



EnerPHit and PAS 2035/2030

March 2023

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QODA

“ I was working as a physicist. I read that the construction industry had experimented with adding insulation to new buildings and that energy consumption had failed to reduce. This offended me – it was counter to the basic laws of physics. I knew that they must be doing something wrong. So I made it my mission to find out what, and to establish what was needed to do it right. ”

– Prof. Dr. Wolfgang Feist

CONTENTS

INTRODUCTION	2
DOCUMENTATION	3
TECHNICAL	3
WHOLE HOUSE APPROACH AND RISK PATHS	4
QUALIFICATIONS	5
HERITAGE	6
FUNDING	6
QUALITY CONTROL	6
SUMMARY	7

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INTRODUCTION

PAS 2035/2030¹ is a process for the retrofit of dwellings and does not set any energy targets to meet. EnerPHit is an energy standard. There are more similarities than one might think, and the two standards complement one another.

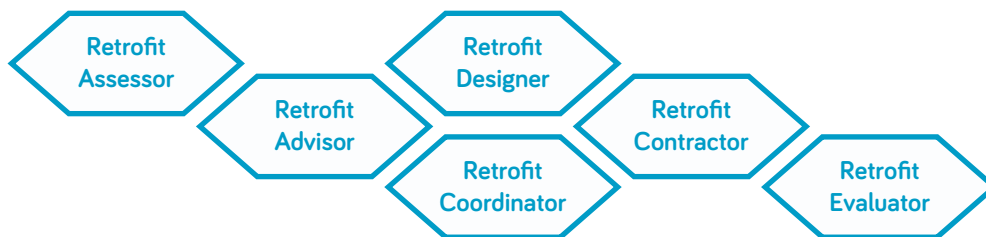
PAS
2035/2030
IS A PROCESS FOR
THE RETROFIT OF
DWELLINGS

EnerPHit IS AN
ENERGY STANDARD

Both came about after evidence about poor building performance emerged. In the case of PAS 2035/2030, this was the *Each Home Counts* review², which showed how retrofit of dwellings was failing to meet the required standards in the UK.

Passivhaus was born after Wolfgang Feist and colleagues discovered that simply adding more insulation to buildings was not producing better building performance. Although originally focused on new build, the Passivhaus Institut went on to develop a modified standard and methodology for retrofit.

PAS 2035/2030 is a framework and tells us about the roles and responsibilities of the people involved in retrofit, their qualifications and the process they should follow. PAS 2035/2030 requires the following roles, although they can be performed by the same person:



While the Passivhaus standard does not prescribe roles and responsibilities, experienced Passivhaus designers, tradespeople and certifiers play a vital role in reducing risk and helping projects succeed in achieving their objectives. PAS 2035/2030 relies more on the qualifications and compliance with the standard as opposed to Passivhaus, which is more focused on quality assurance and building performance.

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retrofit in the UK*



pht.guide/retrofit

Criteria	EnerPHit
Space heating demand	≤ 20 / ≤ 25 / ≤ 30 kWh/m ² .a
Primary Energy demand (PE)	≤ 135 +(QH – 15)
Primary Energy Renewable (PER)	≤ 60 (variable per project)
Airtightness n50	≤ 1 ACH @ 50 Pa
Summer overheating	Max 10% at > 25°C
Surface temperature	> 17°C
Ventilation	Min 20 m ³ /hr.person (>30 recommended)

¹ PAS 2035/2030:2019+A1:2022 *Retrofitting dwellings for improved energy efficiency. Specification and guidance* BSI (2022) <https://knowledge.bsigroup.com/products/retrofitting-dwellings-for-improved-energy-efficiency-specification-and-guidance-3/standard>

² P. Bonfield, *Each Home Counts*, BEIS and MHCLG (2016) <https://www.gov.uk/government/publications/each-home-counts-review-of-consumer-advice-protection-standards-and-enforcement-for-energy-efficiency-and-renewable-energy>

Documentation

PAS 2035/2030 specifies the production of several documents to aid the retrofit process. The Improvement Options Evaluation (IOE) can be calculated using RdSAP, SAP or PHPP³ and it has specific results that must be included. So long as these results are included, then an EnerPHit-informed Retrofit Plan (EiRP) can be designed to fulfil the criteria for a PAS 2035/2030 IOE. The EnerPHit-informed Retrofit Plan is defined in the Passivhaus Trust's paper *Passivhaus retrofit in the UK* (2022)⁴.

