



PAS2035:2023 Retrofit Design Guidance

Rev 00 December 2024

1 Foreword – Updated Design Guidance for PAS2035:2023

The following text is an update on earlier design guidance provided for **PAS2035:2019+A1:2022**, which will be withdrawn and superseded by **PAS2035:2023** by March 2025.

This guidance has been prepared to assist the preparation of Retrofit Designs and corresponding documentation, to help comply with the requirements of **PAS2035:2023**, which can now be downloaded for free from <https://www.bsigroup.com/en-GB/insights-and-media/insights/brochures/pas-2035-retrofitting-dwellings-for-improved-energy-efficiency/>

This guidance document has been prepared by ecmk in consultation with TrustMark and other scheme providers including: Elmhurst Energy, The Installation Assurance Authority (The IAA) and Quidos Ltd.

1.1 PAS2035:2023 Updates

There are a total of 15 revisions listed in PAS2035:2023. Not all of these have a direct impact on the requirements for a compliant retrofit design, but are listed below for the reader's further reference:

- 1) PAS 2035 guidance clauses have been updated to:
 - a) reflect national policy; and
 - b) emphasize the role of PAS 2035 in protecting the consumer.
- 2) Clauses have been included to facilitate scale retrofit by allowing retrofit design to commence based on assessments of archetypes.
- 3) The BEIS retrofit technical guides have been included as references.
- 4) The risk assessment process has been simplified to avoid unintended complexities.
- 5) Change of emphasis from measures-based retrofit to whole dwelling retrofit by including more reference to a Main Contractor.
- 6) Clarification of the role of the Retrofit Coordinator, including site visits and recording of non-compliance.
- 7) Contents of a Medium-Term Improvement Plan is now a requirement rather than guidance.
- 8) Requirements to produce an airtightness strategy for projects, which can include setting of an airtightness target and air leakage testing.
- 9) Clarification of what happens in the PAS 2035 process if historic significance is identified. A new Annex E is included.
- 10) Annex C has been simplified where possible and brought in line with the new Approved Document F
- 11) Further Monitoring and Evaluation references the new BS 40101 Building Performance Evaluation, and Monitoring and Evaluation is now considered from inception through to completion.
- 12) A process has been included whereby distressed replacement of heating appliances can retrospectively comply with PAS 2035.
- 13) The guidance and requirements for climate resilience and adaptation in retrofit has been strengthened.
- 14) The requirements and qualifications for independent inspection of the pre-installation building inspection (PIBI) in some PAS 2030 annexes have been strengthened.
- 15) Requirements and guidance around moisture in buildings has been brought in line with language in BS 5250:2021.

All areas relevant to the above 15 revisions have been added to the following guidance.

This document is divided into convenient sections covering, all areas of the design, with each section including reference to specific PAS2035:2023 paragraphs and notes on evidence requirements where relevant.

Where further information or clarification is required on specific areas of this guidance, the reader is recommended to refer to the **PAS2035:2023** document, any referenced best practice documents, or their scheme provider.

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2 Overview – Property Specific Designs

Each retrofit design and all corresponding documents shall be prepared and recorded as being specific to each individual property. As such, all documentation shall include the property address within the header or at the start of the content of each document.

In cases where non-property-specific documentary evidence is included as part of the design, e.g.:

- Thermal bridge mitigation design details (from best practice or system designer guidance)
- Best practice installation guidance e.g. BEIS, BRE or CITB guidance documents;
- Energy Efficiency Measure (EEM) product specification details.

only relevant thermal bridge details should be copied from such guidance and added to the design document – not the whole document.

It is recognized that documents such as the above form an integral part of the design, for them to be property-specific, and these should be saved with the main design document as a single pdf document. This can be quickly and efficiently achieved using online software such as [iLovePDF | Online PDF tools for PDF lovers](#).

All designs shall document the following where relevant:

3 Preliminaries – Retrofit Design Overview

3.1 Retrofit Designer Qualifications (Ref PAS2035:2023 Annex A Qualifications)

The designer and their relevant experience and qualifications shall be detailed in accordance with the relevant sections of **Annex A, A.3 Qualifications for Retrofit Designers** and the type and number of EEM's being installed.

A review of the qualifications requirements is provided in Section 13 of this document for further reference.

3.2 Compliance of the Design with the Relevant Guidance and Technical Standards

The design shall confirm that the retrofit design has considered the guidance in Sections 4 & 5 of PAS2035:2023 and confirm that a “fabric first” approach is being followed where relevant.

The design shall confirm compliance with, and list all relevant standards as listed in PAS2035:2023 15.1 Retrofit Framework Standards. This shall include:

- Each relevant Measure-specific Annex in PAS2030:2023;
- Specific System Designer’s installation guidance and Agrément Certificate specifications;
- Any relevant standards or best practice documents;
- All relevant building regulations.

Please refer to PAS2035:2023 15.1.3 Insulation standards and guides or the reference section of this document for further details.

3.3 Assessment information

Confirmation that the information captured for the property during the PAS Assessment, Preinstallation Building Inspection (PIBI), Pre-Design Survey, and any other technical assessments is sufficient to allow for the preparation of the design.

3.4 Retrofit Coordinator Role

Confirmation that the Improvement Option Evaluation, Medium Term Plan, and any modelling required shall be prepared by the Retrofit Coordinator.

3.5 Scope of the Design

The scope of design shall confirm that this has been agreed with the Retrofit Coordinator and that the measures proposed have been selected to achieve the Proposed Intended Outcomes, which are in line with the relevant energy grant scheme and its objectives where relevant. This shall include details of the package of EEMs proposed for the dwelling, including materials, products, processes, and relevant standards.

3.6 Sequence of Installation

The retrofit design shall also specify the sequence of installation of the EEMs, especially where incorrect sequencing might adversely affect the resilience of the EEMs, the integrity of the building, its historic significance, or its energy performance. This should generally follow the “fabric first” approach.

3.7 Property-Specific Designs

As for all design documents, the Scope of Design document and any documentary evidence shall be specific to each individual property.

3.8 Condition of the Existing Building

The design shall confirm that the condition of the existing building has been considered, including any defects requiring remediation including:

- Structural defects;
- Damp, mould and condensation;
- Damp structural timbers;
- Limited ventilation in loft or underfloor void;
- Leaks/rainwater ingress;
- Faulty rainwater goods;
- Height of external ground level in relation to DPC;
- Rising or penetrative damp.

