RETROFIT ACADEMY CIC

Midlands Retrofit Toolkit

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MIDLANDS
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HUB

ABOUT MIDLANDS RETROFIT TOOLKIT

The Midlands Energy Hub (MEH) identified a knowledge gap between the technical standard of PAS 2035 and the operational requirements for implementation by local authorities (LAs) delivering building retrofit schemes. Given the mandate of PAS 2035 in all publicly funded projects, MEH has commissioned The Retrofit Academy to produce a Retrofit Toolkit to provide a clear process for all LAs to follow to help facilitate PAS 2035 compliance. The toolkit highlights key steps and points for intervention for LAs in order to be well-informed Funding Clients.

Introduction to PAS 2035

The purpose of PAS 2035 is to protect the integrity of dwellings that are being retrofitted and the health of the people who live in them. PAS 2035 achieves its purpose by defining a retrofit process, based on extensive experience over many years, that manages and removes technical risks. It is part of the BSI Retrofit Standards Framework, the development of which was a key recommendation of the industry-led Each Home Counts review published in 2016.

These guidance notes and templates have been:

- Developed by building upon work previously done by other Hubs or Retrofit Academy projects
- Informed through Task and Finish Groups comprised of LA and MEH representatives from the Midlands area
- Contributed to by legal and technical experts
- Built with PAS 2035 compliance in mind at all stages

The notes and templates are intended to enable those in LAs to construct and manage retrofit projects that will be PAS 2035 compliant. They offer practical guidance but still require the reader to consider their own specific projects and local conditions.

THE PURPOSE OF THE TOOLKIT

Retrofit is complex in many ways. The tools in this toolkit are designed to help with the variety of engagement, management, contractual and technical challenges. The sections in this document contain advice, guidance, processes and samples of best practice in these four broad areas.

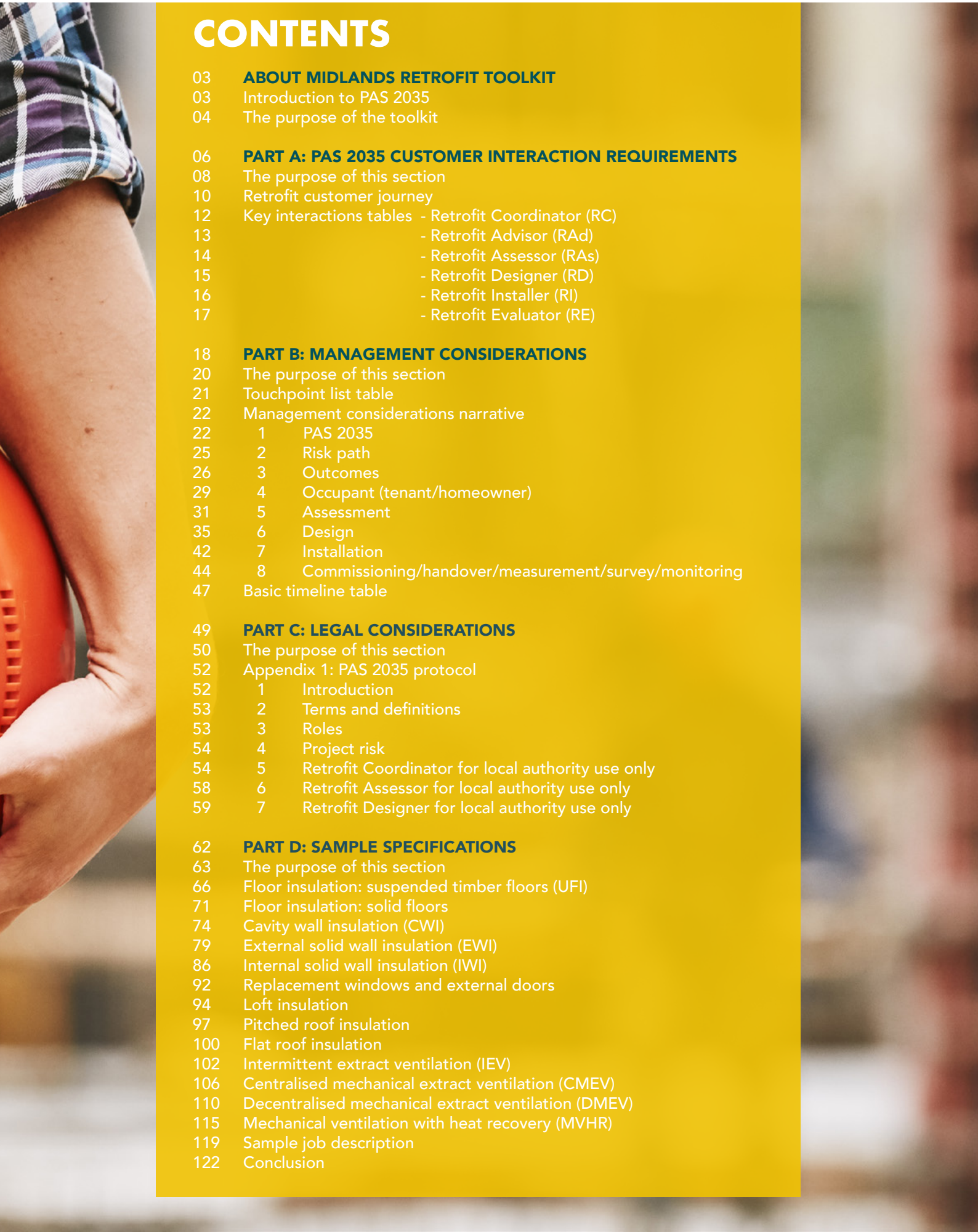
Section A – Customer Interaction Requirements looks at PAS 2035 through a Resident Client lens, helping the person responsible at the local authority level (Funding Client) to consider the Resident Client's requirements at each stage of the process.

Section B – Management Considerations looks at PAS 2035 through a Funding Client or local authority programme manager lens. It details the key touchpoints for managing the PAS 2035 process, which is essentially a process to get the right people to ask the right questions at the right time.

Section C – Legal Considerations looks at PAS 2035 through the legal representative's lens. It is written to assist those letting contracts to make sure PAS 2035 requirements are contractually highlighted and covered.

Section D – Sample Specifications looks at PAS 2035 through a technical lens and offers sample specification clauses to deliver PAS 2035 compliant specifications of work.

Although one document, each section stands alone and can be read in isolation. However, the most effective use of this document is to refer to all sections, even if that is over time and by different readers in the organisation delivering the programme. There is no specific order to follow, and the contents page will help you navigate to the part that interests you most now.



CONTENTS

Part A

PAS 2035 Customer Interaction Requirements

PART A – PAS 2035 CUSTOMER INTERACTION REQUIREMENTS

The Midlands Energy Hub (MEH) has commissioned the Retrofit Academy (RA) to produce a PAS 2035 Toolkit to provide specifications, resources and guidance to local authorities (LAs) involved in retrofit schemes such as the Green Homes Grant Local Authority Delivery and Sustainable Warmth Competition.

PAS 2035 is the comprehensive domestic retrofit process users of the TrustMark Government Endorsed Quality Scheme are required to comply with. PAS 2035 takes a holistic approach to retrofit that considers the building as a system of elements, interfaces and occupants. Moreover, it specifies new roles for building professionals involved in publicly funded retrofit projects.

The aim of the toolkit is to assist LAs in gaining a deeper understanding of how to develop and manage retrofit projects in compliance with the PAS 2035 process. For this purpose, this toolkit includes helpful tools such as compliance checklists and lists of tasks to be undertaken by each new retrofit role.

Templates and guidance notes included in this toolkit were developed building upon work previously undertaken by the Local Energy North West Hub, the Greater South East Energy Hub and other Retrofit Academy projects. Outputs from three Task and Finish Groups, comprising Midlands local authorities and Energy Hub representatives, informed the initial material with further contributions from legal and technical experts. All stages of the toolkit were developed with LA needs concerning PAS 2035 compliance in mind.

The Client is often considered to be the party funding the works, and there is the potential for people living in the property – owners and tenants – to be forgotten in the process. PAS 2035 is clear that there may be multiple clients. This set of templates is designed to clarify what the interactions of each PAS 2035 role should be with the Resident Client.

PAS 2035 has a clear set of requirements for ensuring that the Client is engaged in the process of retrofitting a dwelling. However, in the case of retrofit projects within publicly funded schemes there may be multiple clients (reference p.5, paragraph 3.1 of PAS 2035:2019) in relation to a single property. These are:

The Funding Client – such as a local authority;
The Landlord Client – the owner of a social or private rented home;
The Resident Client* – the person who lives in the home (this may be the owner or the tenant).

THE PURPOSE OF THIS SECTION

This series of Retrofit Customer Journey Documents is designed to support local authorities (LAs) with gaining a better understanding regarding PAS 2035 compliance from a 'Resident Client' perspective in order to inform and protect the interests of the Resident Client. It represents a streamlined version of the requirements of PAS 2035 detailed in a way that is clear and which identifies what is required of each new retrofit role – what they should ask and be able to answer, what information they need to pass on to the Funding Client / Resident Client, as well as additional good practice when engaging with people. It is critical that persons in all retrofit roles have the confidence and knowledge to ask the right questions of the right people at the right time.

For all retrofit roles, there are key things that should not be done, key questions that should be asked or be answered, key documents provided and, lastly, issues that should be passed on to the Funding Client and/or the next role in the communication chain.

This section considers the key things that should be considered in terms of Resident Client Engagement.

* Resident Client refers to the occupiers/homeowners/ tenants/residents/renters etc of the property. This term was coined by Aneaka Kellay of Carbon Co-op, 2021.

These have been categorised into four sections in the following graphics:

Key Restrictions – This section refers to key elements and pieces of information we would not expect to be discussed and which are specific to each role type. It is extremely important, for example, not to disclose opinions or any detail that may affect the retrofit outcomes and for the relevant information to be given and discussed by the appropriately qualified person.

Key Resident Client Questions – Anticipating questions from the Resident Client will help support consistency and build trust. Questions may arise in relation to wider housing needs or other additional queries. Although it is important to acknowledge and record these, it is equally important not to deviate from the retrofit task. Formulating standard responses to FAQs as well as ensuring the correct information is asked at key points by the relevant retrofit role will promote consistency in responses and avoidance of miscommunication.

Key Information to Resident Client – To ensure compliance, it is essential that the correct documentation is collected, collated and distributed by the appropriately qualified person in a format that is tailored to the audience. PAS 2035 requires that a minimum set of documents is owned by the resident client. Where key information is not collected/disseminated at the appropriate time and to the relevant person, key details may be missed thus increasing costs and causing project delays.

Key Information to Retrofit Team / Retrofit Coordinator – To ensure compliance and the quality of retrofit works, all parties must be kept informed for the process to be successful. Ensuring consistent and accurate information is shared to enables each retrofit role to successfully complete their part of the retrofit process in compliance with the specific clauses of PAS 2035. This section highlights information that is to be held/generated by each role and who should thereafter be in receipt/take responsibility for completion.

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Retrofit Customer Journey

Key Restrictions	This section refers to key elements and pieces of information we would not expect to be discussed specific to each role type. It is extremely important, for example, not to disclose opinions or any detail that may affect the retrofit outcomes and for the relevant information to be given and discussed by the appropriately qualified person.
Key Resident Client Questions	Anticipating questions from the Resident Client will help support consistency and build trust. Questions may arise in relation to wider housing needs or other additional queries. Although it is important to acknowledge and record these, it is equally important not to deviate from the retrofit task. Formulating standard responses to FAQs as well as ensuring the correct information is asked at key points by the relevant retrofit role will promote consistency in responses and avoidance of miscommunication.
Key Information to Resident Client *Permission must be sought by the Funding Client to enable access to documentation*	To ensure compliance, it is essential that the correct documentation is collected, collated and distributed by the appropriately qualified person in a format that is tailored to the audience. PAS 2035 requires that a minimum set of documents is owned by the resident client. Where key information is not collected/disseminated at the appropriate time and to the relevant person, key details may be missed thus increasing costs and causing project delays.
Key Information to Retrofit Team / Retrofit Coorindator	To ensure compliance and the quality of retrofit works, all parties must be kept informed for the process to be successful. Ensuring consistent and accurate information is shared enables each retrofit role to successfully complete their part of the retrofit process in compliance with the specific clauses of PAS 2035. This section highlights information that is to be held/generated by each role and who should thereafter be in receipt / take responsibility for completion.

[ ] Denotes reference to the clause number found in the PAS 2035:2019 Specification and Guidance

The **Retrofit Coordinator** is responsible for overseeing the assessment, identification, specification and evaluation of energy efficiency measures (EEMs) for installation and their subsequent in-use monitoring and evaluation. The below table outlines the interactions at each stage.

	RETROFIT COORDINATOR (RC)	RETROFIT ADVISOR (RAd) Delivers retrofit advice to Resident Clients	RETROFIT ASSESSOR (RAs) Assesses dwellings and supplies data	RETROFIT DESIGNER (RD) Qualifies to prepare a retrofit design	RETROFIT INSTALLER (RI) Undertakes the physical energy efficient works	RETROFIT EVALUATOR (RE) Monitors, evaluates and provides feedback
Key Restrictions		- No suggestion of solutions - No money saving specifics - No timing specifics	- No suggestion of solutions - No money saving specifics - No comment on existing issues	- Adhere to funding specification targets - No money saving specifics	- No discussions of specifics - No opinions on energy efficiency measures	- No discussions of individual results, circumstances - No speculation on success of measures
Key Resident Client Questions		- Will it save/cost money? - Will I need to move out? - How do I use new system?	- Which rooms will require access? - How long will the visit take? - What happens next?	- How do I decide what measures to get? - Is there any funding available?	- What will be installed where? - How long will it take? - What if something goes wrong?	- Who will see the data? - Why do you need it? - What does it mean for me?
Key Information to Resident Client ***Permission must be sought by the Funding Client to enable access to documentation***		- Consumer Charter - Code of Conduct - Key contacts - Recommendations for behaviour change - Tenant vulnerabilities - Welfare concerns - Accessibility needs	- Advise on any disruption - Occupancy Assessment - No timing specifics - Retrofit Assessment Report [8]	- Building regs approval - Design specification - TrustMark certifications - EEMs specified	- Information and documents identified in Installation Method Statement [6.1]	- Feedback on outcomes - Recommendations for behaviour change - Client questionnaire - Data analysis - Evaluation reports - Project review
Key Information to Retrofit Team / Retrofit Coorindator		- Access availability - Tenant welfare - Contact details	- Retrofit Assessment Report [8.5]	- Medium Term Improvement Plan (MTIP) / Improvement Option Evaluation (IOE) data - Plans and specifications	- Installation records - EEM accreditations e.g. MCS	- Data analysis - Evaluation reports - Project review

[ ] Denotes reference to the clause number found in the PAS 2035:2019 Specification and Guidance

RETROFIT ACADEMY CIC

RETROFIT COORDINATOR (RC)

Qualified as a specialist retrofit project manager, taking overall responsibility for overseeing the assessment, identification, specification and evaluation of energy efficiency measures (EEMs) for installation and their subsequent in-use monitoring and evaluation.

Key Restrictions

The Retrofit Coordinator is the fundamental role in ensuring the retrofit process is efficient and implemented accordingly. They are not, however, responsible for the success of the project but are critical for ensuring each element assigned to the correct professional (i.e. the Designer, the Installer, the Client, etc) is delivered as required. They are not responsible for the individual tasks associated with the retrofit project, but they are responsible for ensuring the appropriately qualified team is in place to ensure efficient and effective delivery in compliance with PAS 2035.

Key Questions

From Resident Client: Who will visit my home? How many visits will there be? What work will be completed? Who do I speak to if there is a problem? Do I need to move out? What is wrong with my home? What if the system fails? Will it be noisy? What if works are delayed, will I be compensated? How do I know you are trustworthy? Can I change my mind? Will it work as part of other works to my home, e.g. extensions?

To Resident Client: Do you have any concerns? Do you need any additional support, e.g. information in another format or help to move furniture? Do you know how much energy you currently use? Are you interested in being more involved? Do you understand the outcomes/process?

Key Information to Resident Client

The RC will undertake the key components of the retrofit process and provide to the Client a Retrofit Risk Assessment, Improvement Option Evaluation and Medium-Term Improvement Plan ensuring that every dwelling has an assessment undertaken. The RC will identify Path A, B or C and apply the appropriate methodology. Key responsibilities regarding information sharing include:

- Ensuring advice is delivered as per PAS 2035 [13].
- Ensuring a key contact is established, offering a range of ways to contact, e.g. phone, email, letter, home visits.
- Overseeing information regarding the standards, code of conduct and code of practice and having it translated into customer-friendly terminology to ensure it is understood.
- Confirming: questionnaires are issued / initial data is collected / training needs and area-specific queries are identified.
- Securing collateral warranty, which provides assurance that all involved have complied with their professional appointment.
- Advising the Client of any need for statutory approvals (e.g. planning).
- Making the Client aware of any safety, vulnerabilities, wellbeing, safeguarding issues or risk associated with the dwelling itself and the owner-occupier.
- Issuing advice to the Resident Client or RA at timely intervals (e.g. project conception, design and post-installation).
- Establishing the outcomes with the Client at the beginning of the project before any other processes have taken place and subsequently agreeing the intended outcomes of the project [6.2.1], taking into account the initial condition of the building.
- Raising any retrofit role's failure to comply with PAS 2035 with the Resident Client

Key Documents:
Improvement Option Evaluation
Retrofit Design Documents
Medium-Term Improvement Plans
Testing and Commissioning Documents
Warranties, Guarantees, etc
PAS Conformance
Collateral Warranty
Code of Conduct
Code of Practice
Handover Documents

Key Advice:
Payback and Carbon Cost Effectiveness
Recommended EEMs
Recommendation for new/updated EPC
Retrofit Advice [13]
Evaluation Outcomes

Key Information to Funding Client

Additional documentation may be required, for example where the local authority requires access to data. Possible documentation to be discussed, designed and developed, e.g. Permissions Agreement, Data Release Forms. Permission must be sought by the Funding Client to access the documentation as stated above.

Key Information to/from Retrofit Team

It is the RC's responsibility to upload the relevant documentation to TrustMark and to ensure all information is up to date and accurate. It is also their responsibility to ensure and demonstrate compliance with PAS 2035.
Retrofit Advisor - the RC will ensure general advice is given and at the correct intervals
Retrofit Assessor - instructed by the RC to collate data to pass on to the RD
Retrofit Designer - the primary relationship between design and installation lies with the RC and RI
Retrofit Installer - to work closely with the RC to ensure measures are installed as per design
Retrofit Evaluator - review and disseminate information to RC to feedback to the Client and project team

Key Documents to:
RI - Retrofit Design Documents
RI/RD - Copies of Retrofit Assessment
RI - ToolBox Talks
RAd - Retrofit Advice as per clause 13 of PAS 2035

Key Documents from:
RD - Retrofit Design Documents
RI - Pre-install Inspection
RI - Installation Testing
RI - Commissioning
RI - Handover (guides/manuals, guarantees, etc)
RI - Complaints Record
RAd - Occupancy Assessment
RE - Evaluator's Report

[] Denotes reference to the clause number found in the PAS 2035:2019 Specification and Guidance. PAS 2035:2019 can be purchased at www.bsigroup.com

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RETROFIT ADVISOR (RAd)

Delivers retrofit advice to Resident Clients. The Retrofit Advisor is the first point of contact for householders, setting expectations, signposting and helping orientate Resident Clients.

Key Restrictions

In order to manage residents' expectations appropriately and effectively, it is important that the Retrofit Advisor does not suggest any potential solutions that may be installed or allude to any possible monetary values in terms of potential customer fuel bill savings or earnings, for example from a scheme such as the Renewable Heat Incentive (RHI) or Feed-in Tariffs (FiT). Specifics around timings are also discouraged, as many factors in the process are still to be identified at this stage.

Key Questions

From Resident Client: Who will visit my home? How many visits will there be? What work will be completed? Who do I speak to if there is a problem? Do I need to move out? What is wrong with my home? How do I know who is working on the project and that they are trusted? When do I need to pay? How does the process work?

To Resident Client: Do you have any concerns? Do you need any additional support, e.g. information in another format or help to move furniture? Do you know how much energy you currently use? Are you interested in being more involved? Do you have / can you get last 12 months energy bills? Do you need help to get them?

Key Information to Resident Client

This role may also be completed by the Retrofit Coordinator. Where an individual Advisor is appointed, they are required to ensure the following information is provided to the Resident Client:

- Details of the key contact, including a range of ways to contact, e.g. phone, email, letter, home visits. The Advisor should also ensure the Client's contact preferences are communicated to the rest of the Retrofit Team.
- Information regarding the standards, quality assurance regimes, code of conduct and code of practice, which should be translated into Resident-Client-friendly terminology to ensure it is understood.
- Questionnaires / initial data collection / identified training needs / answers to area-specific queries.
- The collateral warranty, which provides assurance that all involved have complied with their professional appointments.
- Information regarding any safety, vulnerabilities, welfare or accessibility issues in terms of the retrofit process as well as anything else raised that the Retrofit Team may need to be aware of, e.g. issues with the maintenance of current installations/appliances. It is important that the Resident Client is aware of what information is being shared.
- Specific property requirements that may affect future installations, such as removal of any key internal/external mechanisms, e.g. unusual entrances, etc. It is important that the Resident Client understands the details of the work.

Key Advice:
Behavioural Advice
Reducing Energy Costs
Retrofit Technologies and EEMs
Data Considerations
Repairs and Maintenance
Warranties

Key Advice:
Payback and Carbon Cost Effectiveness
Recommended EEMs
Recommendation for new/updated EPC
Retrofit Advice [13]
Evaluation Outcomes

Key Information to Funding Client

Additional documentation may be required, for example where the local authority requires access to data. Possible documentation to be discussed, designed and developed, e.g. Permissions Agreement, Data Release Forms. Permission must be sought by the Funding Client to access the documentation as stated above.

Key Information to/from Retrofit Team

Clear and consistent communication is key, therefore contact details and access availability are critical to ensure projects run efficiently, particularly in terms of the Retrofit Advisor informing the Retrofit Assessor and Installer via the Retrofit Coordinator or directly.

Key Documents:
Register Advice Report with TrustMark
Advise Retrofit Coordinator of any issues/concerns

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RETROFIT ASSESSOR (RAs)

Carry out dwelling assessment and supply data to the Retrofit Coordinator.

Key Restrictions

In order to manage Resident Client expectations appropriately and effectively, it is important that the Retrofit Assessor does not enter into any engagement regarding the current state of the property or allude to the reasons as to why it has been identified for retrofit. For example, do not discuss the age of the property, previous workmanship, use of technologies or any potential future works.

Key Questions

From Resident Client: Why do you need to go in the loft? What are you looking for? Can you tell me the results of the assessment? Why do you need to make a hole in the wall? Will you need to come back? Can I see the results of the assessment? What if you find a problem?

