

## NOTE TO SUBSCRIBER:

This document is a combined PDF containing two PASs: PAS 2035:2019, incorporating Corrigendum No.1 2020 and PAS 2030, incorporating Corrigendum No.1 2020. PAS 2035 is the key over-arching document and should be used in conjunction with PAS 2030. Together, both documents supersede PAS 2030:2017.

PAS 2035:2019, incorporating Corrigendum No.1 2020

*Retrofitting dwellings for improved energy efficiency – Specification and guidance*

PAS 2030:2019, incorporating Corrigendum No.1 2020

*Specification for the installation of energy efficiency measures in existing dwellings and insulation in residential park homes*



# PAS 2035:2019

*Incorporating Corrigendum No. 1*

## Retrofitting dwellings for improved energy efficiency – Specification and guidance



Department for  
Business, Energy  
& Industrial Strategy

**bsi.**

## Publishing and copyright information

The BSI copyright notice displayed in this document indicates when the document was last issued.

© The British Standards Institution 2020

Published by BSI Standards Limited 2020

ISBN 978 0 539 06020 1

ICS 91.120.10, 91.140.10

*No copying without BSI permission except as permitted by copyright law.*

## Publication history

First edition June 2019

## Amendments issued since publication

Date	Text affected
29 February 2020	Corrigendum No.1 contains: <ul style="list-style-type: none"><li>• updates to the transition period in the Foreword;</li><li>• editorial correction to 3.9;</li><li>• update to the Note in 8.4.3;</li><li>• deletion of the Note in A.1.1; and</li><li>• editorial correction to table title in Table B.2.</li></ul>

# Contents

Foreword .....	ii	<b>12 Requirements for handover .....</b>	<b>25</b>
<b>0 Introduction.....</b>	<b>iv</b>	12.1 Specification of handover requirements .....	25
<b>1 Scope .....</b>	<b>1</b>	12.2 Handover recipients.....	25
<b>2 Normative references .....</b>	<b>3</b>	<b>13 Requirements for retrofit advice .....</b>	<b>26</b>
<b>3 Terms and definitions .....</b>	<b>5</b>	13.1 Qualifications for Retrofit Advisors .....	26
<b>4 Guidance about retrofit building physics.....</b>	<b>8</b>	13.2 Delivery of retrofit advice.....	26
4.1 Introduction.....	8	13.3 Retrofit advice: Path A.....	26
4.2 Building pathology .....	8	13.4 Retrofit advice: Paths B and C .....	27
4.3 Thermal models and calculations.....	8	<b>14 Requirements for monitoring and evaluation .....</b>	<b>28</b>
<b>5 Guidance about approaches to retrofit.....</b>	<b>10</b>	14.1 The purpose of monitoring and evaluation .....	28
5.1 Retrofit performance considerations, standards and constraints .....	10	14.2 Retrofit Evaluator.....	28
5.2 Medium-term improvement plans .....	10	14.3 Levels of monitoring and evaluation.....	28
5.3 Retrofit at scale .....	11	14.4 Basic monitoring and evaluation .....	28
5.4 Fabric first.....	11	14.5 Intermediate monitoring and evaluation.....	29
5.5 Concentrate on the interfaces.....	12	14.6 Advanced monitoring and evaluation.....	29
5.6 Retrofit advice .....	12	<b>15 Claims of compliance .....</b>	<b>30</b>
<b>6 Requirements for retrofit coordination and risk management .....</b>	<b>13</b>	15.1 General .....	30
6.1 Retrofit Coordinator .....	13	15.2 Basis of claim .....	30
6.2 Establishing intended outcomes .....	13	15.3 Permitted forms of disclosure .....	30
<b>7 Requirements for retrofit risk assessments .....</b>	<b>14</b>	<b>16 References .....</b>	<b>31</b>
7.1 Risk assessment process .....	14	16.1 Retrofit framework standards.....	31
7.2 Consequences of the outcome of the risk assessment .....	14	16.2 List of references (other than formal standards, for guidance only).....	33
7.3 Repeating the risk assessment.....	14	<b>Annexes</b>	
<b>8 Requirements for whole-dwelling assessments .....</b>	<b>15</b>	Annex A (Normative) Qualifications.....	34
8.1 The purpose of the assessment .....	15	Annex B (Normative) Risk Assessments.....	37
8.2 The Retrofit Assessor.....	15	Annex C (Normative) Requirements for provision of adequate ventilation .....	41
8.3 Assessment: Path A .....	15	Annex D (Normative) Requirements for dealing with interactions between EEMs .....	46
8.4 Assessment: Path B.....	15	Bibliography .....	48
8.5 Assessment: Path C.....	16	<b>List of tables</b>	
8.6 Reporting the assessment and handing over assessment data.....	16	Table B.1 – Risk assessment table for determining PAS 2035 Path .....	37
<b>9 Requirements for retrofit designs .....</b>	<b>18</b>	Table B.2 – Inherent technical risks of energy efficiency measures (EEMs).....	38
9.1 Design: Path A .....	18	<b>List of figures</b>	
9.2 Design: Path B .....	20	Figure 0.1 – A diagrammatic overview of the domestic retrofit process required by PAS 2035 and PAS 2030.....	v
9.3 Design: Path C .....	22	Figure 0.2 – A flow-chart illustrating the domestic retrofit process that users are expected to follow in order to meet the requirements of PAS 2035 .....	vi
<b>10 Requirements for installation of retrofit designs.....</b>	<b>23</b>	Figure D.1 – The measures interaction matrix.....	47
<b>11 Requirements for testing and commissioning .....</b>	<b>24</b>		
11.1 Requirements for testing .....	24		
11.2 Requirements for commissioning.....	24		
11.3 Test certificates and commissioning records .....	24		

# Foreword

This PAS was sponsored by the Department for Business, Energy and Industrial Strategy (BEIS). Its development was facilitated by BSI Standards Limited and it was published under licence from The British Standards Institution. It comes into effect on 30 June 2019.

Acknowledgement is given to Dr. Peter Rickaby, BSI Retrofit Standards Task Group, as the technical author, and the following organizations that were involved in the development of this PAS as members of the steering group:

- Association for Environment Conscious Building (AECB)
- British Board of Agrément (BBA)
- British Electrotechnical and Allied Manufacturers' Association (BEAMA)
- BSI Retrofit Standards Task Group
- Building Research Establishment (BRE)
- Building Services Research and Information Association (BSRIA)
- Build Test Solutions (BTS)
- Cavity Insulation Guarantee Agency (CIGA)
- Chartered Institute of Building (CIOB)
- Chartered Institution of Building Services Engineers (CIBSE)
- CORGI Fenestration
- Department for Business, Energy and Industrial Strategy (BEIS)
- Each Home Counts (EHC)
- Edwards Hart Ltd
- Electrical Contractors' Association (ECA)
- Elmhurst Energy
- Energy UK
- Environmental Change Institute (ECI), University of Oxford
- Fortem
- Historic Environment Scotland (HES)
- Institution of Engineering and Technology (IET)
- Mineral Wool Insulation Manufacturers Association (MIMA)
- Ministry of Housing, Communities and Local Government (MHCLG)
- National Inspection Council for Electrical Installation Contracting (NICEIC)
- National Insulation Association (NIA)
- Office of Gas and Electricity Markets (Ofgem)
- Oil Firing Technical Association (Oftec)
- Prewett Bizley Architects
- Rockwool
- Solid Wall Insulation Guarantee Agency (SWIGA)
- Sustainable Traditional Buildings Alliance (STBA)
- THS Inspection Services Ltd
- TrustMark
- United Kingdom Accreditation Service (UKAS)

Acknowledgement is also given to the members of a wider review panel who were consulted in the development of this PAS.

The British Standards Institution retains ownership and copyright of this PAS. BSI Standards Limited as the publisher of the PAS reserves the right to withdraw or amend this PAS on receipt of authoritative advice that it is appropriate to do so. This PAS will be reviewed at intervals not exceeding two years, and any amendments arising from the review will be published as an amended PAS and publicized in *Update Standards*.

This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.

The PAS process enables a Specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS can be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

## Supersession

PAS 2035:2019, incorporating Corrigendum No.1 2020 supersedes PAS 2035:2019 which will be withdrawn. Together with PAS 2030:2019, incorporating Corrigendum No.1 2020, PAS 2035:2019, incorporating Corrigendum No.1 2020 also supersedes PAS 2030:2017. This will be withdrawn on 30 June 2021.

## Relationship with other publications

PAS 2035 is intended to be read, and used, in conjunction with the current version of PAS 2030.

## Information about this document

The PAS provides a specification for the energy retrofit of domestic buildings and best practice guidance about domestic retrofit projects. It is intended not only to support the Each Home Counts quality mark (now known as the TrustMark Government endorsed quality scheme) for domestic retrofit (see Clause 1) but also to be applied to any domestic retrofit work carried out in the UK.

- ☐ PAS 2035:2019, incorporating Corrigendum No.1 2020 is published with the expectation that users intending to claim compliance with it will commence adoption of its provisions immediately following publication with a view to fully meeting its requirements and claiming compliance with PAS 2035:2019, incorporating Corrigendum No.1 2020 and therefore also PAS 2030:2019, incorporating Corrigendum No.1 2020, by 30 June 2021. During this period PAS 2030:2017 remains available for use where required but will be withdrawn on 30 June 2021. ☐

## Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to a competent person or persons for whose use it has been produced.

This PAS is not to be regarded as a British Standard, European Standard or International Standard. In the event that this PAS is used to form the basis of a full British Standard, European Standard or International Standard, it will be withdrawn.

BSI permits the reproduction of PAS 2035:2019, Figure D.1. This reproduction is only permitted where it is necessary for the user during the decision-making process for retrofit designs during each application of the PAS. A larger version of Figure D.1 is available.

## Presentation conventions

This PAS combines requirements for retrofit of domestic buildings with guidance about best practice in undertaking domestic retrofit projects.

Both requirements and guidance are presented in roman (i.e. upright) type, but they are distinguished in Clause and annex titles. Requirements are expressed in sentences in which the principal auxiliary verb is “shall”. Recommendations and guidance are expressed in sentences in which the principal auxiliary verb is “should”.

*Commentary, explanation and general informative material, e.g. notes, are presented in italic type, and do not constitute a normative element.*

## Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with this PAS does not confer immunity from legal obligations.

# 0 Introduction

## 0.1 Context

**0.1.1** Statutory national targets for the reduction of greenhouse gas emissions in response to the threat of climate change imply that very significant improvements need to be made in the energy efficiency of the UK's building stock, including nearly all its 27 million domestic buildings. The EU objective is to achieve Near Zero Energy Buildings throughout the EU. This PAS supports work towards those objectives by promoting and defining technically robust and responsible "whole-building" domestic retrofit work, i.e. high-quality work, that supports:

- improved functionality, usability and durability of buildings;
- improved comfort, health and well-being of building occupants and visitors;
- improved energy efficiency, leading to reduced fuel use, fuel costs and pollution (especially greenhouse gas emissions associated with energy use);
- reduced environmental impacts of buildings;
- protection and enhancement of the architectural and cultural heritage as represented by the building stock;
- avoidance of unintended consequences related to any of the above;
- minimization of the "performance gap" that occurs when reductions in fuel use, fuel cost and carbon dioxide emissions are not as large as intended or predicted.

**0.1.2** The requirements and guidance presented in this PAS are intended to apply to improvement measures in the context of a holistic approach to retrofit that takes the points listed above into account. The holistic approach considers the building as a system of elements, interfaces and occupants that interact, and not as a set of elements that are independent of each other or of occupants' practices and lifestyle.

**0.1.3** This PAS is intended to support both the one-off installation of improvement measures and a staged approach in which improvement measures are implemented over time. It is compatible with current national and EU schemes including the Building Performance Institute Europe scheme and Building Renovation Passports.

## 0.2 Each Home Counts

**0.2.1** In 2015 the Government commissioned the Each Home Counts review [8] (originally known as the Bonfield Review) to determine ways of improving the confidence of both Government and consumers in the domestic retrofit industry and improving the quality of retrofit work. The report of the review published in December 2016 contains 27 recommendations including the establishment of a quality mark for domestic retrofit supported by an industry Code of Conduct, a Consumer Charter and a framework of technical standards for retrofit. The quality mark has subsequently been established as the TrustMark Government endorsed quality scheme.

## 0.3 The retrofit standards framework

**0.3.1** PAS 2035 is the over-arching document in the retrofit standards framework, with which users of the TrustMark Government endorsed quality scheme are required to comply when carrying out domestic retrofit work. All the other standards referred to in this PAS are part of the retrofit standards framework (see Clause 16); users of the TrustMark Government endorsed quality scheme should also comply with those standards, as appropriate. PAS 2035 may also be applied to retrofit projects outside the TrustMark quality assurance framework.

## 0.4 The relationship with PAS 2030

**0.4.1** Designs for the installation of retrofit measures in domestic buildings that are prepared in accordance with PAS 2035 are required to be installed, commissioned and handed over in accordance with PAS 2030:2019, or in some cases in accordance with the Microgeneration Certification Scheme (MCS) standards [N7], [N8].

**0.4.2** Requirements for the installation, commissioning and handover of retrofit measures are provided in PAS 2030, or in some cases in the MCS standards. Users of PAS 2030:2019 are required to work to designs that comply with this PAS.

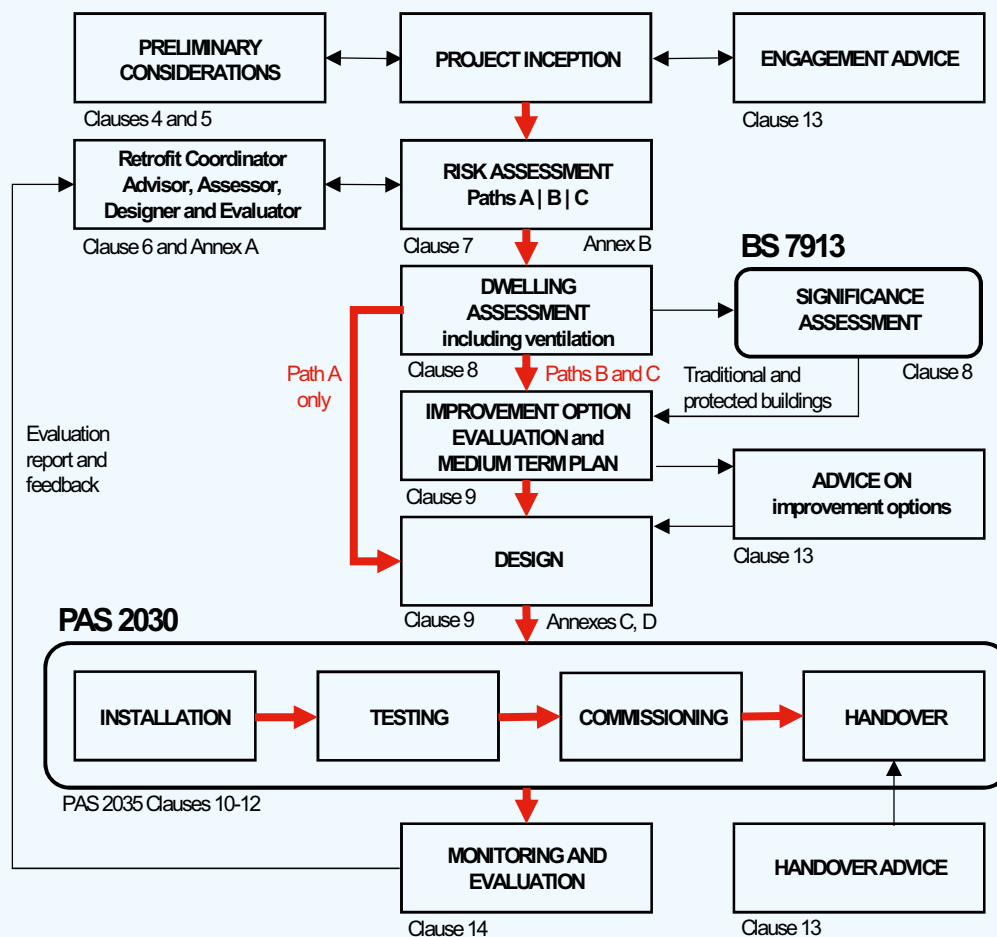
**0.4.3** Thus, for domestic retrofit projects, PAS 2035 and PAS 2030:2019 are effectively "locked together", because one standard may not be used without the other. The only exception is installation of some measures in accordance with the MCS standards, rather than PAS 2030, where specified.



## 0.5 The PAS 2035 process

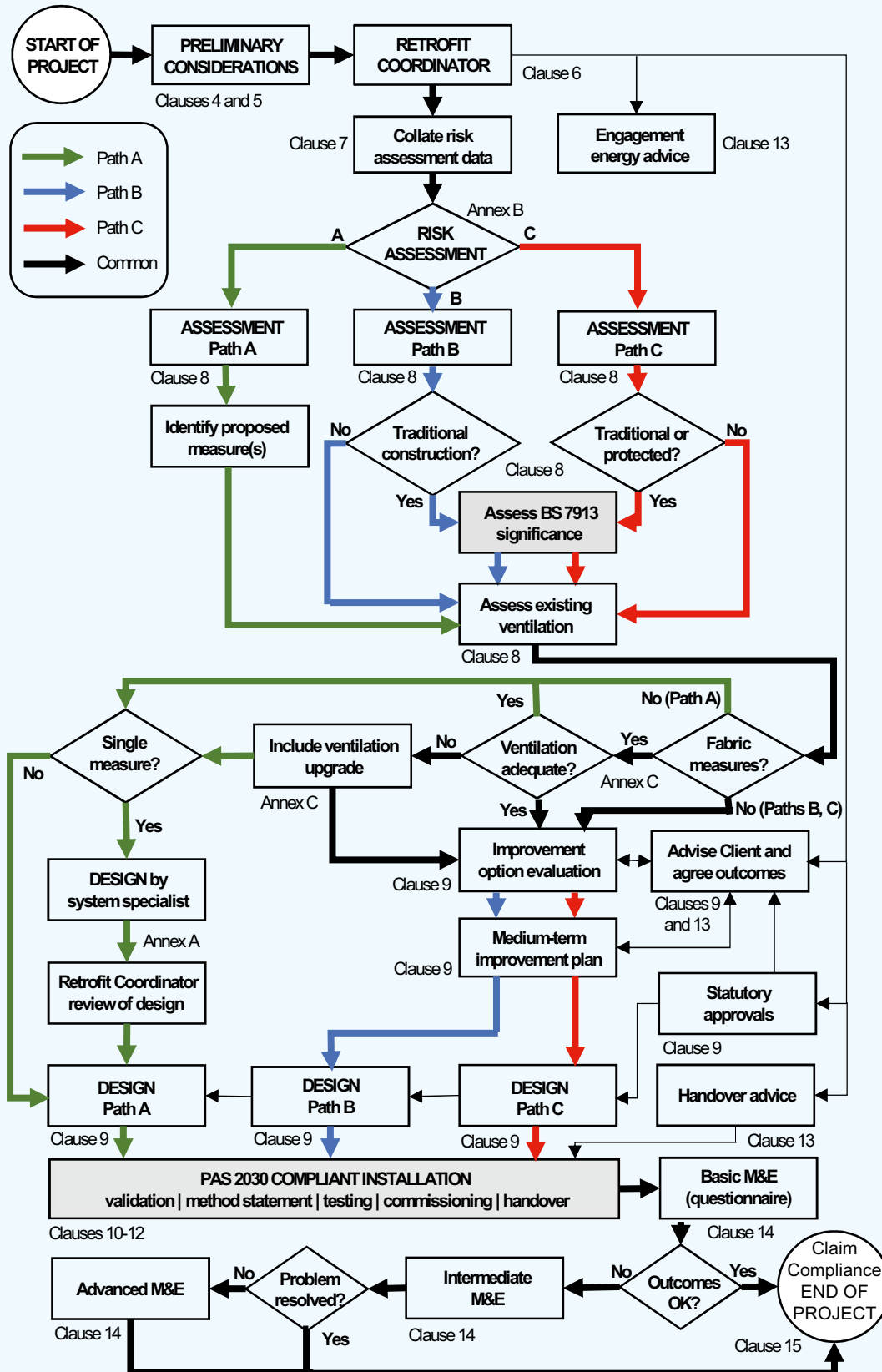
0.5.1 Figure 0.1 illustrates the broad overall process that users of PAS 2035 are expected to follow in order to comply with its requirements.

**Figure 0.1** – A diagrammatic overview of the domestic retrofit process required by PAS 2035 and PAS 2030



0.5.2 Figure 0.2 illustrates in more detail the process that users of PAS 2035 are expected to follow in order to comply with its requirements.

Figure 0.2 – A flow-chart illustrating the domestic retrofit process that users are expected to follow in order to meet the requirements of PAS 2035



# 1 Scope

This PAS specifies requirements for retrofit of dwellings, including:

- assessment of dwellings for retrofit;
- identification and evaluation of improvement options (energy efficiency measures, or EEMs);
- design and specification of EEMs (whether individual measures or packages of multiple measures); and
- monitoring and evaluation of retrofit projects.

This PAS covers EEMs that are intended to:

- improve the insulation of the elements of the building fabric (exposed floors, walls, roofs, windows and external doors) and reduce thermal bridging;
- improve the air-tightness of the building envelope;
- establish a safe dynamic moisture equilibrium through each element of the building fabric;
- improve the resistance of the building envelope to water penetration in order to maintain the thermal properties of the building fabric and the capability of the building envelope to manage moisture in a manner suited to its construction;
- provide or upgrade ventilation to ensure good internal air quality and minimize the risk of condensation;
- minimize the risks associated with vapour or other products, for example volatile organic compounds (VOCs), released within buildings subsequent to their air-tightness being improved;
- minimize the risks associated with overheating;
- provide efficient heating and cooling systems with responsive, intelligent or “smart” controls, including systems that use low or zero carbon (LZC) technologies;
- provide efficient water heating systems with responsive controls, including systems that use LZC technologies;
- provide efficient fixed lighting with appropriate controls;
- provide efficient appliances and equipment to reduce electricity use and minimize internal heat gains;
- provide locally generated renewable electric power systems that use LZC technologies;
- provide on-site energy storage to improve the usefulness of energy generated by LZC technologies; and

- provide metering and monitoring systems to promote the efficient use of energy.

In addition to setting out requirements for the commissioning and handover of all of the above, this PAS also specifies requirements for advising building occupants about improvement options appropriate to their homes, and the efficient and appropriate use and maintenance of their retrofitted homes as well as for monitoring and evaluating retrofit projects when appropriate, and feeding back lessons learned to all parts of the supply chain, including the building occupants.

Many aspects of domestic retrofit are covered by existing standards. Where appropriate, those standards are referred to in this PAS, and compliance with the standards referred to is thereby a requirement of this PAS.

This PAS and the retrofit standards framework may be applied to all domestic retrofit activity and embrace work that is initiated, procured, funded and delivered in a wide variety of ways including:

- programmes of retrofit promoted and/or funded by national or local government schemes;
- programmes of retrofit initiated and/or funded by landlords, including social housing organizations, private landlords in the domestic sector and commercial property portfolio holders;
- retrofit of individual buildings by their owners and/or occupants, including both domestic and commercial owner-occupiers;
- retrofit that is integrated with and forms part of broader repairs, maintenance and improvement (RMI) activity related to individual buildings or building stocks.

This PAS and the retrofit standards framework may also be applied not only to retrofit work carried out by commercial building contractors and specialist installers of retrofit measures but also to work carried out by local SME builders and independent trades people working alone or in small teams.

## PAS 2035:2019

This PAS does not apply to maintenance or repair of any element of an existing dwelling, or system installed in it, which does not involve improvement of the energy performance or ventilation of the dwelling, or a reduction of the carbon dioxide emissions associated with energy use in the dwelling. Nor does this PAS apply to “like-for-like” replacement of damaged or worn out elements or systems that do not involve improvement of the energy performance or ventilation of the dwelling, or a reduction of the carbon dioxide emissions associated with energy use in the dwelling.

***NOTE** Appropriate repair and maintenance of the building fabric can improve energy efficiency and should always be the first step in energy efficiency improvements, even though it is not covered in this PAS. Otherwise an unacceptable level of risk to the future condition of the building might be introduced.*

## 2 Normative references

References, which form part of the retrofit standards framework, are listed in Clause 16.

Of the documents listed in Clause 16, the following references are central to the application of this PAS. They are referred to in the text in such a way that some or all of their content constitutes provisions of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

### Standards publications

BS 5250, *Code of practice for control of condensation in buildings*

BS 7913, *Guide to the conservation of historic buildings*

BS 8233, *Guidance on sound insulation and noise reduction for buildings*

BS EN 13141-1, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Externally and internally mounted air transfer devices*

BS EN 13141-4, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Fans used in residential ventilation systems*

BS EN 13141-6:2014, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Exhaust ventilation system packages used in a single dwelling*

BS EN 13141-7, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Performance testing of a mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for single family dwellings*

BS EN 13141-11, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Supply ventilation units*

BS EN 31010, *Risk management – Risk assessment techniques*

BS EN ISO 14021, *Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)*

PAS 2030:2019, *Specification for the installation of energy efficiency measures (EEM) in existing dwellings and insulation in residential park homes*

### Other publications

[N1] ROYAL INSTITUTION OF CHARTERED SURVEYORS. *Surveys of residential property*. London: RICS, 2016.

[N2] BUILDING RESEARCH ESTABLISHMENT. *IP1/06 Assessing the effects of thermal bridging at junctions and around openings*. Bracknell: BRE, 2006.

[N3] CHARTERED INSTITUTION OF BUILDING SERVICES. *TM59 Design methodology for the assessment of overheating risk in homes*. London: CIBSE, 2017.

[N4] UK Climate Impacts Programme (UKCIP) at [www.ukcip.org.uk](http://www.ukcip.org.uk).

[N5] BRITISH BLIND AND SHUTTER ASSOCIATION. *Guide to low energy shading*. Suffolk: BBSA, 2015.

[N6] AIR TIGHTNESS TESTING AND MEASUREMENT ASSOCIATION. *(TSL1) Measuring air permeability in the envelopes of dwellings*. Amersham: ATTMA September 2016.

[N7] Microgeneration Certification Scheme (MCS) *Product Standards* at <https://www.microgenerationcertification.org/mcs-standards/product-standards>.

[N8] Microgeneration Certification Scheme (MCS) *Installer Standards* at [www.microgenerationcertification.org/mcs-standards/installer-standards](http://www.microgenerationcertification.org/mcs-standards/installer-standards).

[N9] DEPARTMENT FOR BUSINESS, ENERGY AND INDUSTRIAL STRATEGY. *Supporting the delivery of energy efficiency advice to consumers during smart meter installations*. London: BEIS, 2016.

[N10] BUILDING SERVICES RESEARCH AND INFORMATION ASSOCIATION. *Domestic ventilation systems*. Bracknell: BSRIA, 2013.

[N11] MINISTRY OF HOUSING, COMMUNITIES AND LOCAL GOVERNMENT. *The Building Regulations 2010 – Approved Document F: Ventilation*. 2010 ed. incorporating 2010 and 2013 amendments. London: National Building Specification (NBS), 2013.

[N12] Building Standards Technical Handbook 2017: *Domestic buildings*. Available at <https://www.gov.scot/publications/building-standards-2017-domestic/>

[N13] BUILDING CONTROL NORTHERN IRELAND. *Building Regulations (Northern Ireland) 2012 Guidance: Technical Booklet K: Ventilation*. Building Control NI, 2012.

[N14] BUILDING SERVICES RESEARCH AND INFORMATION ASSOCIATION. *Flexible ductwork*. Bracknell: BSRIA, 2006.

## 3 Terms and definitions

The following terms and definitions are considered indispensable to the understanding and application of this PAS.

### 3.1 client

property owner, householder, landlord and/or tenant of a dwelling that is subject to retrofit, sometimes also including the funding body

**NOTE** In this PAS the term *client* refers to the recipient of domestic retrofit work.

### 3.2 commissioning

activities that ensure that an installed retrofit measure (EEM), or a package of measures that form a retrofit design, operates within the boundaries and conditions of the design specification

### 3.3 conventional (construction)

masonry cavity wall construction (brick and/or block) with or without render, tile hanging or other external cladding

### 3.4 dwelling

a self-contained unit of accommodation such as a house or flat or park home used by one household as a home

### 3.5 dwelling assessment

process of assessing the characteristics of an existing dwelling, including its local context, built form, construction, services, condition and energy efficiency and occupancy, in order to provide information for the preparation of a retrofit design

### 3.6 (EEM) product

item intended for installation in existing buildings for the purpose of enhancing the energy efficiency of those buildings, that is not made available as an (EEM) system

### 3.7 energy efficiency measure (EEM)

planned work undertaken to improve the energy performance of a building by saving or generating energy

### 3.8 handover

process by which completed retrofit work is transferred from the retrofit project team (i.e. the Retrofit Coordinator) to the Client, together with the delivery of appropriate documentation and advice

### 3.9 high-rise (building)

a building over  $\geq 12$  metres or over four storeys in height above the ground

### 3.10 installation

location, placement and/or fixing of an energy efficiency measure in, or connected to, an existing building excluding any related work to enable the installation of the measure

### 3.11 (installation) location

building or group of buildings that are the subject of EEM installation(s)

### 3.12 (installation) method statement

definition of sequence of actions to be undertaken in installing one or more EEM products or systems in accordance with their specification, in a safe manner at a building

**NOTE** An installation method statement can be a single document prepared specifically for this purpose or could consist of a collection of documents, in the sequence of required application, contributing to the complete definition of the intended method.

### 3.13 measures interaction matrix

chart that illustrates the ways in which measures interact in a domestic building and indicates action to be taken by the Retrofit Designer when developing the retrofit design

### 3.14 monitoring and evaluation

process by which the effectiveness of a retrofit project is measured and evaluated after completion, with reference to the intended and actual outcomes, in order to identify and correct problems and provide feedback to improve subsequent projects

### 3.15 operative

person employed by the Retrofit Installer, either directly or under a subcontract arrangement, to undertake installation tasks on an EEM in accordance with the relevant method statement

*NOTE Related requirements are given in PAS 2030:2019.*

### 3.16 pre-installation building inspection

inspection undertaken by or on behalf of, the Retrofit Installer prior to commencement of installation to confirm that the EEM design provided by the Retrofit Designer is complete and can be fulfilled at the location specified

*NOTE 1 Requirements on carrying out this inspection are given in PAS 2030:2019.*

*NOTE 2 The inspection can show that the proposed installation does not result in non-compliance with statutory requirements and/or generally accepted industry good practice.*

### 3.17 professional qualification

recognition of building-related knowledge and capability involving registration by a professional body, based on training and/or academic study to at least degree level

Note For example, the Architects Registration Board (ARB), the Chartered Institute of Architectural Technologists (CIAT), the Royal Institution of Chartered Surveyors (RICS), the Chartered Institution of Building Services Engineers (CIBSE) or the Chartered Institute of Building (CIOB).

### 3.18 proprietary (EEM) system

combination of products and materials together with any related installation method, equipment requirements and performance objectives, placed on the market exclusively by a specific supplier, for installation in existing buildings for the purpose of enhancing the energy efficiency of those buildings

### 3.19 protected (building)

a building that is Listed as of special architectural or historic interest, or located in a Conservation Area or World Heritage Site

### 3.20 Recognition of Prior Experience and Learning (RPEL)

process by which prior experience and learning is assessed against relevant criteria to provide evidence for credit towards a vocational qualification

### 3.21 Register of Regulated Qualifications

register of nationally accredited professional and vocational qualifications maintained by Ofqual for England and by its equivalents for the devolved nations

### 3.22 retrofit advice

advice given to a client or householder during the retrofit process about the process, the evaluation of improvement options, the selection of improvement measures (EEM), the retrofit design, the operation and maintenance of installed measures, or how to operate a home in an energy efficient way, after retrofit

### 3.23 Retrofit Advisor

person qualified to deliver retrofit advice to clients and householders

*NOTE See A.1.1 for details on the qualifications needed for this role.*

### 3.24 retrofit assessment

survey, inspection and assessment of a building to collate information for a retrofit design

### 3.25 Retrofit Assessor

person qualified to carry out a retrofit assessment

*NOTE See A.2 for details on the qualifications needed for this role.*

### 3.26 Retrofit Coordinator

person qualified as a specialist retrofit project manager, taking overall responsibility for overseeing the assessment of dwellings, the identification, specification and evaluation of energy efficiency measures for installation at a given dwelling as a single project, and their subsequent monitoring and evaluation

See Clause 6 and A.3 for details on the qualifications needed for this role.



### 3.27 retrofit design

package of information prepared by a Retrofit Designer that determines the unique combination of EEM systems, products, materials and their interrelationships, to be installed in a building in order to achieve specified energy efficiency and other outcomes for that building

### 3.28 Retrofit Designer

person qualified to prepare a retrofit design

**NOTE** See A.4 for details on the qualifications needed for this role.

### 3.29 Retrofit Evaluator

person qualified to monitor and evaluate the effectiveness of a retrofit project and provide feedback to the Client and/or the project team

**NOTE** Note See A.5 for details on the qualifications needed for this role.

### 3.30 Retrofit Installer

person or organization undertaking the physical placement of an energy efficiency measure(s) in an existing building

**NOTE** See PAS 2030 for further details.

### 3.31 retrofit risk assessment

process of assessing the risks associated with a retrofit project in order to determine which of the three requirement Paths should be chosen

**NOTE** Further details on the Paths are given in Clauses 7, 8, 9 and 13.

### 3.32 system-built (building)

building of frame (timber, steel or concrete) and pre-fabricated panel (concrete or timber, or a combination) construction, or timber-framed construction with brick or stone external cladding

### 3.33 thermal bridge

area of the building envelope where the insulation is:

- a) discontinuous or thinner than the adjacent insulation;
- b) has higher thermal conductivity than the adjacent insulation; or
- c) has reduced effectiveness due to the building geometry;

leading to locally increased heat loss and therefore locally reduced internal surface temperature

### 3.34 thermal by-pass

unintended penetration or circulation of external air on the warm side of the insulation layer in a construction, rendering the insulation ineffective

### 3.35 toolbox talk

meeting of the Retrofit Coordinator with the Retrofit Installer and installation operatives to explain the design intent and draw attention to key points

### 3.36 traditional (construction)

building construction consisting of solid brick or stone external walls, or pre-1919 timber-framed external walls with any infill

### 3.37 ventilation assessment

assessment of the adequacy of an existing ventilation system in a building that is to be retrofitted

**NOTE** See Annex C for the requirements on providing adequate ventilation.

### 3.38 ventilation upgrade

replacement or improvement of an existing ventilation system as part of a retrofit process

**NOTE** See Annex C for the requirements on providing adequate ventilation.

## 4 Guidance about retrofit building physics

### 4.1 Introduction

**4.1.1** Persons involved in domestic retrofit projects, including Retrofit Advisors, Retrofit Assessors, Retrofit Coordinators, Retrofit Designers and Retrofit Evaluators, should have working knowledge of building physics (also known as building science), appropriate to the nature and scale of the retrofit project(s) on which they work, and the types of buildings, with emphasis on the movement of heat, moisture and air through dwellings.

**4.1.2** Occupants' comfort, health and safety depend on control and management of the flows of heat, moisture and air through their homes, in order to maintain appropriate dynamic thermal and moisture equilibriums. The dynamic heat balance of a dwelling (i.e. the way in which heat losses are satisfied by heat inputs) is an important element of its energy efficiency. The moisture balance of a home is important to the maintenance of healthy internal conditions.

### 4.2 Building pathology

**4.2.1** Building pathology is the process by which the history and condition of a building, and its suitability for improvement, are analysed systematically, as part of its assessment for retrofit.

**4.2.2** This type of analysis helps to establish the condition of the building and to identify defects and performance failures. It also establishes how defects have arisen and identifies the work that should be carried out not only to repair them and restore performance, prior to retrofit, but also to prevent them from recurring.

**4.2.3** It is important when a dwelling is assessed for retrofit, and when improvement options are evaluated, that the dwelling is treated as a system comprising the building envelope (or building fabric), the building services (ventilation, heating, hot water, lights and appliances), any LZC technologies or 'renewable energy systems', and the occupants.

**4.2.4** The occupants are key elements of the system because they:

- require certain conditions for comfort;
- operate energy-using lights and appliances;
- give off heat;

- produce moisture and carbon dioxide through respiration; and
- produce moisture through activities such as cooking, bathing and drying clothes.

**4.2.5** Internal temperature and humidity are critical to comfort, and to managing the risk of internal surface condensation and mould growth. Managing the dynamic moisture equilibrium across the building envelope (i.e. the transfer of moisture between the internal air, the materials in floors, walls and roofs and the external air) is critical both to maintaining internal air quality (IAQ) and to protecting the building fabric against interstitial condensation, rot, mould growth and decay.

**4.2.6** Retrofit work designed to reduce heat loss from a dwelling, and/or reduce air infiltration and air leakage, in order to improve energy efficiency, might have unintended consequences for IAQ and for the movement of moisture through the building fabric, particularly in older (pre-1919) traditionally constructed buildings, and in non-traditional buildings constructed in the 1960s and 1970s.

### 4.3 Thermal models and calculations

**4.3.1** Thermal models such as the Standard Assessment Procedure (SAP) and the Passive House Planning Package (PHPP) attempt to simulate whole-dwelling thermal performance, but most versions do not deal with moisture. Such models provide estimates of the energy performance of dwellings, based on limited amounts of data from surveys and assessments, but they inevitably involve a compromise between accuracy and functionality – a truly accurate prediction of energy performance requires complex simulation models that use large amounts of data that are difficult and expensive to collate, and thus are rarely used in retrofit projects.

**4.3.2** Retrofit Assessors, Retrofit Designers and Retrofit Coordinators should be familiar with the use of Full SAP or PHPP software to support their work. Reduced Data SAP (RDSAP) software might be useful where detailed data are not available, and Retrofit Assessors are trained in its use, but users should be aware that RDSAP makes default assumptions about some aspects of existing dwellings. If RDSAP is used to support a retrofit assessment, then the data should be reviewed carefully, and preferably exported to Full SAP software.

#### 4.3.3 Mathematical techniques are available for:

- calculating the thermal transmittances ( $U$  values) of building elements (i.e. floors, walls and roofs, etc.) from data on the thermal conductivities ( $\lambda$  values) of building materials;
- assessing the risk of interstitial condensation within the construction of a building element, using data on internal and external temperature and humidity and on material moisture contents and vapour pressures;
- calculating linear thermal transmittances ( $\psi$  values) and critical temperature factors ( $f_{Rsi}$ ) at the corners, junctions and edges of building envelopes that are identified as “thermal bridges”, i.e. places where the envelope of insulation is either thinner or discontinuous;
- calculating the component of a building’s overall thermal transmittance that is due to thermal bridging ( $\gamma$  value);
- calculating overall heat losses from a dwelling due to conduction, convection (i.e. air leakage), radiation, deliberate ventilation and the inefficiency of heating system(s);
- calculating overall heat gains in a dwelling from occupants, cooking, hot water, lighting, the use of appliances and solar gains through glazed openings;
- calculating the whole-dwelling ventilation rate required to maintain good IAQ and minimize the risk of condensation and mould growth;
- assessing the risk of surface condensation and mould growth using temperature factors and data on internal and external temperature and relative humidity to calculate vapour pressure differentials;
- assessing the dynamic moisture equilibrium through a building element; and
- calculating internal daylight levels from data about the sizes, locations and orientations of windows, and any local shading, and assessing requirements for artificial lighting.

#### 4.3.4 Testing and investigation techniques are available for:

- measuring heat losses through individual building elements;
- measuring heat loss through the whole building envelope;
- assessing the air-tightness (or “air permeability”) of a building envelope;
- identifying air infiltration and air leakage points;
- measuring the vapour permeabilities of building materials; and
- assessing the moisture content of building fabric.

#### 4.3.5 There are also techniques for:

- monitoring overall energy use in dwellings, from utility meters;
- monitoring the energy use of individual systems, using sub-meters;
- monitoring internal temperatures, using sensors and loggers;
- monitoring internal relative humidity, using sensors and loggers; and
- monitoring IAQ (e.g. carbon dioxide concentration) using sensors and loggers.

4.3.6 Retrofit Assessors, Retrofit Designers, Retrofit Coordinators and Retrofit Evaluators should be familiar with the relevant techniques described or listed in 4.3.3. Retrofit Coordinators and Retrofit Evaluators should be able to apply the techniques listed in 4.3.4 and 4.3.5, as appropriate, and should keep themselves updated about new and emerging monitoring techniques.

4.3.7 Many academic, vocational training and Continuous Professional Development (CPD) courses deal with thermal aspects of building physics. More detailed explanations of aspects of retrofit building physics are provided in the following:

- *Code of practice for the energy efficient retrofit of dwellings* [1]; and
- *Moisture in buildings: An integrated approach to risk assessment and guidance* [2].

## 5 Guidance about approaches to retrofit

### 5.1 Retrofit performance considerations, standards and constraints

**5.1.1** Domestic retrofit projects range from the installation of single improvement measures to whole-house projects involving multiple measures installed at the same time. Both types of project should be seen in the context of national emissions reduction targets; by 2050 it is necessary to reduce the average greenhouse gas (principally carbon dioxide) emissions associated with energy use in our homes by between 80% and 100% compared with current emissions, through a combination of improved efficiency and low- or zero-carbon energy supply. The Climate Change Committee sets “carbon budgets” under the Climate Change Act 2008 [3], and the Government’s Clean Growth Strategy includes a commitment to improvements in Energy Performance Certificates (EPC) scores for fuel poor homes by 2030 and an aspiration for improvements in EPC scores of the wider housing stock by 2035. The Government’s “Buildings Mission”, under the *Clean Growth Strategy* [4], is to halve the current (2019) cost of reducing energy use in all existing buildings by 50%, by 2030.

**5.1.2** However, it is not appropriate to attempt to achieve the same level of emissions reduction from every domestic building, because the same target applied to every dwelling might result in significant damage to some older, traditionally constructed buildings (which make up approximately one quarter of the housing stock), rendering them unhealthy to live in or possibly even uninhabitable, and damaging our architectural heritage. An average emissions reduction target might be appropriate, but greater reductions need to be made where they are technically feasible and safe, in order to compensate for the constraints on improvements to traditional buildings. In each case, protecting and improving occupants’ health, well-being and comfort should be prioritized, then energy use and emissions should be minimized within the constraints of protecting the building and its architectural heritage.

### 5.2 Medium-term improvement plans

**5.2.1** For any dwelling that is proposed for retrofit, consideration should be given to the scope for improving energy efficiency and reducing emissions, bearing in mind the need for significant emissions reduction. The overall scope for improvement by 2050 should be identified, even if only limited improvements can be undertaken in the short term. One way of doing this is to prepare a “medium-term improvement plan” for every dwelling (or in the case of managed housing, for every dwelling type) for implementation over a period of 20 or 30 years.

**5.2.2** The purpose of a medium-term improvement plan is to guide the staged or phased improvement of a dwelling by identifying the improvements that are needed and an appropriate order for their implementation, and by highlighting critical interactions between them. Such plans should be updated to respond to changes in standards or the availability of new technologies, and to record improvements as they are made.

**5.2.3** A medium-term improvement plan should:

- identify constraints imposed by the history, construction, architectural character and setting of the building, and by its pattern of use;
- identify the set of improvement measures necessary to achieve an appropriate target improvement in energy efficiency and reduction of the emissions associated with energy use, without compromising the comfort and health and of the occupants or the integrity of the building;
- identify potential interactions between measures to ensure a whole-house approach is followed and thus avoid thermal bridging and other unintended consequences;
- identify an appropriate order in which the identified measures should be installed, bearing in mind that some measures are best installed together, and that installation of some measures may preclude the later installation of other measures (or make subsequent installation more difficult);
- be presented in a format that allows it to be updated as work proceeds, and revised as new knowledge and new materials, products or technologies for energy efficiency become available.

**5.2.4** The preparation of a medium-term improvement plan should be the responsibility of the Retrofit Coordinator (see 9.2), working in collaboration with the Retrofit Designer and the Client for the project.

## 5.3 Retrofit at scale

**5.3.1** Large-scale retrofit programmes are likely to become more common and are often driven by the objective of alleviating fuel poverty as well as improving energy efficiency and reducing emissions. There are two types:

- Programmes that seek to install a single improvement measure (or a small number of measures) in many dwellings, irrespective of their locations, in order to make incremental improvements in performance across the housing stock.

**NOTE 1** *The Government's Energy Company Obligation (ECO) programme is an example of this type.*

- Programmes that seek to install packages of multiple measures in dwellings in defined areas, in order to make more significant improvements in performance. Areas of focus might be estates owned by housing organizations, local authority areas where there is fuel poverty, or whole cities.

**NOTE 2** *The GLA's Energy for Londoners fuel poverty programme is an example of this type.*

**5.3.2** In the first type of programme, because of time and budget constraints, the scope for adequate assessment of dwellings prior to improvement is often reduced, so there might be a risk of technically or architecturally inappropriate measures being installed. Risk assessment and management techniques should be carried out in accordance with BS EN 31010.

**5.3.3** In the second type of programme, medium-term low carbon improvement plans should be focused on dwelling types within the areas of interest, rather than on individual dwellings, in order to identify generic solutions and economies of scale. Plans for dwelling types may be modified for individual dwellings, because very few homes are exactly the same, even those of superficially similar appearance, so individual retrofit assessments and designs are still necessary.

## 5.4 Fabric first

**5.4.1** Whatever the scale of retrofit, a technically sound and usually cost-effective approach is the one known as "fabric first", which should always be considered when a retrofit plan is formulated. This approach prioritizes improvements in five stages.

- 1) Bring the building fabric into good repair, by dealing with defects that inhibit energy efficiency and compromise improvement measures. Deal with water penetration and damp (and ensure that the building fabric is properly dried out) and with structural defects (cracks, etc.) and poor pointing of masonry.
- 2) Implement "low hanging fruit" measures that are low cost and easy to install, e.g. energy efficient lighting, basic heating controls, better control settings.
- 3) Improve the building fabric by means of insulation and air-tightness measures, and by minimizing thermal bridging, in order to reduce heat losses and reduce the demand for heat and the required capacity of the heating system.
 

**NOTE** *When the insulation and air-tightness of the building fabric are improved, adequate ventilation should be maintained.*
- 4) Satisfy the remaining heat demand as efficiently as possible using efficient heating technology and responsive controls.
- 5) Use LZC "renewable" energy technologies to reduce emissions further and "top up" the performance of the dwelling to the target level.

**5.4.2** It makes sense to ensure that the existing building fabric is as energy efficient as possible before spending resources on other measures. Subsequently, because insulation measures are generally amongst the most cost effective and long-lasting, and thus the best investment, insulation is usually the most appropriate next step. Insulating the fabric first also reduces the required capacity and cost of the heating system. The heating system usually has a shorter life than the improved building fabric (typically 15 years compared with possibly 60 years), so a dwelling might have four heating systems during the life of the installed insulation. LZC systems such as solar water heating (also known as "solar thermal") and solar photovoltaic systems are the final step because they are relatively expensive (often requiring subsidy), and their capacity is often limited by available space (e.g. on the roof). Most UK dwellings cannot be heated exclusively by renewable energy systems unless they are first insulated, and the building services efficiency is improved, to reduce the remaining energy demand so that LZCs can make a significant contribution.

**5.4.3** Although “fabric first” is often a cost-effective approach, sometimes other issues dictate different priorities. For example, a worn-out boiler should be replaced, even if insulation cannot be afforded (but note that when the insulation is eventually installed the boiler will be over-sized).

**5.4.4** Often, architectural heritage considerations limit or rule out many insulation options, some of which are irreversible, leaving scope only for using measures that can be reversed, improving the building services or installing LZCs. In the case of older, traditionally constructed or protected buildings, a risk-based approach to the selection of improvement options is usually appropriate.

## 5.5 Concentrate on the interfaces

**5.5.1** “Concentrate on the interfaces” is a way of approaching retrofit that complements and enhances “fabric first”. It acknowledges that retrofit projects often go wrong because of poor attention to the corners, junctions and edges of building elements (where insulation and air barriers should be continuous) and the interfaces between the building fabric, the building services and the occupants. For example, heating output should be matched to heat loss, ventilation should be matched to the air permeability of the building fabric, and occupants should be able to make efficient use of systems installed in their homes.

**5.5.2** “Concentrate on the interfaces” is an approach that focuses the attention of Retrofit Designers and Retrofit Installers on critical factors. It is the basis of much of the guidance and some of the requirements specified in this PAS.

## 5.6 Retrofit advice

**5.6.1** Domestic retrofit projects should always include the delivery of retrofit advice to the occupants of the dwelling(s), at appropriate times, by a qualified Retrofit Advisor. There is evidence that where retrofit projects do not include advice, the intended outcomes are often only partially achieved, particularly with respect to fuel cost savings and reductions in the carbon dioxide emissions associated with energy use.

**5.6.2** Retrofit advice should be delivered at several stages of a retrofit project, and the topics covered by advice should be appropriate to the scope of the improvement work and the stage at which it is delivered. Retrofit advice should be delivered in accordance with the requirements in Clause 13.

