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Summary

PAS 2035 is a national standard for carrying out retrofit projects to ensure they deliver the intended outcomes, and avoid unintended consequences such as damp, mould, and rot.

All retrofit projects receiving public funding in the UK must comply with PAS 2035.

This toolkit will help you understand PAS 2035. What it covers, what the key processes are, and the benefits you will gain by following it. It is not a definitive guide to how to use PAS 2035 in a project, but it summarises the key features and provides links to more advanced material.

Who should use the toolkit?

The toolkit will help the leadership and project team to understand what PAS 2035 is, its requirements, why it is important and where it fits in to the project lifecycle. It will be particularly useful for people with little or no experience of PAS 2035.

When should you use the toolkit?

PAS 2035 has implications for how a retrofit project is set up, managed, and delivered. All key decision makers in the project should become familiar with the basics of the standard as soon as project planning begins.

How should you use the toolkit?

The toolkit has three levels of increasing detail:

- Level 1 – a brief introduction
- Level 2 – a framework for understanding the key processes in PAS 2035
- Level 3 – the key task for each part of PAS 2035, with high-level guidance on what to do and links to more detailed information and training.

Recommended process

1. Read the information in Levels 1 and 2 to understand the basics
2. Take the self-assessment questionnaire to get a picture of your current areas of strengths and weakness and where you need to focus your attention
3. Use Level 3 to suggest key activities, identify gaps and link to additional resources.

N.B. PAS 2035 has recently been updated. This toolkit is based on the text of the latest available version; PAS 2035:2019 Incorporating Corrigenda No. 1 and No. 2 and Amendment 1, 31st January 2022.

Level 1 – Introduction

“PAS 2035 - Retrofitting dwellings for improved energy efficiency – Specification and guidance” is managed by the British Standards Institute for retrofitting energy efficiency measures in homes. PAS stands for Publicly Available Specification and is a fast-track approach to standards used where there is a specific and immediate requirement for advice. A PAS can become a BSI or ISO standard with further development.

Publicly funded retrofit projects in the UK must comply with this standard, including Government funded programmes such as the Social Housing Decarbonisation Fund (SHDF).

Although it is essential to retrofit existing homes to a high level of performance to meet the UK's net zero targets, it is not proving easy. The [“Each Home Counts”](#) review in 2017 and other industry studies identified many of the problems:

- Performance gap – predicted energy savings are not delivered in practice
- Defects – failures in installation create future problems for the building and residents
- Shallow retrofit – only tackling single measures leading to poor performance and higher costs in the long term
- Unintended consequences – poor design and installation make the building worse; for example, increasing airtightness without controlled ventilation can lead to damp, mould, and rot
- Lack of accountability – participants in a project passing the buck.

To solve these problems, PAS 2035 provides a standard process and good practices for retrofit projects, and [TrustMark](#) registers businesses that comply.

TrustMark is a UK Government sponsored scheme to provide assurance to homeowners having work done in and around their homes. TrustMark registered businesses are thoroughly vetted and monitored to ensure they meet required standards in competence, customer service and trading practices.

PAS 2035, like most standards, is a long and complex document. However, the basic concepts are simple:

- **A ‘Whole House’ approach** – making sure a solution is developed for the entire home, not simply fitting the most obvious or easiest energy efficiency measures
- **‘Fabric first’** – in retrofitting, first focus on improving the energy efficiency of the building's outer skin (the ‘building envelope’), and then add low-carbon heating, cooling, and appliances
- **‘Medium-term plan’** – it may not be possible to carry out all the improvements at the same time. A plan covering 20-30 years can show in which order to make upgrades to get the best performance improvements for the available funds. It avoids the risk of making an

improvement that is not compatible with the long-term goals and needs to be replaced in the future at additional cost

- **Retrofit Coordinator** – the project should be managed by someone with the appropriate skills and experience, trained in energy efficiency and retrofit. The Retrofit Coordinator ensures the retrofit process is efficient and meets all the requirements of the standard. PAS 2035 identifies five key roles for retrofit projects, but the Retrofit Coordinator is the key
- **Transparency and accountability** – information should be clear and shared. Everyone should know what they must deliver and when.

PAS 2035 may appear complex, but it is there to avoid many of the known pitfalls of retrofit projects and maximise the value of your investment. Using PAS 2035 in your retrofit projects will:

- Maximise the chance of getting the performance benefits you have invested in
- Reduce the risk of damaging your housing stock through inappropriate retrofit
- Allow you to create an investment plan that meets future needs with a ‘no regrets’ approach to investments
- Give you a way to work closely and effectively with suppliers and contractors to get the best value for money with minimum hassle and rework
- Make sure your project is professionally managed at all stages.