To Resident Client: Are there any additional installations or adaptations to be made aware of (e.g. decking, boarded loft, etc)? Occupancy Assessment Questions. Do they know who their key contact is? Do you have 12 months energy bills available? Have you any warranties/guarantees/info on previously installed measures/alterations?

Key Information to Resident Client

With regard to the current condition and history of the property, the Assessor needs to share with or receive from the Funding Client and Resident Client details that include:

- The approximate age of the property.
- The number and age of extensions and any supporting documentation.
- Documents for rooms in the roof.
- Warranties and certificates, e.g., cavity wall and loft insulation, solar panels, extractor fans, boiler, hot water cylinder.
- Information about the heating and hot water systems / Last 12 months energy bills – gas and electricity.
- Copies of the Energy Assessment / Condition Report / Occupancy Assessment [8.5].
- Additional documentation depending on the risk level of the project, such as RICS Survey level 3, if traditional or historic – BS 7913 Significance Assessment, air permeability test and, at the Retrofit Coordinator's discretion, a structural engineer's report.

The Retrofit Assessor will ascertain with the Resident Client and make the Funding Client aware of any safety, vulnerabilities, wellbeing, safeguarding or risk issues associated with the dwelling itself and the residents.

Key Documents:
Occupancy Assessment
Energy Bills
Energy Report
Whole Dwelling Assessment

Key Advice:
Process of the Assessment
Condition of Properties
Areas of Concern

Key Information to Funding Client

Additional documentation may be required, for example where the local authority requires access to data. Possible documentation to be discussed, designed and developed, e.g. Permissions Agreement, Data Release Forms. Permission must be sought by the Funding Client to access the documentation as stated above.

Key Information to/from Retrofit Team

As above - critical data is to be shared with the Retrofit Coordinator and Retrofit Designer for the Medium-Term Improvement Plan (MTIP) and Improvement Option Evaluation (IOE). Information to be shared with the Advisor on any issues raised in the Occupancy Assessment, e.g. use of current heating controls, energy awareness advice required. The Assessor must also raise any specific concerns regarding floor plans or existing infrastructure, including any anomalies or issues with current building performance vs expected performance.

Key Documents:
As above
Photographic Records
PHPP, SAP or RdSAP

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RETROFIT DESIGNER (RD)

Qualified to prepare a retrofit design to specify appropriate energy efficiency measures (EEMs) in compliance with PAS 2035.

Key Restrictions

The Retrofit Designer is responsible for designing a PAS 2035 compliant measure or combination of measures. The Retrofit Designer may have significant input to the process for the selection of measures. It is important that the Designer does not present personal opinion, or preference, as fact and allows the Retrofit Coordinator and Client to make a judgement based on data available and targets to be achieved.

Key Questions

From Resident Client: Can I decide what measures are installed? I don't want to lose my cupboard space. How much room will the new measures take up? What if I don't like the proposed measures, do I have to go ahead? Do I have to keep it (ventilation) on all the time? Will the new system be noisy? How do I turn it off? Will you also include other works, e.g., design for new bathroom/kitchen?

To Resident Client: Do you have any concerns? Do you need any additional support, e.g. information in another format or help to move furniture? Do you understand the works undertaken? Do you understand the type of measures to be installed / how they work? Do you have a preference for particular measures? What is your budget?

Key Information to Resident Client

In the presence of the Retrofit Coordinator, the Retrofit Designer should discuss with the Funding and Resident Client the following information:

- How specific measures work and interact with each other.
- The benefits of each measure in terms of energy use, savings, and cost-effectiveness, including savings taken as comfort.
- The design and specification, including recommended energy efficiency measures (EEMs), also if fabric insulation/airtightness measures have been identified, define airtightness testing requirements (e.g. Air Tightness Testing and Measurement Association [ATTMA]).

The Retrofit Designer will also work alongside the Retrofit Coordinator to determine the intended outcomes from the IOE. Together, they will review and agree on the measures to be applied. Where measures cannot be delivered within budget, the Retrofit Designer will highlight to the Client the options available through the MTIP / Improvement Option Evaluation (IOE), e.g. where EWI is required but without sufficient budget for ventilation, options may be given to achieve this across a phased approach.

Documents:
Design and Specification
Applications of Statutory Approvals

Advice:
Fabric Insulation and Airtightness
Intended Outcomes

Key Information to Funding Client

Additional documentation may be required, for example where the local authority requires access to data. Possible documentation to be discussed, designed and developed, e.g. Permissions Agreement, Data Release Forms. Permission must be sought by the Funding Client to access the documentation as stated above.

Key Information to/from Retrofit Team

The relationship between the Retrofit Coordinator and Retrofit Designer is key. Should any assessment data be incomplete, the Retrofit Designer will advise the Retrofit Coordinator to instruct the Retrofit Advisor to collate the missing information. The design and specification from the Retrofit Designer are key for the Retrofit Coordinator to complete the MTIP and IOE. The Retrofit Coordinator will also use the information to create Toolbox Talks or other communications with tradespersons. for the installer and advise the Retrofit Designer and Installer of the energy efficiency measures specified.

Documents:
Design Documentation and Costs Work
Retrofit Assessment Report
Design Compliance, Guarantee and Warranty Requirements
Construction Details / Specifications / Installation Instructions
Testing Details
Commissioning Details
Handover Requirements

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RETROFIT INSTALLER (RI)

Undertakes the physical placement of an energy efficiency measure (EEM) in an existing building.

Key Restrictions

In order to manage customer expectations appropriately and effectively, it is important that the Retrofit Installer does not enter into any engagement regarding the current state of the property or allude to the reasons as to why it has been identified for retrofit. For example, do not discuss the age of the property, previous workmanship, use of technologies or any potential future works. Refer customer to Client for any housing related concerns or RC if more specific requests regarding installations.

Key Questions

From Resident Client: How long will the work take? Who will complete the work? How do I use the new system(s)? Who will help me if there is a problem? Will I see savings straight away? Who will replace / pay for something if it is damaged? Will you be using my electricity for tools? Will you be tidy?

To Resident Client: Do you need help understanding/using the measures installed? Would you like a demonstration of how to use the system(s)? Is everything working as expected? Do you have any problems? Are any other works to be completed outside of the retrofit, e.g. an extension?

Key Information to Resident Client

The Retrofit Installer is required to support the owner-occupier's knowledge of new measures installed and deliver advice in relation to completed works. This includes providing user manuals, information on the EEMs, and copies of the warranties, repairs and maintenance and quality assurance documentation (where appropriate). It also involves addressing behavioural issues and identifying where change is needed. The Resident Client should receive all relevant documentation in relation to warranties and certification. This includes:

- test and commissioning records.
- claims of conformity.
- repairs and maintenance specifications.
- EEM specific documentation.

The Retrofit Installer is also responsible for the provision of all costs and invoicing as well as commissioning and warranty registrations. Alongside the RC and the Resident Client, the Retrofit Installer also undertakes a pre-installation building inspection to eradicate any issues that may arise during installation and resolve any discrepancies.

Key Documents:
EEM Documents
Warranties
Operation Manuals
Installation Method Statement
Risk Assessment
Testing and Commissioning Documents
Warranties, Guarantees
Repairs & Maintenance Manuals

Key Advice:
via RC
Operation of EEMs
Code of Conduct/Practice
Toolbox Talks

Key Information to Funding Client

Additional documentation may be required, for example where the local authority requires access to data. Possible documentation to be discussed, designed and developed, e.g. Permissions Agreement, Data Release Forms. Permission must be sought by the Funding Client to access the documentation as stated above.

Key Information to/from Retrofit Team

The Retrofit Installer works with the Retrofit Coordinator to ensure that all documentation has been accurately detailed in the design and consults with the Designer regarding any issues or concerns.

Key Documents:
As above
Handover Documents
Photographic Evidence of Installation at Key Points
Pre-installation Building Inspection

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RETROFIT EVALUATOR (RE)

Qualified to monitor and evaluate the effectiveness of a project and provide feedback.

Key Restrictions

In order to manage tenant expectations appropriately and effectively it is important that the Retrofit Evaluator does not suggest any intended outcomes not met or allude to any possible monetary values in terms of potential tenant fuel bill savings.

Key Questions

From Resident Client: How much data do you need to collect? Why do I need to answer these questionnaires? How will the information be used? What is in it for me? My bills have gone up, what should I do? My energy company says I need "x" for the new measures, what does this mean?

To Resident Client: Do you understand the works that have been completed? Do you have any questions/concerns? Has anything impacted the way in which you access / move around your home?

Key Information to Resident Client

The Retrofit Evaluator's role includes:

- Using a measures-specific questionnaire [14.4.1] to determine how the tenant is interacting with the new installations.
- Undertaking basic levels of monitoring.
- Providing guidance as to whether further evaluation is required (e.g., where there are unintended consequences of the retrofit or if the Retrofit Coordinator or Client requests additional evaluation).
- Arranging the following tests, reviews, and evaluations where necessary: Airtightness Test, Inspection, Post-Construction Review, and a Thermographic Survey,
- Completing a Post-Occupancy Evaluation within two years of the basic survey.
- Offering advice where the Resident Client may have taken benefits in comfort rather than monetary or efficiency savings where they were previously fuel poor.
- Giving guidance on how to increase feedback in instances where not all questionnaires were completed.

Key Documents:
Retrofit Evaluator's Report
Questionnaire
Airtightness Test
Inspection
Post-Occupancy Evaluation

Key Advice:
Recommendations for Remedial Actions
Recommendations for Changes to Retrofit Process
Recommendations for increasing Questionnaire Returns

Key Information to Funding Client

Additional documentation may be required, for example where the local authority requires access to data. Possible documentation to be discussed, designed and developed, e.g. Permissions Agreement, Data Release Forms. Permission must be sought by the Funding Client to access the documentation as stated above.

Key Information to/from Retrofit Team

The Retrofit Evaluator's Report should be communicated to all involved in the project to determine if appropriate outcomes have been achieved. The Retrofit Coordinator will liaise with the Funding and Resident Client as appropriate to determine additional levels of monitoring if required.

Key Documents:
Retrofit Evaluator's Report
Questionnaire
As above

[] Denotes reference to the clause number found in the PAS 2035:2019 Specification and Guidance. PAS 2035:2019 can be purchased at www.bsigroup.com

Part B
Management Considerations

B – MANAGEMENT CONSIDERATIONS

In PAS 2035

Within PAS 2035 the term 'Client' can mean multiple people/organisations at once, most typically, the person in the home (the Resident Client) and the organisation contracting the work (the Funding Client).

In this section, we have typically used the term Funding Client when referring to local authorities (LAs) that are delivering projects.

This section highlights some key areas which a LA could consider using as 'touchpoints' to try to check that their projects are compliant with PAS 2035 and are likely to be delivering their intended Outcomes.

PAS 2035 contains comprehensive detail on the process for retrofit, however many LAs will have a general rather than detailed understanding of PAS 2035. The Retrofit Academy created "The PAS 2035 Compliance Process Map" to create a checklist of key actions for each of three key PAS 2035 defined roles, this contains c.217 line items. All public funded retrofit projects must be PAS 2035 compliant, however each LAs delivery model will determine the level of detail required to effectively project manage. This section highlights 'touchpoint' areas where an LA can consider checking that the detail of PAS 2035 is being met, with the greatest impact. This does not replace the need for complete compliance with PAS 2035 by the Funding Client's service providers. The touchpoints provide impactful areas for a checking process.

The Considerations Narrative below attempts to highlight these areas, explain (at a basic level) how they work in PAS 2035, and suggest how a LA might consider engaging to check robust delivery in these areas. These touchpoints alone do not guarantee PAS 2035 compliance, but they can assist the Funding Client to manage retrofit projects, facilitate likely PAS 2035 compliance, reduce risk, and help deliver the project's intended Outcomes.

Ideally, many of these tasks will be undertaken by independent RCs (i.e. not employed or contracted by the Retrofit Installer) for the Funding Client. In this case the Funding Client can engage with the RC in a relatively 'light touch' process. If the RC is not independent, then the Funding Client (or its agents) will need to be more proactively engaged in these elements. Either way, the areas highlighted are key points that will help to maximise project robustness and minimize risks without Funding Clients

needing to review all the detailed elements of PAS 2035 for all properties within a project.
The Retrofit Academy (TRA) recommends that the Retrofit Coordinator role is independent of the Retrofit Installer. However, this document recognises that some Funding Clients may utilise a single turnkey provider for pragmatic reasons, especially in the near term.

Section Contents

- **Touchpoint List:** A list of the key touchpoint areas associated with the PAS 2035 process.
- **Considerations Narrative:** Each touchpoint explained with examples of project delivery approaches the Funding Client could choose to take.
- **Basic Timeline:** The listed touchpoint areas are not necessarily sequential, some occur at various points and some are iterative. For this reason, the Basic Timeline Table at the end of this section was created to provide a simple touchpoint chronology.

THE PURPOSE OF THIS SECTION

Contracting authorities need to consider and decide the extent to which they choose to rely on the self-certification of delivery partners and how deeply they wish to engage in proactive project management or quality assurance (QA) checking. PAS 2035 was created to improve the standards of retrofit delivery. These touchpoints are identified as the most impactful points for Funding Clients to engage with delivery in their effort to ensure that the detail of the PAS 2035 process is being delivered.

The Touchpoint List includes a selection of key areas from the PAS 2035 process. Items in bold within it are a further distillation for Funding Clients who want to keep their oversight to the very minimum.

TOUCHPOINT LIST

The table overleaf provides a list of the key touchpoint areas which could provide a Funding Client with focused points for monitoring and reviewing project delivery. This would help secure confidence that projects are robust and PAS 2035 compliant. Further detail on these touchpoints is provided in the following section (Management Considerations Narrative).

Delivery Area	Touchpoints	Section No.
PAS 2035	Check the following are included in contracts:	**1.1**
	1. "All PAS 2035 requirements"	
	2. Consider using The Retrofit Academy (TRA) process map*	1.2
Risk Path	Check this has been determined before Assessments take place	2
Outcomes	Check these have been identified at the start	3.1
	Review these after the Assessments	3.2
	Review these again after the Improvement Options Evaluation (IOE) and retrofit design (in tandem with associated costs)	3.3
Tenant/Homeowner	How is/are the measure[s] and specification[s] determined?	4.1
	Check for evidence that occupants can use the measure[s] installed	**4.2**
Assessements	Request and review an Assessment proforma	5.1
	Specifically look at any issues concerning ventilation, condensation, damp and mould	**5.2**
	Establish checks and/or review process	5.3
Design	**Establish the methodology for the selection of appropriate measures.** (Improvement Option Evaluation (IOE), and Medium-Term Improvement Plan (MTIP)).	**6.1**
	Challenge why option A is selected instead of B (i.e. air source heat pump (ASHP) instead of walls – also 100mm vs 150mm)	6.2
	Check the design detail on a selection of key interfaces and junctions	**6.3**
Installation	Check installers are TrustMark/MCS certified for the measures being installed	7.1
	Who is responsible for on-site quality assurance?	7.2
	How is on-site work checked?	7.3
	Check the design details align with what takes place on-site	**7.4**
Commissioning/ Handover/ Measurement/ Survey/ Monitoring	Who looks at/reviews the finished job?	8.1
	Who looks at/reviews the commissioning/handover documents?	8.2
	What determines a successful result (design and implement a monitoring strategy to answer this question)	8.3

* A link to the TRA process map can be found in Section 1.2

NB - Touchpoints in **bold** are a further distillation for authorities seeking minimal involvement in project delivery.

MANAGEMENT CONSIDERATIONS NARRATIVE

1 PAS 2035

1.1 CONTRACT EVERYTHING IN PAS 2035 FOR THE PAS 2035 DEFINED ROLES

1.1.1 The contract for each role should state that all work completed must be fully compliant with all PAS 2035 requirements.

1.1.2 The location of the roles set out in PAS 2035 must be clear and allocated within the contract structure, i.e. who is doing what role in this project. Make sure that the allocation of all the PAS 2035 roles is clear within tender and contract documents and includes named organisations (and individuals where known). If this is unclear, there is the potential for incorrect assumptions (for example, everybody thinks somebody else is the Retrofit Designer). Such issues are not to be ignored as they are always more difficult to resolve down the line.

1.1.3 Typically Retrofit Installers must be registered with TrustMark (or Microgeneration Certification Scheme (MCS) for renewables). PAS 2030 relates to the installation of energy efficiency measures. It is easiest to think of PAS 2030 almost as the installers' chapter of PAS 2035 to help as a way to understand the relationship between PAS 2035 and PAS 2030. PAS 2035 covers the whole process, and PAS 2035 requires PAS 2030 compliance for the actual installation of measures.

Installers & PAS 2030

Installers need to be able to demonstrate competence for the measures they are installing, this is via one of the PAS 2030 Accreditation Schemes that has been accredited by UKAS. Each Accreditation body sets out how this competence is demonstrated in line with the requirements of PAS 2030 and UKAS. The installer can register with Trustmark to help its credentials and to meet the requirements of government funded work (e.g. ECO, LADs, Social Housing Decarbonisation Fund, etc). Installers need to be registered with the Accreditation Body who has certified their competence according to PAS2030, the Accreditation Body has to support the application to register with Trustmark. However, it is the Installer that must demonstrate "competence".

1.1.4 Everything required by/for TrustMark for the relevant funding stream[s]. Each government funding stream has TrustMark requirements that must be met. This is normally about the detail of how PAS 2035 compliance is demonstrated and the format of data provided to TrustMark.

1.2 USE THE RETROFIT ACADEMY PROCESS MAP

The Retrofit Academy (TRA) process map provides a series of steps (c.217 in total) for the: Retrofit Coordinator; Retrofit Assessor; and Retrofit Designer. This effectively creates a checklist, which if correctly followed in full, should guide a project to PAS 2035 compliance. The Process Map is essentially a 'checklist for PAS 2035' for the RAs, RC and RD roles. It was created by the TRA for their members to help identify all the actions required in PAS 2035 (in a straightforward list). The 'TRA Process Map' exists as a guidance document and as also as software.

Each of the Process Map steps (line items) can be used by the Funding Client (or Client's representative) as individual questions directed to service providers. Service providers need to be able to respond to any of these queries the Funding Client chooses to ask. Effectively, for a project to be PAS 2035 compliant, service providers need to be in a position to provide answers to all queries based on the TRA process map.

The Process Map Compliance Software is available to all Retrofit Academy members by logging into the members area (Hub members in the Midlands are currently TRA members).

https://www.retrofitacademy.org/coe/resource/pas-2035-compliance-process-map

Depending on the degree of management involvement, the Funding Client could act on any of the following:

- **Possibly** require service providers to provide their own evidence for each line item in the Retrofit Academy process map. Define how this will be done, and to whom it will be provided.
- **Definitely** highlight that service providers may be asked (by the Funding Client or Client representative) to evidence any line item from the Retrofit Academy process map for any property.
- **At least** check a sample (selected by the Funding Client).
  - For example, select one property in ten and then select some of the line items from the process map. If all evidence is in place, the sampling ratio could be reduced (of line items and/or properties). If the evidence is not immediately available, then the ratio should increase (say to 1-in-5). If the missing evidence is concerning, that should prompt a review.

Access to data and reports, etc

It is intended that the functionality of the TrustMark data warehouse will be enhanced, and this could potentially make the platform more accessible as a shared point for locating PAS 2035 data.

For the moment, the data warehouse does not work in this way. LAs might be able to use the platforms of scheme providers to access data and reports – but this is not an option that is uniform across all schemes. That could result in the use of multiple platforms across different projects. Note that compatibility between scheme providers can also be limited.

If an existing platform does not allow data sharing, then LAs can use their own software (for example SharePoint) to access information through the project.

2 Risk Path

Additional Detail

In PAS 2035

PAS 2035 requires a 'Risk Assessment', to determine the compliance path (often referred to as the risk Path) within PAS 2035. There are three Paths (A, B, C), in ascending risk order. Hence a Path C project has more requirements within PAS 2035 than a Path A project.

The Risk Assessment utilises a pre-set list of 5 questions: Number of properties; Measures per dwelling; Inherent risk of the measures; Measure combinations; and Construction/built form. Hence if a project is initially assessed as Path A or B then a change to any of these areas could mean the project moves into a higher risk Path.

Expect

Most Local Authority Delivery scheme (LADs) type projects will be highest risk Path (C) because more than 30 properties in a project automatically means Path C.

Where can I find it?

The Risk Assessment is Annex B in PAS 2035 (the standard can be purchased from the British Standards Institute [BSI] website).

The Risk Assessment is also part of the Retrofit Academy Process Software, see link in Section 1.2.

2.1 CHECK BEFORE ASSESSMENTS

- Check that the risk Path is defined before any Assessments take place.
- Request the Risk Assessment from the RC and consider the following:
  - Usually a LADs-type project will be Path ("C"), as the project is likely to include more than 30 properties.
  - Be suspicious of the suggestion that a LADs project is not Path C.

3 Outcomes

Additional Detail

In PAS 2035

PAS 2035 (Section 6.2) requires the 'intended Outcomes' for a project to be agreed (by the RC and Client) and recorded at the outset.

Where can I find them?
Example 'intended Outcomes' are included within section 6.2 of PAS 2035 (the standard can be purchased from the British Standards Institute [BSI] website). An illustrative list of examples is in the box below.

There is a section for recording Outcomes in The Retrofit Academy Compliance Software, see the link in Section 1.2.

Outcomes are important as they set out the purpose of the project for all stakeholders. Decisions regarding the selection of measures and their specification should be driven by the Outcomes. Constraints such as funding and building condition will all feed in – but the starting point is the Outcomes.

The initial or preliminary Outcomes may need to be adapted or changed as the project progresses, potentially only becoming fixed after the design and cost implications are clear.

Example Outcomes:

- Maximise occupant energy cost savings at each property – within the available spending cap.
- Resolve existing problems relating to condensation, damp and mould.
- Achieve 50 kWh/m^2/yr for space heating demand [as box 99 in SAP].
- Achieve SAP band B.
- Maximise carbon dioxide emissions reductions.
- Maximise energy use reductions (kWh).

Note: Outcomes can often require a second level of detail. For example, there is a big difference between maximising a 'saving' for each property versus across the whole programme. Hence the wording of the first bullet point above.

Also note that some terms such as "energy savings" are vague. Clarity on the nature of savings (kWh, carbon dioxide emissions or £s) can be significant.

3.1 IN PLACE FROM THE START

It is important to attempt to get 'preliminary' Outcomes in place as early as possible. These Outcomes need to be discussed and agreed upon by, at least, the Funding Client and the RC. Ideally, the Client should discuss the Outcomes with the RC prior to Assessments taking place.

3.2 REVIEW AFTER ASSESSMENTS

Outcomes should be reviewed after Assessments have taken place. That is because the Assessments may change the Outcomes.

Example of where Assessments might change Outcomes:

For example, the Initial Outcome might have been to increase the SAP score by as much as possible – but the Assessments might discover damp issues. At which point, resolving damp issues could be added as a primary Outcome. This could significantly impact decisions about the 'right' measures.