**5.6.3** In scale- or area-based local retrofit, the potential for peer learning through web forums, open homes events and community meetings should also be considered as a way of delivering appropriate retrofit advice.

## 6 Requirements for retrofit coordination and risk management

### 6.1 Retrofit Coordinator

**6.1.1** Every domestic retrofit project compliant with this PAS shall be coordinated by a Retrofit Coordinator. Retrofit Coordinators are qualified to provide end-to-end project coordination (i.e. from the inception of a retrofit project to handover and beyond, including undertaking basic monitoring and evaluation work), and to identify, assess and manage the technical and process risks associated with domestic retrofit projects.

**6.1.2** A Retrofit Coordinator shall be a person qualified in accordance with the requirements set out in Annex A.

**6.1.3** The role of the Retrofit Coordinator shall be to protect both the Client's interest and the public interest. The Retrofit Coordinator shall be responsible for overseeing the project from inception to completion, i.e. the risk assessment (Clause 7), the dwelling assessment (Clause 8), the retrofit design (Clause 9), installation (in accordance with PAS 2030), and post-completion monitoring and evaluation (Clause 10).

**6.1.4** The Retrofit Coordinator shall also be responsible for ensuring and claiming compliance with PAS 2035.

**NOTE** *The Retrofit Installer is responsible for claiming compliance of the process of installation of EEM with PAS 2030:2019.*

**6.1.5** The Retrofit Coordinator may be employed by the Client or by an organization commissioned to undertake assessment, design, installation, commissioning or monitoring and evaluation work (or a combination of these). Where a conflict of interest arises between the Retrofit Coordinator's duty to protect the Client's interest, the public interest and the employer's interest it shall be declared to the Client so that arrangements can be made to resolve it.

### 6.2 Establishing intended outcomes

**6.2.1** At the outset of the project, the Retrofit Coordinator shall consult the Client and agree and record the intended outcomes of the project. Intended outcomes shall take into account the initial condition of the building(s) and be expressed in terms of one or more of the following:

- reductions in energy use;
- reductions in energy costs and/or alleviation of fuel poverty;
- reductions in emissions associated with energy use;
- improvement in internal comfort;
- improvement of IAQ;
- elimination of condensation, damp and mould;
- reducing the risk of overheating;
- improvement in energy rating (e.g. SAP);
- meeting a performance standard (e.g. NZEB or Passive House EnerPHit);
- improving the usefulness or sustainability of the building;
- protecting the building against decay or deterioration;
- improving resistance to water penetration and resilience against flood risk;
- protection or enhancement of architectural heritage;
- integration of energy efficiency measures with other improvements, e.g. extension, loft conversion or general refurbishment; and
- any other issues that might be considered relevant.

## 7 Requirements for retrofit risk assessments

### 7.1 Risk assessment process

**7.1.1** The Retrofit Coordinator shall ensure that a retrofit risk assessment is undertaken of each dwelling or dwelling type within the project that is subject to retrofit.

**7.1.2** The retrofit risk assessment shall use data from a “triage” process (which does not require nor preclude a visit to the dwelling) and apply the criteria set out in Annex B.

**7.1.3** The triage process shall consist of collecting the data necessary for the risk assessment (see Annex B) from some or all of the following sources:

- telephone enquiries with the Client and/or landlord and/or occupants;
- any existing EPCs;
- the reports of any previous energy or condition surveys or assessments;
- web-based satellite and street views (e.g. Google Earth and Google Street View);
- the Measures Interaction Matrix (see Annex D); and
- information obtained from a visit to the dwelling.

**7.1.4** Data from the triage process shall be used to complete the risk assessment in accordance with Annex B, and a summary shall be retained with the records of the project.

**7.1.5** For each project, the outcome of the retrofit risk assessment is an aggregate risk grade for that project of A, B or C.

### 7.2 Consequences of the outcome of the risk assessment

**7.2.1** If the project risk grade is assessed as A, the **Path A** requirements shall apply.

**7.2.2** If the project risk grade is assessed as B, the **Path B** requirements shall apply.

**7.2.3** If the project risk grade is assessed as C, the **Path C** requirements shall apply.

### 7.3 Repeating the risk assessment

**7.3.1** In the event that, during a retrofit project, circumstances change (e.g. by the addition of measures) in a way that would affect the outcome of the risk assessment, the Retrofit Coordinator shall repeat the risk assessment using updated input data.

**7.3.2** If the outcome of a repeat risk assessment is that the assessed risk grade of the project changes, then the requirements of this PAS relevant to the Path associated with the new assessed risk grade (see 7.2) shall apply.



## 8 Requirements for whole-dwelling assessments

### 8.1 The purpose of the assessment

The Retrofit Coordinator shall ensure that every dwelling that is to be subjected to energy retrofit work is first assessed by a Retrofit Assessor, to provide information about the dwelling for use by a Retrofit Designer (see Clause 9).

**NOTE** A new British Standard for the Assessment of Dwellings for Retrofit is proposed. On publication, the new standard will supersede 8.2 to 8.6 below. Prior to publication of the new standard, 8.2 to 8.6 shall apply to all assessments of dwellings for retrofit.

### 8.2 The Retrofit Assessor

**8.2.1** A Retrofit Assessor shall be a person trained and/or qualified in accordance with the requirements set out in Annex A.

### 8.3 Assessment: Path A

**8.3.1** The assessment shall include:

- an appraisal of the dwelling's heritage, architectural features, structure, construction and condition and the installed building services (ventilation, heating, hot water and lighting) in sufficient detail to establish the suitability of the dwelling for improvement;
- identification of any constraints imposed by the local planning authority (including requirements for planning permission, Listing as of Special Architectural or Historic Interest, Conservation Area constraints, Tree Preservation orders, etc.);
- identification of the location and severity of any existing construction defects or structural defects or leaks, and of any condensation and/or mould growth in the dwelling; and
- identification of any energy efficiency measures already installed or proposed.

**8.3.2** In addition, where appropriate and in order to support an assessment of the dwelling using RDSAP or SAP, the assessment can include:

- a measured survey to establish the overall dimensions of the dwelling's heat loss envelope (including any basements and attics), the dimensions of all building elements (exposed floors, external walls, roofs, etc.) and the dimensions of all window and door openings;

- an appraisal of the dwelling's construction in sufficient detail to establish the thermal transmittances ( $U$  values) and moisture properties of the main building elements (exposed floors, walls and roofs) and the suitability of the dwelling for improvement; and
- identification of the installed building services (ventilation, heating, hot water and lighting systems and their controls).

### 8.4 Assessment: Path B

**8.4.1** The assessment shall include the points listed in 8.3.1 above, together with the following additional points:

- 1) an appraisal of the dwelling's construction in sufficient detail to establish the main materials, thermal transmittances ( $U$  values) and moisture properties of the main building elements (exposed floors, walls and roofs) and the suitability of the dwelling for improvement;
 


**NOTE 1** For traditionally constructed buildings, it might not be appropriate to accept the default  $U$  values offered by RDSAP software; instead, it might be necessary to establish details of the construction in order to calculate  $U$  values.
- 2) a measured survey to establish the overall dimensions of the dwelling's heat loss envelope (including any basements and attics), the dimensions of all building elements (exposed floors, external walls, roofs, etc.) and the dimensions of all window and door openings;
- 3) identification of constraints imposed by the site, e.g. elevation and exposure (to sun, wind and rain, major roads and industrial activity), access, party walls, rights of light, consideration of adjoining properties, etc.;
- 4) identification of the installed building services (ventilation, heating, hot water and lighting systems and their controls), the locations of the equipment, the areas served and confirmation that the systems are working correctly (or otherwise);
- 5) an appraisal of occupancy, including the number of occupants and any special considerations such as the presence of vulnerable persons, e.g. children or elderly people or those with disabilities;

- 6) an assessment of the existing ventilation in accordance with Annex C, including:
- identification of the location and severity of any condensation and/or mould growth in the dwelling;
  - any intermittent extract ventilation fans or passive stack ventilators and where they are located;
  - any background ventilators (air inlets or “trickle ventilators”), and where they are located;
  - any other ventilation system and where it is located, including single-room heat recovery ventilators (srHRVs), positive input ventilation (PIV), whole-house mechanical extract ventilation (centralized cMEV or decentralized dMEV), and mechanical ventilation with heat recovery (MVHR); and
  - whether the identified ventilation systems are functional.

**NOTE 2** Any intermittent or continuous extract ventilation fans should be checked in accordance with BSRIA guide BG46/2015 [5] to ensure that they are providing adequate air movement, and any incidence of inadequate air movement should be reported as part of the assessment.

**8.4.2** The data collected in accordance with 8.4.1 shall be sufficient for an estimate of annual fuel use, fuel costs and carbon dioxide emissions, under standard or actual occupancy (as appropriate) to be made by the Retrofit Assessor, Retrofit Coordinator or Retrofit Designer, using a recognized domestic energy model such as the Reduced Data Standard Assessment Procedure (RDSAP), the Standard Assessment Procedure (SAP) or the Passive House Planning Package (PHPP).

**8.4.3** If the dwelling to be assessed is of traditional construction, an assessment of significance shall also be carried out in accordance with the guidance in BS 7913.

**NOTE** A simplified version of the BS 7913 significance assessment is available on the PAS 2035 Framework (<https://pas2035framework.bsigroup.com>) and is available to all PAS 2035 subscribers. This simplified version may be used as an alternative to the full BS 7913 significance assessment, at the users’ discretion, for traditionally constructed buildings that are not protected. The simplified version will be incorporated into this PAS in a future revision. 

## 8.5 Assessment: Path C

**8.5.1** The assessment shall adopt the principles set out in the RICS guidance note *Surveys of residential properties* [N1], at “survey level three”, as defined in that document, and shall include the points listed in 8.3 and 8.4 above, together with the following additional points:

- a test of the air permeability of the building envelope, using an approved method, including identification of key leakage locations;
- any relevant in situ tests.

**NOTE 1** A test of the air permeability of the building envelope may be useful irrespective of the assessed level of risk, and should be carried out at the discretion of the Retrofit Coordinator.

**NOTE 2** In the case of a building containing multiple dwellings (e.g. a high-rise residential block), it may be sufficient to test a sample of the dwellings, including an example of each dwelling type, in the building.

**NOTE 3** Where invasive tests (e.g. pull-out tests to establish suitability for proposed fixings) are appropriate, then at the discretion of the Retrofit Coordinator they can be required by the design to be included as part of the pre-installation inspection required by PAS 2030:2019 instead of as part of the assessment.

**8.5.2** If the dwelling to be assessed is a protected building, or forms part of a protected building, the assessment shall also be carried out in accordance with the guidance in BS 7913 and shall include:

- an assessment of the significance of the building as defined in BS 7913; and
- at the Retrofit Coordinator’s discretion, a structural engineer’s report on the structural condition of the building and its suitability for any proposed improvement measures.

## 8.6 Reporting the assessment and handing over assessment data

**8.6.1** The whole-dwelling assessment, including the ventilation assessment, shall be recorded and reported to the Retrofit Designer, including any RDSAP, SAP or PHPP data file and a photographic record of all the recorded features of the building and of any identified defects.

**8.6.2** Where the project involves an assessment of similar dwellings located in blocks (e.g. blocks of flats) the assessments can be combined in a single report for each block, but the data presented shall be dwelling-specific, and any RDSAP, SAP or PHPP assessment data shall be provided for at least one example of each dwelling type in each block.

***NOTE** Dwelling types may be defined by architectural layout and/or number of bedrooms, and by the position of the dwellings in the block (e.g. mid-, end or corner, and ground, mid- or top floor).*

**8.6.3** Where the assessment has identified construction defects or structural defects or leaks, or condensation and/or mould growth in any dwelling(s), the report shall include identification of such defects in two categories:

- defects that need to be repaired before any retrofit work can proceed; and
- defects whose repair is recommended but not an essential prerequisite to retrofit.

**8.6.4** The Retrofit Coordinator shall request confirmation from the Retrofit Designer that the information included in the assessment report is sufficient for the preparation of a retrofit design in accordance with Clause 9.

**8.6.5** If the information in the assessment is not sufficient to provide the basis of a retrofit design that complies with this PAS, the Retrofit Designer shall identify any missing information, which the Retrofit Coordinator shall arrange for the Retrofit Assessor to collate and include in an updated assessment report.

***NOTE** If required by the body governing the TrustMark, the Assessor should upload the final assessment report, the RDSAP, SAP or PHPP data file and photographic records of the assessment to the TrustMark "data warehouse" for quality assurance purposes.*

## 9 Requirements for retrofit designs

### 9.1 Design: Path A

**9.1.1** The Retrofit Coordinator shall ensure that the EEMs to be included in each domestic retrofit project shall be the subject of a design and specification (hereafter referred to as the retrofit design) prepared by a Retrofit Designer.

**9.1.2** A Retrofit Designer shall be trained and/or qualified in accordance with Annex A.

**9.1.3** Prior to undertaking the design and specification of retrofit work, the Retrofit Designer shall ensure that they are in possession of a retrofit assessment conforming to Clause 8 for the relevant dwelling or dwelling type, prepared by a Retrofit Assessor, on the basis of which the retrofit design shall be prepared.

**9.1.4** The Retrofit Designer shall review the assessment(s) to confirm that the information included in the assessment report is sufficient for a retrofit design, conforming to Clause 8, to be prepared.

**9.1.5** If the information in the assessment(s) is not sufficient to provide the basis of a retrofit design, the Retrofit Designer shall identify any missing information and report to the Retrofit Coordinator, who shall arrange for the Retrofit Assessor to collate the required information and include it in an updated assessment report in accordance with Clause 8.

**9.1.6** On receipt of an acceptable assessment, the Retrofit Designer shall consider the list of improvements in Clause 1 of this PAS and identify the technically applicable EEMs, bearing in mind the improvement objectives listed in 0.1.1 and the constraints identified by the assessment(s).

**9.1.7** The Retrofit Designer shall review the technically appropriate measures with the Client and agree the measures to be applied to each dwelling included in the project.

**9.1.8** The Retrofit Coordinator shall advise the Client on the need for any statutory approvals (planning approval, Listed Building Consent, Party Wall Notices or approval under the Building Regulations) for the proposed retrofit work, and shall then either:

- make applications for any necessary statutory approvals, and negotiate them with the appropriate authorities, on behalf of the Client; or

- cooperate with the Client or any other persons (e.g. a planning consultant, an architect or the Retrofit Installer) appointed to make applications for and negotiate statutory approvals, including providing information about the retrofit assessment and the retrofit design to support the applications.

**9.1.9** The Retrofit Designer shall prepare design and specification information about the EEM or package of EEMs proposed for the dwelling(s), including materials, products, processes and standards, as appropriate, and in sufficient detail for contractors and installers to work from, taking into account:

- the condition of the existing building, including the need to repair any structural defects, to eliminate the ingress of liquid water or moisture prior to the installation of retrofit measures, and to fit leak protection devices to mitigate the risk of escape of water from internal services;
- the agreed scope of the project, the intended outcomes and any agreed performance targets for the dwelling(s), and the budget;
- the information in the report(s) of the assessment(s) of the dwelling(s);
- any conditions imposed by the local planning authority or the Building Control Body as part of a statutory approval; and

**NOTE** Conditions imposed by the local planning authority or the Building Control Body might not be known for some weeks after the applications described in 9.1.8 are made.

- the assessment of any existing ventilation and any consequent requirement to upgrade it.

**9.1.10** The Retrofit Designer shall ensure that the specified materials and products are compatible with the building and with each other and work as an integrated system, where appropriate. The design and specification shall be consistent with any relevant product manufacturers' installation instructions and with any relevant British or European standards or normative documents of any product or system.

**9.1.11** The retrofit design shall include appropriate provision for the management of moisture within the construction, and of the dynamic equilibrium between the internal and external relative humidity and the moisture content of construction materials, specifying vapour permeable materials and vapour balanced construction as appropriate, such that moisture does not become trapped within any construction leading to risk of interstitial condensation and consequent damp and deterioration. The design shall also adopt a coherent approach to managing moisture risk, consistent with the guidance in BS 5250.

**9.1.12** If any building fabric insulation or air-tightness measures are included in the package of specified EEMs, the Retrofit Designer shall consider the adequacy of the existing ventilation (if any) of the dwellings(s) as revealed by the dwelling assessment report and if necessary include in the design a specification for upgrading the ventilation of the dwelling(s). Assessment and upgrading of ventilation shall be in accordance with Annex C of this PAS. This requirement applies irrespective of the cost effectiveness of the ventilation upgrade as revealed by the improvement option evaluation.

**9.1.13** The retrofit design shall also include provision for managing the interactions between EEMs installed in the same building. The Measures Interaction Matrix provided in Annex D (Figure D.1) identifies four types of combinations of EEMs:

- those that do not interact (shown in green);
- those that might connect or interact physically (shown in yellow);
- those that interact in other ways (shown in orange); and
- those that are incompatible and should not be combined (shown in red).

**9.1.14** Where the retrofit design includes any EEMs for the improvement of the building fabric (e.g. insulation, air-tightness, replacement windows) it shall also include construction details, relevant to the measure, for the corners, junctions and edges of all affected building elements, and for all junctions with other building elements (whether those other elements have been improved or not); this includes all “yellow” combinations on the Measures Interaction Matrix (see Figure D.1).

**9.1.15** Construction details shall be configured to maintain the continuity of the three-dimensional insulated envelope and the integrity of any air-tightness barrier, in order to eliminate thermal by-pass (i.e. the uncontrolled penetration of cold air to the warm side of any insulation layer), minimize thermal bridging and maintain an appropriate or specified standard of air-tightness. Construction details published as part of industry best practice guidance can be used; alternatively, if other details are used it shall be shown by calculating it in accordance with *IP1/06 Assessing the effects of thermal bridging at junctions and around openings* [N2] that the temperature factor ( $f_{Rsi}$ ) of each detail is not less than 0.75.

*NOTE Good practice details for the retrofit of some dwelling types are available at the Retrofit Pattern Book website [6]. In some cases these details provide a guide to good practice and a template for the details required by this PAS.*

**9.1.16** Where the retrofit design includes EEMs that do not physically connect but which may interact in other ways (i.e. “orange” combinations on the Measures Interaction Matrix) the EEM specifications shall take account of the interaction. For example, the capacity of any new heating system (appliances or emitters) shall take account of the heat loss of the dwelling as affected by any improvements to insulation and air-tightness; and the design of any new ventilation system shall take account of the air permeability of the building envelope as affected by any improvements to insulation and air-tightness.

**9.1.17** The retrofit design shall not include any combinations of measures that are identified as incompatible (i.e. shown “red”) in Figure D.1.

**9.1.18** The retrofit design shall also:

- make provision for ventilation for the purpose of the safe operation of all combustion appliances in accordance with the manufacturers’ instructions and the relevant British Standards;
- provide for resilience against rainwater ingress (including ingress due to the failure of any critical element or construction detail);
- provide for resilience of the installed EEM against flood, where appropriate;
- ensure that the fire safety of the building is not compromised by the installation of EEMs, and if necessary include an updated fire safety strategy; and
- specify any maintenance requirements necessary to ensure the long-term integrity of the installation.

*NOTE In providing for resilience against flood, the design should be consistent with the guidance in BS 85500.*

**9.1.19** If any EEMs in the retrofit design are LZC technologies or “renewable energy systems” covered by the MCS the retrofit design shall specify that those systems comply with the relevant MCS standards [N7], [N8].

**9.1.20** The retrofit design shall identify the relevant technical standards for EEMs from those listed in Clause 16, and specify their application to the work that is the subject of the design.

*NOTE Omission from the retrofit design of reference to a relevant standard identified in this PAS does not imply that it does not apply.*

**9.1.21** The retrofit design shall also specify the sequence of installation of the EEMs, especially where incorrect sequencing might adversely affect the resilience of the EEMs, the integrity of the building, its historic significance or its energy performance.

**9.1.22** The Retrofit Coordinator shall provide the complete retrofit design to the Retrofit Installer(s) in writing for the purpose of costing the work and for subsequent installation of the EEMs. The design documentation shall include:

- identification of the address and precise location of the building(s) in which the EEM(s) are to be installed;
- identification of any access constraints and access instructions provided by the Client or the occupants;
- any assumptions on which the design is based, including assumptions that underpin the assessment of the dwelling(s);
- confirmation of the compliance of the design with the relevant standards, and identification of any apparently relevant standards that have been deemed irrelevant;
- specifications of the materials, products and systems to be used, and of where and how they are to be installed, whether within the building or on its exterior;
- construction details for all corners, junctions and edges of the building envelope (whether prepared by the Retrofit Designer or obtained from a system designer), or clear identification of any standards details that are to be used, and where;
- installation instructions for all new systems and equipment;
- testing requirements, including testing of any new gas systems and electrical installations (see Clause 11);
- commissioning requirements (see Clause 11);
- handover requirements (see Clause 12);
- maintenance instructions (see Clause 12);
- list of measures requiring an appropriate guarantee or warranty (see Clause 12); and

- identification of any information required to be supplied by the Contractor or Installer to any applicable quality assurance scheme.

**9.1.23** The Retrofit Coordinator shall also provide the Retrofit Installer(s) with copies of the retrofit assessment(s) for the dwelling(s).

**9.1.24** The Retrofit Coordinator shall request confirmation from the Retrofit Installer(s) that the information included in the retrofit design is sufficient for costing and installation work to proceed.

*NOTE The Retrofit Installer might not be able to provide confirmation until the pre-installation building inspection required by PAS 2030 has been completed.*

**9.1.25** If the information in the retrofit design is not considered sufficient for the costing and installation work to proceed, the Retrofit Installer(s) is required by PAS 2030:2019 to identify any missing information, which the Retrofit Coordinator shall arrange for the Retrofit Designer to collate and include in an updated design.

**9.1.26** If the cost of installing the EEMs in accordance with the retrofit design, as reported by the Retrofit Installer(s), exceeds the agreed budget or funding available, the Retrofit Coordinator shall agree appropriate amendments with the Client, arrange for the Retrofit Designer to revise the design accordingly, and re-submit the retrofit design to the Retrofit Installer(s). The requirements of this PAS shall apply to the revised design.

**9.1.27** At various stages in a retrofit project it can be beneficial for clients to receive advice to assist their decision making. Where advice in respect of a retrofit project undertaken in accordance with this PAS is to be provided to the Client, the Retrofit Coordinator shall ensure that the advice is provided in accordance with Clause 13. Where such advice is to be provided by other parties, the Retrofit Coordinator shall ensure that the Client is aware of the potential benefit of advice being provided in accordance with Clause 13.

*NOTE If required by the body governing the TrustMark for quality assurance purposes, the Retrofit Coordinator should upload the retrofit design(s) for the dwelling(s) to the TrustMark “data warehouse”.*

## 9.2 Design: Path B

**9.2.1** All of the design requirements for **Path A** (i.e.

**9.1.1** to **9.1.27**) shall apply to **Path B**, but **9.2.2** to **9.2.9** shall also apply to **Path B**.

**9.2.2** For every dwelling or dwelling type included in a retrofit assessment, before the retrofit design is prepared, the Retrofit Coordinator shall carry out an improvement option evaluation to identify an appropriate package of EEMs. The evaluation shall make use of the RDSAP, SAP or PHPP data file(s) provided as part of the dwelling assessment(s), and shall include calculation of:

- the simple pay-back period of the capital cost of each candidate EEM in fuel cost savings to occupants if installed on its own;

**NOTE 1** *Simple pay-back (in years) is the capital cost of the EEM or package of EEMs divided by the estimated annual fuel cost savings. It is acknowledged that any person or organization incurring the capital cost might be different from those benefitting from the fuel cost savings.*

- the carbon cost effectiveness of each candidate EEM if installed on its own; and

**NOTE 2** *Carbon cost effectiveness is the lifetime cost of the EEM or package of EEMs (i.e. capital cost less annual savings over the estimated life of the EEMs in years) divided by the lifetime reduction of carbon dioxide emissions (i.e. annual reduction multiplied by estimated life in years).*

- the simple pay-back and carbon cost effectiveness of any suggested or proposed package of EEMs.

**9.2.3** When calculating the simple payback and carbon cost effectiveness of improvement measures and packages of measures for the improvement option evaluation, the Retrofit Coordinator shall:

- use capital cost rates for measures that are approved or recommended by an independent body (e.g. the Energy Saving Trust) and apply them to the relevant areas of the dwelling(s) for which they are being evaluated (taken from the SAP or PHPP assessment data) in order to establish capital costs; and
- use the actual fuel costs (i.e. tariffs) applicable to the dwelling, if available, otherwise use the national rolling average fuel costs embedded in the SAP energy rating; and
- use the carbon dioxide emissions factors embedded in the SAP energy rating, or in PHPP (but the two should not be mixed); and
- adjust the calculation to allow for the pattern(s) of occupancy of the dwelling(s) (e.g. by entering actual occupancy data into the software), unless the occupancy pattern(s) are unknown, in which case SAP standard occupancy shall be assumed.

**NOTE** *Capital costs used in the improvement option evaluation should be dwelling specific. Typical “per dwelling” capital costs of improvement measures should not be used, even if they are differentiated by dwelling type. Deemed savings associated with measures and dwelling types should not be used.*

**9.2.4** If the dwelling to be improved is traditionally constructed, the identification of applicable EEMs shall also be consistent with the guidance given in BS 7913 and shall take account of the significance of the building as defined in the BS 7913 assessment.

**9.2.5** In the event that any building fabric insulation or air-tightness measures are included in the package of proposed EEMs, the Retrofit Coordinator shall assess the adequacy of the existing ventilation (if any) of the dwellings(s) in accordance with Annex C, and if necessary include upgrading the ventilation of the dwelling(s) in the improvement option evaluation and in the proposed package(s) of EEMs. For the purpose of the improvement option, evaluation assessment and upgrading of ventilation shall be carried out in accordance with Annex C.

**9.2.6** The Retrofit Coordinator shall prepare a tabular summary report of the improvement option evaluation and identify a recommended package of appropriate EEMs to form the basis of medium-term improvement plan(s) for the dwelling(s) in accordance with 5.2.

**9.2.7** The Retrofit Coordinator shall review the report of the improvement option evaluation, the recommended package(s) of EEMs and the medium-term improvement plan(s) with the Client for the project (whether householder, landlord or funding body) and agree the scope of the project, the intended outcomes and appropriate energy performance target(s) for the improved dwelling(s), and the budget.

**9.2.8** The retrofit design shall include measures to inhibit overheating of the dwelling during the installed life of the EEMs. In identifying appropriate measures, the Retrofit Designer shall refer to:

- *TM59 Design Methodology for the Assessment of Overheating Risk in Homes*, in order to assess overheating risk [N3];
- the guidance and tools published by the UK Climate Impacts Programme (UKCIP) at [www.ukcip.org.uk](http://www.ukcip.org.uk) [N4], in order to assess future climate vulnerability and identify adaptation options; and
- the *Guide to Low Energy Shading* [N5].

**9.2.9** The measures to be considered for inclusion in the retrofit design to inhibit overheating shall include but not be limited to:

- reduction of internal heat loads through the installation of energy efficient lighting (e.g. LED lamps) and energy efficient domestic appliances (e.g. appliances with A+++ energy ratings);
- smoothing of internal heat loads by separation of spaces with high heat gains (e.g. kitchens) from spaces with solar gains (e.g. those with south-facing glazing);
- reduction of solar gains by external shading of southerly-facing and westerly-facing glazed openings, or the provision of shutters;
- provision of facilities for secure ventilation of the dwelling at night, during warm weather; and
- moderation of internal temperature by exposing high thermal capacity building fabric (e.g. masonry or concrete) to the internal air (inside the insulated envelope) so that heat is absorbed from warm air and re-radiated later when the air is cooler.

**9.2.10** The retrofit design shall also specify the sequence of installation of the EEMs, especially where incorrect sequencing might adversely affect the resilience of the EEMs, the integrity of the building, its historic significance or its energy performance.

*NOTE If required by the body governing the TrustMark for quality assurance purposes, the Retrofit Coordinator should upload the tabular summary of the improvement option evaluation(s), medium-term low carbon improvement plan(s) and the retrofit design(s) for the dwelling(s) to the TrustMark "data warehouse".*

## 9.3 Design: Path C

**9.3.1** All of the design requirements for **Path A** (i.e. 9.1.1 to 9.1.27) and **Path B** (i.e. 9.2.1 to 9.2.10 inclusive) shall apply to **Path C**, but 9.3.2 to 9.3.4 shall also apply to **Path C**.

**9.3.2** If the dwelling to be improved is a protected building, or forms part of a protected building, the identification of applicable EEMs shall be carried out in accordance with the guidance in BS 7913 and shall take account of the significance of the building as defined in the BS 7913 assessment.

**9.3.3** Where the retrofit design includes any EEMs for the improvement of the building fabric (e.g. insulation, air-tightness, replacement windows) and/or a ventilation upgrade (see Annex C) it shall also include an appropriate air-tightness standard for the dwelling after the work has been completed, and a requirement for the Retrofit Installer to demonstrate compliance with the air-tightness standard by means of an approved test, e.g. fan pressurization testing in accordance with *Measuring air permeability in the envelopes of dwellings* [N6].

*NOTE The Retrofit Coordinator should consider the strategy for air-tightness testing, particularly where the dwelling shares envelope with another, i.e. in terraces or multi-residential buildings. In the case of a building containing multiple dwellings (e.g. a high-rise residential block), it may be sufficient to test a sample of the dwellings including an example of each dwelling type in the building. However, in a small block of flats or maisonettes it may be more practical to pressurize the whole block because treating each flat individually would require multiple sets of equipment to pressurize adjacent units and avoid a misleading test result.*

**9.3.4** Before any work to install EEMs in the dwelling(s) begins, the Retrofit Coordinator shall, on request, provide the Retrofit Installers(s) with briefings (or "toolbox talks") to explain the design intent and draw attention to key points including the intended installation sequence(s). Such briefings shall always be provided if:

- the retrofit design includes new or unusual materials, products or systems with which the Installers are not familiar; or
- the dwelling to be improved is a traditionally constructed or protected building, or forms part of a protected building; or
- the Retrofit Installers(s) have not installed the specified EEMs before; or
- the design is intended to achieve particularly challenging performance standards (e.g. with respect to air-tightness).



## 10 Requirements for installation of retrofit designs

The installation of the EEMs specified in the retrofit design shall be carried out in accordance with PAS 2030; where LZC technologies or “renewable energy systems” that are within the scope of the MCS are specified, the installation of those systems shall be carried out in accordance with the applicable MCS [N7], [N8] standards, instead of with PAS 2030.

***NOTE** Responsibility for demonstrating and claiming compliance of installation processes and the competence or qualifications of installation operatives with PAS 2030 and/or the MCS standards rests with the Retrofit Installer. Evidence of compliance should be supplied to the Retrofit Coordinator.*

# 11 Requirements for testing and commissioning

## 11.1 Requirements for testing

**11.1.1** The retrofit design shall specify any requirements for testing of the improved dwelling (e.g. air-tightness testing) before, during or after installation of the EEMs, and for testing of individual building systems (whether new or existing).

**11.1.2** The testing of EEMs as specified in the retrofit design shall be carried out in accordance with the requirements of PAS 2030; where LZC technologies or “renewable energy systems” that are within the scope of the MCS are specified they shall be tested in accordance with the applicable MCS standards [N7], [N8] instead of with PAS 2030.

## 11.2 Requirements for commissioning

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

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

**NOTE** *This does not preclude pre-commissioning of individual measures by the Installer(s).*

**11.2.3** The commissioning of the EEMs as specified in the retrofit design shall be carried out in accordance with the requirements of PAS 2030; where LZC technologies or “renewable energy systems” are specified, they shall be commissioned in accordance with the relevant requirements of the MCS [N7], [N8].

## 11.3 Test certificates and commissioning records

**11.3.1** The retrofit design shall identify the test certificates and commissioning records that are to be supplied to the Client via the Retrofit Coordinator.

## 12 Requirements for handover

### 12.1 Specification of handover requirements

**12.1.1** The retrofit design shall specify requirements for the handover of the completed installation of energy efficiency measures, consistent with PAS 2030. Where LZC technologies or “renewable energy systems” are specified the handover shall also be carried out in accordance with the relevant requirements of the MCS [N7], [N8].

**12.1.2** The specified requirements for handover shall include:

- physical inspection of the installed measures and an explanation of their function and operation, including where appropriate demonstrations of the operation of components, devices and controls;
- information about the safe operation of the installed measure including operable components (e.g. windows, including any restrictor hardware), electrical equipment, mechanical equipment and associated control devices (e.g. boilers and heating controls);
- information about care of the installed measure to avoid detrimental effects (e.g. avoidance of penetrating air barriers by inserting fixings into internally insulated walls, regular cleaning and replacement of air filters in mechanical ventilation systems);
- information about regular maintenance of the installation to ensure that it operates safely, efficiently and effectively, in accordance with the requirements of any guarantees or warranties provided by the manufacturer or supplier;
- information about the efficient operation of the installation to facilitate the delivery of any intended reduction in energy use;
- a visual check that the person receiving the handover is able to operate components and controls;
- information about the importance of ventilation and the implications or potential consequences of switching off or disabling any installed ventilation system; and
- provision of documentation including test certificates and commissioning records, operation and maintenance instructions and manuals for all installed products and systems, warranty and guarantee certificates, and other relevant documentation, as appropriate.

*NOTE Simplified, “user friendly”, plain-language user manuals should be provided whenever possible.*

**12.1.3** The Retrofit Coordinator shall retain copies of test certificates and commissioning records, operation and maintenance instructions and manuals for all installed products and systems, warranty and guarantee certificates, and other relevant documentation, necessary for the safe, efficient and effective care, operation and maintenance of the installed measures, for a period of six years or for the length of the warranties (whichever is longer). Copies of all of these documents shall be made available to the Client.

**12.1.4** After the retrofit work has been handed over, the Retrofit Coordinator shall recommend to the Client that a new or updated EPC is prepared for the dwelling(s), and if the recommendation is accepted the Retrofit Coordinator shall arrange for the EPC to be prepared or updated by a Domestic Energy Assessor.

*NOTE If the Client is a social landlord, a new or updated EPC might be necessary for updating the Client’s housing stock data; if the dwelling(s) are to be re-let or sold after improvement, new or updated EPC(s) might be a legal requirement of the sale or letting process.*

### 12.2 Handover recipients

**12.2.1** The Retrofit Coordinator shall ensure that handover is to the occupants of the dwelling(s). If the occupants are not the clients for the retrofit project, then the Retrofit Coordinator shall ensure that landlord(s) and clients are included in the handover process.

## 13 Requirements for retrofit advice

### 13.1 Qualifications for Retrofit Advisors

**13.1.1** The Retrofit Coordinator shall ensure that appropriate retrofit advice is delivered as part of every domestic retrofit project.

**13.1.2** All retrofit advice delivered in connection with domestic retrofit projects shall be delivered by Retrofit Advisors (except where this PAS specifies otherwise).

**13.1.3** A Retrofit Advisor shall be a person trained and/or qualified in accordance with Annex A.

### 13.2 Delivery of retrofit advice

**13.2.1** Retrofit Advisors shall use the guidance in *Toolkit guide: Supporting the delivery of energy efficiency advice to consumers during smart meter installations* [N9]; some aspects of this guidance are of general application.

**13.2.2** Retrofit advice shall be delivered to the occupants of the dwelling that is subject to retrofit, irrespective of the type of tenure. However, where the occupants are tenants, the same advice shall also be offered to their landlord.

**13.2.3** All retrofit advice shall be delivered in a form that can be understood by the occupants, i.e. taking account of language, the age of the occupants, any hearing or sight difficulties, etc.

### 13.3 Retrofit advice: Path A

**13.3.1** Retrofit advice shall be provided to householders at the following points in the retrofit process:

- on initial engagement of a household and inception of a retrofit project; and
- at the time of or shortly after handover of the completed installation.

**13.3.2** Retrofit advice delivered on initial engagement of a household shall be general domestic energy efficiency advice and may be delivered in person, by telephone, via a website or in printed form (or a combination of these). Where advice is delivered via a website, by telephone or in printed form, the material shall be originated by or approved by a Retrofit Advisor (see **13.1.3**), and in all cases this retrofit advice shall be delivered by an individual or organization independent of the PAS 2030 Retrofit Installer.

**13.3.3** Retrofit advice delivered on initial engagement of a household shall be customized to the householders' needs and cover the following topics, as appropriate:

- behavioural issues, including use of ventilation, heating and hot water systems, lights and appliances and their controls; health and safety risks related to fuel poverty, damp and mould, cold and hypothermia; and the need to maintain buildings properly; and
- reducing energy costs by reviewing and (if appropriate) changing energy tariff or supplier;

**NOTE 1** *Independent consumer information about changing energy supplier is available from the Ofgem website [7].*

- retrofit technologies, including building fabric measures, building services improvements, LZC and "renewable" energy systems, typical capital costs and fuel cost savings and sources of funding;
- retrofit considerations, including the PAS 2035 retrofit process, any applicable quality assurance regime (e.g. TrustMark, including the Consumer Charter), finding and selecting Retrofit Coordinators, Retrofit Assessors, Retrofit Designers and Retrofit Installers, and how to complain about poor service; and
- data considerations, including the need for data about the performance of the home and how that data might be used in monitoring and evaluation.

**NOTE 2** *The report of the Each Home Counts review [8] recommended the setting-up of an Advice Hub; such retrofit advice can currently be obtained from BEIS or the Energy Saving Trust<sup>1)</sup> while an appropriate source of retrofit advice is established.*

<sup>1)</sup> BEIS contact details can be found through their website: <https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy> and the Energy Saving Trust contact details can be found through their website: <https://www.energysavingtrust.org.uk/>.

**13.3.4** Retrofit advice delivered at the time of or shortly after handover of the completed installation shall be coordinated with the PAS 2030:2019 Retrofit Installer and customized to reflect the EEMs installed and their intended outcomes; it shall cover:

- the installed EEMs, their operation and protection (including avoiding damage to any installed airtightness layer) and their intended effect on the energy performance of the dwelling(s) and the level(s) of comfort provided;
- behavioural issues, including use of any installed ventilation, heating and hot water systems, lights and appliances and their controls, how to get the best performance from them, and the potential consequences of switching off or disabling ventilation;
- how repair and maintenance of the building and the installed EEMs can help sustain the building and contribute to its energy efficiency; and
- any applicable quality assurance regime (e.g. TrustMark), any audit and inspection processes that might apply, the guarantees and warranties attached to the installed EEMs, and the procedures for claiming.

## 13.4 Retrofit advice: Paths B and C

**13.4.1** Retrofit advice shall be provided to householders at the following points in the retrofit process:

- on initial engagement of a household and inception of a retrofit project;
- on completion of the improvement option evaluation;
- on completion of the retrofit design; and
- at the time of or shortly after handover of the completed installation.

**13.4.2** Retrofit advice delivered on initial engagement of a household and inception of a retrofit project shall be in accordance with **13.3.3**.

**13.4.3** Retrofit advice delivered after completion of the improvement option evaluation shall be delivered by the Retrofit Coordinator who carried out the improvement option evaluation; it shall cover:

- any consultations that have taken place with the local authority's planning department regarding the retrofit options and their impact on external appearance, particularly where external EEMs are being considered or where Conservation Area or Listed Building constraints apply;
- an explanation of the improvement options (EEMs) considered, their compatibilities and incompatibilities and any other associated opportunities or constraints;
- the estimated capital costs and fuel cost savings associated with the options considered, and their cost effectiveness (including their carbon cost effectiveness);
- identification of the recommended options and priorities included in the medium-term whole-dwelling improvement plan; and
- recommendation of the EEMs to be included in the immediate retrofit project.

*NOTE Where advice includes estimated fuel cost savings arising from improvement measures, the savings should be those calculated using a full SAP or PHPP assessment; capital costs of measures should be dwelling-specific and derived from rates obtained from sources independent of the manufacturer, supplier or installers of the EEMs; see also 9.2.3.*

**13.4.4** Retrofit advice delivered on completion of the retrofit design shall be delivered by the Retrofit Designer who prepared the design or by the Retrofit Coordinator; it shall cover the key features of the design including all the proposed EEMs, and a brief explanation of the installation process.

**13.4.5** Retrofit advice delivered at the time of or shortly after handover of a completed installation shall be in accordance with the requirements of **13.3.4**.

## 14 Requirements for monitoring and evaluation

### 14.1 The purpose of monitoring and evaluation

The Retrofit Coordinator shall ensure that every retrofit project is subject to monitoring and evaluation to determine whether the intended outcomes of the retrofit project have been realized, and to identify and learn from any project-specific or systematic problems with the retrofit risk assessment, the dwelling assessment, the retrofit design, the installation of EEMs or the testing, commissioning or handover of EEMs.

*NOTE A new British Standard is proposed for Building Performance Evaluation, covering domestic retrofit projects. On publication, the new standard may supersede the guidance in 14.2 to 14.6 below. Prior to publication of the new standard, 14.2 to 14.6 should apply to all domestic retrofit projects.*

### 14.2 Retrofit Evaluator

**14.2.1** Monitoring and evaluation shall be carried out by a Retrofit Evaluator.

**14.2.2** A Retrofit Evaluator shall be a person trained and/or qualified in accordance with Annex A.

### 14.3 Levels of monitoring and evaluation

**14.3.1** Three levels of monitoring and evaluation shall be carried out, as appropriate:

- **Basic** monitoring and evaluation shall be applied to every completed domestic retrofit project (irrespective of the level of risk assessed under Clause 8).
- **Intermediate** monitoring and evaluation shall be applied to projects for which (in the opinion of the Client, the Retrofit Coordinator or the Retrofit Evaluator) basic monitoring and evaluation indicates that the outcomes are significantly different from those originally agreed and intended, or there are unintended consequences of the retrofit work.

*NOTE In some cases occupants who experienced fuel poverty prior to retrofit and were consequently unable to heat their homes adequately might take the benefits of retrofit in increased comfort rather than as monetary savings; this should be taken into account in the monitoring and evaluation process.*

- **Advanced** monitoring and evaluation shall be applied to projects for which (in the opinion of the Client, the Retrofit Coordinator or the Retrofit Evaluator) intermediate monitoring and evaluation indicates that further investigation is required to understand

and resolve any discrepancy between predicted performance and outcome performance, or to explain any unintended consequences.

**14.3.2** Intermediate and advanced monitoring involve access to the dwelling(s), possibly on several occasions, and advanced monitoring might require intrusive investigation of the building fabric, so the Client's and occupants' consent shall be obtained by the Retrofit Evaluator; intermediate and advanced monitoring and evaluation shall not proceed without such consent.

### 14.4 Basic monitoring and evaluation

**14.4.1** Basic monitoring shall include the use of a measures-specific questionnaire distributed to the Client and the occupant(s) (if different) of the dwellings that have been retrofitted to establish, as far as possible:

- whether the agreed intended outcomes of the project (see 6.2) have been achieved;
- whether there have been any unintended or unexpected consequences of the work;
- whether the Client and occupant(s) are satisfied with the outcomes;
- whether the Client and occupant(s) are satisfied with the process of assessment, design, installation, testing, commissioning and handover of retrofit measures;
- the identification of any specific points of dissatisfaction;
- the identification of any elements of the installation that are not working as expected; and
- any other comments the Client and occupant(s) might want to make.

**14.4.2** The Retrofit Evaluator shall collate the information provided by the Client and the occupant(s), summarize it, formulate recommendations for any remedial actions required and any changes to the retrofit process that may be appropriate, and circulate the summary and recommendations to the Client, the Retrofit Coordinator, the Retrofit Assessor, the Retrofit Designer and the Retrofit Installer.

*NOTE Not all Clients and occupants may complete and return the basic monitoring and evaluation questionnaire, but most of those who consider the outcomes unsatisfactory are likely to do so. The Retrofit Evaluator's report can only cover dwellings for which questionnaires have been completed and returned. Dwellings for which completed questionnaires are not returned may be assumed to have satisfactory outcomes, unless the Client indicates otherwise.*

**14.4.3** Basic monitoring and evaluation shall be completed and reported within three months after handover of the retrofit project.

## 14.5 Intermediate monitoring and evaluation

**14.5.1** Intermediate monitoring and evaluation shall include:

- a review of the report of the basic monitoring and evaluation carried out;
- an inspection of the dwelling to check that all the installed EEMs are in place and functioning correctly, and to identify any instances of condensation, damp or mould;
- post installation air-tightness testing (if an air-tightness standard was specified, improvement measures that might have affected air-tightness were installed or there is any evidence of condensation or mould);
- fuel use monitoring for a period long enough to acquire useful information, using data from the occupants' fuel bills, meter readings or smart meters, and taking account of the occupancy pattern during the monitoring period;
- recording of internal temperature and relative humidity throughout the monitoring period;
- brief questionnaire-based occupant interviews, covering the points identified in **14.4.1** and the following additional points: the functionality of the installed EEMs; and the ability of the occupants to achieve satisfactory comfort conditions, including temperature and internal air quality; and
- identification of any occupancy factors or occupants' actions that might be contributing to poor outcomes.

**NOTE** *Fuel use monitoring should preferably be carried out during the heating season.*

**14.5.2** The Retrofit Evaluator shall collate the information obtained during the monitoring process, summarize it, formulate recommendations for any remedial actions required and any changes to the retrofit process that might be appropriate, and circulate the summary and recommendations to the Client, the Retrofit Coordinator, the Retrofit Assessor, the Retrofit Designer and the Retrofit Installer.

**14.5.3** Intermediate monitoring and evaluation shall be completed and reported within six months after basic monitoring and evaluation have been completed, or as soon as seasonal weather conditions allow.

## 14.6 Advanced monitoring and evaluation

**14.6.1** Advanced monitoring and evaluation shall include all the elements of intermediate monitoring (**14.5.1**) and in addition shall also include, as appropriate:

- a post construction review to confirm exactly what was installed and whether the installation is consistent with the retrofit design;
- a post occupancy evaluation based on two detailed questionnaire-based interviews with occupant(s), carried out with an interval of one year between them;
- a thermographic survey of the dwelling(s);
- monitoring of internal conditions including temperature, relative humidity, and carbon dioxide concentration for a period of at least one year;
- monitoring of moisture levels within the building fabric and/or at the interfaces between insulation and masonry;
- sub-metering of energy use by any new building services systems including ventilation, heating and hot water, lighting and any LZC or "renewable energy" technologies (e.g. solar thermal systems, solar photovoltaics) for a period of at least one year; and
- investigation of any defects revealed by monitoring (at any level), the post construction review, the post occupancy evaluation, the inspection, the air-tightness test, the thermographic survey, or the monitoring of fuel use and internal conditions.

**14.6.2** The Retrofit Evaluator shall collate the information obtained during the monitoring process, analyse and interpret it to establish the root cause(s) of any performance discrepancy, summarize it including tables and charts as appropriate, formulate recommendations for any remedial actions required and any changes to the retrofit process that might be appropriate, and circulate the summary and recommendations to the Client, the Retrofit Coordinator, the Retrofit Assessor, the Retrofit Designer and the Retrofit Installer.

**14.6.3** Advanced monitoring and evaluation shall be completed within two years after basic monitoring and evaluation has been completed.

**NOTE** *It might be appropriate, with the permission of the Client, to supply copies of evaluation reports (at any level) to any external quality assurance body such as TrustMark, or (on request) to a funding organization or guarantee provider. Such bodies might require more extensive or detailed monitoring or investigation, over and above the requirements of this PAS.*

## 15 Claims of compliance

### 15.1 General

**15.1.1** Where claims of conformance to PAS 2035 are made, the provisions in **15.2** and **15.3** shall apply. These provisions include identification of the basis of the claim (**15.2**) and requirements for how the claim shall be expressed (**15.3**).

### 15.2 Basis of claim

#### 15.2.1 General

The claim shall identify the type of conformity assessment undertaken as one of the following:

- a) independent third-party certification in accordance with **15.2.2**;
- b) other-party validation in accordance with **15.2.3**; or
- c) self-assessment in accordance with **15.2.4**.

#### 15.2.2 Independent third-party certification

Retrofit Coordinators seeking to demonstrate that the energy retrofitting of any dwelling(s) has been independently verified as being in accordance with this PAS shall undergo assessment by an independent third-party certification body or organization accredited by the National Accreditation Body (UKAS).

**NOTE 1** Details on providing assessment and certification are given in Regulation EC765/2008 to ISO/IEC 17065.

**NOTE 2** Independent third-party certification of compliance with PAS 2035 is not currently (2019) available or in development, and is not intended, but the option is included here because it might become a requirement of a user such as TrustMark, in the future.

#### 15.2.3 Other-party validation

Retrofit Coordinators claiming conformance with this PAS for any particular project, or their sub-contractors claiming compliance with relevant parts, and using a method of validation involving parties other than those qualifying as accredited independent third parties, shall satisfy themselves that any such party is able to demonstrate compliance with recognized standards setting out requirements for organizations providing services for the assessment of processes and/or individuals.

**NOTE 1** Other-party assessment bodies are those undertaking assessment services without having achieved accreditation from the authorized accreditation service (e.g. UKAS in the UK). Such bodies could include those which, although independent of the organization undertaking the assessment, cannot demonstrate complete independence (e.g. a

quality assurance scheme such as TrustMark providing assessment services for its members or a consultant employed for such a purpose).