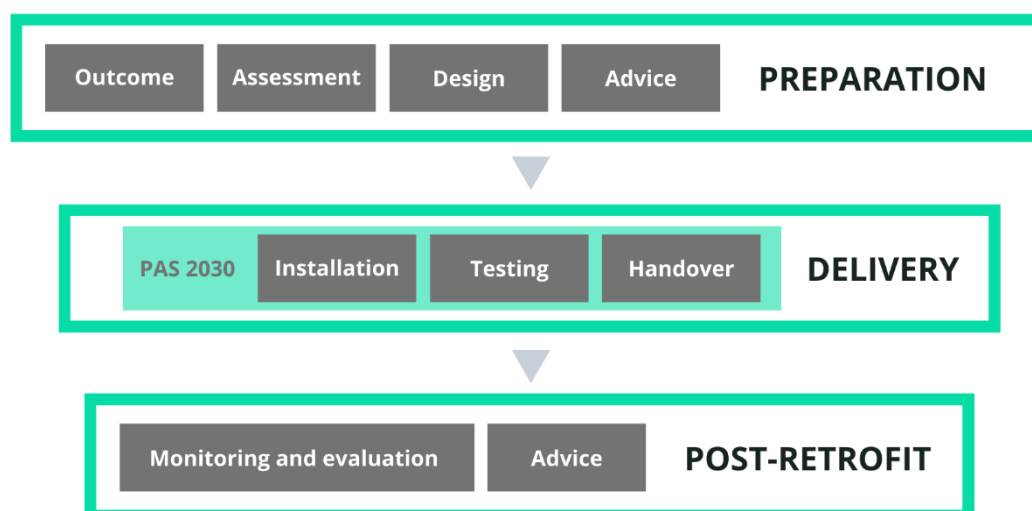
Level 2 – Framework

What is commonly known as PAS 2035 is actually two standards operating together.

PAS 2035 deals with how a retrofit project should be managed, and PAS 2030 covers the installation of specific energy efficiency measures. Together, they ensure that the project delivers the planned performance at the projected price.

The tasks and activities in the PAS 2035 scheme fit into three groups that match the three phases of a retrofit project lifecycle used on the [SHRA website](#):

- Preparation of the retrofit project – including preparation of any bids for external funding (such as SHDF)
- Delivery of the project – installation, testing and handover of the physical retrofit
- Post-retrofit – ongoing monitoring and evaluation, and continuing support to users.



In the **PREPARATION** stage, the projected **Outcome** is the planned performance target of the retrofit project.

The **Assessment** covers surveying the homes to understand their characteristics and current performance and identifying the risks in the project.

Design deals with selecting energy efficiency measures and planning how they will be integrated into the homes to deliver the outcome.

Advice to the home owner and occupier is provided throughout the project. The main points of engagement are in preparation and post-retrofit phases. There is evidence that providing advice and guidance improves the project outcomes. It helps to overcome resistance from residents, engages them fully in the project, and makes sure that they get the best out of the upgrade and avoid problems due to misuse of new technologies.

In the **PREPARATION** phase, advice centres on:

- Discussing the potential for improving the performance of the home and the quality of life of the residents
- Explaining how the retrofit will be carried out and the implications for residents
- Gathering information that can help with selecting the best retrofit strategy and design, for example, occupancy and energy consumption patterns.

Advice, Outcome, Assessment and Design work together to create the retrofit plan.

PAS 2030 then takes over for the **DELIVERY** phase to ensure the **Installation** is carried out correctly. After Installation, the energy efficiency measures must undergo commissioning and **Testing** to ensure they deliver to the specification.

Finally, there is a **Handover** process to transfer all the information about the installed systems to the project manager, home owner and residents. This includes documentation, test results, user guides and instructions, etc.

PAS 2035 specifies two ongoing activities **POST-RETROFIT**:

- **Monitoring and Evaluation** to measure actual performance in use. This helps:
 - Identify whether the design performance has been achieved
 - Learn lessons to integrate into future projects
- **Providing Advice** and guidance shortly after the retrofit is completed. This covers:
 - The operation and use of installed energy efficiency measures
 - Any behavioural changes necessary to get the best out of the upgrades
 - Repair and maintenance schedules required to sustain performance.