Preliminary Outcomes should be in place before the RC undertakes the Improvement Option Evaluation (IOE). That is because the Outcomes can inform the choice of measures to review. Having the preliminary Outcomes in place should help to avoid the possibility of the RC undertaking the IOE in the wrong context.

3.3 REVIEW THE OUTCOMES AFTER THE DESIGN (AND WITH COSTS)

The actual design may change the scope of the work and/or have a significant impact upon costs in some cases.

Project costs may provide a significant constraint for the measures that can be deployed. That could result in an informed review of the Outcomes.

4 OCCUPANT (TENANT/HOMEOWNER)

The Retrofit Academy have generally adopted the term Resident Client to describe the people in the home. In PAS 2035 there can be more than one client, for example in LADs projects there will typically be the LA as the Funding Client, contracting and paying for works, and the Resident Client in the home.

Customer Journey Support in the Midlands:

In the Midlands, through the Hub's delivery model, citizens can benefit from tailored customer journey support throughout the installation process. The customer journey support can also help with additional income maximisation measures such as energy tariff switching and information on measures. This ensures citizens are able to understand and utilise home improvements to achieve maximum energy efficiency in the home and help to alleviate fuel poverty.

4.1 HOW IS/ARE THE MEASURE[S] AND SPECIFICATION[S] DETERMINED?

4.1.1 The Funding Client should determine the measures (and their specifications)

The selection of measures and their specifications should be determined by the Funding Client and agreed with the Resident Client.

Further detail around the selection of measures is included in Sections 6.1 and 6.2.

4.1.2 The Resident Client should agree the measures selection

Within a LADs project the Funding Client will normally review the measures for a property. The measure[s] that are appropriate and acceptable to the Funding Client can then be put to the Resident Client for their agreement including any level of choice that is available to them.

The Resident Client's choice of measures may be open, or it could be limited by the needs and/or constraints of the Funding Client. Therefore, the Funding Client needs to set out:

- Who decides on measures (including performance specification) and how they will make those decisions?
- How is the Resident Client engaged in the choices available to them?

4.2 EVIDENCE THE OCCUPANT CAN USE THE MEASURE[S] THAT THEY RECEIVE

Before any measures are installed, it is essential to agree what information will be provided to occupiers. That agreement should also identify the formats in which that information will be presented and who is responsible for providing it.

In order to ensure that the occupants receive high-quality advice, guidance and information, a QA methodology should be established, which should include a process for providing feedback to the Installer.

Consideration should also be given to the question of whether the results of the QA could have contractual implications. For example, if more than 15% of checks 'fail', that could be a trigger for an intervention, some form of retention, or a contractual review.

Examples

The sort of evidence that is required to show that occupants understand and can use the measure[s] that they receive will vary dependent on the nature of those measures. Some simple examples for different types of measures are given below.

In the case of solid wall insulation, the occupant should be made aware that drilling holes in, and/or making penetrations through, their EWI is likely to invalidate the warranty and could potentially create problems such as water ingress.

Where new heating (and/or controls) have been provided, it is important to check that the occupant knows how to control that system. That is likely to be slightly more complex if the system uses a heat pump.

With ventilation, it might be important to tell the occupant that they should not turn it off and to explain to them why that is the case.

5 ASSESSMENT

In PAS 2035

Section 8 of PAS 2035 sets out the extensive requirements for Assessments.

5.1 ASSESSMENT PROFORMA

In the context of the Funding Client

Assessors should automatically pick up everything that is required for the project. Nevertheless, Funding Clients may wish to do some additional double-checking to ensure that certain key issues are being covered.

Such issues could be related to ventilation, condensation, damp and mould or particular local factors like ground levels being above the damp-proof course. Asking specific questions about these issues will give Funding Clients clear yes/no answers. Recording those answers (even if they are "no") confirms that the question has been asked and the issue considered.

That approach avoids a potential problem with 'normal' reporting; if the Assessor does not record something, it may not be clear whether they asked the question, and the answer was no, or whether the question was not asked.

In addition to issues that the Funding Client may wish to double-check, there are certain things that should be specifically checked (potentially including additional elements that are not necessarily part of PAS 2035). For example, Funding Clients could ask an Assessor to look at the number of spareways in the consumer unit and to take a picture of the unit.

If EWI is a potential measure, then the Assessor should be looking at drainage issues that could impact the suitability, design, installation and costs. Hence it is important to be clear that this is a potential measure – so that the Assessor makes sure to include the relevant information.

During the procurement process, Funding Clients should ask potential suppliers to provide a sample Assessment proforma/checklist. They should also state that:

- the Assessment proforma/checklist will need to be agreed upon before Assessments take place.
- additional items may need to be added to such proformas/checklists during the project.

It is important to note that none of the above replaces the Assessor's PAS 2035 requirements – which may or may not be more extensive. Agreeing a proforma should highlight the things that are, and are not, included in the service provider's Assessment process.

5.2 VENTILATION, CONDENSATION, DAMP AND MOULD

As suggested in Section 5.1, Funding Clients may wish to ask for specific details about how ventilation, condensation, damp and mould are included in Assessments. Further details regarding these issues are provided below.

In PAS 2035

Section 8 and Annex C of PAS 2035 set out the details for ventilation assessments, explaining when they are required and what should be included. Following those requirements, RAs, RCs and RDs should be looking at existing conditions and equipment to review them and assess their adequacy.

It is important to note that, for Path C, the requirements are significant and go beyond what has previously been typical in terms of surveys for retrofit.

Technically, 'ventilation' is separate from condensation, damp and mould in PAS 2035.

Examples of things to look for (or demand)

- Ask the occupier if there is any condensation, damp or mould. Ideally, this question should be asked for every room (not just once for the whole house). As noted above, it is important to record a 'yes' or a 'no' response. Doing so avoids potential confusion where there is not a 'yes' (i.e. was it a 'no' or was the question not asked?).
- Proformas should include a question about condensation, damp and mould for every room (for the Assessor as well as the occupier as above).
- Proformas should also include a question about ventilation for every room. That question should cover (inter alia):
  - trickle vents.
  - fans – including if they are working.
  - door undercut (a 10mm gap at the bottom).
  - purge ventilation (a window you can open).

5.3 CHECK AND REVIEW PROCESS

It is important to establish at the outset a methodology for checking some assessments. Doing so gives the Funding Client confidence that the correct processes are being applied to yield the necessary information. Example approaches to checking surveys are described below.

Example approaches to checking surveys

- Clarify who will be checking on the Funding Client's behalf. Such checks could be performed by:
  - Internal staff.
  - External 'expert'.
  - The Funding Client's independent RC.

  Review the first batch of Assessments (perhaps the first five). Ideally, this review should be done with the RC and the RD. Such a review:
  - Helps to understand the content.
  - Establishes 'what a good one looks like'.
  - Provides an early opportunity to correct Assessments, if required, before large numbers have been completed and it is 'too late' or very expensive to go back to properties again.
- Accompany an Assessor early in the process to see actual Assessments being undertaken. That approach helps to understand the process, methodology, content, etc as early as possible.
- Establish accompanying the Assessor as an ongoing option (i.e. agree that the Funding Client's representative can join any Assessment at any point in the process.
- If the early review is positive, then the sample size for future checks (over and above the requirements of PAS 2035) can be reduced. However, if the early review is not positive, then this process should be repeated until a positive result is achieved.

It is important to note that the review process described above is not an 'approval' that trumps PAS 2035 requirements.

6 DESIGN

6.1 SELECTION OF MEASURES, IOE AND MTIP

In PAS 2035

The Improvement Option Evaluation (IOE) is the methodology for reviewing measures and is a core element in measure selection (along with other considerations). Section 9 of PAS 2035 sets out some specific requirements for IOEs, including Simple Payback and Carbon Cost Effectiveness.

The MTIP sets out which measures will be done now and which measures would be appropriate to do in future stages.

In PAS 2035 the RC agrees the measures with the Client (meaning the Funding Client and the Resident Client). Hence the RC has a role in helping to ensure the most appropriate measures are selected and all considerations are included in decision making.

The Retrofit Academy (TRA) has published IOE and MTIP guidance for its members (NB - currently all MEH members are automatically TRA members). That guidance can be found at the link below, which will work if you have your TRA membership log-in open.

https://www.retrofitacademy.org/memberships/resource/improvement-option-evaluationand-medium-term-improvement-plan

The selection of measures and their specifications should be determined by the Funding Client and agreed with the Resident Client. The RC should undertake the IOE. This will inform which measures may be appropriate, together with other considerations. The Funding Client and the RC should agree the measures.

An important point is that the 'Installer', including any of the other PAS 2035 roles in contract with the Installer (e.g. an RC &/or RD employed or subcontracted by the Installer) does not have control over the selection of measures (nor their performance specification) unless this is consistent with very well-defined criteria set by the Funding Client.

A PAS 2035 role (e.g. RC &/or RD) working for the Installer could provide suggestions for measures. However, these should be, at the very least, sample checked by an independent party. Ideally, all measure options for each home should be agreed by the Funding Client (or their independent representative).

The key is to remove any potential for the Installer's commercial pressures to dictate or influence the selection or specification of measures. If an independent RC (separate from the Installer) is utilised, then the RC could 'agree' the measure selection for the Funding Client.

If the RC is not independent, then the Funding Client should ideally agree/approve the measure selection for each property. This could also be done by the Funding Client's representative – such as an Employer's Agent or Managing Agent (assuming they have suitably qualified staff).

When considering the above PAS 2035 requirements, it is important that Clients agree a methodology for how:

- IOEs are undertaken.
  - What are the targets? These targets should be derived from the agreed Outcomes. For example, if your primary Outcome is around carbon emissions, then carbon emissions should be used as a key metric for comparison.
  - What inputs will be used? If you have real costs in your context for your project's measures, then those costs will be more useful in the IOE than taking 'standard' reference costs.
  - How will the outputs be presented and to whom? If cost savings are one of your key metrics, then you will wish to see the impact on energy bills as a means of measuring that. You may also wish to calculate saving effectiveness (i.e. the amount of money saved for each pound spent on installing the measures). Such impacts can be measured annually or over the course of the installation's lifetime.
- measures are then selected and agreed.
- the selection of measures then feeds into the MTIP.

Please note, it may also be useful to look at packages of measures in addition to looking at the individual measures. It is also important to remember that agreeing on the inputs and outputs early on will make the whole process smoother and more efficient.

In terms of the sequence of events, the MTIP might be produced later than the IOE. That is because the MTIP should start with the actual measures being delivered, which might only be resolved after the production of the IOE.

6.2 CHALLENGE WHY OPTION A IS BEING SELECTED NOT OPTION B

Measure selection can be broken down into two aspects:

- One measure vs another: The Client should be able to understand why one measure is being suggested over another. For example, why is a service provider suggesting an air source heat pump (ASHP) rather than EWI (or vice versa)? Does the suggestion fit with the guidance and spirit of PAS 2035? Does the IOE highlight the cost, impact and benefits, alongside intelligent commentary from the RC?
- The measure's specifications: These should be made clear along with the reasons behind key decisions. For example, why is EWI specified at 100mm rather than 150mm? Bear in mind that only meeting the current building regulations may not always be the best solution. A higher specification might make more sense in the longer term and/or in the context of the project outcomes.

Method

If the LA has an independent RC, then they can provide guidance regarding measures and specifications, potentially taking a primary role in agreeing the measures for each property on behalf of the LA.

If the RC is not independent, then the LA or their agents should be proactively involved in approving or agreeing measures. Decisions should be made in the context of the Outcomes, the IOE, and the wider specific considerations for the overall project and the individual property.

6.3 CHECK DETAIL ON SOME KEY 'INTERFACES'!

Key interfaces come in two categories: junctions and relationships. In terms of the former, the detailing of junctions is key to avoiding unintended consequences from retrofit work. Indeed, poor detailing is often the cause of retrofit failures (e.g. thermal bridging, airtightness issues, water ingress, the 'performance gap', etc).

Note: Key junctions may include those between:

- Walls with windows and doors (cills, jambs, and heads).
- Wall and floor.
- Walls and roof (including eaves and verges).

As indicated above, interfaces also include relationships, such as those between airtightness and ventilation or heat loss and heating capacity.

In PAS 2035

Section 9 of PAS 2035 covers the "Requirements for retrofit designs", with subsection 9.1.15 focussed on thermal bridging.

Annex D covers the "Requirements for dealing with interactions between measures". The measures interaction matrix is contained in Fig D.1 in that annex.

Note: The measures matrix covers measures that are being implemented. It does not cover everything that a Funding Client may wish to look at. For example, walls and existing windows are not covered in the matrix, instead, they are addressed under Section 9.1.15. Also, the matrix does not cover wider considerations, such as proximity to the building next door or occupant behaviour. Nevertheless, the matrix is a good guide and starting point.

Clients should expect to be able to request any details regarding interfaces, for any job, at any time. It is very important to check the construction details before the installation of measures. Funding Clients need to consider who will undertake these checks in their project.

Example

There should be a construction detail for the junction between SWI and a window (actually, three details: cill, jamb and head). This should be an adopted good practice detail or a bespoke detail demonstrating (for example) that there is a PAS 2035 compliant thermal bridging risk (e.g. that the temperature factor fRsi is not less than 0.75). These junctions should be designed with both airtightness and thermal bridging in mind.

Normally, standard industry good practice details can and will be used. The important thing here is to ensure that these details do exist for the junctions in your project.

The Retrofit Academy

The Retrofit Academy Process Map Software includes an updated version of the measures mix. This is available to members (currently including all MEH members). The majority of Retrofit Coordinators are also TRA members. The link below will work if you are logged in to your membership:

https://www.retrofitacademy.org/memberships/resource/pas-2035-compliance-process-map

6.3.1 Method

Method

RECOMMENDED

A Retrofit Coordinator should understand all the construction details that are required. If they are independent, the Funding Client can rely upon their checks (on behalf of the client[s]) more fully and would, therefore, only need a light engagement on this.

Note: an RC may well not be qualified to 'sign off' or approve such details, and 'sign off' is not necessarily part of their PAS 2035 role. The often-used analogy is that:

"The RC role is to check that the homework exists – rather than to mark the homework."

However, the RC should at least be an informed resource to review designs and contribute to the Funding Client's confidence.

Even with an independent RC in place, the methodology for reviewing designs should be clearly set out to avoid any misalignment of expectations. It should be clear that at least a selection of construction details will be requested to demonstrate PAS 2035 compliance to the Funding Client.

EXAMPLE CHECKING PROCESS

The RC can (and should) ask the designer to evidence how designs are PAS 2035 compliant. For example, a typical detail might be for the junction between SWI and a window jamb. The RC should ask the RD:

- For the detail in question (Does it exist? This is where many historic failures have originated). Under PAS 2035, these details should now always exist as standard practice. They are required in the Retrofit Design for compliance, so this should be an 'easy ask'.

- How the detail complies with PAS 2035. Normally, standard industry good practice details will be used (think pattern book). In such cases, the RD should be able to say where that detail has been taken from (e.g. which pattern book). However, in some circumstances, the RD will need to produce a bespoke detail.

CHECK OR VALIDATE?

The process of the RC requesting and reviewing design details should focus attention and act to ensure compliant design details are in place because most of the time this will be a matter of referencing standard industry good practice documents. If a Funding Client wants a 'validation' or 'signing-off' process, it would need a suitably qualified person to fulfil that. Contracting authorities could use Appendix A of PAS 2035 as a guide to suitable qualifications. If the Funding Client requires 'checking' rather than 'validating', that could be undertaken by people with RC qualifications but also by people such as building surveyors. This lighter touch 'checking' process should be sufficient in most cases.

SAMPLING EXAMPLE

If there is not an independent RC, then the Funding Client should engage in a level of oversight or appoint an independent person/organisation to do so. This could be a managing-agent-type organisation utilising building/construction professionals, such as building surveyors or qualified RCs. If the Funding Client does require design work to be 'validated' (as above) then they would require a specialist (such as an architect).

For example, if a Funding Client had a project of 400 homes, then they might look at 40. That would be a reasonable proportion (10%) and provide a large enough absolute number to review. It may be wise to 'front load' checks – so the process helps to establish good practice from the start, rather than finding problems after the event. The checks might be:

a 10 from first 10
b 10 from second 20
c 5 from next 50
d 5 from next 50
e 5 from next 50
f 5 from next 50
g 10 from remaining 170

The checks might be as described in the 'Example Checking Process' above. The exact nature of the checks will be dependent on the measures being installed.

If construction details are not readily available, that should be a 'red flag' and installation should not take place until that issue is resolved. If this checking process is providing robust results and confidence, then the number of checks can be reduced – as described above. If the check results are not robust, then that should trigger interventions, penalties or even the cessation of contracts. The normal intent would be to identify issues and work to resolve them with process improvements.

7 INSTALLATION

7.1 CHECK INSTALLERS ARE TRUSTMARK REGISTERED

It is essential to ensure that all Installers are registered with TrustMark (or MCS) for the measures that they are installing.

7.2 WHO IS RESPONSIBLE FOR ON-SITE QA?

In PAS 2035

Within PAS 2035 (and 2030 within 2035) the Retrofit Installer is responsible for on-site QA (including PAS 2030 compliance).

PAS 2030 covers the installation requirements and there are additional measure specific tables with specific requirements by measure. For example, table B.4 covers EWI.

The Retrofit Coordinator is required to gather the compliance information from the installer.

Relying on the Installer for on-site quality assurance would represent accepting 'self-certification' as the entire (or at least primary) basis for the QA of works.

Ideally, the management of the contract should establish some form of sample checking so there is some independent inspection of the self-certification mandated within PAS 2035 (and 2030).

The measure-specific tables in PAS 2030 provide a ready-made set of checklists for things that an Installer should be doing in their process, and thus a potential set of checkpoints that the Funding Client might use for their contract management.

There are various approaches that a Funding Client could take to establish such a mechanism. They could use:

- Internal staff.
- Their RC for the project (if the RC is independent of the Installer), Note: the RC would need this to be added to their contract as it is not automatically built into their role under PAS 2035.
- A third party, such as managing agents or subcontracted building surveyors, etc.

7.3 HOW IS ON-SITE WORK CHECKED?

It is essential to establish a suitable methodology to, at least, check a sample. A Funding Client should decide what level of checking is appropriate for its project, in terms of sample size and how much detail per sample. The measure specific tables in PAS 2030 can provide a basis for which elements the Funding Client wants to check.

7.4 CHECK A SAMPLE OF DESIGN DETAILS AGAINST CONSTRUCTION

At least check that a sample of the construction design details (as in Section 6.3) corresponds with what takes place on-site.

The issues and approaches set out in 6.3 are similar here. The design details that would be reviewed in 6.3 could provide details that could be checked on-site in the same way. Many of the same properties could be checked – but it would be wise to ensure that checks also take place on homes that are not part of the 'design' checks.

If checks on-site reveal that the work is not being undertaken in accordance with the detail of the design this should trigger some form of intervention. This could include stopping works. Ultimately, if work is not done in accordance with the design, and this is not corrected, this should result in the loss of the contract and potentially penalties.

Checks would need to take place while work is ongoing. That is because many of the details that require checking will be hidden when the work is complete.

8 COMMISSIONING/HANDOVER/MEASUREMENT/SURVEY/MONITORING

When commissioning services, it is important to consider the relationship that payments have with handover, monitoring and evaluation. In that context, Funding Clients may wish to consider using:

- successful handover as the trigger for payment.
- successful monitoring and evaluation as the trigger for retention payment.

8.1 WHO LOOKS AT AND REVIEWS THE FINISHED JOB?

Section 7.4, above, concerns work in progress, this section concerns work once it is 'complete'.

Be clear before installation about what is required for commissioning and handover.

8.2 WHO LOOKS AT / REVIEWS THE COMMISSIONING/HANDOVER DOCUMENTS?

At the point of handover, payment should be dependent upon satisfactory review (and documentation).

If the RC is independent, their oversight can provide an additional layer of checking at the commissioning/handover stage.

In PAS 2035

In PAS 2035, the Retrofit Designer can specify requirements for testing and commissioning. The requirements related to commissioning generally are identified in PAS 2035 and PAS 2030. Requirements related to renewables specifically are identified in MCS.

All documentation must be provided to the RC.

8.3 WHAT DETERMINES A SUCCESSFUL RESULT?

It is recommended that consideration should be given to items that point to a successful result as early as possible in the project. Monitoring and evaluation should be designed so that they contribute to providing that result. The practices associated with such monitoring and evaluation can range from being light touch to being very in-depth.

In PAS 2035

Section 14 sets out the requirements for monitoring and evaluation. These are (initially at least) primarily questionnaire-based.

Area	Considerations	Roles
Project Concept	Consider potential: Outcomes; number of properties; measures; location; costs; risk Path (likely to be C for LADs) etc	**FC**
Procurement/ appointment	Appoint RC Decide on any touchpoints that you intend to use to ensure robust project delivery. Highlight these to service providers and develop the Legal Protocol to enhance these areas in contracts. Highlight that proactive project management will be part of the project	**FC**
Risk Pathway	Confirm risk Path	**RC**
Outcomes	Define preliminary intended Outcomes right from the start	**FC with RC**
Procurement/ appointment	Ask for an Assessment proforma or checklist during procurement/ appointment of Assessor Ask how the Assessor will assess ventilation, condensation, damp and mould during procurement/appointment Confirm capability to provide Annex C compliant ventilation assessment	**FC** **RAs**
Assessment	Review the assessment proforma, including condensation, damp, mould and ventilation – review version from procurement with RC – in the light of the risk Path, Outcomes, RC input, Funding Client input, RD input	**RC** **FC** **RAs**
Assessment	Check a sample of Assessments early in the process to confirm alignment and appropriate detail. Possibly include going out with the Retrofit Assessor to observe a few Assessments take place on-site	**FC** **RC** **RAs**
Outcomes	Review after checking a sample of Assessments	**RC with FC**
Design	IOE (Improvement Option Evaluation) – selection of measures Specification of measures (Why are we doing this, not that? Air source heat pump (ASHP) instead of walls – also 100mm vs 150mm)	**RC** **RD**

BASIC TIMELINE

Area	Considerations	Roles
Design	Look at an early IOE, that will help to establish inputs, measures being reviewed and packages of measures This should create early alignment ahead of the processing of many properties	**RC** **FC** **RD**
Tenant/ Homeowner	How are the measure[s] and specification determined? Homeowner 'agreement' to measure/package selection	**RC** **?**
Approval	Approval of measures and specification	**FC**
Design	Create MTIP (Medium-Term Improvement Plan)	**RC**
Risk Path	Review in light of design	**RC**
Outcomes	Review in light of design	**FC with RC**
Outcomes	Review along with associated costs	**FC with RC**
Design	Check the detail on some key junctions, no installations should start unless it is clear that the correct construction details are in place	**RC** **RD** **FC**
Tenant/ Homeowner	Evidence occupant can use the measure[s] they have received Review and agree what will be provided to the occupier, by whom, in what formats, BEFORE installation starts Agree how evidencing will be done, by whom and when, BEFORE installations start	**FC** **RI**
Commissioning	Agree commissioning detail BEFORE installations start	**RD** **FC** **RC** **RI**
Monitoring and evaluation	Agree monitoring and evaluation detail BEFORE installations start	**RD** **RC/E** **FC** **RD** **RI**

Area	Considerations	Roles
Installations	Agree QA details BEFORE installs start QA process should include somebody checking that the design construction details are being adhered to on-site	**FC** **RI** **RC**
Installations	Who is responsible for on-site QA? How is site work checked? CHECK the QA process – start early, target 'right first time', avoid realising something is wrong only after all the work is done	**FC** **RI**
Commissioning/ Handover	Who looks at and reviews the finished job? Who looks at/reviews commissioning/handover docs? What this all looks like should have been agreed upon before any installation work Payments should only be made after complete and successful commissioning and handover, preferably including the occupier check below	**FC** **RI**
Tenant/ Homeowner	Evidence occupant can use the measures/systems installed	**FC**
Measurement/ Survey/ Monitoring	What shows a successful result? Design 'monitoring' to answer that question Consider retention after successful monitoring	**FC** **RC/E**

Part C
Legal Considerations

C - LEGAL CONSIDERATIONS

THE PURPOSE OF THIS SECTION

The purpose of this note is to advise local authorities (LAs) that wish to avail of the following guidance and input on PAS 2035:2019 in relation to retrofit specifications produced by the Retrofit Academy.

