: Must be **independent** and **deeply involved** in the project to ensure impartial quality assurance.

Passivhaus certified components are also available to make Passivhaus Certified buildings easier to achieve.

Certification provides a built-in **quality assurance process**, helping to ensure that projects meet the required performance standards and avoid common pitfalls such as thermal bridging, poor ventilation, or moisture issues.

It is strongly recommended to work with someone who has **successfully delivered a Passivhaus project before**, or has undergone **Passivhaus retrofit training**, especially for complex retrofits. This experience helps avoid costly mistakes and ensures that the design and construction teams understand the level of precision required.

Figure 6: Certified Passivhaus Designer training. Source: Passivhaus Trust.

Final Thoughts

Passivhaus and EnerPHit offer a powerful, performance-led approach to retrofit—one that prioritises comfort, health, and long-term energy savings. While adoption in the UK is still emerging, these standards provide a clear pathway to achieving high-quality, low-energy homes that are resilient to climate and cost-of-living pressures *(see figure 7)*.

Unlike RdSAP, which is widely used for EPCs but based on limited inputs and assumptions, Passivhaus uses detailed modelling (PHPP) to predict and verify actual performance. This reduces the performance gap and ensures that buildings perform as intended. Compared to the AECB Carbonlite standards—which offer more flexibility and accessibility—Passivhaus and EnerPHit are more rigorous, with certification providing built-in quality assurance.

EnerPHit's step-by-step approach aligns closely with PAS 2035's Medium-Term Improvement Plan, making it especially suitable for phased retrofits. Both frameworks emphasise moisture risk management, ventilation, and whole-dwelling assessment—critical elements for avoiding unintended consequences like mould, condensation, and energy rebound.

Figure 7: A new Passivhaus site in London. Source: Ashden.

Together, these standards and tools form a complementary ecosystem. PAS 2035 and Trustmark provides the consumer protection, while Passivhaus and EnerPHit deliver the performance. AECB Carbonlite standards offer a useful bridge for those tricker projects.

Ultimately, Passivhaus is more than a technical standard—it's a philosophy of care, precision, and long-term thinking. With the right training, planning, and support, it can help transform the UK's housing stock into one that is healthier, more efficient, and future ready.