3.9 Specifications of the Materials, Products and Systems to be Used

Table 1. below, outlines the specification details of the key products used for retrofit projects, the majority of which can be found in product literature. **Note:** - where product literature refers to multiple models in a product line, for clarity, the exact model to be used for the design shall be identified by the Retrofit Designer.

Table 1, Specification Details Required for Each Energy Efficient Measure (EEM)

Energy Efficiency Measures / Product Specification Requirements	All Insulation Measures	Windows/ Doors	Gas Boiler / FTCH	Heating Controls	ESH	Solar Thermal	ASHP	GSHP	Solar PV System	Ventilation	Draught Proofing
BBA, KIWA Certificate*											
Thermal performance											
Vapour permeability											
System Heat capacity (KW)											
Product specification detailing all relevant testing and performance standards											
System Heat capacity (KW)											
Coefficient of Performance (COP)											
Generation Capacity											

* - Where relevant

3.10 Physical Interaction Between Measures

Provision for managing the interactions between EEMs installed in the same dwelling shall be included, following The Measures Interaction Matrix provided in PAS2035 Annex D (Figure D.2). Specific consideration is being given to yellow and orange interactions.

3.11 Resilience to Rainwater Ingress or Flood

The design shall identify any existing flood risk or if the property is in a high rainfall exposure zone (Ref BR262) and record all measures taken to mitigate any such risk.

3.12 Fire Safety

The designer shall ensure that the fire safety of the building is not compromised by the installation of EEMs in accordance with The Building Regulations Approved Document B Fire, and if necessary, include an updated fire safety strategy following the guidance in BS 7974.

3.13 Product – Installation, Operations and Maintenance Manuals

Any relevant sections of the manufacturer's installation and maintenance guidance, referencing any manufacturer-specific or best-practice guidance specific to the EEM, should be included in the design. These shall be attached to the main design document to create a single property-specific design PDF document and shall include:

- Care of the installed measure to avoid detrimental effects (e.g. regular cleaning and replacement of air filters in mechanical ventilation systems);
- Regular maintenance of the installation in order for it to operate safely, efficiently and effectively, in accordance with the requirements of any guarantees or warranties provided by the manufacturer or supplier;

3.14 List of measures requiring an appropriate guarantee or warranty

The design shall list all measures and products that will require appropriate warranty and or guarantees for the coordinator to collate. E.g. external wall insulation will require a SWIGA guarantee and a 25-year insurance backed guarantee from an approved provider.

For details regarding the requirements for Insurance backed guarantees please refer to TrustMark's website. <https://www.trustmark.org.uk/business/information-guidance/financial-protection>

3.15 Testing requirements, Including Testing of Any New Gas Systems and Electrical Installations

The retrofit design shall specify requirements for commissioning of any EEMs that are building services systems (e.g. ventilation, heating and hot water systems) and of any EEMs that are part of the building fabric but include moving parts (e.g. windows, air inlets).

3.16 Commissioning Requirements

Where there are multiple EEMs requiring commissioning, the retrofit design shall specify that all building services systems are to be finally commissioned at the same time, not separately.

The manufacturer's installation, testing and commissioning instructions shall be included for all EEM measures being installed.

3.17 Handover Requirements

The retrofit design shall specify requirements for the Retrofit Installer client handover documents for the completed installation of EEMs, including safe operation and maintenance, information packs, and homeowner advice etc. as specified within each relevant Annex of PAS2030

For LZC technologies or "renewable energy systems", the handover shall also be carried out in accordance with the relevant requirements of the MCS standards. For full details of handover requirements please refer to **PAS2035:2023, 11.1 Specification of handover requirements.**

4 Identification of the address and precise location of the building(s) in which the EEM(s) are to be installed

The design shall include detailed floor plans to clearly illustrate the location(s) where and the extent to which the EEM(s) are being installed in the building. This shall also include any products, systems and ancillary equipment.

5 EEM Specific Design Requirements

In addition to the text in this document, for clarity, Table 2. below, outlines key EEM-specific design requirements to be uploaded with design documentation.

Table 2. EEM Specific Design Requirements

Energy Efficiency Measures / EEM-Specific Design Requirements	CWI	Loft Insulation	UFI	Flat Roof Insulation	EWI	IWI/RII	Windows/ Doors	Gas Boiler / FTCH	ESH	Solar Thermal	ASHP	GSHP	Solar PV
Detailed floor plan showing areas/elements where insulation EEM is to be installed													
Thermal Bridge Mitigation Design Details and locations where these are employed by means of annotated photos or drawings													
Airtightness and air leakage testing strategy													
Crossflow ventilation calculations for underfloor void or loft area*													
Loft hatch insulation and draught proofing													
Skeiling insulation and ventilation*													
Detailed floor plan showing the location of installed main EEM components e.g. boiler, radiators, Heat pump, cylinders etc.													
Detailed floor plan showing location of heat emitters/top-up heating*													
Heat loss/heat generation requirements and efficiency calculations*													
Noise Assessment Calculations													
Roof plan, orientation, performance, and roof structural calculations													

* - Where relevant

5.1 EEM Specific Compliance Notes

- a) Loft ventilation requirements (for loft insulation measures) should be calculated in accordance with BS5250:2021 Table 5: Min. free area of openings for loft-space ventilation;
- b) Suspended timber floor crossflow ventilation requirements (for underfloor insulation measures) should be calculated in accordance with Building Regulations Approved Document C, 2010, Section 4.14.

6 Planning Considerations

6.1 Planning Conditions

The design shall identify any constraints imposed by the local planning authority or the Building Control Body, including requirements for: Listed Building Consent, Party Wall Notices, Listing as of Special Architectural or Historic Interest, Conservation Area constraints, Tree Preservation orders, or approval under the Building Regulations.

6.2 Identification of any Access Constraints and Instructions Provided by the Client or the Occupants

Any constraints to access shall be identified including:

- Elevation, party walls, rights of light, consideration of adjoining properties, etc.
- Access restrictions that may impact upon safety or the installation of the EEM’s, including scaffold access;
- Whether access will be required to a neighbouring property;
- Parking restrictions;
- Client or occupant access requests.