Level 3 – Questions and Actions

Checklist:

- Get access to a copy of PAS 2035
- Watch the 30 min video – “PAS2030 the Movie” (see [3.9](#))
- Make sure a Retrofit Coordinator is appointed
- Review on-demand masterclasses, and the Midlands Retrofit Toolkit (see [3.9](#))
- Ensure all installers of energy efficiency measures are PAS 2030 registered.

3.1 Key team members

Key question – Do you understand the specific roles required for the project?

PAS 2035 specifies several key roles required for retrofit projects. It includes the required skills, qualifications, and certifications. The roles are:

Retrofit Assessor	Carry out dwelling assessment and supply data to the Retrofit Coordinator. This role is essential for making sure high-quality data is collected before any work is committed and work can be specified appropriately.
Retrofit Coordinator	A person with overall responsibility for each stage of the project, sometimes also fulfilling other project roles under PAS2035, where they hold the correct qualifications. This role helps to manage the contract with a focus on a quality retrofit and meeting the needs of the occupant.
Retrofit Designer	A person qualified to prepare a retrofit design. E.g. an architect. The role is highly technical and will make sure the risks are designed out of the installation.
Retrofit Installer	A person or organisation that is undertaking the physical placement of energy efficiency measures in an existing building.
Retrofit Evaluator	A person qualified to monitor and evaluate the effectiveness of a project and provide feedback. This role will benefit your organisation by giving assurance of high quality retrofit before handover is completed.

The most important role is the Retrofit Coordinator, they are accountable for delivering the overall project.

You must ensure that the retrofit project team covers all these roles, either internally, through outsourcing, or through project partners. Multiple roles can be fulfilled by the same individual, providing they are properly qualified, and conflicts of interest are avoided.

3.2 Software

Key question – Is commercial software the most practical way for you to meet the requirements of PAS 2035?

Many of the key tasks and activities in PAS 2035 are integrated into commercial software. This helps to keep all the information in one place, allows alternative ideas to be tested, and takes some of the complexity away from the project team. Examples of software that can fulfil PAS 2035 requirements are given in [3.9 External Resources](#).

3.3 Outcome

Key question – What will the project deliver?

It is important to decide the intended outcome of the project at the very beginning. Without knowing what you are trying to achieve, you cannot develop a design that will deliver it.

Possible target outcomes cover a wide range, including:

- Achieving a target EPC rating
- Reductions in energy use, cost, or carbon content of the energy source
- Improving indoor air quality and resident comfort
- Protecting the building from damp, mould, water penetration and other structural damage.

The technical outcome chosen for the physical retrofit and used in the PAS 2035 process should be derived from the overall project outcomes you use in your business case. However, it is not automatically the same. The overall retrofit project may target a net-zero carbon emissions objective for your organisation, but the outcome you specify in PAS 2035 may be a target EPC rating or kWh/m²/year. This will guide the selection of energy efficiency measures.

Recognise that the initial chosen outcome may not be practical, economically or physically. The outcome is part of a three-way discussion between what you want to achieve, your assessment of the building condition and constraints and the workable energy efficiency measures.

Before starting installation, you must be completely clear on your desired outcomes.

3.4 Assessment

Key question - What is the building design and condition, and what are the risks for retrofit?

Assessment in PAS 2035 has two components:

- Whole-dwelling assessment – gathering the information needed to carry out the retrofit design
- Risk assessment – establishing the risk of the planned approach. Risk depends on the number of energy efficiency measures planned and the inherent risk of each measure.

These two types of assessment go together. PAS 2035 classifies the risk associated with a retrofit plan in three levels: A, B, and C. Each risk level points to a different pathway through the project. It changes the way data is gathered on the property, how the retrofit interventions are designed, and the provision of advice. You can find a full description of the triage process used to assign the risk level, and details of the different retrofit pathways in [PAS 2035](#) and the resources referenced in [3.9](#).

This is a key part of the PAS 2035 process and must be understood by the project team.

3.5 Design

Key question – What energy efficiency measures will deliver the desired outcome on the target properties?

Based on the assessment of the property, the Retrofit Designer decides which energy efficiency measures will produce the desired outcome.

PAS 2035 provides useful information on all the standard energy efficiency measures. This covers the risks associated with each measure and how the measures interact. i.e. which measures can be successfully combined, and which cannot.

Software tools are available to simplify the process of effective retrofit design (see [3.9](#)).

The design should consider three of the key PAS 2035 principles:

- Whole-house thinking
- Fabric first – focus on making sure the building envelope is energy efficient before adding low-carbon heating and cooling
- Medium-term improvement plan – it may not be possible to carry out all the improvements at the same time. The medium-term plan provides a roadmap to upgrading the property, showing in which order to carry out the improvements to get the best increase in performance at the lowest cost.

