Llywodraeth Cymru
Welsh Government

The Building Regulations 2010

Approved Document L

Volume 1- Dwellings

Conservation of fuel and power and the minimisation of greenhouse gases

2026 version - For use in Wales*

2026 edition

This approved document supports Part L of Schedule 1 to the Building Regulations 2010.

This approved document takes effect on 4 March 2027 for use in Wales. It does not apply to work on a particular building where a building notice, full plans application or initial notice have been submitted before that date, provided the work for each building is started before 4 March 2028.Full detail of the transitional arrangements can be found in Circular Letter **003/2026** published on Building regulations | Sub-topic | GOV.WALES

*This approved document gives guidance for compliance with the Building Regulations for building work carried out in Wales.

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The Approved Documents

What is an Approved Document?

This Approved Document, which takes effect on 4 March 2027, has been approved and issued by the Welsh Ministers to provide practical guidance on ways of complying with the **energy efficiency requirements** of the Building Regulations 2010 for Wales, as amended, which are referred to throughout the remainder of this document as 'the Building Regulations'.

These Approved Documents give guidance on each of the technical parts of the regulations and on regulation 7 (see the back of this document). The Approved Documents provide guidance for common building situations.

It is the responsibility of those carrying out building work to meet the requirements of the Building Regulations 2010. Although it is ultimately for the courts to determine whether those requirements have been met, the Approved Documents provide practical guidance on potential ways to achieve compliance with the requirements of the regulations in Wales.

Although Approved Documents cover common building situations, compliance with the guidance set out in the Approved Documents does not provide a guarantee of compliance with the requirements of the regulations because the Approved Documents cannot cater for all circumstances, variations and innovations. Those with responsibility for meeting the requirements of the regulations will need to consider for themselves whether following the guidance in the Approved Documents is likely to meet those requirements in the particular circumstances of their case.

Note that there may be other ways to comply with the requirements than the method described in an approved document. If you prefer to meet a relevant requirement in some other way than described in an Approved Document, you should seek to agree this with the relevant building control body at an early stage.

Where the guidance in the Approved Document has been followed, a court or inspector will tend to find that there is no breach of the regulations. However, where the guidance in the approved document has not been followed, this may be relied upon as tending to establish breach of the regulations and, in such circumstances, the person carrying out building works should demonstrate that the requirements of the regulations have been complied with by some other acceptable means or method.

In addition to guidance, some Approved Documents include provisions that must be followed exactly, as required by regulations or where methods of test or calculation have been prescribed by the Welsh Ministers.

Each approved document relates only to the particular requirements of the Building Regulations 2010 that the document addresses. However, building work must also comply with all other applicable requirements of the Building Regulations 2010 and all other applicable legislation.

How to use this approved document

This document uses the following conventions.

a. Text against a blue background is an extract from the Building Regulations 2010 or the Building (Registered Building Control Approvers etc.) (Wales) Regulations 2024 (both as amended). These extracts set out the legal requirements of the regulations.

b. Key terms, printed in blue, are defined in Appendix A.

c. References are made to appropriate standards or other documents, which can provide further useful guidance. When this approved document refers to a named standard or other reference document, the standard or reference has been clearly identified in this document. Standards are highlighted in **bold** throughout. The full name and version of the document referred to is listed in Appendix C (other documents) or Appendix D (standards). However, if the issuing body has revised or updated the listed version of the standard or document, you may use the new version as guidance if it continues to address the relevant requirements of the Building Regulations.

d. Standards and technical approvals also address aspects of performance or matters that are not covered by the Building Regulations and may recommend higher standards than required by the Building Regulations. Nothing in this Approved Document precludes you from adopting higher standards.

e. Additional *commentary in italic* text appears after some numbered paragraphs. This commentary is intended to assist understanding of the immediately preceding paragraph or sub-paragraph, or to direct readers to sources of additional information, but is not part of the technical guidance itself.