Publicly Available Specification (PAS) 2035:2019 Retrofitting dwellings for improved energy efficiency: Specification and guidance (BSI, London) is the main component of a framework of standards that LAs are required to use when appointing persons to the following roles for government-funded retrofit works and/or services:

- Retrofit Advisor;
- Retrofit Assessor;
- Retrofit Coordinator;
- Retrofit Designer;
- Retrofit Evaluator; and/or,
- Retrofit Installer.

The Retrofit Academy has produced a Retrofit Protocol, contained at [Appendix 1] of this guidance. The Protocol should be used when any LA appoints an individual, company or person who shall carry out retrofit works or services that are captured within PAS 2035:2019. The Protocol is intended to highlight key touchpoints only and not replace the requirements of PAS 2035:2019. For this reason it is focused on activities around the Retrofit Coordinator, Retrofit Assessor and Retrofit Designer roles only.

The Protocol is suitable for use with any standard form construction or building contract or consultant›s appointment that the LA wishes to use. The Protocol is to be included within the services document. By way of guidance only, the non-exhaustive and only illustrative examples of these service documents are:

- NEC3 Engineering and Construction Contract (ECC): ***Works Information***
- NEC3 Term Service Contract (TSC): ***Service Information***
- NEC3 Professional Services Contract (PSC): ***Scope***
- NEC4 Engineering and Construction Contract, Term Service Contract, Professional Services Contract: ***Scope***
- JCT (DB, SB, IC and MW): ***Employer's Requirements***.

Other bespoke or standard form documents the LA may use will require the Protocol to be included within it.

PURPOSE OF THE PROTOCOL

1. The Protocol serves as a check list that flags key elements of PAS 2035:2019 to responsible parties. The Protocol relies on an understanding of PAS 2035:2019 and is not a mere repurposing or reformatting of the guidance or requirements contained within PAS 2035:2019.

2. It is the LAs responsibility to include the Protocol within their contracts.

3. The Protocol is not a complete scope document. It is for guidance and information purposes to ensure the standards envisaged within PAS 2035:2019 are met.

4. It remains the responsibility of individual LAs to obtain their own legal advice on the most appropriate form of contract for retrofit projects and to consider the Protocol and its incorporation within the LAs chosen form of contract.

HIGHLIGHTED RISKS FOR LAS

1. There are significant risks to any LA should they not include the Protocol within the contract scope document as set out above. These are set out as follows:

- There may be no clear contractual guidance as to how retrofit works/services are to be completed in a diligent, safe and robust manner. This will likely affect build or service quality, increasing time and cost;
- There is an increased likelihood of failures to meet the requirements that are specifically referred to in PAS 2035:2019;
- There is an increased likelihood of failures to satisfy audits for completed works;
- There is a likely increase in cost and resource in ensuring compliance with PAS 2035:2019 "after the fact", having to re-do work to ensure the standard is met.

2. The Protocol contains guidance notes for LAs. These will require review before the Protocol is incorporated within any scope document.

3. It is likely that within 18 months PAS 2035 will be updated. This update may require the Protocol at Appendix 1 and accompanying documents to be updated to reflect any changes.

APPENDIX 1: PAS 2035 PROTOCOL

THIS PROTOCOL IS TO BE IMPLEMENTED AND INSERTED INTO THE RESPONSIBLE PERSON´S CONTRACT SCOPE DOCUMENT[1]

An editable version of this protocol can be downloaded by clicking the button below.

DOWNLOAD

[DRAFTING INSTRUCTIONS FOR LOCAL AUTHORITIES]

[IN THIS PROTOCOL WHERE THERE IS YELLOW HIGHLIGHT DELETE AS APPROPRIATE – ANY INFORMATION CONTAINED BELOW NOT DELETED IS THE RESPONSIBILITY OF THE RESPONSIBLE PERSON]

PAS 2035:2019

1. INTRODUCTION

1.1 This Protocol is created as a guidance note for implementing the British Standards Institutes (**"BSI"**) published document called Publicly Available Specification 2035:2019, incorporating Corrigendum No.1 – Retrofitting dwellings for improved energy efficiency – Specification and guidance (**"PAS 2035:2019"**) and is effective from 30 June 2019.

1.2 In this Protocol, unless the context otherwise requires, the words and phrases used shall have the meaning prescribed to them in PAS 2035:2019.

1.3 This Protocol is to be read in conjunction with:

1.3.1 PAS 2035:2019;

1.3.2 the BSI published document called Publicly Available Specification 2030:2019 which sets out the requirements for installing, commissioning and handing over energy efficiency measures (**"PAS 2030:2019"**); and

1.3.3 the Retrofit Academy PAS 2035 Compliance Process Map.

The Responsible Person is to have read and understood the terms and its obligations under PAS 2035:2019.

1.4 This Protocol forms part of the Agreement between the Parties. In the event of any

[1] This includes, but is not limited to, any consultant's scope of services or NEC3 (Works Information / Scope / Service Information), NEC4 (Scope, Service Information) or JCT (Employer's Requirements) documents.

conflict or inconsistency between the documents, the following documents take the order of precedence:

1.4.1 the PAS 2035:2019 and PAS 2030:2019 as may be updated from time to time, including any revisions or amendments;

1.4.2 the Retrofit Academy PAS 2035 Compliance Process Map as may be updated from time to time, including any revisions or amendments;

1.4.3 this Protocol;

1.4.4 any other document that forms part of the Parties' contract.

2. TERMS AND DEFINITIONS

2.1 The Terms and Definitions provided for at section 3 of PAS 2035:2019 are incorporated in to this Protocol. Further definitions are as set out below:

2.1.1 **Agreement** means the contract formed between the Parties.

2.1.2 **Client** means the occupier of the dwelling, as more specifically defined in section 3 of PAS 2035:2019.

2.1.3 **Employer** means the local authority providing finance or instructing works or services in respect of a retrofit project captured by the Agreement, PAS 2035:2019, or any part of it.

2.1.4 **Outcomes** means the outcomes as defined in section 6.2 of PAS 2035:2019 and established at the outset of the retrofit project.

2.1.5 **Parties** means the Employer and any successor in title, assignee or affiliate and the Responsible Person.

2.1.6 **Responsible Person** means the collective term given to the contractor/ consultant carrying out or fulfilling the role of Retrofit Advisor, Retrofit Assessor, Retrofit Coordinator, Retrofit Designer, Retrofit Evaluator and/ or Retrofit Installer as defined in section 3 of PAS 2035:2019.

3. ROLES

3.1 PAS 2035:2019 deals with six distinct roles[2] and outlines what each role is required to do in the life cycle of a retrofit project to comply with PAS 2035:2019.

3.2 For the purposes of this Protocol, the roles and requirements of the following three distinctive roles are considered:

3.2.1 Clause 4: Retrofit Coordinator;

3.2.2 Clause 5: Retrofit Assessor;

3.2.3 Clause 6: Retrofit Designer.

[2] Retrofit Advisor, Retrofit Assessor, Retrofit Coordinator, Retrofit Designer, Retrofit Evaluator and Retrofit Installer

4. PROJECT RISK

4.1 The distinct roles under PAS 2035:2019 are determined by the assessed level of project risk. The assessed level of risk Paths is categorised as:

4.1.1 Path A (Low);

4.1.2 Path B (Medium);

4.1.3 Path C (High).

4.2 The Retrofit Academy PAS 2035 Compliance Process Map sets out where each distinct role must implement the requirements of PAS 2035:2019 to the relevant assessed level of project risk.

4.3 FOR LOCAL AUTHORITY USE ONLY: This project will be a Category [A] [B] [C] [*DELETE AS APPROPRIATE*]

5. **RETROFIT COORDINATOR FOR LOCAL AUTHORITY USE ONLY:** [RESPONSIBLE PERSON SHALL PERFORM THESE DUTIES AND OBLIGATIONS] / [RESPONSIBLE PERSON MUST BE AWARE OF THESE DUTIES AND OBLIGATIONS IN THE CARRYING OUT OF ITS ROLE] [*DELETE AS APPROPRIATE*]

5.1 The Retrofit Coordinator is fully responsible for collation and review of all necessary information required such that the works or services can be carried out in compliance with PAS 2035:2019. The Retrofit Coordinator is to use the professional skill, care and diligence reasonably to be expected of a suitably qualified and experienced retrofit coordinator fully versed in the implementation of the PAS 2035:2019 (as may be amended from time-to-time) and other duties required to be performed under PAS 2035:2019 in relation to projects similar in scale and character to the retrofit project.

5.2 This Protocol considers the following key elements of PAS 2035:2019, specific to the role of the Retrofit Coordinator and required to be carried out by the Retrofit Coordinator:

5.2.1 **Preliminaries**

5.2.1.1 Collaborate and liaise with the Employer, the Client (if deemed necessary by the Employer and/or PAS 2035:2019) and all other relevant parties to determine and set the Outcomes to be achieved throughout the retrofit project.

5.2.1.2 Monitor the progress of the retrofit project against the Outcomes and where applicable, review and make such changes, as may be required from time to time.

5.2.1.3 Review and adjust the design and cost of the retrofit project as reasonably required to achieve the Outcomes.

5.2.1.4 Activity 1 to 4 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Coordinator.

5.2.2 **Risk Path**

5.2.2.1 Prior to any assessment or installation works being carried out, the project risk Path must be determined. The Responsible Person must be able to demonstrate to the Employer that the level of risk Path is appropriate to the retrofit project. It is advised that the Retrofit Academy compliance software is used; however any compliance software used must be of an accepted industry standard that meets or exceeds the processes set out in the PAS 2035:2019.

5.2.2.2 Activity 5 and 6 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Coordinator.

5.2.3 **Whole-dwelling Assessment**

5.2.3.1 Review the format of the assessment, to ensure it meets the Employer's needs and confirm to the Employer that the assessment complies with PAS 2035:2019.

5.2.3.2 Notwithstanding the remoteness of the retrofit project, ensure an assessment of the entire dwelling is carried out.

5.2.3.3 Liaise with the Employer to determine the role and rights of the homeowner and/or occupier of the dwelling to inspect and/or input and/or specify the selection of measures.

5.2.3.4 Report the results of the assessment to the Retrofit Designer and include all relevant photographs and RdSAP, SAP or PHPP data.

5.2.3.5 Activity 7 to 18 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Coordinator.

5.2.4 Retrofit Design

5.2.4.1 Improvement Option Evaluation (**"IOE"**) **FOR LOCAL AUTHORITY USE ONLY:** [If IOE generation is by the Retrofit Assessor – review the IOE] / [If IOE generation is by the Retrofit Coordinator – generate the IOE] [If IOE generation is by the Retrofit Designer – review the IOE] [*DELETE AS APPROPRIATE*].

5.2.4.2 Consistently review throughout the course of the works or services and amend (where necessary) the IOE in line with the design input and agree with the Employer.

5.2.4.3 Review and report to the Employer on the results of IOE and the recommended measures.

5.2.4.4 The SAP (or PHPP) software should be used to demonstrate to the Employer the Carbon Cost Effectiveness and the cost savings.

5.2.4.5 Ensure that the retrofit design complies with PAS 2035:2019.

5.2.4.6 Review a selection of construction details for interfaces and share with the Employer before work on site commences.

5.2.4.7 **FOR LOCAL AUTHORITY USE ONLY:** [The Employer] [The Retrofit Coordinator] [*DELETE AS APPROPRIATE*] will determine the number (sample[3]) of details that are required to illustrate and demonstrate PAS 2035:2019 compliance to the Employer and to provide an additional question and answer process for the project.

5.2.4.8 Once measures have been determined, generate the Medium-Term Improvement Plan.

5.2.4.9 Activity 19 to 61 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Coordinator.

5.2.5 Installation

5.2.5.1 Review and implement a clear process of the requirements for installing, commissioning and handing over energy efficiency measures in compliance with the requirements of PAS 2030:2019 and (where relevant) achieving Microgeneration Certification Scheme ("**MCS**") certification.

[3] Where multiple properties have similar features and characteristics (such as size, scope and design) that require retrofit projects, only one sample would typically be needed to be provided to the Employer. This is, however, at the discretion and risk of the Responsible Person. However, where there are differentiating features and characteristics within properties, multiple samples must be provided to the Employer.

5.2.5.2 Ensure the Retrofit Installer is complying with PAS 2030:2019 (and/or MCS where relevant).

5.2.5.3 Prior to installation of the retrofit project, liaise with the Employer, the Client and other parties to determine:

5.2.5.3.1 the 'Claim of Compliance' detail and process in compliance with PAS 2030:2019 (and/or MCS) and PAS 2035:2019;

5.2.5.3.2 which documents and/or information will be provided to the Client (if necessary) at handover stage in compliance with PAS 2035:2019.

5.2.5.4 Activity 62 to 64 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Coordinator.

5.2.6 **Testing and Commissioning/Handover/Advice/ Monitoring and Evaluation**

5.2.6.1 Liaise with the Employer, the Client (if necessary) and other parties to determine:

5.2.6.1.1 who will be commissioning the retrofit project including the commissioning process to be carried out and defining the commissioner's role; and

5.2.6.1.2 the acceptance criteria of the retrofit project.

5.2.6.2 Activity 65 to 106 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Coordinator.

5.2.7 **Claims of Compliance**

5.2.7.1 Activity 107 to 113 of the Retrofit Academy PAS 2035 Compliance Process Map provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Coordinator.

5.2.8 **Qualifications**

5.2.8.1 Activity 114 of the Retrofit Academy PAS 2035 Compliance Process Map provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Coordinator.

5.3 Notwithstanding the specific roles and requirements set out in clause 5.2, the Retrofit Coordinator must comply with all required sections in PAS 2035:2019.

6. **RETROFIT ASSESSOR FOR LOCAL AUTHORITY USE ONLY:** [RESPONSIBLE PERSON SHALL PERFORM THESE DUTIES AND OBLIGATIONS] / [RESPONSIBLE PERSON MUST BE AWARE OF THESE DUTIES AND OBLIGATIONS IN THE CARRYING OUT OF ITS ROLE] [*DELETE AS APPROPRIATE*]

6.1 The Retrofit Assessor is to use the professional skill, care and diligence reasonably to be expected of a suitably qualified and experienced retrofit assessor fully versed in the implementation of the PAS 2035:2019 (as may be amended from time-to-time) and other duties required to be performed under PAS 2035:2019 in relation to projects similar in scale and character to the retrofit project.

6.2 This Protocol considers the following key elements of PAS 2035:2019, specific to the role of the Retrofit Assessor:

6.2.1 **Preliminaries**

6.1.1.1 Request the preliminary Outcomes from the Employer and the Retrofit Coordinator.

6.2.1.2 Activity 1 to 4 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Assessor.

6.2.2 **Risk Path**

6.2.2.1 Ensure that the risk Path is provided by the Retrofit Coordinator prior to commencement of the whole-dwelling assessment.

6.2.2.2 Review and inform the Employer and the Retrofit Coordinator if any changes occur that might affect the risk Path.

6.2.2.3 Activity 5 to 8 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Assessor.

6.2.3 **Retrofit Advice** (***if provided by the Retrofit Assessor***)

6.2.3.1 Activity 6 to 13 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Assessor.

6.2.4 **Confirmation of the Scope of the Site Inspection**

6.2.4.1 Activity 14 to 23 of the Retrofit Academy PAS 2035 Compliance Process Map provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Assessor.

6.2.5 **Retrofit Assessment**

6.2.5.1 Activity 24 to 44 of the Retrofit Academy PAS 2035 Compliance Process Map provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Assessor.

6.2.6 **Assessment Report**

6.2.6.1 A draft assessment proforma is to be provided to the Employer in a form approved by the Retrofit Assessor's certification body.

6.2.6.2 Notwithstanding the remoteness of the retrofit project, carry out an assessment of the entire dwelling in accordance with the requirements of PAS 2035:2019.

6.2.6.3 The assessment should clearly set out the assessment results of ventilation, condensation, damp and mould.

6.2.6.4 Report the results of the assessment to the Retrofit Coordinator and include all relevant notes, photographs and RdSAP, SAP or PHPP data.

6.2.6.5 Advise (the Retrofit Coordinator and Employer) of any changes that may impact the project Outcomes.

6.2.6.6 **FOR LOCAL AUTHORITY USE ONLY:** [If specified by the Employer, Generate the IOE.] [*DELETE AS APPROPRIATE*]

6.2.6.7 Activity 45 to 49 of the Retrofit Academy PAS 2035 Compliance Process Map provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Assessor.

6.3 Notwithstanding the specific roles and requirements set out in clause 6.2, the Retrofit Assessor must comply with all relevant requirements in PAS 2035:2019.

7. **RETROFIT DESIGNER FOR LOCAL AUTHORITY USE ONLY:** [RESPONSIBLE PERSON SHALL PERFORM THESE DUTIES AND OBLIGATIONS] / [RESPONSIBLE PERSON MUST BE AWARE OF THESE DUTIES AND OBLIGATIONS IN THE CARRYING OUT OF ITS ROLE] [*DELETE AS APPROPRIATE*]

7.1 The Retrofit Designer is to use the professional skill, care and diligence reasonably to be expected of a suitably qualified and experienced retrofit designer fully versed in the implementation of PAS 2035:2019 (as may be amended from time-to-time) and other duties required to be performed under PAS 2035:2019 in relation to projects similar in scale and character to the retrofit project.

7.2 This Protocol considers the following key elements of PAS 2035:2019, specific to the role of the Retrofit Designer:

7.2.1 **Preliminaries**

7.2.1.1 Review the Outcomes, the IOE and potential measures required to achieve the Outcomes, and the whole-dwelling assessment.

7.2.1.2 Activity 1 to 5 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Designer.

7.2.2 **Retrofit Design**

7.2.2.1 Create an appropriate retrofit design in the context of the project's Outcomes that complies with the requirements of PAS 2035:2019.

7.2.2.2 Respond to the request of the Employer to provide the details that will help to demonstrate how the design is compliant with PAS 2035:2019.

7.2.2.3 The samples[4] required to illustrate compliance to the Employer will be determined by the Employer.

7.2.2.4 Incorporate all required construction details into the design for PAS 2035:2019 compliance.

7.2.2.5 Ensure the retrofit design takes account of any requirements for ventilation from the retrofit assessment.

7.2.2.6 Activity 6 to 35 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Designer.

7.2.3 **IOE and Confirmation of the Scope of the Project** (if delivered by the Retrofit Designer)

7.2.3.1 Carry out the IOE in the form agreed by the Employer.

7.2.3.2 Activity 36 to 45 of the Retrofit Academy PAS 2035 Compliance Process Map further provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Designer.

7.2.4 **Liaison with the Retrofit Installer regarding the Retrofit Design** (if delivered by the Retrofit Designer)

7.2.4.1 Activity 46 to 51 of the Retrofit Academy PAS 2035 Compliance Process Map provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Designer.

[4] See note above.

7.2.5 **Retrofit Advice** (if delivered by the Retrofit Designer)

7.2.5.1 Activity 52 to 54 of the Retrofit Academy PAS 2035 Compliance Process Map provides the relevant sections of PAS 2035:2019 that must be adhered to by the Retrofit Designer.

7.3 Notwithstanding the specific roles and requirements set out in clause 7.2, the Retrofit Designer must comply with all relevant sections in PAS 2035:2019.

Part D
Sample Specifications

D – SAMPLE SPECIFICATIONS

THE PURPOSE OF THIS SECTION

This section provides a number of sample technical specifications for some of the most common retrofit measures that may be recommended in a Medium Term Improvement Plan completed by a Retrofit Coordinator (RC). It is the responsibility of the Retrofit Designer to design and specify improvements but these sample specifications may assist LA programme managers or RCs to understand the standard and detail they should expect. Additionally, this section provides a sample specification for the RC Job Role.

These retrofit specifications for building fabric improvement measures and ventilation systems are intended for use by Retrofit Designers. PAS 2035 requires every retrofit project to have a Retrofit Designer, whose role is to design and specify the package of improvements for each stage of the Medium-Term Improvement Plan (at the appropriate time). The retrofit design must include detailed specifications for all the materials, products and systems that are to be installed, as well as construction details, etc. Non-specific performance specifications, or specifications that allow the installer to choose materials, products or systems, or configure systems, or to substitute them, are not PAS 2035 compliant (although substitutions can be made with the formal approval of the Retrofit Designer and/or the Retrofit Coordinator). Traditional procurement procedures used by local authorities and housing organisations are not usually PAS 2035 compliant, so must be modified.

The specifications provided here are not intended simply to be copied and pasted into retrofit designs. They are reasonably comprehensive in scope, but generic, and in most cases they will need editing by the Retrofit Designer to customise them for to the particular circumstances of the dwelling or project, in response to the Client's brief, the Whole-dwelling Assessment Report, the Improvement Option Evaluation and the Medium-Term Improvement Plan. The ventilation specifications are not intended to be provided as options – the type of ventilation system to be installed (i.e. the most appropriate option) should be identified in the retrofit design by the Retrofit Designer, usually in collaboration with a specialist. Ventilation suppliers' suggestions of 'equivalent', 'better' or 'cheaper' ventilation systems should usually be rejected – most ventilation suppliers are simply fan manufacturers, not domestic ventilation consultants or experts, so their advice is often commercially biased and unreliable. Poor or inappropriate ventilation significantly increases the technical risk associated with domestic retrofit.

It is recommended that once collated by the Retrofit Designer, all retrofit project specifications should be sense checked by the Retrofit Coordinator for consistency with the Client's brief, the Whole-dwelling Assessment Report(s), the Improvement Option Evaluation(s) and the Medium-Term Improvement Plan(s). Retrofit designs should be approved by the Client's representative (i.e the Retrofit Coordinator) prior to issue for costing or installation. Document numbering and robust version control should be used to keep track of specification variants during the design, pricing and installation processes.

