AECB Retrofit Standard

Effective retrofit is crucial to decarbonising the UK's energy systems and is a major step towards achieving Net Zero.

The AECB Retrofit Standard tackles our historic underperformance when upgrading buildings. UK construction must deliver better energy efficiency for a low carbon future.

The AECB Retrofit Standard allows for easy self certification and increasing comfort & energy performance; it engages and upskills construction professionals to adopt and deliver higher performance targets for retrofit projects.

AECB Retrofit Standard Further Information

Contents

1. AECB Retrofit Standard and PHPP

The AECB Retrofit Standard is achieved when a building meets the requirements shown in the table below AND meets the AECB Retrofit Requirements outlined in this document.

Parameter	Target	Notes
Delivered Heat and cooling	≤ 50kWh/m².a OR ≤100 kWh/m².a **with exemption**	According to the methodology described in the PHPP* handbook.
Primary Energy (P.E.)	NA	PHPP MUST BE FULLY FILLED IN**
Primary Energy Renewable (P.E.R)	NA	
Air tightness (n50)	≤ 2 h^{-1}	With MVHR or MEV ***
Thermal Bridges ****	Psiexternal	all thermal bridges should be calculated as per Passivhaus Methodology ****
Summer overheating	<10%	<10% recommended with no window opening and <2% with window opening
Surface Condensation (fRsi)	>0.75	Anywhere on the building envelope

TABLE 1: Summary of AECB Retrofit Standard Performance Requirements

* Passive House Planning Package.
** to ensure all building services are input to more accurately model overheating
*** It may not be possible to meet the heat demand target without MVHR for some buildings.
**** Standard Passivhaus methodology is used. All thermal bridges should be modelled.

Note: If your project was started using an older version of PHPP you can certify the building within those parameters. If you choose you may also re-build the model in a later release of PHPP and certify under those criteria.

Primary Energy

The AECB Retrofit Standard does not include a primary energy (PE) or primary energy renewable (PER) target. Although some retrofits will renew the heating system at the same time as improving the fabric, the standard is primarily focused on improving the fabric in a way that delivers good thermal comfort and healthy homes. However, access to low carbon heat needs to be considered.

Gas boilers

Existing boilers may be retained for the AECB Retrofit Standard provided the design shows provision for future low carbon heat. New gas boilers will not be acceptable for certification under the AECB Retrofit Standard.

Heat supply

For rural or other areas, where electrification of heat is more likely, there is an assumption that generally heat pumps will be the preferred low carbon heating system of choice: certifiers should ensure, where a heat pump is *not* being installed as part of the retrofit, that they explain their strategy for future proofing the retrofit design to allow for easy future installation. However, in urban areas with future potential for district heating, heat pumps whether installed as part of the retrofit or planned to be installed later in the building's life may not be appropriate: certifiers can instead set out the alternative strategy based on their assessment of future local heat supply.

Direct electric heating

Using only direct electricity to provide space or hot water heating is **not** considered to be an appropriate solution in the UK and therefore will not be accepted for the AECB Retrofit Standard.

When assessing a design using PHPP's PER function the technical panel is aware that direct electric heating can appear attractive. However, as the resultant peak electrified heating loads are likely to negatively impact the power grid, the AECB discourages direct electric heating and will not currently certify such designs for 1 – 3 storeys detached, semi-detached and terraced homes.

The AECB accepts that in certain circumstances a case could be made for an exemption on a project-by-project basis e.g., for flats, maisonettes, multi-residential high-rise, and certain non-domestic buildings where heat distribution losses would result in increased energy demand and overheating risk. At this stage we are not offering an exemption process for direct electric heating but would ask that in these circumstances that AECB Certifiers contact the AECB and are prepared to provide the AECB with evidence, in the form of PHPP calculations and a report, showing assumptions, the options explored and the rationale for the conclusions – for feedback and research purposes.

2. Exemptions for the AECB Retrofit Standard

There may be good reason why ambitious and well-designed projects exceed the 50 kWh/(m2a), whilst achieving below 100 kWh/(m2a). At this stage, we are not offering an exemption process for projects exceeding 50 kWh/(m2a) and so are allowing certification at the Certifier's discretion. However, we wish to understand such situations encountered and so AECB Certifiers should ensure that that they upload a clear report or statement justifying the reasons as indicated by the exemption guidance below[1].