Improvement options evaluation requirements

- Calculations using RdSAP, SAP or PHPP
- Simple pay-back of each energy efficiency measure and package or measures
- The carbon cost effectiveness of each energy efficiency measure and package measures
- Costs of measures from independent body e.g. Energy Savings Trust
- Actual fuel costs from the dwelling (if available)
- Using actual occupancy patterns (if known)

Figure 2 Requirement for a PAS 2035/2030 compliant Improvement Options Evaluation (IOE) to be completed for every dwelling or dwelling type

The next stage in the PAS 2035/2030 process is development of a Medium-Term Improvement Plan (MTIP) which takes the results from the IOE. Along with other information from the client such as funding and available budget, this forms a final retrofit plan to 2050 for a dwelling. The MTIP should include as a minimum:

- context of the dwelling
- intended outcomes
- energy efficiency measures proposed
- order of installation and programme

The MTIP could be likened to an EnerPHit step-by-step plan. Therefore, if the right information were included an EnerPHit step-by-step plan could also form the MTIP required for PAS 2035/2030.

Technical

Interestingly, although PAS 2035/2030 is mainly process guidance it has a few specific points on the technical design and installation:

- internal surface temperature ($fR_{si} > 0.75$)
- airtightness – must have a continuous air barrier
- architectural junction details should be developed
- ventilation, if air permeability is $< 5 \text{ m}^3/\text{m}^2\text{hr}$ then continuous ventilation of some kind is required
- PAS 2030 annexes include measure-specific installation quality requirements

All of these are key elements of EnerPHit, so if you build to EnerPHit then you will achieve the technical level required to meet PAS 2035/2030.

³ Although RdSAP is not recommended because of the assumptions it makes, it is still permissible under PAS 2035/2030.

⁴ *Passivhaus retrofit in the UK*, Passivhaus Trust (2022) <https://pht.guide/retrofit>

Whole house approach and risk paths

EnerPHit is undoubtedly a whole-house retrofit standard, whether that is delivered in a step-by-step approach or all in one go. PAS 2035/2030 primarily aims to be a whole house retrofit standard, but it also contains a 'low risk' pathway (path A) for some single energy efficiency measures, which was included to support the Government's existing single measure funding schemes such as ECO. Medium- and high-risk paths (B and C) describe a whole house retrofit process, with some energy efficiency measures and types of building considered to be of the highest risk and so requiring a slightly more rigorous process and qualifications⁵.

There is actually very little difference between paths B and C in reality⁶. If an EnerPHit project were to comply with PAS 2035/2030, it would end up in risk path C because of the number of measures. Path C retrofit requires the setting of an airtightness standard, with testing, as well as the highest levels of qualifications for the retrofit roles. The EnerPHit process helps reduce risks with excellent quality assurance and attention to detail by a team that can understand and implement building physics techniques.

Risk path A

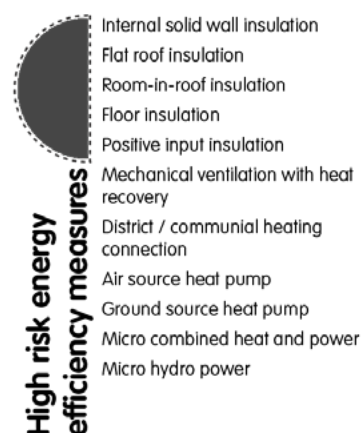
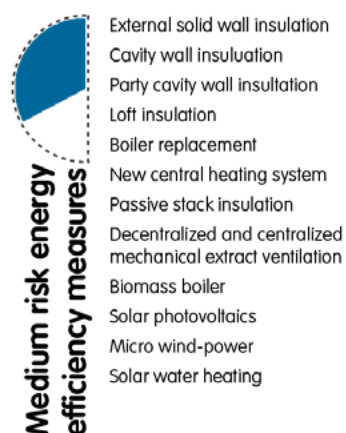
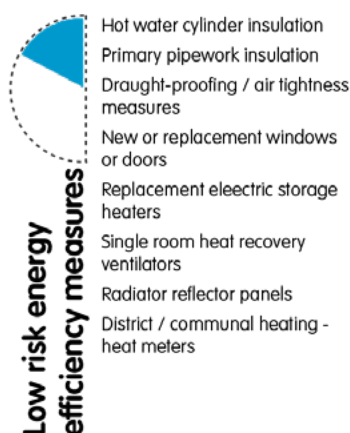
- 1 - 10 conventional dwellings
- 1 - 2 low risk energy efficiency measures (see following table)