The types of insulation projects that fall under the remit of Retrofit Coordinators include:

- Floor insulation: suspended timber floors.
- Floor insulation: solid floors.
- Cavity wall insulation.
- External solid wall insulation.
- Internal solid wall insulation.
- Replacement windows and external doors.
- Loft insulation.
- Pitched roof insulation.
- Flat roof insulation.

They also work on the following types of ventilation projects:

- Intermittent extract ventilation.
- Centralised mechanical extract ventilation.
- Decentralised mechanical extract ventilation.
- Mechanical ventilation with heat recovery.

Detailed specifications are available for all the above projects, they explain the:

- Standards that each type of project must meet.
- Process from pre-installation surveys through to project completion.
- Legal requirements that must be met (e.g. applications for planning permission).
- Materials that must be used.
- Qualifications that an installer must have.
- Guarantee certificates or warranties that must be provided.
- Outcomes that must be achieved.

The key outcome is how successful the final structure is in terms of preventing heat loss, which is measured by its "U-value". The lower the U-value, the better the insulation.

Please note the specifications only provide examples, there may be other options in terms of insulation type and/or thickness that would achieve similar U-values. Also, following the Retrofit Assessment and Improvement Option Evaluation, the specifications might need to be enhanced to meet an overall heat demand target of 50 kWh/m²/year.

This note is developed from a project originally commissioned by the SE Energy Hub and completed by The Retrofit Academy. The documents have been refreshed and reformatted to complement work commissioned by the Midlands Energy Hub to make them easier to access and use.

SPECIFICATION - FLOOR INSULATION: SUSPENDED TIMBER FLOORS (UFI)

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of floor insulation beneath suspended timber floors. The specifications:

- Identify the standards with which all such work must comply.
- Describe the requirements of such insulation work.
- Outline the process leading from the pre-installation assessment to the completion of the insulation work.
- Define the purpose of the initial assessment.
- Explain which types of floors are unsuitable for insulation.
- Detail the scope of work and the insulation options available.
- State the roles played by different people in the process.

Note that the insulation options provided in this document illustrate different methods that may be used. However, there may be alternative combinations of insulation type and / or thickness that would achieve similar U-values or that might be required to achieve predefined performance targets.

2 Introduction

Where dwellings are identified for the insulation of suspended timber floors, the work is to be carried out strictly in accordance with ***Guide to Best Practice: Retrofit Floor Insulation – Suspended Timber Floors*** published by the Department for Business, Energy and Industrial Strategy (London, July 2020). In addition, the contractor is to:

1 Carry out a pre-installation assessment.
2 Define the work required to insulate the exposed floor(s) in the dwelling properly and provide. designs for review by the Retrofit Coordinator.
3 Submit notices as required by the Building Regulations.
4 Install floor insulation in accordance with the approved designs.

3 Pre-Installation Assessment

The pre-installation assessment is to be carried out by an assessor trained and approved by the contractor. The purpose of the assessment is to:

- Confirm the type of floor construction(s), including whether or not the floor(s) are solid or suspended (note that some dwellings may have floors of more than one construction type).
- Establish the type, thickness, location and extent of any existing insulation.
- Identify any services located in the floor void (e.g. radiator pipes, water pipes, gas pipes, etc.).
- Establish how the floor void is ventilated.
- Assess the severity of any condensation (and associated mould or rot).
- Identify any access constraints.
- Assess the extent to which residents' property needs to be cleared before floor insulation can be installed and then replaced after installation.

A written pro-forma report of every assessment must be supplied to the Retrofit Coordinator.
Floors with the following characteristics should be recorded as not suitable for the installation of insulation:

- Suspended floors with at least 150 mm thickness of existing mineral wool quilt insulation (or the equivalent thickness of another insulation material) laid between the floor joists over the whole floor area, without gaps and in good condition.
- Suspended floors where there is evidence of condensation, mould growth or timber rot in the floor void.
- Suspended floors for which there is no provision for cross ventilation of the floor void by outside air and no possibility of installing suitable cross ventilation.

4 Design

On completion of each assessment, the contractor is to prepare a design for the installation of floor insulation in each dwelling and submit it for approval by the Retrofit Coordinator. The design is to identify the type of floor to be insulated, the insulation option proposed (see below), the materials and products to be used, and the floor U-value that will be achieved.

5 Suspended Floors: Scope of Work

The scope of work to be carried out is to be defined separately for each dwelling following the assessment and agreed with the Retrofit Coordinator, subject to the following requirements:

1 All suitable floors are to be insulated to achieve a maximum thermal transmittance (U-value) of 0.25 W/m^2K^1, or with at least 150mm thickness of mineral fibre quilt (placed between the floor joists), or with the thermally equivalent thickness of another insulation material.

2 Where there is existing insulation in poor condition (i.e. disturbed, damaged, damp or not covering the whole of the floor area), it is to be removed and replaced with new insulation to achieve the required standard.

3 The floor void must be adequately ventilated: existing under-floor ventilation must be maintained and not blocked by new insulation material; ventilators and airbricks are to be inspected and cleared if necessary.

4 Where the floor void is not cross-ventilated (i.e. from one side to the other), new ventilators or airbricks are to be installed below the floor level to facilitate adequate cross-ventilation equivalent to that provided by a continuous 10mm wide gap along the exposed perimeter.

5 Insulation material is to be placed in such a way that cold air (from outside or from the floor void) cannot penetrate to the warm side of the insulation through gaps or joints, beside timber joists, at floor-wall junctions, etc.

6 Existing radiator pipework is to be removed from the cold floor void, as far as possible, and re-routed on the warm side of the insulation. Existing electrical wiring is not to be encased in insulation material and must be re-routed on the warm side of the insulation. Existing gas and water supply pipes may remain in the floor void beneath the insulation; points of penetration into the house, through the insulated floor, are to be sealed with tape and/or expanding polyurethane foam.

Suspended floors are to be insulated using one of the three options specified below. For options A and B, furniture (including fitted furniture), kitchen and bathroom fittings, floor finishes and skirting boards are to be removed and stored safely, floorboards are to be lifted (and numbered so that they can be re-fitted in the same arrangement). When the insulation has been installed the floorboards are to be re-fixed (using screws, not nails) in the original arrangement, the skirtings are to be replaced and made good, and the floor finishes, furniture and fittings are to be replaced. This work is not necessary if option C is adopted.

The floor insulation options are:

1 Fix a continuous vapour permeable membrane over and between the floor joists, stapled to the lower sides of the joists and stretched between them to form 'pockets' between each pair of joists of the full depth of the joists. Overlap all joints in the membrane by at least 150mm, and tape them securely. Turn the edges of the membrane up the wall to a level that will be behind the skirting boards, cut back the plaster, tape the edges of the membrane to the wall substrate and make good. Fill the pockets with mineral wool batts (fitted tightly to eliminate air spaces) or with loose cellulose fibre insulation. Ensure that the pockets are fully filled with insulation and that any small gaps around the edges of the floor are insulated in a similar way. Fix a polythene membrane across the top of the joists and insulation to form an air and moisture barrier; overlap all joints in the membrane by at least 150mm and tape them; tape the edges of the membrane to the wall behind the skirting boards. Re-fix the floorboards as specified above.

or

2 Fix timber battens beneath the floor joists, at right angles to and at the same spacing as the joists, to support rigid insulation boards. Cut rigid polyurethane, polyisocyanurate or phenolic foam insulation boards to fit between the joists. The insulation boards must be of sufficient thickness to achieve the required thermal performance (as specified above). Seal the joints between insulation boards and the gaps between the insulation boards and the joists with continuous beads of expanding polyurethane foam. Ensure that any small gaps around the edges of the floor are insulated and sealed in a similar way. Fix a polythene membrane across the top of the joists and insulation to form an air and moisture barrier; overlap all joints in the membrane by at least 150 mm and tape them; tape the edges of the membrane to the wall behind the skirting boards. Re-fix the floorboards as specified above.

or

3 Insulate the floor from below, using sprayed polyurethane foam insulation of the thickness needed to achieve the required thermal performance (as specified above) applied by a robot inserted into the floor void, using the Q-bot system provided by Q-Bot Limited, of Block G, Riverside Business Centre, Bendon Valley, Wandsworth, London, SW18 4UQ, UK (www.q-bot.co/index.php). A survey robot is to be inserted to survey the floor void prior to the installation of the insulation; both robots are to be inserted through holes created by the temporary removal of airbricks or small areas of brickwork.

If this option is adopted, the supplier is to confirm prior to installation that the floor is suitable for insulation by this method, and the insulation is to be installed by Q-Bot Limited's approved installers and strictly in accordance with Q-Bot Limited's recommendations and instructions.

6 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing floor insulation beneath suspended timber floors:

- All such work must be carried out strictly in accordance with the Department for Business, Energy and Industrial Strategy's ***Guide to Best Practice: Retrofit Floor Insulation – Suspended Timber Floors*** (London, July 2020).
- The process that the contractor must follow consists of a pre-installation assessment, defining the work, creating appropriate designs, submitting the notices required by Building Regulations and installing the insulation (see Section 2, above).
- The pre-installation assessment must examine specific criteria (see Section 3, above) and culminates with the submission of a written pro-forma to the Retrofit Coordinator for approval.
- The assessment judges whether the floor is suitable for installation (see the list of unsuitable types of floor in Section 3, above).
- Following the assessment, the contractor must submit a design to the Retrofit Coordinator for approval (see Section 4, above, for the details that the design must include).
- The assessment determines the specific scope of work for each dwelling and must be agreed with the Retrofit Coordinator (subject to the requirements outlined in Section 5, above).
- The three options for suspended floor insulation are to fix a continuous vapour permeable membrane over and between the floor joists, to fix timber battens beneath the floor joists, or to insulate the floor from below using sprayed polyurethane foam insulation. Further details on these three options are provided in Section 5, above).

Please note that for any of these options there may be alternative combinations of insulation type and/or thickness that would achieve similar U-values. Also, following the Retrofit Assessment and Improvement Option Evaluation, the specifications might need to be enhanced to meet an overall heat demand target of 50 kWh/m²/year.

SPECIFICATION - FLOOR INSULATION: SOLID FLOORS

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of floor insulation beneath solid floors. The specifications describe the requirements of such insulation work and outline the process leading from the pre-installation assessment to the completion of the insulation work. They also:

- Describe the process for surveying the conditions beneath the existing floor and creating a design for the replacement
- Outline the specifications of the various options for the build-up of the new floor

Note that the insulation options provided in this document illustrate different methods that may be used. However, there may be alternative combinations of insulation type and/or thickness that would achieve similar U-values or that might be required to achieve predefined performance targets.

2 Initial Survey

If a ground floor is to be completely replaced with a new, insulated solid concrete floor, then after removal of the existing floor, the contractor is to carry out a survey to confirm the ground conditions beneath the existing floor and to identify any services located beneath it (e.g. radiator pipes, water pipes, gas pipes, etc.) that will need to be protected, removed or diverted.

3 Design

On completion of the survey, the contractor is to prepare a design for the replacement of the floor and submit it for review by the Retrofit Coordinator. The finished floor level of the new floor is to be the same as that of the existing floor. The new floor is to have a U-value not exceeding 0.25 W/m^2K. U-values are to be calculated in accordance with BS EN ISO 6946: 2007 and BRE report BR443, and a copy of the U-value calculation is to be supplied to the Retrofit Coordinator.

4 Solid Floors: Scope of Work

Subject to agreement with RC and the Client, the build-up of the new floor is to be:

- A lightly reinforced mass concrete slab of minimum 150mm thickness laid on sand blinding and hardcore; reinforcement is to be specified by a consultant structural engineer; concrete is to consist of cement, fine and coarse aggregate, and water, with no other additives; cement is to be Ordinary Portland Cement to BS12; sand is to be good quality clean building sand to BS12; water is to be fresh and clean;
- A polythene damp-proof membrane laid on the new floor slab, with joints lapped at least 150mm, edges turned at least 100mm up the surrounding walls, and all joints and edges sealed with tape;
- A continuous layer of rigid interlocking polyurethane (PU) or polyisocyanurate (PIR) insulation boards of the thickness needed to achieve the required maximum thermal transmittance (U-value) and of minimum compressive strength 140kPa, on top of the damp-proof membrane; edges and joints between boards are to be taped; and
- A 75 mm thick sand-cement screed, reinforced with 20-50mm wire anti-cracking mesh to BS4449, BS4461 and BS4483, accurately placed in the middle of the screed with 25mm cover and minimum 300mm laps; the screed is to receive a power floated finish.

Note: depending on the design of the heating system, it may be necessary to install proprietary underfloor heating pipework in the new floor screed, in which case the above build-up may need to be modified.

5 Summary

The following key points must be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing floor insulation beneath solid floors:

- If a ground floor is to be replaced with an entirely new floor, a survey must be completed to identify the conditions beneath the floor and any services that must be protected, removed or diverted (see Section 2, above).
- If a ground floor is to be replaced with an entirely new floor, a survey must be completed to identify the conditions beneath the floor and any services that must be protected, removed or diverted (see Section 2, above).
- Following completion of the survey, a design must be presented to the Retrofit Coordinator, showing how the new floor meets the specifications (see Sections 3 and 4, above).
- Subject to agreement with the Client, the build-up of the new floor is to be either:
- A lightly reinforced mass concrete slab of minimum 150mm thickness laid on sand blinding and hardcore;
- A polythene damp-proof membrane laid on the new floor slab;
- A continuous layer of rigid interlocking polyurethane (PU) or polyisocyanurate (PIR) insulation boards;
- a 75 mm thick sand-cement screed (see Section 4, above, for more details on all these options).
- NB – the build-up may require modification depending on the design of the heating system (see Section 4, above).

Please note that there may be alternative combinations of insulation type and/or thickness that would achieve similar U-values. Also, following the Retrofit Assessment and Improvement Option Evaluation, the specifications might need to be enhanced to help meet an overall heat demand target of 50 kWh/m²/year.

SPECIFICATION - CAVITY WALL INSULATION (CWI)

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of cavity wall insulation. The specifications:

- Identify the standards with which all such work must comply.
- Describe the requirements of cavity wall insulation work.
- Outline the process leading from the pre-installation assessment to completing and providing a guarantee for the work.
- Highlight which types of walls are unsuitable for insulation.
- Explain the process for submitting building control notices.
- Set out the U-values that must be achieved based on the width of the cavity.
- Detail the insulation material to use.
- Define the role of the installer and describe the processes of installation and providing guarantees.

Note that the insulation options provided in this document illustrate different methods that may be used. However, there may be alternative combinations of insulation type and/or thickness that would achieve similar U-values or that might be required to achieve predefined performance targets.

2 Introduction

The selection of dwellings for the installation of cavity wall insulation is to be made in accordance with the guidance in ***Thermal Insulation: avoiding risks***.[1] Cavities must not be filled where the guidance indicates that the exposure to wind-driven rain is too great, or where the construction or the width or state of the cavity is inappropriate.

Where dwellings are identified for the installation of cavity wall insulation the contractor is to:

1 Carry out a pre-installation assessment.

2 Submit notices as required by the Building Regulations.

3 Install cavity wall insulation.

4 Provide a guarantee of the work.

[1]STIRLING C (2002) Thermal Insulation: avoiding risks BRE report BR262, ISBN 1-86081-515-4, BRE, Watford. See http://www.brebookshop.com/details.jsp?id=556

3 Pre-Installation Assessment

The pre-installation assessment is to be carried out by an assessor approved under the BBA Approved Assessor Scheme for Assessing the Suitability of Buildings for the Installation of Cavity Wall Insulation. The assessment is to comply with the requirements of that scheme and is to confirm the type of wall construction, establish the width of the wall cavities, and confirm that they have not previously been filled with insulation and are suitable for filling with the insulation material proposed. The assessment should also record any identified problems, define any areas of wall not to be insulated (and record the reasons) and identify any special requirements for making good.

A written pro-forma report of every assessment is to be supplied to the Retrofit Coordinator. In addition to the information listed above, all reports are to include the minimum contents required by the BBA Approved Assessor Scheme for Assessing the Suitability of Buildings for the Installation of Cavity Wall Insulation.

Only empty cavities in walls of masonry construction (with brick, concrete block or stone inner and outer leaves) are to be filled. Cavities in other forms of construction discovered during pre-installation inspections are not to be filled, and the type of construction found is to be reported to the Retrofit Coordinator.

Walls of the following types should be recorded as not suitable for filling with insulation:

- Walls with cavities less than 50mm wide.
- Walls that have already been filled with insulation, fully or partially, either at the time of construction or subsequently.
- Walls where there is evidence of structural or frost damage in the form of cracking or spalling of the outer leaf.
- Walls where the outer leaf has not been constructed or pointed with flush mortar joints. Weathered or bucket-handled joints are acceptable; raked or recessed joints are only acceptable in exposure zone 1 as defined in the BRE guide Thermal insulation: avoiding risks.
- Walls where there is evidence of rising or penetrating damp on the inner faces.
- Walls where there is evidence that the cavity is obstructed and the obstruction(s) may transmit water towards the inner leaf.
- Walls that are rendered externally, where the render shows evidence of being defective.
- Walls with cavities less than the minimum width specified in the BRE guide Thermal Insulation: avoiding risks for the type of construction and the exposure zone in which the dwelling is located.

- Walls that are particularly exposed to driving rain by virtue of being close to the coast, at high elevation, on the edge of an urban or suburban area adjacent to open land or elevated above the surrounding townscape.
- Walls in which the cavity is being used as a source of combustion air or as a flue for ventilation purposes (this will be rare).

4 Submission of Building Control Notices

The contractor is to submit formal notice of the work to the local Building Control Body, as required by the Building Regulations. Alternatively, if the contractor is a member of a Competent Person Scheme recognised by the Ministry of Housing, Communities and Local Government (MHCLG) and thus able to self-certify the compliance of the work with the regulations, then notice need not be submitted, but a certificate of compliance is to be supplied to the Retrofit Coordinator.

5 Cavity Wall Insulation: Scope of Work

Subject to identification during the pre-installation inspection as suitable for filling, cavity walls are to be insulated to achieve maximum thermal transmittances (U-values) as follows:

Cavity width (mm)	**U-value** (W/m^2K)
50	0.52
75	0.38
100	0.30

The insulation material is to be either expanded polystyrene in bead form, combined with a bonding agent, or mineral fibre. The chosen product is to be the subject of a British Board of Agrément (BBA) certificate confirming its suitability for use as cavity wall insulation, a copy of which is to be supplied to the Retrofit Coordinator. The insulation material and any bonding agent are to be delivered to sites in packaging that carries the BBA identification mark and the number of the BBA certificate.

The insulation material and any necessary bonding agent are to be injected into the walls by installers trained and approved by the holder of the BBA certificate for the insulation product and by the BBA. An approved installer is one who:

- Has been required to satisfy an initial site installation check by the BBA and is subject to the BBA Assessment and Surveillance Scheme for Installation of Cavity Wall Insulation;
- Has undertaken to comply with the BBA certificate holder's installation procedure;
- Employs technicians who have been issued with appropriate identity cards by the holder of the BBA certificate (at least one member of each installation team must carry a card); and
- Is subject to oversight and inspection by the holder of the BBA certificate.

The installation of the insulation is to be strictly in accordance with the:

- Procedure set out in the BBA Certificate;
- TBBA Assessment and Surveillance Scheme for Installation of Cavity Wall Insulation;
- BBA Certificate holder's instructions and recommendations; and
- Requirements of the Cavity Insulation Guarantee Agency (CIGA) for the issue of a guarantee certificate.

During the installation, the installer is to:

- Use only injection equipment approved by the BBA and marked with the appropriate BBA certificate number;
- Ensure that injection holes drilled through the outer leaves of the walls (where possible through the mortar joints between bricks) are of the minimum diameter specified in the BBA Certificate for the insulation product;
- Check and confirm in writing that the pattern of injection holes complies with the description and recommended spacing in the BBA certificate for the insulation product;
- Drill additional holes as required to help ensure that the filled cavity will be void-free; and
- Ensure that injection of the insulation material takes place at every hole to ensure complete filling of the cavity.

After installation of the insulation material the installer is to:

- Make the walls good by fully filling the drill holes with mortar of a type, colour, texture and weather-tightness similar to the existing mortar;
- Check all air vents (e.g. those providing under-floor ventilation or combustion air for heating appliances) by means of an appropriate test (e.g. a smoke test) to confirm that they have not been blocked by insulation material;
- Remove any insulation material that has been blown through the top of the wall cavities into the loft space; and
- Seal any points of leakage of the insulation material.

6 Provision of Guarantee

Within thirty days of the completion of each installation, the contractor is to provide the Retrofit Coordinator with a guarantee certificate issued by the Cavity Insulation Guarantee Agency (CIGA) for each dwelling that has been insulated. The guarantee is to be valid for twenty-five years from the date of installation, and each certificate is to include the full address of the dwelling to which it applies.

7 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing cavity wall insulation:

- The process that the contractor must follow consists of a pre-installation assessment, submitting the notices required by Building Regulations, installing the cavity wall insulation and providing a guarantee of the work.
- All such work must be carried out strictly in accordance with the guidance ***Thermal Insulation: avoiding risks*** (see Section 2, above).
- The guidance specifies circumstances in which cavities must not be filled (see Section 2, above).
- There are ten types of walls that are not suitable for such insulation work (see the list in Section 3, above).
- Cavity walls that are suitable should be insulated to achieve maximum U-values depending on the cavity width in millimetres (see Section 5, above, for further details).
- The insulation material must be either expanded polystyrene in bead form, combined with a bonding agent, or mineral fibre. The chosen product must have a BBA Certificate confirming its suitability for use as cavity wall insulation (see Section 5, above).
- The role of the installer and the requirements that they must follow are detailed in Section 5, above.
- The contractor must provide the Retrofit Coordinator with a guarantee certificate issued by the CIGA within thirty days of the completion of each installation (see Section 6, above).

Note that following the Retrofit Assessment and Improvement Option Evaluation, additional measures might be needed to help meet an overall heat demand target of 50 kWh/m²/year.

SPECIFICATION - EXTERNAL SOLID WALL INSULATION (EWI)

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of external solid wall insulation. The specifications describe the requirements of such insulation work and outline the process leading from the pre-installation assessment to the completion of the insulation work. They also:

- Describe the issues that the pre-installation assessment must cover.
- Outline the requirements of the design that must be submitted to the Client following the completion of the initial assessment.
- Set out the requirements that the installer must follow, including ensuring that all installations are strictly in accordance with the designs reviewed by the Retrofit Coordinator and with the guidance in Best Practice Guide: External Wall Insulation published by the Insulated Render and Cladding Association (INCA) in 2015.
- Detail the insulation process and the certificate that must be provided following completion ot the work.

Note that a U-value of better than 0.3 W/m²K might be required to help achieve predetermined whole dwelling performance targets.