The 50 kWh/(m2a) target may be exceeded - but no more than 100 kWh/(m2a) - if absolutely necessary, based on one or more of the following compelling reasons for which the certifier will need to submit evidence:

[1] we have based these exemptions on those used by the Passivhaus Institute for EnerPHit.

- If required by the historical building preservation authorities
- Due to legal requirements
- If implementation of the required thickness or fire related properties of thermal insulation would result in unacceptable restriction of the use of the building or adjacent outer areas[2]
- If reliably moisture-robust construction is only possible with a reduced insulation thickness in the case of interior insulation
- If other compelling reasons relating to construction are present

If the thickness of the thermal insulation is restricted due to any of the reasons mentioned above, and an exemption is applicable, then the insulation thickness that is still possible must be implemented with a high-performance insulation material with a thermal conductivity $\lambda \leq 0.025$ W/(mK) if this can be implemented cost-effectively, in a damage-free way (in the case of interior insulation).

To Apply for an Exemption
It is to the certifier's discretion as to whether or not an exemption is justified. It is also the certifier's responsibility, to provide an auditable report/statement justifying the exemption. This report should be submitted at the time of certification (bound into the verification PDF.) The report, including the information specified above, should be clear and to the point, and based on PHPP modelling.

The AECB reserves the right to change these requirements and, in cases of consistently poor judgement, to ban certifiers that do not enter into the spirit of the standard.

Report Content Requirements
The exemption methodology is currently undergoing a rapid process of testing and refinement. The requirements above represent those aspects of the application process that are considered comprehensive but not overly onerous. Further queries may be raised by the AECB once your initial report has been reviewed.

3. Evidence for Certification

Evidence required to meet the AECB Retrofit Standard is as follows and for certification should be uploaded to the AECB Low Energy Building Database (LEBD). More detail can be found regarding the minimum requirements for this evidence in the remainder of the document.

Please note that currently the LEBD currently only provides an evidence upload facility for new-build projects – when uploading evidence for certifying to the retrofit Standard please follow the instructions below. Where the LEBD requires items not required under this retrofit standard, please upload a suitable jpeg image e.g.,

[2] For example, EWI on a street side elevation where the façade is the public boundary and where the Local Authority will not allow encroachment. However, we would expect to see evidence of those discussions. A simple example might be where a communal, narrow side passage between houses must retain its full width. Fire related aspects may also be implicated.

Certification Stages

1. Register for a user account on LEBD.
2. Create a project in the (publicly visible) part of LEBD, ensuring you include all items listed below ('LEBD' items)
3. Start a certification process for that project & upload all evidence required in the 4 certification sections of the LEBD, which are 1. 'Enter Project Data' 2. 'Upload Images' 3: 'Upload Evidence' 4: 'Review & Declaration'.

The evidence required to certify to the AECB Retrofit Standard is set out below.

Checklist of Evidence Required		
Certification registration stage (required): LEBD publicly visible entry	1.	Design Strategies (please treat this section as describing the 'as-built' project) - Planned Occupancy - Space Heating Strategy - Water Heating Strategy - Fuel Strategy - Renewable Electricity Generation Strategy - Space Cooling Strategy - Ventilation Strategy - Airtightness Strategy - Strategy for Minimising Thermal Bridges - Insulation Strategy - Modelling Strategy
	2.	Services strategy and specification to include heating and hot water (including storage). Ventilation strategy and specification
	3.	Pre-Development Energy Use (if actual figures are available)
	4.	Energy Forecast (must be modelled in PHPP)
	5.	Airtightness (results)
Certification stage: LEBD Section 2, JPG or PDF files	6.	Elevations of building after retrofit - one photo for each elevation - alternatively, for hard-to-photograph elevations a drawing may be uploaded, pdf
	7.	Primary airtightness barriers as built - three photos showing the general method used for walls, floors, and roof
	8.	Floor to wall junction as built - two photos: one showing thermal bridge mitigation and the other showing the air barrier
	9.	Intermediate floor to wall junction as built - two photos, one showing thermal bridge mitigation and the other showing the air barrier
	10.	Roof to wall junction as built - two photos, one showing thermal bridge mitigation and the other showing the air barrier