Risk path B

- 11 - 30 dwellings OR
- 3 - 5 energy efficiency measures OR
- Traditional construction (not protected) OR
- System-built, not high-rise OR
- Medium or high risk energy efficiency measures (see following table)

Risk path C

- More than 30 dwellings OR
- more than 5 energy efficiency measures OR
- High rise OR
- Protected buildings



⁵ For more information about what is included in each of the risk paths, please refer to PAS 2035:2019 Retrofitting dwellings for improved energy efficiency – Specification and Guidance and PAS 2030:2019, Specification for the installation of energy efficiency measures in existing dwellings, BSI

⁶ Please note that this information is up-to-date as of October 2022; however, PAS 2035/2030 now has an annual update cycle with the next update due in Summer 2023.

Qualifications

Unfortunately, being an experienced Certified European Passivhaus Consultant (CEPH) does not automatically mean you can do any of the roles under PAS 2035/2030 (see table below). However, courses are available to get the approved qualifications, and Passivhaus Consultants / Designers are in an excellent position to understand and deliver the requirements of PAS 2035/2030 because of their understanding of building physics and attention to detail. A Retrofit Coordinator must act in the interests of the public and the client. They are trained to understand and identify the major risks in retrofit building performance.

Certified European Passivhaus training does not include formal training or assessment in retrofit-related moisture risks. Moisture is a major contributor towards unintended consequences and is thought to be responsible for up to 80% of building failures. Moisture building physics is a core part of the Retrofit Coordinator course, but it is still an emerging area and more research is needed, especially in retrofit scenarios. There are limited recommendations in EnerPHit to address interstitial condensation risks where internal insulation is proposed⁷, but further work is currently being done by the Passivhaus Trust and the Passivhaus Institut to offer additional advice, guidance and tools around moisture in existing buildings.

	Path A (low)	Path B (medium)	Path C (high)	Heritage / Traditional Building
Retrofit assessor	Domestic energy assessor OR ●	Domestic energy assessor		As left + ●
Retrofit coordinator	●			
Retrofit designer	● OR CIAT*	● OR MCIAT OR Architect OR MCIQB OR M/FRICS	MCIAT OR Architect + ● OR CIBSE + ● OR MCIQB + ● OR M/FRICS + ●	Path B + ● OR Member of building conservation scheme (by CIAT, CION, CARE, AABC, RIBA, RSAW, RSUA, RICS or RIAS) Path C quals + ● Member of building conservation scheme (by CIAT, CION, CARE, AABC, RIBA, RSAW, RSUA, RICS or RIAS)
Retrofit installer	Operatives are required to have measure specific competencies as defined in the Annex's of PAS2030			
Retrofit evaluator		●		As left + ●

● Level 5 Diploma in Retrofit Coordination and Risk Management

● Level 3 Award in Energy Efficiency and Retrofit or Traditional Buildings (or Scottish / Welsh equivalent)

MCIAT
a Chartered Architectural Technologist registered by the Chartered Institute of Architectural Technologists

MCIQB
a professional member of the Chartered Institute of Building

M/FRICS
a Chartered Building Surveyor

CIBSE
a professional member of the Chartered Institute of Building Services Engineers

*
for single measure projects, the qualifications listed do not apply - instead the Retrofit Designer is a specialist designer or specifier of that measure and holds a measure-specific recognised qualification

⁷ Criteria for buildings: Passive House – EnerPHit – PHI Low Energy Building, version 10c, Passivhaus Institut (2023) https://passiv.de/downloads/03_building_criteria_en.pdf

Heritage

PAS 2035/2030 currently puts all buildings with heritage significance in a high-risk category which requires more detailed surveys and assessments. While this is admirable, and entirely suitable for whole house retrofit where we need to be careful to protect our heritage, it doesn't work so well for low risk measures that have no impact on the heritage significance. It also requires quite significant qualifications for retrofit designers working on traditional⁸ or heritage buildings. EnerPHit simply allows an exemption for those buildings with historic significance, recognising the challenges associated with both preserving our heritage and improving energy efficiency. All exemptions must be agreed with the Passivhaus Certifier for the project.