6.3 Exposure Assessment

The design shall identify exposure (to sun, wind and rain, major roads, and industrial activity), The selection of EEM specifications shall ensure the suitability of the EEM installation for the exposure conditions at the dwelling location i.e. wind and rain.

The orientation of the dwelling shall be considered for both overheating and the performance of solar thermal and solar PV measures.

7 Identification of any repairs or maintenance required prior to implementation of the EEMs

This shall include any areas that would either adversely affect the EEM installation or would be worsened by the EEM:

- Any areas of dampness due to leaks, penetrative or rising damp;
- Any significant fabric issues such as cracks in building fabric, subsidence, brick spalling, failing render, leaking rainwater products, degraded mortar beds, damp or rotting timbers in construction, evidence of cavity wall tie failure, air bricks located in line with or below ground level, restricted underfloor ventilation etc.

8 Thermal Bridge Considerations

Property-specific construction details shall be provided to maintain the continuity of the three-dimensional insulated envelope and the integrity of any airtightness barrier to eliminate thermal by-pass (i.e. the uncontrolled penetration of cold air to the warm side of any insulation layer), minimize thermal bridging and maintain an appropriate or specified standard of airtightness.

Where construction details published as part of industry best practice guidance, or details from the system designer are used, only details relevant to the installation shall be included in the design.

8.1 Property-Specific Thermal Bridge Designs

The design shall illustrate all thermal bridges relevant to each EEM installation and which specific construction details will be used in each location.

The most practical solution for detailing where each of the construction details is to be used would be to annotate photographs of the actual property (taken from the Retrofit Assessment photo pack), with the annotations referencing each relevant thermal bridge construction detail.

8.2 Calculation Methods

If other details are used, it shall be shown by calculating the thermal bridge in accordance with BRE IP1/06, assessing the effects of thermal bridging at junctions and around openings, that the temperature factor (f_{Rsi}) of each detail is greater than the critical temperature factor (f_{CRsi}) 0.75.

9 Overheating

The retrofit design shall include measures to reduce or limit overheating in the dwelling during the life of the installed EEM's. The Retrofit Designer shall record these in accordance with :

- a. CIBSE TM59 Design methodology for the assessment of overheating risk in homes (2017)
- b. The guidance and tools published by the UK Climate Impacts Programme (UKCIP) to assess future climate vulnerability and identify adaptation options; and
- c. the Guide to low energy shading
- d. The Building Regulations Approved Document O Overheating

This shall take into consideration the following as a minimum:

- Manage heat by incorporating areas of exposed thermal mass into the specification;
 - Limit solar gains through the implementation of fixed shading devices, such as blinds, shutters or overhangs;
 - Specify low g-value glazing where applicable;
 - Limit the size of openings, particularly on South and West facing elevations;
 - Remove excess heat from the dwelling by specifying sufficient areas of openable windows (the effectiveness of this method is improved by cross-ventilation);
 - Specify natural ventilation louvres in external walls;
 - Specify a mechanical ventilation system with sufficient ventilation rates.

10 Airtightness Strategy

Where the retrofit design includes any EEMs for the improvement of the building fabric (e.g. insulation, airtightness, replacement windows and doors), the Retrofit Designer shall develop an air tightness and air leakage testing strategy as part of the design.

The strategy should consider the impacts of the EEMs on the airtightness of the dwelling and shall include:

Airtightness Strategy

- a. A description of how an airtight barrier is created on the warm side of the insulation e.g. membrane, air-tight tapes, wet plaster or lime render;
- b. How are junctions, corners, edges and service connections sealed, e.g. tapes, grommets, air-tight paint or adhesive;
- c. Explanation of any sequencing required to ensure the sealing or any challenging or higher risk junctions;
- d. Specify how the airtightness measures will be quality assessed.

Air Leakage Testing Strategy

- a. Explain the benefits of air leakage testing and the risks of not doing so;
- b. If required for the dwelling, include the airtightness target(s). This would typically be required where a whole-house retrofit is undertaken or if required to specify the correct ventilation system (Ref PAS2035:2034 Annex C3.2); and
- c. Recommend any other airtightness or air leakage testing required before, during or after installation of the EEMs.

10.1 Airtightness Testing

Where an airtightness target is set as part of the Airtightness Strategy, the retrofit design shall also include a requirement for the Main Contractor or Retrofit Installer to demonstrate compliance with the airtightness standard by means of an approved test for every dwelling, following CIBSE guidance Testing buildings for air leakage. TM23. London: CIBSE, 2022.

11 Intended Outcomes

The scope of design shall confirm that this has been agreed with the Retrofit Coordinator and that the measures proposed have been selected to achieve the Proposed Intended Outcomes, which are in line with the relevant energy grant scheme and its objectives where relevant. This shall include details of the package of EEMs proposed for the dwelling, including materials, products, processes, and relevant standards.

12 Heritage Impact Assessment (HIA)

If the dwelling to be improved is traditionally constructed and/or of significance, the identification of applicable EEMs shall also be consistent with BS 7913: 2013 - Guide to the Conservation of Historic Buildings. Where an assessment identifies that a traditional building is of significance, particularly with regard to the appearance and form of the building and its relationship with its surroundings (architectural and aesthetic value) and with significant fabric (evidential value), the Retrofit Designer and Retrofit Co-ordinator shall take this into account when selecting and designing retrofit measures.















If a proposed measure might impact an aspect of a building identified as significant, a heritage impact assessment following BS 7913 shall be carried out as part of the options appraisal.

Guidance on heritage significance can be found <https://historicengland.org.uk/images-books/publications/statements-heritage-significance-advice-note-12/heag279-statements-heritage-significance>

13 Retrofit Designer Qualification Compliance










Table A.3 below provides an overview of [PAS2035:2023 A.3 Qualification for Retrofit Designers](#), a key for each symbol is listed on the following page.