	11.	Window cill, jamb and head detail as built - two photos for each (6 in total), one showing thermal bridge mitigation and the other showing the air barrier)
	12.	Service penetration detail as built one photo showing air barrier
	13.	Internal load bearing (or party) wall to ground as built - two photos, one showing thermal bridge mitigation and the other showing the air barrier
	14.	Internal wall to external wall as built - two photos, one showing thermal bridge mitigation and the other showing the air barrier
	15.	MEV or MVHR installation as built - photo(s) showing ducts & duct insulation
Certification stage: combine items into a single PDF & upload to LEBD in Section 3. A4 format, max. file-size 8 MB	16.	A report covering a pre-retrofit condition survey including a comprehensive retrofit risk strategy (includes moisture risk) - see Appendix 1
	17.	AECB Standard Exemption report (if required) - Exemption at certifier's discretion
	18.	Radon test or monitoring reports - Pre-retrofit (optional) Radon measures as built - photos(s) - Post-retrofit test or monitoring report (optional)
	19.	Elevations of building before retrofit - one photo for each elevation - alternatively, for hard-to-photograph elevations a drawing may be used
Certification stage: PDF uploaded to LEBD in Section 3: A4 format, max. file-size 8 MB	20.	Air pressure test certificate(s) - final, post retrofit,
	21.	Section and plan of building indicating air barrier - Drawing
	22.	Floor to wall junction (showing thermal bridge mitigation and air barrier) - Drawing, pdf
	23.	Intermediate floor to wall junction (showing thermal bridge mitigation and air barrier) - Drawing, pdf
	24.	Roof to wall junction (showing thermal bridge mitigation and air barrier) - Drawing, pdf
	25.	Window cill, jamb and head detail (showing thermal bridge mitigation and air barrier) - Drawing, pdf
	26.	Service penetration detail (showing air barrier) - Drawing, pdf
	27.	Internal load bearing (or party) wall to ground (showing thermal bridge mitigation and air barrier) - Drawing, pdf

28.	Internal wall to external wall (for IWI projects showing thermal bridge mitigation and air barrier) - Drawing, pdf
29.	MEV or MVHR layout showing ducts & duct insulation and design flow rates - Drawing, pdf
30.	Engineer's heating, hot water and ventilation system commissioning as built (combine into single PDF) - heating system certificate - hot water system certificate - ventilation commissioning certificate
31.	Energy & Comfort - As-built PHPP verification sheet, PDF

4. Notes on Compliance

Compliance with the AECB Retrofit Standard cannot be assumed unless the building has been modelled in PHPP, construction quality has been verified and the supporting data has been publicly declared.

4.1. Thermal Bridges

The AECB Retrofit Standard uses the Passivhaus approach of using external dimensions to simplify modelling. It also requires that thermal bridges be minimised and there are the necessary guards against mould and condensation.

There are no targets for psi-values, however, no junction between insulated elements in areas where improvement measures have been installed should have an fRsi <0.75.

4.2. PHPP Verification Sheet and MVHR

Ventilation system design shall follow the General Minimum criteria as specified in 'Criteria for the Passive House, EnerPHit and PHI Low Energy Building Standard'.

As per the Passivhaus Criteria[3], an MVHR commissioning report "Final Protocol Worksheet for Ventilation Systems",[4] shall be submitted. MHVR systems must be Passivhaus Certified or they will receive a 12% penalty on heat recovery efficiency in the PHPP.

For MEV systems, the "Final Protocol Worksheet for Ventilation Systems" is not required, but a commissioning sheet should be submitted showing that the system is operating at the design flow rates.

4.3. Airtightness Testing

Airtightness testing shall follow the Passivhaus testing protocols as defined by ATTMA TSL4.

[3] Criteria for the Passive House, EnerPHit and PHI Low Energy Building Standard https://passiv.de/downloads/03_building_criteria_en.pdf
[4] source PHPP CD or www.passivehouse.com

5. AECB Retrofit Standard Certification

How are AECB Retrofit Standard projects certified?

5.1. Client

For your piece of mind AECB recommends that a suitably experienced person or a certified Passivhaus designer/consultant certifies the project. Ideally, they are already a part of your design team, which means many costs associated with meetings and site visits can be absorbed without incurring significant additional cost.

5.2. Architects, Engineers and Consultants

A self-certification route has been developed whereby the self-certifier takes responsibility for certification and for underwriting the AECB Retrofit Standard claim. The certifier may be a suitably experienced person or a certified Passivhaus designer/consultant, or the building's energy assessor.

5.3. Contractors

It is advised that you ensure a suitably experienced person or a certified Passivhaus designer/consultant, or the building's energy assessor, has been appointed to act as certifier, and that design conformance has been demonstrated prior to commencing on site.