Funding

This is an ever-changing landscape and there is a raft of funding streams for low-income households and social housing providers, including at the time of writing SHDF, ECO, LAD, HUGS⁹, the Optimised Retrofit Programme¹⁰ in Wales and the Home Energy Scotland grants and loans¹¹. All government-funded programmes will require compliance with PAS 2035/2030. However, the Government seems reluctant to fully embrace a whole house retrofit approach, with many of the funding streams still funding single energy efficiency measures.

So while EnerPHit does help us achieve the kind of quality and building performance required under PAS 2035/2030, it doesn't necessarily help us achieve the funding, as the focus still seems to be on quantity not quality.

Quality control

The quality control in EnerPHit and Passivhaus projects is one of the keys to their success. Detailed scrutiny by an independent Passivhaus Certifier is the only way that the building can be certified. Aspiring to the EnerPHit standard in a retrofit project often brings with it a culture of excellent workmanship within the design and construction teams. PAS 2035/2030 has some work to do in this area. Retrofit Coordinators are the lynchpin of the process and are the ones who sign off the project as being compliant with PAS 2035/2030.

A government-endorsed quality scheme named Trustmark is there to oversee the process, but the checking is nowhere near as frequent or detailed as that provided by a Passivhaus Certifier. So, what then can occur is that the Retrofit Coordinator is undermined and the role is diminished, with the control going back to the Retrofit Contractor who continues to install the way they always have. That's not to say that progress isn't being made in some areas. For example, there has been much work in improving thermal bridging in external wall insulation projects and there are now a number of excellent Retrofit Coordinators who are slowly but surely biting away at the retrofit quality issue.

8 That is, construction consisting of solid brick or stone external walls, or pre-1919 timber framed walls with any infill.

9 <https://www.gov.uk/government/collections/home-energy-performance-retrofit-funding-for-local-authorities-and-housing-associations-to-help-improve-the-energy-performance-of-homes>

10 <https://www.gov.wales/optimised-retrofit-programme>

11 <https://www.homeenergyscotland.org/funding/grants-loans/>

SUMMARY

The intentions of PAS 2035/2030 are commendable, aiming to reduce risks in retrofit by bringing back retrofit design, improving the consumer journey and improving skills and experience across the industry. PAS 2035/2030 also brings back the simple but effective concept of setting the goals of the retrofit, with the identification of 'intended outcomes' at the outset, and testing whether these outcomes have been achieved on completion. However, we still have a long way to go to consistently avoid unintended consequences and the energy performance gap. The PAS 2035/2030 retrofit industry is still in its infancy, so there is hope yet, provided it maintains Government support.

EnerPHit is a proven standard with excellent results in the area of space heating demand and comfort. Where it lacks rigour, (for example in moisture and heritage), the industry involved in EnerPHit projects tend to be meticulous and attentive, which ultimately produces some of the best buildings in the world.

The Passivhaus Trust is currently in the early stages of developing moisture specific guidance for EnerPHit projects, which will be complemented by a new moisture modelling tool, currently under development at the Passivhaus Institut, Darmstadt. These innovations will further support the delivery of these industry leading projects.



Above: Certified EnerPHit at King Street, Great Yarmouth - before and after

The Passivhaus Trust is an independent, non-profit organisation that provides leadership in the UK for the adoption of the Passivhaus standard and methodology.

Passivhaus is the leading international low energy design standard, backed with over 30 years of building performance evidence. It is a tried & tested solution that enables a meaningful transition to net-zero now. Over 65,000 buildings have been certified to this standard worldwide. The Trust promotes Passivhaus as a robust way of providing high standards of occupant comfort and health AND slashing energy use and carbon emissions from buildings in the UK.

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