Table A.3 Qualifications for Retrofit Designers

	A.3.1. Single Measure	A.3.2 Single Measure - Proprietary System	A.3.3 Single Measure - Combustion Appliance	A.3.4 Single Measure - System Covered by MCS	A.3.5 Two Interacting Fabric Measures	A.3.7 Three or more interacting fabric measures, or fabric insulation measures or replacement windows high-rise or system-built	A.3.8 Projects traditionally constructed, and proposed EEM(s) likely to have an impact on the heritage significance and/or building fabric	A.3.9 Two or more measures not classified by: A.3.5, A.3.7 or A.3.8
Retrofit Designer Qualifications	 or 	 or 	 or 	 or 			 and  or 	

A.3.6 In all cases where there is a designer as specified above, the Retrofit Designer qualifications shall be reviewed by a Retrofit Coordinator

Table A.3 Key

Symbol	Description
	Retrofit Designer shall be a specialist designer or specifier of that measure, and hold a measure-specific qualification via a recognized RPEL process or via a training course that appears on the register maintained by Ofqual (for England), the Council for Curriculum Examinations and Assessment (for Northern Ireland), the Scottish Qualifications Authority (for Scotland) or Qualifications in Wales (for Wales)
	Retrofit Designer shall be a specialist designer or specifier of that system who has been trained and approved by the manufacturer or supplier of that system
	Retrofit Designer shall be a specialist designer or specifier who has been trained and approved by the manufacturer and/or for gas installations holds Gas Safe registration or for oil heating holds competent person registration,
	Retrofit Designer shall be a Chartered building services engineer (registered with CIBSE, IMECHE or CABE)
	Retrofit Designer shall be a specialist designer or specifier of the system who is MCS certified
	Retrofit Designer shall be: <ul style="list-style-type: none"> • a chartered architectural technologist (MCIAT or FCIAT) registered by the Chartered Institute of Architectural Technologists (CIAT); or • an architect registered by the Architects Registration Board (ARB); or • a professional member of the Chartered Institute of Building (MCIQB or FCIQB); or • a chartered building surveyor (MRICS or FRICS).
	Retrofit Designer shall be a Level 5 Diploma in Retrofit Coordination and Risk Management
	Retrofit Designer Shall hold: <ul style="list-style-type: none"> • Level 3 Award in Energy Efficiency for Older and Traditional Buildings; or • Scottish Level 6 Award in Energy Efficiency Measures for Older and Traditional Buildings; or • Welsh Level 3 Award in Energy Efficiency Measures for Older and Traditional Buildings.
	Retrofit Designer shall be Conservation Accredited with one of the following: <ul style="list-style-type: none"> • Chartered Institute of Architectural Technologists (CIAT); • Chartered Institute of Building (CIOB); • Conservation Accreditation Register for Engineers (CARE); • Register of Architects Accredited in Building Conservation (AABC); • Royal Institute of British (RIBA, RSAW, RSUA); • Royal Institution of Chartered Surveyors (RICS); or • Royal Incorporation of Architects in Scotland (RIAS).

13.1 PAS2035:2023 A.3 Retrofit Design Qualification Clarification

The following text provides further clarification on each section from Table A.3:

A.3.1 - For projects where only one measure is proposed, the designer is required to have an NVQ qualification for that measure. (Loft or Cavity (GBIS))

A.3.2 - For projects where only one measure is going to be installed and that measure is a Branded system, the designer needs to be carded by that system designer/manufacturer as being deemed competent.

A.3.3 - For projects where only one measure is going to be installed and that measure is a boiler then the designer needs to be GAS Safe or OFTEC registered.

A.3.4 - For projects where only one measure is going to be installed and that measure is for example an ASHP or PV the designer needs to be MCS registered.

A.3.5 - The retrofit designer shall be qualified as per below:

- a chartered architectural technologist (MCIAT or FCIAT) registered by the Chartered Institute of Architectural Technologists (CIAT);
- an architect registered by the Architects Registration Board (ARB);
- a professional member of the Chartered Institute of Building (MCIOB or FCIQB);
- a chartered building surveyor (MRICS or FRICS).

A.3.6 - The retrofit coordinator shall review all the retrofit designer's qualifications to ensure they are compliant with section A.3 Qualifications for Retrofit Designers within PAS 2035:2023

A.3.7 - This section is split into 3 definitions:

- a. For projects with any number of measures but contain 3 or more interacting fabric improvement measures;
- b. For projects with any number of measures but contain an insulation or window measure on a High-Rise property;
- c. For projects with any number of measures but contain an insulation or window measure on a System-built property.

The retrofit designer shall be one of the following:

- a chartered architectural technologist (MCIAT or FCIAT) registered by the Chartered Institute of Architectural Technologists (CIAT)
- an architect registered by the Architects Registration Board (ARB)
- a professional member of the Chartered Institute of Building (MCIOB or FCIQB)
- a chartered building surveyor (MRICS or FRICS)

A.3.8 - This can be split into 2 definitions for clarity:

- a. For all projects with any number of measures where the building is Traditionally Constructed, and the proposed measures are likely to impact the fabric of the building;
- b. For all projects with any number of measures where the building is Traditionally Constructed, and the proposed measures are likely to have an impact on the Heritage significance of the building.

The above shall include single measures and heating measures requiring, for example, flues, services or pipework that may impact the fabric of the building).

The retrofit designer shall be one of the following:

- a chartered architectural technologist (MCIAT or FCIAT) registered by the Chartered Institute of Architectural Technologists (CIAT)

- an architect registered by the Architects Registration Board (ARB)
- a professional member of the Chartered Institute of Building (MCIOB or FCIOB)
- a chartered building surveyor (MRICS or FRICS)

And have either:

- Level 3 Award in Energy Efficiency for Older and Traditional Buildings
- Scottish Level 6 Award in Energy Efficiency Measures for Older and Traditional Buildings
- Welsh Level 3 Award in Energy Efficiency Measures for Older and Traditional Buildings

Or Conservation Accredited with one of the following:

- Chartered Institute of Architectural Technologists (CIAT)
- Chartered Institute of Building (CIOB)
- Conservation Accreditation Register for Engineers (CARE)
- Register of Architects Accredited in Building Conservation (AABC)
- Royal Institute of British Architects (which incorporates the Royal Society of Architects in Wales and the Royal Society of Ulster Architects (RIBA, RSAW, RSUA))
- Royal Institution of Chartered Surveyors (RICS)
- Royal Incorporation of Architects in Scotland (RIAS)

A.3.9 - For any other projects with 2 or more measures where those measures are not interacting insulation measures (A.3.5, A.3.7 or A.3.8), the Retrofit Designer shall be:

- a chartered architectural technologist (MCIAT or FCIAT) registered by the Chartered Institute of Architectural Technologists (CIAT)
- an architect registered by the Architects Registration Board (ARB)
- a professional member of the Chartered Institute of Building (MCIOB or FCIOB)
- a chartered building surveyor (MRICS or FRICS)

14 U-Values Overridden

Overridden u-values will only be accepted as permissible, where there is a prior agreement with the scheme provider following receipt of suitable compliant validated evidence.