2 Requirements for External Solid Wall Insulation

Where the external walls of dwellings are identified for the installation of external solid wall insulation (EWI) the contractor is to install EWI as specified below. Where internal solid wall insulation (IWI) is to be applied to adjoining walls or sections of walls, the IWI and EWI must overlap horizontally by at least 400 mm, in order to minimise thermal bridging.

3 Pre-Installation Survey

A pre-installation survey is to be carried out by an assessor trained and approved by the contractor or by the specialist installer of the EWI. The assessment is to include:

- Contact with the local authority's Planning Department to establish whether planning permission is required for the installation of EWI.
- Assessment of whether the existing dwelling should be classified as 'vulnerable' (i.e. it was constructed prior to 1919) and whether the external walls are of vapour permeable construction (i.e. porous brickwork with lime mortar and lime plaster) or vapour sealed (i.e. with gypsum plaster or cement render).

- A check of whether there is sufficient space for EWI to be installed (both space for the EWI system and for access for installation and subsequent maintenance). This is particularly important where the external walls are located close to property boundaries.
- Measurement of the dimensions of the external walls, including heights and openings; and a line and level survey to determine if a dubbing out or a levelling coat is required before EWI can be installed.
- A record of any architectural features or details that should be preserved or repositioned or replicated within or on the EWI.
- Identification of attachments to the walls such as gates and fences, sheds, clotheslines, trellises and satellite dishes, which will have to be removed prior to installation of EWI and subsequently re-fixed and made good.
- Identification of any vines, creepers or adjacent soft landscaping that will have to be disturbed during the installation of EWI and subsequently made good, or permanently removed.
- Identification of services such as electricity, TV, telephone and broadband cables and equipment, gas or oil pipework, electricity and gas meters, lights, rainwater goods, brackets, etc. that will have to be removed or repositioned prior to the installation of EWI and subsequently re-fixed, reconnected and made good.
- Assessment of how the EWI can be connected or overlapped with proposed insulation in adjacent elements (other exposed walls, roofs and exposed floors) in order to minimise thermal bridging and preserve airtightness at the junctions.
- A record of any evident structural defects (e.g. cracks, bulges) and assessment of their causes and of the remedial work required before installation of EWI.
- A record of any evident rising or penetrating damp, and assessment of its causes and of the remedial work and drying out required before the installation of EWI.
- A record of any existing movement joints that should be taken account of in the design of the EWI.
- A record of the positions of damp proof courses that should be taken account of in the design of the EWI.
- A record of any moss, lichen or mould on wall surfaces, and assessment of any treatment required prior to the installation of EWI.
- A record of any efflorescence (lime bloom), or if efflorescence has been treated a check that the masonry has dried out sufficiently.
- Testing of the walls to establish acceptable pull-out loads so that EWI fixing types and spacings can be determined.

A written report of the survey is to be supplied to the Retrofit Coordinator. Where it is determined that planning permission or Listed Building Consent is required for the installation of EWI, this is to be reported to the Client and no installation work is to be carried out until the required consent has been obtained.

4 Design

Once the pre-installation survey has been completed, an EWI design (drawings and specifications) are to be prepared by the Retrofit Designer and submitted to the Client for approval.

5 External Solid Walls: Scope of Work

The design requirements are:

- Only incombustible and vapour permeable insulation materials (e.g. mineral fibre), adhesives and finishes may be used; the maximum thickness of the insulation is 110mm and the insulated external walls are to have thermal transmittances (U-values) not exceeding 0.30 W/m^{2}K. U-values are to be calculated in accordance with BS EN ISO 6946: 2007 and BRE report BR443, and copies of the U-value calculations are to be supplied by the Retrofit Designer to the Retrofit Coordinator.
- Insulation is to be fixed to the existing walls with adhesive and with mechanical fixings.
- In locations where the thickness of the insulation is limited (e.g. window and door cills, soffits and reveals, alongside narrow alleyways or where a wall is very close to a property boundary), high-performance insulation (e.g. polyurethane board or aerogel board) should be used.
- EWI is to be finished with through-coloured thin-coat (5mm) acrylic or silicate render (both are vapour permeable) on appropriate scrim and basecoat layers. Dark coloured renders are less durable than light coloured ones, so only light-coloured render is to be used (the colour will be specified by the Retrofit Coordinator).
- All EWI must be continuous (to eliminate thermal bridging), air-tight (to eliminate the possibility of cold external air getting behind the insulation layer, causing thermal by-pass) and water-tight (to eliminate the possibility of rainwater penetrating into or behind the insulation). Exposed edges of the insulation layer must be protected by adequate overhangs, overlaps, seals, flashings or extended cills, as appropriate.
- Metal fittings (fixings, trays, beads, etc.) are not to be used, because they introduce unacceptable thermal bridges. Only plastic fittings are acceptable. Fixings through the EWI (for rainwater downpipes, satellite dishes, etc.) are to be through pattress blocks placed in the insulation layer.

- In order to minimise thermal bridging, the EWI must connect or overlap with the existing or proposed roof insulation at eaves, gables and verges, as appropriate. Connection of the two insulation elements is preferred, but if a connection is not practical an overlap of at least 400mm is required.
- Where the existing eaves overhang is inadequate to protect the top of the insulation, the eaves roof construction and finishes should be extended over the top of the insulation. Similarly, where the overhangs at gable verges are inadequate to protect the top of the insulation, gable ladders should be constructed and the roof finishes extended. These arrangements will also facilitate the connection of the EWI with pitched roof insulation.
- In order to minimise thermal bridging, the EWI must not terminate above the level of the damp proof course (DPC). The DPC is to be preserved through the EWI layer, and waterproof insulation (e.g. expanded extruded polystyrene, XPS) is to be used below the DPC level. The EWI must overlap with the proposed ground floor insulation by at least 400mm. Note that this will usually involve groundworks and subsequent making good.
- Any new windows or external doors that are included in the energy efficiency measures to be installed are to be located in the plane of the wall insulation, and the internal finishes are to be made good. Any new windows or external doors are to be installed before the EWI installation, and the contractors will be required to cooperate.
- New windows and external doors are to be supported in the plane of the insulation by a minimum of 50mm x 50mm timber battens around the entire perimeter of the openings, fixed to the walls and sealed with tape. Windows are then to be fixed and sealed to the battens, and the EWI should overlap the window frames by at least 10mm (subject to there being sufficient clearance for window opening).

The drawings and specifications provided by the Retrofit Designer must include:

- The type of EWI system to be used. Only ETICS (external thermal insulation composite systems) certified by the British Board of Agrément (BBA) as suitable for use as external wall insulation are acceptable, and a copy of the BBA Certificate for the proposed system is to be supplied to the Retrofit Coordinator.
- Confirmation of whether the proposed EWI system includes vapour-permeable or vapour-closed materials.
- Construction details showing how the EWI will connect or overlap with any existing or proposed roof insulation at eaves and verges and how the top of the EWI will be protected.

- Construction details showing how the EWI will connect or overlap with any existing or proposed floor insulation, including details of the type of insulation to be used below the damp proof course and below ground level, and how the ground adjacent to the building will be made good.
- Construction details of how the new windows and external doors will be fixed, and how the EWI will be configured around door and window openings (including soffits, reveals and cills) and at copings, abutments, etc.
- Details of how services such as electricity, TV, telephone and broadband cables and equipment, satellite dishes, gas or oil pipes, electricity and gas meters, lights, rainwater goods, brackets, etc. will be dealt with.
- The type and pattern of fixings.
- The types and locations of fittings (trays, beads, trims and flashings).
- The positions of starter tracks and render beads, and the positions and amounts of reinforcement scrim, corner mesh and scrim patches to be used at corners and around openings.
- The types and locations of weather seals and sealants.
- The types and positions of DPCs.
- The types and positions of fire barriers (if required).
- The locations of any movement joints and details of how they will be carried through the EWI layer.
- Details of how attachments such as gates, fences and satellite dishes will be dealt with.

Installation of EWI must be carried out by an approved installer recommended or recognised by the holder of the BBA Certificate for the ETICS. The installer must:

- Undertake to comply with the installation procedures specified by the holder of the BBA Certificate;
- Employ operatives trained and approved by the holder of the BBA Certificate, working in teams each containing at least one operative trained by the holder of the BBA Certificate; and
- Be subject to at least one inspection per year (including unannounced inspections) by the holder of the BBA Certificate to confirm that suitable site practices are being employed.

EWI installations are to be strictly in accordance with the designs reviewed by the Retrofit Coordinator and be consistent with the guidance in ***Best Practice Guide: External Wall Insulation*** published by the Insulated Render and Cladding Association (INCA) in 2015.

EWI should not be installed when the temperature is below 5ºC or above 25ºC.

- Before EWI is installed, the existing wall surfaces should be cleaned by brushing and/or power-washing with mild detergent solution, as appropriate, then allowed to dry out completely. EWI should only be applied to walls that are clean and completely dry.

Where the walls have existing rendered finishes, and the render is in poor condition, the render should be removed using a hammer drill. Areas of loose render should also be hammer tested and removed locally. Any small, rendered areas that have been removed should be made good with either sand and cement or a proprietary render repair system before the EWI is installed.

Insulation boards should be fixed to walls with 100% coverage of adhesive applied with a notched trowel to produce an adhesive coat between 2mm and 5mm in thickness. A minimum of four mechanical fixings should be used per square metre of wall unless a greater fixing frequency is specified in the design or the BBA certificate.

Insulation boards should be arranged so that vertical joints are staggered and boards are overlapped at building corners; the edges of boards must be butted tightly together; all joints and gaps should be filled with strips of insulation and/or with expanding polyurethane foam sealant, as appropriate, before the render coats are applied.

Insulation boards, once fixed and sealed, should be allowed to stabilise before basecoats, scrim and render finishes are applied.

All rendering is to be in accordance with the BBA Certificate for the ETICS and with BS EN 139141-1. Rendering should only be carried out when the weather is fine and free from rain. The base render should be applied in two coats, incorporate a scrim reinforcement layer between them and be completed by a finishing coat. Particular attention should be paid to thickness and to allowing adequate curing time after the application of each layer. Render finishes must be protected from rapid drying and should not be applied to elevations that are in direct sunlight or where the substrate is hot, or in high winds.

During breaks in the work (e.g. at weekends or during inclement weather) unfinished EWI should be protected by opaque tarpaulin or nylon-reinforced polythene temporarily restrained to the structure or scaffolding. Any insulation material that becomes wet must be cut out and replaced.

6 Provision of Guarantee

Within thirty days of the completion of each installation, the contractor is to provide the Retrofit Coordinator with a guarantee certificate issued by the Solid Wall Insulation Guarantee Agency (SWIGA) for each dwelling that has been insulated. The guarantee is to be valid for twenty-five years from the date of installation, and the certificate is to include the full address of the dwelling.

7 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing external solid wall insulation:

- All such work must be carried out in accordance with the guidance in Best Practice Guide: External Wall Insulation published by the Insulated Render and Cladding Association (INCA) in 2015.
- A pre-installation survey must be carried out by an assessor trained and approved by the contractor or by the specialist installer of the EWI. A written report of the survey must be supplied to the Retrofit Coordinator (see Section 3, above).
- Where it is determined that planning permission or Listed Building Consent is required for the installation of EWI, this is to be reported to the Client and no installation work is to be carried out until the required consent has been obtained (see Section 3, above).
- Following the pre-installation survey, an EWI design (drawings and specifications) must be prepared and submitted to the Client for approval. The design requirements are specified in Section 5, above.
- Installation must be carried out by an approved installer recommended or recognised by the holder of the BBA Certificate for the ETICS. The installer must comply with the installation procedures specified by the holder of the certificate, employ operatives trained and approved by the holder of the certificate, and be subject to at least one inspection per year by the holder of the certificate to confirm that suitable site practices are being employed (see Section 5, above).
- The contractor must provide the Retrofit Coordinator with a guarantee certificate issued by the SWIGA within thirty days of the completion of each installation (see Section 6, above).

Please note that following the Retrofit Assessment and Improvement Option Evaluation, a U-value of better than 0.3 W/m²K might be needed to help meet an overall heat demand target of 50 kWh/m²/year.

SPECIFICATION - INTERNAL SOLID WALL INSULATION (IWI)

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of internal solid wall insulation. The specifications describe the requirements of such insulation work and outline the process leading from the pre-installation assessment to the completion of the work. They also:

- Describe the issues that the pre-installation assessment must cover.
- Outline the requirements of the design that must be submitted by the Retrofit Designer following the completion of the initial assessment. This is whoever carries out the pre-installation survey – see section 3.
- Set out the requirements that the installer must follow, including ensuring that all installations are strictly in accordance with the designs reviewed by the Retrofit Coordinator and with the guidance in A Bristolians' Guide to Solid Wall Insulation (Bristol City Council 2015), as endorsed by the Department for Business, Energy and Industrial Strategy (BEIS) and the Sustainable Traditional Buildings Alliance (STBA).
- Detail the insulation process and the certificate that must be provided by the Contractor following completion of the work.

Note that in the case of internal wall insulation, less ambitious U-values are recommended in order to ensure that good moisture performance is achieved.

2 Requirements for Internal Solid Wall Insulation

Where walls are identified for the installation of internal wall insulation (IWI) the contractor is to install internal solid wall insulation as specified below. Where external solid wall insulation (EWI) is to be applied to adjoining walls or sections of walls, the EWI and IWI must overlap horizontally by at least 400mm, in order to minimise or eliminate thermal bridging.

3 Pre-Installation Survey

A pre-installation survey is to be carried out by an assessor trained and approved by the contractor or by a specialist installer of IWI. The assessment is to include:

- Assessment of whether the external walls are of vapour permeable construction (i.e. porous brickwork with lime mortar and lime plaster) or vapour sealed (i.e. with gypsum plaster or sand-cement render).

- A check of whether there is sufficient space for IWI to be installed without compromising access or circulation within the house.
- Measurement of the dimensions of the external walls, including heights and openings.
- Identification of services such as electricity, TV, telephone and broadband cables and equipment, sockets and switches, radiators, gas pipework, electricity and gas meters, lights, brackets, etc. that will have to be removed or repositioned prior to the installation of IWI and subsequently re-fixed, reconnected and made good.
- Assessment of how the IWI can be connected or overlapped with existing or proposed insulation in adjacent elements (other exposed walls, roofs and exposed floors) in order to minimise thermal bridging and preserve airtightness at the junctions.
- A record of any condensation or mould on internal wall surfaces, and assessment of any treatment required prior to the installation of IWI.
- A record of the external condition of the walls, especially of any defects in brickwork pointing or render finishes, and identification of any remedial work required prior to the installation of IWI.
- A record of any evident structural defects (e.g. cracks, bulges) and assessment of their causes and of the remedial work required before installation of IWI.
- A record of any evident rising or penetrating damp, and assessment of its causes and of the remedial work and drying out required before the installation of IWI.
- A record of any external efflorescence (lime bloom), or if efflorescence has been treated a check that the masonry has dried out sufficiently.
- A record of any existing movement joints that should be taken account of in the design of the IWI.

A written report of the survey is to be supplied by the Contractor to the Retrofit Coordinator.

4 Design

Once the pre-installation survey has been completed, a design (drawings and specifications) is to be prepared by the Retrofit Designer and submitted to the Retrofit Coordinator for review. The design should comply with the guidance in A Bristolians' Guide to Solid Wall Insulation (Bristol City Council 2015), as endorsed by the Department for Business, Energy and Industrial Strategy (BEIS) and the Sustainable Traditional Buildings Alliance (STBA).

5 Internal Solid Walls: Scope of Work

The design requirements are:

- The specified walls are to be insulated to achieve a thermal transmittance (U-value) of approximately 0.60 W/m^{2}K[1], with a maximum insulation thickness of 80mm. U-values are to be calculated in accordance with BS EN ISO 6946:2007 and BRE report BR443, and copies of the U-value calculations are to be supplied by the Retrofit Designer to the Retrofit Coordinator.
- Only vapour permeable ('moisture open') insulation materials, adhesives and finishes may be used. These materials are compatible with traditionally constructed buildings and have a greater capacity for moisture absorbance and drying than moisture closed, impermeable systems, thus reducing the risk of interstitial condensation and mould growth.
- The insulation layer is to consist of wood fibreboard with an integral mineral layer to help control moisture, e.g. NBT Pavadry or NBT Pavadentro as supplied by Natural Building Technologies (part of Soprema UK) of Witham, Essex, or equivalent products of equal thermal and moisture performance.
- The NBT Dry Lined Internal Wall Insulation System supplied by Natural Building Technologies is preferred, but the contractor may propose the use of other systems that provide equal thermal and moisture performance.
- The NBT system referred to above comprises of the following: a minimum 5mm thick layer of absorbent lime plaster applied to the prepared existing wall; an insulation layer of Pavadry tongued-and-grooved wood fibreboard with an integral mineral layer; Pavafix 60mm wide sealing tape for external corners, joints and edges; and an internal finishing layer of gypsum plasterboard or Fermacell board. The system is to be installed strictly in accordance with the supplier's instructions and recommendations.
- In locations where the thickness of the insulation is limited (e.g. window and door cills, soffits and reveals, or beside narrow stairways) high-performance vapour permeable insulation (e.g. NBT Reveal Board or plasterboard-faced aerogel board) should be used
- All IWI must be continuous (to eliminate thermal bridging) and airtight (to eliminate the possibility of warm moist air getting behind the insulation layer, causing condensation and mould growth). ***These requirements are critical and must be given detailed attention in the design.***
- In order to minimise thermal bridging, the IWI must connect to or overlap with existing or proposed roof insulation at eaves, gables and verges, as appropriate. Connection of the two insulation elements (or provision for connection) is preferred, but if a connection is not practical an overlap of at least 400mm is required.

[1]This is consistent with the guidance in **Building Regulations Approved Document L1B** (2013); note that the U-value of a floor depends on its exposed perimeter as well as on its construction, so for example an end of terrace house will require more insulation than a mid-terrace house to achieve the same U-value.

- In order to minimise thermal bridging and reduce condensation risk, the IWI must connect with any existing or proposed ground floor insulation.
- At junctions of the insulated external wall with party walls or with internal masonry partitions, in order to minimise thermal bridging, the IWI must be returned along party walls and along both sides of internal masonry partitions for a distance of at least 400mm.
- Where the existing windows and external doors are to be replaced, this work must be carried out at the same time as the IWI installation, and the contractors will be required to cooperate.
- The insulation applied to window and external door cills, reveals and soffits should overlap the new or existing window frames by at least 10mm (subject to there being sufficient clearance for window opening).
- As part of the installation process, electric power sockets and switches, and radiators located on the external wall, should all be re-located onto adjacent internal or party walls, as far as possible, in order to maintain the integrity of the air barrier. Where this is not possible, fixings through the IWI (e.g. for radiator brackets) are to be through timber blocks placed in the insulation layer, and pipework must run only on the warm side of the insulation, not through it. Wiring penetrations are to be minimised and are to be sealed with mastic at the back of the backbox; metal backboxes are to be replaced with plastic ones.

The drawings and specifications provided by the Retrofit Designer must include:

- The type of IWI system to be used. Only systems certified by the British Board of Agrément (BBA) as suitable for use as internal solid wall insulation are acceptable, and a copy of the BBA Certificate for the proposed system is to be supplied to the Retrofit Coordinator.
- Confirmation that the proposed IWI system includes only vapour permeable materials.
- Details of how the IWI will connect or overlap with existing or proposed roof insulation at eaves and verges.
- Details of how the IWI will connect or overlap with existing or proposed floor insulation.
- Details of how the windows will be dealt with, and how the IWI will be configured around door and window openings (including soffits, reveals and cills).
- Details of how services such as electricity, TV, telephone and broadband cables, power outlet sockets and switches, electricity and gas meters, lights, etc., will be dealt with.

Installation of IWI must be carried out by an installer trained and approved by the holder of the BBA Certificate for the IWI system. The installer must:

- Undertake to comply with the installation procedures specified by the holder of the BBA Certificate;
- Employ operatives trained and approved by the holder of the BBA Certificate, working in teams each containing a foreman and at least one in three operatives trained by the holder of the BBA Certificate; and
- Be subject to at least one inspection per year (including unannounced inspections) by the holder of the BBA Certificate to confirm that suitable site practices are being employed.

IWI installations are to be strictly in accordance with the designs reviewed by the Retrofit Coordinator and the suppliers' instructions and recommendations.The installation process is to consist of preparatory work, including removal of any existing wallpaper and any oil-based paint finishes, followed by installation of the internal wall insulation system in accordance with the approved design.

6 Provision of Guarantee

Within thirty days of the completion of the installation, the contractor is to provide the Retrofit Coordinator with a guarantee certificate issued by a recognised guarantee agency (e.g. Kinnell ECO). The guarantee is to be valid for twenty-five years from the date of installation, and the certificate is to include the full address of the dwelling. The contractor is also to provide the Retrofit Coordinator with a copy of the supplier's ten-year product warranty for the IWI system.

7 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing internal solid wall insulation:

- All such work must be carried out in accordance with the guidance in A Bristolians' Guide to Solid Wall Insulation (Bristol City Council 2015), as endorsed by the Department for Business, Energy and Industrial Strategy (BEIS) and the Sustainable Traditional Buildings Alliance (STBA).
- A pre-installation survey must be carried out by an assessor trained and approved by the contractor or by the specialist installer of the IWI. A written report of the survey must be supplied to the Retrofit Coordinator (see Section 3, above).

- Following the pre-installation survey, an IWI design (drawings and specifications) must be prepared and submitted by the Retrofit Designer to the Retrofit Coordinator for approval. The design requirements are specified above (see Section 5, above).
- Installation must be carried out by an approved installer recommended or recognised by the holder of the BBA Certificate for the ETICS. The installer must comply with the installation procedures specified by the holder of the certificate, employ operatives trained and approved by the holder of the certificate, and be subject to at least one inspection per year by the holder of the certificate to confirm that suitable site practices are being employed (see Section 5, above).
- The contractor must provide the Retrofit Coordinator with a guarantee certificate issued by a recognised guarantee agency within thirty days of the completion of each installation (see Section 6, above).

Please note that there may be alternative combinations of insulation type and/or thickness that would achieve similar U-values. Also, following the Retrofit Assessment and Improvement Option Evaluation, additional measures might be needed to help meet an overall heat demand target of 50 kWh/m²/year.

SPECIFICATION - REPLACEMENT WINDOWS AND EXTERNAL DOORS

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of replacement windows and external doors. The specifications describe the requirements of such work and outline the process leading from the initial review to the completion of the work. They also:

- Describe the requirements that all new windows and glazed doors must fulfil.
- Outline where and how new windows and doors should be installed.

Note that the maximum U-value of 1.2 W/m²K referred to in this document might need to be further improved to help achieve specific whole dwelling performance targets.

2 Initial Review

Where replacement windows and external doors are to be installed, the proposed make and specification of the new windows and external doors are to be reviewed by the Retrofit Coordinator prior to ordering.