User requirements

The Approved Documents provide technical guidance. Users of the Approved Documents should have adequate knowledge and skills to understand and apply the guidance correctly to the building work being undertaken.

Where you can get further help

If you are not confident that you possess adequate knowledge and skills to apply the guidance correctly or if you do not understand the technical guidance or other information in this approved document or the additional detailed technical references to which it directs you, you should seek further help. Help can be obtained through a number of routes, some of which are listed below:

a. If you are the person undertaking the building work: either from your local authority building control service or from a registered building control approver.

b. If you are registered with a competent person scheme: from the scheme operator

c. If your query is highly technical: from a specialist or an industry technical body for the relevant subject.

The Building Regulations

The following is a high level summary of the Building Regulations relevant to most types of building work. Where there is any doubt you should consult the full text of the regulations, available at www.legislation.gov.uk .

Building work

Regulation 3 of the Building Regulations defines 'building work'. Building work includes among other things:

a. the erection or extension of a building

b. the provision or extension of a controlled service or fitting in or in connection with a building

c. the material alteration of a building or a controlled service or fitting.

Regulation 4 states that building work should be carried out in such a way that, when work is complete:

a. For new buildings or work on a building that complied with the applicable requirements of the Building Regulations: the building complies with the applicable requirements of the Building Regulations.

b. For work on an existing building that did not comply with the applicable requirements of the Building Regulations:

   i. the work itself must comply with the applicable requirements of the Building Regulations and

   ii. the building must be no more unsatisfactory in relation to the requirements than before the work was carried out.

Material change of use

Regulation 5 defines a 'material change of use' in which a building or part of a building that was previously used for one purpose will be used for another.

The Building Regulations set out requirements that must be met before a building can be used for a new purpose. To meet the requirements, the building may need to be upgraded in some way.

Materials and workmanship

In accordance with regulation 7, building work must be carried out in a workmanlike manner using adequate and proper materials. Guidance on regulation 7(1) is given in Approved Document 7, and guidance on regulation 7(2) is provided in Approved Document B.

Independent third party certification and accreditation

Independent schemes of certification and accreditation of installers can provide confidence that the required level of performance for a system, product, component or structure can be achieved.

Building control bodies may accept certification under such schemes as evidence of compliance with a relevant standard. However, a building control body should establish before the start of the building work that a scheme is adequate for the purposes of the Building Regulations. The local authority still retains inspection and enforcement powers in these circumstances.

Energy efficiency requirements

Part 6 of the Building Regulations imposes additional specific requirements for energy efficiency.

If a building is extended or renovated, the energy efficiency of the existing building or part of it may need to be upgraded.

Notification of work

Most building work and material changes of use must be notified to a building control body unless one of the following applies.

a. It is work that will be self-certified by a registered competent person or certified by a registered third party.

b. It is work exempted from the need to notify by regulation 12(6A) of, or Schedule 4 to, the Building Regulations.

Responsibility for compliance

People who are responsible for building work (e.g. agent, designer, builder or installer) must ensure that the work complies with all applicable requirements of the Building Regulations. The building owner may also be responsible for ensuring that work complies with the Building Regulations. If building work does not comply with the Building Regulations, the building owner may be served with an enforcement notice.

Section 0

Introduction

0.1 This Approved Document, Approved Document L, Volume 1: Dwellings, gives guidance on how to comply with Part L of Schedule 1 to the Building Regulations and the energy efficiency requirements for dwellings. For guidance for non-domestic buildings, use Approved Document L, Volume 2: Buildings other than dwellings.