U-value calculations must be completed in compliance with BR443 Conventions for U-value calculations, the scheme provider reserves the right to audit any calculations should the need arise.

Where agreement is provided, the post-equivalent u-values in the post-EPR must be calculated based on the u-value of the pre-EPR and the thermal resistance of the insulation product installed.

For further reference please see [RdSAP Conventions V11.4 3.08](#).

Evidence Requirements

- Full detailed photographic evidence of the property including records of all fabric elements upon which any revised calculations are based;
 - RdSAP Site notes;
 - BBA Product Certification* of the insulation being installed;
 - Copy of the qualification of the person who has done the U-value calculation(s);
 - Scheme U-Value permission form;
 - Calculations must match the product's BBA Product Certification* recorded thermal conductivities;
 - Products within the calculation must be suitable for the building part they are being applied to.
- * Or equivalent e.g. Kiwa.

This guidance supports the [TrustMark Energy Performance Report \(EPR\) Variation Conventions V1.2](#).

15 Ventilation Strategy Ref PAS2035:2019+A1:2022 Annex C and Approved Document F

The Retrofit Designer shall assess the adequacy of the existing ventilation system in the dwelling and if necessary, include a design specification for upgrading the ventilation system, under either of the following circumstances:

- a) The package of specified and existing EEM's falls into category B or C as defined in Diagram 3.1 and Table 3.1 in Building Regulations Approved Document F1 Ventilation (ADF1) (*please see Figure 1 overleaf*); or
- b) There is evidence of condensation and/or mould growth as recorded in the dwelling in the retrofit assessment.

Note: For b) Where there is evidence of surface condensation or mould growth in the home, but no insulation or airtightness measures are proposed, and the ventilation is inadequate as it does not comply with Approved Document F, Table D1, then the ventilation system shall be upgraded. (Ref PAS2035:2023 C3.1)

The ventilation upgrade design shall be prepared in accordance with PAS2035:2023 Annex C and ADF1.

A complete ventilation system should include the following:

- Extract ventilation – to remove stale or moist air from wet rooms;
- Background ventilation – to permit the controlled entry of fresh air into habitable rooms to replace the air being extracted from the wet rooms; via –
- Door undercuts beneath all internal doors which allow air to move throughout the dwelling;
- Purge ventilation available in each room – by means of an opening window or door on an external wall of the dwelling to the outside.

Where any of the above are not available, in correct working order, or to the correct specification to satisfy the requirements of ADF1, the ventilation system shall be considered as inadequate.

The ventilation design shall detail all ventilation system components required, with specifications compliant with the minimum size or extract/ventilation rates as specified in the relevant tables contained within ADF1.

Figure 2. overleaf, provides an assessment process developed from ADF1 to help the designer assess the existing ventilation system and prepare an upgrade strategy to ensure compliance with ADF1 and PAS2035. This is available to ecmk members, accessed via Scheme Documents.

15.1 Acceptable Complete Ventilation System (Ref C.2.2)

An acceptable, complete ventilation system for a dwelling with Category C EEMs shall be:

- a) a continuous MEV system that extracts moist, “stale” air from all “wet” rooms combined with correctly sized background ventilators; or
- b) a whole-dwelling supply and extract MVHR system that extracts moist “stale” air from all wet rooms, supplies “fresh” external air to all living spaces; or
- c) other ventilation systems, if they can be shown to meet an equal level of performance and ventilation effectiveness, and extract moisture at source. In this case, expert advice shall be sought.

Note: The above excludes the use of Positive Input Ventilation systems (PIV) as these do not “extract at source”.

15.2 Property-Specific Ventilation Strategy

As for all design documents, the Ventilation strategy and any documentary evidence shall be specific to each individual property.

15.3 ADF1 Appendix D: Checklist for Ventilation Provision in Existing Dwellings

Table D1 in ADF1 is considered to be an adequate means of demonstrating compliance with the minimum standards of requirement ADF1 (*please see figure 3 overleaf*). This should be completed before energy efficiency measures are implemented to help establish compliance with the minimum standards of requirement ADF1.

Approved Document F Volume 1: Dwellings Section 3. Work on Existing Dwellings – Simplified Method

Table 3.1 Energy efficiency measures		Category of measure
Roof insulation		
a.	Renewing loft insulation, including effective edge sealing at junctions and penetrations	Minor
b.	Loft conversions or works that include changing a cold loft (insulation at ceiling level) to a warm loft (insulation at roof level)	Minor
Wall insulation		
c.	Installing cavity wall insulation to any external wall	Minor
d.	Installing external or internal wall insulation to less than or equal to 50% of the external wall area	Minor
e.	Installing external or internal wall insulation to more than 50% of the external wall area	Major
Replacement of windows and doors ⁽¹⁾		
f.	Replacing less than or equal to 30% of the total existing windows or door units	Minor
g.	Replacing more than 30% of the total existing windows or door units	Major
Draught-proofing (other than openings) ⁽²⁾		
h.	Replacing a loft hatch with a sealed/insulated unit	Minor
i.	Sealing around structural or service penetrations through walls, floors or ceiling/roof	Minor
j.	Sealing and/or insulating a suspended ground floor	Major
k.	Removing chimney or providing another means of sealing over chimney, internally or externally	Major
NOTES:		
1. If the energy efficiency works involve only replacing windows, then the guidance in paragraphs 3.14 to 3.16 may be followed as an alternative means of demonstrating compliance.		
2. Draught-proofing measures might not, on their own, constitute building work. This work may be controllable under the Building Regulations if carried out as part of other building work.		