3 Replacement Windows and External Doors: Scope of Work

All new windows and glazed doors are to have high-performance thermally broken composite timber | metal frames and be double-glazed with sealed units incorporating plastic (not metal) spacers, one low emissivity ('low e') coating and argon filing of the glazing cavity, all to achieve 'whole window' U-values not exceeding 1.2 W/m^{2}K. Opening lights are to be equipped with double seals and locking three-point 'espagnolette' type ironmongery that ensures the seals are compressed all around the frame when the windows are closed.

The entrance doors are to be of a proprietary timber or composite type, incorporating double weather seals, a viewing panel, a letterbox with brush seal, and appropriate ironmongery including 'espagnolette' type three-point locking to provide security and ensure that the seals are compressed all around the door when it is closed. Doors are to achieve whole-unit U-values not exceeding 1.2 W/m^{2}K.

Wherever possible, new windows and external doors are to be located in the plane of any existing or new external wall insulation, and the internal finishes are to be made good. Where external solid wall insulation (EWI) is proposed, replacement of windows and external doors must be carried out before the EWI installation, and the contractors will be required to cooperate. The new windows and external doors are to be supported in the plane of the insulation by a minimum of 50mm x 50mm timber battens around the entire perimeter of the openings, fixed to the walls and sealed with tape. Windows and doors are then to be fixed and sealed to the battens, and the EWI should overlap the frames by at least 10 mm, subject to there being sufficient clearance for window opening. Once the EWI has been installed, the windows are to be sealed into the openings from the inside, and the internal reveals of the window and door openings are to be made good.

4 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing replacement windows and external doors:

- The Retrofit Coordinator must review the make and specifications of all replacement windows and external doors before they are ordered (see Section 2, above).
- The specifications for windows and external doors are given in Section 3, above. Please note that all windows and doors should achieve whole-unit U-values not exceeding 1.2 W/m^{2}K. Also, following the Retrofit Assessment and Improvement Option Evaluation, lower U-values might be needed to help meet an overall heat demand target of 50 kWh/m^2/year.
- Wherever possible, new windows and external doors are to be located in the plane of any existing or new external wall insulation and the internal finishes are to be made good. Further details on placement and insulation are given in Section 3, above.

SPECIFICATION - LOFT INSULATION

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of loft insulation. The specifications:

- Describe the requirements of such work
- Outline the process leading from the pre-installation survey to the completion of the work.

Note that the insulation options provided in this document illustrate different methods that may be used. However, there may be alternative combinations of insulation type and/or thickness that would achieve similar U-values or that might be required to achieve predefined performance targets.

2 Pre-Installation Assessment

Where loft insulation is required, the Contractor is to carry out a pre-installation assessment, and define and agree the scope of work required to insulate the loft properly.

The pre-installation survey is to be carried out by an assessor trained and approved by the Contractor. The purpose of the survey is:

- To confirm the type of roof construction (including whether or not there are trusses or trussed rafters).
- To establish the type, thickness, location and extent of any existing insulation.
- To identify any services located in the loft (e.g. water tanks, ventilation equipment, solar PV installations, wiring, lighting).
- To establish how the loft is ventilated;
- To assess the severity of any condensation (and associated mould or rot);
- To identify any access constraints; and
- To determine whether the loft hatch is insulated and/or draught stripped.

A written report of the assessment is to be supplied to the Retrofit Coordinator.

3 Loft Insulation: Scope of Work

The scope of work to be carried out is to be reviewed with the Retrofit Coordinator, subject to the following requirements:

- Lofts are to be insulated to achieve a maximum thermal transmittance (U-value) of 0.11 W/m^{2}K, with at least 300mm thickness of mineral fibre quilt (placed between and over the ceiling joists); the U-value is to be calculated in accordance with BS EN ISO 6946: 2007 and BRE report BR443, and a copy of the U-value calculation is to be supplied to the Retrofit Coordinator.
- Where there is existing insulation in poor condition (i.e. disturbed, damaged or not covering the whole of the loft area) it is to be removed and replaced with new insulation to achieve the required standard.
- Where there is existing insulation in good condition additional insulation is to be added in order to bring thermal performance of the construction up to the required standard.
- Where the roof structure consists of simple rafters (possibly supported on purlins), new insulation is to consist of mineral fibre quilt in two layers, placed between the ceiling joists (to the full depth of the joists) and over the ceiling joists (at right angles to the direction of span) to achieve the required U-value, and covering the whole of the loft area.
- Where the roof structure consists of timber trussed rafters with braces connected to ties at ceiling level, quilt insultation is not to be used, and a loose insulant (e.g. blown mineral fibre, or vermiculite) is to be used instead. Care is to be taken to ensure that the insulation is evenly distributed across the loft space, to the required thickness, and does not block any fixed ventilation at the eaves or in gable walls.
- Insulated loft spaces must be adequately ventilated in accordance with the guidance in the BRE guide Thermal insulation: avoiding risks[1] : existing eaves ventilation equivalent to a continuous 25mm wide gap is to be maintained on two opposite sides of the loft, and not blocked by new insulation material (install proprietary plastic ventilation trays if necessary); existing tile ventilators, ridge ventilators and airbricks are to be inspected and cleared if necessary.
- If a loft space cannot be cross-ventilated (i.e. from one side to the other at eaves level) new tile ventilators or ridge ventilators are to be installed to facilitate adequate cross ventilation equivalent to that provided by a continuous 25mm wide gap at eaves level.
- Insulation material is to be placed in such a way that cold air (from outside or from inside the loft) cannot penetrate to the warm side of the insulation through gaps, joints between rolls of material, beside timber joists, at party-wall junctions or at the eaves.

[1] STIRLING C (2002) Thermal Insulation: avoiding risks BRE report BR262, ISBN 1-86081-515-4, BRE, Watford. See http://www.brebookshop.com/details.jsp?id=556

- Where water tanks are located in the loft, insulation is not to be placed beneath them; the sides and tops of tanks, and all associated pipework, are to be carefully insulated with an appropriate closely fitted insulating material which connects with the loft insulation, in accordance with the guidance in the BRE Guide Thermal insulation: avoiding risks (mineral wool quilt should be turned up the sides of the tanks to make the connection).
- Electrical wiring running in the loft space must not be buried beneath insulation; it must be disconnected, realigned to run on the cold side of the insulation, reconnected and tested; points where wiring penetrates through the insulation layer are to be carefully sealed to eliminate air leakage.
- Any recessed lighting fittings located in the ceiling (serving the rooms below) are to be boxed in plywood with 50 mm clear space all around each fitting, to separate them from the overlaid insulation.
- A timber storage platform is to be provided above the insulation, supported by legs or blocks fixed to the joists below (an approved proprietary platform product may be used); the platform should be at least 6m^2 in area and located adjacent to the loft hatch.
- Where the loft hatch is not already insulated, fix rigid plastic foam insulation to the top of the hatch, of a thickness sufficient to provide thermal performance equivalent to that of the adjacent loft insulation (approximately 150mm thick).
- Where the loft hatch is not already draught-proofed, install draught-proofing and ensure that the hatch has a catch that forces the hatch to compress the seal when it is closed.

4 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing loft insulation:

- Before installing loft insulation, the contractor must carry out a pre-installation assessment and provide a written report to the Retrofit Coordinator to define and agree the scope of work required to insulate the loft properly. The full purpose of the survey is detailed in Section 2, above.
- Following the assessment, the scope of work to be carried out must be reviewed with the Retrofit Coordinator, subject to the requirements set out in Section 3, above, which include ensuring that lofts are insulated to achieve a maximum U-value of 0.11 W/m^{2}K.

Note that following the Retrofit Assessment and Improvement Option Evaluation, additional measures might be needed to help meet an overall heat demand target of 50 kWh/m^2/year.

SPECIFICATION - PITCHED ROOF INSULATION

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of pitched roof insulation. The specifications:

- Describe the requirements of such work.
- Outline the process leading from the pre-installation survey to the completion of the work.
- **May need further enhancement to help achieve specific whole dwelling performance targets**

2 Pre-Installation Survey

Where roofs are to be insulated in the plane of the roof pitch, using insulation installed from below (i.e. without removing the roof covering, creating a 'warm loft'), any existing loft insulation installed in the plane of the horizontal ceiling is to be removed.

The roofs are to be insulated with an appropriate thickness of rigid or semi-rigid, insulation board (e.g. polyisocyanurate PIR, Polyurethane PU, phenolic board or mineral wool batts) to achieve a U value not exceeding 0.11 W/m^{2}K. The U-value of each roof is to be calculated in accordance with BS EN ISO 6946:2007 and BRE report BR443, and a copy of the U-value calculation is to be supplied to the Retrofit Coordinator.

A pre-installation survey is to be carried out by an assessor trained and approved by the Contractor. This is an assessor employed by the Contractor and is likely to be a different person from the one who carried out the Retrofit Assessment (and who may not necessarily be qualified as a Retrofit Assessor). The purpose of the survey is:

- To confirm that the roof is suitable for insulation by this method, and to identify any defects that must be repaired before the installation is installed.
- To confirm the type of roof construction (including whether or not there are trusses or trussed rafters).
- To establish the type, thickness, location and extent of any existing insulation.
- To identify any services located in the loft (e.g. water tanks, ventilation equipment, solar PV installations, wiring, lighting).
- To establish how the loft is ventilated;
- To assess the severity of any condensation (and associated mould or rot); and
- To identify any access constraints;

3 Pitched Roof Insulation: Scope of Work

A written report of the survey is to be supplied to the Retrofit Coordinator by the Contractor. The scope of work to be carried out is then to be reviewed with the Retrofit Coordinator, the Contractor and might also include the Client. subject to the following requirements:

- Any pitched ceilings in top-floor rooms are to be removed, to permit the installation of insulation.
- A vapour-permeable membrane (e.g. Intello) is to be fixed to the underside of the existing roof, wrapping the rafters tightly and spanning between them against the underside of the roof. The membrane is to be fixed by stapling it securely to the sides of the rafters, near the top, creating 'pockets' of the same depth as the rafters, in which insulation can be installed. Joints in the membrane are to be lapped at least 400mm and sealed with vapour permeable air-tightness tape. The edges of the membrane are also to be taped to surrounding surfaces.
- Insulation material is to be cut to fit tightly into the pockets between the rafters, and pushed into place, filling the whole length of the spaces between rafters, from the eaves to the ridge. The insulation is to be continuous at the ridge, i.e. the insulation boards in each pitch are to connect together. The insulation is also to connect with the wall insulation, at the eaves. Note that since a warm loft will be created, the existing eaves ventilation to the loft space need not be preserved.
- Fix a second layer of insulation beneath the rafters, in order to achieve the required U-value (see above) and reduce thermal bridging of the main insulation layer by the rafters. Note: if a finished ceiling is required in the insulated loft, a laminated insulation board consisting of PU insulation and plasterboard may be used in this position.
- In any top-floor rooms where pitched ceilings have been removed, replace the pitched ceilings, after the membrane and insulation have been installed between the rafters, with new laminated insulation board consisting of PU insulation and plasterboard, and make good at the junctions with the walls and the existing horizontal ceilings.

4 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing pitched roof insulation:

- Before installing pitched roof insulation, the Contractor must carry out a pre-installation survey and provide a written report to the Retrofit Coordinator to define and agree the scope of work required to insulate the loft properly. The full purpose of the survey is detailed in Section 2, above.
- Following the survey, the scope of work to be carried out must be reviewed with the Retrofit Coordinator, subject to the requirements set out in Section 3, above, which include ensuring that pitched roofs are insulated to achieve a U-value not exceeding 0.11 W/m^{2}K.
- The specific U-value of each roof is to be calculated in accordance with BS EN ISO 6946:2007 and BRE report BR443 (see section 3, above).

Depending on the outcomes of the Retrofit Assessment and Improvement Option Evaluation, an even lower U-value might be needed to help meet an overall heat demand target of 50 kWh/m^2/year

SPECIFICATION - FLAT ROOF INSULATION

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of flat roof insulation. The specifications:

- Describe the requirements of such work.
- May need further enhancement to help achieve whole dwelling performance targets.

2 Flat Roof Insulation: Scope of Work

Where flat roofs are required to be insulated they are to become 'warm deck' roofs (i.e. with insulation placed above the structural deck). Any insulation beneath the deck (i.e. within the void above the ceiling) is to be removed, and the ceiling is to be made good. Any existing rainwater goods are also to be removed.

The existing roof finishes are to be removed to expose the roof deck, and any wet, damaged or rotted areas of the deck are to be replaced[1]. A new waterproof membrane is to be fixed on top of the deck. The membrane is to extend at least 200mm up any abutting external wall of the house, and at least 200mm down the external wall of the flat roofed area (in both cases before any EWI is fixed) and sealed to those walls.

If external wall insulation (EWI) is proposed, the roof is to be extended at the edges to cover the top of the EWI, supported by short timber joists of the same depth as the insulation, fixed into the roof deck. Timber firrings are also to be fixed to ensure that the finished roof will drain correctly away from the house.

The roof is to be insulated with an appropriate thickness of rigid insulation board (extruded polystyrene EPS, extruded expanded polystyrene XPS, Polyisocyanurate PIR or Polyurethane PU) to achieve a U-value not exceeding 0.11 W/m^2K. The U-value of the roof is to be calculated by the Retrofit Designer in accordance with BS EN ISO 6946: 2007 and BRE report BR443, and a copy of the U-value calculation is to be supplied to the Retrofit Coordinator.

[1]If the existing roof deck is in poor condition it may be more appropriate and economical to replace the whole deck, using new plywood.

A new waterproof finishing membrane is to be fixed above the insulation and dressed down the face of new timber fascia boards and into new rainwater guttering. The extended eaves are to completely cover the top edge of any EWI, and not allow rainwater to penetrate behind the EWI. At any abutment, a 150mm high x 85mm thick block of insulation is to be fixed to the wall, and the waterproof finishing membrane is to be dressed over it and sealed to the wall, before any EWI is fixed above it.

3 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing flat roof insulation:

- The requirements for flat roof insulation are set out in Section 2, above. They include ensuring that flat roofs are insulated to achieve a U-value not exceeding 0.11 W/m^{2}K.
- The specific U-value of each roof is to be calculated in accordance with BS EN ISO 6946:2007and BRE report BR443 (see Section 2, above).

Depending on the outcomes of the Retrofit Assessment and Improvement Option Evaluation, an even lower U-value might be needed to help meet an overall heat demand target of 50 kWh/m^2/year.

SPECIFICATION - INTERMITTENT EXTRACT VENTILATION (IEV)

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of intermittent extract ventilation. The specifications describe:

- The purpose of the ventilation system.
- The ventilation system type.
- Ventilation capacity and control.
- Noise reduction.
- Ventilation system configurations.
- Protection and maintenance access.
- The removal of redundant ventilation.
- Installation and commissioning.
- Warranties.

2 The Purpose of the Ventilation System

The purpose of the ventilation system is:

1 To provide and maintain good indoor air quality (IAQ) by removing indoor pollutants (moisture, carbon dioxide and VOCs) and enabling a supply of 'fresh' external air.

2 To lower the internal relative humidity (RH) and reduce the vapour pressure differential between inside and outside to minimise surface condensation and eliminate the growth of mould.

3 Ventilation System Type

The system that is to be installed is intermittent extract ventilation (IEV). This system operates intermittently, under either manual or automatic control. Intermittent extract ventilation is only appropriate in dwellings with fabric air permeability greater than $5m^3/m^2h$ @ 50Pa. If the fabric air permeability is $5m^3/m^2h$ @ 50Pa or lower, a continuous ventilation system (e.g. cMEV, dMEV or MVHR) must be installed instead.

An IEV system extracts moist 'stale' air from 'wet' rooms (i.e. kitchens, bathrooms, utility rooms and any WC without an openable window) by a fan in each room, and exhausts it to the exterior either directly or via a short duct to an external terminal. Exhaust ducts are to be as short and straight as possible, with the number of bends kept to a minimum. All ductwork joints and connections are to be properly made and sealed with tape. Suitable external exhaust terminals are to be provided.

A balancing supply of 'fresh' external air to all living spaces and bedrooms is to be enabled via passive air inlets (i.e. without fans) or 'background ventilators' in all those rooms. Air inlets may be of 'through the wall' type, or located in window heads, including insect screens and where necessary external noise attenuation. At least one air inlet is to be provided in each living space and bedroom. Humidity sensitive background ventilators are recommended.

Airflow through the dwelling is to be facilitated by 10mm undercuts beneath all internal doors (or an equivalent area of ventilators installed in the doors at a low level).

4 Ventilation Capacity and Control

The ventilation system is to be capable of providing the minimum room ventilation rates specified in Building Regulations Approved Document F. Background ventilators in each room are to be sized in accordance with the guidance in Building Regulations Approved Document F.

The installed IEV system is to be manually controlled via switches, or via connections to light switches in the rooms where fans are located (except in kitchens). For each fan, an isolating switch for maintenance use should be located at a high level, to discourage occupants from disabling the ventilation.

5 Noise

The ventilation system design should include provisions to ensure that the location, configuration and fixing of the fans allows them to operate as quietly as possible, without unnecessary noise or vibration, inside or outside the dwelling. The maximum acceptable internal noise level in a room where a fan is operating is 30 dBLAeq,T. Noise levels should be measured as specified in BS 8233.

The specifier of the ventilation system should take account of the acoustic data provided by the fan manufacturer to ensure that noise levels are acceptable and do not cause annoyance to occupants. Noise levels lower than that specified are desirable in bedrooms, and higher noise levels may be acceptable in less sensitive rooms, such as kitchens.

6 Ventilation System Configurations

The specifier of the ventilation system is to provide the Retrofit Coordinator with a layout identifying all proposed equipment and showing on a sketch plan the locations of the fans, the exhaust points and all air inlets, and the routes and sizes of any ductwork. The specifier should also calculate the ventilation rates required for the dwelling and show that the proposed equipment will be capable of providing them. A copy of the ventilation rate calculations is to be given to the Retrofit Coordinator.

7 Protection and Maintenance Access

Where ductwork is fixed in an exposed position, it must be neatly boxed-in using material with half-hour fire resistance, and the boxing must be decorated by painting to match the surrounding surfaces.

8 Removal of Redundant Ventilation

All existing redundant ventilation equipment, including extract fans, ducts, terminals, switches, etc., is to be removed and the locations made good.

All existing, redundant ventilation openings in walls and ceilings (including airbricks) must be cleaned out then properly blocked by completely filling them with suitable, incombustible material, finished externally with brickwork and internally with covers to match the surrounding surfaces.

9 Installation and Commissioning

The ventilation system is to be installed, tested and commissioned by installers who have completed the NICEIC training course for ventilation system installers. The installers are to fit all fans, ducts, exhaust terminals and air inlets (unless the air inlets are background ventilators supplied ready-fitted to the windows) and complete any boxing-in and making good.

The ventilation system supplier is to provide written instructions for the householder about the correct operation of the ventilation system and the implications of not using it.

10 Warranty

The installed ventilation equipment is to be subject to the suppliers' guarantees and/or parts and labour warranties, copies of which are to be provided to the Retrofit Coordinator.

11 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing intermittent extract ventilation:

- The purpose of the ventilation system is to provide and maintain good indoor air quality while lowering internal relative humidity to eliminate the growth of mould (see Section 2, above).
- Intermittent extract ventilation is only appropriate in dwellings with fabric air permeability greater than 5m^3/m^2h @ 50Pa (see Section 3, above).
- The ventilation system must be capable of providing the minimum room ventilation rates specified in Building Regulations Approved Document F (see Section 4, above).
- The ventilation system design should include provisions to ensure that the location, configuration and fixing of the fans allows them to operate as quietly as possible (see Section 5, above).
- The specifier of the ventilation system must provide the Retrofit Coordinator with a layout identifying all proposed equipment and showing on a sketch plan the locations of the fans, the exhaust points and all air inlets, and the routes and sizes of any ductwork (see Section 6, above).
- Where ductwork is fixed in an exposed position, it must be neatly boxed-in using material with half-hour fire resistance (see Section 7, above).
- All existing redundant ventilation equipment, including extract fans, ducts, terminals, switches, etc., is to be removed and the locations made good (see Section 8, above).
- The ventilation system is to be installed, tested and commissioned by installers who have completed the NICEIC training course for ventilation system installers (see Section 9, above).
- The supplier must provide written instructions for the householder about the correct operation of the ventilation system and the implications of not using it (see Section 9, above).
- The installed ventilation equipment is to be subject to the suppliers' guarantees and/or parts and labour warranties, copies of which are to be provided to the Retrofit Coordinator (see Section 10, above).

SPECIFICATION - CENTRALISED MECHANICAL EXTRACT VENTILATION (CMEV)

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of centralised mechanical extract ventilation. The specifications describe:

- The purpose of the ventilation system.
- The ventilation system type.
- Ventilation capacity and control
- Noise reduction.
- Ventilation system configurations.
- Protection and maintenance access.
- The removal of redundant ventilation.
- Installation and commissioning.
- Warranties.

2 The Purpose of the Ventilation System

The purpose of the ventilation system is:

1 To provide and maintain good indoor air quality (IAQ) by removing indoor pollutants (moisture, carbon dioxide and VOCs) and providing a supply of 'fresh' external air.

2 To lower the internal relative humidity (RH) and reduce the vapour pressure differential between inside and outside to minimise surface condensation and eliminate the growth of mould.

3 Ventilation System Type

The system that is to be installed is demand-controlled centralised mechanical extract ventilation (DC cMEV). This system is to operate continuously (24/7), not intermittently, although intermittently increased ventilation rates or 'boost' should be provided in response to demand (see below).

Moist 'stale' air is to be extracted from 'wet' rooms (i.e. kitchens, bathrooms, utility rooms and WCs) and exhausted to the exterior via ductwork and a single centralised fan. Extract and exhaust ducts are to be as short and straight as possible, with the number of bends kept to a minimum. All ductwork joints and connections are to be properly made and sealed with tape. A suitable external exhaust terminal is to be provided.

A balancing supply of 'fresh' external air is to be admitted to all living spaces and bedrooms via humidity sensitive passive air inlets (i.e. without fans) in all living spaces and bedrooms. Air inlets are to be of 'through the wall' type, or located in window heads, including insect screens and where necessary external noise attenuation. At least one air inlet is to be provided in each living space and bedroom.

Air flow through the dwelling is to be facilitated by 10mm undercuts beneath all internal doors (or an equivalent area of ventilators installed in the doors at low level).

4 Ventilation Capacity and Control

The ventilation system is to be capable of providing 150% of the minimum whole-dwelling ventilation rates specified in Building Regulations Approved Document F. This capacity is required to allow the ventilation system to cope with over-occupancy and associated high moisture loads.

In order that high ventilation capacity does not result in excessive energy use or noise, the ventilation system is to be equipped with 'demand control' to ensure that ventilation rates are matched to demand, on a room-by-room basis, at all times. Demand control is to be achieved by sensing internal RH in all rooms and adjusting the supply and/or extract ventilation rates accordingly. The minimum ventilation rate is to be provided at or below 35% internal RH, and the maximum ventilation rate is to be provided at or above 65% internal RH. The system should be designed to control internal RH between 40% and 60%, as far as possible.