6. AECB Retrofit Standard Certification: Trading Standards and Legal Considerations

- *The claim that a building is designed to the AECB Retrofit Standard can be independently verified.*
  Where a certificate is provided by the AECB, the responsibility for certification rests with the professional signing this certificate and not with the AECB.
  The AECB reserves the right to recall any certificate in the event of proven malpractice or false claims.
- *Trading Standards and legal considerations:*
  By making a project's claim explicit and a matter of public record the self-certification process has been designed to provide a degree of consumer protection under trading standards – without the AECB having to get involved in quality control and legal matters.
- *Duty of care:*
  Responsibility for certification and claims regarding building performance rest with the person signing the certificate. There is also a duty of care placed on the client to ensure that the consultant is competent and suitably insured.

The Role of The AECB in the Certification Process

Records: The AECB will retain electronic copies of such details as required to verify that a building meets the AECB Retrofit Standard, but it does not necessarily check for compliance.

Queries: The AECB reserves the right to query submissions at its own discretion. Self-certifiers shall respond to all queries to the AECB's satisfaction. In the event of a failure to respond to queries within 20 working days then the AECB reserves the right to disallow the claim of AECB Retrofit Standard compliance.

Declaration certificate: Though the AECB provides a declaration certificate it does not audit or take responsibility for the certification process. In this respect the responsibility for certification lies firmly with the certifying consultant making the declaration. To this end the declaration certificate, and all other relevant information must be completed by the certifying consultant.

In the event of a non-conformance claim the onus lies with the certifying consultant, not with the AECB.

7. What Design Tools are Required?

If you want to start designing your AECB Retrofit Standard project today you can purchase the latest version of PHPP here.

Appendix 1
Condition Survey & Retrofit Risk Report

A critical part of the retrofit process is understanding the building and its context to inform the holistic application of the AECB Retrofit Standard. The report should consist of two sections

1. Information from a pre-retrofit condition survey (Section 1)
2. A description of pre- and post-retrofit risks (Section 2)

The condition survey report may be a RICS Level 3 survey report or may be commissioned from other suitably expert persons, including a qualified Retrofit Coordinator or a Retrofit Designer. Until such time as more definitive guidance or standards are published covering this important assessment stage of the retrofit process please use the following guidance to format and prepare your report for submission.
The purpose of such guidance is to identify all information that will assist the process of establishing the condition of any building where works to improve thermal performance of the building envelope, by installing retrofit insulation (and other measures), are being planned. AECB certification to the Retrofit Standard requires a Condition Survey & Retrofit Risk Report is uploaded, however what is set out below is guidance only to aid in preparation of such a report.

Section 1

Location related

1. Flood risk
2. Radon Risk
3. Exposure zone
4. Conservation Area / Listed status
5. Google Earth / Street View information
6. Heat maps

Statutory related

7. Planning Permissions
8. Building Control approvals
9. Notified approved works (replacement windows, heating systems etc.)
10. Party Wall Act related

Reports & Certificates

11. Existing Energy Performance Certificate
12. AECB 'Home Energy Check Report' (pre-retrofit) https://www.lowenergybuildings.org.uk/
1. Structural engineer reports, building surveyor reports, architect reports or surveys Landlord condition surveys, estate agents' particulars, Historical Guarantees, Warrantees, and user handbooks available to the owner / occupier.
13. Any monitoring results or related reports e.g., Radon, CO2, Humidity, Temperature, moisture content

Site-visit related

Understanding the existing building

14. Description of existing house type, construction type, and main methods and materials for principal construction elements (walls, floors, roof, windows)
15. A description of key changes from the original house type – including:
    a. Any extensions
    b. major internal remodelling

c. to principal construction elements (walls, floors, roof, windows) including all ‘improvements’: weatherisation, moisture related and energy efficiency measures, internal plasters and wall, floor and ceiling finishes

16. Pre-retrofit details: dimensions, floor plans; windows and doors; heating, hot water, lighting, and ventilation systems (including controls and make and model where appropriate) – adequate information to build the energy model for modelling the whole house retrofit measures.
17. An assessment of pre-retrofit ventilation provision, Indoor Air Quality & potential issues including any noise, smells or airborne particulate emissions affecting neighbouring properties or the surrounding area
18. Pre-retrofit Form Factor. You may find it useful to consider the nearest, appropriate AECB energy target to help identify a project-specific target – please reference the latest AECB CLR targets.