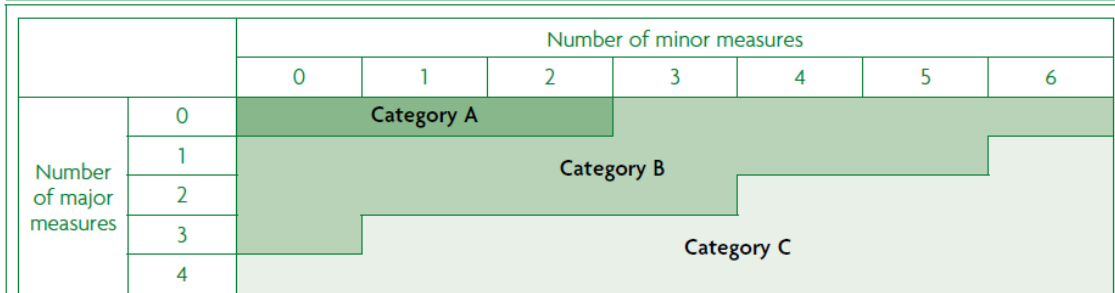


Diagram 3.1 Chart for categorising impact on ventilation when carrying out works in existing dwellings

Figure 1 The Building Regulations 2010 Ventilation F1 Dwellings Table 3.1

When carrying out energy efficiency measures on an existing dwelling, Table 3.1 should be used to calculate the number of major and minor energy efficiency measures involved. This calculation should include all of the following:

- Energy efficiency measures fitted since the original dwelling was constructed;
- Energy efficiency measures planned.

NOTE: Where specific energy efficiency measures are not included in Table 3.1, the most similar category should be chosen instead.

Diagram 3.1 Results

Category A – the dwelling’s ventilation system **will not** require an upgrade design;

Category B or C – the ventilation system **will** require an upgrade design.

15.4 Diagram 3.1 Worked Examples

Example 1

Measures included in the design:

Item	Measure	Category of Measure
1	Loft insulation	Minor
2	Cavity wall insulation	Minor
Result = 2 Minor measures - Category A		

Example 2

Measures included in the design:

Item	Measure	Category of Measure
1	External wall insulation >50% of walls	Major
2	Loft Insulation	Minor
3	Underfloor insulation	Major
Result = 2 Major and 1 Minor measure - Category B		

Example 3

Measures included in the design:

Item	Measure	Category of Measure
1	External wall insulation >50% of walls	Major
2	New windows and doors >30%	Major
3	Loft Insulation	Minor
4	Underfloor insulation	Major
Result = 3 Major and 1 Minor measure - Category C		

PAS2035:2023 Domestic Ventilation Assessment (Ref ADF1 2021)



This process has been developed to assist Retrofit Assessors, Coordinators and Designers in assessing the existing ventilation system in a dwelling and to provide guidance on providing compliant upgrades. This process follows the guidance provided by the Reference Documents listed overleaf.

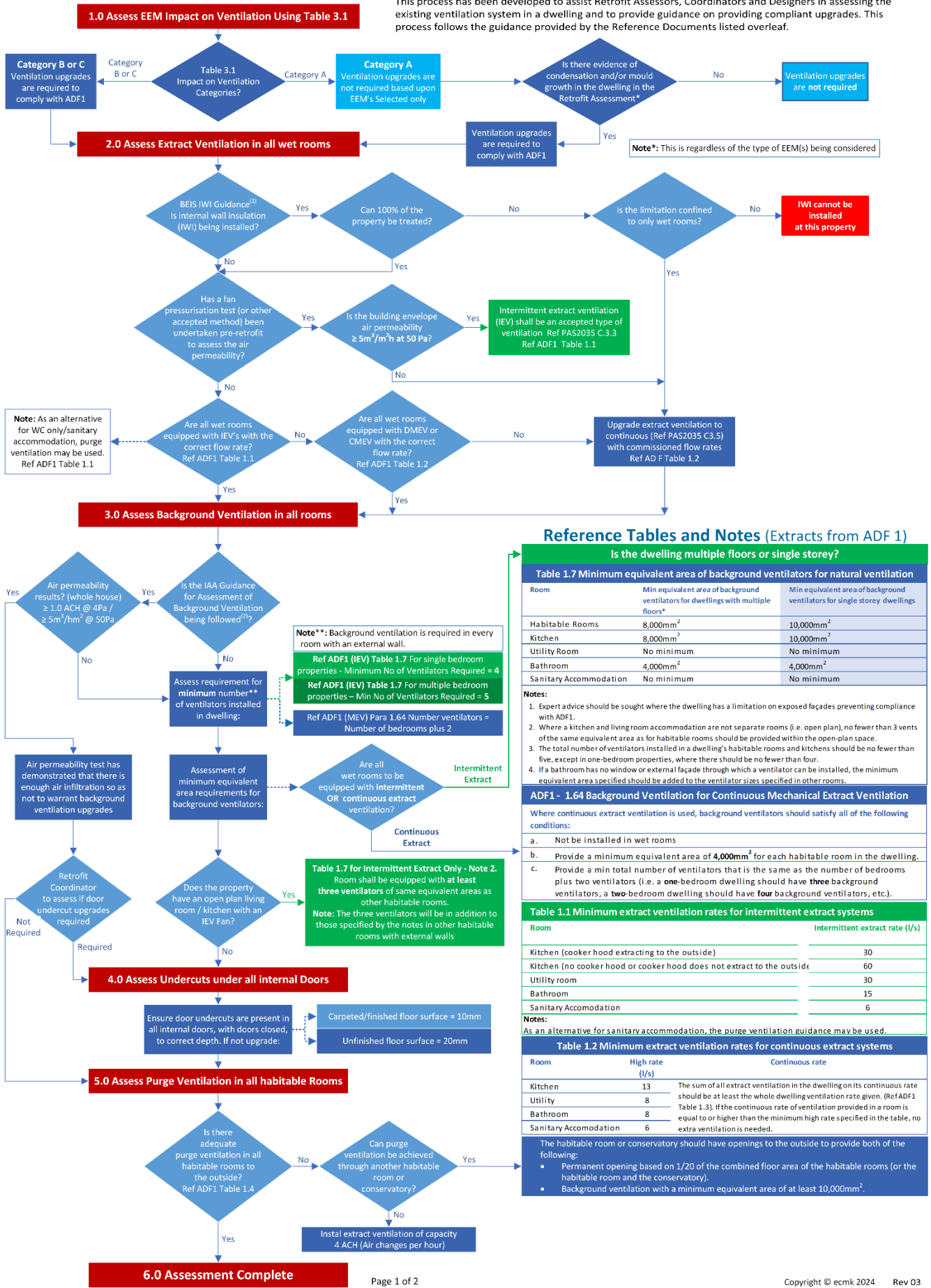


Figure 2 PAS2035:2023 Domestic Ventilation Assessment Flowchart



Appendix D from ADF1 provides a checklist, Table D1 below, for determining the ventilation provision in an existing dwelling. It should be used before energy efficiency measures are carried out to establish whether an existing dwelling complies with the requirement for adequate means of ventilation.