3.6 PAS 2030 – Installation

Key question - Will the design be executed properly to give the desired outcome?

PAS 2030 covers the installation, testing and handover for all the common energy efficiency measures. It ensures that installers can deliver energy efficiency measures to specification, and that they can demonstrate success.

The standard provides detailed guidance for specific measures, including the skills, qualifications, and certification of the installer.

It is important that all your contractors and installers should be familiar with and compliant with PAS 2030.

3.7 Monitoring and Evaluation

Key question – Is performance in use as expected?

In any retrofit project, it is useful to find out whether you got what you expected and what you paid for. There is usually a gap in performance between the design intention and how a building works in the real world. Monitoring and evaluation of each project allows you to identify and learn from any project specific or systematic problems.

Understanding any gaps will help with developing subsequent projects, and with any warranty or contract negotiations with suppliers and contractors.

PAS 2035 provides for three levels of monitoring and evaluation depending on the complexities and risks of a project. Basic level evaluation is carried out for all projects and uses questionnaires to gather data from client and residents. It does not require access to the property.

Intermediate and advanced monitoring and evaluation processes are used in more complex retrofits, or where there is a specific problem to be analysed. Both require access to the property, and direct testing of the performance using standard protocols.

Ongoing monitoring and evaluation of performance in use is a requirement of many public funding schemes, including SHDF.

3.8 Advice

Key question – Have the building owners and residents been included throughout the project?

Retrofit projects can be long, complex and disruptive. It is essential that landlords and residents understand what is happening throughout the project. There should be no surprises.

Advice and resident engagement are important in the preparation and post-retrofit phases.

Energy efficiency measures may involve the use of unfamiliar technologies that impact how the building is operated. Residents and those responsible for ongoing repairs and maintenance must understand what changes have been made to the property and how to get the best out of any upgrades. For example, making the most of a more efficient building envelope may need changes in how the heating system is used, such as different on- and off-times and temperatures. Failure to change can lead to overheating and wasted energy.

PAS 2035 provides guidance on engaging with the clients and residents throughout the project, depending on the project risk. A separate toolkit for Resident Engagement throughout a retrofit programme is available on the SHRA webpage.

3.9 External Resources

This toolkit gives you an overview of PAS 2035 – what it is, why it matters and what it delivers. It is not meant to be a definitive guide to PAS 2035 and how to implement it. There are excellent external resources that provide the detail needed to integrate PAS 2035 into your project.

We recommend that the next step after this toolkit is to review the on-demand video masterclass [Understanding PAS 2030/2035](#) and [PAS 2035: the Movie](#). The [Midlands Retrofit Toolkit](#) is an excellent introduction to the details of working with PAS 2035. Other resources are there to expand on your knowledge, or to tackle specific issues in depth.

- Knowledge Hub – [Understanding PAS 2035](#)
- On-demand Masterclasses:
 - [Understanding PAS 2030/2035](#)
 - [Role of a Retrofit Coordinator](#)
 - [PAS 2035 Compliance](#)
 - [SHDF Ensuring Compliance for Installers, Contractors and Suppliers](#)
- SHRA Toolkits:
 - [Business Case Toolkit](#)
 - [Resident Engagement Toolkit](#)
 - [Monitoring and Evaluation Toolkit](#)
- BSI Standard - [PAS 2035/2030:2019 Retrofitting Dwellings for Improved Energy Efficiency. Specification and Guidance](#)
- Retrofit Academy Video – [PAS 2035: the Movie](#)
- Retrofit Academy Reports:
 - [Midlands Retrofit Toolkit](#)
 - [PAS 2035 – What is it and what does it mean for you?](#)
 - [PAS 2035 – Frequently Asked Questions](#)
 - [PAS 2035 – Compliance Process Map](#)
- PAS 2035 training courses:
 - [Stroma](#)
 - [Retrofit Academy](#)
 - [Elmhurst Energy](#)
- Examples of commercial software for PAS 2035 compliant projects (other software tools are available, and this list is not an endorsement of any specific solution):
 - [Parity Projects Portfolio](#)
 - [SAVA - Intelligent Energy](#)
 - [Energy Saving Trust - Home Analytics](#)
 - [Elmhurst - Streamline](#)
 - [IRT - DREam](#)

SHRA Toolkits available online

The full selection of SHRA Toolkits are available at:

www.socialhousingretrofit.org.uk/knowledge-hub