**NOTE 2** An example of such recognized standards is ISO/IEC 17065.

#### 15.2.4 Self-assessment

Retrofit Coordinators claiming conformance with this PAS for any project, or their sub-contractors claiming compliance with relevant parts of it, shall be able to demonstrate that the activities involved have been undertaken in accordance with this PAS, and make supporting documentation available on request. The self-assessment and presentation of the results shall be carried out in accordance with BS EN ISO 14021.

**NOTE** Retrofit Coordinators for whom neither independent third-party certification nor other-party validation is a realistic option may rely on self-assessment. In so doing they should be aware that independent validation could be required in the event of a challenge and that stakeholders and interested parties could have less confidence in this self-assessment option.

### 15.3 Permitted forms of disclosure

Claims of conformity with this PAS shall be made by Retrofit Coordinators using the appropriate form of disclosure, as follows:

- a) For claims of conformity based on independent third-party certification in accordance with **15.2.1a**):  
"Retrofit project undertaken at [insert unambiguous identification of relevant property] in accordance with PAS 2035 by [insert unambiguous identification of the claimant], [insert unambiguous identification of the certification body] certified."
- b) For claims of conformity based on other-party validation in accordance with **15.2.1b**):  
"Retrofit project undertaken at [insert unambiguous identification of relevant property] in accordance with PAS 2035 by [insert unambiguous identification of the claimant], [insert unambiguous identification of the validating body] validated."
- c) For claims of conformity based on self-assessment in accordance with **15.2.1c**):  
"Retrofit project undertaken at [insert unambiguous identification of relevant property] in accordance with PAS 2035 by [insert unambiguous identification of the claimant], self-assessed."



## 16 References

### 16.1 Retrofit framework standards

#### COMMENTARY ON Clause 16

*These standards are included in the Retrofit Standards Framework. Therefore, users of the TrustMark should comply with them.*

#### 16.1.1 Standards publications

PAS 2030, *Specification for the installation of energy efficiency measures in existing dwellings and insulation in residential park homes*

BS 5250, *Code of practice for control of condensation in buildings*

BS 5410-1, *Code of practice for oil firing – Part 1: Installations up to 45 kW output capacity for space heating and hot water supply purposes*

BS 5410-2, *Code of practice for oil firing – Part 2: Installations of 45 kW and above output capacity for space heating, hot water and steam supply service*

BS 5440-1, *Flueing and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd, 3rd family gases) – Part 1: Specification for installation of gas appliances to chimneys and for maintenance of chimneys*

BS 5440-2, *Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 2: Specification for the installation and maintenance of ventilation provision for gas appliances*

BS 5482-1, *Code of practice for domestic butane and propane gas burning installations – Part 1: Permanent dwellings*

BS 5864, *Installation and maintenance of gas-fired ducted air heaters of rated heat input not exceeding 70 kW net (2nd and 3rd family gases) – Specification*

BS 5918, *Solar heating systems for domestic hot water – Code of practice for design and installation*

BS 5970, *Code of practice for thermal insulation of pipework and equipment in the temperature range of -100°C to +870 °C*

BS 6100-1, *Building and civil engineering – Vocabulary – Part 1: General terms*

BS 6262-2, *Glazing for buildings – Part 2: Code of practice for energy light and sound*

BS 6262-3, *Glazing for buildings – Part 3: Code of practice for fire security and wind loading*

BS 6262-4, *Glazing for buildings – Part 4: Code of practice for safety related to human impact*

BS 6262-6, *Glazing for buildings – Part 6: Code of practice for special applications*

BS 6262-7, *Glazing for buildings – Part 7: Code of practice for the provision of information*

BS 6644, *Specification for installation of gas-fired boilers of rated inputs between 70 kW (net) and 1.8 MW (net) (2nd and 3rd family gases)*

BS 6798, *Specification for installation and maintenance of gas-fired boilers of rated input not exceeding 70 kW net*

BS 6891, *Installation of low-pressure gas pipework of up to 35 mm (R1 1/4) on premises*

BS 7386, *Specification for draughtstrips for the draught control of existing doors and windows in housing (including test methods)*

BS 7593, *Code of practice for treatment of water in domestic hot water central heating systems*

BS 7619, *Extruded cellular unplasticized white PVC (PVC-UE) profiles – Specification*

BS 7671, *Requirements for electrical installations – IET Wiring Regulations*

BS 7880, *Code of Practice for draught control of existing doors and windows in housing using draughtstrips*

BS 7913, *Guide to the conservation of historic buildings*

BS 8000-0, *Workmanship on building sites – Part 0: Introduction and general principles*

BS 8102, *Code of practice for protection of below ground structures against water from the ground*

BS 8123-4, *Windows and doors – Part 4: Code of practice for the survey and installation of windows and external doorsets*

BS 8550-0, *Flood resistant and resilient construction – Guide to improving the flood performance of buildings*

BS 8558, *Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complimentary guidance to BS EN 806*

BS 8660-1, *Gas-fired micro-cogeneration appliances of rated thermal input not exceeding 70 kW net – Part 1: Specification for selection, installation, inspection, commissioning, servicing and maintenance of Stirling engine micro-cogeneration appliances*

BS EN 3781, *Refrigerating systems and heat pumps – Safety and environmental requirements – Basic requirements, definitions, classification and selection criteria*

BS EN 3783, *Refrigerating systems and heat pumps – Safety and environmental requirements – Installation location and personal protection*

BS EN 3784, *Refrigerating systems and heat pumps – Safety and environmental requirements – Operation, maintenance, repair and recovery*

BS EN 8061, *Specifications for installations inside buildings conveying water for human consumption – General*

BS EN 8064, *Specifications for installations inside buildings conveying water for human consumption – Installation*

BS EN 8065, *Specifications for installations inside buildings conveying water for human consumption – Operation and maintenance*

BS EN 1264-1, *Water based surface embedded heating and cooling systems – Part 1: Definitions and symbols*

BS EN 1264-2, *Water based surface embedded heating and cooling systems – Part 2: Floor heating: Prove methods for the determination of the thermal output using calculation and test methods*

BS EN 1264-3, *Water based surface embedded heating and cooling systems – Part 3: Dimensioning*

BS EN 1264-4, *Water based surface embedded heating and cooling systems – Part 4: Installation.*

BS EN 1264-5, *Water based surface embedded heating and cooling systems – Part 5: Heating and cooling surfaces embedded in floors. Determination of the thermal output*

BS EN 1670, *Building hardware – Corrosion resistance – Requirements and test methods*

BS EN 12828, *Heating systems in Buildings – Design for water-based heating systems*

BS EN 12831-1, *Energy performance of buildings – Part 1: Method for calculation of the design heat load – Space heating load, Module M3-3*

BS EN 12831-3, *Energy performance of buildings – Part 3: Method for calculation of the design heat load – Domestic hot water systems heat load and characterisation of needs, Module M8-2, M8-3*

BS EN 13120, *Internal blinds – Performance requirements including safety*

BS EN 13141-1, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 1: Externally and internally mounted air transfer devices*

BS EN 13141-4, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 4: Fans used in residential ventilation systems*

BS EN 13141-6, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 6: Exhaust ventilation system packages used in a single dwelling*

BS EN 13141-7, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 7: Performance testing of a mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for single family dwellings*

BS EN 13141-8, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 8: Performance testing of un-ducted mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for a single room*

BS EN 13141-9, *Ventilation for buildings – Performance testing of components/products for residential*

ventilation – Part 9: Externally mounted humidity controlled air transfer device

BS EN 13141-10, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 10: Humidity controlled extract air terminal device*

BS EN 13141-11, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 11: Supply ventilation units*

BS EN 13561, *External blinds and awnings – Performance requirements including safety*

BS EN 13659, *Shutters and external venetian blinds – Performance requirements including safety*

BS EN ISO 14021, *Environmental labels and declarations – Self-declared environmental claims*

BS EN 14336, *Heating systems in buildings – Installation and commissioning of water-based systems*

BS EN 15316-4-8, *Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Space heating generation systems, air heating and overhead radiant heating systems*

BS EN 16484-1, *Building automation and control systems (BACS) – Part 1: Project specification and implementation*

BS EN 16883, *Conservation of cultural heritage – guidelines for improving the energy performance of historic buildings*

BS EN 62446-1, *Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance – Part 1: Grid connected systems – Documentation, commissioning tests and inspection*

BS EN ISO 11600, *Building construction – Jointing products – Classification and requirements for sealants*

#### 16.1.2 MCS standards:

MCS *Installer Standards* [N7]

MCS *Product Standards* [N8]

#### 16.1.3 Insulation standards and guides

- *Specification for the installation of external wall insulation ensuring the safety and operation of fuel burning appliances* [10]
- *External Wall Insulation Specification for Weathering and Thermal Bridge Control* [11]

- *External Wall Insulation pre-installation building inspection checklist* [12]

- *Retrofit Floor Insulation Guidance* [13]

- *CITB Loft Insulation Guide TRM 152/1* [14]

- *Room in Roof Insulation Guide* [15]

#### 16.1.4 Ventilation standards and guides

Ecodesign Commission Regulation (EU) 1253/2014 (energy efficiency of ventilation) [16]

BESA DW 144, *Guidance on Ductwork for MVHR* [19]

BESA DW 154, *Specification for Plastics Ductwork* [20]

BSRIA Guide 46/2013, *Domestic Ventilation Systems* [21]

BSRIA Guide 43/2013, *Flexible Ductwork* [N14]

## 16.2 List of references (other than formal standards, for guidance only)

*Climate Change Tools* online guidance for architects consisting of seven guides:

- 1 *Climate Change Briefing*
- 2 *Carbon Literacy*
- 3 *The Principles of Low Carbon Design and Refurbishment*
- 4 *Low Carbon Standards and Assessment Methods*
- 5 *Low Carbon Design Tools*
- 6 *Skills for Low Carbon Buildings*
- 7 *Whole-Life Assessment for Low Carbon Design*

Royal Institute of British Architects, London, 2009

## Annex A (Normative) Qualifications

### COMMENTARY ON Annex A

*RPEL is Recognition of Prior Experience and Learning. To meet the requirements of this PAS, RPEL processes should lead to a nationally recognized vocational or professional qualification that appears in the Register of Regulated Qualifications maintained by Ofqual for England and by its equivalents for the devolved nations.*

### A.1 Qualifications for Retrofit Advisors

**A.1.1** A Retrofit Advisor shall be either:

- a person who has completed the City & Guilds Energy awareness and energy advice training and passed the associated examination and practical test, or who is working towards that qualification via a recognized training course or RPEL process;

C1 *Text deleted* C1

- a Green Deal Advisor certified and registered by a recognized certification body; or
- a Retrofit Coordinator qualified in accordance with **A.3**.

### A.2 Qualifications for Retrofit Assessors

**A.2.1** For projects assessed as risk grade A, to which the requirements of **Path A** apply, a Retrofit Assessor shall be a Retrofit Coordinator qualified in accordance with **A.3**, or a Domestic Energy Assessor certified and registered by a UKAS-accredited assessor body, or who is working towards such certification and registration via a recognized RPEL process or via a training course that appears on the register maintained by Ofqual (for England), the Council for Curriculum Examinations and Assessment (for Northern Ireland), the Scottish Qualifications Authority (for Scotland) or Qualifications in Wales (for Wales).

**A.2.2** For projects assessed as risk grade B or C, to which the requirements of **Path B** or **Path C** apply, a Retrofit Assessor shall be a Domestic Energy Assessor certified and registered by a UKAS-accredited assessor body, or who is working towards such certification and registration via a recognized RPEL process or via a training course that appears on the register maintained by Ofqual (for England), the Council for Curriculum Examinations and Assessment (for Northern Ireland), the Scottish Qualifications Authority (for Scotland) or Qualifications in Wales (for Wales).

**A.2.3** For projects assessed as risk grade B or C, to which the requirements of **Path B** or **Path C** apply, where the dwelling to be assessed is a protected building, the Retrofit Assessor shall meet the requirements of **A.2.2** and shall also hold one of the following qualifications:

- the Level 3 Award in Energy Efficiency and Retrofit of Traditional Buildings;
- the Scottish Level 6 Award in Energy Efficiency Measures for Older and Traditional Buildings; and
- the Welsh Level 3 Award in Energy Efficiency Measures for Older and Traditional Buildings.

*NOTE These three qualifications are almost identical and may be regarded as interchangeable for the purpose of this PAS. The Scottish qualification has been withdrawn and the Welsh qualification is no longer available, but holders of these qualifications still meet the requirements of A.2.3.*

### A.3 Qualifications for Retrofit Coordinators

**A.3.1** A Retrofit Coordinator shall be a person who holds a Level 5 Diploma in Retrofit Coordination and Risk Management, or who can provide evidence of currently working towards such a qualification via a recognized RPEL process or via a training course that appears on the register maintained by Ofqual (for England), the Council for Curriculum Examinations and Assessment (for Northern Ireland), the Scottish Qualifications Authority (for Scotland) or Qualifications in Wales (for Wales).

*NOTE Building-related professional or vocational qualifications are required as pre-requisites for the Level 5 Diploma in Retrofit Coordination and Risk Management. Contact the Awarding Body or an appropriate training organisation for further information.*

## A.4 Qualifications for Retrofit Designers

**A.4.1** For projects assessed as risk grade A, and to which the requirements of **Path A** apply:

- where the only improvement measure proposed is a single measure, a Retrofit Designer shall be a specialist designer or specifier of that measure, who holds or who is working towards a measure-specific recognized qualification via a recognized RPEL process or via a training course that appears on the register maintained by Ofqual (for England), the Council for Curriculum Examinations and Assessment (for Northern Ireland), the Scottish Qualifications Authority (for Scotland) or Qualifications in Wales (for Wales);
- where the only improvement measure proposed is a single proprietary system, a Retrofit Designer shall be a specialist designer or specifier of that system, who has been trained and approved by the manufacturer or supplier of that system;
- where the only improvement measure proposed is a combustion appliance, the Retrofit Designer shall be a specialist designer or specifier who has been trained and approved by the manufacturer and/or for gas installations holds Gas Safe registration or for oil heating holds competent person registration; and
- where a measure is a system covered by the MCS [N7], [N8], the Retrofit Designer shall be a specialist designer or specifier of the system who is MCS certified.

In all of the above cases, the design prepared shall be reviewed by a Retrofit Coordinator qualified in accordance with **A.3**, and any concerns shall be reported to the specialist designer.

**A.4.2** For other projects assessed as risk grade A, and to which the requirements of **Path A** apply, a Retrofit Designer shall be either:

- a Retrofit Coordinator qualified in accordance with **A.3**; or
- a Chartered Architectural Technologist (MCIAT) registered by the Chartered Institute of Architectural Technologists (CIAT), or who is working towards such registration via a recognized RPEL process or training course.

**A.4.3** For projects assessed as risk grade B, and to which the requirements of **Path B** apply, a Retrofit Designer shall be:

- a Retrofit Coordinator qualified in accordance with **A.3**; or
- a Chartered Architectural Technologist (MCIAT) registered by the Chartered Institute of Architectural Technologists (CIAT), or who is working towards such registration via a recognized RPEL process or training course; or
- an Architect registered by the Architects Registration Board (ARB); or
- a professional member of the Chartered Institute of Building (MCIQB); or
- a Chartered Building Surveyor (MRICS or FRICS only).

**A.4.4** For projects assessed as risk grade B, and to which the requirements of **Path B** apply, and the building to be improved (or any part of it) is traditionally constructed, the Retrofit Designer shall also be a member of a certification/accreditation building conservation scheme run by one of the following organizations:

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

**A.4.5** For projects assessed as risk grade C, and to which the requirements of **Path C** apply, a Retrofit Designer shall be:

- a Chartered Architectural Technologist (MCIAT) registered by the Chartered Institute of Architectural Technologists (CIAT), or who is working towards such registration via a recognized RPEL process or training course; or

- an Architect registered by the Architects Registration Board (ARB), who is also either a Retrofit Coordinator qualified in accordance with **A.3** or holds one of the qualifications listed in **A.2.3**; or
- a professional member of the Chartered Institute of Building Services Engineers (CIBSE) who is also either a Retrofit Coordinator qualified in accordance with **A.3** or holds one of the qualifications listed in **A.2.3**; or
- a professional member of the Chartered Institute of Building (MCIQB or FCIOB) who is also either a Retrofit Coordinator qualified in accordance with **A.3** or holds one of the qualifications listed in **A.2.3**; or
- a Chartered Building Surveyor (MRICS or FRICS only) who is also either a Retrofit Coordinator qualified in accordance with **A.3** of this PAS or holds one of the qualifications listed in **A.2.3**.

**A.4.6** For projects assessed as risk grade C, and to which the requirements of **Path C** apply, and the building to be improved (or any part of it) is traditionally constructed or protected, the Retrofit Designer shall also be accredited or certified in building conservation via a scheme run by one of the following organizations:

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

and where the dwelling is protected and such scheme provides for more than one level of accreditation or certification the accreditation or certification shall be at the highest level available.

## A.5 Qualifications for Retrofit Evaluators

**A.5.1** A Retrofit Evaluator shall be a Retrofit Coordinator qualified in accordance with **A.3**.

**NOTE** *Although the role of Retrofit Evaluator is filled by a Retrofit Coordinator, the separately defined role of Retrofit Evaluator is retained so that specialist qualifications that are proposed for this role can be added to later editions.*

**A.5.2** A Retrofit Evaluator for a project involving any traditionally constructed or protected building shall also hold one of the qualifications listed in **A.2.3**.

## A.6 Multiple roles

**NOTE** *It is not a requirement that the roles of Retrofit Advisor, Retrofit Assessor, Retrofit Coordinator, Retrofit Designer and Retrofit Evaluator be filled by separate individuals. The same person can have two or more of these roles provided that he or she is qualified for each role, as defined in this Annex of this PAS, and either there is no conflict of interest involved or any conflict of interest is reported to the Client and appropriately managed.*

**A.6.1** Where basic monitoring and evaluation (see **14.3**) is carried out, the Retrofit Evaluator and the Retrofit Coordinator may be the same person. Where intermediate and/or advanced monitoring and evaluation (see **14.3**) is carried out the Retrofit Evaluator may not be the same person as the Retrofit Coordinator, and shall be independent of the Retrofit Assessor, the Retrofit Coordinator, the Retrofit Designer and the PAS 2030 Retrofit Installer.

## Annex B (Normative) Risk Assessments

**B.1** The risk assessment process (7.1) shall consist of the assessment of risk grades for each of five criteria and their aggregation into an overall risk grade that is used to determine the relevant compliance path for the application of this PAS, in accordance with Table B.1 and Table B.2.

**Table B.1** – Risk assessment table for determining PAS 2035 Path

Criterion 1: Number of dwellings in the project		
The number of dwellings to be improved	Risk grade	Assessed grade
1–10	A	
11–30	B	
More than 30	C	
Criterion 2: Number of measures per dwelling <sup>A)</sup>		
The average number of improvement measures per dwelling	Risk grade	Assessed grade
1–2	A	
3–5	B	
More than 5	C	
Criterion 3: Measures proposed		
The inherent technical risk of the highest risk measure (from Table B.2)	Risk grade	Assessed grade
1	A	
2	B	
3	B	
Criterion 4: Combination of measures		
The highest risk combination of measures (from the Measures Interaction Matrix, Figure D1)	Risk grade	Assessed grade
GREEN	A	
ORANGE	B	
YELLOW	B	
Criterion 5: Construction and Built Form		
Construction and built form of buildings	Risk grade	Assessed grade
Conventional <sup>B)</sup> , not high-rise, not protected <sup>C)</sup>	A	
Traditional <sup>D)</sup> , not protected <sup>C)</sup>	B	
System-built <sup>E)</sup> , not high-rise, not protected <sup>C)</sup>	B	
High rise <sup>F)</sup> , any construction	C	
Protected <sup>G)</sup> , any construction or built form	C	

Table B.1 – Risk assessment table for determining PAS 2035 Path *continued*

Overall Risk Grade		
Highest assessed grade (from Criteria 1 to 5 above)	PAS 2035 Path	Assessed Path
A	A	
B	B	
C	C	
<p><sup>A)</sup> For this risk assessment, the number of measures excludes any ventilation upgrade required by Annex C.</p> <p><sup>B)</sup> Conventional means masonry cavity wall construction (brick and/or block) with or without render, tile hanging or other external cladding.</p> <p><sup>C)</sup> For the purpose of this PAS, protected buildings include Listed Buildings and buildings in Conservation Areas or World Heritage Sites.</p> <p><sup>D)</sup> Traditional means constructed with solid brick or stone walls, or timber-framed walls with any infill.</p> <p><sup>E)</sup> System-built means frame (timber, steel or concrete) and pre-fabricated panel (concrete or timber, or a combination) construction, or timber-framed construction with brick or stone external cladding.</p> <p><sup>F)</sup> High-rise means over 12 metres or over four storeys in height above the ground.</p> <p><b>NOTE</b> The format of Table B.1 is provided as an example only; users of this PAS may meet the requirement for use of the content of the table in whatever manner is appropriate to their operation.</p>		

Table B.2 – Inherent technical risks of energy efficiency measures (EEMs)

Measure	IHT	Measure	IHT
Internal solid wall insulation (IWI)	3	Passive stack ventilation	2
External solid wall insulation (EWI)	2	Single-room heat recovery ventilators	1
Cavity wall insulation	2	Decentralized mechanical extract ventilation	2
Party cavity wall insulation	2	Centralized mechanical extract ventilation	2
Loft insulation (between and over joists)	2	Positive input ventilation	3
Loft insulation between/under/over rafters	2	Mechanical ventilation with heat recovery	3
Flat roof insulation	3	Radiator reflector panels	1
Room in roof insulation (all elements)	3	District / communal heating – connection	3
Floor insulation (solid or suspended)	3	District / communal heating – heat meters	1
Hot water cylinder insulation	1	Air source heat pump	3
Primary pipework insulation	1	Ground source heat pump	3
Draught-proofing / air-tightness measures	1	Biomass boiler	2
New or replacement windows	1	Micro combined heat and power	3
New or replacement external doors	1	Solar photovoltaics	2
Boiler replacement	2	Micro wind-power	2
New central heating system	2	Micro hydro-power	3
Replacement of electric storage heaters	1	Solar water heating	2



**Table B.2** – Inherent technical risks of energy efficiency measures (EEMs) *continued*

Measure	IHT	Measure	IHT
New warm air heating	2	Energy efficient lighting	1
Heating and hot water controls	1	Energy efficient appliances	1
Flue gas heat recovery	2	Park home insulation	3
Intermittent extract ventilation	1	Other EEMs, including innovations	3

**NOTE** The inherent technical risk of measures is rated comparatively on a scale of 1 to 3.

**B.2** Where the intended Retrofit Installer operates under an industry quality assurance scheme that has the features listed in **B.6**, the inherent technical risk scores for the measure(s) covered by that scheme in **Table B.2** may be reduced by one.

**B.3** Where a measure complies with the MCS standards, [N7], [N8] and is installed by an MCS certified installer the inherent technical risk score for that measure in **Table B.2** may be reduced by one.

**B.4** For the installation of external solid wall insulation (EWI), if the construction details in the NIA/INCA/SWIGA guide *External wall insulation specification for weathering and thermal bridge control* [11] are not used, or the details coded amber are used (rather than those coded green), the inherent technical risk score for the relevant measure in **Table B.2** shall be increased by one.

**B.5** Any industry quality assurance scheme used to claim a reduction of inherent technical risk, as referred to in **B.2**, shall apply only to measures that are proprietary systems (not individual materials and components) and shall have at least the characteristics set out in **B.6**.

**B.6** The industry quality assurance scheme shall:

- 1) be operated by a body independent of the system provider and the installer (referred to here as the scheme operator);
- 2) subject system providers to initial and regular assessments of their technical and financial resources and documented management systems;
- 3) include provision for the imposition of sanctions (including possible removal from the scheme) on members who do not comply with the scheme rules;
- 4) require maintenance by the scheme operator of expertise to investigate complaints and assist with their resolution;

5) require that:

- systems and their components are subject to independent technical approval by a UKAS accredited body;
- the UKAS accredited body carries out independent checks of manufacturing activity at least annually;
- any equipment used to install a system is tested, calibrated and plated for the system;
- procedures are in place to ensure that only installers approved by the system providers can purchase or install their systems;
- materials and components for systems are appropriately stored and handled, and traceable via an audit process;
- systems' documentation includes generic method statements for their correct installation;
- systems' documentation includes appropriate care and maintenance instructions;
- systems are covered by independent guarantees of the materials and products used, and of any designs prepared by system providers; and
- system providers hold appropriate professional indemnity assurance;

- 6) require independent checks of compliance with any requirements for independent surveillance of pre-installation inspections;
- 7) provide for random targeted quality inspections by the scheme operator of installations at a rate of not less than 1% of installations by each scheme member;
- 8) require system providers to:
  - train installers of their systems;
  - assess installers' qualifications and competence;
  - issue system-specific "competence cards" to qualified and competent operatives;
  - provide qualified and competent operatives with CPD; and
  - re-assess competence at least bi-annually, and maintain records of their training and CPD.
- 9) require system providers to make comprehensive good practice guidance available in relation to their systems, covering:
  - assessment for suitability;
  - installation;
  - dealing with non-standard installations;
  - guidance on handover to users;
  - guidance for users;
  - complaint handling; and
  - remedial procedures;
- 10) require system providers to make available regularly updated technical notes to advise installers of trends, identified technical issues, system changes or changes to installation procedures or requirements for qualifications and competence;
- 11) subject installers of systems to regular random quality inspections by the scheme operators, at a rate not less than 1% of all installations; these inspections shall be additional to any certification body surveillance and shall focus on system-specific performance and quality;
- 12) require installers of systems to provide the scheme operator with evidence of compliance with the Building Regulations 2010 [22] through membership of a Competent Person Scheme (where applicable), and of certification under PAS 2030:2019;
- 13) require installers to provide independent guarantees of their work covering pre-installation inspections, any designs they prepare, and installation workmanship;
- 14) require installers to operate complaints handling procedures and to provide customers with access to alternative dispute resolution; and
- 15) require installers' compliant handling procedures to be audited annually by the scheme operator.

## Annex C (Normative) Requirements for provision of adequate ventilation

### COMMENTARY ON Annex C

Reference is made in this annex to *The Building Regulations 2010 – Approved Document F: Ventilation [N11]* (applicable in England) (referred to in this Annex as “Approved Document F”. The equivalent references for the devolved administrations are:

- for Wales, *The Building Regulations 2010 – Approved Document F: Ventilation [N11]*;
- for Scotland, *the Scottish Building Standards Technical Handbook 2017: Domestic [N12]*;
- for Northern Ireland, *Building Regulations (Northern Ireland) 2012 Guidance: Technical Booklet K: Ventilation [N13]*.

The requirement for those undertaking the specification, design and installation of EEM in an existing dwelling to ensure that ventilation at least complies with all relevant requirements of Approved Document F is fully recognized in this PAS but is not a requirement of this specification (see also reference to contractual and legal considerations in the Foreword). The technical requirements of this PAS are not, however, restricted to those included in Approved Document F and in some instances might go beyond the requirements of that document where this is judged to deliver better outcomes.

### C.1 Introduction

**C.1.1** Traditionally, UK dwellings have relied on wind-driven air infiltration and air leakage to provide adequate ventilation, i.e. to expel “stale” air (containing pollutants such as moisture and high concentrations of carbon dioxide), to provide a supply of “fresh” (i.e. external) air and to maintain IAQ. The average air permeability of dwelling envelopes in the UK (with fans and background ventilators sealed), as measured by BRE research [23], is approximately 10 m<sup>3</sup>/m<sup>2</sup>h at 50 Pa, and infiltration and air leakage provide most (approximately three-quarters) of the required ventilation.

**C.1.2** Since the 1970s the installation of double-glazed, draught-stripped windows, the draught-stripping of external doors and the insulation of lofts and cavity walls have improved energy efficiency but also reduced the air permeability of many homes, reducing infiltration and air leakage. In some cases, this has been compensated for by introducing intermittent extract ventilation fans into “wet” spaces (kitchens and bathrooms) to expel moist stale air and by installing background ventilators (air inlets, commonly known as trickle ventilators) in other spaces to provide balancing supplies of fresh air. However, the existence of a ventilation system is not proof that a building is adequately ventilated, and many existing buildings are not adequately ventilated.

**C.1.3** Improving the air-tightness of a dwelling to reduce “adventitious” or uncontrolled wind-driven air infiltration and air leakage, when combined with the provision of adequate controlled ventilation, significantly improves energy efficiency. However, without adequate ventilation, the installation of any additional insulation or air-tightness measure anywhere in the building, or the blocking of any existing ventilator, reduces the infiltration and air leakage rate, and increases the risk that there is insufficient ventilation to maintain adequate IAQ. Poor IAQ includes high relative humidity (which carries a risk of condensation and mould growth) and high concentrations of pollutants such as carbon dioxide and VOCs and dust mites, all of which are associated with serious health risks for occupants or potential damage to building finishes, fabric and structure.

**C.1.4** When installing any insulation or air-tightness measures, or replacing windows, in existing buildings, the adequacy of the existing ventilation shall be assessed and if necessary improved.

**NOTE** *Air-tightness measures include draught-stripping, window replacement and any other measure designed to reduce the infiltration rate of the building envelope. Like-for-like replacement of a window that is already draught-stripped and/or equipped with a background ventilator should not be counted as an air-tightness measure.*

## C.2 Assessment of existing ventilation

**NOTE** Subclause 8.4 requires Retrofit Assessors to identify and assess existing ventilation systems and confirm that they are working correctly as part of the whole-dwelling assessment.

**C.2.1** For every dwelling proposed for improvement, the Retrofit Designer shall use the information provided by the Retrofit Assessor to assess the adequacy of the existing ventilation according to the following criteria.

**C.2.2** Existing ventilation shall be assessed as inadequate for the improved dwelling if one or more of the following are apparent:

- there is evidence of condensation and/or mould growth in the dwelling;
- there is no ventilation system, or the ventilation system is incomplete (see C.2.3) or not functional;
- there are not undercuts of at least 7 600 mm<sup>2</sup> beneath all internal doors, above the floor finish, to allow air to move through the dwelling; or
- there is no provision for purge ventilation of each habitable room (e.g. by opening windows) as required by Approved Document F [N11].

**C.2.3** An acceptable, complete ventilation system shall be:

- an intermittent extract ventilation (IEV) system consisting of correctly sized extract fans in all “wet” rooms and correctly sized background ventilators (to admit “fresh” external air) in all living spaces and bedrooms; or
- a passive stack ventilation (PSV) system consisting of passive stack ventilators serving all “wet” rooms, and correctly sized background ventilators (to admit “fresh” external air) in all living spaces and bedrooms; or
- a continuous positive input ventilation (PIV) system that supplies “fresh” air, combined with correctly sized background ventilators (to allow moist ‘stale’ air to escape) in all living space and bedrooms;
- a continuous mechanical extract ventilation (MEV) system that extracts moist, “stale” air from all “wet” rooms combined with correctly sized background ventilators (to admit “fresh” external air) in all living spaces and bedrooms;
- a whole-house supply and extract MVHR system that extracts moist “stale” air from all wet rooms, supplies “fresh” external air to all living spaces and bedrooms, and has been properly commissioned and balanced.

**NOTE 1** Wet rooms include kitchens, bathrooms, shower rooms, utility rooms, and WCs without openable windows; a procedure for sizing background ventilators is given in Approved Document F [N11].

**NOTE 2** If the only factor rendering the ventilation inadequate is a lack of intermittent extract ventilation fans in all wet rooms, the ventilation can be rendered adequate by providing such fans.

**NOTE 3** If the only factor rendering the ventilation inadequate is a lack of background ventilators, the ventilation can be rendered adequate by providing such ventilators.

**NOTE 4** If the only factor rendering the ventilation inadequate is a lack of undercuts beneath all internal doors, the ventilation can be rendered adequate by providing such undercuts.

**NOTE 5** If the only factor rendering the ventilation inadequate is lack of provision for purge ventilation, the ventilation can be rendered adequate by provision of an opening window in each room.

**NOTE 6** Evidence that a ventilation system is not working properly would be a lack of significant air flow through the extract or supply grilles, or fans. This can be measured easily with a simple vane anemometer.

**C.2.4** However, if the proposed energy efficiency improvement measures are either intended to reduce the air permeability of the building envelope below 5 m<sup>3</sup>/m<sup>2</sup>h at 50 Pa or might do so, then existing IEV or PSV as described in C.2.3 shall be assessed as inadequate.

## C.3 Upgrading of ventilation

**NOTE 1** A new British Standard for air-tightness and ventilation for domestic retrofit is proposed. On publication, the new standard supersedes C.3.1 to C.3.15 below. Prior to publication of the new standard, clauses C.3.1 to C.3.15 are applicable to all domestic retrofit projects.

**NOTE 2** Some of the following clauses (C.3.3 to C.3.11 inclusive) refer to the ventilation equipment testing standard series BS EN 13141. The relevant clauses of each part of BS EN 13141 are specified in Approved Document F, Table 5.3 [N11].

**C.3.1** Where the existing ventilation is assessed as inadequate, and any insulation or air-tightness measures are proposed, the Retrofit Coordinator shall ensure that the Retrofit Designer includes upgrading of the ventilation in the retrofit design.

**NOTE** Air-tightness measures include (but are not limited to):

- draught-stripping of existing windows and doors;
- secondary glazing;
- replacement of existing windows and doors (irrespective of whether the original units were draught-stripped or the new units include background ventilators);

- *the provision of a new air barrier layer in the construction or lining of any exposed floor, wall or roof;*
- *sealing up of existing chimneys and flues; and*
- *the replacement of any open-flued heating or hot water appliance with a room-sealed appliance (i.e. one with a balanced flue).*

**C.3.2** Where the existing ventilation is assessed as inadequate, but no insulation or air-tightness measures are proposed, the Retrofit Coordinator shall bring the results of the ventilation assessment to the attention of the Client and the Retrofit Designer, with a recommendation that the ventilation system is upgraded. For projects with assessed risk grades of B or C (**Paths B or C**) upgrading of the ventilation system shall be included in any medium-term improvement plan for the dwelling required by **9.2.4**.

**C.3.3** Where ventilation is to be upgraded and it can be shown by fan pressurization testing (or another accepted method) that the air permeability of the building envelope, after installation of the proposed energy efficiency measures, is not less than 5 m<sup>3</sup>/m<sup>2</sup>h at 50 Pa, then an acceptable type of ventilation shall be IEV tested in accordance with BS EN 13141-4, or PSV in all “wet” spaces combined with correctly sized background ventilators tested in accordance with BS EN 13141-1 in all living spaces and bedrooms. In either case, the ventilation system capacity shall be determined in accordance with the procedures set out in Approved Document F [N11], but assuming occupancy equal to the number of bed-spaces in the dwelling, i.e. two persons in each double bedroom and one in each single bedroom, to ensure adequate capacity. In the case of PSV, the apertures of the air extract grilles (in wet spaces) shall be automatically controlled in response to internal relative humidity (RH).

**C.3.4** Due consideration shall also be given to building location, local topography, orientation and internal layouts and dimensions to confirm that natural ventilation (IEV or PSV) is effective. If this is not the case, then neither IEV nor PSV is acceptable, and the ventilation system shall be upgraded in accordance with **C.3.5**.

**NOTE** *Whether IEV is likely to be effective should be determined in accordance with the procedures set out in Approved Document F, Appendix A [N11].*

**C.3.5** In all other cases where ventilation is to be upgraded the minimum acceptable type of ventilation shall be:

- continuous MEV consisting of one or more fans tested in accordance with BS EN 13141-6 and extracting

moist “stale” air from all “wet” spaces, combined with background ventilators tested in accordance with BS EN 13141-1 in all living spaces and bedrooms to admit a balancing supply of “fresh” external air;

- continuous whole-dwelling MVHR tested in accordance with BS EN13141-7, extracting moist “stale” air from “wet” spaces and providing a balanced supply of “fresh” external air to all living spaces and bedrooms; or
- continuous PIV tested in accordance with BS EN 13141-11, providing a supply of “fresh” external air to the centre of the dwelling, combined with background ventilators tested in accordance with BS EN 13141-1 in all living spaces and bedrooms to allow moist “stale” air to escape.

**NOTE 1** *MVHR provides benefits from the recovery of heat from exhaust air, reducing heating demand. The use of MVHR is a requirement of the Passive House EnerPHit standard [24], if it is adopted. MVHR was developed for new dwellings, so it requires careful design to install it in existing dwellings, especially smaller ones. To ensure adequate performance and heat recovery efficiency, fan boxes, heat exchangers and ductwork should not be installed in unheated spaces, and cold air ducts should be insulated to reduce condensation risk. To achieve adequate performance and noise levels, ductwork should be as short and straight as possible. Attention should be given to balancing and commissioning MVHR systems in accordance with manufacturers’ instructions and recommendations.*

**NOTE 2** *PIV fans are often mounted in a roofspace so that the systems can benefit from some degree of solar heat gain in the roof (or heat loss from the house into the roofspace), and supply air that is slightly warmer than external air. However, PIV systems can drive warm moist air through gaps and holes into cold parts of the construction, and into construction voids (e.g. beneath floors), with a consequent risk of condensation and mould growth.*

**C.3.6** Assessment of the suitability of a proposed ventilation system should take account of the air permeability of the building envelope and the fact that after retrofit the air permeability might be lower. In all cases where ventilation is upgraded, provision shall also be made for purge ventilation in any habitable room that does not already have such provision; see Approved Document F [N11] for details on providing purge ventilation.

**NOTE** *Purge ventilation can be provided by means of openable windows, or by mechanical means if window opening is not possible.*

**C.3.7** Any fan specified as part of any of the ventilation systems described in C.2 shall be an energy efficient model compliant with EcoDesign Commission Regulation (EU) 1253/2014 [16]. Ventilation systems shall conform to *Domestic ventilation systems* [N10].

**C.3.8** If MEV is installed, it may be either centralized (cMEV, i.e. a single central fan with ducts) or decentralized (dMEV, i.e. one fan in each “wet” room, with only minimal ducting connecting the fans to the exterior, if required). If dMEV fans are used, they shall either meet the requirements for listing on the SAP Product Characteristics Database (PCDB) [17] or they shall be tested in accordance with BS EN 13141-6; the effect of wind on the performance of a dMEV system shall not reduce the air flow rate by more than 10%. Continuous extract fans can also be used, provided they have the capability to achieve the minimum flow rates specified in Approved Document F, Table 5.1a [N11] for intermittent extract fans.

**NOTE** For dMEV fans, the installation configuration of the fan unit is specified in BS EN 13141-6:2014, 5.2.2 and the test conditions (e.g. normal conditions, wind conditions, temperature, electrical conditions) are specified in BS EN 13141-6:2014, 5.2.4. The wind conditions specified in BS EN 13141-6:2014, 5.2.4.1.2 are applied with a counter pressure of 5 Pa.

**C.3.9** Whichever of the options (C.3.5) is adopted, the ventilation system shall be capable of providing a whole-dwelling background ventilation rate equivalent to at least the “minimum low rate” of whole-dwelling ventilation specified in Approved Document F [N11], assuming occupancy equal to the number of bed-spaces in the dwelling, i.e. two persons in each double bedroom and one in each single bedroom, to ensure adequate capacity. The system shall also provide sufficient additional capacity to ensure that adequate ventilation is maintained throughout the year. Additional ventilation capacity shall also be available intermittently to achieve at least the “minimum high rate” specified in Approved Document F [N11].

**NOTE** Approved Document F [N11] specifies that the “minimum low rate” of whole-dwelling ventilation should be based on the highest of three rates, calculated according to the number of wet rooms, the number of bedrooms (adjusted for occupancy) and the floor area. This approach should be adopted here, but with the bedroom occupancy level assumed as defined above.

**C.3.10** Whichever of the options (C.3.5) is adopted, the whole-house ventilation rate shall be controlled automatically so that it can maintain good internal air quality and avoid waste of energy. Controls shall be provided that sense and monitor a control parameter in order to automatically regulate ventilation rate(s) either on a whole house basis or room-by-room in order to match them with demand. Ventilation shall not be controlled solely via light switches or manual switches.

**NOTE 1** The automatic control process is sometimes referred to as “demand control”. Demand control complements the provision of adequate capacity in a ventilation system (over and above minimum regulatory requirements) by eliminating unnecessary energy use and noise.

**NOTE 2** A control parameter is a measurable variable or variables that are assumed to be representative of the ventilation demand, e.g. the level of RH, carbon dioxide, VOC or other gases, or presence, motion or occupancy detection from infrared body heat or from reflection of ultrasonic waves, electrical signals from human operation of lights or equipment.

**NOTE 3** If RH is used as a control parameter, then any humidity-controlled air terminal or air inlet devices should be tested in accordance with BS EN 13141-9 and BS EN 13141-10.

**C.3.11** Single-room heat recovery ventilators (SRHRVs) or alternate flow heat recovery (AFHR) fans tested in accordance with BS EN 13141-8 can be specified to complement an existing or new ventilation system where appropriate (e.g. in a room that is difficult to connect to a whole-dwelling system), but multiple SRHRVs or AFHR fans shall not be used as a whole-dwelling system.

**C.3.12** Any metal or plastic ductwork specified as part of any of the ventilation systems shall conform to the *Domestic ventilation compliance guide* [N14]. Flexible ductwork shall only be used for final connections to fan boxes, extract grilles or terminals, and shall conform to *Flexible ductwork* [N14].

**NOTE** Specifiers may also wish to consider BESA guidance DW 144: *Specification for sheet metal ductwork* [19] or DW 154: *Specification for plastics ductwork* [20], as appropriate.

**C.3.13** Where any new or upgraded ventilation system is proposed, the ventilation system design shall include calculations provided by a technical consultant, specialist designer or the supplier of the system, to demonstrate that the whole-dwelling ventilation rates specified in C.3.7 are provided by the equipment proposed.

**C.3.14** The ventilation system design shall include provisions to ensure that the location, configuration and fixing of ventilation systems allow them to operate as quietly as possible, without unnecessary noise or vibration, inside or outside the home. For intermittent ventilation systems, the maximum acceptable noise level when the ventilation system is working shall be  $30 \text{ dB}_{\text{LAeq,T}}$  in habitable rooms. For continuous ventilation systems, the maximum acceptable noise level when the ventilation system is working at its background capacity shall be  $30 \text{ dB}_{\text{LAeq,T}}$  in habitable rooms. Ventilation system designers shall take account of the acoustic data provided by fan manufacturers to ensure that system noise levels are acceptable and do not cause annoyance to occupants. Noise levels lower than those specified might be desirable in bedrooms, and higher noise levels might be acceptable in less sensitive rooms, such as kitchens and bathrooms. Noise levels shall be measured as specified in BS 8233 and in accordance with the guidance in Approved Document F [N11].

**C.3.15** The retrofit design shall specify that the ventilation system is to be installed by operatives holding suitable qualifications identified in the Register of Regulated Qualifications maintained by Ofqual for England (and by its equivalents for the devolved nations) and approved by the manufacturer or supplier of the system.

**NOTE** *In the temporary absence of suitable training courses on the Register of Regulated Qualifications, installers should be trained via the competent persons course available from the National Inspection Council for Electrical Installation Contracting (NICEIC) [18].*

## Annex D (Normative) Requirements for dealing with interactions between EEMs

### D.1 Introduction

**D.1.1** When energy efficiency measures are installed in any existing building it is essential to take account of the fact that some measures can impact upon the performance of other measures or can themselves be impacted by those measures. There are also energy efficiency measures that when installed in a building without appropriate care can significantly impair the functionality of the building.

**D.1.2** For this reason this PAS emphasizes the need for the Retrofit Designer to consider and make adequate provision for the interfaces between the energy efficiency measures in the retrofit design. PAS 2030 also imposes responsibilities on installers of energy efficiency measures to be alert to these potential issues and to closely follow the retrofit design. This extends to the requirement for installers to pay attention to such matters during the pre-installation building inspection and to bring any perceived issues that they believe not to have been adequately provided for in the retrofit design to the attention of the Retrofit Coordinator.

### D.2 Avoidance of thermal bridging

The retrofit design shall include construction details for eliminating thermal bypass and minimizing thermal bridging at corners, junctions and edges of insulation layers either occurring because of geometry or resulting from discontinuity of the insulation or from insulation being thinner than in the adjacent area (e.g. at window reveals, around meter boxes, etc.).

**NOTE** *These construction details should be based on accepted industry guidance or standards. e.g. External Wall Insulation Specification for Weathering and Thermal Bridge Control [11] (see 10.9.1). Alternatively, temperature factors for construction details should be calculated in accordance with IP1/06 [N2]. Temperature Factors ( $f_{Rsi}$ ) should be not less than 0.75.*

### D.3 The Measures Interaction Matrix

Figure D.1 provides information about the nature of relationships between co-installed EEMs, identifying measures that are independent and do not interact and measures that are not appropriate together and shall not be combined; other intermediate relationships (e.g. when a construction detail is required for an interface) are also identified. These relationships shall be taken into account by the Retrofit Designer when developing the retrofit design.



Figure D.1 – The measures interaction matrix



## Bibliography

### Standards publications

BS 85500, *Flood resistant and resilient construction – Guide to improving the flood performance of buildings*

BS EN 13141-8, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 8: Performance testing of un-ducted mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for a single room*

BS EN 13141-9, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 9: Externally mounted humidity controlled air transfer device*

BS EN 13141-10, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 10: Humidity controlled extract air terminal device*

BS EN ISO/IEC 17065, *Conformity assessment – Requirements for bodies certifying products, processes and services*

### Other publications

[1] NATIONAL STANDARDS AUTHORITY OF IRELAND. *Code of practice for the energy efficient retrofit of dwellings*. Dublin: NSAI, 2014.

[2] BRITISH STANDARDS INSTITUTION. *Moisture in buildings: An integrated approach to risk assessment and guidance*. London: BSI, 2017.

[3] GREAT BRITAIN. *Climate Change Act 2008*. London: The Stationery Office.

[4] DEPARTMENT FOR BUSINESS, ENERGY AND INDUSTRIAL STRATEGY. *Clean growth strategy*. London: BEIS, 2017.

[5] BUILDING SERVICES RESEARCH AND INFORMATION ASSOCIATION. *Domestic ventilation systems – A guide to measuring airflow rates*. BG 46/2015. Bracknell: BSRIA, 2015.

[6] Retrofit Pattern Book website. Available from <https://retrofit.support> [viewed May 2019].

[7] Ofgem website. Available from <https://www.ofgem.gov.uk/consumers/household-gas-and-electricity-guide/how-switch-energy-supplier-and-shop-better-deal> [viewed May 2019].

[8] DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT. *Each home counts: An independent review of consumer advice, protection, standards and enforcement for energy efficiency and renewable energy*. Available at [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/578749/Each\\_Home\\_Counts\\_December\\_2016\\_.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/578749/Each_Home_Counts_December_2016_.pdf) London: DCLG, 2016.

[9] EUROPEAN COMMUNITIES. 765/2008/EEC. Council Directive 765/2008 of 9 July 2008, on setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) 339/93. Office for Official Publication of the European Communities, 2008.

[10] SOLID WALL INSULATION GUARANTEE AGENCY. *Specification for the installation of external wall insulation ensuring the safety and operation of fuel burning appliances*. Available from <https://www.dropbox.com/s/48g0py3bjfzhdq/Document%201%20FINAL.pdf?dl=0> [viewed May 2019].

[11] SOLID WALL INSULATION GUARANTEE AGENCY. *External wall insulation specification for weathering and thermal bridge control*. Available at <https://www.swiga.co.uk/news/new-external-wall-insulation-industry-documents> [viewed May 2019].

[12] SOLID WALL INSULATION GUARANTEE AGENCY. *External wall insulation pre-installation building inspection checklist*. Available from <https://www.dropbox.com/s/4ay242vbqf46zyj/Document%202%20FINAL.pdf?dl=0> [viewed May 2019].

[13] GREENSPEC. *Retrofit Floor insulation Guidance*. Available from <http://www.greenspec.co.uk/building-design/ground-floor-insulation/> [viewed May 2019].

[14] CONSTRUCTION INDUSTRY TRAINING BOARD. *A Trainer resource manual for insulation and building treatments. TRM 152/1*. Available from <https://www.citbni.org.uk/CITB/files/71/71d5ac59-31a6-4489-8f62-2cd2613276d5.pdf> [viewed May 2019].