Table D1 Checklist for ventilation provision in existing dwellings		
Natural ventilation⁽¹⁾		
What is the total equivalent area of background ventilators currently in dwelling?		mm ²
Does each habitable room satisfy the minimum equivalent area standards in Table 1.7 ⁽²⁾ ?	Yes	No
Have all background ventilators been left in the open position?	Yes	No
Are fans and background ventilators in the same room at least 0.5m apart?	Yes	No
Are there working intermittent extract fans in all wet rooms?	Yes	No
Is there the correct number of intermittent extract fans to satisfy the standards in Table 1.1?	Yes	No
Does the location of fans satisfy the standards in paragraph 1.20?	Yes	No
Do all automatic controls have a manual override?	Yes	No
Does each room have a system for purge ventilation (e.g. windows)?	Yes	No
Do the openings in the rooms satisfy the minimum opening area standards in Table 1.4?	Yes	No
Do all internal doors have sufficient undercut to allow air transfer between rooms as detailed in paragraph 1.25 (i.e. 10mm above the floor finish or 20mm above the floor surface)?	Yes	No
Continuous mechanical extract ventilation⁽¹⁾		
Does the system have a central extract fan, individual room extract fans, or both?	Yes	No
Does the total combined continuous rate of mechanical extract ventilation satisfy the standards in Table 1.3?	Yes	No
Does each minimum mechanical extract ventilation high rate satisfy the standards in Table 1.2?	Yes	No
Is it certain that there are <i>no</i> background ventilators in wet rooms?	Yes	No
Do all habitable rooms have a minimum equivalent area of 5000mm ² ?	Yes	No
Does each room have a system for purge ventilation (e.g. windows)?	Yes	No
Do the openings in the rooms satisfy the minimum opening area standards in Table 1.4?	Yes	No
Do all internal doors have sufficient undercut to allow air transfer between rooms as detailed in paragraph 1.25 (i.e. 10mm above the floor finish or 20mm above the floor surface)?	Yes	No
Mechanical ventilation with heat recovery⁽¹⁾		
Does each habitable room have mechanical supply ventilation?	Yes	No
Does the total continuous rate of mechanical ventilation with heat recovery satisfy the standards in Table 1.3?	Yes	No
Does each minimum mechanical extract ventilation high rate satisfy the standards in Table 1.2?	Yes	No
Have all background ventilators been removed or sealed shut?	Yes	No
Does each room have a system for purge ventilation (e.g. windows)?	Yes	No
Do the openings in the rooms satisfy the minimum opening area standards in Table 1.4?	Yes	No
Do all internal doors have sufficient undercut to allow air transfer between rooms as detailed in paragraph 1.25 (i.e. 10mm above the floor finish or 20mm above the floor surface)?	Yes	No
NOTES:		
1. Make a visual check for mould or condensation. If either are present, install additional ventilation provisions or seek specialist advice.		
2. All references to tables and paragraphs are to Approved Document F, Volume 1: Dwellings.		

Figure 3 The Building Regulations 2010 Ventilation F1 Dwellings Table D.1

15.5 IAA Background Ventilation Assessment of Existing Buildings

The Installation Assurance Authority (IAA) has developed a TrustMark-approved process for assessing the requirement for background ventilation only. Where this test is being used to determine the requirements for background ventilation for a property, for the test to be compliant:

- Testing must be undertaken both pre and post EEM installation, by a competent person registered with Elmhurst or ATTMA;
- The process described in the IAA guidance document (link below) must be adhered to;
- For a test to demonstrate that there is sufficient air infiltration so as not to warrant any upgrades of background ventilation:
 - Whole House test demonstrating air permeability of - $\geq 1.0 \text{ ACH @4Pa}$
 - Room tests in bedrooms where there are no ventilators and/or mould or condensation issues present demonstrating air permeability of - $\geq 1.5 \text{ ACH @4Pa}$
- Only the total building volume (m^3) needs to be measured, allowing the measured air leakage rate to be expressed as air changes per hour (Ach). For reporting air permeability results, a measurement of the dwelling envelope area will also be needed.
- Evidence shall be submitted including copies of the test results, fully completed, for both pre and post-installation testing, and the list of evidence outlined under Section 7. of the guidance, titled “Documentation”;

Where the above permeabilities are recorded, in the section for Background Ventilation, in the ventilation strategy should include a statement to the effect:

“Background ventilation testing has successfully completed in accordance with the IAA Background Ventilation Assessment Guidance, demonstrating there is sufficient air infiltration so as not to warrant background ventilation upgrades.”

[Background ventilation assessment of existing buildings | IAA - The Installation Assurance Authority](#)

16 Pre-installation Building Inspection (PIBI)

To facilitate the preparation of the design the Retrofit Installer shall undertake a pre-installation inspection of the designated location based on the installation method statement prepared under PAS203 Clause 6.1, using a vocationally competent person as defined in the relevant measure-specific Annex of this PAS.

The inspection shall be undertaken at a level of detail sufficient to confirm that the specified EEM can be safely and effectively installed at the designated location paying particular attention to:

- the measures installed;
- the functionality and/or safety of installed services (gas, electricity, water, telecommunications, etc.);
- the use of specified installation methods;
- potential moisture build-up as a result of the installation;
- the fire safety of the dwelling;
- any required ventilation upgrade including where necessary the procurement and installation of any required ventilation upgrade from a ventilation specialist;
- avoidance of thermal bridging;
- testing;
- commissioning and handover.

The inspection shall include all, but not be limited to the measure-specific pre-installation inspection requirements from the relevant measure-specific Annexes of PAS2030.

As part of the pre-installation Inspection, the Retrofit Installer shall confirm to the Retrofit Coordinator that the repair works identified by pre-installation assessment or the design have been undertaken.

17 Revisions to the Retrofit Design

There will be occasions where, due to unforeseen circumstances occurring during installation, aspects of the design may require revising. If this should occur, any relevant design documents must be revised in line with any such changes. Omission of this may result in a non-compliant lodgement. This is particularly relevant to the ventilation strategy.