The installed system is to operate automatically and autonomously, without intervention from occupants. No manual controls or connections to light switches are to be provided. An isolating switch for maintenance use should be located within boxing or at high level in a service cupboard, to discourage occupants from disabling the ventilation.

5 Noise

The ventilation system design should include provisions to ensure that the location, configuration and fixing of the system allows it to operate as quietly as possible, without unnecessary noise or vibration, inside or outside the flat. The maximum acceptable internal noise level when the ventilation system is working at its background capacity shall be 30 dBLAeq,T in habitable rooms. Noise levels should be measured as specified in BS 8233.

The system designer should take account of the acoustic data provided by the fan manufacturer to ensure that system noise levels are acceptable and do not cause annoyance to occupants. Noise levels lower than that specified are desirable in bedrooms, and higher noise levels may be acceptable in less sensitive rooms, such as kitchens.

6 Ventilation System Configurations

The ventilation system supplier is to provide a layout identifying all proposed equipment and showing on a sketch plan the locations of the fan box, the extract and exhaust points and all air inlets, and the routes and sizes of all ductwork. The supplier should also calculate the ventilation rates required for the dwelling and show that the proposed design and configuration will be capable of providing them.

7 Protection and Maintenance Access

The fan box should be mounted at high level in a service cupboard, ceiling void or loft space. Where the fan box and/or ductwork are fixed in exposed positions, they must be neatly boxed-in using material with half-hour fire-resistance, and the boxing must be decorated by painting to match the surrounding surfaces. Boxing-in of the fan box should include a removable cover (fixed with screws) to allow access to the equipment for maintenance or repair.

8 Removal of Redundant Ventilation

All existing redundant ventilation equipment, including extract fans, ducts, terminals, switches, etc., is to be removed and the locations made good.

All existing, redundant ventilation openings in walls and ceilings (including airbricks) must be cleaned out then properly blocked by completely filling them with suitable, incombustible material, finished externally with brickwork (prior to the installation of internal or external solid wall insulation) and internally with covers to match the surrounding surfaces.

9 Installation and Commissioning

The ventilation system is to be installed, tested and commissioned by specialist installers trained and approved by the system supplier. The installers are to fit all air inlets, extract terminals, ducts, fans and the external exhaust terminal, including boxing-in and making good.

Commissioning records are to be provided to confirm that the performance of the installed system is as specified. The ventilation system installer is to provide written instructions for the householder, and a short face-to-face briefing, on the correct operation of the ventilation system and the implications of disabling it.

10 Warranty

The installed ventilation system is to be subject to the supplier's five-year performance guarantee and parts and labour warranty, a system-specific copy of which is to be provided to the Retrofit Coordinator by the Installer.

11 Overview

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing centralised mechanical extract ventilation:

- The purpose of the ventilation system is to provide and maintain good indoor air quality while lowering internal relative humidity to eliminate the growth of mould (see Section 2, above).
- The system that is to be installed is demand-controlled centralised mechanical extract ventilation (DC cMEV). This system is to operate continuously (24/7), not intermittently (see Section 3, above).
- The ventilation system must be capable of providing 150% of the minimum whole-dwelling ventilation rates specified in Building Regulations Approved Document F (see Section 4, above).
- The ventilation system design should include provisions to ensure that the location, configuration and fixing of the fans allows them to operate as quietly as possible (see Section 5, above).
- The ventilation system supplier is to provide a layout identifying all proposed equipment and showing on a sketch plan the locations of the fan box, the extract and exhaust points and all air inlets, and the routes and sizes of all ductwork (see Section 6, above).
- Where ductwork is fixed in an exposed position, it must be neatly boxed-in using material with half-hour fire-resistance (see Section 7, above).
- All existing redundant ventilation equipment, including extract fans, ducts, terminals, switches, etc., is to be removed and the locations made good (see Section 8, above).
- The ventilation system is to be installed, tested and commissioned by specialist installers who have been trained and approved by the system suppliers (see Section 9, above).
- The ventilation system installer is to provide written instructions for the householder, and a short face-to-face briefing, on the correct operation of the ventilation system and the implications of disabling it (see Section 9, above).
- The installed ventilation system is to be subject to the supplier's five-year performance guarantee and parts and labour warranty, copies of which are to be provided to the Retrofit Coordinator (see Section 10, above).

SPECIFICATION - DECENTRALISED MECHANICAL EXTRACT VENTILATION (DMEV)

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of decentralised mechanical extract ventilation. The specifications describe:

- The purpose of the ventilation system.
- The ventilation system type.
- Ventilation capacity and control.
- Noise reduction.
- Ventilation system configurations.
- Protection and maintenance access.
- The removal of redundant ventilation.
- Installation and commissioning.
- Warranties.

2 The Purpose of the Ventilation System

The purpose of the ventilation system is:

1 To provide and maintain good indoor air quality (IAQ) by removing indoor pollutants (moisture, carbon dioxide and VOCs) and providing a supply of 'fresh' external air.

2 To lower the internal relative humidity (RH) and reduce the vapour pressure differential between inside and outside to minimise surface condensation and eliminate the growth of mould.

3 Ventilation System Type

The system that is to be installed is decentralised mechanical extract ventilation (dMEV). This system is to operate continuously (24/7), not intermittently, although intermittently increased ventilation rates or 'boost' should be provided in response to demand (see below).

Moist 'stale' air is to be extracted from 'wet' rooms (i.e. kitchens, bathrooms, utility rooms and WCs) by a fan in each room, and exhausted to the exterior either directly or via a short duct to an external terminal. Exhaust ducts are to be as short and straight as possible, with the number of bends kept to a minimum. All ductwork joints and connections are to be properly made and sealed with tape. Suitable external exhaust terminals are to be provided.
A balancing supply of 'fresh' external air is to be admitted to all living spaces and bedrooms via passive air inlets (i.e. without fans) or 'background ventilators' in all living spaces and bedrooms. Air inlets may be of 'through the wall' type, or located in window heads, including insect screens and where necessary external noise attenuation. At least one air inlet is to be provided in each living space and bedroom.

Air flow through the dwelling is to be facilitated by 10mm undercuts beneath all internal doors (or an equivalent area of ventilators installed in the doors at low level).

4 Ventilation Capacity and Control

The ventilation system is to be capable of providing the minimum whole-dwelling background and boost ventilation rates specified in Building Regulations Approved Document F.

The ventilation system is to be equipped with a 'boost' facility to ensure that ventilation rates are increased, in response to internal relative humidity (RH). Every fan must include an RH sensor to invoke the boost facility. The background ventilation rate is to be provided at or below 50% internal RH, and the boosted ventilation rate is to be provided above 50% internal RH. The system should be designed to control internal RH between 40% and 60%, as far as possible.

The installed system is to operate automatically and autonomously, without intervention from occupants. No manual controls or connections to light switches are to be provided, except for switches in kitchens to manually invoke the boost. Isolating switches for maintenance use, connected to all fans, should be located within boxing or at high level in a service cupboard, to discourage occupants from disabling the ventilation.

5 Noise

The ventilation system design should include provisions to ensure that the location, configuration and fixing of the system allows it to operate as quietly as possible, without unnecessary noise or vibration, inside or outside the dwelling. The maximum acceptable internal noise level when the ventilation system is working at its background capacity shall be 30 dBLAeq,T in habitable rooms. Noise levels should be measured as specified in BS 8233.

The system designer should take account of the acoustic data provided by the fan manufacturers to ensure that system noise levels are acceptable and do not cause annoyance to occupants. Noise levels lower than that specified are desirable in bedrooms, and higher noise levels may be acceptable in less sensitive rooms, such as kitchens.

6 Ventilation System Configurations

The ventilation system supplier is to provide a layout identifying all proposed equipment and showing on a sketch plan the locations of the fans, the exhaust points and all air inlets, and the routes and sizes of any ductwork. The supplier should also calculate the ventilation rates required for the dwelling and show that the proposed design will be capable of providing them.

7 Protection and Maintenance Access

Where ductwork is fixed in an exposed position, it must be neatly boxed-in using material with half-hour fire-resistance, and the boxing must be decorated by painting to match the surrounding surfaces.

8 Removal of Redundant Ventilation

All existing redundant ventilation equipment, including extract fans, ducts, terminals, switches, etc., is to be removed and the locations made good.

All existing, redundant ventilation openings in walls and ceilings (including airbricks) must be cleaned out then properly blocked by completely filling them with suitable, incombustible material, finished externally with brickwork and internally with covers to match the surrounding surfaces.

9 Installation and Commissioning

The ventilation system is to be installed, tested and commissioned by installers who have completed the NICEIC training course for ventilation system installers. The installers are to fit all fans, ducts, exhaust terminals and air inlets, (unless the air inlets are background ventilators supplied ready-fitted to the windows) and complete any boxing-in and making good.

Commissioning records are to be provided by the installer to confirm that the performance of each fan and of the overall system are as specified. The installer is to provide written instructions for the householder, and a short face-to-face briefing on the correct operation of the ventilation system and the implications of disabling it.

10 Warranty

The installed ventilation system is to be subject to the supplier's performance guarantee and parts and labour warranty, a system-specific copy of which is to be provided to the Retrofit Coordinator.

11 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing decentralised mechanical extract ventilation:

- The purpose of the ventilation system is to provide and maintain good indoor air quality while lowering internal relative humidity to eliminate the growth of mould (see Section 2, above).
- The system that is to be installed is demand-controlled decentralised mechanical extract ventilation (dMEV). This system is to operate continuously (24/7), not intermittently (see Section 3, above).
- The ventilation system is to be capable of providing the minimum whole-dwelling background and boost ventilation rates specified in Building Regulations Approved Document F (see Section 4, above).
- The ventilation system design should include provisions to ensure that the location, configuration and fixing of the fans allows them to operate as quietly as possible (see Section 5, above).
- The ventilation system supplier is to provide a layout identifying all proposed equipment and showing on a sketch plan the locations of the fan box, the extract and exhaust points and all air inlets, and the routes and sizes of all ductwork (see Section 6, above).

- The fan box should be mounted at high level in a service cupboard, ceiling void or loft space. Where ductwork is fixed in an exposed position, it must be neatly boxed-in using material with half-hour fire-resistance (see Section 7, above).
- All existing redundant ventilation equipment, including extract fans, ducts, terminals, switches, etc., is to be removed and the locations made good (see Section 8, above).
- The ventilation system is to be installed, tested and commissioned by specialist installers who have been trained and approved by the system suppliers (see Section 9, above).
- The ventilation system installer is to provide written instructions for the householder, and a short face-to-face briefing, on the correct operation of the ventilation system and the implications of disabling it (see Section 9, above).
- The installed ventilation system is to be subject to the supplier's five-year performance guarantee and parts and labour warranty, copies of which are to be provided to the Retrofit Coordinator (see Section 10, above).

SPECIFICATION - MECHANICAL VENTILATION WITH HEAT RECOVERY (MVHR)

1 Overview

This specification provides essential information for all staff involved in either the procurement or the operational management of retrofit projects requiring the installation of mechanical ventilation with heat recovery. The specifications describe:

- The purpose of the ventilation system.
- The ventilation system type.
- Ventilation capacity and control.
- Noise reduction.
- Ventilation system configurations.
- Protection and maintenance access.
- The removal of redundant ventilation.
- Installation and commissioning.
- Warranties.

2 The Purpose of the Ventilation System

The purpose of the ventilation system is:

1 To provide and maintain good indoor air quality (IAQ) by removing indoor pollutants (moisture, carbon dioxide and VOCs) and providing a supply of 'fresh' external air.

2 To lower the internal relative humidity (RH) and reduce the vapour pressure differential between inside and outside to minimise surface condensation and eliminate the growth of mould.

3 Ventilation System Type

The system that is to be installed is whole-dwelling supply-and-extract mechanical ventilation with heat recovery (MVHR). This system is to operate continuously (24/7), not intermittently, although intermittently increased ventilation rates or 'boost' should be provided in response to demand (see below).

Moist 'stale' air is to be extracted from 'wet' rooms (i.e. kitchens, bathrooms, utility rooms and WCs) via ducts, filters and a heat exchanger, and exhausted to the exterior via a short, insulated duct to an external terminal. A balancing supply of external 'fresh' air is to be brough into the dwelling via a short, insulated duct, passed through a filter and the heat exchanger and supplied to living spaces and bedrooms via ducts and inlet terminals. The heat exchanger is to extract heat from the exhaust air and transfer it to the fresh air supply, thus providing warmed fresh air.

All ducts are to be as short and straight as possible, with the number of bends kept to a minimum. All ductwork joints and connections are to be properly made and sealed with tape. Suitable external intake and exhaust terminals are to be provided, and located at least 3m apart to minimise recirculation. The fan box, heat exchanger and all ductwork are to be installed within the insulated envelope of the dwelling; no equipment is to be installed in any unheated space. The fan box must be located and oriented so that there is easy access to the filters, for cleaning and/or replacement.

Air flow through the dwelling is to be facilitated by 10mm undercuts beneath all internal doors (or an equivalent area of ventilators installed in the doors at low level).

4 Ventilation Capacity and Control

The ventilation system is to be capable of providing the minimum whole-dwelling background and boost ventilation rates specified in Building Regulations Approved Document F. The system is also to be Passive House certified; system fan power is not to exceed the maximum permitted by Passive House certification, and heat recovery efficiency must be at least the minimum required for Passive House certification. To ensure efficient and cost-effective operation, fan power should be as low as possible and heat recovery efficiency should be as high as possible.

The system is to be equipped with a 'boost' facility to ensure that ventilation rates are increased, in response to increased levels of internal relative humidity (RH). The background ventilation rate is to be provided at or below 65% internal RH, and the boosted ventilation rate is to be provided above 65% internal RH in any wet room. The system should be designed to control internal RH between 40% and 60%, as far as possible.

The installed system is to operate automatically and autonomously, without intervention from occupants. No manual controls or connections to light switches are to be provided, except for switches in kitchens to manually invoke the boost. A system isolating switch for maintenance use, should be located within boxing or at high level in a service cupboard, to discourage occupants from disabling the ventilation.

5 Noise

The ventilation system design should include provisions to ensure that the location, configuration and fixing of the system allows it to operate as quietly as possible, without unnecessary noise or vibration, inside or outside the dwelling. The maximum acceptable internal noise level when the ventilation system is working at its background capacity shall be 30 dBLAeq,T in habitable rooms. Noise levels should be measured as specified in BS 8233.

The system designer should take account of the acoustic data provided by the manufacturer to ensure that system noise levels are acceptable and do not cause annoyance to occupants. Noise levels lower than that specified are desirable in bedrooms, and higher noise levels may be acceptable in less sensitive rooms, such as kitchens and bathrooms.

6 Ventilation System Configurations

The ventilation system supplier is to provide a layout identifying all proposed equipment and showing on a sketch plan the locations of the fan box and heat exchanger, the external exhaust and air inlet points, the internal air extract and supply points and the routes and sizes of all ductwork. The supplier should also calculate the ventilation rates required for the dwelling to show that the proposed design will be capable of providing them, and give a copy of the calculations to the Retrofit Coordinator.

7 Protection and Maintenance Access

Where ductwork is fixed in an exposed position, it must be neatly boxed-in using material with half-hour fire-resistance, and the boxing must be decorated by painting to match the surrounding surfaces.

8 Removal of Redundant Ventilation

All existing redundant ventilation equipment, including extract fans, ducts, terminals, switches, etc., is to be removed and the locations made good.

All existing, redundant ventilation openings in walls and ceilings (including airbricks) must be cleaned out then properly blocked by completely filling them with suitable, incombustible material, finished externally with brickwork and internally with covers to match the surrounding surfaces.

9 Installation and Commissioning

The ventilation system is to be installed and tested by specialist installers trained and approved by the system supplier. The installers are to fit and connect the fan box and heat exchanger, including the filters, and all ducts, supply and extract terminals, the exhaust terminal and the air inlet, and complete any boxing-in and making good. The system is to be commissioned by an independent MVHR specialist who is to adjust the supply and extract air-flow rates room-by-room, ensuring that they are within 5% of the specified rates and that the overall supply and extract rates are balanced to within + 5%.

Commissioning records are to be provided to confirm that the performance of the system is as specified. Copies of the commissioning records are to be given to the Retrofit Coordinator. The ventilation system installer is to provide written instructions for the householder, and a short face-to-face briefing on the correct operation and maintenance of the ventilation system (including regular cleaning or replacement of the filters) and the implications of disabling it.

10 Warranty

The installed ventilation system is to be subject to the supplier's performance guarantee and parts and labour warranty, a system-specific copy of which is to be provided to the Retrofit Coordinator.

11 Summary

The following key points should be noted by all staff responsible for procuring or operationally managing retrofit projects that involve installing mechanical ventilation with heat reduction:

- The purpose of the ventilation system is to provide and maintain good indoor air quality while lowering internal relative humidity to eliminate the growth of mould (see Section 2, above).
- The system that is to be installed is whole-dwelling supply-and-extract mechanical ventilation with heat recovery (MVHR). This system is to operate continuously (24/7), not intermittently (see Section 3, above).
- The ventilation system is to be capable of providing the minimum whole-dwelling background and boost ventilation rates specified in Building Regulations Approved Document F (see Section 4, above).
- The ventilation system design should include provisions to ensure that the location, configuration and fixing of the fans allows them to operate as quietly as possible (see Section 5, above).

SAMPLE JOB DESCRIPTION:

What is a Retrofit Coordinator?

All projects that have to comply with PAS 2035 must be coordinated from start to finish by a qualified Retrofit Coordinator (RC). It is recommended that when appointing a RC, they are commissioned to complete all steps in the PAS 2035 Process map for the first project. If measures identified in the Medium Term Investment are split over several projects over time the original Retrofit Coordinator may not be the available – in this case a new RC must be appointed.

The role of the RC includes the following six steps of any retrofit project:

- **Initial evaluation** - Agreeing on the intended outcomes of the project with the Client and completing an initial risk assessment.
- **Assessment** - Overseeing a Whole-dwelling Assessment by a qualified Retrofit Assessor and using that to identify options for improvement.
- **Planning** - Preparing a Medium-Term Improvement Plan for the building and agreeing the measures to be installed with the Client.
- **Design and installation** - Overseeing the design, specification and installation of the selected measures (working with a Retrofit Designer and specialist installers if required).
- **Handover** - Testing and handing over the completed installation, plus providing energy advice to the occupants and landlord.
- **Post-project evaluation** - Evaluating the project and giving feedback to the Client and project team. If the initial evaluation reveals any issues, another RC must make a more detailed evaluation and identify solutions to any problems.

The only way to become a RC is to attain the Level 5 Diploma in Retrofit Coordination and Risk Management offered by the Open College Network West Midlands. Training and assessment are available from The Retrofit Academy. On successful completion of this course, it is also necessary to join a TrustMark accreditation scheme to practice as an RC.

RCs can be independent, employed by the Client, or employed by any member of the project team, including contractors and installers. However, no matter who is employing them, the RC has to protect the interests of the Client and the public. Any conflicts of interest regarding the RC's role must be reported to the Client to be resolved.

A suggested sample of specifying a RC Job Role is shown here.

Retrofit Coordinator

Salary:* £ – £ plus pension

Term:**

Location:

Reports to:

Purpose of the Role

We are seeking to appoint a Retrofit Coordinator to coordinate from inception to completion all projects that are required to comply with Publicly Available Specification 2035 (PAS 2035). When discharging those duties, the Retrofit Coordinator is required to act at all times in the interests of both the Client (i.e. the occupants, the landlord and the funding body, or some combination of them) and the public.

The focus of this role is to undertake, coordinate or oversee the activities listed under "responsibilities" (below) during retrofit projects, ensuring compliance with the requirements of PAS 2035.

Responsibilities

- Agree with clients on the intended outcomes of each project undertaken.
- Revisit outcomes where appropriate and agree with all clients, including Resident Clients.
- Risk assess projects to determine PAS 2035 risk grades and paths.
- Oversee Whole-dwelling Assessments by qualified Retrofit Assessors.
- Prepare Improvement Option Evaluations to identify appropriate improvements.
- Create Medium-Term Improvement Plans for dwellings or types.
- Agree with clients on the measures to be installed immediately.
- Discuss where appropriate with Retrofit Designers to ensure all information is available to enable the most appropriate PAS 2035 compliant design.
- Oversee the design and specification of the selected measures by Retrofit Designers.
- Oversee and monitor the process of installing selected measures in accordance with designs.
- Oversee the testing, completion, and handover of completed installations.
- Ensure the provision of energy advice by a suitably qualified advisor to Resident Clients and landlords at three stages of each project.
- Complete basic evaluation of projects and feedback to clients and project teams.
- Collate evidence that all the above activities have been completed in accordance with the requirements of PAS 2035 and submit that evidence to organisations requiring compliance.
- Undertake intermediate or advanced monitoring of the work of other Retrofit Coordinators in cases in which the intended outcomes have not been achieved or unintended consequences produced.

Suggested Requirements (R = Required, D = Desirable)

- The Level 5 Diploma in Retrofit Coordination and Risk Management (R) – this is an essential requirement for PAS 2035 compliance.
- Outstanding organisational and coordination skills (R).
- Excellent oral and written communication skills (R).
- Excellent listening skills and the ability to engage with a diverse range of audiences (R).
- Project management experience (D).
- Proven ability to manage collaborations with a wide range of stakeholders and workers (D).
- Experience acting as an advocate and technical advisor on projects (D).
- Experience conducting risk assessments in the built environment sector (D).

Additional Information

* Market rates for salaries for Retrofit Coordinators are in the range of £32-38,000 per annum. A comprehensive Retrofit Coordinator salary package typically includes a bonus.

** Typically, Retrofit Coordinators are employed on temporary contracts to cover specific projects. Organisations may, however, wish to consider ways to make posts more permanent to ensure ongoing retrofit support. One option to explore could be retaining sub-contracted Retrofit Coordinators to ensure continuity.

CONCLUSION

The landscape is changing but retrofit and requirements to comply with retrofit standards are likely to be here to stay.

The challenge of retrofit sits with many organisations and individuals but LAs have the unique position of being able to tie into their other commissioning responsibilities for improving fuel poverty, wellbeing and emissions reduction targets.

As the roll out of LADs2, HUG, etc, takes place there will also be revisions to PAS 2035:2019, which will have to be observed and acted upon. However, the practical suggestions made in this toolkit will provide good practice to protect the Resident Client and to assist LAs to understand where the key interventions in PAS 2035:2019 compliance are.

Further Information

If you have questions on any aspect of this toolkit please contact The Midlands Energy Hub via email at MEH.SustainableWarmth@nottinghamcity.gov.uk or The Retrofit Academy at info@retrofitacademy.org.

If you are a member of The Retrofit Academy, you will find useful additional resources in the Member Area. If you would like to join us get in touch. We can also undertake tailored projects to support organisations with their retrofit projects.

RETROFIT ACADEMY CIC

Midlands Retrofit Toolkit

info@retrofitacademy.org