- [15] NATIONAL INSULATION ASSOCIATION. *A guide to retrofit room in roof insulation guide*. Available at [https://www.nia-uk.org/media/1214/nia\\_atma-riri-guide-v10.pdf](https://www.nia-uk.org/media/1214/nia_atma-riri-guide-v10.pdf) [viewed May 2019]
- [16] EUROPEAN COMMUNITIES. 2009/125/EC. Commission Regulation (EU) No. 1253/2014 of 7 July 2014, implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for ventilation units. Official Journal of the European Union, 2014.
- [17] SAP Product Characteristics Database (PCDB). Available from <https://www.ncm-pcdb.org.uk/sap/searchpod.jsp?id=17> [viewed May 2019].
- [18] National Inspection Council for Electrical Installation Contracting (NICEIC). Available from <http://www.niceic.com/> [viewed May 2019].
- [19] BUILDING ENGINEERING SERVICES ASSOCIATION. *Guidance on ductwork for MVHR*. DW/144. London: BESA, 2016.
- [20] BUILDING ENGINEERING SERVICES ASSOCIATION. *Specification for plastics ductwork*. DW/154. London: BESA, 2000.
- [21] Building Services Research and Information Association. *Domestic ventilation systems*. Guide 46/2013. Berkshire: BSRIA, 2013.
- [22] GREAT BRITAIN. *The Building Regulations 2010*. London: The Stationery Office.
- [23] Building Research Establishment. *Airtightness in UK dwellings*. Information Paper IP1/00: Watford: BRE, 2000.
- [24] ENERPHIT. *Certified retrofits with Passive House components*. Hanover: Passive House Institute. Available from [https://passiv.de/en/03\\_certification/02\\_certification\\_buildings/04\\_enerphit/04\\_enerphit.htm](https://passiv.de/en/03_certification/02_certification_buildings/04_enerphit/04_enerphit.htm).

## Further Reading

- JONES, M., KIELY, J., LUPTON, M. and RICKABY, P. *Repairs and maintenance*. London: National Housing Federation, 2011.
- JONES, M., KIELY, J., LUPTON, M. and RICKABY, P. *Managing the assets*. London: National Housing Federation, 2011.
- INSTITUTE FOR SUSTAINABILITY. *Low carbon domestic retrofit: business opportunity guides*. Available from <https://www.instituteforsustainability.co.uk/retrofitguides.html> [viewed May 2019].
- MAY, N. and RYE, C. *Responsible retrofit of traditional buildings*. London: Sustainable Building Alliance, 2012.
- GETHING, W. and PUCKETT, K. *Design for climate change*. London: RIBA Publications, 2013.
- McLAREN-WEBB, C. RICKABY, P., WARREN, E. and WILLOUGHBY, J. *An introduction to low carbon domestic refurbishment*. Second edition. London: Construction Products Association and RIBA Publishing, 2014.
- SUSTAINABLE TRADITIONAL BUILDINGS ALLIANCE. *What is whole house retrofit?* London: 2016. Available from <http://www.sdffoundation.org.uk/downloads/What-is-Whole-House-Retrofit-Dec2016.pdf> [viewed May 2019].
- BRISTOL CITY COUNCIL. *A Bristolian's guide to solid wall insulation*. Bristol: 2016. Available from [http://files.site-fusion.co.uk/webfusion58199/file/2015\\_bristolsolidwallinsulationguidance.pdf](http://files.site-fusion.co.uk/webfusion58199/file/2015_bristolsolidwallinsulationguidance.pdf) [viewed May 2019].
- BURKE, A. and RICKABY, P. *Maintaining quality homes: keeping residents warm and healthy*. London: National Housing Maintenance Forum, 2016.

## British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

### About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards-based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

### Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at [bsigroup.com/standards](http://bsigroup.com/standards) or contacting our Customer Services team or Knowledge Centre.

### Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at [bsigroup.com/shop](http://bsigroup.com/shop), where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

### Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to [bsigroup.com/subscriptions](http://bsigroup.com/subscriptions).

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

**PLUS** is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit [bsigroup.com/shop](http://bsigroup.com/shop).

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email [bsmusales@bsigroup.com](mailto:bsmusales@bsigroup.com).

### Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

### Copyright

All the data, software and documentation set out in all British Standards and other BSI publications are the property of and copyrighted by BSI, or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. Details and advice can be obtained from the Copyright & Licensing Department.

### Useful Contacts:

#### Customer Services

Tel: +44 845 086 9001

Email (orders): [orders@bsigroup.com](mailto:orders@bsigroup.com)

Email (enquiries): [cservices@bsigroup.com](mailto:cservices@bsigroup.com)

#### Subscriptions

Tel: +44 845 086 9001

Email: [subscriptions@bsigroup.com](mailto:subscriptions@bsigroup.com)

#### Knowledge Centre

Tel: +44 20 8996 7004

Email: [knowledgecentre@bsigroup.com](mailto:knowledgecentre@bsigroup.com)

#### Copyright & Licensing

Tel: +44 20 8996 7070

Email: [copyright@bsigroup.com](mailto:copyright@bsigroup.com)





BSI, 389 Chiswick High Road  
London W4 4AL  
United Kingdom  
[www.bsigroup.com](http://www.bsigroup.com)

ISBN 978-0-539-06020-1



9 780539 060201

# PAS 2030:2019

*Incorporating Corrigendum No. 1*

## Specification for the installation of energy efficiency measures in existing dwellings and insulation in residential park homes



### Publishing and copyright information

The BSI copyright notice displayed in this document indicates when the document was last issued.

© The British Standards Institution 2020

Published by BSI Standards Limited 2020

ISBN 978 0 539 12816 1

ICS 91.120.10, 91.140.10

*No copying without BSI permission except as permitted by copyright law.*

### Publication history

First edition February 2012

Second edition December 2012

Third edition January 2014

Fourth edition February 2017

Fifth edition May 2019

### Amendments issued since publication

Date	Text affected
29 February 2020	Corrigendum No.1 contains: <ul style="list-style-type: none"><li>• updates to the transition period in the Foreword; and</li><li>• editorial corrections to Table B.12.</li></ul>



# Contents

Foreword .....	iii	10.6 Ministry of Housing, Communities and Local Government.....	21
Introduction.....	v	10.7 Other insulation installation guidance references	21
<b>1 Scope.....</b>	<b>1</b>	<b>Annex A (normative)</b>	
<b>2 Normative references .....</b>	<b>2</b>	Measure-specific Annex selection and co-installation requirements .....	22
<b>3 Terms and definitions .....</b>	<b>4</b>	A.1 Introduction.....	22
<b>4 Retrofit project management .....</b>	<b>7</b>	A.2 Energy efficiency measures and types arranged by measure category.....	22
<b>5 The retrofit design .....</b>	<b>8</b>	A.3 Explanation of PAS 2030 measure-specific Annex referencing system .....	24
5.1 Installer responsibility to be in possession of a retrofit design .....	8	Annex B (normative) BFM energy efficiency measures	24
5.2 Validation of the retrofit design.....	8	A.4 Interactions between EEMs.....	24
<b>6 Installation process .....</b>	<b>10</b>	A.5 Avoidance of thermal bridging .....	26
6.1 Installation method statement .....	10	<b>Annex B (normative)</b>	
6.2 Installation equipment and tools.....	10	BFM energy efficiency measures .....	27
6.3 Checking, handling and storage of materials and supplies .....	11	B.1 Measure BFM.1 Cavity wall insulation including that installed in party walls.....	27
6.4 Provision of installation instructions to operatives.....	11	B.2 Measure BFM.2 Draught proofing .....	30
6.5 People .....	11	B.3 Measure BFM.3 – Energy efficient glazing and doors including replacement Insulating Glass Units (IGU) .....	33
6.6 Subcontract Installers.....	12	B.4 Measure BFM.4 – External wall insulation .....	36
6.7 Testing.....	12	B.5 Measure BFM.5 Flat roof insulation .....	41
6.8 Commissioning .....	12	B.6 Measure BFM.6 Floor insulation .....	44
6.9 Handover .....	12	B.7 Measure BFM.7 Hybrid wall insulation.....	47
6.10 Installation control.....	13	B.8 Measure BFM.8 Internal wall insulation.....	52
6.11 Installation documents and record keeping.....	13	B.9 Measure BFM.9 Loft insulation .....	57
<b>7 Installation process management.....</b>	<b>14</b>	B.10 Measure BFM.10 Pitched roof insulation .....	60
7.1 Operation and process oversight .....	14	B.11 Measure BFM.11: Solar Blinds, Shutters and Shading Devices (internal and external).....	63
7.2 Pre-installation building inspection .....	14	B.12 Measure BFM.12: Room-in-roof insulation .....	66
7.3 Action in respect of intermediate inspection.....	15	B.13 Measure BFM.13: Insulation of existing park homes.....	68
7.4 Installation change .....	15	<b>Annex C (normative)</b>	
7.5 Process continuity plan .....	15	BSM energy efficiency measures.....	71
7.6 Process control.....	16	C.1 Measure BSM.1 Condensing boilers, natural gas-fired and liquefied petroleum gas-fired.....	71
7.7 Internal audit and corrective action .....	16	C.2 Measure BSM.2 Oil-fired condensing boilers .....	74
7.8 Installation process records .....	16	C.3 Measure BSM.3 Flue-gas heat recovery devices .....	77
7.9 Business and financial probity.....	16	C.4 Measure BSM.4: Heating system insulation (ducting, pipes and cylinders).....	79
<b>8 Service provision.....</b>	<b>17</b>	C.5 Measure BSM.5 Heating, hot water system, air conditioning or ventilation controls and components.....	81
8.1 Complaints procedure.....	17	C.6 Measure BSM.6 Hot water systems .....	84
8.2 Complaints records.....	17	C.7 BSM.8 Mechanical Ventilation with Heat Recovery.....	87
8.3 Interaction with clients .....	17	C.8 Measure BSM.8 Under-floor heating.....	90
<b>9 Claims of compliance .....</b>	<b>18</b>	C.9 Measure BSM.9 Warm-air heating systems .....	93
9.1 Applicability of claims.....	18	C.10 BSM.10 Water efficient taps and showers.....	96
9.2 Requirement to claim .....	18	<b>Annex D (normative)</b>	
9.3 Basis of claim .....	18	BSE energy efficiency measures .....	98
<b>10 Documents essential to the application of the Annexes of this PAS.....</b>	<b>19</b>	D.1 Measure BSE.1 Electric storage heaters (including electric warm air heating units that incorporate heat storage).....	98
10.1 Use of the identified documents.....	19	D.2 Measure BSE.2 Lighting fittings, lighting systems and lighting system controls .....	101
10.2 Publicly Available Specification and British Standards.....	19		
10.3 Institution of Gas Engineer and Managers – Standards.....	21		
10.4 Energy Networks Association Engineering Recommendations.....	21		
10.5 UKLPG .....	21		

**Annex E (informative)**

PAS 2030:2017 to PAS 2030:2019 – Substantive change .....	104
---	-----

**Annex F (informative)**

Installer guidance on the use and application of PAS 2030:2019 .....	107
F.1 Overview .....	107
F.2 A staged approach to installation .....	107

**Annex G (informative)**

Example installation project information collation form .....	109
G.1 Use of this form .....	109
G.2 Location of installation .....	109
G.3 Measure(s) to be installed.....	109
G.4 Source of PAS 2035 compliant design (5.1).....	110
G.5 Validation of design (5.2).....	110
G.6 Products and/or system specified/ to be installed.....	111
G.7 Installation method statement.....	111
G.8 Installation process.....	112
G.9 Operation and process oversight .....	115
G.10 Pre-installation building inspection .....	115
G.11 Provision for any intermediate inspection required (7.3).....	117
G.12 Installation change (7.4).....	117
G.13 Process continuity (7.5).....	117
G.14 Process control records (7.6 & 7.8).....	117
G.15 Details of any problems encountered during installation, corrections agreed and remedial work undertaken.....	118
G.16 Client complaints (8).....	118
G.17 Commissioning – EEM performance testing carried out.....	119
G.18 Record of information left with Client at handover .....	119
G.19 Installation sign-off .....	119

<b>Bibliography .....</b>	<b>120</b>
---------------------------	------------

**List of Tables**

Table A.1 – Category BFM (Building Fabric Measures) ..	22
Table A.2 – Category BSM (Building Services Mechanical) .....	23
Table A.3 – Category BSE (Building Services Electrical).....	24
Table B.1 – Measure-specific requirements for cavity wall insulation (BFM.1) .....	27
Table B.2 – Measure-specific requirements for draught proofing (BFM.2) .....	30
Table B.3 – Measure-specific requirements for energy efficient glazing and doors (BFM.3).....	33
Table B.4 – Measure-specific requirements for external wall insulation (BFM.4) .....	36
Table B.5 – Measure-specific requirements for flat roof insulation (BFM.5) .....	41
Table B.6 – Measure-specific requirements for floor insulation (BFM.6) .....	44
Table B.7 – Measure-specific requirements for hybrid wall insulation (BFM.7) .....	47
Table B.8 – Measure-specific requirements for internal wall insulation (BFM.8) .....	52

Table B.9 – Measure-specific requirements for loft insulation (BFM.9) .....	57
Table B.10 – Measure-specific requirements for pitched roof insulation (BFM.10) .....	60
Table B.11 – Solar Blinds, Shutters and Shading Devices (BFM.11) .....	63
Table B.12 – Room-in-roof insulation (BFM12).....	66
Table B.13 – Insulation of existing park homes (BFM13).....	68
Table C.1 – Measure-specific requirements for gas-fired condensing boilers (BSM.1) .....	71
Table C.2 – Measure-specific requirements for oil-fired condensing boilers (BSM.2) .....	74
Table C.3 – Measure-specific requirements for Flue-gas recovery devices (BSM.3).....	77
Table C.4 – Measure-specific requirements for heating system insulation (including ducting, pipes and cylinders) (BSM.4) .....	79
Table C.5 – Measure-specific requirements for Heating, hot water system, air conditioning or ventilation controls and components (BSM.5) .....	81
Table C.6 – Measure-specific requirements for hot water systems (BSM.6) .....	84
Table C.7 – Measure-specific requirements for Mechanical Ventilation with Heat Recovery (BSM.7) ..	87
Table C.8 – Measure-specific requirements for under-floor heating (BSM.8).....	90
Table C.9 – Measure-specific requirements for gas and /or oil-fired warm-air heating systems (domestic and non-domestic) (BSM.9).....	93
Table C.10 – Water efficient taps and showers (BSM.10).....	96
Table D.1 – Measure-specific requirements for Electric storage heaters (BSE.1) .....	98
Table D.2 – Measure-specific requirements for Lighting fittings, lighting systems and lighting system controls (BSE.2) .....	101
Table E.1 – Substantive change introduced in PAS 2030:2019 .....	104

**List of Figures**

Figure 1 – EEM installation and validation system – Overview, indicating the relevant specifications and their areas of application .....	vi
Figure A1 – The measures interaction matrix.....	27

# Foreword

This PAS was sponsored by the Department for Business, Energy and Industrial Strategy (BEIS). Its development was facilitated by BSI Standards Limited and it was published under licence from The British Standards Institution. It comes into effect on 30 June 2019.

Acknowledgement is given to Dr. Peter Rickaby, BSI Retrofit Standards Task Group, as the technical author, and the following organizations that were involved in the development of this PAS as members of the steering group:

- Association of Technical Monitoring Agents (ATMA)
- Blue Flame Certification
- British Board of Agrément (BBA)
- British Electrotechnical and Allied Manufacturers' Association (BEAMA)
- BSI Retrofit Standards Task Group
- Building Engineering Services Association (BESA)
- Building Research Establishment (BRE)
- Building Services Research and Information Association (BSRIA)
- Cavity Insulation Guarantee Agency (CIGA)
- Construction Industry Training Board (CITB)
- CORGI Fenestration
- Department of Business, Energy and Industrial Strategy (BEIS)
- Each Home Counts (EHC)
- Edwards Hart Ltd
- Electrical Contractors Association (ECA)
- Energy UK
- Glass Qualifications Authority (GQA)
- Historic Environment Scotland (HES)
- Kiwa Ltd
- Ministry of Housing, Communities and Local Government (MHCLG)
- National Association of Professional Inspectors and Testers (NAPIT)
- National Inspection Council for Electrical Installation Contracting (NICEIC)
- National Insulation Association (NIA)
- Office of Gas and Electricity Markets (Ofgem)
- Oil Firing Technical Association (Oftec)
- Solid Wall Insulation Guarantee Agency (SWIGA)
- United Kingdom Accreditation Service (UKAS)



Acknowledgement is also given to the members of a wider review panel who were consulted in the development of this PAS.

The British Standards Institution retains ownership and copyright of this PAS. BSI Standards Limited as the publisher of the PAS reserves the right to withdraw or amend this PAS on receipt of authoritative advice that it is appropriate to do so. This PAS will be reviewed at intervals not exceeding two years, and any amendments arising from the review will be published as an amended PAS and publicized in *Update Standards*.

This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.

The PAS process enables a Specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS can be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

## Supersession

-  PAS 2030:2019, incorporating Corrigendum No.1 2020 supersedes PAS 2030:2019 which will be withdrawn. Together with PAS 2035:2019, incorporating Corrigendum No.1 2020, PAS 2030:2019, incorporating Corrigendum No.1 2020 also supersedes PAS 2030:2017. This will be withdrawn on 30 June 2021. 

## Relationship with other publications

PAS 2030 is intended to be read, and used, in conjunction with PAS 2035.

## Information about this document

This is a full revision of PAS 2030, which continues to provide a specification for the installation of energy efficiency measures in existing dwellings but has been amended to align with the parallel introduction of PAS 2035 *Retrofitting Dwellings for Improved Energy Efficiency: Specification and Guidance*, which is applicable only to dwellings. As a result, this PAS is no longer applicable to non-dwellings.

- ☐ PAS 2030:2019, incorporating Corrigendum No.1 2020 is published with the expectation that users intending to claim compliance with it will commence adoption of its provisions immediately following publication with a view to fully meeting its requirements and claiming compliance with PAS 2030:2019, incorporating Corrigendum No.1 2020 and therefore also PAS 2035:2019, incorporating Corrigendum No.1 2020, by 30 June 2021. During this period PAS 2030:2017 remains available for use where required but will be withdrawn on 30 June 2021. ☐

## Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to a competent person or persons for whose use it has been produced.

This PAS is not to be regarded as a British Standard, European Standard or International Standard. In the event that this PAS is put forward to form the basis of a full British Standard, European Standard or International Standard, it will be withdrawn.

BSI permits the reproduction of Figure A.1. This reproduction is only permitted where it is necessary during the decision-making process for retrofit designs during each application of the PAS. A larger version of Figure A.1 is available.

BSI permits the reproduction of the form in Annex G to assist installers in meeting the record keeping requirements of this PAS.

## Presentational conventions

The provisions of this PAS are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

*Commentary, explanation and general informative material, e.g. Notes, are presented in italic type, and do not constitute a normative element.*

## Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with this PAS does not in itself confer immunity from legal obligations.

# Introduction

This revision of PAS 2030 continues to provide a specification for the installation of energy efficiency measures (EEM) in existing dwellings but has been modified in response to market changes that have altered the context in which it is applied and to align with the parallel introduction of PAS 2035 *Retrofitting Dwellings for Improved Energy Efficiency: Specification and Guidance*, which is applicable only to dwellings. As a result, this PAS is no longer applicable to buildings used for purposes other than dwellings.

Although this PAS was originally developed with support for the United Kingdom Green Deal Financing Mechanism as a primary objective, it has always been appropriate for application in respect of any EEM installation, irrespective of how that installation is to be funded.

In this edition, the independence of the PAS has been further clarified with the removal of all references to specific funding schemes of any type and reliance on the generally accepted use of UKAS accredited certification bodies to provide compliance assessment where this is required. **Figure 1** provides a graphic overview of the principal elements of the system and their various relationships.

The most significant areas of change to PAS 2030 are:

- Removal of guidance about the scope and content of designs for EEMs, which has been moved to PAS 2035;
- Removal of guidance about the interactions between EEMs (except for the *Measures Interaction Matrix*), which has been moved to PAS 2035;
- Removal of guidance about assessment and upgrading of existing ventilation systems, which has been moved to PAS 2035; and
- For demonstration of competence, requirement for the use of regulated and industry agreed vocational qualifications or apprenticeships, personal certificates of competence relevant to the EEM to be installed or for electrical work, compliance with the EAS to replace the reliance on Minimum Technical Competencies that was applicable in earlier editions.

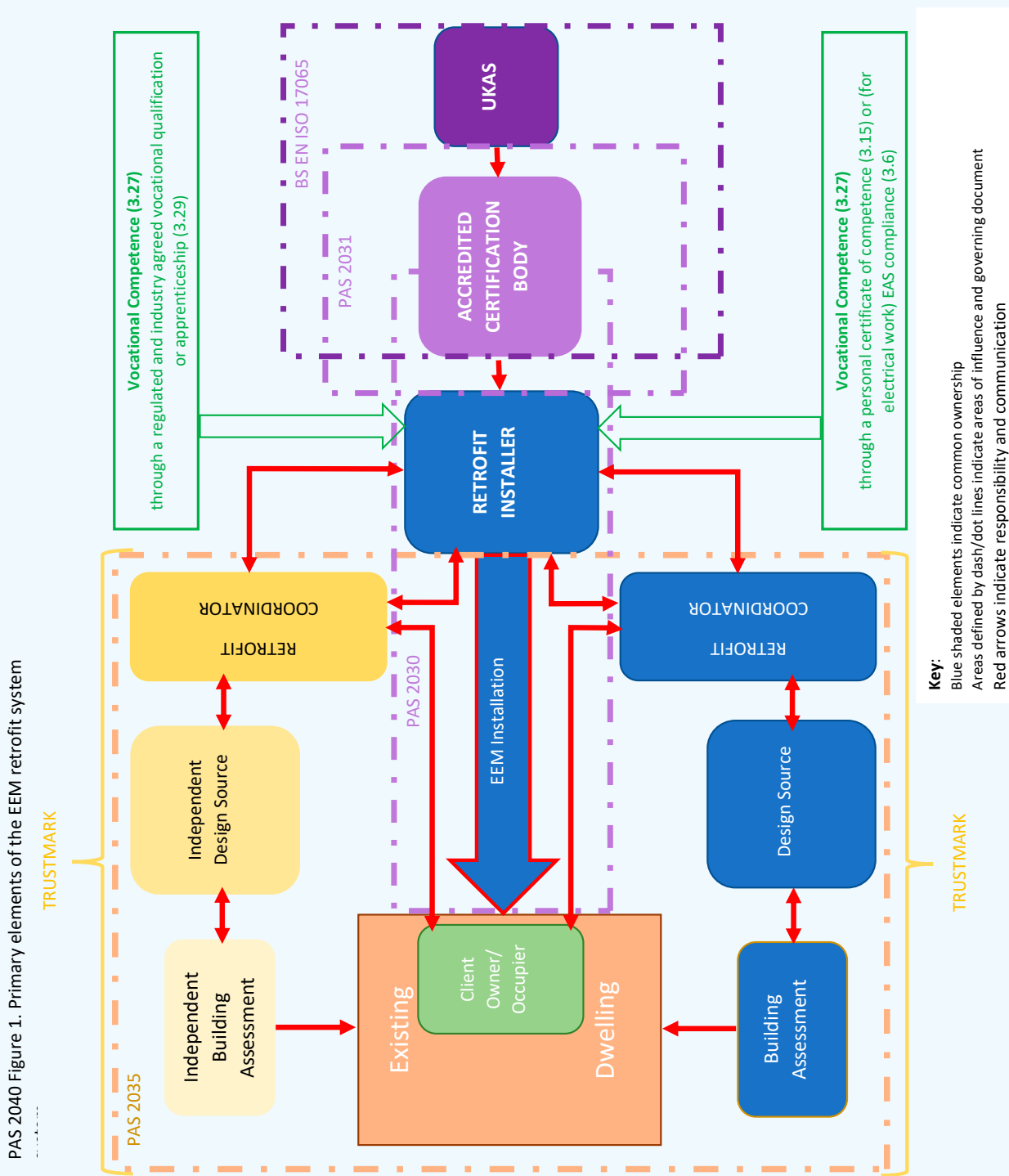
Attention is drawn to the fact that this PAS does not set out a specification for the design of EEM or for the assessment of dwellings undertaken to inform such designs – those topics are covered by PAS 2035. It does however set out critical aspects of retrofit design (the retrofit design) that Retrofit Installers should expect to find addressed in the designs they work to and without which they should not commence installation.

The primary objective for the PAS remains the provision of a robust, uniformly applicable EEM installation process that will assist Installers that comply with its requirements in full to demonstrate that their installation processes are capable of providing installation to specification and in accordance with the Client's expectations.

Each of the energy efficiency measures covered by this PAS is provided for in a measure-specific Annex. Compliance with this PAS requires that for each installation, the installer has to meet all the requirements of Clauses 1 to 9 of PAS 2030 together with those set out in the Annex relevant to each measure to be installed.

This edition of PAS 2030 includes changes to the list of included measures with one new measure-specific annex setting out requirements for the insulation of residential park homes, and removal of Annexes C1, C9 and D3 and of non-domestic measures from other annexes. It is anticipated that the list of included measures will further change over time and therefore future editions of this PAS should be anticipated.

Figure 1 – EEM installation and validation system – Overview, indicating the relevant specifications and their areas of application



# 1 Scope

This PAS specifies requirements for the installation of Energy Efficiency Measures (EEM) in existing dwellings (not new build) and no longer covers buildings used for non-dwelling purposes. It is intended for use by any entity undertaking the installation of any products and/or systems designed to improve the energy efficiency of such dwellings in accordance with PAS 2035.

As with previous editions, this PAS includes requirements in respect of installation processes, process management and service provision and includes criteria relating to installation methods, equipment, tools, product or system and material suitability, the commissioning of installed measures and the training, skills and vocational qualification of the people undertaking such installation. The PAS includes information provided to assist Installers to fulfil their responsibility to ensure the effective co-functioning of EEM installed in the same dwelling.

This PAS consists of core requirements to be met by any entity claiming compliance with it, and normative measure-specific Annexes setting out supplementary requirements for each included measure type.

Claims of compliance with this PAS will be in respect of the processes and procedures employed and their application in the installation of EEM in any given dwelling. Such claims do not reflect the quality or performance of the retrofit design, which will be the subject of claims of compliance with PAS 2035.

This PAS requires claims of compliance to be in respect of the core requirements and all Annexes relevant to the installation undertaken by the claiming entity. The entity is also required to identify whether the claim is on the basis of self-assessment, other party assessment or independent third-party validation and to differentiate between installation undertaken on the basis of an installer provided retrofit design and that undertaken in accordance with a retrofit design provided by an independent third party.

**Annex A** provides detail of the PAS 2030 measure-specific Annex structure and its relationship to the list of specified measures and includes information to assist Installers to fulfil their responsibility for ensuring the correct functional relationship between EEM installed in the same dwelling.

**Annexes B, C and D** provide specific requirements relating to particular energy efficiency measures for application by Installers undertaking installation of those measures. These Annexes also include additional requirements in respect of the provision of information to clients.

**Annex E** identifies the points of substantive change between PAS 2030:2017 and PAS 2030:2019.

**Annex F** sets out guidance on the use and application of PAS 2030:2019

**Annex G** provides an example installation project information collation form that can be copied and used by Installers to assist demonstration of their compliance with this PAS

This PAS does not include requirements relating to the certification of PAS 2030 compliance by independent third parties, which subject is covered by PAS 2031, developed in conjunction with this PAS.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

**NOTE** The application of this PAS requires users to select measure specific Annexes that are relevant to the measure to be installed from the range of Annexes provided. Because of this all normative references are Annex-specific. Clause 10 lists all documents that are considered indispensable for the application of particular Annexes.

### Standards publications

- ISO IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes and services*
- BS 5250, *Code of practice for the control of condensation in buildings*
- BS 7913, *Guide to the conservation of historic buildings*
- BS 3632, *Residential park homes — Specification*
- BS 6798, *Specification for installation and maintenance of gas-fired boilers of rated input not exceeding 70 kW net*
- BS 8213-4, *Code of practice for the survey and installation of windows and external door sets*
- BS 6262 2, *Glazing for buildings — Part 2: Code of practice for energy light and sound*
- BS 6262 3, *Glazing for buildings — Part 3: Code of practice for fire security and wind loading*
- BS 6262 4, *Glazing for buildings — Part 4: Code of practice for safety related to human impact*
- BS 6262 6, *Glazing for buildings — Part 6: Code of practice for special applications*
- BS 6262 7, *Glazing for buildings — Part 7: Code of practice for the provision of information*
- BS 8000-7, *Workmanship on building sites — Part 7: code of practice for glazing*
- BS EN 13120, *Internal blinds — Performance requirements including safety*
- BS EN 13561, *External blinds — Performance requirements including safety*
- BS EN 13659, *Shutters — Performance requirements including safety*
- BS 6644, *Specification for installation of gas fired boilers of rated inputs between 70 kW (net) and 1.8 MW (net) (2nd and 3rd family gases)*
- BS 6891, *Installation of low pressure gas pipework of up to 35 mm (R1 1/4) in domestic premises (2nd family gas) — Specification*
- BS 5440-1, *Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) — Part 1: Specification for installation of gas appliances to chimneys and for maintenance of chimneys*
- BS 5440-2, *Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) — Part 2: Specification for the installation and maintenance of ventilation provision for gas appliances*
- BS 7593, *Code of practice for treatment of water in domestic hot water central heating systems*
- BS 5482-1, *Code of practice for domestic butane and propane gas burning installations — Part 1: Permanent dwellings*
- BS 5410-1, *Code of practice for oil firing — Part 1: Installations up to 45 kW output capacity for space heating and hot water supply purposes*
- BS 5410-2, *Code of practice for oil firing — Part 2: Installations of 45 kW and above output capacity for space heating, hot water and steam supply service*
- BS 7593, *Code of practice for treatment of water in domestic hot water central heating systems*
- BS 7671, *Requirements for Electrical Installations — IET Wiring Regulations*
- BS EN 378-1, *Refrigerating systems and heat pumps — Safety and environmental requirements — Basic requirements, definitions, classification and selection criteria*
- BS EN 378-3, *Refrigerating systems and heat pumps — Safety and environmental requirements — Installation location and personal protection*
- BS EN 378-4, *Refrigerating systems and heat pumps — Safety and environmental requirements — Operation, maintenance, repair and recovery*



BS EN 14336, *Heating systems in buildings — Installation and commissioning of water based heating systems*

BS EN 16484-1 *Building automation and control systems (BACS) — Project specification and implementation*

BS EN 806-1, *Specifications for installations inside buildings conveying water for human consumption — General*

BS EN 806-4, *Specifications for installations inside buildings conveying water for human consumption — Installation*

BS EN 806-5, *Specifications for installations inside buildings conveying water for human consumption — Operation and maintenance*

BS 8558, *Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings*

BS 5970, *Code of practice for thermal insulation of pipework and equipment in the temperature range of -100°C to +870°C*

BS 5864, *Installation and maintenance of gas-fired ducted air heaters of rated heat input not exceeding 70 kW net (2nd and 3rd family gases) — Specification*

BS 6891, *Installation of low pressure gas pipework of up to 35 mm (R1 1/4) in domestic premises (2nd family gas) — Specification*

## Other publications

[N1] SWIGA. *External Wall Insulation Specification for Weathering and Thermal Bridge Control*. Available at <https://www.swiga.co.uk/news/new-external-wall-insulation-industry-documents> [viewed May 2019].

[N2] MINISTRY OF HOUSING, COMMUNITIES AND LOCAL GOVERNMENT. *Approved Documents A-P*, London: 2010. Available at <https://www.gov.uk/government/collections/approved-documents> [viewed May 2019].

[N3] MINISTRY OF HOUSING, COMMUNITIES AND LOCAL GOVERNMENT. *Regulation 7: Workmanship and Materials*, London: 2013. Available at <https://www.gov.uk/government/publications/material-and-workmanship-approved-document-7> [viewed May 2019].

[N4] MINISTRY OF HOUSING, COMMUNITIES AND LOCAL GOVERNMENT. *Approved Documents A-R*, London: 2010. Available at <https://www.gov.uk/government/collections/approved-documents> [viewed May 2019].

[N5] SCOTTISH GOVERNMENT. *Domestic Technical Handbook*, Scotland: 2004. Available at <https://www.gov.scot/publications/building-standards-2017-domestic/> [viewed May 2019].

[N6] SCOTTISH GOVERNMENT. *Non-domestic Technical Handbook*, Scotland: 2004. Available at <https://www.gov.scot/publications/building-standards-2017-non-domestic/> [viewed May 2019].

[N7] SOLID WALL INSULATION GUARANTEE AGENCY. *External Wall Insulation pre-installation building inspection checklist*. Available from: <https://www.dropbox.com/s/4ay242vbqf46zyj/Document%20%20FINAL.pdf?dl=0> [viewed May 2019]

[N8] CONSTRUCTION INDUSTRY TRAINING BOARD. *General requirements and guidance for the installation of loft insulation*. Available at <http://www.glidevale.com/uploads/dab79298b0219093005220b716485704.pdf> [viewed May 2019].

[N9] INSTITUTION OF ENGINEERING AND TECHNOLOGY. *Engineering and Technology (IET) Wiring Regulations (BS 7671)*. London: 2018.

[N10] NATIONAL INSULATION ASSOCIATION. *A Guide to Retrofit Room in Roof Insulation, Dunstable: 2017*. Available from: [https://www.nia-uk.org/media/1214/nia\\_atma-ri-ri-guide-v10.pdf](https://www.nia-uk.org/media/1214/nia_atma-ri-ri-guide-v10.pdf) [viewed May 2019].

[N11] UKLPG, *Code of practice 22: Design, installation and testing of LPG Piping systems*. August 2011.

[N12] THE INSTITUTION OF GAS ENGINEERS AND MANAGERS. *IGEM UP/1, 1A & 1B, Strength testing, tightness testing and direct purging each standard covers industrial commercial and domestic testing and purging requirements*, Loughborough: 2005.

[N13] MINISTRY OF HOUSING, COMMUNITIES AND LOCAL GOVERNMENT. *The Domestic Building Services Compliance Guide*, London: 2018.

[N14] HEALTH AND SAFETY EXECUTIVE. *Gas Safety (Installation and Use) Regulations 1998*. London: 2018.

[N15] THE STATIONERY OFFICE. *Water Supply (Water Fittings) Regulations*. Great Britain: 1999.

[N16] EUROPEAN PARLIAMENT. (EU) No 517/2014, *F-gas regulations*. 2014. Available at [http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\\_.2014.150.01.0195.01.ENG](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.150.01.0195.01.ENG) [viewed May 2019].

[N17] YOUNG. Y., SHIRET. A., HAYTON. J. AND GRIFFITHS. W., *Design of low temperature domestic heating systems – A guide for system designers and installers*. BRE Trust. Hertfordshire: 2013.

[N18] THE INSTITUTION OF GAS ENGINEERS AND MANAGERS. *IGEM/UP/7, Edition 2, Gas installations in timber-framed and light steel buildings*. Loughborough: 2006.

[N19] THE STATIONERY OFFICE. *Electricity at Work Regulations 1989*. HMSO, London: 1989.

## 3 Terms and definitions

The following terms and definitions are considered indispensable to the understanding and application of this PAS.

### 3.1 client

property owner, householder, landlord and/or tenant of a dwelling that is subject to retrofit, sometimes also including the funding body

*NOTE In this PAS, the term Client refers to the recipient of a domestic retrofit project.*

### 3.2 commissioning

activities that ensure that an installed measure operates within the boundaries and conditions of the design specification

### 3.3 dwelling

self-contained unit of accommodation such as a house or flat or park home used by one household as a home

### 3.4 (EEM) product

item intended for installation in existing dwellings for the purpose of enhancing the energy efficiency of those buildings, that is not made available as an (EEM) system

### 3.5 proprietary (EEM) system

combination of particular products and materials together with any related installation method, equipment requirements and performance objectives, placed on the market exclusively by a specific supplier, for installation in existing dwellings for the purpose of enhancing the energy efficiency of those dwellings

### 3.6 EAS compliance

holding a certificate of compliance with the EAS for the category of work relevant to the EEM to be installed, issued by a Certification Body accredited by UKAS against the requirements of ISO IEC 17065, or being registered as an Approved Certifier of Construction as defined in EAS Appendix 7 (Particular requirements for Scottish Building Standards)

*NOTE EAS is Electrotechnical Assessment Specification for use by Certification and Registration Bodies.*

### 3.7 energy efficiency measure (EEM)

planned work undertaken to improve the energy performance of a dwelling by saving or generating energy

### 3.8 installation

location, placement and/or fixing of an energy efficiency measure in, or connected to, an existing dwelling excluding any related work to enable the installation of the measure

### 3.9 (installation) location

dwelling or group of dwellings that are the subject of EEM installation(s) under the supervision of a single, designated, competent person

### 3.10 (installation) method

the sequence of actions to be undertaken in installing one or more EEM products or systems in accordance with their particular specification, in a safe manner at a particular dwelling

### 3.11 (installation) method statement

precise description of the installation method

*NOTE An installation method statement can be a single document prepared specifically for this purpose or could consist of a collection of documents, in the sequence of required application, contributing to the complete definition of the intended method.*

### 3.12 operative

person employed by the installer, either directly or under a subcontract arrangement, to undertake installation tasks on an energy efficiency measure in accordance with the relevant method statement

*NOTE 1 There are two categories of operative permitted under the provisions of this PAS, those who can demonstrate vocational competence (3.26) and those who are acquiring vocational competence (3.27).*

**NOTE 2** Individuals employed to provide labouring, carrying or loading/unloading capability do not constitute operatives in the terms of this PAS.

### 3.13 operative (experienced)

operative who has been installing EEM relevant to the occupation in which they operate, prior to the requirements for a vocational qualification included in this PAS for new entrants

**NOTE** This term is not used in this PAS other than as part of the definition of personal certificate of competence (3.15).

### 3.14 operative (new entrant)

operative who is new to installing an EEM and who can therefore only demonstrate vocational competence by (acquiring) vocational competence (see 3.26)

### 3.15 personal certificate of competence

certificate, issued by a certification body accredited by UKAS against the requirements of ISO IEC 17024, to an experienced operative who meets the certification scheme's competence criteria or as a means of on-going assessment for ensuring continued competence of an individual following the award of a vocational qualification

**NOTE 1** See 3.13 for definition of experienced operative

**NOTE 2** Certificates of competence may not be issued to new entrants (3.14) other than as a means of on-going assessment of individual competence following the award of a vocational qualification.

**NOTE 3** The period for re-confirming competence following a vocational qualification should be set by the industry sector.

### 3.16 pre-installation building inspection

inspection of an installation location (3.9) undertaken by or on behalf of the EEM installer prior to commencement of installation, to confirm that the retrofit design provided is complete, complies with this PAS, can be fulfilled at the location specified and that the proposed installation will not result in noncompliance with statutory requirements and/or generally accepted industry good practice

**NOTE** The application of this inspection to particular measures is addressed through the pre-installation building inspection requirements and the inspector competence requirements in the relevant measure-specific Annex.

### 3.17 Recognition of Prior Experience and Learning (RPEL)

process by which prior experience and learning is assessed against relevant criteria to provide evidence for credit towards a vocational qualification

### 3.18 Register of Regulated Qualifications (RRQ)

register of nationally regulated qualifications maintained by:

- in England, the Office of the Qualifications Examinations Regulators;
- in Northern Ireland, the Council for Curriculum, Examinations and Assessment;
- In Scotland, the Scottish Qualification Authority;
- In Wales, Qualifications in Wales

**NOTE** For information, visit: <https://register.ofqual.gov.uk/>

### 3.19 retrofit assessment

survey, inspection and assessment of a dwelling to collate information for a retrofit design

### 3.20 Retrofit Assessor

person qualified to carry out a retrofit assessment

### 3.21 Retrofit Coordinator

person qualified as a specialist retrofit project manager, taking overall responsibility for overseeing the assessment of dwellings, the identification, specification and evaluation of energy efficiency measures for installation at a given dwelling as a single project, and their subsequent monitoring and evaluation

### 3.22 retrofit design

package of information prepared by a Retrofit Designer that determines the unique combination of EEM systems, products, materials and their inter-relationship, to be installed in a particular dwelling in order to achieve specified energy efficiency and other outcomes for that dwelling

### 3.23 Retrofit Designer

person qualified to prepare a retrofit design, in accordance with PAS 2035

### 3.24 (Retrofit) Installer

person or organisation undertaking the physical placement of an energy efficiency measure(s) in an existing dwelling

### 3.25 supervision

provision of operational oversight by an operative who meets the threshold and/or specialist competence or vocational qualification level required for the installation of an EEM type in the type of building being improved and is appointed by the Retrofit Installer to do so

### 3.26 vocational competence

holding a regulated and industry agreed, vocational qualification or apprenticeship, or a personal certificate of competence relevant to the EEM to be installed, or for electrical work compliance with the EAS, all of which include assessment of ability to deliver required outcomes through the practical application of acquired knowledge and skills in a workplace environment

### 3.27 (acquiring) vocational competence

process of becoming vocationally competent through participation in a structured training and/or assessment programme

### 3.28 vocational competence ratio

quantitative relationship between the number of operatives working on any particular retrofit project with vocational competence and the number of operatives engaged on the same project who are acquiring vocational competence

### 3.29 vocational qualification

recognition of knowledge, understanding and skills relevant to a particular occupation or employment and to the EEM) to be installed, necessary to deliver required outcomes safely through the practical application of that acquired knowledge and skills in a workplace environment as defined by the demands and outcome of a regulated, industry agreed, approved course or apprenticeship included in the RRQ

### 3.30 vocational qualification currency

period for which vocational competence will be considered adequate without further training or knowledge acquisition specified in respect of the particular vocational qualification(s), personal certification scheme(s) or EAS compliance, relied upon for the demonstration of vocational competence

## 4 Retrofit project management

Prior to commencement of installation the Retrofit Installer shall confirm that a Retrofit Coordinator has been appointed in accordance with the requirements of PAS 2035, and make the Retrofit Coordinator's identity and role responsibilities known to all personnel working on or in connection with the project. The Retrofit Installer shall also make provision for the Retrofit Coordinator to have access to work in progress (including pre-installation inspection, installation, testing, commissioning and handover), for the purpose of inspecting progress and quality.

## 5 The retrofit design

### 5.1 Installer responsibility to be in possession of a retrofit design

For each planned installation of EEM, the Retrofit Installer shall obtain a location-specific retrofit design complying with PAS 2035 for the complete package of measures to be installed as part of that project, at that location. The Installer shall not commence installation until the relevant design has been obtained and validated.

***NOTE** The Retrofit Installer is entitled to rely on a claim of compliance of the retrofit design with PAS 2035 provided by the Retrofit Coordinator unless she/he becomes aware of evidence to the contrary.*

### 5.2 Validation of the retrofit design

#### 5.2.1 General requirement

Before incorporating the retrofit design into the installation method statement and commencing installation, the Retrofit Installer shall satisfy himself/herself that the retrofit design is complete and suitable for the dwelling(s) for which it has been prepared by means of the pre-installation building inspection (see 7.2) and through application of 5.2.2 to 5.2.5.

If the retrofit design provided is found to be deficient or is considered unsuitable for the dwelling(s) in which installation is to be undertaken, then clarification, further information or a revised retrofit design shall be obtained from the Retrofit Coordinator and installation shall not proceed until both the Installer and the Retrofit Coordinator are satisfied that the design is complete and suitable for the dwelling(s). However, final responsibility for the suitability of the design remains with the Retrofit Coordinator.

***NOTE** Throughout this PAS, the primary relationship between design and installation is assumed to be between the roles of Retrofit Coordinator and Retrofit Installer. The Retrofit Coordinator may however designate members of his or her team e.g. the Retrofit Designer, to undertake communication as appropriate to the topic to be communicated.*

#### 5.2.2 Retrofit design documentation

The Retrofit Installer shall check that the retrofit design documents received from the Retrofit Coordinator include the items identified in this clause, where relevant to the EEM installation to be undertaken:

- identification of the address and precise location of the dwelling(s) in which the EEM(s) are to be installed;
- identification of any access constraints and access instructions provided by the Client or the occupants;
- a copy of the assessment report of the condition of the dwellings including identification of any repairs necessary before installation of EEMs;
- any assumptions on which the design is based, including assumptions that underpin the assessment of the dwelling(s);
- confirmation of the compliance of the design with the relevant standards;
- specifications of the materials, products and systems to be used, and of where and how they are to be installed, whether within the dwelling or on its exterior;
- construction details for all affected corners, junctions and edges of installed measures (whether prepared by the Retrofit Designer or obtained from a proprietary system designer, or clear identification of any standards details that are to be used, and where);
- installation instructions for all new systems and equipment;
- testing requirements, e.g. testing of new gas systems and electrical installations, thermography to confirm the integrity of the insulated envelope, fan pressurization testing to demonstrate compliance with any airtightness standard, etc.;
- commissioning requirements;
- handover requirements;
- maintenance instructions; and
- guarantee and warranty requirements.

Where any of these elements are missing from the design documentation the retrofit installer shall consult the Retrofit Coordinator about whether this was intended.

### 5.2.3 Scope, adequacy and suitability of the design

The Retrofit Installer shall check that the retrofit design includes, takes into account and makes provision for, the elements set out in this clause. Where any of these elements has not been included the Retrofit Installer shall consult the Retrofit Coordinator about whether this was intended:

- all interfaces between measures, both physical junctions and technical interactions as identified by the Measures Interaction Matrix (see Annex A of this PAS);
- improvement of the airtightness of the building envelope, i.e. reduction of wind-driven air infiltration and air leakage;
- management of moisture within the construction, and of the dynamic equilibrium between the internal and external relative humidity and the moisture content of construction materials, using vapour permeable materials as appropriate, such that moisture will not become trapped within any construction leading to risk of interstitial condensation and consequent damp and deterioration;

*NOTE Retrofit Installers should be aware that retrofit designs for dwellings where condensation could be an issue will be likely to make reference to BS 5250 Code of practice for the control of condensation in buildings. Where required, dynamic modelling of moisture transfer should be carried out.*

- minimizing thermal bridging at the corners, junctions and edges of installed measures, and at interfaces between them;
- eliminating thermal bypass, i.e. the uncontrolled penetration of cold external air to the warm side of any insulation layer;
- resilience against rainwater ingress (including ingress due to failure of any critical element or construction detail);
- provision of combustion air supplies for any open-flued combustion appliances located within the dwelling;
- mitigation of the risk of summer overheating;
- maintenance requirements to ensure the long-term integrity of the installation;
- protection of the dwelling against the risk of fire occasioned by the installation of EEM;
- resilience of installed EEM to flood risk.

### 5.2.4 Provision of adequate ventilation

For any retrofit design in which one or more EEM with the potential to reduce the level of background infiltration in habitable rooms is included (e.g. wall insulation, floor insulation, roof and loft insulation, draught stripping or replacement windows), the Retrofit Installer shall check that the retrofit design includes details of how adequate ventilation is to be maintained or provided to ensure good internal air quality and minimize surface and interstitial condensation risk. Where such detail is not included or is perceived as being inadequate, the Installer shall consult the Retrofit Coordinator about whether this was intended.

*NOTE When checking the design, the Installer should also take account of any measure-specific ventilation related requirements in the applicable measure-specific annexes of this PAS.*

### 5.2.5 Testing and commissioning

The Retrofit Installer shall check that the retrofit design includes instruction about how installed EEM are to be tested and commissioned, and that such instructions take account of any relevant manufacturer's instructions and/or measure-specific requirements in the relevant Annex in this PAS. Where such information has not been included the Retrofit Installer shall consult the Retrofit Coordinator about whether this was intended.

*NOTE Where the retrofit design includes multiple EEMs that are required to be commissioned, PAS 2035 requires the retrofit design to specify that building services measures may be pre-commissioned individually but should be finally commissioned together at the same time, not separately.*

## 6 Installation process

### 6.1 Installation method statement

#### 6.1.1 Inclusion of relevant installation process(es)

Prior to commencement of any installation work the Retrofit Installer shall define and record in a location-specific installation method statement the complete installation process to be followed for each energy efficiency measure to be installed, under the scope of this PAS and in accordance with the retrofit design. The method statement shall include and take account of the elements specified in 6.1.2 to 6.1.6 of this PAS.

*NOTE A generic method statement may be used, but if the installation method deviates from it in any way, then a location-specific method statement should be created either by editing the generic method statement or appending information to it to define the variation.*

#### 6.1.2 Reference to normatively referenced standards

In incorporating the retrofit design in the location-specific EEM installation method statement, the Retrofit Installer shall take account of all normatively referenced standards and any other relevant documents identified in this PAS, and where these are relevant to the installation to be undertaken shall be able to demonstrate how they have been incorporated in the installation method statement.

*NOTE Should the Installer be aware of potentially relevant standards or other similar documents that have not been referenced in the retrofit design, it is recommended that the Installer draws these to the attention of the Retrofit Coordinator.*

#### 6.1.3 Identification of the relevant measure-specific annexes

The Retrofit Installer shall identify from the measure-specific Annex(es) included in this PAS (see A.1, Tables A.1 to A.3) the measures relevant to the retrofit design including any reference to EEM types, that could determine the scope of required competence for that installation. The Retrofit Installer shall make provision in the method statement for implementation of the requirements set out in the identified annexes.

#### 6.1.4 Inclusion of relevant installation methods

The method statement shall include method(s) and sequences for the installation of the EEM(s) as specified in the retrofit design or originating from the product/system specification sheets, from system certification documents or other such information provided by the product or system manufacturer(s) or supplier(s).