0.2 This Approved Document contains the following sections.

Approved Document Section	Related Building Regulations requirements
Section 0: Introduction	N/A
Section 1: Calculating the target emissions rate, target primary energy rate, target fabric performance values and target energy use intensity rating.	Regulations 24, 25, 25C, 25D, 26, 26A, 26B, 26C, 27, 27A, 27B and 27C
Section 2: Calculating the dwelling CO_2 emissions and primary energy	
Section 3: Limiting heat losses and gains	Requirement L1(a) of Schedule 1
Section 4: Building services efficiencies and controls – general guidance	Requirement L1(b)(i), (ai),(ii), L2, and L2A of Schedule 1
Section 5: System Specific Guidance	
Section 6: Air permeability and pressure testing	Regulation 43
Section 7: Commissioning	Regulation 44 and 44ZA, and Requirement L1(b)(iii) of Schedule 1 and L2(b) of Schedule 1
Section 8: Competence general requirement	Regulation 11W
Section 9: Providing information	Regulation 40 and 40A
Section 10: New elements in existing dwellings, including extensions	Requirement L1(a) of Schedule 1
Section 11: Works to elements in existing dwellings	Requirement L1(a) of Schedule 1 and Regulations 6, 22 and 23
Section 12: Consequential improvements	Regulation 28
Section 13: Optional approaches for more design flexibility	Requirement L1(a)and (b) of Schedule 1

Approved Document Section	*Related Building Regulations requirements*
Appendix A: Key terms	N/A
Appendix B: Reporting evidence of compliance	N/A
Appendix C: Documents referred to	N/A
Appendix D: Standards referred to	N/A
Appendix E: Elemental specification for the PER/TER	N/A
Appendix F – Continuity of insulation	N/A
Appendix G – Thermal Bridging	N/A
Appendix H – Airtightness in new dwellings	N/A

Application

0.3 The guidance in this volume 1 of Approved Document L applies to dwellings only. In a mixed-use building, Approved Document L Volume 2 should be consulted for building work in those parts of the building that are not dwellings.

Note: *Dwellings are self-contained units. Rooms for residential purposes and buildings that contain only rooms for residential purposes are not dwellings, and so Approved Document L Volume 2 applies to them.*

New Dwellings

0.4 Guidance for newly constructed dwellings is given in **Sections 1 to 9** of this Approved Document.

New dwellings with conservatories and porches

0.5 Conservatories and porches should be included in the dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity rating calculations only if they are constructed at the same time as a new dwelling, and:

a. there is no thermal element between the dwelling and the conservatory and/or porch; or

b. the conservatory and/or porch will be heated via fixed heating.

Common areas in buildings with multiple dwellings

0.6 The common areas of buildings containing more than one dwelling fall outside the scope of this document. For the common areas:

a. If they are heated follow Approved Document L, volume 2: Buildings other than dwellings.
b. if they are unheated, individual fabric elements should meet the minimum standards set out in **Section 3**.

Extensions and work in existing dwellings

0.7 Guidance for building work on existing dwellings is given in the relevant paragraphs within **Sections 3 to 12** of this Approved Document.

Exemptions for historic and traditional buildings

0.8 Work to the following types of dwellings does not need to comply fully with the energy efficiency requirements where to do so would unacceptably alter the dwelling's character or appearance:

a. Those listed in accordance in accordance with section 76 of the Historic Environment (Wales) Act 2023.
b. Those in a conservation area designated in accordance with section 158 of the Historic Environment (Wales) Act 2023.
c. Those included in the schedule of monuments maintained under section 3 of the Historic Environment (Wales) Act 2023.

0.9 Work to a dwelling in paragraph 0.8 must comply with the energy efficiency requirements where this would not unacceptably alter the dwelling's character or appearance. The work should comply with standards in this Approved Document to the extent that it is reasonably practicable.

Historic and traditional dwellings where special considerations apply

0.10 In addition, special considerations apply to works to the following three classes of non-exempt existing buildings:

a. of architectural and historic interest and are referred to as a material consideration in a local authority's development plan or local development framework; or
b. of architectural and historic interest and are within national parks, areas of outstanding natural beauty, registered historic parks and gardens, registered battlefields, the curtilages of scheduled monuments, and world heritage sites; or
c. of traditional construction with permeable fabric that both absorbs and readily allows the evaporation of moisture.

0.11 Work to such buildings is required to comply with the energy efficiency requirements as far as is reasonably practicable. In considering what is reasonably practicable, the work should not unacceptably alter or mar the character of the building or increase the risk of long-term deterioration of the building's fabric or fittings.