18 PAS2035:2023 Retrofit Design Checklist

It is recommended that the Retrofit Designer completes the following checklist for each design to help ensure compliance of the retrofit design with PAS2035:2023.

Table 3. PAS2035:2023 Retrofit Design Checklist

	Design Item Description	Included in Design / Compliant
1	Designer qualifications compliant?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
2	Is the design based upon a suitable Pre-installation building inspection (PIBI)?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
3	Design compliance with all relevant guidance and technical standards?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
4	Is assessment information sufficient to allow for the preparation of the design?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
5	Scope of design and sequence of installation prepared in sufficient detail?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
6	Are all design documents prepared specific to this property?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
7	Has the condition of the building been described including the requirements for any remedial works required prior to EEM installation?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
8	Have all key product details been included in the design as listed in Table 1?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
9	Have all EEMs been checked against The Measures Interaction Matrix provided in PAS2035 Annex D (Figure D.2	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
10	Flood risk and rainfall exposure recorded?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
11	Fire Safety assessed?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
12	Installation, operation, and maintenance manuals included in the design?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
13	Testing and commissioning requirements detailed?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
14	Handover document requirements detailed?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
15	Are all EEM specific design requirements covered as detailed in Table 2?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
16	Planning considerations considered?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
17	Thermal bridge designs detailed and locations to be used recorded?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
18	Thermal bridge calculations included where required	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
19	Has overheating been assessed in the property?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
20	Has an air tightness strategy been prepared and if required, specific air tightness targets been recorded?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
21	Have the intended outcomes been agreed with the Retrofit Coordinator?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
22	Heritage Impact Assessment (HIA) included if required?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
23	Scheme provider compliant overridden u-values included, if required?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>
24	Ventilation assessment and strategy included?	Yes <input type="checkbox"/> / N/A <input type="checkbox"/>

Checklist completed by designer: _____

Date Complete: _____

19 References

- PAS 2035:2023 Retrofitting dwellings for improved energy efficiency – Specification and guidance. [PAS 2035 - Retrofitting Dwellings for improved Energy Efficiency](#)
- BRE Group IP 1/06 Assessing the effects of thermal bridging at junctions and around openings, March 2006. <https://www.brebookshop.com/IP106>
- External wall insulation specification for weathering and thermal bridge control guide. August 2024 update including roofline closure details <https://inca2016.wpenginpowered.com/wp-content/uploads/2024/08/Weathering-and-Thermal-Details-August-2024.pdf>
- Specification for the installation of external wall insulation ensuring the safety and operation of fuel-burning appliances V1.0 March 2017 [Document 1 FINAL.pdf \(dropbox.com\)](#)
- External wall insulation pre-installation building inspection checklist, Wrest Park: SWIGA, 2017 <https://inca2016.wpenginpowered.com/wp-content/uploads/2024/08/Weathering-and-Thermal-Details-August-2024.pdf>
- BEIS Guide to Best Practice Retrofit Internal Wall Insulation, September 2021 <https://assets.publishing.service.gov.uk/media/iwi-guidance.pdf>
- BEIS Guide to Best Practice Retrofit Floor Insulation – Suspended Timber Floors <https://assets.publishing.service.gov.uk/media/suspended-timber-floors-underfloor-insulation-best-practice.pdf>
- BEIS Guide to Best Practice Solid floor insulation (SFI) <https://assets.publishing.service.gov.uk/media/solid-floor-insulation-best-practice.pdf>
- BEIS Guide to Best Practice Room in roof insulation (RIRI) <https://assets.publishing.service.gov.uk/media/retrofit-room-in-roof-insulation-best-practice.pdf>
- CIBSE TM59 Design methodology for the assessment of overheating risk in homes (2017) <https://www.cibse.org/knowledge-research/knowledge-portal/technical-memorandum-59-design-methodology-for-the-assessment-of-overheating-risk-in-homes>
- Guidance on extending the roofline on domestic properties to ensure sufficient overhang to accommodate external wall insulation <https://cms.trustmark.org.uk/media/Guidance on Extending the Roof Line on domestic properties for EWI>
- CITB loft insulation guide TRM 152/1 [Loft V2.indd \(citbni.org.uk\)](#)
- The Building Regulations 2010 Fire Safety Approved Document B, Volume 1: Dwellings. <https://assets.publishing.service.gov.uk/Approved Document B fire safety vol 1 - Dwellings.pdf>
- The Building Regulations 2010 Site Preparation of Resistance to Contaminants and Moisture, Approved Document C <https://www.gov.uk/government/publications/site-preparation-and-resistance-to-contaminates-and-moisture-approved-document-c>
- The Building Regulations 2010 Ventilation Approved Document F Volume 1: Dwellings <https://assets.publishing.service.gov.uk/media/ADF1.pdf>
- The Building Regulations 2010 Conservation of fuel and power, Approved Document L, Volume 1: Dwellings, 2021 Edn. <https://www.gov.uk/government/publications/conservation-of-fuel-and-power-approved-document-l>
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- ETAG 014 Edition January 2002, Revised 2008, 2011, Guideline for European Technical Approval of Plastic Anchors for Fixing of External Thermal Insulation Composite Systems with Rendering. <https://www.eota.eu/sites/default/files/uploads/ETAGs/etag-014-en.pdf>
- BS5250:2021 Management of moisture in buildings —Code of practice
- CITB General Requirements and Guidance for the Installation of Cold Roof Loft Insulation, Ver 2 CITB 2013
- NHBC 7.2.15 Ventilation, vapour control and insulation
- BS 493:1995 Specification for airbricks and gratings for wall ventilation (+A1:2010)
- Zero Carbon Hub Thermal Bridging Guide. <https://www.labc.co.uk/sites/default/zch/thermalbridgingguide-screen.pdf>

- BRE 262 Thermal insulation: avoiding risks A good practice guide supporting building regulations requirements 2002 edition <https://www.brebookshop.com/details.jsp>
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- BS 7913:2013 Guide to the conservation of historic buildings <https://knowledge.bsigroup.com/products/guide-to-the-conservation-of-historic-buildings?version=standard>
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- BR262 Thermal Insulation: Avoiding Risks <https://www.brebookshop.com/details.jsp?id=556>