#### 6.1.5 Acquisition of missing method(s)

Where an installation method is not provided with a product or system, the installer shall, prior to commencing the installation, contact the manufacturer, supplier or Retrofit Coordinator, as applicable, to obtain the required information. In the event that installation methods cannot be obtained, commencement of the installation shall be deferred until the required alternative or customized method has been agreed with and issued to the installer by, the Retrofit Coordinator.

#### 6.1.6 Provision for intermediate inspection

The Retrofit Installer shall include in the method statement the necessary facility to accommodate any intermediate inspections required by external parties.

### 6.2 Installation equipment and tools

#### 6.2.1 Availability

The Retrofit Installer shall determine and make available the equipment necessary for the installation process to be correctly undertaken, including any requirements/ instructions for selection and/or use of that equipment.

*NOTE Attention is drawn to the existence of health and safety at work legislation in relation to the provision and use of tools and equipment.*

#### 6.2.2 Maintenance

The Retrofit Installer shall ensure that all equipment and tools used for installation work shall be maintained in a fit-for-purpose and safe condition, providing resources for this purpose as required.

#### 6.2.3 Calibration

**6.2.3.1** Equipment requiring calibration shall be calibrated in accordance with the manufacturer's instruction or verified at intervals determined by the Retrofit Installer prior to use. The interval between such calibrations shall not exceed that recommended by the equipment manufacturer. Where equipment requiring calibration is hired, copies of calibration certificates shall be obtained and retained as a record.

**6.2.3.2** Calibration and verification records for equipment, gauges, measuring and test equipment shall include:

- equipment identification, including the measurement reference standard against which the equipment is calibrated;



- any out-of-specification readings when equipment is submitted for calibration; and
- a statement of conformity to specification after each calibration or verification.

**6.2.3.3** In the event that the Retrofit Installer has reason to believe that a calibrated item may be out of calibration (e.g. the item has been dropped or mistreated), the Installer shall have in place instruction that operatives cease using the item immediately and arrange for its recalibration or replacement at the earliest practicable time. The Installer shall record the date and time of all instances where recalibration or replacement is required during an installation, and take action to confirm any measurements that may have been made while the item was out of calibration.

### 6.3 Checking, handling and storage of materials and supplies

The Retrofit Installer shall operate a procedure to ensure that operatives are aware of any handling instructions and/or storage conditions for the products or systems that they are installing under the scope of this PAS, whether they are specified by the retrofit design, the manufacturer or the supplier, and that those instructions and conditions are followed.

### 6.4 Provision of installation instructions to operatives

The Retrofit Installer shall make available to the operative(s) for every installation undertaken, the necessary product/system specifications, work instructions, installation methods and relevant standards, repair requirements and location-specific information to enable the installation to be completed in accordance with the retrofit design.

Location-specific information shall include at least the following:

- briefing of operatives undertaking installation tasks about the importance of their installation activities and how they contribute to the achievement of the measure installation specified;
- installation times agreed by the Client and any commitments made;
- known special needs or expectations of the Client;
- notification of any inter-relationship between measures and measure installation at the same location, particularly in respect of the mutual efficiency and effectiveness of measures, working procedures and timing;
- any guidance or restrictions about weather conditions in which the specified EEMs may be installed.

## 6.5 People

### 6.5.1 Operative selection, training and work assignment

The Retrofit Installer shall establish and operate procedures to:

- determine the vocational competence required by operatives to undertake the required installation tasks, and by others engaged on the project (e.g. for enabling work);
- ensure the engagement of a sufficient number of vocationally competent operatives as specified in the relevant measure-specific Annex;
- undertake periodic assessment of the individual vocational competence (3.26) of its skilled workforce (direct or sub-contracted) to ensure that all individuals involved in skilled installation work are either vocationally competent or are acquiring vocational competence (3.27);
- ensure that all operatives have access to any training required to maintain their skills and knowledge, including any relevant system-specific training;
- provide and arrange access to training (including any relevant system-specific training) and assessment, for any operatives acquiring vocational competence whilst working under the supervision of a vocationally competent operative;
- provide and arrange for training of new entrant operatives (3.14) via a measure relevant vocational qualification, apprenticeship or EAS compliance route, and not rely on personal certificates of competence other than as a means of on-going assessment of individual competence following the award of a vocational qualification;
- assign operatives to installation projects commensurate with the vocational competence specified in the relevant measure-specific Annex and maintain a record of the operatives assigned to and working on each project;
- obtain and maintain evidence of the current capability, training, qualifications, competence and identified route to vocational competence for each operative;
- periodically assess the effectiveness of procedures operated under a), b), c), d), e), f), g) and h).

**NOTE** Attention is drawn to the fact that there may be requirements relating to the employment and registration of vocationally competent operatives engaged in EEM installations, under some funding schemes.

### 6.5.2 Briefing

Before any work to install EEMs begins, the Retrofit Installer shall consider the requirements for briefings (or 'toolbox talks') by the Retrofit Coordinator to explain the design intent and draw attention to key points including the intended installation sequence(s) where relevant. Briefings shall always be requested if:

- the PAS 2035 retrofit risk assessment has placed the project in the Path C risk category; or
- the retrofit design includes new or unusual materials, products or systems with which the Retrofit Installer(s) are not familiar; or
- the Retrofit Installers(s) have not installed the specified EEMs before; or
- the design is intended to achieve unusually challenging performance standards (e.g. with respect to air-tightness).

If a request for a briefing is refused, then the Retrofit Installer shall ask the Retrofit Coordinator to justify why a briefing need not or cannot be provided.

### 6.5.3 Installation supervision

**6.5.3.1** The Retrofit Installer shall assess the respective vocational competence of operatives assigned to the installation tasks required for each installation and provide a level of supervision in accordance with the vocational competence and vocational competence ratio provided in the relevant measure-specific Annex of this PAS.

**6.5.3.2** Supervision shall include monitoring and inspecting operatives and testing their work at the location of the work to ensure that:

- they comply with the requirements of this PAS and that measures are installed at the designated location in accordance with the retrofit design and to the satisfaction of the Client;
- no actions are taken during the installation that might be detrimental to the health or welfare of the occupants, the Installer's operatives or other members of the public, or detrimental to the integrity of the dwelling, even if specified in the retrofit design (and instead to bring such issues to the attention of the Retrofit Coordinator and request appropriate amendments).

**6.5.3.3** Supervision shall be continuous during working hours if:

- the PAS 2035 retrofit risk assessment carried out by the Retrofit Coordinator has placed the project in the Path C risk category; or
- the retrofit design includes new or unusual materials, products or systems with which the Installers are not

familiar; or

- the Retrofit Installers(s) have not installed the specified EEMs before; or
- the design is intended to achieve unusually challenging performance standards (e.g. with respect to air-tightness).

## 6.6 Subcontract Installers

Where the Retrofit Installer subcontracts any part of the installation to another installer, the Installer shall include the contractual requirement that the subcontract installer complies with all requirements of the retrofit design and of this PAS that are relevant to the installation related tasks to be undertaken and ensure that the subcontract installer has the necessary vocational competence for the installation tasks sub-contracted. The Retrofit Installer shall retain responsibility for compliance with the retrofit design and with this PAS for all work sub-contracted.

## 6.7 Testing

The Retrofit Installer shall arrange any testing of the improved dwelling (e.g. air-tightness testing) before, during and/or after installation of the EEMs, and of individual building systems (whether new or existing) to be carried out as specified by the retrofit design. The Installer shall supply copies of test results and certificates to the Retrofit Coordinator.

## 6.8 Commissioning

The Retrofit Installer shall be responsible for ensuring that:

- the installed EEMs are commissioned in accordance with the retrofit design; and
- a record is made of commissioning action undertaken, including any performance measurement results obtained; and
- commissioning certificates confirming satisfactory results are obtained or prepared as appropriate and copies are supplied to the Retrofit Coordinator.

## 6.9 Handover

### 6.9.1 Timing and extent of handover

When the EEMs are fully installed and commissioned and with any operationally material defects corrected, the Retrofit Installer shall undertake a handover procedure with the Client in accordance with the instructions provided in the retrofit design and

the relevant measure-specific Annex, including the handover of any documentation identified by them.

The handover process shall, where possible, involve physical inspection of the installed measures and an explanation of their function and operation, including where appropriate demonstrations of the operation of components, devices and controls. The use of any user guides, maintenance manuals and other documents necessary for the safe, efficient and effective care, operation and maintenance of the installed measures, shall also be explained. All guides, manuals, guarantee certificates and other relevant documentation shall be provided to the Client(s) via the Retrofit Coordinator and/or located adjacent to the installed measures where appropriate and convenient to do so. The Retrofit Installer shall retain and ensure access to copies of these documents for future reference.

The handover shall include a visual check that the person receiving the instruction is able to operate components and controls, and information about:

- the safe operation of the installed measure including operable components (e.g. windows, including any restrictor hardware), electrical equipment, mechanical equipment and associated control devices (e.g. boilers and heating controls). Where practicable, this shall include both demonstration and a visual check that the person receiving the instruction is able to operate components and controls;
- the care of the installed measure to avoid detrimental effects (e.g. avoidance of penetrating air barriers by inserting fixings into internally insulated walls, regular cleaning and replacement of air filters in mechanical ventilation systems);
- the regular maintenance of the installation to ensure that it operates safely, efficiently and effectively, in accordance with the requirements of any guarantees or warranties provided by the manufacturer and/or the Retrofit Designer or the relevant measure specific Annex;
- the efficient operation of the installation to facilitate the delivery of the expected reduction in energy use.

#### 6.9.2 Personnel undertaking the handover

Prior to the handover process the Retrofit Installer shall ensure that the operatives undertaking the handover are vocationally competent to do so and have access to adequate knowledge on the measures involved in the installation together with the behaviour required for their safe, efficient and effective operation and maintenance. Information provided to assist operatives in the handover process shall be clear, structured, relevant and appropriate.

### 6.10 Installation control

The Retrofit Installer shall have in place and operate a documented installation control procedure appropriate for validating that:

- the installations undertaken conform to the retrofit design and the location-specific method statement; and
- nothing has been done during the installation that could invalidate any manufacturer's or system supplier's guarantee or warranty.

Records of the installation control outcomes for each installation undertaken shall be made and signed by the supervisor appointed to that installation or other person authorized to do so on behalf of the Installer.

### 6.11 Installation documents and record keeping

The Retrofit Installer shall have in place and operate a documented procedure to demonstrate that the information contained in the location-specific method statement (6.1) for each installation is available to, and has been used by, the operatives undertaking that installation.

The Retrofit Installer shall keep photographic records of all installation work that is subsequently covered up by later work or by linings or finishes or was accessed via scaffolding or similar means such that it subsequently becomes inaccessible for inspection. Photographs shall be sufficiently numerous and detailed to demonstrate that the work has been completed in accordance with the retrofit design and the method statement. The date and location of each photograph shall be marked on the photograph automatically by the camera.

Records relating to the use of work instructions, relevant installation methods and constituent tasks shall include the nature and timing of any changes to installation related activities that may be authorized.

## 7 Installation process management

### 7.1 Operation and process oversight

The Retrofit Installer shall have in place, and operate, procedures designed to ensure that pre-installation building inspection and installation processes in relation to the installation of EEM measures are undertaken and completed in accordance with the retrofit design, to the satisfaction of the Client(s) and in accordance with the requirements of this PAS, particularly in respect of:

- the measures installed;
- the use of specified installation methods;
- any required ventilation upgrade including where necessary the procurement and installation of any required ventilation upgrade from a ventilation specialist;
- avoidance of thermal bridging;
- testing;
- commissioning; and
- handover.

### 7.2 Pre-installation building inspection

#### 7.2.1 Undertaking the inspection

The Retrofit Installer shall undertake a pre-installation inspection of the designated location on the basis of the installation method statement prepared under 6.1, using a vocationally competent person as defined in the relevant measure-specific Annex of this PAS.

The inspection shall be undertaken at a level of detail sufficient to confirm that the specified EEM can be safely and effectively installed at the designated location paying particular attention to potential moisture buildup as a result of the installation and taking into account the fire safety of the dwelling and the functionality and/or safety of installed services (gas, electricity, water, telecommunications, etc.); the inspection shall include any specific pre-installation inspection requirements from the relevant measure-specific Annex of this PAS.

#### 7.2.2 Notification of pre-installation building inspection

The Retrofit Installer shall provide information as to the location and timing of forthcoming pre-installation building inspections to the Retrofit Coordinator and to any relevant certification body, and make arrangements

for the inspection to be assessed, upon request by that body if it wishes to do so.

#### 7.2.3 Suitability and completeness of the installation method statement

The suitability and completeness of the installation method statement (6.1) shall be checked as part of the pre-installation building inspection. In the event that the method statement is found to be inadequate, the findings of the pre-installation inspection shall be used to inform the correction or further development of the method statement.

#### 7.2.4 The suitability and completeness of the retrofit design

The suitability and completeness of the retrofit design (Clause 5) shall be reviewed as part of the pre-installation building inspection and action taken to bring to the attention of the Retrofit Coordinator:

- anything missing from the retrofit design that might reasonably be expected to be included (see Clause 5);
- anything that is contrary to the stated design assumptions (e.g. assumptions about areas that can only be examined after opening-up the construction); and
- any aspect of the design and specification that cannot be implemented, for whatever reason.

The Retrofit Installer shall request appropriate amendment of the retrofit design or the provision by the Retrofit Coordinator of written confirmation that installation can proceed without amendment.

#### 7.2.5 Confirmation with the Client

Before conclusion of the pre-installation building inspection, the Retrofit Installer shall confirm with the Client that:

- the nature and extent of the specified installation is known to the Client and is in line with that Client's expectations;
- the arrangements made for site access and installation materials storage are adequate and appropriate for the installation to be undertaken; and
- the intended days and hours of working are acceptable.

### 7.2.6 Pre-installation building inspection records

Records of the pre-installation building inspection and its findings, including those relating to the suitability and completeness of the installation method statement, the retrofit design and any Client-related issues, shall be made by the inspector and retained by the Retrofit Installer, with a copy being made available to the Retrofit Coordinator and/or any relevant validation body, on request.

**NOTE 1** *For loft insulation and draught-proofing measures only, the pre-installation building inspection could be included as a first stage of an installation visit provided provision is made for actual installation not to proceed until any identified problems have been resolved.*

**NOTE 2** *Attention is drawn to the need to comply with applicable statutory requirements e.g. Building Regulations.*

**NOTE 3** *Attention is drawn to the need for the pre-installation building inspection to note any potential risk in relation to the on-going performance of installed services so as to enable liaison with the retrofit designer and/or service providers where relevant.*

**NOTE 4** *Retrofit Installers should encourage the persons appointed to undertake pre-installation inspections to familiarize themselves with the guidance provided in BS 7913 Guide to the conservation of historic buildings and BS 5250 Code of practice for the control of condensation in buildings.*

### 7.2.7 Presence of protected species

In the event that species (e.g. bats, birds, butterflies, dormice) or plants that could be subject to special protection are found to be present at the designated location, the inspector shall include report of that presence in the inspection record and make the presence known to the Retrofit Installer and the Retrofit Coordinator.

### 7.2.8 Action in response to inspection findings

In the event that the pre-installation building inspection reveals potential installation problems, the Retrofit Installer shall notify the Retrofit Coordinator and any relevant statutory authorities, and work with the Retrofit Coordinator, as necessary, to develop a mutually agreed solution. Installation shall not commence until such a solution has been agreed by the Retrofit Coordinator and confirmed with the Client. The Retrofit Installer shall always obtain the written agreement of the Retrofit Coordinator to any introduction of changes to the defined installation process.

## 7.3 Action in respect of intermediate inspection

Where an intermediate inspection is required in respect of particular measures as part of the overall installation process, the Retrofit Installer shall establish and operate procedures to ensure that work that might impede subsequent inspection cannot continue until the intermediate inspection has been completed and clearance to continue has been given.

## 7.4 Installation change

### 7.4.1 Introduction of new or modified materials, products, construction details or processes

Any proposed variation to the retrofit design or location-specific method statement (including the substitution of alternative materials, products, construction details or processes) shall be defined, documented and submitted to the Retrofit Coordinator for approval. Installation work shall not proceed until such approval has been obtained.

### 7.4.2 Compatibility of installation process change

Any change to an installation process shall be accompanied by a review of related tasks and methods to ensure compatibility with the installation of other measures being installed at the same premises.

### 7.4.3 Internal feedback

The Retrofit Installer shall establish and operate a process to facilitate internal feedback on the installation process, whether positive or negative, from inspectors and installation operatives. Any feedback received shall be documented and acknowledged prior to being investigated and corrected where judged beneficial. Any decision not to take corrective action in relation to negative feedback shall be documented, including the reasons for reaching that decision.

## 7.5 Process continuity plan

When not otherwise arranged by the Retrofit Coordinator, the Retrofit Installer shall have in place and operate arrangements that, in the event of an unforeseen circumstance that prevents the Retrofit Installer completing an installation, all uncompleted installations can be transferred to another Retrofit Installer and completed in accordance with the retrofit design and in accordance with this PAS. Where the Retrofit Installer is providing sub-contracted services to a main contractor it shall be the responsibility of the main contractor to ensure there is a process continuity plan in place.

## 7.6 Process control

The Retrofit Installer shall have in place and operate a documented installation process control procedure capable of demonstrating that the requirements of this PAS have been met for each installation undertaken, including the completion of the installation control procedure. Records of the application of the installation process control procedure shall be maintained for each installation and signed by a competent person authorized to do so on behalf of the Installer.

## 7.7 Internal audit and corrective action

### 7.7.1 Procedure

The Retrofit Installer shall conduct a review of their operating system(s) at least once each year for each type of installation undertaken, to ensure conformity with the requirements of this PAS. Records of the review and any resulting actions taken to correct and prevent any future noncompliance shall be made and retained.

*NOTE It is recommended that Retrofit Installers carrying out large numbers of installations of the same type consider undertaking audits more frequently on a percentage basis, in preference to the maximum interval specified above.*

### 7.7.2 Investigation

The cause and consequences of issues raised during internal audit (7.7.1) shall be identified, systematically examined and the findings documented.

### 7.7.3 Corrective action

Corrective action shall include rectification of the particular occurrences identified under 7.7.2 and initiation of measures to prevent recurrence.

### 7.7.4 Verification of corrective action

The effectiveness of corrective actions undertaken (7.7.3) shall be assessed by the Retrofit Installer and outcomes documented.

## 7.8 Installation process records

The Retrofit Installer shall establish and maintain records containing at least the information identified in a) through r) of this Clause, in relation to each installation undertaken for which compliance with this PAS is claimed. Installation process records shall be retained for six years or the term of any EEM guarantees (whichever is longer) and shall be made available to the Retrofit Installer's PAS 2030 certification body and to the Retrofit Coordinator, when requested:

a) location of the installation;

- b) identification of the Retrofit Coordinator;
- c) identification of the Retrofit Designer;
- d) type of measure(s) installed;
- e) dates of installation commencement, completion, testing, commissioning and handover;
- f) identification of specific products/systems installed;
- g) the installation method statement including all related retrofit design documents;
- h) records of any assessments of exposure and wind load calculations;
- i) records of any pull-out tests carried out;
- j) details of any problems encountered, corrections agreed and remedial work undertaken;
- k) records of inclement weather and duration of delay or hold up experienced when installing EEM;
- l) name(s) of operatives undertaking the installation and their vocational competence levels;
- m) photographs as required by Clause 6.11;
- n) results of performance testing carried out;
- o) commissioning records;
- p) relevant installation certificates;
- q) confirmation that the installation process has been undertaken in accordance with this PAS signed off by a vocationally competent person, authorized to do so on behalf of the retrofit installer; and
- r) Confirmation of any claim of compliance with this PAS, issued to the Client or funding body.

## 7.9 Business and financial probity

### 7.9.1 Financial resource and insurance

The Retrofit Installer shall be able to demonstrate the financial stability and business resources likely to sustain the operation of an EEM installation service and shall have adequate arrangements, including insurance, to underwrite the liabilities arising from any claims resulting from deficiencies of product or system selection, design, detailing or installation, together with appropriate guarantees and warranties of the work, as required by the retrofit design or by any applicable quality assurance scheme, in respect of its operations and/or activities undertaken under the scope of this PAS.

### 7.9.2 Clarity of contractual liability

Where the Retrofit Installer is contracted to the Client on a 'design and build' basis, the roles of the Retrofit Designer and Retrofit Installer shall be sufficiently clearly defined and distinguished in the contract documentation to permit claims against either or both of them, as appropriate, in the event of a defective installation.

## 8 Service provision

### 8.1 Complaints procedure

The Retrofit Installer shall have in place and operate a documented complaints procedure appropriate for receiving, recording, acknowledging and resolving all complaints from clients.

### 8.2 Complaints records

The Retrofit Installer shall maintain records of all complaints and their resolution for six years or the duration of any EEM guarantees (whichever is longer) and shall make copies of such records available to the Retrofit Installer's PAS 2030 certification body or to the Retrofit Coordinator, when requested.

### 8.3 Interaction with clients

The Retrofit Installer shall have in place and operate a procedure to instruct each operative likely to have direct contact with clients or the occupants of the dwellings being improved, as to how to act in response to an approach from clients especially, but not exclusively, in respect of:

- vulnerable occupants (e.g. elderly or disabled persons or children);
- pre-notified Client requirements and expectations particularly issues of work timing and access;
- agreed Client service requirements;
- Client questions or requests for information;
- Client request for additional measure-related work extending beyond the installation process definition;
- Client complaint or other Client feedback in respect of some aspects of the installation or installation process.

## 9 Claims of compliance

### 9.1 Applicability of claims

Claims of compliance with this PAS shall be in respect of the processes and procedures employed and their application in the installation of EEM in any given dwelling. Such claims shall not be used to imply the quality or performance of the EEM installed, which will be the subject of claims of compliance with PAS 2035.

### 9.2 Requirement to claim

The installation of energy efficiency measures for which the processes, procedures and methods of application used are claimed to be in compliance with the requirements of this PAS shall be supported by a declaration of conformity to this PAS, expressed in the form provided in 9.3, as appropriate, issued to the Client and to the Retrofit Coordinator and where the claim is to 9.3.1, notified to the certification body providing evaluation services in respect of the installation.

### 9.3 Basis of claim

#### 9.3.1 Independent third-party certification

Where compliance with PAS 2030 is confirmed by an independent third-party certification body:

- The installation of [energy efficiency measure(s)] at [location of installation] and handed over on [date of handover] has been undertaken by [name of Retrofit Installer] on the basis of a retrofit design claimed to comply with PAS 2035, using a process complying with PAS 2030, including Annex(es) [insert references to relevant measure-specific Annex(es)]. [Insert unambiguous identification of the certification body].

#### 9.3.2 Other party confirmation

Where compliance with PAS 2030 is confirmed by an alternative method relying on parties other than those qualifying as an accredited independent third-party certification body:

- The installation of [energy efficiency measure(s)] at [location of installation] and handed over on [date of handover] has been undertaken by [name of Retrofit Installer] on the basis of a retrofit design claimed to comply with PAS 2035 using a process complying with PAS 2030, including Annex(es) [insert references to relevant measure-specific Annex(es)]. [Insert unambiguous identification of the confirmation body].

#### 9.3.3 Retrofit Installer self-assessment

Where compliance with PAS 2030 is assessed by the Retrofit Installer:

- The installation of [energy efficiency measure(s)] at [location of installation] and handed over on [date of handover] has been undertaken by [name of Retrofit Installer] on the basis of a retrofit design claimed to comply with PAS 2035, using a process complying with PAS 2030, including Annex(es) [insert references to relevant measure-specific Annex(es)].

**NOTE** The inclusion of reference to PAS 2030 in relation to any particular installed measure or measures represents the Retrofit Installer's declaration that the process used meets the requirements of this PAS. The accuracy of the claim is solely the claimant's responsibility and is not to be confused with third-party certification of conformity.



## 10 Documents essential to the application of the Annexes of this PAS

### 10.1 Use of the identified documents

The documents listed in 10.2 to 10.9 are cited in the core text or one or more of the measure-specific Annexes of this PAS and shall be used as required in the application of any Annex in which they are cited. For dated or edition-specific references, only the edition cited shall apply. For undated references or references that are not edition-specific, the latest edition of the referenced document (including any amendments) shall apply.

**NOTE** At the time of publication of the 2019 edition of PAS 2030, several of the standards listed in 10.2 have been updated from the versions applying in the 2017 edition. However, because the references to these documents in this PAS are undated those references remain unchanged. Attention is therefore drawn to the requirement to use the latest edition where references to documents are undated. To assist users of this PAS to identify the correct document, a list of the most recent editions of these standards is available from the PAS 2030 website.

### 10.2 Publicly Available Specification and British Standards

**PAS 2035**, *Retrofitting Dwellings for Improved Energy Efficiency – Specification and Guidance*

**BS 5250**, *Code of practice for the control of condensation in buildings*

**BS 5410-1**, *Code of practice for oil firing – Part 1: Installations up to 45 kW output capacity for space heating and hot water supply purposes*

**BS 5410-2**, *Code of practice for oil firing – Part 2: Installations of 45 kW and above output capacity for space heating, hot water and steam supply service*

**BS 5440-1**, *Flueing and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd, 3rd family gases) – Specification for installation of gas appliances to chimneys and for maintenance of chimneys*

**BS 5440-2**, *Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 2: Specification for the installation and maintenance of ventilation provision for gas appliances*

**BS 5482-1**, *Code of practice for domestic butane and propane gas burning installations – Part 1: Permanent dwellings*

**BS 5864**, *Installation and maintenance of gas-fired ducted air heaters of rated heat input not exceeding 70 kW net (2nd and 3rd family gases) – Specification*

**BS 5970**, *Code of practice for thermal insulation of pipework and equipment in the temperature range of -100°C to +870°C*

**BS 6100-1**, *Building and civil engineering – Vocabulary- Part 1 General terms*

**BS 6262-2**, *Glazing for buildings- Part 2: Code of practice for energy light and sound*

**BS 6262-3**, *Glazing for buildings- Part 3: Code of practice for fire security and wind loading*

**BS 6262-4**, *Glazing for buildings- Part 4: Code of practice for safety related to human impact*

**BS 6262-6**, *Glazing for buildings- Part 6: Code of practice for special applications*

**BS 6262-7**, *Glazing for buildings- Part 7: Code of practice for the provision of information*

**BS 6644**, *Specification for installation of gas-fired boilers of rated inputs between 70 kW (net) and 1.8 MW (net) (2nd and 3rd family gases)*

**BS 6798**, *Specification for installation and maintenance of gas-fired boilers of rated input not exceeding 70 kW net*

**BS 6891**, *Installation of low-pressure gas pipework of up to 35 mm (R1 1/4) on premises*

**BS 7386**, Draught-strips for the draught control of existing doors and windows in housing (including test methods)

**BS 7593**, Code of practice for treatment of water in domestic hot water central heating systems

**BS 7619**, Specification for extruded cellular unplasticized PVC (PVCU) profiles

**BS 7671**, Requirements for electrical installations — IET Wiring Regulations

**BS 7880**, Draught control of existing doors and windows in housing using draught strips

**BS 7913**, Guide to the conservation of historic buildings

**BS 8000-0**, Workmanship on building sites- Part 0: Introduction and general principles

**BS 8558**, Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages — Complimentary guidance to BS EN 806

**BS 81234**, Windows and doors — Code of practice for the survey and installation of windows and external door sets

**BS 8660-1**, Gas-fired micro-cogeneration appliances of rated thermal input not exceeding 70 kW net — Part 1: Specification for selection, installation, inspection, commissioning, servicing and maintenance of Stirling engine micro-cogeneration appliances

**BS EN 378-1**, Refrigerating systems and heat pumps — Safety and environmental requirements — Basic requirements, definitions, classification and selection criteria

**BS EN 378-3**, Refrigerating systems and heat pumps — Safety and environmental requirements — Installation location and personal protection

**BS EN 378-4**, Refrigerating systems and heat pumps — Safety and environmental requirements — Operation, maintenance, repair and recovery

**BS EN 806-1**, Specifications for installations inside buildings conveying water for human consumption — General

**BS EN 806-4**, Specifications for installations inside buildings conveying water for human consumption — Installation

**BS EN 806-5**, Specifications for installations inside buildings conveying water for human consumption — Operation and maintenance

**BS EN 1264-1**, Water based surface embedded heating and cooling systems – Part 1: Definitions and symbols

**BS EN 1264-2**, Water based surface embedded heating and cooling systems – Part 2: Floor heating: Prove methods for the determination of the thermal output using calculation and test methods

**BS EN 1264-3**, Water based surface embedded heating and cooling systems – Part 3: Dimensioning

**BS EN 1264-4**, Water based surface embedded heating and cooling systems – Part 4: Installation

**BS EN 1264-5**, Water based surface embedded heating and cooling systems – Part 5: Heating and cooling surfaces embedded in floors — Determination of the thermal output

**BS EN 1670**, Building hardware – Corrosion resistance – Requirements and test methods

**BS EN 12828**, Heating systems in buildings — Design for water-based heating systems

**BS EN 12831**, Heating systems in buildings: Method for calculation of the design heat load

**BS EN 13120**, Internal blinds – Performance requirements including safety

**BS EN 13561**, External blinds and awnings – Performance requirements including safety

**BS EN 13659**, Shutters and external venetian blinds – Performance requirements including safety

**BS EN 14336** (including Corrigendum January 2009), Heating systems in buildings – Installation and commissioning of water-based systems

**BS EN 15316-4-8**, Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Space heating generation systems, air heating and overhead radiant heating systems

**BS EN 16484**, Building automation and control systems (BACS) — Project specification and implementation

**BS EN 16883**, *Conservation of cultural heritage — Guidelines for improving the energy performance of historic buildings*

**BS EN 62446-1**, *Photovoltaic (PV) systems — Requirements for testing, documentation and maintenance — Grid connected systems — Documentation, commissioning tests and inspection*

**BS EN ISO 11600**, *Building construction — Jointing products- Classification and requirements for sealants*

### 10.3 Institution of Gas Engineer and Managers – Standards

(available from [www.igem.org.uk/technicalstandards/standards/](http://www.igem.org.uk/technicalstandards/standards/))

IGEM UP/1, 1A & 1B, *Strength testing, tightness testing and direct purging each standard covers industrial commercial and domestic testing and purging requirements*

IGEM/UP/2, *Installation of pipework on industrial and commercial premises*

IGEM/UP/7, *Gas installations in timber-framed and light steel buildings*

### 10.4 Energy Networks Association Engineering Recommendations

(Available from [www.energynetworks.org/electricity/engineering/distributedgeneration.html](http://www.energynetworks.org/electricity/engineering/distributedgeneration.html))

G59/3, *Distributed Generation Connection Guide – A guide for connecting generation that falls under G59/3 to the distribution network*

G83/1-1, *Stage 1: Distributed Generation Connection Guide – A guide for connecting generation that falls under G83/1-1 STAGE 1 to the distribution network*

G83/2-1, *Stage 2: Distributed Generation Connection Guide – A Guide for connecting generation that falls under G83/1-1 STAGE 2 to the distribution network*

Recommendations for the Connection of Small-scale Embedded Generators (up to 16 A per phase) in Parallel with Public Low-voltage Distribution Networks

### 10.5 UKLPG

(available from [www.uklpg.org/shop/codesofpractice/](http://www.uklpg.org/shop/codesofpractice/))

Code of Practice 22, *Design installation and testing of LPG Piping Systems*

### 10.6 Ministry of Housing, Communities and Local Government

Domestic Building Services Compliance Guide (available from [www.planningportal.gov.uk/uploads/br/domestic\\_building\\_compliance\\_guide\\_2013.pdf](http://www.planningportal.gov.uk/uploads/br/domestic_building_compliance_guide_2013.pdf))

### 10.7 Other insulation installation guidance references

#### 10.7.1 External solid wall insulation

*Specification for the installation of external wall insulation ensuring the safety and operation of fuel burning appliances, version 2*

*External Wall Insulation Specification for Weathering and Thermal Bridge Control*

External Wall Insulation Pre-Installation Building Inspection Checklist

EWI Building Owner Maintenance Pack/Schedule

All available from the National Insulation Association (NIA), the Insulated Render and Cladding Association (INCA) or the Solid Wall Insulation Guarantee Agency (SWIGA)

#### 10.7.2 Room in roof insulation (see B.12)

*A Guide to Retrofit Room in Roof Insulation*

*Room in Roof Insulation pre-installation checklist*

Both available from the National Insulation Association and Association for Technical Monitoring Agents

#### 10.7.3 Loft insulation (see B.9)

General requirements and guidance for the installation of loft insulation  
<http://www.glidevale.com/uploads/dab79298b0219093005220b716485704.pdf>

# Annex A (normative)

## Measure-specific Annex selection and co-installation requirements

### A.1 Introduction

The clauses of this Annex provide:

- in **A.2** and **A.3**, information to facilitate the inclusion of measures specified in each retrofit design in the installation method statement (**6.1**);
- in **A.4**, information in respect of the potential for relationship between installed measures and between installed measures and the dwelling in which they are installed;
- in **A.5**, information to assist the avoidance of thermal bridging.

### A.2 Energy efficiency measures and types arranged by measure category

**Table A.1** – Category BFM (Building Fabric Measures)

Measure	Measure type	Measure reference	Current Annex
Cavity wall insulation including that installed in party walls	As measure	BFM.1	B1
Draught proofing	As measure	BFM.2	B2
Energy efficient glazing and doors including replacement insulating glass units (IGU)	As measure	BFM.3	B3
External wall insulation	1. Site rendered external wall insulation systems	BFM.4.1	B4
	2. Pre-finished external wall insulation systems	BFM.4.2	
Flat roof insulation	As measure	BFM.5	B5
Floor Insulation	As measure	BFM.6	B6
Hybrid wall insulation	As measure	BFM.7	B7
Internal wall insulation	As measure	BFM.8	B8
Loft insulation	1. Roll insulation	BFM.9.1	B9
	2. Blown insulation	BFM.9.2	
Pitched roof insulation	As measure	BFM.10	B10
Solar blind, shutters and shading devices (internal and external)	1. Mechanically operated devices	BFM.11.1	B11
	2. Electrically operated devices	BFM.11.2	
Room-in-roof insulation	As measure	BFM 12	B12
Park Homes insulation	As measure	BFM 13	B13

**Table A.2 – Category BSM (Building Services Mechanical)**

Measure	Measure type	Measure reference	Current Annex
Condensing boilers, natural gas-fired and liquefied petroleum gas-fired	As measure	BSM.1	C1
Condensing boilers, oil-fired	As measure	BSM.2	C2
Flue gas heat recovery devices	Devices for use with gas-fired condensing boilers (domestic scale)	BSM.3	C3
Heating system insulation	As measure	BSM.4	C4
Heating, hot water system, air conditioning or ventilation system controls and components	1. Heating and hot water system controls (domestic)	BSM.5.1	C5
	2. Air conditioning controls	BSM.5.2	
	3. Ventilation controls	BSM.5.3	
	4. Low energy circulator pumps	BSM.5.4	
	5. Low temperature radiators and fan convectors	BSM.5.5	
Hot water systems	Domestic hot water systems	BSM.6.1	C6
Mechanical ventilation with heat recovery	Domestic ventilation systems with heat recovery	BSM.7.1	C7
Under-floor heating	Hydraulic (wet) systems*	BSM.8	C8
Warm-air heating	1. Natural gas-fired and liquefied petroleum gas-fired warm air heating systems	BSM.9.1	C9
	2. Oil-fired warm air heating systems	BSM.9.2	
<i>NOTE Electric warm air heating systems are included under the measure electric storage heaters (see D.1).</i>			
Water efficient taps and showers	As measure	BSM.10	C10

**Table A.3 – Category BSE (Building Services Electrical)**

Measure	Measure type	Measure reference	New Annex
Electric storage heaters (including electric warm air heating units that incorporate heat storage)	1. Electric storage heaters	BSE.1.1	D1
	2. Electric storage heaters with warm air heat distribution	BSE.1.2	
Light fittings, lighting systems and lighting system controls	As measure	BSE.2	D2

### A.3 Explanation of PAS 2030 measure-specific Annex referencing system

EEM included in PAS 2030 are organised in three groups, building fabric measures (BFM), building services mechanical (BSM and building services electrical (BSE). These groups are each presented in an Annex referenced as Annex B for BFM, Annex C for BSM and Annex D for BSE. Within these annexes, the related measures are each allocated a separate sub-Annex e.g. **B.1, B.2, B.3** etc. Referencing within each sub-Annex is provided for as follows:

#### Annex B (normative) BFM energy efficiency measures

##### B.1 Measure BFM.1 Cavity wall insulation including that installed in party walls

**B, C, D** There are three annexes each presenting a single category of energy efficiency measures (e.g. BFM, BSM, and BEM).

**B.1, B.2, C.1, D.1** etc. – Measure specific sub-Annex reference, presented alongside title

**B.1.1, B.1.2, B.1.3** etc. – Measure focussed requirements clauses within each sub-Annex B1.

**Table B.1** – Table of required technical, competence and other requirements for sub-Annex B1

**B1-11, B1-12, B1-13 B1-14** etc. – line references within the Table B.1.

### A.4 Interactions between EEMs

#### A.4.1 Introduction

When EEMs are installed in any existing dwelling it is essential to take account of the fact that some measures can impact upon the performance of other measures or can themselves be impacted by those measures. There are also EEM that when installed in a dwelling without appropriate care can significantly impair the functionality of the dwelling.

For this reason, PAS 2035 emphasizes the need for the Retrofit Designer to consider and make adequate provision for the interfaces between the EEMs in the retrofit design. PAS 2030 also imposes responsibilities on Retrofit Installers of EEMs to be alert to these potential issues and to closely follow the retrofit design. This extends to the requirement for Retrofit Installers to pay attention to such matters during the pre-installation building inspection and to refer to the Retrofit Coordinator any issues that they consider not to have been adequately provided for in the retrofit design.

#### A.4.2 The measures interaction matrix

Figure A1 (which also appears in PAS 2035) provides information about the nature of relationships between co-installed EEMs, identifying measures that are independent and do not interact and measures that are not appropriate together and should not be combined; other intermediate relationships (e.g. when a construction detail is required for an interface) are also identified. PAS 2035 specifies that these relationships shall be taken into account by the Retrofit Designer when developing the retrofit design.



## A.5 Avoidance of thermal bridging

As required in 5.2.1, Retrofit Installers shall satisfy themselves that the retrofit design provided by the Retrofit Designer includes construction details for eliminating thermal by-pass and minimizing thermal bridging at corners, junctions and edges of insulation layers either occurring as a consequence of geometry or resulting from discontinuity of the insulation or from insulation being thinner than in the adjacent area (e.g. around meter boxes, etc.).

**NOTE** *It is recommended that these construction details be based on accepted industry guidance or standards. e.g. External Wall Insulation Specification for Weathering and Thermal Bridge Control [N1] (see 10.7.1) Alternatively, temperature factors for construction details should be calculated in accordance with BRE Information Paper IP1106 Assessing the effects of thermal bridging at junctions and around openings (BRE 2006) [1]. Temperature Factors ( $f_{Rsi}$ ) should be not less than 0.75.*

Where the retrofit design does not include construction details for eliminating thermal by-pass and minimizing thermal bridging the Retrofit Installer shall obtain confirmation from the Retrofit Coordinator that this was intentional.

**NOTE** *The Retrofit Coordinator should provide in writing valid reasons why no such detail is required; the cost of preparing or constructing such details is not a valid reason.*



# Annex B (normative)

## BFM energy efficiency measures

### B.1 Measure BFM.1 Cavity wall insulation including that installed in party walls

#### B.1.1 Additional installation requirements

When installing cavity wall insulation, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Retrofit Installer shall also work to any standards, specifications, instructions or guidance identified in B1-I1 of Table B.1.

#### B.1.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the cavity wall insulation at location, the Retrofit Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in B1-I2 of Table B.1.

#### B.1.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of cavity wall insulation, the Retrofit Installer shall employ or contract only an inspector meeting the competence requirements of B1-I3 of Table B.1.

#### B.1.4 Operative competence

When installing cavity wall insulation, the Retrofit Installer shall employ or contract only operatives with the required level of qualification attained through one of the permitted routes (B1-I4 of Table B.1), with competence currency specified in B1-I5 of Table B.1 at the competency ratio specified in B1-I6 of Table B.1.

#### B.1.5 Provision of information in respect of cavity wall insulation

At the time of handover of the cavity wall insulation to the Client, the Retrofit Installer shall ensure that the information identified at B1-I7 of Table B.1 is provided to the Client as part of the handover process required in 6.9.

**Table B.1 – Measure-specific requirements for cavity wall insulation (BFM.1)**

<b>Measure description</b>	Cavity Wall Insulation including that installed in party walls
<b>Measure type</b>	As measure description (no sub-division)
<b>B1-I1 Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The Installer shall ensure that the methods used for the installation of cavity wall insulation (CWI) products or systems are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design and incorporated in the installation method statement (6.1).</p> <p>The Installer responsibilities include preparation of the site and finishing work, incorporating:</p> <ul style="list-style-type: none"> <li>• identification of essential ventilation openings that require sleeving or safeguarding before installation;</li> <li>• the position of all flues whether or not they are in service and measures that shall be taken to safeguard their proper functioning; and</li> <li>• ensuring that upon completion of the installation or at the end of each working day, if the installation takes longer than one day, the operatives investigate and confirm the proper functioning of all ventilation openings and flues.</li> </ul> <p><i>NOTE 1 The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the Installer should be aware that training from the supplier or training acceptable to the supplier may be necessary before an application for assessment/certification is made to a certification body.</i></p>

Table B.1 – continued

	<p><b>NOTE 2</b> Attention is drawn to the need, where relevant, for all cavity wall insulation installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</p> <p><b>NOTE 3</b> Where the installation is to include party walls, and the Installer is not responsible for any necessary notices or agreements in respect of the work have been issued then the Installer should confirm with the Retrofit Designer that any necessary notice of work to be undertaken has been issued (e.g. any notice required under the Party Wall etc. Act [2]).</p> <p><b>NOTE 4</b> Additional assistance can be obtained from the NIA Building Fabric Assessment and Cavity Wall Insulation Remedial Work Scheme.</p>
<p><b>B1-I2</b>      <b>Pre-installation building inspection requirements</b></p>	<p>As a minimum the pre-installation building inspection shall:</p> <ul style="list-style-type: none"> <li>• investigate and assess if the CWI installation work will: <ul style="list-style-type: none"> <li>• result in non-compliance with the Building Regulations, e.g. in relation to workmanship; materials; structural stability; fire safety; resistance to moisture;</li> <li>• result in unsafe operation of a combustion appliances;</li> <li>• compromise the functionality of existing ventilation ducts/systems; and</li> <li>• compromise the functionality and/or safety of existing services (gas, electric, water, telephone, etc.);</li> </ul> </li> <li>• identify: <ul style="list-style-type: none"> <li>• if the proposed installation would be non-compliant with any requirements stated by the supplier;</li> <li>• if the type and condition of the dwelling structure is suitable for the works to commence;</li> <li>• the extent of the cavity to be filled;</li> <li>• if the site layout or conditions will impair the execution of the works; and</li> <li>• if relevant checks have been undertaken to determine if asbestos containing materials are present;</li> </ul> </li> <li>• be accompanied by evidence that the findings of the pre-installation building inspection have been independently checked by an appropriately qualified person (see <b>B1-I3</b>) prior to commencement of installation, with at least a randomly selected 1 in 10 of those checks (minimum of 1) including physical inspection of the dwelling by an appropriately qualified person; the appropriately qualified person shall: <ul style="list-style-type: none"> <li>• be independent and not an employee of the inspector or of the Installer of the CWI, or a peer installer; and</li> <li>• not be paid by results nor remunerated only where an assessment is found to be valid;</li> </ul> </li> <li>• ensure that each inspection checked includes a unique identifier and the names of the persons who completed the inspection and the check.</li> </ul>

**Table B.1 – continued**

Installation role	Evidence of vocational competence required
<b>B1-I3</b> <b>Building inspector</b>	able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B1-I4</b> <b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>
<b>B1-I5</b> <b>Competence currency</b>	To be verified by the Retrofit Installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.
<b>B1-I6</b> <b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Retrofit Installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a higher competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<b>B1-I7</b> <b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<ul style="list-style-type: none"> <li>• Details of safe use and maintenance of the cavity wall insulation system, as specified by the supplier;</li> <li>• Any relevant product warranty information and guarantees; and</li> <li>• Building Regulations compliance certificate where appropriate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days).</li> </ul>

## B.2 Measure BFM.2 Draught proofing

### B.2.1 Additional installation requirements

When installing draught proofing, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS the Installer shall also work to any standards, specifications, instructions or guidance identified in **B2-I1** of **Table B.2**.

### B.2.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the draught proofing at location the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in **B2-I2** of **Table B.2**.

### B.2.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of draught proofing, the Installer shall employ or contract only an inspector meeting the competence requirements of **B2-I3** of **Table B.2**.

### B.2.4 Operative competence

When installing draught proofing, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (**B2-I4** of **Table B.2**), with competence currency specified in **B2-I5** of **Table B.2** at the competency ratio specified in **B2-I6** of **Table B.2**.

### B.2.5 Provision of information in respect of draught proofing

At the time of handover of the draught proofing to the Client, the Installer shall ensure that the information identified at **B2-I7** of **Table B.2** is provided to the Client as part of the handover process required in **6.9**.

**Table B.2** – Measure-specific requirements for draught proofing (BFM.2)

Measure description	Draught Proofing
Measure type	As measure (no sub-division)
<b>B2-I1</b> Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)	<p>The Installer shall ensure that the methods used for the installation of draught proofing products or systems are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design, and incorporated in the installation method statement (<b>6.1</b>).</p> <p>The Installer responsibilities include preparation of the site and finishing work.</p> <p>When fitting draught-stripping products as a retrofit measure to hinged doors in wood, sliding windows in wood, hinged windows in wood and steel and domestic loft hatches, in houses that were not originally designed to incorporate draught-stripping, Installers shall use products meeting the requirements of BS 7386 working to the recommendations of BS 7880.</p> <p><i><b>NOTE 1</b> The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the installer should be aware that training from the supplier or training acceptable to the supplier may be necessary before an application for assessment/certification is made to a certification body.</i></p> <p><i><b>NOTE 2</b> Attention is drawn to the need, where relevant, for all draught proofing installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</i></p>

Table B.2 – continued

<b>B2-I2</b>	<b>Pre-installation building inspection requirements</b>	<p>As a minimum the pre-installation building inspection shall investigate and determine as far as practicable:</p> <ul style="list-style-type: none"> <li>• pre-existing damage to the areas that will be accessed by the installation operatives;</li> <li>• the extent of the area and elements to be draught-proofed;</li> <li>• if relevant checks have been undertaken to determine if asbestos-containing materials are present;</li> <li>• if the condition of the elements to be draught-proofed is suitable for the works to commence in relation to: <ul style="list-style-type: none"> <li>• timbers free from rot and/or infestation;</li> <li>• metal components being free from visible signs of corrosion; and</li> <li>• the surfaces that will receive draught-proofing materials being free from grease, etc.;</li> </ul> </li> <li>• if the proposed installation would: <ul style="list-style-type: none"> <li>• be non-compliant with any requirements stated by the Retrofit Designer;</li> <li>• compromise the functionality of existing ventilation systems in relation to air movement within the dwelling; and</li> <li>• result in unsafe operation of combustion appliances (combustion ventilation and or cooling ventilation);</li> </ul> </li> <li>• if the site layout or conditions will impair the execution of the works in relation to appropriate access to the property and to the elements to be draught-proofed; and</li> <li>• If the installation to be undertaken will result in non-compliance with the Building Regulations, e.g. in relation to workmanship; materials; structural stability; fire safety; resistance to moisture.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
<b>B2-I3</b>	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B2-I4</b>	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B2-I5</b>	<b>Competence currency</b>	To be verified by the installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.

Table B.2 – continued

<b>B2-16</b> <b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<b>B2-17</b> <b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<ul style="list-style-type: none"> <li>• Any relevant product warranty information and guarantees.</li> </ul>

## B.3 Measure BFM.3 – Energy efficient glazing and doors including replacement Insulating Glass Units (IGU)

### B.3.1 Additional installation requirements

When installing energy efficient glazing and doors, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in B3-I1 of Table B.3.

### B.3.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the energy efficient glazing and doors at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in B3-I2 of Table B.3.

### B.3.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of energy efficient glazing and doors, the Installer shall employ or contract only an inspector meeting the competence requirements of B3-I3 of Table B.3.

### B.3.4 Operative competence

When installing energy efficient glazing and doors, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (B3-I4 of Table B.3), with competence currency specified in B3-I5 of Table B.3 at the competency ratio specified in B3-I6 of Table B.3.

### B.3.5 Provision of information in respect of energy efficient glazing and doors

At the time of handover of the energy efficient glazing and doors to the Client, the Installer shall ensure that the information identified at B3-I7 of Table B.3 is provided to the Client as part of the handover process required in 6.9.