Buildings as ‘Cultural Artefacts’

The significance of the building with respect to

19. its place in the Landscape or City- or Townscape
20. neighbouring, nearby, same county, or otherwise individual unusual buildings representing social, or architectural history, design or construction movements, trends, exemplars, or relationship to important events.

Section 2

Pre-retrofit and post-retrofit residual risk
The application of the AECB Retrofit Standard to older buildings should be considered thoughtfully, and deploy the guidance and learning provided by the AECB CarbonLite Retrofit training courses. All sensible efforts should be made to improve the performance health and comfort of the building as far as possible to reduce, and adapt to, climate change impacts. To do this efficiently and to avoid unintended consequences e.g., particularly relating to moisture, the potential risks arising from the sorts of measures being considered should be identified at an early stage including the adequate identification of structural, moisture and disrepair issues.

Key elements to include in the risk section of this report

- Please set out the risks that were anticipated at the pre-retrofit design stage
- Please indicate how these were mitigated
- Please list any residual risks that have been communicated to the client, along with any criteria that were adopted to manage or monitor these risks on an ongoing basis.

The checklist below may be useful when assessing a building for the suitability of various measures:

Key features	Pre-retrofit condition in areas due to receive measures	Anticipated risks for the different measures and how these risks were minimised	Any residual risks, and any monitoring or planned 'check-ups'
• Significant heat loss pathways, or thermal weakness in the building envelope • Surface condensation • Airtightness, draughts • Ventilation and air quality • Rising and penetrating damp • Reported or observed overheating • Flood damage and future risk • Fire risk • Radon, other ground gases, mould spores			

Moisture

It can be easier to set out moisture related risks as it affects building assemblies – such as a suspended floor construction, and as it affects junctions – such as the point at which a suspended floor meets a gable or external masonry wall. Therefore, a general risk relates to the floor assembly and a related but more specific risk relates to a junction.

It is also good practice for assemblies and junctions to identify the general moisture sources and mechanisms that are likely or observed to be affecting it. Then, for example a report could adopt a 'traffic light' risk register of moisture risks – or use more specific criteria such as moisture content or humidity thresholds. The risk assessment section will reflect is your judgement of the risks based on either hygrothermal modelling and/or - where no modelling has been carried out - on your own renovation or retrofit experience to gauge the risk.

- 'No significant risks' means that you consider there to be no significant sources of moisture able to move (via the various moisture transfer mechanisms) from the source(s) thereby creating risks for vulnerable areas or components in the construction assembly.
- Potentially significant risk is where you have gauged the potential risks significant enough to warrant specific measures to manage moisture loads within the assembly.

However, it will be assumed that suitable surveys and building investigations have been carried out, as necessary.

Any moisture-robustness strategy should factor in sources of moisture you consider to be present and creating a risk.

Moisture risks are associated with the following sources

- rain wetting
- surface water
- ground water
- historically saturated or damp materials
- water vapour in interior air
- water vapour in exterior air

and the following mechanisms

- rising damp (capillary action)
- penetrating damp (capillary action)
- water ingress (leaks)
- hygroscopic absorption by salts
- condensation
- suppressed evaporation rate

Radon

Radon is a significant risk in the UK and should be considered in every retrofit. A Radon strategy shall be included in the submission for the AECB Retrofit Standard. A desktop survey shall be undertaken, and if the property is in a Radon Risk Are then measurement should be taken as per the UK Government guidance
https://www.ukradon.org/information/measuringradon

Overheating

Overheating risk for the retrofit design could for example be established using the Good Homes

Alliance Overheating in New Homes Tool5 (pending the development of the Good Homes Alliance Overheating in Existing Homes Tool due in 2021). The inputs and outputs of the tool could be included in the overheating strategy, alongside the PHPP summer overheating factor. Retrofit design elements that are aimed at reducing overheating risk shall be included, such as (but not limited to)

- Shading
- Changing opening (door and window) sizes
- Increasing summer ventilation
- Reducing wild heat gains from domestic hot water distribution or storage
- Including thermal mass within the thermal envelope

Flood
If the property is in a flood prone area as identified in the Condition survey report, then the retrofit risk strategy should set out how the designs are flood resilient.

Fire
A statement should be included to show how the design is following the latest guidance and requirements of the UK Building Regulations. It should also address any fire risks identified in the Condition Survey report.

5 https://goodhomes.org.uk/overheating-in-new-homes