**Table B.3 – Measure-specific requirements for energy efficient glazing and doors (BFM.3)**

Measure description		Energy Efficient Glazing and Doors including replacement insulating glass units (IGU)
Measure type		As measure description (no sub-division)
<b>B3-I1</b>	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>Where relevant to the work to be undertaken, Installers shall take account of the guidance and information provided by:</p> <p><b>BS 8213-4</b>, <i>Code of practice for the survey and installation of windows and external door sets</i> or <i>A good practice guide: Installation of replacement windows and doors</i>; and the guidance provided by GGF.</p> <p><b>BS 6262-2</b>, <i>Glazing for buildings- Part 2: Code of practice for energy light and sound</i></p> <p><b>BS 6262-3</b>, <i>Glazing for buildings- Part 3: Code of practice for fire security and wind loading</i></p> <p><b>BS 6262-4</b>, <i>Glazing for buildings- Part 4: Code of practice for safety related to human impact</i></p> <p><b>BS 6262-6</b>, <i>Glazing for buildings- Part 6: Code of practice for special applications</i></p> <p><b>BS 6262-7</b>, <i>Glazing for buildings- Part 7: Code of practice for the provision of information</i></p> <p><b>BS 8000-7</b> <i>Workmanship on building sites- Part 7: code of practice for glazing</i></p> <p><b>NOTE 1</b> Attention is drawn to the need for all energy efficient glazing and doors work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: workmanship; materials; structural stability; fire safety; resistance to moisture; ventilation; conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</p> <p><b>NOTE 2</b> For IGU replacements only safety glazing requirements are applicable.</p>

**Table B.3 – continued**

<b>B3-I2</b>	<b>Pre-installation building inspection requirements</b>	<p>1) As a minimum the pre-installation building inspection shall include:</p> <ul style="list-style-type: none"> <li>• review of contract;</li> <li>• measurement check, include fire egress*;</li> <li>• assessment of structure*;</li> <li>• check for asbestos*;</li> <li>• safety glazing requirements;</li> <li>• requirements relating to fire-resistant glazing;</li> <li>• ventilation requirements</li> <li>• check render and decorations condition*</li> <li>• user access requirements (e.g. disabled access);</li> <li>• specialist access equipment; and</li> <li>• explanation to existing owner.</li> </ul> <p><i>NOTE Not applicable to IGU replacement.</i></p> <p>2) The pre-installation building inspection shall investigate and assess if the installation to be undertaken will result in non-compliance with the Building Regulations, e.g. in relation to workmanship, materials, structural stability, fire safety, resistance to moisture.</p>
	<b>Installation role</b>	<b>Vocational competence required</b>
<b>B3-I3</b>	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B3-I4</b>	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B3-I5</b>	<b>Competence currency</b>	To be verified by the Installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.



Table B.3 – continued

<b>B3-16</b> <b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative per team of four operatives. For each installation, the vocational competence ratio (see 3.28) over and above this minimum shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken;</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<b>B3-17</b> <b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<ul style="list-style-type: none"> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days);</li> <li>• Relevant operating, maintenance, safety and security documentation relevant to the installation; and</li> <li>• Any relevant product warranty information and guarantees.</li> </ul>

## B.4 Measure BFM.4 – External wall insulation

### B.4.1 Additional installation requirements

When installing external wall insulation, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in **B4-I1** of **Table B.4**.

### B.4.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the external wall insulation at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in **B4-I2** of **Table B.4**.

### B.4.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of external wall insulation, the Installer shall employ or contract only an inspector meeting the competence requirements of **B4-I3** of **Table B.4**.

### B.4.4 Operative competence

When installing external wall insulation, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (**B4-I4** of **Table B.4**), with competence currency specified in **B4-I5** of **Table B.4**, at the competency ratio specified in **B4-I6** of **Table B.4**.

### B.4.5 Provision of information in respect of external wall insulation

At the time of handover of the external wall insulation to the Client, the Installer shall ensure that the information identified at **B4-I7** of **Table B.4** is provided to the Client as part of the handover process required in **6.9**.

**Table B.4** – Measure-specific requirements for external wall insulation (BFM.4)

Measure description		External Wall Insulation
Measure type	BFM.4.1	Site rendered external wall insulation systems
	BFM.4.2	Pre-finished external wall insulation systems
<b>B4-I1</b>	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>Because of the high risk of thermal by-pass rendering the insulation ineffective, external wall insulation shall not be installed on walls of cavity construction that have unfilled cavities or have had cavity wall insulation removed and not replaced, unless the cavities have been sealed in accordance with specifications and construction details provided by the Retrofit Designer (See PAS 2035 for further details).</p> <p>The Installer shall ensure that the methods used for the installation of external wall insulation (EWI) products or systems are as recommended by the system supplier and in accordance with the relevant retrofit design and incorporated in the installation method statement.</p> <p>In undertaking the installation, the Installer’s responsibilities shall include:</p> <p>a) Before installation starts, confirming that the retrofit design has made provision for ensuring that:</p> <ul style="list-style-type: none"> <li>• the EWI system provided for installation is that recommended by the pre-design building survey and specified by the retrofit design;</li> <li>• wind loads have been calculated and taken into account in the fixing requirements;</li> <li>• all essential ventilation openings that require sleeving or safeguarding before installation are located and identified;</li> <li>• the position of all flues whether or not they are in service is determined and the measures that shall be taken to safeguard their proper functioning is determined;</li> <li>• any existing cables, pipework, ducting etc. that require it are removed or repositioned as/where necessary to accommodate the planned EWI system, with authorization from the relevant responsible body (where required) and undertaken by a person competent to undertake such work;</li> </ul>

Table B.4 – continued

- the existing ground levels, paths or decking adjacent to the dwelling are 150 mm below the level of the damp proof course; and
- other areas of the dwelling and surrounding area that could be at risk during installation are adequately protected to ensure they are not damaged.

In the event that any of these aspects is not adequately covered, liaising with the Retrofit Designer to provide for their undertaking.

b) During installation, ensuring that:

- all work is carried out in accordance with the site-specific retrofit design, drawings and method statement and that work is not permitted to progress unless copies of the site-specific specification documentation are accessible at location and all operatives are aware of the content and requirements relevant to their designated activities;
- the system and all detailed interfaces with other parts of the dwelling or other planned EEMs to be undertaken in a manner and sequenced such, that all measures are fully effective, with optimized performance and junctions that are safe, durable and fully weatherproof for all expected exposure conditions. e.g. interface between EWI system and planned replacement windows; and
- whether or not specifically required by the retrofit design, the items listed in i to viii below are given particular attention with regard to the efficacy and durability of the detail especially concerning the management and exclusion of moisture and/or the risk of surface/interstitial condensation or rising damp. Mastic sealants shall always be supported by a primary seal below, and all details shall be fully weatherproof:
  - i. system base detail (including below dpc);
  - ii. interfaces with roofs at eaves and verges (where metal or plastic cappings and trims shall not be used);
  - iii. window/door reveals/heads;
  - iv. system/cill interfaces (incl. overhang requirements/weepholes/thermal movement);
  - v. surface fixtures (structurally sound);
  - vi. penetrations through the system;
  - vii. interfaces with roof soffits, flat roofs, conservatory roofs etc.; and
  - viii. detailing and sealing around vents/flues, meters and other heating related structures/pipework.
- all weather seals at the interface between EWI systems and other structures/finishes are installed with particular attention given to the soundness/cleanliness of contact surfaces, continuity and effectiveness around corners, bond to surfaces and the durability of the water seal;
- all details are installed to minimize the risks of thermal bridging, removing/relocating/extending to allow continuity of insulation in all cases e.g. rooflines, meter boxes, pipework, flues, ducts;
- photographic evidence of key stages of the installation is prepared and retained for the period of the guarantee, including close up photographs of representative examples of all moisture and thermally sensitive details;

**Table B.4 – continued**

	<ul style="list-style-type: none"> <li>• installations are undertaken in accordance with the specification for the installation of external wall insulation ensuring the safety and operation of fuel burning appliances, taking account of the recommendations provided in the document <i>External wall External Wall Insulation Specification for Weathering and Thermal Bridge Control</i> [N1] (see 10.7.1);</li> <li>• ventilation of the dwelling is assessed and if necessary upgraded in accordance with the retrofit design and with the requirements of PAS 2035; and</li> <li>• upon completion of the installation or at the end of each working day, if the installation takes longer than one day, the operatives investigate and confirm the proper functioning of all ventilation openings and flues.</li> </ul> <p><i>NOTE 1 The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the installer should be aware that training from the supplier or training acceptable to the supplier is necessary before an application for assessment/certification is made to a certification body.</i></p> <p><i>NOTE 2 Attention is drawn to the need, where relevant, for all external wall insulation installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</i></p>
<p><b>B4-I2</b>      <b>Measure-specific pre-installation building inspection requirements supplementary to those in the core of this PAS (Clause 7.2)</b></p>	<p>1) In meeting the requirements specified in Clause 7.2 of this PAS, the designated competent person shall confirm that:</p> <ol style="list-style-type: none"> <li>a) a full and detailed pre-design building assessment had been undertaken by a competent person (see B4-I3 of this Table), prior to the retrofit design being undertaken; and</li> <li>b) the retrofit design relevant to the installation under inspection has been produced in accordance with Clause 5 of this PAS taking full account of the findings and recommendations of the pre-design building assessment, including: <ul style="list-style-type: none"> <li>• thermal performance calculations;</li> <li>• condensation risk analysis;</li> <li>• ventilation requirements and standard/bespoke drawing details;</li> <li>• the main components of the system including the fixing type/method, the insulation type and thickness, the joint details and specifications, the reinforcing coat and type of reinforcement and the finish;</li> </ul> </li> </ol>

Table B.4 – continued

- the proposed details for the main interfaces; (thermal bridging, meter boxes, reveals, roofline joists, party walls, base detail with particular reference to below dpc, base/floor details, seals at windows/doors, seals to penetrations, light fittings, sockets, fixing and sealing of surface mounted structures, interfaces with ceilings, interfaces with roof, junctions between the system and other finishes and/or other EEM) clearly demonstrate how the installation will avoid condensation risk particularly at moisture sensitive locations such as timber joist ends and within the wall structure (interstitial/surface condensation); and
  - the installation to the retrofit design is practical and achievable given the particular EWI system chosen for the project and the specific dwelling construction, site conditions and other EEMs planned for the property. (See also the Measures Interaction matrix Figure A.1).
- 2) As a minimum the pre-installation building inspection shall investigate and assess if the EWI installation work will:
- result in non-compliance with the Building Regulations, e.g. in relation to workmanship, materials, structural stability, fire safety;
  - provide resistance to moisture. Where possible, any areas of non-compliance shall be rectified by selection of another solution/detail, which shall be documented in the pre-installation building inspection and all contract documentation amended accordingly i.e. specification, drawings, method statement;
  - result in avoidable thermal bridging; where thermal bridging is avoidable by adaptation of the detail, such measures shall be taken and the contract documents amended to suit. Design details shall be such that they incorporate additional capacity, that for example, will provide water management within the system should surface or interstitial condensation occur;
  - result in unsafe operation of combustion appliances; unless an alternative safe detail can be found, EWI works shall not progress in the area causing the unsafe operation;
  - compromise the functionality of existing ventilation ducts/systems; unless an alternative safe detail can be found, EWI works shall not progress in the area causing the unsafe operation;
  - compromise the functionality and/or safety of existing services (gas, electric, water, telephone, etc.); unless an alternative safe detail can be found, EWI works shall not progress in the area causing the unsafe operation; and
  - result in the proposed installation being non-compliant with any requirements of the EEM supplier or of the retrofit design.
- 3) The pre-installation building inspection shall include confirmation that the condition of the substrate is suitable for the works to commence and where all or any of the substrate does not fulfil the requirements for installation, preparation of proposals for adaptations to be made or additional preparation undertaken that will be necessary in order that works can commence.
- 4) All instances of potential non-compliance identified in the pre-installation building inspection shall be documented and referred to the Retrofit Coordinator for resolution. Any design adjustments, special adaptations and/or additional preparation requirements shall be confirmed as acceptable in writing, by the system supplier and/or the Retrofit Coordinator.
- 5) The retrofit design documentation shall be amended to include any specified changes to the installation, the installation method statement modified accordingly and the pre-installation building inspection records updated to provide documentary evidence that the intended modified installation will address all the issues identified in the pre-installation building inspection and meets the requirements of all parties.

**NOTE** In undertaking pre-installation building inspections it is recommended that Installers consider using an industry recommended checklist e.g. the External Wall Insulation pre-installation building inspection checklist [N7] (see 10.7.1).

Table B.4 – continued

Installation role	Vocational competence required
B4-I3 Building Inspector	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
B4-I4 Operative, (threshold)	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
Operative, (specialist)	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
B4-I5 Competence Currency	To be verified by the installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.
B4-I6 Competence ratio	<p>For each installation task to be undertaken, the installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale, geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised;</li> </ul> <p>but shall not be less than one carded operative per team of 4 (1 to 3), at the specified installation location at any time.</p> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
B4-I7 Measure-specific information to be handed over to the Client in addition to 6.9	<ul style="list-style-type: none"> <li>• As a minimum the user manual shall include details on fixing to the system, drilling or cutting the system, repairs to damaged areas, avoiding damage (e.g. ladders), cleaning recommendations, importance of weather seals, name/contact details of both the installer and system certificate holder, materials specification (name, colours etc.) and guidance on living in a highly insulated property, including the need for appropriate ventilation. The contents of the manual should be explained to the Client (not just left with them).</li> <li>• Where end-user maintenance is possible, details of how to undertake the maintenance including frequency and any product or tools that shall be used and where to obtain the required products and tools.</li> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days).</li> <li>• It should be explained to the Client that repairs should be carried out by a competent person, but that maintenance is their responsibility.</li> <li>• Any relevant product warranty information and guarantees.</li> </ul>

## B.5 Measure BFM.5 Flat roof insulation

### B.5.1 Additional installation requirements

When installing flat roof insulation, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in B5-I1 of Table B.5.

### B.5.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the flat roof insulation at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in B5-I2 of Table B.5.

### B.5.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of flat roof insulation, the Installer shall employ or contract only an inspector meeting the competence requirements of B5-I3 of Table B.5.

### B.5.4 Operative competence

When installing flat roof insulation, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (B5-I4 of Table B.5), with competence currency specified in B5-I5 of Table B.5 at the competency ratio specified in B5-I6 of Table B.5.

### B.5.5 Provision of information in respect of flat roof insulation

At the time of handover of the flat roof insulation to the Client, the Installer shall ensure that the information identified at B5-I7 of Table B.5 is provided to the Client as part of the handover process required in 6.9.

**Table B.5** – Measure-specific requirements for flat roof insulation (BFM.5)

Measure description		Flat Roof Insulation
Measure type		As measure description (no sub-divisions)
B5-I1	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10).</b>	<p>The Installer shall ensure that the methods used for the installation of flat roof insulation products or systems are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design, and incorporated in the installation method statement.</p> <p>The Installer's responsibilities shall include preparation of the site and finishing work incorporating:</p> <ul style="list-style-type: none"> <li>• identification of essential ventilation openings that require sleeving or safeguarding before installation;</li> <li>• the position of all flues whether or not they are in service and measures that shall be taken to safeguard their proper functioning and to prevent combustion of all newly installed adjacent materials; and</li> <li>• ensuring that upon completion of the installation or at the end of each working day, if the installation takes longer than one day, the operatives investigate and confirm the proper functioning of all ventilation openings and flues.</li> </ul> <p><i>NOTE 1 The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the installer should be aware that training from the supplier or training acceptable to the supplier of the insulation and where applicable the waterproofing products may be necessary before an application for assessment/certification is made to a certification body.</i></p> <p><i>NOTE 2 Attention is drawn to the need, where relevant, for all flat roof insulation installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</i></p>

**Table B.5 – continued**

<b>B5-I2</b>	<b>Pre-installation building inspection requirements</b>	<p>As a minimum the pre-installation building inspection shall investigate and determine as far as practicable:</p> <ul style="list-style-type: none"> <li>• pre-existing damage to the areas that will be accessed by the installation operatives;</li> <li>• the extent of the area and elements to be insulated;</li> <li>• if relevant checks have been undertaken to determine if asbestos-containing materials are present;</li> <li>• if the condition of the roof is suitable for the works to commence in relation to: <ul style="list-style-type: none"> <li>• existence of appropriate roof internal ventilation arrangements;</li> <li>• the roof build up being free from rodents/pests and protected species, e.g. bats;</li> <li>• timbers free from rot and/or infestation;</li> <li>• the condition of the ceiling (if applicable);</li> <li>• metal structural roof members being free from visible signs of corrosion;</li> <li>• electrical wiring is free from visible defects, e.g. damaged cables, trailing cables, exposed conductors;</li> <li>• no visible signs of water penetration; and</li> <li>• no visible signs of leakage from water system components, e.g. pipework.</li> </ul> </li> <li>• if the proposed installation would: <ul style="list-style-type: none"> <li>• be non-compliant with any requirements stated by the designer/ specifier;</li> <li>• compromise the functionality of existing air supply/extract ventilation ducts/systems; and</li> <li>• result in unsafe operation of a combustion appliances.</li> </ul> </li> <li>• if the site layout or conditions will impair the execution of the works in relation to appropriate access to the property and to the elements to be insulated;</li> <li>• if the installation to be undertaken will result in non-compliance with the Building Regulations, e.g. in relation to workmanship; materials; structural stability; fire safety; resistance to moisture.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
<b>B5-I3</b>	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B5-I4</b>	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B5-I5</b>	<b>Competence currency</b>	To be verified by the installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.



Table B.5 – continued

<b>B5-16</b> <b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ol style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<b>B5-17</b> <b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<ul style="list-style-type: none"> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days).</li> <li>• any relevant product warranty information and guarantees.</li> </ul>

## B.6 Measure BFM.6 Floor insulation

### B.6.1 Additional installation requirements

When installing floor insulation, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the installer shall also work to any standards, specifications, instructions or guidance identified in **B6-I1** of **Table B.6**.

### B.6.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the floor insulation at location, the installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in **B6-I2** of **Table B.6**.

### B.6.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of floor insulation, the installer shall employ or contract only an inspector meeting the competence requirements of **B6-I3** of **Table B.6**.

### B.6.4 Operative competence

When installing floor insulation, the installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (**B6-I4** of **Table B.6**), with competence currency specified in **B6-I5** of **Table B.6** at the competency ratio specified in **B6-I6** of **Table B.6**.

### B.6.5 Provision of information in respect of floor insulation

At the time of handover of the floor insulation to the Client, the installer shall ensure that the information identified at **B6-I7** of **Table B.6** is provided to the Client as part of the handover process required in **6.9**.

**Table B.6** – Measure-specific requirements for floor insulation (BFM.6)

<b>Measure description</b>	Floor Insulation
<b>Measure type</b>	As measure description (no sub-division)
<b>B6-I1 Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The Installer shall ensure that the methods used for the installation of floor insulation products or systems are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design, and incorporated in the installation method statement (5.1).</p> <p><i>NOTE 1 The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the installer should be aware that training from the supplier or training acceptable to the supplier may be necessary before an application for assessment/certification is made to a certification body.</i></p> <p><i>NOTE 2 Attention is drawn to the need, where relevant, for all floor insulation installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England and Wales is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</i></p>

Table B.6 – continued

B6-I2	Pre-installation building inspection requirements	<p>As a minimum the pre-installation building inspection shall investigate and determine as far as practicable:</p> <ul style="list-style-type: none"> <li>• pre-existing damage to the areas that will be accessed by the installation operatives;</li> <li>• the extent of the area and elements to be insulated;</li> <li>• if relevant checks have been undertaken to determine if asbestos-containing materials are present;</li> <li>• if the condition of the floor structure and the sub- floor void is suitable for the works to commence in relation to: <ul style="list-style-type: none"> <li>• existence of appropriate floor void ventilation arrangements;</li> <li>• the under-floor area being free from rodents/pests;</li> <li>• timbers free from rot and/or infestation;</li> <li>• metal structural floor support members being free from visible signs of corrosion;</li> <li>• electrical wiring is free from visible defects, e.g. damaged cables, trailing cables, exposed conductors;</li> <li>• no visible signs of water penetration or water accumulation in the under-floor area; and</li> <li>• no visible signs of leakage from water system components, e.g. pipework;</li> </ul> </li> <li>• if the proposed installation would: <ul style="list-style-type: none"> <li>• be non-compliant with any requirements stated by the designer/specifier;</li> <li>• compromise the functionality of existing air supply/extract ventilation ducts/systems; and</li> <li>• result in unsafe operation of a combustion appliances (floor vents, etc.);</li> </ul> </li> <li>• if the site layout or conditions will impair the execution of the works in relation to: <ul style="list-style-type: none"> <li>• appropriate access to the property and to the floor to be insulated; and</li> <li>• the room being free from stored items, floor coverings, etc.;</li> </ul> </li> <li>• if the installation to be undertaken will result in non-compliance with the Building Regulations, e.g. in relation to workmanship; materials; structural stability; fire safety; resistance to moisture.</li> </ul>
	Installation role	Vocational competence required
B6-I3	Building Inspector	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
B6-I4	Operative, (threshold)	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	Operative, (specialist)	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
B6-I5	Competence currency	To be verified by the Installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.

**Table B.6 – continued**

<b>B6-16</b>	<b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i><b>NOTE 1</b> Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><i><b>NOTE 2</b> It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<b>B6-17</b>	<b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<ul style="list-style-type: none"> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days).</li> <li>• any relevant product warranty information and guarantees.</li> </ul>

## B.7 Measure BFM 7 Hybrid wall insulation

### B.7.1 Additional installation requirements

When installing hybrid wall insulation, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in B7-I1 of Table B.7.

### B.7.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the hybrid wall insulation at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in B7-I2 of Table B.7.

### B.7.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of hybrid wall insulation, the Installer shall employ or contract only an inspector meeting the competence requirements of B7-I3 of Table B.7.

### B.7.4 Operative competence

When installing hybrid wall insulation, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (B7-I4 of Table B.7), with competence currency specified in B7-I5 of Table B.7 at the competency ratio specified in B7-I6 in Table B.7.

### B.7.5 Provision of information in respect of hybrid wall insulation

At the time of handover of hybrid wall insulation to the Client, the Installer shall ensure that the information identified at B7-I7 of Table B.7 is provided to the Client as part of the handover process required in 6.9.

**Table B.7** – Measure-specific requirements for hybrid wall insulation (BFM.7)

Measure description		Hybrid Wall Insulation
Measure type		As measure description (no sub-division)
<b>B7-I1</b>	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The Installer shall ensure that the methods used for the installation of hybrid wall insulation (HWI) systems are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design, and incorporated in the installation method statement (5.1). In undertaking the installation, the Installer's responsibilities shall include:</p> <p>a) before installation starts, confirming that the retrofit design has made provision for ensuring that:</p> <ul style="list-style-type: none"> <li>• the HWI system provided for installation is that recommended in the pre-design building survey and specified by the retrofit design;</li> <li>• all essential ventilation openings that require sleeving or safeguarding before installation are located and identified;</li> <li>• the position of all flues whether or not they are in service is determined and the measures that shall be taken to safeguard their proper functioning is determined;</li> <li>• any existing cables, pipework, ducting etc. that require it are removed or repositioned as/where necessary to accommodate the planned EWI system, with authorization from the relevant responsible body (where required) and undertaken by a person competent to undertake such work;</li> <li>• other areas of the dwelling and surrounding area that could be at risk during installation are adequately protected to ensure they are not damaged; and</li> <li>• in the event that any of these aspects is not adequately covered, liaising with the Retrofit Coordinator to provide for their undertaking;</li> </ul>

Table B.7 – continued

	<p>b) during installation, ensuring that:</p> <ul style="list-style-type: none"> <li>• all work is carried out in accordance with the site specific retrofit design, drawings and method statement and that work is not permitted to progress unless copies of the site specific specification documentation are accessible at location and all operatives are aware of the content and requirements relevant to their designated activities;</li> <li>• the system and all detailed interfaces with other parts of the dwelling or other planned EEMs to be undertaken in a manner and sequenced such, that all measures are fully effective, with optimized performance and junctions that are safe, durable and fully weatherproof for all expected exposure conditions, e.g. interface between EWI/IWI system and planned replacement windows;</li> <li>• whether or not specifically required by the retrofit design, the items listed in I to IX below are given particular attention with regard to the efficacy and durability of the detail especially concerning the management and exclusion of moisture and/or the risk of surface/interstitial condensation or rising damp. Mastic sealants shall always be supported by a secondary seal and all details shall be fully weatherproof:             <ol style="list-style-type: none"> <li>i. system base detail (including below dpc);</li> <li>ii. window/door reveals/heads;</li> <li>iii. junctions of internal solid wall insulation with intermediate floors and suspended ground floors;</li> <li>iv. locations where the thickness of internal wall insulation is reduced;</li> <li>v. system/cill interfaces (incl. overhang requirements/weepholes/thermal movement);</li> <li>vi. surface fixtures (structurally sound);</li> <li>vii. penetrations through the system;</li> <li>viii. interfaces with roof soffits, flat roofs, conservatory roofs etc.; and</li> <li>ix. detailing and sealing around vents/flues, meters and other heating related structures/pipework.</li> </ol> </li> <li>• all weatherseals at the interface between HWI systems and other structures/finishes are installed with particular attention given to the soundness/cleanliness of contact surfaces, continuity and effectiveness around corners, bond to surfaces and the durability of the water seal;</li> <li>• all details are installed to minimize thermal bridging, removing/relocating/extending to allow continuity of insulation in all cases where feasible e.g. rooflines, meter boxes, pipework, flues, ducts;</li> <li>• photographic evidence of key stages of the installation is prepared and retained, including close up photographs of representative examples of all moisture and thermally sensitive details;</li> <li>• all installations are in accordance with industry good practice. Where conflict with the requirements of this PAS exists, this PAS takes precedence;</li> <li>• ventilation of the dwelling is no worse following the installation of the measure than prior to the installation of the measure (This may require additional ventilation); and</li> </ul>
--	---

**Table B.7 – continued**

	<ul style="list-style-type: none"> <li>upon completion of the installation or at the end of each working day, if the installation takes longer than one day, the operatives investigate and confirm the proper functioning of all ventilation openings and flues.</li> </ul> <p><i><b>NOTE 1</b> The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the installer should be aware that training from the supplier or training acceptable to the supplier may be necessary before an application for assessment/certification is made to a certification body.</i></p> <p><i><b>NOTE 2</b> Attention is drawn to the need, where relevant, for all hybrid wall insulation installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</i></p>
<p><b>B7-I2</b>      <b>Measure specific pre-installation building inspection requirements supplementary to those in the core of this PAS (Clause 7.2)</b></p>	<p>1) In meeting the requirements specified in Clause 7.2 of this PAS, the designated competent person shall confirm that:</p> <ol style="list-style-type: none"> <li>a) a full and detailed pre-design building assessment had been undertaken by a competent person (see <b>B7-I3</b> of this Table), prior to the retrofit design being undertaken;</li> <li>b) the retrofit design relevant to the installation under inspection has been produced in accordance with Clause 4 of this PAS taking full account of the findings and recommendations of the pre-design building assessment, including: <ul style="list-style-type: none"> <li>thermal performance calculations;</li> <li>condensation risk analysis;</li> <li>ventilation requirements and standard/bespoke drawing details;</li> <li>the main components of the system including the fixing type/method, the insulation type and thickness, breather membrane vapour control layer, board type and jointing and the finish;</li> <li>the proposed details for the main interfaces; (thermal bridging, meter boxes, reveals, roofline joists, party walls, base detail with particular reference to below dpc, base/floor details, seals at windows/doors, seals to penetrations, light fittings, sockets, fixing and sealing of surface mounted structures, interfaces with suspended floors, intermediate floors and ceilings, interfaces with roof, junctions between the system and other finishes and/or other EEM) clearly demonstrate how the installation will avoid condensation risk particularly at moisture sensitive locations such as timber joist ends and within the wall structure (interstitial/surface condensation); and</li> <li>the installation to the retrofit design is practical and achievable given the particular HWI system chosen for the project and the specific dwelling construction, site conditions and other EEMs planned for the property. (See also Measures interaction matrix Figures <b>A.1</b> and <b>A.2</b>).</li> </ul> </li> </ol>

Table B.7 – continued

	<p>2) As a minimum the pre-installation building inspection shall investigate and assess if the HWI installation work will:</p> <ul style="list-style-type: none"> <li>• result in non-compliance with the Building Regulations, e.g. in relation to workmanship, materials, structural stability, fire safety;</li> <li>• provide resistance to moisture. Where possible, any areas of non-compliance shall be rectified by selection of another solution/detail, which shall be documented in the pre-installation building inspection and all contract documentation amended accordingly i.e. specification, drawings, method statement;</li> <li>• result in avoidable thermal bridging; where thermal bridging is avoidable by adaptation of the detail, such measures shall be taken and the contract documents amended to suit. Design details shall be such that they incorporate additional capacity, that for example, will provide water management within the system should surface or interstitial condensation occur;</li> <li>• result in unsafe operation of combustion appliances; unless an alternative safe detail can be found, HWI works shall not progress in the area causing the unsafe operation;</li> <li>• compromise the functionality of existing ventilation ducts/systems; unless an alternative safe detail can be found, HWI works shall not progress in the area causing the unsafe operation;</li> <li>• compromise the functionality and/or safety of existing services (gas, electric, water, telephone, etc.); unless an alternative safe detail can be found, HWI works shall not progress in the area causing the unsafe operation; and</li> <li>• result in the proposed installation being non-compliant with any requirements of the retrofit design.</li> </ul> <p>3) The pre-installation building inspection shall include confirmation that the condition of the substrate is suitable for the works to commence and where all or any of the substrate does not fulfil the requirements for installation, preparation of proposals for adaptations to be made or additional preparation undertaken that will be necessary in order that works can commence.</p> <p>4) All instances of potential non-compliance identified in the pre-installation building inspection shall be documented and referred to the Retrofit Coordinator for resolution. Any design adjustments, special adaptations and/or additional preparation requirements shall be confirmed as acceptable in writing, by the system supplier and/or Retrofit Coordinator.</p> <p>5) The retrofit design documentation shall be amended to include any specified changes to the installation, the installation method statement modified accordingly and the pre-installation building inspection records updated to provide documentary evidence that the intended modified installation will address all the issues identified in the pre-installation building inspection and meets the requirements of all parties.</p> <p>The findings of the pre-installation building inspection shall be independently checked by an appropriately qualified person (see <b>B17-I3</b>) prior to commencement of installation, with at least a randomly selected 1 in 10 sample of those checks (minimum of 1) including physical inspection of the dwelling by an appropriately qualified person.</p>
Installation role	Vocational competence required
<b>B7-I3</b>	<b>Building Inspector</b>
	Able to demonstrate vocational competence as defined in <b>3.26</b> of this PAS.
<b>B7-I4</b>	<b>Operative (threshold)</b>
	Able to demonstrate that vocational competence is being acquired as defined in <b>3.27</b> of this PAS.
	<b>Operative (specialist)</b>
	Able to demonstrate vocational competence as defined in <b>3.26</b> of this PAS.
<b>B7-I5</b>	<b>Competence currency</b>
	To be verified by the installer at no greater than 12 monthly intervals, as defined in <b>3.30</b> of this PAS.



**Table B.7 – continued**

<p><b>B7-16</b>      <b>Competence ratio</b></p>	<p>For each installation task to be undertaken, the installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised;</li> </ul> <p>but shall not be less than one carded operative per team of 4 (1 to 3), at the specified installation location at any time.</p> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<p><b>B7-17</b>      <b>Measure-specific information to be handed over to the Client in addition to 6.9</b></p>	<ul style="list-style-type: none"> <li>• As a minimum the user manual shall include details on fixing to the system, drilling or cutting the system, repairs to damaged areas, avoiding damage (e.g. ladders), the importance of weather seals, how to hang items on IWI including restrictions on weights, breaking the vapour control layer and sealing, advice on fixing radiators, changes of electrical sockets, name/contact details of both the installer and system certificate holder, materials specification and guidance on living in a highly insulated property, including the need for appropriate ventilation. The contents of the manual should be explained to the Client (not just left with them);</li> <li>• Where end-user maintenance is possible, details of how to undertake the maintenance including frequency and any product or tools that shall be used and where to obtain the required products and tools;</li> <li>• Any relevant product warranty information and guarantees;</li> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days);</li> <li>• It should be explained to the Client that repairs should be carried out by a competent person, but that maintenance is their responsibility.</li> </ul>

## B.8 Measure BFM.8 Internal wall insulation

### B.8.1 Additional installation requirements

When installing internal wall insulation, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in B8-I1 of Table B.8.

### B.8.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the internal wall insulation at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in B8-I2 of Table B.8.

### B.8.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of internal wall insulation, the Installer shall employ or contract only an inspector meeting the competence requirements of B8-I3 of Table B.8.

### B.8.4 Operative competence

When installing internal wall insulation, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (B8-I4 of Table B.8) with the competence currency specified in B8-I5 of Table B.8, at the competency ratio specified in B8-I6 of Table B.8.

### B.8.5 Provision of information in respect of internal wall insulation

At the time of handover of the internal wall insulation to the Client, the Installer shall ensure that the information identified at B8-I7 of Table B.8 is provided to the Client as part of the handover process required in 6.9

**Table B.8** – Measure-specific requirements for internal wall insulation (BFM.8)

Measure description		Internal Wall Insulation
Measure type		As measure description (no sub-division)
<b>B8-I1</b>	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The Installer shall ensure that the methods used for the installation of internal wall insulation (IWI) systems are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design and incorporated in the installation method statement (5.1).</p> <p>In undertaking the installation, the Installers responsibilities shall include:</p> <p>a) before installation starts, confirming that the retrofit design has made provision for ensuring that:</p> <ul style="list-style-type: none"> <li>• the IWI system provided for installation is that recommended in the pre-design building assessment and specified in the retrofit design;</li> <li>• all essential ventilation openings that require sleeving or safeguarding before installation are located and identified;</li> <li>• the position of all flues whether or not they are in service is determined and the measures that shall be taken to safeguard their proper functioning is determined;</li> <li>• any existing cables, pipework, ducting etc. that require it are removed or repositioned as/where necessary to accommodate the planned IWI system, with authorization from the relevant responsible body (where required) and undertaken by a person competent to undertake such work;</li> <li>• other areas of the dwelling and surrounding area that could be at risk during installation are adequately protected to ensure they are not damaged;</li> </ul> <p>and in the event that any of these aspects is not adequately covered, liaising with the Retrofit Coordinator to provide for their undertaking.</p>

Table B.8 – continued

	<p>b) during installation, ensuring that:</p> <ul style="list-style-type: none"> <li>• all work is carried out in accordance with the site specific retrofit design, drawings and method statement and that work is not permitted to progress unless copies of the site-specific specification documentation are accessible at location and all operatives are aware of the content and requirements relevant to their designated activities;</li> <li>• the system and all detailed interfaces with other parts of the dwelling or other planned EEMs to be undertaken in a manner and sequenced such, that all measures are fully effective, with optimized performance and junctions that are safe and durable for all expected conditions. Particular attention shall be given to the need to control moisture and prevent the risk of surface or interstitial condensation;</li> <li>• whether or not specifically required by the retrofit design, the items listed in i to viii below are given particular attention with regard to the efficacy and durability of the detail especially concerning the management and exclusion of moisture and/or the risk of surface/interstitial condensation or rising damp; <ul style="list-style-type: none"> <li>i. system floor and ceiling details;</li> <li>ii. window/door reveals/heads;</li> <li>iii. junctions of internal solid wall insulation with intermediate floors and suspended ground floors;</li> <li>iv. locations where the thickness of internal wall insulation is reduced;</li> <li>v. system/cill interfaces;</li> <li>vi. surface fixtures (structurally sound);</li> <li>vii. penetrations through the system;</li> <li>viii. detailing and sealing around vents/flues, meters and other heating related structures/pipework;</li> </ul> </li> <li>• all details are installed to minimize the risks of cold bridging, removing/relocating/extending to allow continuity of insulation in all cases where feasible e.g. pipework, flues, ducts, switches, sockets, radiators etc.;</li> <li>• photographic evidence of key stages of the installation is prepared and retained, including close up photographs of representative examples of all moisture and thermally sensitive details;</li> <li>• all installations are in accordance with industry best practice. Where conflict with the requirements of this PAS exists, this PAS takes precedence;</li> <li>• ventilation of the dwelling is no worse following the installation of the measure than prior to the installation of the measure (this may require additional ventilation see also A.5); and</li> </ul>
--	--

Table B.8 – continued

	<ul style="list-style-type: none"> <li>upon completion of the installation or at the end of each working day, if the installation takes longer than one day, the operatives investigate and confirm the proper functioning of all ventilation openings and flues.</li> </ul> <p><i>NOTE 1 The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the installer should be aware that training from the supplier or training acceptable to the supplier may be necessary before an application for assessment/certification is made to a certification body.</i></p> <p><i>NOTE 2 Attention is drawn to the need, where relevant, for all internal wall insulation installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook[N5] and Non-Domestic Technical Handbook [N6].</i></p>
<b>B8-I2</b> <b>Measure-specific pre-installation building inspection requirements supplementary to those in the core of this PAS (Clause 7.2)</b>	<p>1) In meeting the requirements specified in Clause 7.2 of this PAS, the designated competent person shall confirm that:</p> <ol style="list-style-type: none"> <li>a full and detailed pre-design building assessment had been undertaken by a competent person (see <b>B7-I3</b> of this Table), prior to the retrofit design being undertaken; and</li> <li>the retrofit design relevant to the installation under inspection has been produced in accordance with Clause 4 of this PAS taking full account of the findings and recommendations of the pre-design building assessment, including: <ul style="list-style-type: none"> <li>thermal performance calculations,</li> <li>condensation risk analysis;</li> <li>ventilation requirements and standard/bespoke drawing details;</li> <li>the main components of the system including the fixing type/method, the insulation type and thickness, the breather membrane, vapour control layer, board type and jointing, and the finish;</li> <li>the proposed details for the main interfaces; (thermal bridging, meter boxes, reveals, roofline joists, party walls, base detail with particular reference to below dpc, base/floor details, seals at windows/doors, seals to penetrations, light fittings, sockets, fixing and sealing of surface mounted structures, interfaces with ceilings, interfaces with roof, junctions between the system and other finishes and/or other EEM) clearly demonstrate how the installation will avoid condensation risk particularly at moisture sensitive locations such as timber joist ends and within the wall structure (interstitial/surface condensation); and</li> <li>the installation to the retrofit design is practical and achievable given the particular IWI system chosen for the project and the specific dwelling construction, site conditions and other EEMs planned for the property. (See also Measures Interaction Matrix Figure A.1).</li> </ul> </li> </ol>

Table B.8 – continued

	<p>2) As a minimum the pre-installation building inspection shall investigate and assess if the IWI installation work will:</p> <ul style="list-style-type: none"><li>• result in non-compliance with the Building Regulations, e.g. in relation to workmanship, materials, structural stability, fire safety;</li><li>• provide resistance to moisture. Where possible, any areas of non-compliance shall be rectified by selection of another solution/detail, which shall be documented in the pre-installation building inspection and all contract documentation amended accordingly i.e. specification, drawings, method statement;</li><li>• result in avoidable thermal bridging; where thermal bridging is avoidable by adaptation of the detail, such measures shall be taken and the contract documents amended to suit. Design details shall be such they incorporate additional capacity, that for example, will provide water management within the system should surface or interstitial condensation occur;</li><li>• result in unsafe operation of combustion appliances; unless an alternative safe detail can be found, IWI works shall not progress in the area causing the unsafe operation;</li><li>• compromise the functionality of existing ventilation ducts/systems; unless an alternative safe detail can be found, IWI works shall not progress in the area causing the unsafe operation;</li><li>• compromise the functionality and/or safety of existing services (gas, electric, water, telephone, etc.); unless an alternative safe detail can be found, IWI works shall not progress in the area causing the unsafe operation; and</li><li>• result in the proposed installation being non-compliant with any requirements of the EEM supplier or of the retrofit design.</li></ul> <p>3) The pre-installation building inspection shall include confirmation that the condition of the substrate is suitable for the works to commence and where all or any of the substrate does not fulfil the requirements for installation, preparation of proposals for adaptations to be made or additional preparation undertaken that will be necessary in order that works can commence.</p> <p>4) All instances of potential non-compliance identified in the pre-installation building inspection shall be documented and referred to the Retrofit Coordinator for resolution. Any design adjustments, special adaptations and/or additional preparation requirements shall be confirmed as acceptable in writing, by the system supplier and/or the Retrofit Coordinator.</p> <p>5) The retrofit design documentation shall be amended to include any specified changes to the installation, the installation method statement modified accordingly and the pre-installation building inspection records updated to provide documentary evidence that the intended modified installation will address all the issues identified in the pre-installation building inspection and meets the requirements of all parties.</p> <p>The findings of the pre-installation building inspection shall be independently checked by an appropriately qualified person (see <b>B8-I3</b>) prior to commencement of installation, with at least a randomly selected 1 in 10 sample of those checks (minimum of 1) including physical inspection of the dwelling by an appropriately qualified person.</p>
--	---

Table B.8 – continued

Installation role	Vocational competence required
B8-13	<b>Building Inspector</b> Able to demonstrate vocational competence as defined in 3.26 of this PAS.
B8-14	<b>Operative, (threshold)</b> Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b> Able to demonstrate vocational competence as defined in 3.26 of this PAS.
B8-15	<b>Competence currency</b> To be verified by the installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.
B8-16	<b>Competence ratio</b> For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the: <ol style="list-style-type: none"> <li>range, scale geographical spread and complexity of the work being undertaken;</li> <li>supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> but shall not be less than one carded operative per team of 4 (1 to 3), at the specified installation location at any time. <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so. <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
B8-17	<b>Measure-specific information to be handed over to the Client in addition to 6.9</b> <ul style="list-style-type: none"> <li>As a minimum the user manual shall include details on fixing to the system, drilling or cutting the system, repairs to damaged areas, avoiding damage (e.g. ladders), the importance of weather seals, how to hang items on IWI including restrictions on weights, breaking the vapour control layer and sealing, advice on fixing radiators, changes of electrical sockets, name/contact details of both the installer and system certificate holder, materials specification and guidance on living in a highly insulated property, including the need for appropriate ventilation. The contents of the manual should be explained to the Client (not just left with them).</li> <li>Where end-user maintenance is possible, details of how to undertake the maintenance including frequency and any product or tools that shall be used and where to obtain the required products and tools.</li> <li>Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days).</li> <li>It shall be explained to the Client that repairs should be carried out by a competent person, but that maintenance is their responsibility.</li> <li>Any relevant product warranty information and guarantees.</li> </ul>

## B.9 Measure BFM.9 Loft insulation

### B.9.1 Additional installation requirements

When installing loft insulation, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in B9-I1 of Table B.9.

### B.9.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the loft insulation at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in B9-I2 of Table B.9.

### B.9.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of loft insulation, the Installer shall employ or contract only an inspector meeting the competence requirements of B9-I3 of Table B.9.

### B.9.4 Operative competence

When installing loft insulation, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (B9-I4 of Table B.9), with competence currency specified in B9-I5 of Table B.9 at the competency ratio specified in B9-I6 of Table B.9.

### B.9.5 Provision of information in respect of loft insulation

At the time of handover of the loft insulation to the Client, the Installer shall ensure that the information identified at B9-I7 of Table B.9 is provided to the Client as part of the handover process required in 6.9.

**Table B.9** – Measure-specific requirements for loft insulation (BFM.9)

Measure description		Loft Insulation	
Measure type		BFM.9.1	Roll insulation
		BFM.9.2	Blown insulation
B9-I1	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The installer shall ensure that the methods used for the installation of loft insulation products or systems are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design and incorporated in the installation method statement (5.1). Where relevant to the type of installation being undertaken, the requirements or guidance given in <i>General requirements and guidance for the installation of loft insulation</i> [N8] (see 10.7.3) shall also apply.</p> <p>The installer responsibilities include preparation of the site and finishing work, incorporating:</p> <ul style="list-style-type: none"> <li>• identification of essential ventilation openings;</li> <li>• ensuring that upon completion of the installation or at the end of each working day, if the installation takes longer than one day, the operatives investigate and confirm the proper functioning of all ventilation openings;</li> <li>• Identification of any electrical wiring that shall not be covered by insulation (because of the risk of overheating) and shall therefore be relocated above the insulation; and</li> <li>• Identification of any downlighters recessed into the ceiling that shall not be covered by insulation (because of the risk of overheating) and shall therefore be boxed to permit adequate surrounding ventilation.</li> </ul> <p><i>NOTE 1 The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the installer should be aware that training from the supplier or training acceptable to the supplier may be necessary before an application for assessment/certification is made to a certification body.</i></p>	

Table B.9 – continued

		<p><b>NOTE 2</b> Attention is drawn to the need, where relevant, for all loft insulation installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</p>
<b>B9-I2</b>	<b>Pre-installation building inspection requirements</b>	<p>As a minimum the pre-installation building inspection shall investigate and determine as far as practicable:</p> <ul style="list-style-type: none"> <li>• pre-existing damage to the areas that will be accessed by the installation operatives;</li> <li>• the extent of the area and elements to be insulated;</li> <li>• if relevant checks have been undertaken to determine if asbestos containing materials are present;</li> <li>• if the condition of the roof space is suitable for the works to commence in relation to: <ul style="list-style-type: none"> <li>• existence of appropriate roof space ventilation arrangements;</li> <li>• the roof space being free from rodents/pests and protected species, e.g. bats;</li> <li>• timbers free from rot and/or infestation;</li> <li>• the condition of the ceiling;</li> <li>• metal structural roof members being free from visible signs of corrosion;</li> <li>• electrical wiring is free from visible defects, e.g. damaged cables, trailing cables, exposed conductors;</li> <li>• no visible signs of water penetration; and</li> <li>• no visible signs of leakage from water system components, e.g. pipework, cisterns, tanks, etc.;</li> </ul> </li> <li>• if the proposed installation would: <ul style="list-style-type: none"> <li>• be non-compliant with any requirements stated by the designer/specifier;</li> <li>• compromise the functionality of existing air supply/extract ventilation ducts/systems; and</li> <li>• result in unsafe operation of a combustion appliances.</li> </ul> </li> <li>• if the site layout or conditions will impair the execution of the works in relation to: <ul style="list-style-type: none"> <li>• appropriate access to the property and to the roof space; and</li> <li>• the roof space being free from stored items, boarding etc.;</li> </ul> </li> <li>• if the installation to be undertaken will result in non-compliance with the Building Regulations, e.g. in relation to workmanship; materials; structural stability; fire safety; resistance to moisture.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
<b>B9-I3</b>	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.



Table B.9 – continued

B9-14	Operative, (threshold)	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	Operative, (specialist)	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
B9-15	Competence currency	To be verified by the installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.
B9-16	Competence ratio	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives, carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
B9-17	Measure-specific information to be handed over to the Client in addition to 6.9	<ul style="list-style-type: none"> <li>• Building Regulations compliance certificate where appropriate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days); and</li> <li>• Any relevant product warranty information and guarantees.</li> </ul>

## B.10 Measure BFM.10 Pitched roof insulation

### B.10.1 Additional installation requirements

When installing pitched roof insulation, in addition to meeting the core requirements set out in Clauses 4 to 10, of this PAS the Installer shall also work to any standards, specifications, instructions or guidance identified in B10-I1 of Table B.10.

### B.10.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the pitched roof insulation at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in B10-I2 of Table B.10.

### B.10.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of pitched roof insulation, the Installer shall employ or contract only an inspector meeting the competence requirements of B10-I3 of Table B.10.

### B.10.4 Operative competence

When installing pitched roof insulation, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (B10I-4 of Table B.10), with competence currency specified in B10-I5 of Table B.10 at the competency ratio specified in B10-I6 of Table B.10.

### B.10.5 Provision of information in respect of pitched roof insulation

At the time of handover of the pitched roof insulation to the Client, the Installer shall ensure that the information identified at B10-I7 of Table B.10 is provided to the Client as part of the handover process required in 6.9.

**Table B.10** – Measure-specific requirements for pitched roof insulation (BFM.10)

Measure description		Pitched Roof Insulation
Measure type		As measure description (no sub-division)
<b>B10-I1</b>	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The Installer shall ensure that the methods used for the installation of pitched roof insulation products or systems are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design, and incorporated in the installation method statement (5.1).</p> <p>The Installer's responsibilities shall include preparation of the site and finishing work incorporating:</p> <ul style="list-style-type: none"> <li>• identification of essential ventilation openings; and</li> <li>• ensuring that upon completion of the installation or at the end of each working day, if the installation takes longer than one day, the operatives investigate and confirm the proper functioning of all ventilation openings.</li> </ul> <p><i><b>NOTE 1</b> The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the installer should be aware that training from the supplier or training acceptable to the supplier may be necessary before an application for assessment/certification is made to a certification body.</i></p> <p><i><b>NOTE 2</b> Attention is drawn to the need, where relevant, for all pitched roof insulation installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N2]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-domestic Technical Handbook [N6].</i></p> <p><i><b>NOTE 3</b> Where third-party accreditation exists to support it, non-vented roofs may be acceptable when using certain air and/or vapour permeable underlays.</i></p>

**Table B.10** – *continued*

<b>B10-I2</b>	<b>Pre-installation building inspection requirements</b>	<p>As a minimum the pre-installation building inspection shall investigate and determine as far as practicable:</p> <ul style="list-style-type: none"> <li>• pre-existing damage to the areas that will be accessed by the installation operatives;</li> <li>• the extent of the area and elements to be insulated;</li> <li>• if relevant checks have been undertaken to determine if asbestos-containing materials are present;</li> <li>• if the condition of the roof space is suitable for the works to commence in relation to: <ul style="list-style-type: none"> <li>• existence of appropriate roof space ventilation arrangements where required (<b>Note 3 to B10I1</b>);</li> <li>• the roof space being free from rodents/pests and protected species, e.g. bats;</li> <li>• timbers being free from rot and/or infestation;</li> <li>• metal structural roof members being free from visible signs of corrosion;</li> <li>• electrical wiring is free from visible defects, e.g. damaged cables, trailing cables, exposed conductors;</li> <li>• no visible signs of water penetration; and</li> <li>• no visible signs of leakage from water system components, e.g. pipework, cisterns, tanks, etc.</li> </ul> </li> <li>• if the proposed installation would: <ul style="list-style-type: none"> <li>• be non-compliant with any requirements stated by the designer/specifier;</li> <li>• compromise the functionality of existing air supply/extract ventilation ducts/systems; and</li> <li>• result in unsafe operation of a combustion appliances.</li> </ul> </li> <li>• if the site layout or conditions will impair the execution of the works in relation to: <ul style="list-style-type: none"> <li>• appropriate access to the property and to the roof space; and</li> <li>• the roof space being free from stored items, boarding, etc.;</li> </ul> </li> <li>• If the installation to be undertaken will result in non-compliance with the Building Regulations, e.g. in relation to workmanship; materials; structural stability; fire safety; resistance to moisture.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
<b>B10-I3</b>	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in <b>3.26</b> of this PAS.
<b>B10-I4</b>	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in <b>3.27</b> of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in <b>3.26</b> of this PAS. <b>For electrical installation work</b> , vocational competence ( <b>3.26</b> ) through EAS compliance ( <b>3.6</b> ).
<b>B10-I5</b>	<b>Competence currency</b>	To be verified by the installer at no greater than 12 monthly intervals, as defined in <b>3.30</b> of this PAS.

Table B.10 – continued

<b>B10-16</b> <b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives, carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<b>B10-17</b> <b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<ul style="list-style-type: none"> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days).</li> <li>• Any relevant product warranty information and guarantees.</li> </ul>

## B.11 Measure BFM.11: Solar Blinds, Shutters and Shading Devices (internal and external).

### B.11.1 Additional installation requirements

When installing solar blinds, shutters or shading devices, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in B11-I1 of Table B.11.

### B.11.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the solar blinds, shutters or shading devices at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in B11-I2 of Table B.11.

### B.11.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of solar blinds, shutters or shading devices, the Installer shall employ or contract only an inspector meeting the competence requirements of B11-I3 of Table B.11.

### B.11.4 Operative competence

When installing solar blinds, shutters or shading devices, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (B11-I.4 of Table B.11), with competence currency specified in B11-I5 of Table B.11 at the competency ratio specified in B11-I6 of Table B.11.

### B.11.5 Provision of information in respect of solar blinds, shutters and shading devices

At the time of handover of solar blinds, shutters or shading devices to the Client, the Installer shall ensure that the information identified at B11-I7 of Table B.11 is provided to the Client as part of the handover process required in 6.9.

**Table B.11** – Solar Blinds, Shutters and Shading Devices (BFM.11)

Measure description		Solar Blinds, Shutters and Shading Devices (Internal and External)
Measure type		BFM11.1 Solar Blinds, Shutters and Shading Devices for internal or external use, mechanical or manually operated
		BFM11.2 Solar Blinds, Shutters and Shading Devices for internal or external use, electrically operated
<b>B11-I1</b>	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The Installer shall ensure that the methods used for the installation of solar blinds, shutters or shading devices products or systems are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design and incorporated in the installation method statement (5.1).</p> <ul style="list-style-type: none"> <li>a) BS EN 13120: <i>Internal blinds – Performance requirements including safety;</i></li> <li>b) BS EN 13561: <i>External blinds – Performance requirements including safety; and</i></li> <li>c) BS EN 13659: <i>Shutters – Performance requirements including safety.</i></li> </ul> <p><b>NOTE 1</b> Attention is drawn to the need, where relevant, for all electrically operated solar blind, shutter and shading devices installation work to comply with the current edition of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671) [N9].</p> <p><b>NOTE 2</b> Attention is drawn to the need, where relevant, for all solar blind, shutter and shading devices installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: workmanship; materials; structural stability; fire safety; and conservation of fuel and power and electrical safety. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</p>

Table B.11 – continued

<b>B11-I2</b>	<b>Pre-installation building inspection requirements</b>	<p>As a minimum, the pre-installation building inspection shall investigate and determine if:</p> <ul style="list-style-type: none"> <li>• the condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>• the Client has been provided with the guidance to low energy shading;</li> <li>• the energy saving calculations of the installation are conducted in accordance with EN shading performance standards and are correct for the site dimensions and the glazing installed;</li> <li>• any required planning or listed building related consents have been obtained;</li> <li>• the installation work will result in non-compliance with the building regulations in relation to workmanship; materials; structural stability and fire safety;</li> <li>• the proposed installation will be compliant with any requirements stated by the manufacturer;</li> <li>• the site layout or conditions will impair the execution of the works;</li> <li>• the proposed installation will not compromise or impede the operation of the fenestration;</li> <li>• specialist access equipment is required;</li> <li>• child safety measures are required for internal window coverings;</li> <li>• relevant checks have been undertaken to determine if asbestos containing materials are present;</li> <li>• the installation to be undertaken will result in non-compliance with the Building Regulations, e.g. in relation to workmanship; materials; structural stability; fire safety; resistance to moisture.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
<b>B11-I3</b>	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B11-I4</b>	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B11-I5</b>	<b>Competence currency</b>	To be verified by the installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.
<b>B11-I6</b>	<b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ol style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><b>NOTE 1</b> Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><b>NOTE 2</b> It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</p>

Table B.11 – continued

<p><b>B11-I7</b>    <b>Measure-specific information to be handed over to the Client in addition to 6.9</b></p>	<p><b>Written information</b></p> <ul style="list-style-type: none"> <li>• Relevant operating, maintenance, safety and security documentation relevant to the installation;</li> </ul> <p><i>NOTE See also</i></p> <p><i>BS EN 13120: Internal blinds – Performance requirements including safety.</i></p> <p><i>BS EN 13561: External blinds – Performance requirements including safety</i></p> <p><i>BS EN 13659:2004 Shutters – Performance requirements including safety.</i></p> <ul style="list-style-type: none"> <li>• Product warranty information and guarantees;</li> <li>• Product manufacturer installation and servicing instructions;</li> <li>• Electrical certification, if relevant;</li> <li>• Child safety information, if relevant;</li> <li>• Maintenance and cleaning recommendations (if any); and</li> <li>• Guidance to Low Energy Shading.</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>• An explanation of the purpose and relevance of the written information provided;</li> <li>• An explanation of what controls/components should not be adjusted by the system user; and</li> <li>• Demonstration of: <ul style="list-style-type: none"> <li>• Product operation especially with relevance to best practice for energy saving;</li> <li>• Child safety components, if relevant; and</li> <li>• What to do in the case of an emergency or perceived emergency.</li> </ul> </li> </ul>
--	--

## B.12 Measure BFM.12: Room-in-roof insulation

### B.12.1 Additional installation requirements

When installing insulation to a room constructed in the roof space of an existing dwelling, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in **B12-I1** of **Table B.12**.

This measure includes insulating all of the relevant heat-loss elements of a RIR (flat ceiling, sloping roofs, dwarf walls and gable ends). Partial insulation of a room in roof omitting elements and thereby leaving the dwelling prone to heat loss and at risk of condensation and other related issues is not compliant with this PAS. The only exception to this, in line with Building Regulations, is where health and safety is compromised (i.e. width of stairwells, ceiling height etc) or more than 5% of the room floorspace would be lost.

### B.12.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of room-in-roof insulation at location, the installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in **B12-I2** of **Table B.12**.

### B.12.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of room-in-roof insulation the Installer shall employ or contract only an inspector meeting the competence requirements of **B12-I3** of **Table B.12**.

### B.12.4 Operative competence

When installing room-in-roof insulation the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (**B12-I4** of **Table B.12**), with competence currency specified in **B12-I5** of **Table B.12** at the competency ratio specified in **B12-I6** of **Table B.12**.

### B.12.5 Provision of information in respect of room-in-roof insulation

At the time of handover of installed room-in-roof insulation to the Client, the Installer shall ensure that the information identified at **B12-I7** of **Table B.12** is provided to the Client as part of the handover process required in **6.9**.

**Table B.12 – Room-in-roof insulation (BFM12)**

<b>Measure description</b>	Room in roof insulation (RIRI) including all heat-loss elements of the room in the roof
<b>Measure type</b>	As measure description (no sub-division)
<b>B12-I1 Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The Installer shall ensure that the methods used for the installation of insulation products or systems in a room in roof, are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design, as incorporated in the installation method statement (5.1).</p> <p>In undertaking the installation, Installers shall comply with all requirements set out in I1 of the measure-specific annexes of this PAS that are relevant to the insulation types to be installed and take account of the guidance provided in A guide to retrofit room-in-roof insulation [N10] (see 10.7.2).</p>



Table B.12 – continued

B12-12	<b>Measure-specific pre-installation building inspection requirements supplementary to those in the core of this PAS (Clause 7.2)</b>	<p>Installers shall ensure that the pre-installation building inspection of a room in roof prior to the installation of insulation, is undertaken in accordance with all requirements set out in I2 of the measure-specific annexes of this PAS that are relevant to the insulation types to be installed and in addition that</p> <ul style="list-style-type: none"> <li>a) the ventilation to spaces within the roof void and not included in the Room-in-Roof space, are checked and assessed to ensure that adequate ventilation is provided and maintained (see A.5); and</li> <li>b) there is no requirement for thermal bridging to be addressed at the ridge or other connections with the main structure (C1 A.5 C1).</li> </ul> <p><i>NOTE 1 In undertaking pre-installation building inspections it is recommended that Installers consider using an industry recommended checklist e.g. the Room-in-Roof insulation pre-installation building inspection checklist (see C1 10.7.2 C1)</i></p> <p><i>NOTE 2 It is expected that the retrofit design will provide detailed instruction for addressing both a) and b). Where the pre-installation building inspection identifies ventilation or thermal bridging issues that are perceived not to have been adequately provided for, the Installer is required to refer these to the Retrofit Coordinator (4.2.4 and 4.2.5).</i></p> <p>The findings of the pre-installation building inspection shall be independently checked by an appropriately qualified person (see B12-13) prior to commencement of installation, with at least a randomly selected 1 in 10 sample of those checks (minimum of 1) including physical inspection of the dwelling by an appropriately qualified person.</p>
	<b>Installation role</b>	<b>Vocational competence required</b>
B12-13	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
B12-14	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
B12-15	<b>Competence currency</b>	To be verified by the installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.
B12-16	<b>Competence ratio</b>	<p>For each installation task to be undertaken, the installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken;</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised,</li> </ul> <p>but shall not be less than one specialist operative (carded) operative per team of 4 (1 to 3), at the specified installation location at any time.</p> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
B12-17	<b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<ul style="list-style-type: none"> <li>• Installers shall ensure that the information provided to the Client at handover of an insulated room in roof is in accordance with all requirements set out in I7 of the measure-specific annexes of this PAS that are relevant to the EEM installation types that have been installed including that related to any relevant product warranty information and guarantees.</li> </ul>

## B.13 Measure BFM.13: Insulation of existing park homes

### B.13.1 Additional installation requirements

When installing insulation to an existing park home, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in **B13-I1** of **Table B.13**.

### B.13.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of insulation at an existing park home, the Installer shall undertake a pre-installation inspection of that particular park home in accordance, as a minimum, with the requirements set out in **B13-I2** of **Table B.13**.

### B.13.3 Inspector competence

When undertaking a pre-installation inspection of a park home in respect of the installation of insulation the Installer shall employ or contract only an inspector meeting the competence requirements of **B13-I3** of **Table B.13**.

### B.13.4 Operative competence

When installing room-in-roof insulation the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (**B13-I4** of **Table B.13**), with competence currency specified in **B13-I5** of **Table B.13** at the competency ratio specified in **B13-I6** of **Table B.13**.

### B.13.5 Provision of information in respect of insulation of existing park homes

At the time of handover of installed room-in-roof insulation to the Client, the Installer shall ensure that the information identified at **B13-I7** of **Table B.13** is provided to the Client as part of the handover process required in **6.9**.

**Table B.13** – Insulation of existing park homes (BFM13)

<b>Measure description</b>	Insulation of existing park homes
<b>Measure type</b>	As measure description (no sub-division)
<b>B13-I1</b> <b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 9)</b>	<p>The Installer shall ensure that the methods used for the installation of insulation products or systems in an existing residential park home, are as specified by the system supplier (where provided) and in accordance with the relevant retrofit design, as incorporated in the installation method statement (<b>6.1</b>).</p> <p>In undertaking the installation of insulation in residential park homes, Installers shall comply with all requirements set out in <b>I1</b> of the measure-specific annexes of this PAS that are relevant to the insulation types to be installed and in addition, take account of the provisions of BS 3632. In the event of conflict between the provisions of BS 3632 and the standards cross-referenced in respect of particular insulation types, the provisions of BS 3632 shall be given precedence.</p>

Table B.13 – continued

<b>B13-I2</b> <b>Measure-specific pre-installation park home inspection requirements supplementary to those in the core of this PAS (Clause 7.2)</b>	<p>Installers shall ensure that the pre-installation residential park home inspection is undertaken in accordance with all requirements set out in I2 of the measure-specific annexes of this PAS that are relevant to the insulation types to be installed, including:</p> <ul style="list-style-type: none"> <li>• B2 Draught proofing;</li> <li>• B3 Energy efficient glazing and doors including replacement insulating glass units;</li> <li>• B4 External wall insulation (including rendered and pre-finished external wall insulation systems);</li> <li>• B5 Flat roof insulation;</li> <li>• B6 Floor insulation;</li> <li>• B9 Loft insulation (including both blown and roll insulation); and</li> <li>• B10 Pitched roof insulation.</li> </ul> <p>and, in addition, that:</p> <p>a) the ventilation to any spaces within the park home that are not included in the insulation retrofit project, are checked and assessed to ensure that ventilation is provided and maintained at least in accordance with the requirements of BS 3632:2015, 4.10; and</p> <p>b) there is no requirement for thermal bridging to be addressed, in addition to that included in the retrofit design provided, either in areas covered by the project or other connected spaces within the residential park home (A.5).</p> <p><i>NOTE 1 In undertaking pre-installation inspections of residential park homes, it is recommended that Installers consider using an industry recommended checklist.</i></p> <p><i>NOTE 2 It is expected that the retrofit design will provide detailed instruction for addressing both a) and b). Where the pre-installation inspection of a residential park home identifies ventilation or thermal bridging issues that are perceived not to have been adequately provided for, the installer is required to refer these to the Client (7.2.4 and 7.2.5).</i></p> <p>The findings of the pre-installation residential park home inspection shall be independently checked by an appropriately qualified person (see B13-I3) prior to commencement of installation, with at least a randomly selected 1 in 10 of those checks (minimum of 1) including physical inspection of the particular residential park home by an appropriately qualified person.</p>
<b>Installation role</b>	<b>Vocational competence required</b>
<b>B13-I3</b> <b>Park Homes Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B13-I4</b> <b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>B13-I5</b> <b>Competence Currency</b>	To be verified by the installer at no greater than 12 monthly intervals, as defined in 3.30 of this PAS.

**Table B.13** – *continued*

<p><b>B13-I6</b>      <b>Competence ratio</b></p>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see <b>3.28</b>) shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i><b>NOTE 1</b> Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the installer to do so.</p> <p><i><b>NOTE 2</b> It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<p><b>B13-I7</b>      <b>Measure-specific information to be handed over to the Client in addition to 6.9</b></p>	<ul style="list-style-type: none"> <li>• Installers shall ensure that the information provided to the Client at handover of a retro-insulated park home, is in accordance with all requirements set out in <b>I7</b> of the measure-specific annexes of this PAS that are relevant to the EEM installation types that have been installed including that related to any relevant product warranty information and guarantees.</li> </ul>

# Annex C (normative)

## BSM energy efficiency measures

### C.1 Measure BSM.1 Condensing boilers, natural gas-fired and liquefied petroleum gas-fired

#### C.1.1 Additional installation requirements

When installing a gas-fired condensing boiler, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in C1-I1 of Table C.1.

#### C.1.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the gas-fired condensing boiler at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C1-I2 of Table C.1

#### C.1.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of a gas-fired condensing boiler, the Installer shall employ or contract only an inspector meeting the competence requirements of C1-I3 of Table C.1.

#### C.1.4 Operative competence

When installing a gas-fired condensing boiler, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C1-I4 of Table C.1), at the competency ratio specified in C1-I6 of Table C.1.

**NOTE** Gas Safe registration is a legal requirement for anyone carrying out gas work in the United Kingdom, Isle of Man and Guernsey under the Gas Safety (Installation and Use) Regulations 1998 [N17].

#### C.1.5 Provision of information in respect of gas-fired condensing boilers

At the time of handover of a gas-fired condensing boiler to the Client, the Installer shall ensure that the information identified at C1-I7 of Table C.1 is provided to the Client as part of the handover process required in 6.9.

**Table C.1** – Measure-specific requirements for gas-fired condensing boilers (BSM.1)

Measure description	Condensing Boilers, Natural Gas-fired and Liquefied Petroleum Gas-fired
Measure type	As measure description (no sub-division)
<b>C1-I1</b> <b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The requirements or guidance given in product manufacturer's instructions.</p> <p>Where relevant to the type of installation being undertaken, the requirements or guidance given in:</p> <ul style="list-style-type: none"> <li>i. BS 6798 <i>Specification for installation and maintenance of gas-fired boilers of rated input not exceeding 70 kW net</i>;</li> <li>ii. BS 6644, <i>Specification for installation of gas-fired boilers of rated inputs between 70 kW (net) and 1.8 MW (net) (2nd and 3rd family gases)</i>;</li> <li>iii. BS 6891, <i>Installation of low pressure gas pipework of up to 35 mm (R1 1/4) in domestic premises (2nd family gas). Specification</i>;</li> <li>iv. BS 54401 <i>Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 1: Specification for installation of gas appliances to chimneys and for maintenance of chimneys</i>;</li> <li>v. BS 54402 <i>Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 2: Specification for the installation and maintenance of ventilation provision for gas appliances</i>;</li> </ul>

**Table C.1 – continued**

	<p>vi. BS 7593 <i>Code of practice for treatment of water in domestic hot water central heating systems</i>;</p> <p>vii. UKLPG, <i>Code of practice 22, Design, installation and testing of LPG piping systems</i> [N11];</p> <p>viii. BS 54821, <i>Code of practice for domestic butane and propane gas burning installations – Part 1: Permanent dwellings</i>;</p> <p>ix. IGEM UP/1, 1A &amp; 1B, <i>Strength testing, tightness testing and direct purging each standard covers industrial commercial and domestic testing and purging requirements</i> [N12]; and</p> <p>x. The <i>Domestic Building Services Compliance Guide</i> (published by MHCLG) [N13].</p> <p><b>NOTE</b> Attention is drawn to the need, where relevant, for all gas-fired condensing boiler installation work to comply with:</p> <p>a) the current <i>Gas Safety (Installation and Use) Regulations</i> [N14] that apply in the UK country or locality in which the installation is being carried out. The <i>Gas Safety (Installation and Use) Regulations</i> [N14] have requirements relating to both technical gas safety standards and qualification and supervision of persons carrying out gas work;</p> <p>b) the current <i>Building Regulations</i> that apply in the UK country in which the installation is being carried out. In particular, compliance in relation to the following aspects is highlighted: workmanship; materials; structural stability; fire safety; resistance to moisture; ventilation, hot water safety, combustion appliances, conservation of fuel and power and electrical safety. Further guidance on the requirements of the <i>Building Regulations in England</i> is provided in <i>Approved Documents A-P</i> [N2] and <i>Regulation 7: Workmanship and Materials</i> [N3]. Further guidance on the requirements of the <i>Building Regulations in Wales</i> is provided in <i>Approved Documents A-R</i> [N4] and guidance on <i>Regulation 7: Workmanship and Materials</i> [N3]. Further guidance on the requirements of the <i>Building Regulations in Scotland</i> is provided in the <i>Domestic Technical Handbook</i> [N5] and <i>Non-Domestic Technical Handbook</i> [N6];</p> <p>c) the current <i>Water Supply (Water Fittings) Regulations or Water Byelaws</i> [N15] that apply in the UK country in which the installation is being carried out; and</p> <p>d) the current edition of the <i>Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671)</i> [N9].</p>
<p><b>C1-I2</b>      <b>Pre-installation building inspection requirements</b></p>	<p>As a minimum, the pre-installation building inspection shall investigate and determine if:</p> <ul style="list-style-type: none"> <li>• the condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>• the condition of the existing electrical installation is satisfactory in relation to the proposed work;</li> <li>• the installation work will result in non-compliance with the <i>Building Regulations</i> in relation to workmanship; materials; structural stability; fire safety; resistance to moisture; heat-producing appliances; conservation of fuel and power;</li> <li>• the installation work will result in non-compliance with relevant gas safety regulations;</li> <li>• the proposed installation will be compliant with any requirements stated by the boiler manufacturer;</li> <li>• the proposed installation may or will result in a plume nuisance situation;</li> <li>• any special condensate disposal arrangements are required;</li> <li>• the dwelling is located in a hard water area (above 200 ppm);</li> <li>• water conditioning arrangements are required in relation to the water hardness; and</li> <li>• relevant checks have been undertaken to determine if asbestos containing materials are present.</li> </ul>

Table C.1 – continued

Installation role	Vocational competence required
C1-I3 <b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
C1-I4 <b>Operative, (threshold)</b>  <b>Operative, (specialist)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	Able to demonstrate vocational competence as defined in 3.26 of this PAS. <b>For electrical installation work, vocational competence (3.26) through EAS compliance (3.6).</b>
C1-I5 <b>Competence currency</b>	To be verified by the installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
C1-I6 <b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the:</p> <ol style="list-style-type: none"> <li>range, scale geographical spread and complexity of the work being undertaken; and</li> <li>supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
C1-I7 <b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<p><b>Written information</b></p> <ul style="list-style-type: none"> <li>Product manufacturer installation and servicing instructions;</li> <li>Product manufacturer user manuals/guides;</li> <li>Product warranty information and guarantees;</li> <li>Benchmark commissioning certificate of other commissioning certificate that meets the requirements of the Building Regulations;</li> <li>System cleaning and water treatment record (if not included in the commissioning certificate);</li> <li>Installer details (if not included in the commissioning certificate), e.g. mechanical, electrical;</li> <li>Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days); and</li> <li>A copy of any electrical inspection and testing certificates that have completed to meet the requirements of Building Regulations and/or the current version of BS 7671 (IET Wiring Regulations).</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>An explanation of the purpose and relevance the written information provided;</li> <li>An explanation of what controls/components should not be adjusted by the system user; and</li> <li>Demonstration of: <ul style="list-style-type: none"> <li>how to set user controls for maximum efficiency;</li> <li>any safety checks that the system user should undertake; and</li> <li>what to do in the case of an emergency or perceived emergency.</li> </ul> </li> </ul>

## C.2 Measure BSM.2 Oil-fired condensing boilers

### C.2.1 Additional installation requirements

When installing oil-fired condensing boilers, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the installer shall also work to any standards, specifications, instructions or guidance identified in C2-I1 of Table C.2.

### C.2.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the oil-fired condensing boiler at location, the installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C2-I2 of Table C.2.

### C.2.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of oil-fired condensing boilers, the installer shall employ or contract only an inspector meeting the competence requirements of C2-I3 of Table C.2.

### C.2.4 Operative competence

When installing oil-fired condensing boilers, the installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C2-I4 of Table C.2), at the competency ratio specified in C2-I6 of Table C.2.

### C.2.5 Provision of information in respect of oil-fired condensing boilers

At the time of handover of the oil-fired condensing boiler to the Client, the installer shall ensure that the information identified at C2-I7 of Table C.2 is provided to the Client as part of the handover process required in 6.9.

**Table C.2 – Measure-specific requirements for oil-fired condensing boilers (BSM.2)**

Measure description	Condensing Boilers, Oil-fired
Measure type	Oil-fired Condensing Boilers
<b>C2-I1 Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The requirements or guidance given in product manufacturer's instructions.</p> <p>Where relevant to the type of installation being undertaken, the requirements or guidance given in:</p> <ul style="list-style-type: none"> <li>a) BS 54101, <i>Code of practice for oil firing – Part 1: Installations up to 45 kW output capacity for space heating and hot water supply purposes</i>;</li> <li>b) BS 54102, <i>Code of practice for oil firing – Part 2: Installations of 45 kW and above output capacity for space heating, hot water and steam supply service</i>;</li> <li>c) BS 7593, <i>Code of practice for treatment of water in domestic hot water central heating systems</i>.</li> </ul> <p><b>NOTE</b> Attention is drawn to the need, where relevant, for all oil-firing condensing boiler installation work to comply with:</p> <ul style="list-style-type: none"> <li>a) the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, compliance in relation to the following aspects is highlighted: workmanship; materials; structural stability; fire safety; resistance to moisture; ventilation; hot water safety; combustion appliances; conservation of fuel; and power and electrical safety. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6];</li> <li>b) the current Water Supply (Water Fittings) Regulations or Water Byelaws [N15] that apply in the UK country in which the installation is being carried out; and</li> <li>c) the current edition of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671) [N9].</li> </ul>



**Table C.2 – continued**

<b>C2-I2</b>	<b>Pre-installation building inspection requirements</b>	<p>As a minimum, the pre-installation building inspection shall investigate and determine if:</p> <ul style="list-style-type: none"> <li>• the condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>• the condition of the existing electrical installation is satisfactory in relation to the proposed work;</li> <li>• the installation work will result in non-compliance with the Building Regulations in relation to workmanship; materials; structural stability; fire safety; resistance to moisture; heat-producing appliances; conservation of fuel and power;</li> <li>• the installation work will result in non-compliance with relevant safety regulations;             <ul style="list-style-type: none"> <li>• the proposed installation will be compliant with any requirements stated by the boiler manufacturer;</li> <li>• the proposed fuel storage arrangements are compliant with regulatory requirements/recognized industry standards;</li> <li>• the proposed installation may or will result in a plume nuisance situation;</li> <li>• any special condensate disposal arrangements are required;</li> <li>• the dwelling is located in a hard water area (above 200 ppm);</li> <li>• water conditioning arrangements are required in relation to the water hardness;</li> <li>• relevant checks have been undertaken to determine if asbestos containing materials are present.</li> </ul> </li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
<b>C2-I3</b>	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>C2-I4</b>	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS <b>For electrical installation work</b> , vocational competence (3.26) through EAS compliance (3.6).
<b>C2-I5</b>	<b>Competence currency</b>	To be verified by the installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
<b>C2-I6</b>	<b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative as defined in 3.6 of this PAS. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the:</p> <ol style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><i><b>NOTE 1</b> Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i><b>NOTE 2</b> It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>

Table C.2 – continued

<p><b>C2-17</b>      <b>Measure-specific information to be handed over to the Client in addition to 6.9</b></p>	<p><b>Written information</b></p> <ul style="list-style-type: none"> <li>• Product manufacturer’s installation and servicing instructions;</li> <li>• Product manufacturer’s user manuals/guides;</li> <li>• Product warranty information and guarantees;</li> <li>• Commissioning certificate that meets the requirements of the Building Regulations;</li> <li>• System cleaning and water treatment record (if not included in the commissioning certificate);</li> <li>• Installer details (if not included in the commissioning certificate); <ul style="list-style-type: none"> <li>• mechanical; and</li> <li>• electrical.</li> </ul> </li> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required in participating regions and will be provided within 30 days); and</li> <li>• A copy of any electrical inspection and testing certificates that have been completed to meet the requirements of Building Regulations and/or the current version of BS 7671 (IET Wiring Regulations).</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>• An explanation of the purpose and relevance of the written information provided;</li> <li>• An explanation of what controls/components should not be adjusted by the system user;</li> <li>• Demonstration of: <ul style="list-style-type: none"> <li>• how to set user controls for maximum efficiency;</li> <li>• any safety checks that the system user should undertake; and</li> <li>• what to do in the case of an emergency or perceived emergency.</li> </ul> </li> </ul>
---	--

## C.3 Measure BSM.3 Flue-gas heat recovery devices

### C.3.1 Additional installation requirements

When installing Flue-gas recovery devices, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the installer shall also work to any standards, specifications, instructions or guidance identified in C3-I1 of Table C.3

### C.3.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the gas-fired condensing boiler at location, the installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C3-I2 of Table C.3.

### C.3.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of Flue-gas recovery devices, the installer shall employ or contract only an inspector meeting the competence requirements of C3-I3 of Table C.3.

### C.3.4 Operative competence

When installing Flue-gas recovery devices, the installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C3-I4 of Table C.3), at the competency ratio specified in C3-I6 of Table C.3.

### C.3.5 Provision of information in respect of Flue-gas recovery devices

At the time of handover of the Flue-gas recovery device to the Client, the installer shall ensure that the information identified at C3-I7 of Table C.3 is provided to the Client as part of the handover process required in 6.9.

**Table C.3** – Measure-specific requirements for Flue-gas recovery devices (BSM.3)

<b>Measure description</b>	Flue-gas Heat Recovery Devices for use with gas-fired condensing boilers
<b>Measure type</b>	As measure description (no sub-division)
<b>C3-I1 Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The requirements or guidance given in product manufacturer's instructions.</p> <p>Where relevant to the type of installation being undertaken, the requirements or guidance given in:</p> <ul style="list-style-type: none"> <li>• BS 54401, <i>Flueing and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd, 3rd family gases) – Part 1: Specification for installation of gas appliances to chimneys and for maintenance of chimneys</i>; and</li> <li>• BS 54402, <i>Flueing and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd, 3rd family gases) – Part 2: Specification for the installation and maintenance of ventilation for gas appliances</i>.</li> </ul> <p><b>NOTE</b> Attention is drawn to the need, where relevant, for all Flue-gas recovery device installation work to comply with:</p> <ol style="list-style-type: none"> <li>a) the current <i>Gas Safety (Installation and Use) Regulations [N14]</i> that apply in the UK country or locality in which the installation is being carried out. The <i>Gas Safety (Installation and Use) Regulations [N14]</i> have requirements relating to both technical gas safety standards and qualification and supervision of persons carrying out gas work and work on gas appliances;</li> <li>b) the current <i>Building Regulations</i> that apply in the UK country in which the installation is being carried out. Further guidance on the requirements of the <i>Building Regulations in England</i> is provided in <i>Approved Documents A-P [N2]</i> and <i>Regulation 7: Workmanship and Materials [N3]</i>. Further guidance on the requirements of the <i>Building Regulations in Wales</i> is provided in <i>Approved Documents A-R [N4]</i> and guidance on <i>Regulation 7: Workmanship and Materials [N3]</i>. Further guidance on the requirements of the <i>Building Regulations in Scotland</i> is provided in the <i>Domestic Technical Handbook [N5]</i> and <i>Non-Domestic Technical Handbook [N6]</i>;</li> <li>c) the current <i>Water Supply (Water Fittings) Regulations or Water Byelaws [N15]</i> that apply in the UK country in which the installation is being carried out; and</li> <li>d) the current edition of the <i>Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671) [N9]</i>.</li> </ol>

Table C.3 – continued

C3-I2	<b>Pre-installation building inspection requirements</b>	As a minimum the pre-installation building inspection shall investigate and determine if the: <ul style="list-style-type: none"> <li>• condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>• installation work will result in non-compliance with the Building Regulations in relation to workmanship; materials; structural stability; fire safety; heat-producing appliances;</li> <li>• proposed installation will be compliant with any requirements stated by the flue-recovery devices product manufacturer; and</li> <li>• relevant checks have been undertaken to determine if asbestos-containing materials are present.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
C3-I3	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
C3-I4	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS. <b>For electrical installation work</b> , vocational competence (3.26) through EAS compliance (3.6).
C3-I5	<b>Competence currency</b>	To be verified by the Installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
C3-I6	<b>Competence ratio</b>	For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the: <ol style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
C3-I7	<b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<b>Written information</b> <ul style="list-style-type: none"> <li>• Product manufacturer's installation and servicing instructions;</li> <li>• Product warranty information and guarantees;</li> <li>• Benchmark commissioning certificate of other commissioning certificate that meets the requirements of the Building Regulations; and</li> <li>• Installer details: <ul style="list-style-type: none"> <li>• mechanical; and</li> <li>• electrical.</li> </ul> </li> </ul> <b>Verbal information and/or demonstration</b> <ul style="list-style-type: none"> <li>• An explanation of the purpose and relevance of the written information provided.</li> </ul>

## C.4 Measure BSM.4: Heating system insulation (ducting, pipes and cylinders)

### C.4.1 Additional installation requirements

When installing heating system insulation (ducting, pipes and cylinders), in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the installer shall also work to any standards, specifications, instructions or guidance identified in C4-I1 of Table C.4.

### C.4.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the heating system insulation (ducting, pipes and cylinders) at location, the installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C4-I2 of Table C.4.

### C.4.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of heating system insulation (ducting, pipes and cylinders), the installer shall employ or contract only an inspector meeting the competence requirements of C4-I3 of Table C.4.

### C.4.4 Operative competence

When installing heating system insulation (ducting, pipes and cylinders), the installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C4-I4 of Table C.4), at the competency ratio specified in C4-I6 of Table C.4.

### C.4.5 Provision of information in respect of heating system insulation (pipes and cylinders)

At the time of handover of the heating system insulation (ducting, pipes and cylinders) to the Client, the installer shall ensure that the information identified at C4-I7 of Table C.4 is provided to the Client as part of the handover process required in 6.9.

**Table C.4** – Measure-specific requirements for heating system insulation (including ducting, pipes and cylinders) (BSM.4)

<b>Measure description</b>	Heating System Insulation (ducting, pipes and cylinders) including retrofitting of insulation to existing ducting and pipework or cylinders to refurbish or enhance the system
<b>Measure type</b>	As measure description
<b>C4-I1 Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>Where relevant to the type of installation being undertaken, the requirement or guidance given in:</p> <p>BS 5970 <i>Code of practice for thermal insulation of pipework and equipment in the temperature range of -100°C to +870°C, shall be applied.</i></p> <p><b>NOTE 1</b> <i>The relevant installation methods will have been included under current certification issued by a product certification body, with respect to the product/system to be installed, against UK requirements and regulation and the Installer should be aware that training from the supplier or training acceptable to the supplier may be necessary before an application for assessment/certification is made to a certification body.</i></p> <p><b>NOTE 2</b> <i>Attention is drawn to the need, where relevant, for all heating system insulation installation work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, compliance in relation to the following aspects is highlighted: fire safety; resistance to moisture; ventilation; and conservation of fuel and power. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</i></p>

Table C.4 – continued

C4-I2	<b>Pre-installation building inspection requirements</b>	<p>As a minimum the pre-installation building inspection shall investigate and determine as far as practicable:</p> <ul style="list-style-type: none"> <li>• if the proposed heating system insulation work will be compliant with the requirements of the Building Regulations relating to conservation of fuel and power/energy;</li> <li>• pre-existing damage to the areas that will be accessed by the installation operatives;</li> <li>• the extent of the heating system elements to be insulated;</li> <li>• if relevant checks have been undertaken to determine if asbestos-containing materials are present;</li> <li>• if the proposed installation would be non-compliant with any requirements stated by the designer/specifier; and</li> <li>• if the site layout or conditions will impair the execution of the works in relation to appropriate access to the property and to the heating system elements to be insulated.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
C4-I3	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
C4-I4	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
C4-I5	<b>Competence currency</b>	To be verified by the Installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
C4-I6	<b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the:</p> <ol style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken;</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
C4-I7	<b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	Any relevant product warranty information and guarantees.

## C.5 Measure BSM.5 Heating, hot water system, air conditioning or ventilation controls and components

### C.5.1 Additional installation requirements

When installing controls and/ or components for heating, hot water system, air conditioning or ventilation, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in C5-I1 of Table C.5.

### C.5.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of controls and/ or components for heating, hot water system, air conditioning or ventilation at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C5-I2 of Table C.5

### C.5.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of controls and/ or components for heating, hot water system, air conditioning or ventilation, the Installer shall employ or contract only an inspector meeting the competence requirements of C5-I3 of Table C.5.

### C.5.4 Operative competence

When installing controls and/ or components for heating, hot water system, air conditioning or ventilation, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C5-I4 of Table C5), at the competency ratio specified in C5-I6 of Table C.5.

### C.5.5 Provision of information in respect of heating and hot water controls

At the time of handover of controls and/ or components for heating, hot water system, air conditioning or ventilation to the Client, the Installer shall ensure that the information identified at C5-I7 of Table C.5 is provided to the Client as part of the handover process required in 6.9.

**Table C.5 – Measure-specific requirements for Heating, hot water system, air conditioning or ventilation controls and components (BSM.5)**

Measure description	Heating, hot water system, air conditioning or ventilation, controls and components	
Measure type	BSM.5.1	Heating and hot water system controls (domestic)
	BSM.5.2	Air conditioning controls
	BSM.5.3	Ventilation controls
	BSM.5.4	Low energy circulator pumps
	BSM.5.5	Low temperature radiators and fan convectors

Table C.5 – continued

<p><b>C5-I1</b></p> <p><b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b></p>	<p>As applicable:</p> <ul style="list-style-type: none"> <li>• BS EN 3781 <i>Refrigerating systems and heat pumps. Safety and environmental requirements. Basic requirements, definitions, classification and selection criteria</i></li> <li>• BS EN 3783 <i>Refrigerating systems and heat pumps. Safety and environmental requirements. Installation location and personal protection</i></li> <li>• BS EN 3784 <i>Refrigerating systems and heat pumps. Safety and environmental requirements. Operation, maintenance, repair and recovery</i></li> <li>• BS EN 14336 <i>Heating systems in buildings – Installation and commissioning of water based heating systems.</i></li> <li>• BS EN 164841 <i>Building automation and control systems (BACS). Project specification and implementation</i></li> </ul> <p>The requirements or guidance given in product manufacturer's instructions.</p> <p><b>NOTE</b> Attention is drawn to the need, where relevant, for all heating hot water air conditioning and ventilation controls installation work to comply with:</p> <p>a) <i>the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: workmanship; materials; structural stability; fire safety; resistance to moisture; ventilation; hot water safety; combustion appliances; conservation of fuel; and power and electrical safety. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6];</i></p> <p>b) <i>the current edition of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671) [N9];</i></p> <p>c) <i>the current F gas Regulations [N16] that apply in all EU countries or locality in which the installation is being carried out. The Regulations have requirements relating to businesses and persons who install, service or maintain systems that contain or are designed to contain refrigerant gases. The Regulations set both the technical standards for the Business and the qualifications and supervision of persons carrying out work; and</i></p> <p>d) <i>For the installation of Low-Temperature Heating Systems, information contained in the publication <i>Design of low temperature domestic heating systems – A guide for system designers and installers</i> [N17] published by BRE Trust, could be of assistance.</i></p>
<p><b>C5-I2</b></p> <p><b>Pre-installation building inspection requirements</b></p>	<p>As a minimum the pre-installation building inspection shall investigate and determine if the:</p> <ul style="list-style-type: none"> <li>• proposed control arrangement is compatible with any existing controls for heating, hot water system, ventilation or air conditioning;</li> <li>• installation work will result in non-compliance with the Building Regulations;</li> <li>• proposed installation will be compliant with any requirements stated by the heating controls product manufacturer; and</li> <li>• relevant checks have been undertaken to determine if asbestos containing materials are present.</li> </ul>



**Table C.5 – continued**

Installation role	Vocational competence required
<b>C5-I3</b> <b>Building Inspector</b>	Able to demonstrate vocational competence as defined in <b>3.26</b> of this PAS.
<b>C5-I4</b> <b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in <b>3.27</b> of this PAS.
	<b>Operative, (specialist)</b> Able to demonstrate vocational competence as defined in <b>3.26</b> of this PAS. <b>For electrical installation work</b> , vocational competence ( <b>3.26</b> ) through EAS compliance ( <b>3.6</b> ).
<b>C5-I5</b> <b>Competence currency</b>	To be verified by the installer at no greater than 12 monthly intervals, as defined in <b>3.30</b> of this PAS.
<b>C5-I6</b> <b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see <b>3.28</b>) shall be determined by the Installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken;</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i><b>NOTE 1</b> Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i><b>NOTE 2</b> It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<b>C5-I7</b> <b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<p><b>Written information</b></p> <ul style="list-style-type: none"> <li>• Product manufacturer installation and servicing instructions;</li> <li>• Product manufacturer user manuals/guides;</li> <li>• Product warranty information and guarantees;</li> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days), where required; and</li> <li>• A copy of any electrical inspection and testing certificates that have completed to meet the requirements of Building Regulations and/or the current version of BS 7671 (IET Wiring Regulations).</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>• An explanation of the purpose and relevance of the written information provided;</li> <li>• An explanation of what controls/components should not be adjusted by the system user;</li> <li>• Demonstration of: <ul style="list-style-type: none"> <li>• how to set user controls for maximum efficiency; and</li> <li>• any safety checks that the system user should undertake.</li> </ul> </li> </ul>

## C.6 Measure BSM.6 Hot water systems

### C.6.1 Additional installation requirements

When installing a hot water system, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in C6-I1 of Table C.6.

### C.6.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the hot water system at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C6-I2 of Table C.6.

### C.6.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of a hot water system, the Installer shall employ or contract only an inspector meeting the competence requirements of C6-I3 of Table C.6.

### C.6.4 Operative competence

When installing a hot water system, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C6-I4 of Table C.6), at the competency ratio specified in C6-I6 of Table C.6.

### C.6.5 Provision of information in respect of hot water systems.

At the time of handover of a hot water system to the Client, the Installer shall ensure that the information identified at C6-I7 of Table C.6 is provided to the Client as part of the handover process required in 6.9.

**Table C.6** – Measure-specific requirements for hot water systems (BSM.6)

Measure description		Hot water systems including hot water systems with heat recovery.
Measure type		BSM.6.1 Hot water system (domestic)
C6-I1	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>As applicable,            BS EN 8061 <i>Specifications for installations inside buildings conveying water for human consumption. General</i>            BS EN 8064 <i>Specifications for installations inside buildings conveying water for human consumption. Installation</i>            BS EN 8065 <i>Specifications for installations inside buildings conveying water for human consumption. Operation and maintenance</i>            BS 8558 <i>Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings</i>            The requirements or guidance given in product manufacturer's instructions.</p> <p><b>NOTE</b> Attention is drawn to the need, where relevant, for all hot water system installation work to comply with:</p> <p>a) <i>The current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, compliance in relation to the following aspects is highlighted: workmanship; materials; structural stability; fire safety; resistance to moisture; hot water safety, combustion appliances and fuel storage systems, conservation of fuel and power and electrical safety. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6];</i></p> <p>b) <i>The current Water Supply (Water Fittings) regulations or Water Byelaws [N15] that apply in the UK country in which the installation is being carried out; and</i></p> <p><i>Particular guidance can be found in the following:</i></p> <p>c) <i>The current edition of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671) [N9].</i></p>

Table C.6 – continued

C6-12	<b>Pre-installation building inspection requirements</b>	<p>As a minimum, the pre-installation building inspection shall investigate and determine if:</p> <ul style="list-style-type: none"> <li>the condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>proposed hot water system arrangement is compatible with the existing heating and hot water system installation and fittings;</li> <li>the installation work will result in non-compliance with the Building Regulations in relation to workmanship; materials; structural stability; fire safety; resistance to moisture; hot water safety; combustion appliances and fuel storage systems, conservation of fuel and power; electrical safety;</li> <li>the proposed installation will be compliant with any requirements stated by the hot water system product manufacturers; and</li> <li>The asbestos register for the dwelling has been reviewed and relevant checks have been undertaken to determine if any asbestos containing materials are present in the areas where work is to be carried out.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
C6-13	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
C6-14	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	<p>Able to demonstrate vocational competence as defined in 3.26 of this PAS.</p> <p><b>For electrical installation work</b>, vocational competence (3.26) through EAS compliance (3.6).</p>
C6-15	<b>Competence currency</b>	To be verified by the installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
C6-16	<b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the:</p> <ol style="list-style-type: none"> <li>range, scale geographical spread and complexity of the work being undertaken; and</li> <li>supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><b>NOTE 1</b> Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><b>NOTE 2</b> It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</p>

Table C.6 – continued

<p><b>C6-17</b>      <b>Measure-specific information to be handed over to the Client in addition to 6.9</b></p>	<p>Written information, as applicable</p> <ul style="list-style-type: none"> <li>• Product manufacturer installation and servicing instructions;</li> <li>• Product manufacturer user manuals/guides;</li> <li>• Product warranty information and guarantees;</li> <li>• Revisions to the building Health and Safety file;</li> <li>• Revisions to the building log book;</li> <li>• A commissioning certificate that meets the requirements of the Building Regulations;</li> <li>• A user guide that meets the requirements of the Building Regulations;</li> <li>• Building regulations compliance certificate or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days, where required; and</li> <li>• A copy of any electrical inspection and testing certificates that have been completed to meet the requirements the current version of BS 7671 (IET Wiring Regulations).</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>• An explanation of the purpose and relevance the written information provided.</li> <li>• An explanation of what controls/components should not be adjusted by the system user.</li> <li>• Demonstration of: <ul style="list-style-type: none"> <li>• how to set user controls for maximum efficiency;</li> <li>• any safety checks that the system user should undertake;</li> <li>• any maintenance activity that the system user should undertake; and</li> <li>• what to do in the case of an emergency or perceived emergency.</li> </ul> </li> </ul>
---	--

## C.7 BSM.8 Mechanical Ventilation with Heat Recovery

### C.7.1 Additional installation requirements

When installing a mechanical ventilation with heat recovery (MVHR) system, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in C7-I1 of Table C.7.

### C.7.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the mechanical ventilation and heat recovery system at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C7-I2 of Table C.7.

### C.7.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of a mechanical ventilation and heat recovery system, the Installer shall employ or contract only an inspector meeting the competence requirements of C7-I3 of Table C.7.

### C.7.4 Operative competence

When installing a mechanical ventilation and heat recovery system, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C7-I4 of Table C.7), at the competency ratio specified in C7-I6 of Table C.7.

### C.7.5 Provision of information in respect of Mechanical Ventilation and Heat Recovery systems

At the time of handover of a mechanical ventilation and heat recovery system to the Client, the Installer shall ensure that the information identified at C7-I7 of Table C.7 is provided to the Client as part of the handover process required in 6.9.

**Table C.7 – Measure-specific requirements for Mechanical Ventilation with Heat Recovery (BSM.7)**

<b>Measure description</b>	Mechanical Ventilation with Heat Recovery
<b>Measure type</b>	As measure description (no sub-division)
<b>C7-I1 Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The requirements or guidance given in product manufacturer's instructions.</p> <p><i>NOTE Attention is drawn to the need, where relevant, for all Mechanical Ventilation and Heat Recovery installation work to comply with:</i></p> <ol style="list-style-type: none"> <li><i>the current Building Regulations are those that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: workmanship; materials; structural stability; fire safety; resistance to moisture; ventilation, conservation of fuel and power and electrical safety. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6]; and</i></li> <li><i>the current edition of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671) [N9].</i></li> </ol>

Table C.7 – continued

C7-I2	<b>Pre-installation building inspection requirements</b>	As a minimum, the pre-installation building inspection shall investigate and determine if: <ul style="list-style-type: none"> <li>the condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>the installation work will result in non-compliance with the Building Regulations in relation to workmanship; materials; structural stability; fire safety; resistance to moisture; ventilation; conservation of fuel and power;</li> <li>the proposed duct work (routing) is appropriate;</li> <li>the proposed installation will be compliant with any requirements stated by the equipment manufacturers; and</li> <li>The asbestos register for the dwelling has been reviewed and relevant checks have been undertaken to determine if any asbestos containing materials are present in the areas where work is to be carried out.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
C7-I3	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
C7-I4	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS. <b>For electrical installation work, vocational competence (3.26) through EAS compliance (3.6)</b>
C7-I5	<b>Competence currency</b>	To be verified by the Installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
C7-I6	<b>Competence ratio</b>	For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the: <ol style="list-style-type: none"> <li>range, scale geographical spread and complexity of the work being undertaken; and</li> <li>supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><b>NOTE 1</b> Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><b>NOTE 2</b> It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</p>

**Table C.7 – continued**

<p><b>C7-17</b></p> <p><b>Measure-specific information to be handed over to the Client in addition to 6.9</b></p>	<p><b>Written information</b></p> <ul style="list-style-type: none"> <li>• Product manufacturer installation and servicing instructions;</li> <li>• Product manufacturer user manuals/guides;</li> <li>• Product warranty information and guarantees;</li> <li>• Revisions to the building Health and Safety file;</li> <li>• Revisions to the Building log book;</li> <li>• Commissioning records that confirm that the system is balanced and the air supply or extract rates from each room are within 5% of the rates specified in the design;</li> <li>• A commissioning certificate that meets the requirements of the Building Regulations;</li> <li>• A user guide that meets the requirements of the Building Regulations;</li> <li>• Installer details (if not included in the commissioning certificate), e.g. mechanical, electrical;</li> <li>• Evidence that the installation has been notified to Building Control; and</li> <li>• A copy of any electrical inspection and testing certificates that have completed to meet the requirements the current version of BS 7671 (IET Wiring Regulations).</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>• An explanation of the purpose and relevance the written information provided;</li> <li>• An explanation of what controls/components should not be adjusted by the system user; and</li> <li>• Demonstration of:             <ul style="list-style-type: none"> <li>• how to set user controls for maximum efficiency;</li> <li>• any safety checks that the system user should undertake; and</li> <li>• what to do in the case of an emergency or perceived emergency.</li> </ul> </li> </ul>
---	---

## C.8 Measure BSM.8 Under-floor heating

### C.8.1 Additional installation requirements

When installing under-floor heating, in addition to meeting the core requirements set out in Clauses 4 to 10, of this PAS the Installer shall also work to any standards, specifications, instructions or guidance identified in C8-I1 of Table C.8.

### C.8.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the under-floor heating at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C8-I2 of Table C.8.

### C.8.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of under-floor heating, the Installer shall employ or contract only an inspector meeting the competence requirements of C8-I3 of Table C.8.

### C.8.4 Operative competence

When installing under-floor heating, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C8-I4 of Table C.8), at the competency ratio specified in C8-I6 of Table C.8.

### C.8.5 Provision of information in respect of under-floor heating

At the time of handover of under-floor heating, the Installer shall ensure that the information identified at C8-I7 of Table C.8 is provided to the Client as part of the handover process required in 6.9.

**Table C.8** – Measure-specific requirements for under-floor heating (BSM.8)

Measure description		Under-floor Heating (wet systems)
Measure type		As measure description
C8-I1	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The requirements or guidance given in product manufacturer's instructions.</p> <p>The requirements stated in BS EN 12644, <i>Water based surface embedded heating and cooling systems – Part 4: Installation</i>.</p> <p><b>NOTE</b> Attention is drawn to the need, where relevant, for all under-floor heating system work to comply with:</p> <ul style="list-style-type: none"> <li>a) the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: workmanship; materials; structural stability; fire safety; resistance to moisture; ventilation; sanitation; hot water safety; water efficiency; conservation of fuel; and power and electrical safety. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6];</li> <li>b) the current Water Supply (Water Fittings) Regulations or Water Byelaws [N15] that apply in the UK country in which the installation is being carried out. In particular, compliance in relation to the following aspects is highlighted: prevention of contamination of the wholesome water supply, energy conservation, safe operation, testing and commissioning; and</li> <li>c) the current edition of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671) [N9].</li> </ul>



Table C.8 – continued

<b>C8-I2</b>	<b>Pre-installation building inspection requirements</b>	<p>As a minimum the pre-installation building inspection shall investigate and determine if the:</p> <ul style="list-style-type: none"> <li>• structural precondition requirements to enable the installation to proceed have been met;</li> <li>• pipe circuit lengths are broadly appropriate in relation to room area and pipe spacing;</li> <li>• the under-floor heating layout design has taken account of the location of all fixtures to avoid overheating issues;</li> <li>• proposed location of the under-floor heating manifold(s) is appropriate;</li> <li>• installation work will result in non-compliance with the Building Regulations in relation to workmanship; materials; structural stability; fire safety; resistance to moisture; conservation of fuel and power;</li> <li>• proposed installation will be compliant with any requirements stated by the under-floor heating product manufacturer; and</li> <li>• relevant checks have been undertaken to determine if asbestos-containing materials are present.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
<b>C8-I3</b>	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
<b>C8-I4</b>	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	<p>Able to demonstrate vocational competence as defined in 3.26 of this PAS.</p> <p><b>For electrical installation work</b>, vocational competence (3.26) through EAS compliance (3.6).</p>
<b>C8-I5</b>	<b>Competence currency</b>	To be verified by the installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
<b>C8-I6</b>	<b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the:</p> <ol style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><b>NOTE 1</b> Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><b>NOTE 2</b> It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</p>

Table C.8 – continued

<p><b>C8-17</b></p> <p><b>Measure-specific information to be handed over to the Client in addition to 6.9</b></p>	<p><b>Written information</b></p> <ul style="list-style-type: none"> <li>• Product manufacturer’s user manuals/guides and guarantee documents;</li> <li>• Testing and commissioning certificates;</li> <li>• Water treatment records;</li> <li>• Electrical certification, if relevant;</li> <li>• Building Regulations Compliance Certificate; and</li> <li>• Installer details: <ul style="list-style-type: none"> <li>• mechanical; and</li> <li>• electrical.</li> </ul> </li> </ul> <p><b>Diagrammatic information</b></p> <ul style="list-style-type: none"> <li>• Hydraulic schematic; and</li> <li>• Wiring schematic.</li> </ul> <p><b>Verbal information/demonstration</b></p> <ul style="list-style-type: none"> <li>• Setting of controls;</li> <li>• Awareness of the effect that changing to a different type of floor covering may have on system output; and</li> <li>• Awareness of which system components should only be adjusted by a competent engineer.</li> </ul>
---	--

## C.9 Measure BSM.9 Warm-air heating systems

### C.9.1 Additional installation requirements

When installing gas and /or oil-fired warm-air heating systems (domestic and non-domestic), in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in C91 of Table C.9.

### C.9.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the gas and /or oil-fired warm-air heating systems (domestic and non-domestic) at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C9-I2 of Table C.9.

### C.9.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of gas and /or oil-fired warm-air heating systems (domestic and non-domestic), the Installer shall employ or contract only an inspector meeting the competence requirements of C9-I3 of Table C.9.

### C.9.4 Operative competence

When installing gas and /or oil-fired warm-air heating systems (domestic and non-domestic), the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C9-I4 of Table C.9), at the competency ratio specified in C9-I6 of Table C.9

### C.9.5 Provision of information in respect of gas-fired warm-air heating systems

At the time of handover of the gas and /or oil-fired warm-air heating system (domestic and non-domestic), the Installer shall ensure that the information identified at C9-I7 of Table C.9 is provided to the Client as part of the handover process required in 6.9.

**Table C.9** – Measure-specific requirements for gas and /or oil-fired warm-air heating systems (domestic and non-domestic) (BSM.9)

<b>Measure description</b>	Gas and /or oil-fired warm-air Heating Systems	
<b>Measure type</b>	BSM.9.1	Natural gas-fired and liquefied petroleum gas-fired warm air heating systems
	BSM.9.2	Oil-fired warm air heating systems
	<i>NOTE Electric warm air heating systems are provided for under measure BSE.1 Electric storage heaters</i>	
<b>C9-I1 Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The requirements or guidance given in product manufacturer's instructions.</p> <p>Where relevant to the type of installation being undertaken, the requirements or guidance given in:</p> <ul style="list-style-type: none"> <li>a) BS 54101 <i>Code of practice for oil firing. Installations up to 45 kW output capacity for space heating and hot water supply purposes;</i></li> <li>b) BS 54401, <i>Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 1: Specification for installation of gas appliances to chimneys and for maintenance of chimneys;</i></li> <li>c) BS 54402, <i>Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 2: Specification for the installation and maintenance of ventilation provision for gas appliances;</i></li> <li>d) BS 5864, <i>Installation and maintenance of gas-fired ducted air heaters of rated heat input not exceeding 70 kW net (2nd and 3rd family gases). Specification;</i></li> <li>e) BS 6891, <i>Installation of lo- pressure gas pipework of up to 35 mm (R1 1/4) in domestic premises (2nd family gas). Specification;</i></li> <li>f) IGEN/UP/7, Edition 2, <i>Gas installations in timber-framed and light steel buildings</i> [N18];</li> <li>g) UKLPG, <i>Code of Practice 22, Design, installation and testing of LPG piping systems</i> [N11];</li> </ul>	

Table C.9 – continued

		<p>h) IGEM UP/1, 1A &amp; 1B, <i>Strength testing, tightness testing and direct purging each standard covers industrial commercial and domestic testing and purging requirements</i> [N12]; and</p> <p>i) <i>The Domestic Building Services Compliance Guide</i> (published by MHCLG) [N13].</p> <p><b>NOTE</b> Attention is drawn to the need, where relevant, for all gas-fired warm air heating system installation work to comply with:</p> <p>a) <i>the current Gas Safety (Installation and Use) Regulations</i> [N14] that apply in the UK country or locality in which the installation is being carried out. The Gas Safety (Installation and Use) Regulations [N14] have requirements relating to both technical gas safety standards and qualification and supervision of persons carrying out gas work and work on gas appliances;</p> <p>b) <i>the current Building Regulations that apply in the UK country in which the installation is being carried out. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P</i> [N2] and <i>Workmanship and Materials. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R</i> [N4] and <i>guidance on Regulation 7: Workmanship and Materials</i> [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the <i>Domestic Technical Handbook</i> [N5];</p> <p>c) <i>the current Water Supply (Water Fittings) Regulations or Water Byelaws</i> [N15] that apply in the UK country in which the installation is being carried out; and</p> <p>d) <i>the current edition of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671)</i> [N9].</p>
C9-I2	<b>Pre-installation building inspection requirements</b>	<p>As a minimum the pre-installation building inspection shall investigate and determine if the:</p> <ul style="list-style-type: none"> <li>• the condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>• the installation work will result in non-compliance with the Building Regulations in relation to workmanship; materials; structural stability; fire safety; resistance to moisture; heat producing appliances; conservation of fuel and power;</li> <li>• where applicable, the installation work will result in non-compliance with relevant gas safety regulations;</li> <li>• the proposed installation will be compliant with any requirements stated by the gas and/or oil-fired warm-air heating systems product manufacturer;</li> <li>• the proposed installation may or will result in a plume nuisance situation;</li> <li>• any special condensate disposal arrangements are required; and</li> <li>• relevant checks have been undertaken to determine if asbestos-containing materials are present.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
C9-I3	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
C9-I4	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS. For electrical installation work, vocational competence (3.26) through EAS compliance (3.6).
C9-I5	<b>Competence currency</b>	To be verified by the installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.

**Table C.9 – continued**

<p><b>C9-16</b>      <b>Competence ratio</b></p>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken;</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
<p><b>C9-17</b>      <b>Measure-specific information to be handed over to the Client in addition to 6.9</b></p>	<p><b>Written information</b></p> <ul style="list-style-type: none"> <li>• Product manufacturer’s installation and servicing instructions;</li> <li>• Product manufacturer’s user manuals/guides;</li> <li>• Product warranty information and guarantees;</li> <li>• Commissioning certificate that meets the requirements of the Building Regulations;</li> <li>• Installer details (if not included in the commissioning certificate): <ul style="list-style-type: none"> <li>• mechanical; and</li> <li>• electrical.</li> </ul> </li> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days);</li> <li>• A copy of any electrical inspection and testing certificates that have completed to meet the requirements of Building Regulations and/or the current version of BS 7671 (IET Wiring Regulations);</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>• An explanation of the purpose and relevance the written information provided;</li> <li>• An explanation of what controls/components should not be adjusted by the system user; and</li> <li>• Demonstration of: <ul style="list-style-type: none"> <li>• how to set user controls for maximum efficiency;</li> <li>• any safety checks that the system user should undertake; and</li> <li>• what to do in the case of an emergency or perceived emergency.</li> </ul> </li> </ul>

## C.10 BSM.10 Water efficient taps and showers

### C.10.1 Additional installation requirements

When installing water efficient taps and showers, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in C10-I1 of Table C.10.

### C.10.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the water efficient taps and showers at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in C10-I2 of Table C.10.

### C.10.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of water efficient taps and showers, the Installer shall employ or contract only an inspector meeting the competence requirements of C10-I3 of Table C.10.

### C.10.4 Operative competence

When installing water efficient taps and showers, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (C10-I4 of Table C.10), at the competency ratio specified in C10-I6 of Table C.10.

### C.10.5 Provision of information in respect of Water efficient taps and showers

At the time of handover of water efficient taps and showers to the Client, the Installer shall ensure that the information identified at C10-I7 of Table C.10 is provided to the Client as part of the handover process required in 6.9.

**Table C.10 – Water efficient taps and showers (BSM.10)**

Measure description		Water efficient taps and showers excluding taps for cold water only (Sanitary tapware e.g. showers, pillar taps, mixing taps etc)
Measure type		As measure description (no sub-division)
C10-I1	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The requirements or guidance given in product manufacturer's instructions.</p> <p><i>NOTE Attention is drawn to the need, where relevant, for all hot water system installation work to comply with:</i></p> <ol style="list-style-type: none"> <li><i>The current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, compliance in relation to the following aspects is highlighted: workmanship; materials; resistance to moisture; hot water safety and electrical safety. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6];</i></li> <li><i>The current Water Supply (Water Fittings) regulations or Water Byelaws [N15] that apply in the UK country in which the installation is being carried out. Particular guidance can be found in WRAS water regulations guide; and</i></li> <li><i>The current edition of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671) [N9].</i></li> </ol>
C10-I2	<b>Pre-installation building inspection requirements</b>	<p>As a minimum, the pre-installation building inspection shall investigate and assess if the:</p> <ul style="list-style-type: none"> <li>condition of the existing water supply and sanitary tapware installation is satisfactory in relation to the proposed work;</li> <li>condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>the existing or proposed water supply system is compatible with the sanitary tapware to be installed;</li> <li>sanitary tapware installation work will result in non-compliance with the building regulations in relation to workmanship; materials and sanitation, hot water safety and water efficiency;</li> <li>sanitary tapware installation work will result in non-compliance with the water regulations in relation to waste, misuse, undue consumption or contamination or erroneous measurement of the water supplied; and</li> <li>proposed installation will be compliant with any requirements stated by the sanitary tapware product manufacturer.</li> </ul>

**Table C.10** – *continued*

	Installation role	Vocational competence required
C10-13	<b>Building Inspector</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS.
C10-14	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence as defined in 3.26 of this PAS. <b>For electrical installation work</b> , vocational competence (3.26) through EAS compliance (3.6).
C10-15	<b>Competence currency</b>	To be verified by the installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
C10-16	<b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the installer in relation to the:</p> <ul style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken;</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ul> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>
C10-17	<b>Measure-specific information to be handed over to the Client in addition to 6.9</b>	<p><b>Written Information</b></p> <ul style="list-style-type: none"> <li>• Product manufacturer installation and servicing instructions;</li> <li>• Product manufacturer user manuals/guides; and</li> <li>• Product warranty information and guarantees.</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>• An explanation of the purpose and relevance of the written information provided;</li> <li>• An explanation of the product controls;</li> <li>• How the controls affect the efficiency of water delivery and how that impacts on the efficiency of the hot water supply; and</li> <li>• Any safety requirements that the user should regularly undertake.</li> </ul>

## Annex D (normative)

### BSE energy efficiency measures

#### D.1 Measure BSE.1 Electric storage heaters (including electric warm air heating units that incorporate heat storage)

##### D.1.1 Additional installation requirements

When installing electric storage heaters, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in D1-I1 of Table D.1.

##### D.1.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of the electric storage heaters at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in D1-I2 of Table D.1.

##### D.1.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of electric storage heaters, the Installer shall employ or contract only an inspector meeting the competence requirements of D1-I3 of Table D.1.

##### D.1.4 Operative competence

When installing electric storage heaters, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (D1-I4 of Table D.1), at the competency ratio specified in D1-I6 of Table D.1.

##### D.1.5 Provision of information in respect of electric storage heaters

At the time of handover of electric storage heaters to the Client, the Installer shall ensure that the information identified at D1-I7 of Table D.1 is provided to the Client as part of the handover process required in 6.9.

**Table D.1** – Measure-specific requirements for Electric storage heaters (BSE.1)

Measure description	Electric Storage Heaters (including electric warm air heating units that incorporate heat storage and high heat retention storage heaters)	
Measure type	BSE.1.1	Domestic electric storage heaters
	BSE.1.2	Domestic electric storage heaters with warm air heat distribution
	BSE.1.3	Non-domestic electric storage heaters with warm air heat distribution
<b>D1-I1</b>	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>The Installer is responsible for:</p> <ul style="list-style-type: none"> <li>• following the requirements of guidance given in product manufacturer's instructions; and</li> <li>• ensuring all electric storage heater work complies with the current edition of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671) [N9].</li> </ul>



Table D.1 – continued

<b>D1-I2</b>	<b>Pre-installation building inspection requirements</b>	As a minimum, the pre-installation building inspection shall investigate and determine if the: <ul style="list-style-type: none"> <li>• condition of the existing electrical installation is satisfactory in relation to the proposed work;</li> <li>• condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>• installation work will result in non-compliance with the Building Regulations in relation to workmanship, materials, structural stability, fire safety, conservation of fuel and power and electrical safety;</li> <li>• storage heater installation work will result in non-compliance with the IET Wiring Regulations;</li> <li>• proposed installation will be compliant with any requirements set by the storage heater product manufacturer; and</li> <li>• relevant checks have been undertaken to determine if asbestos containing materials are present.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
<b>D1-I3</b>	<b>Building Inspector</b>	Able to demonstrate vocational competence (3.26) through EAS compliance (3.6)
<b>D1-I4</b>	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence (3.26) through EAS compliance (3.6)
<b>D1-I5</b>	<b>Competence currency</b>	To be verified by the Installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
<b>D1-I6</b>	<b>Competence ratio</b>	For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the: <ol style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>

Table D.1 – continued

D1-17	Measure-specific information to be handed over to the Client in addition to 6.9	<p><b>Written information</b></p> <ul style="list-style-type: none"> <li>• Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days) as relevant to the requirements of the Building Regulations;</li> <li>• A copy of any electrical inspection and testing certificates that have completed to meet the requirements of Building Regulations and/or the current version of BS 7671 (IET Wiring Regulations);</li> <li>• Product manufacturer’s installation and servicing instructions;</li> <li>• Any manufacturer or product data or information sheets;</li> <li>• Product warranty information and guarantees; and</li> <li>• Commissioning certificate that meets the requirements of the Building Regulations.</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>• An explanation of the purpose and relevance the written information provided;</li> <li>• An explanation of what controls/components should not be adjusted by the system user;</li> <li>• Demonstration of: <ul style="list-style-type: none"> <li>• how to set user controls for maximum efficiency, including an explanation of tariffs;</li> <li>• any safety checks that the system user should undertake; and</li> <li>• what to do in the case of an emergency or perceived emergency.</li> </ul> </li> </ul>
-------	---	---

## D.2 Measure BSE.2 Lighting fittings, lighting systems and lighting system controls

### D.2.1 Additional installation requirements

When installing lighting fittings, systems and or controls, in addition to meeting the core requirements set out in Clauses 4 to 10 of this PAS, the Installer shall also work to any standards, specifications, instructions or guidance identified in D2-I1 of Table D.2.

### D.2.2 Pre-installation building inspection requirements

Prior to commencing the physical installation of lighting fittings, systems and or controls at location, the Installer shall undertake a pre-installation building inspection in accordance, as a minimum, with the requirements set out in Section D2-I2 of Table D.2.

### D.2.3 Inspector competence

When undertaking a pre-installation building inspection in respect of the installation of lighting fittings, systems and or controls, the Installer shall employ or contract only an inspector meeting the competence requirements of D2-I3 of Table D.2.

### D.2.4 Operative competence

When installing lighting fittings, systems and or controls, the Installer shall employ or contract only operatives with the required level of competence attained through one of the permitted routes (D2-I4 of Table D.2) at the competency ratio specified in D2-I4 of Table D.2.

### D.2.5 Provision of information in respect of lighting fittings

At the time of handover of the lighting fittings, systems and or controls to the Client, the Installer shall ensure that the information identified at D2-I7 of Table D.2 is provided to the Client as part of the handover process required in 6.9.

**Table D.2 – Measure-specific requirements for Lighting fittings, lighting systems and lighting system controls (BSE.2)**

<b>Measure description</b>		Lighting fittings, lighting systems and lighting system controls
<b>Measure type</b>		BSE.2.1   Lighting fittings
<b>D2-I1</b>	<b>Additional installation requirements to those in the core of this PAS (Clauses 4 to 10)</b>	<p>Any requirements provided in the manufacturers' instructions</p> <p><i><b>NOTE 1</b> Attention is drawn to the need for all lighting fittings work to comply with the current Building Regulations that apply in the UK country in which the installation is being carried out. In particular, the need for compliance in relation to the following aspects is highlighted: workmanship; materials; structural stability; fire safety; resistance to moisture; conservation of fuel and power, electrical safety. Further guidance on the requirements of the Building Regulations in England is provided in Approved Documents A-P [N2] and Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Wales is provided in Approved Documents A-R [N4] and guidance on Regulation 7: Workmanship and Materials [N3]. Further guidance on the requirements of the Building Regulations in Scotland is provided in the Domestic Technical Handbook [N5] and Non-Domestic Technical Handbook [N6].</i></p> <p><i><b>NOTE 2</b> Attention is drawn to the need for all work relating to non-domestic electrical work to comply with the Electricity at Work Regulations [N19].</i></p>

Table D.2 – continued

D2-I2	<b>Pre-installation building inspection requirements</b>	<p>As a minimum, the pre-installation building inspection shall investigate and assess if the:</p> <ul style="list-style-type: none"> <li>• condition of the existing electrical installation is satisfactory in relation to the proposed work;</li> <li>• condition of the building fabric is satisfactory in relation to the proposed work;</li> <li>• the existing or proposed lighting control arrangement is compatible with the lighting fittings, systems and or controls to be installed;</li> <li>• installation work will result in non-compliance with the Building Regulations in relation to workmanship; materials; structural stability; fire safety; resistance to moisture; conservation of fuel and power, electrical safety;</li> <li>• installation work will result in non-compliance with the IET Wiring Regulations;</li> <li>• proposed installation will be compliant with any requirements stated by the product or system manufacturer; and</li> <li>• relevant checks have been undertaken to determine if asbestos-containing materials are present.</li> </ul>
	<b>Installation role</b>	<b>Vocational competence required</b>
D2-I3	<b>Building Inspector</b>	Able to demonstrate vocational competence (3.26) through EAS compliance (3.6).
D2-I4	<b>Operative, (threshold)</b>	Able to demonstrate that vocational competence is being acquired as defined in 3.27 of this PAS.
	<b>Operative, (specialist)</b>	Able to demonstrate vocational competence (3.26) through EAS compliance (3.6).
D2-I5	<b>Competence currency</b>	To be verified by the Installer at no greater than twelve-monthly intervals, as defined in 3.30 of this PAS.
D2-I6	<b>Competence ratio</b>	<p>For each installation task to be undertaken, the Installer shall employ or subcontract at the particular location, at least one vocationally competent operative. For each installation, the vocational competence ratio (see 3.28) shall be determined by the Installer in relation to the:</p> <ol style="list-style-type: none"> <li>a) range, scale geographical spread and complexity of the work being undertaken; and</li> <li>b) supervision and experience of the individual that meets the vocational competence requirements for the relevant tasks and the relative experience of the operatives being supervised.</li> </ol> <p><i>NOTE 1 Where a vocationally competent operative is newly qualified, it may be appropriate for a lower competency ratio to be applied.</i></p> <p>For each installation task to be undertaken at a particular location, supervision, inspection and confirmation of compliance of all work undertaken in respect of that task at that location shall be undertaken by a vocationally competent operative appointed by the Installer to do so.</p> <p><i>NOTE 2 It is recommended that vocationally competent operatives carry a document supporting the nature, currency and source of that competency, for production upon request.</i></p>

**Table D.2 – continued**

<p><b>D2-17</b></p> <p><b>Measure-specific information to be handed over to the Client in addition to 6.9</b></p>	<p><b>Written information</b></p> <ul style="list-style-type: none"> <li>Product manufacturer’s installation and maintenance instructions;</li> <li>Product warranty information and guarantees;</li> <li>Building Regulations compliance certificate (or information explaining that a Building Regulations compliance certificate is required and will be provided within 30 days) as relevant to the requirements of the Building Regulations; and</li> <li>A copy of any electrical inspection and testing certificates that have completed to meet the requirements of Building Regulations and/or the current version of BS 7671 (IET Wiring Regulations).</li> </ul> <p><b>Verbal information and/or demonstration</b></p> <ul style="list-style-type: none"> <li>An explanation of the purpose and relevance the written information provided;</li> <li>How to set user controls for maximum efficiency;</li> <li>An explanation of what controls/components should not be adjusted by the system user; and</li> <li>Where end-user maintenance is possible, details how to undertake the maintenance including details of any product or tools that shall be used and details of where to obtain the required products and tools.</li> </ul>
---	---

# Annex E (informative)

## PAS 2030:2017 to PAS 2030:2019 – Substantive change

**Table E.1** – Substantive change introduced in PAS 2030:2019

PAS 2030 Clause Reference		Nature of changes
2017	2019	
<b>Foreword</b>	<b>Foreword</b>	Explains that PAS 2030 has been updated to align with PAS 2035 <i>Retrofitting Dwellings for Improved Energy Efficiency: Specification and Guidance</i> which is applicable only to dwellings. Consequently, PAS is no longer applicable to non-dwellings, and may only be used in conjunction with PAS 2035. Other minor editorial changes.
<b>Introduction</b>	<b>Introduction</b>	Explains the most significant areas of change to PAS 2030: <ul style="list-style-type: none"> <li>removal of guidance about the scope and content of designs for EEMs, which has been moved to PAS 2035;</li> <li>removal of guidance about the interactions between EEMs (except for the <i>Measures Interaction Matrix</i>), which has been moved to PAS 2035;</li> <li>removal of guidance about assessment and upgrading of existing ventilation systems, which has been moved to PAS 2035; and</li> <li>for demonstration of competence, requirement for the use of regulated and industry agreed vocational qualifications or apprenticeships, personal certificates of competence relevant to the EEM to be installed or for electrical work, compliance with the EAS to replace the reliance on Minimum Technical Competencies that was applicable in earlier editions.</li> </ul> Other minor editorial changes.
<b>1 Scope</b>	<b>1 Scope</b>	Modified to reflect changes to the detail and structure of the revised PAS 2030. Includes reference to the addition of retrofit design validation requirements and to the amended annexes.
<b>2 Normative references</b>	<b>2 Normative references</b>	Updated and made consistent with PAS 2035.
<b>3 Terms and definitions</b>	<b>3 Terms and definitions</b>	Updated and made consistent with PAS 2035.
	<b>4 Retrofit project management</b>	Introduces a new requirement for the Retrofit Coordinator whose appointment is required by PAS 2035 to be identified to the Retrofit Installer and given access to the installation work to inspect progress and quality.
	<b>5 Retrofit Design</b>	New requirement for the Retrofit Installer to use a retrofit design that complies with PAS 2035. Clarification about the use of subcontractors and some minor editorial changes (see 5.6).
<b>4 Installation process</b>	<b>6 Installation process</b>	Updated requirements for validation of the PAS 2035-compliant retrofit design, for briefing of operatives by the Retrofit Coordinator and for testing, commissioning and handover. Changes to requirements in relation to 'business and financial probity (6.9), clarifying/ enhancing requirements for product liability insurance, guarantees and warranties and for clarity of contractual liability where Installers are contracted on a design and build basis.
<b>5 Installation process management</b>	<b>7 Installation process management</b>	Minor editorial changes for clarification and ease of understanding. New requirements added for proposed changes to the retrofit design to be referred to the Retrofit Coordinator for approval, and for photographic records to be made of installation work.

Table E.1 – continued

<b>6 Service provision</b>	<b>8 Service provision</b>	Minor editorial changes for clarification and ease of understanding.
<b>7 Claims of conformity</b>	<b>9 Claims of conformity</b>	Specified claim enhanced to include and clarify responsibility for the retrofit design.
<b>8 Documents essential to the application of the annexes of this PAS</b>	<b>10 Documents essential to the application of the annexes of this PAS</b>	Existing references confirmed or updated where necessary. Additional references added for Fenestration. Statement included with regard to on-going reliance on MTC Annexes NOS and NVQ for competence requirements. Additional and updated references to new insulation guidance documents added.
<b>Annex A Energy efficiency measures/ types with PAS references</b>	<b>Annex A Measure-specific Annex selection and co-installation requirements</b>	Annex A still contains the definitive list of included measures and measure types and an updated matrix providing information about the interaction and potential conflict between measures installed in the same building. Additional information has been included in respect of thermal bridging. Requirements to assess and, if necessary, upgrade ventilation in buildings where the installation of one or more EEM has improved the airtightness have been moved to PAS 2035. The following non-domestic measures, and their annexes, have been removed from this PAS: <ul style="list-style-type: none"> <li>• chillers (previously Annex C.1);</li> <li>• non-domestic heating and hot water system controls (previously part of Annex C.6);</li> <li>• non-domestic hot water systems (previously part of Annex C.7);</li> <li>• non-domestic ventilation systems with heat recovery (previously part of Annex C.8);</li> <li>• radiant heating (previously Annex C.9);</li> <li>• non-domestic electric storage heaters (previously part of Annex D.1);</li> <li>• non-domestic electric storage heaters with warm-air heat distribution (previously part of Annex D.1);</li> <li>• variable-speed drives for fans and pumps (previously Annex D.3); and</li> <li>• non-domestic light fittings, lighting systems and controls (previously part of Annex D.1);</li> </ul> Consequently, most sections of Annexes C and D have been <b>re-numbered</b> , as summarized in <b>Table A.2</b> and <b>Table A.3</b> .
<b>Annex B</b>	<b>Annex B</b>	Annex B.1 Significant change in respect of pre-installation building inspection requirements. Annex B.3 Additional cross references added for Fenestration. Adjustment to routes to competence. Annexes B.4, B.7 and B.8, Significant changes, particularly with regard to Installer responsibilities in respect of design/ specification. Annex B.12 Flexible thermal linings no longer included. New Annex B.12 Annex for Room-in Roof Insulation (RIRI) included. New Annex B.13 for Insulation of Park Homes included. Other annexes some minor editorial changes.

Table E.1 – continued

<b>Annex C</b>	<b>Annex C</b>	<p>Updating of NOS references. Some minor editorial changes.</p> <p>The following non-domestic measures, and their annexes, have been removed from this PAS:</p> <ul style="list-style-type: none"> <li>• Chillers (previously Annex C.1);</li> <li>• Non-domestic heating and hot water system controls (previously part of Annex C.6);</li> <li>• Non-domestic hot water systems (previously part of Annex C.7);</li> <li>• Non-domestic ventilation systems with heat recovery (previously part of Annex C.8); and</li> <li>• Radiant heating (previously Annex C.9).</li> </ul> <p>Consequently, most sections of Annex C have been <b>re-numbered</b>, as summarized in <b>Table A.2</b>.</p>
<b>Annex D</b>	<b>Annex D</b>	<p>Updating of NOS references Some minor editorial changes.</p> <p>The following non-domestic measures, and their annexes, have been removed from this PAS:</p> <ul style="list-style-type: none"> <li>• Non-domestic electric storage heaters (previously part of Annex D.1);</li> <li>• Non-domestic electric storage heaters with warm-air heat distribution (previously part of Annex D.1);</li> <li>• Non-domestic light fittings, lighting systems and controls (previously part of Annex D.2); and</li> <li>• Variable-speed drives for fans and pumps (previously Annex D.3).</li> </ul> <p>Consequently, most sections of Annexes D have been <b>re-numbered</b>, as summarized in <b>Table A.3</b>.</p>
<b>Annex E</b>	<b>Annex E</b>	Annex updated to provide comparison between PAS 2030:2017 and PAS 2030:2019 and identifying salient points of change.
<b>Annex F</b>	<b>Annex F</b>	Annex providing guidance on the application of PAS 2030:2019.
<b>Annex G</b>	<b>Annex G</b>	Example 'installation project information collation form', modified to reflect the changes introduced by 2019 revision.



# Annex F (informative)

## Installer guidance on the use and application of PAS 2030:2019

### F.1 Overview

In addition to setting out requirements to be met by Retrofit Installers in undertaking the installation of EEM in existing buildings, PAS 2030 presents a logical approach to such activity, providing a suggested sequence of actions that if followed, should enable the Installer to ensure and demonstrate, that all required actions have been undertaken in compliance with the PAS requirements.

Before making use of PAS 2030, it is important that Installers understand that this PAS is prepared against the assumption that a retrofit design compliant with PAS 2035 *Retrofitting Dwellings for Improved Energy Efficiency: Specification and Guidance* has been made available to the Installer, and that a Retrofit Coordinator has been assigned to the project (as required by PAS 2035). It is expected that the retrofit design will be based on an assessment of the dwelling(s) and will be functionally and environmentally compatible with the designated building(s) and with any other EEM that are already installed or may later be installed in the same building(s).

It is acknowledged that in some situations, the dwelling(s) assessment and the preparation of a PAS 2035 compliant retrofit design could be undertaken by the same organization as that undertaking the EEM installation, but in other circumstances this may not be so and to accommodate this fundamental difference in approach, PAS 2030 treats the installation process as being wholly independent of those of assessment and retrofit design.

For this reason, the PAS 2030 installation process begins with a detailed review of the content and relevance of the retrofit design, leading to an inspection of the designated building (the pre-installation building inspection) to enable the Installer to satisfy him/herself that what has been specified in the retrofit design is complete, appropriate for the building concerned, technically feasible and capable of delivering the intended efficiencies.

The PAS includes specific instruction that where the circumstances or conditions at the building are not as provided for in the retrofit design, the Installer is required to refer such matters back to the Retrofit Coordinator for resolution. It could be that the Retrofit Coordinator seeks contribution from the Installer in the determination of corrective action, but this is not a requirement of PAS 2030 and such contribution is outside the remit of this PAS.

### F.2 A staged approach to installation

The core text of PAS 2030 (Clauses 4 to 10) are presented in the sequence recommended for their application.

Clause 5.1. Sets out the requirement for Installers not only to be in possession of a retrofit design compliant with PAS 2035 but also to take some responsibility for ensuring that the retrofit designs they are provided with are complete and appropriate for the buildings in which the EEM are to be installed.

This does not however include any requirement or expectation that the Retrofit Installer should be responsible for correcting or enhancing the design in the event that it is judged to be inadequate or inappropriate. PAS 2030:2019 is quite specific in requiring the Installer to refer back to the Retrofit Coordinator where any such inadequacy is identified or where the pre-installation building inspection identifies potential issues in respect of the building designated for installation or with other EEM that have been or are to be installed in the same building.

Subclause 5.2 Sets out the principle retrofit design elements that the installer should expect to find in the provided design and as such whilst providing the detail of what the installer is required to look for and confirm provision of, it also establishes the basis for the Installer to refer back to the Retrofit Coordinator where there are concerns about the retrofit design provided.

In setting out requirements against which the Installer's processes and procedures will be assessed, Clause 6 together with the measure-specific annexes relevant to the measures installed, also provides the installer with a route map to planning and undertaking each installation.

All stages of installation are included from planning (installation method statement Clause 6.1), through the provision of equipment and tools (6.2), the checking and handling of materials (6.3), and the selection, training, instruction and supervision of operatives (6.4 and 6.5).

The PAS also addresses installer responsibilities when subcontracting all or part of an installation (6.6), and for commissioning and handing over installed EEM (6.7 and 6.9).

Finally, in 6.10 and 6.11, the PAS, deals with the requirements for process control, documentation and record keeping that are so important for demonstrating good process management.

Clause 7 enlarges on the theme of installation process management, initially by providing detailed requirements for the undertaking of a pre-installation building inspection (7.2) that is proving to be such a significant element of good EEM installation.

This inspection is the final opportunity, before installation commences, to confirm that the retrofit design is appropriate for the building in which EEM are to be installed and that the Installer's plan for installation has been correctly prepared, taking account not only of the details of the EEM to be installed but also of the condition and status of the building (including the presence of protected species) as well as the presence of other measure types that could have implications for or impact on the performance or effectiveness of the measure(s) any particular installer is to install.

This Clause also covers the Installer's responsibility to provide for any required intermediate inspections (7.3).

The remainder of Clause 7 (7.4 to 7.9) sets out a standard procedure for process management (along ISO 9000 lines) that is intended to ensure that the quality intentions of the installation process are not only delivered but can be audited subsequent to installation. Installers will find that close attention to following this procedure will contribute meaningfully to the performance and reputation of their business.

Clause 8 establishes requirements for Installers to have and operate a basic procedure for receiving and dealing with Client complaints and generally interacting with clients.

Finally, Clause 9 sets out in precise terms, how an Installer can claim compliance with PAS 2030:2019, including identification of the EEM that the Installer is qualified to install, the source of the retrofit design and whether the claim is made on the basis of the Installer's own assessment or has been validated by another party, particularly by an independent third-party certification body.

Retrofit Installers can claim compliance with PAS 2030:2019 on the basis of their own assessment provided they use the correct form of declaration and are confident that they can demonstrate such compliance through their recorded procedures, installation documentation and installation performance, if required to do so.

It is important to recognize however that terms of particular contracts or of some energy efficiency funding schemes can require that compliance with PAS 2030 be validated by an external party and indeed for some schemes (e.g. the UK Government ECO scheme), validation by an accredited certification body is required.

Other party validation is not therefore a requirement of this PAS, but the PAS makes provision for self-assessment, other party validation and independent, third party (certified body) validation. For all of these, use of the correct form of declaration is part of the requirement for compliance with this PAS.

Whether or not external validation is required by scheme requirements or commercial contract, Installers should be aware that clients can have greater confidence in work for which the correct undertaking has been validated by another party, particularly if that other party is an organization that has itself been independently accredited as being fit to do so.

## Annex G (informative)

### Example installation project information collation form

#### G.1 Use of this form

*This form is provided to assist Installers in meeting the record keeping requirements of PAS 2030. It is presented in a form that may be copied and used by Installers as required.*

#### PAS 2030 Installation Process Record

Unique reference for installation to which this record relates

*It is recommended that the reference allocated here should be the primary identifier used to collate the set of information required to support each application of PAS 2030, including for the elements of the method statement.*

#### G.2 Location of installation

Record full address of the dwelling in which the specified EEM is/are, to be installed.

---



---



---



---

#### G.3 Measure(s) to be installed

Identify each measure/ measure type, to be installed as part of this project.

_____	measure specific annex	_____
_____	measure specific annex	_____
_____	measure specific annex	_____
_____	measure specific annex	_____

Confirmation that all required measures are within scope of installer certification \_\_\_\_\_

### G.4 Source of PAS 2035 compliant design (5.1)

In-organization or independent third party provided.

---

If independent third-party record name and contact details.

---

---

Design claimed to comply with PAS 2035.

Document Reference: \_\_\_\_\_

Date liaison with Client confirmed (4): \_\_\_\_\_

### G.5 Validation of design (5.2)

**G.5.1 Design adequacy (5.2.1)**  
Installer assured of validity of PAS 2035 compliance: Date:

---

Document references:

---

---

**G.5.3 Design scope, adequacy and suitability (5.2.3)**  
Installer assured of design content: Date:

---

Document references:

---

**G.5.4 Suitability of specified EEM (5.2.3)**  
Installer agrees that installation project specified is in line with Client expectations and is in accordance with information provided. Date:

---

Document references:

---

**G.5.5 Ventilation requirements (5.2.4)**  
Installer assured the retrofit design provided includes appropriate and sufficient provision for the maintenance/enhancement of ventilation in the property in which the installation specified is to be undertaken. Date:

---

Document references:

---

**G.5.6 Testing and commissioning (5.2.5)**  
Installer confirmation of provision of testing and commissioning requirements:  
Document references:

---

---

## G.6 Products and/or system specified/ to be installed

<p><b>Product 1:</b></p> <hr/> <p>Available date:</p> <hr/>
<p><b>Product 2:</b></p> <hr/> <p>Available date:</p> <hr/>
<p><b>Product 3:</b></p> <hr/> <p>Available date:</p> <hr/>
<p><b>System:</b></p> <hr/> <hr/> <p>Available date:</p> <hr/>

## G.7 Installation method statement

The installer is required to possess and make available when required, the information that constitutes the method statement applicable to each EEM installation, before commencement of its installation (6.1). Completion of the following fields could assist the creation of the required record.

### G.7.1 Reference for the retrofit design provided by the Retrofit Coordinator (6.1.1 & G.5)

### G.7.2 Identification of the relevant measure-specific installation Annex(es) from PAS 2030 (6.1.2).

Annex(es)

### G.7.3 The method(s) to be used for installing the product, including all constituent tasks (6.1.3, 6.1.4, 6.1.5).

Enter references to all relevant methods

### G.7.4 Requirement for intermediate inspections (6.1.6)

Confirmation that the installer is aware of any requirement for intermediate inspections and that the method statement includes appropriate provision for their undertaking.

Inspection required at (stage)

Anticipated date:

## G.8 Installation process

### G.8.1 Equipment and tools

Identification/availability of the tooling and equipment required for the installation, including any requirement for calibration (5.2).

---

---

### G.8.2 Materials and Supplies

Identification/availability of product related checking, handling and storage instructions (6.3).

---

### G.8.3 Operative instructions

Confirmation of provision of installation instructions to operatives (6.4).

---

---

---

### G.8.4 Operative selection, training, work assignment and briefing

The training and competence required of operatives by the installer to install the measure(s) in compliance with this PAS and its constituent Annexes (6.5). This should cross reference relevant personnel and training records and be reflected in record G.11.

---

---

---

**G.8.5 Name(s) of operatives undertaking this installation, their vocational competence and project specific briefing**Operative name:  

---

Vocational competence and record reference:  

---

Briefing given for this installation:  

---

Date:  

---

Operative name:  

---

Vocational competence and record reference:  

---

Briefing given for this installation:  

---

Date:  

---

Operative name:  

---

Vocational competence and record reference:  

---

Briefing given for this installation:  

---

Date:  

---

Operative name:  

---

Vocational competence and record reference:  

---

Briefing given for this installation:  

---

Date:  

---

Operative name:  

---

Vocational competence and record reference:  

---

Briefing given for this installation:  

---

Date:  

---

**G.8.6 Installation supervision**

Confirmation that the installer has assessed the vocational competence of operatives assigned to this project and has allocated operatives to provide a vocational competence ratio appropriate to the requirements of the project as well as arranging for appropriate supervision (6.5.3).

Vocational competence confirmed.

Vocational competence ratio confirmed:

Supervisor(s) designated:

**G.8.7 Subcontracting**

Enter the identification of any subcontractors to be engaged for this installation (5.6) together with confirmation that the primary installer’s contract with the subcontractor requires that the subcontractor will comply with all requirements of this PAS that are relevant to the installation related tasks to be undertaken and that sub-contracted operatives have the necessary skills and competence for the installation tasks sub-contracted.

**G.8.8 Testing and Commissioning**

Detail of any ‘commissioning’ action required of the installer (6.7 & 6.8).

**G.8.9 Handover**

The information to be delivered to the Client at handover (6.9).

Identity of operatives authorized to undertake handover (6.9.2).

**G.8.10 Installation control**

This will be the identification of the competent person authorized by the installer to sign off the satisfactory completion of the installation (6.10).

Installer signature:

Date:



## G.9 Operation and process oversight

Confirmation that the installer has in place, and operates, procedures designed to ensure that pre installation building inspection and installation processes in relation to the installation the EEM measures undertaken in this project (7.1), are undertaken and completed in accordance with the retrofit design, to the satisfaction of the Client(s) and in accordance with the requirements of this PAS, particularly in respect of:

The measures installed:

The use of specified installation methods:

Any required ventilation upgrade including where necessary the procurement and installation of any required ventilation upgrade from a ventilation specialist:

Avoidance of thermal bridging:

Testing:

Commissioning:

Handover:

## G.10 Pre-installation building inspection

### G.10.1 inspection findings

Date of notification to relevant certification body (7.2.2).

Record report reference and brief description of any issues raised, including in relation to:

- The suitability and completeness of the design specification; (7.2.3);
- The suitability and completeness of the installation method statement (7.2.4);
- Confirmation that the specified EEM can be safely and effectively installed at the designated location and is in accordance with the Client's expectations (7.2.5);
- Potential for moisture build-up as a result of the installation;
- Confirmation of the adequacy of ventilation prior to installation;
- Potential instances of thermal bridging and planned actions for amelioration;
- Risk to functionality and/or safety of installed services (7.2.6);
- The presence of protected species (7.2.7).
- Other issues recorded:

Date report issued to Client:



### G.11 Provision for any intermediate inspection required (7.3)

Confirmation that where an intermediate inspection is required, adequate provision has been made for its undertaking and that any issues arising from that inspection have been communicated to the Client for resolution.

---



---



---

Date of any communication with Client:

---

### G.12 Installation change (7.4)

Installer confirmation that any proposed changes to the retrofit design or method statement (including the substitution of alternative materials, products, construction details or processes) have been submitted to/ approved by, the Retrofit Coordinator prior to installation (7.4.1).

Installer confirmation that any change approved has been checked for compatibility with the installation of other measures being installed at the same site (7.4.2).

Installer confirmation that project related feedback from the Retrofit Coordinator, inspectors' operatives or assessment bodies has been documented, reviewed and actioned where appropriate (7.4.3).

---

### G.13 Process continuity (7.5)

Identification of alternative installation resource for use should the installer be unable to complete the installation.

Approval received from Retrofit Coordinator:

---

### G.14 Process control records (7.6 & 7.8)

References for the installation process control records relevant to this project:

---



---



---

### G.15 Details of any problems encountered during installation, corrections agreed and remedial work undertaken

Please provide a brief record of the nature and extent of the problem(s), the date of reporting to the Client and the method and timing of its resolution. This record should include reference to any tools or equipment requiring recalibration. Include references to any relevant documentation held separately.

---



---



---



---

Date or reporting to Retrofit Coordinator:

---

### G.16 Client complaints (8)

Date complaint received:

Date acknowledged to customer:

Date complaint reported to Retrofit Coordinator:

Date certification body informed (when requested):

**Nature of complaint**

*(e.g. complaint related to: installation, installer attitude, operative behaviour, measure efficiency, measure suitability, timing, delay).*

---



---



---



---

**Complaint resolution**

*(Where complaint to be corrected or resolved by installer, record action taken and date of resolution.)*

Action taken:

---



---



---



---

Date of resolution:

---

### G.17 Commissioning – EEM performance testing carried out

Record date of commissioning, tests undertaken and any adjustments made. Date of commissioning:
_____
Retrofit Coordinator informed:
_____
Tests and adjustments:
_____
_____
_____
_____

### G.18 Record of information left with Client at handover

Record identity of Client actually receiving information, items of information left, any physical demonstration provided and date of handover Customer name:
_____
Information provided:
_____
_____
_____
_____
Date of handover:
_____
_____

### G.19 Installation sign-off

The following statement is to be signed off by a competent person authorized to do so on behalf of the installer.

**The installation identified in this process record has been undertaken in accordance with PAS 2030 and is confirmed as meeting the relevant design specification.**

<b>Name of authorized signatory:</b>
_____
<b>Signature:</b>
_____
<b>Date:</b>
_____
_____

## Bibliography

### Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

PAS 2031, *Certification of energy efficiency measure installation in existing buildings and insulation in residential park homes*

### Other publications

[1] BRE. Information Paper, *IP1/06 Assessing the effects of thermal bridging at junctions and around openings*. BRE, 2006.

[2] THE STATIONERY OFFICE. *The Party Wall etc. Act 1996*. London: 1997.

# British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

## About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards-based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

## Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at [bsigroup.com/standards](http://bsigroup.com/standards) or contacting our Customer Services team or Knowledge Centre.

## Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at [bsigroup.com/shop](http://bsigroup.com/shop), where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

## Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to [bsigroup.com/subscriptions](http://bsigroup.com/subscriptions).

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

**PLUS** is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit [bsigroup.com/shop](http://bsigroup.com/shop).

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email [bsmusales@bsigroup.com](mailto:bsmusales@bsigroup.com).

## Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

## Copyright

All the data, software and documentation set out in all British Standards and other BSI publications are the property of and copyrighted by BSI, or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. Details and advice can be obtained from the Copyright & Licensing Department.

## Useful Contacts:

### Customer Services

Tel: +44 845 086 9001

Email (orders): [orders@bsigroup.com](mailto:orders@bsigroup.com)

Email (enquiries): [cservices@bsigroup.com](mailto:cservices@bsigroup.com)

### Subscriptions

Tel: +44 845 086 9001

Email: [subscriptions@bsigroup.com](mailto:subscriptions@bsigroup.com)

### Knowledge Centre

Tel: +44 20 8996 7004

Email: [knowledgecentre@bsigroup.com](mailto:knowledgecentre@bsigroup.com)

### Copyright & Licensing

Tel: +44 20 8996 7070

Email: [copyright@bsigroup.com](mailto:copyright@bsigroup.com)









BSI, 389 Chiswick High Road  
London W4 4AL  
United Kingdom  
[www.bsigroup.com](http://www.bsigroup.com)

ISBN 978-0-539-12816-1



9 780539 128161