0.12 Additional guidance on how to implement specific energy efficiency or renewable energy measures is available in Cadw's *How to Improve Energy Efficiency in Historic Buildings in Wales (2022*) and *Renewable energy and your historic building (2010).*

0.13 In general, new extensions to dwellings of historic and architectural interest should comply with the energy efficiency requirements: guidance on how to comply is set out within **Sections 9 and 10**. The only exception would be where there is a need for the extension to be consistent with the character of the existing building.

0.14 Particular issues relating to work to dwellings of historic and architectural interest warrant sympathetic treatment and would benefit from further specialist professional advice. These issues include:

a. restoring the historic character of a building that has been subject to a previous inappropriate alteration, for example, replacement windows and doors; or
b. rebuilding a former historic building, for example, following a fire or infilling a gap site in a terrace; or
c. enabling the fabric of historic buildings to control moisture (as originally designed) and avoid potential long-term deterioration.

0.15 When assessing dwellings of historic and architectural interest where special consideration may apply, it is important that the building control body takes into account the advice of the local authority's conservation officer, particularly where the work requires planning permission and/or listed building consent.

Exemptions for covered areas, conservatories and porches

0.16 Parts of a building which are not heated, for example garages, carports and outbuildings are exempt. Conservatories and porches are also exempt from the energy efficiency requirements if they fulfil **all** of the following requirements:

a. be at ground level; and
b. have an internal floor area that is less than $30m^2$; and
c. be thermally separate from the heated area of the dwelling, and
d. the conservatory or porch contains no fixed heating appliance or the buildings heating system is not extended into the conservatory or porch.

Live–work units

0.17 A unit that contains both living accommodation and space to be used for commercial purposes (e.g. as a workshop or office) should be treated as a dwelling, as long as the commercial part can revert to domestic use.

0.18 The commercial part of a building can revert to domestic use if, all of the following apply:

a. there is direct access between the commercial space and the living accommodation; and
b. the commercial space and the living accommodation are within the same thermal envelope; and
c. the living accommodation comprises a substantial proportion of the total area of the unit. What constitutes a 'substantial proportion' should be assessed on a case-by-case basis.

Note: *A large non-domestic building that contains a small flat for a manager is not treated as a dwelling. A dwelling that contains a room used as an office or utility space is still treated as a dwelling.*

Mixed-use developments

0.19 When constructing a dwelling as part of a larger building that contains other types of accommodation, sometimes called a mixed-use development, refer to the two volumes of Approved Document L as follows:

a. For guidance on each individual dwelling, use this **Approved Document (Approved Document L volume 1)**.
b. For guidance on the non-dwelling parts of the building, such as heated common areas and the commercial or retail space, use **Approved Document L, volume 2: Buildings other than dwellings**

Selected key interactions with other parts of the Building Regulations

0.20 The Approved Documents set out, what in ordinary circumstances, may be accepted as one way to comply with the Building Regulations. It remains the responsibility of those designing or undertaking building work to assess, on a case-by-case basis, whether specific circumstances require additional or alternative measures to achieve compliance with the regulatory requirements. There are interactions between many of the requirements of the Building Regulations, here is guidance on some key interactions.

Interaction with Part B

0.21 This Approved Document provides guidance for fixed building services and on-site electricity generation. Where on-site electricity is provided for occupant use in dwellings and buildings containing dwellings, the guidance on the fire safety requirements (including means of escape) for the building in Approved Document B should be followed. Where insulation is installed and becomes part of the external wall in a relevant building as defined in regulation 7(2), the guidance of **Approved Document B, Volume 1**, should be followed.

Interaction with Part C

0.22 This Approved Document provides guidance and examples on upgrading thermal elements. A lesser standard may be acceptable in order to ensure thermal elements comply with the requirements of Part C of interstitial and surface condensation. Guidance in **Approved Document C** should be followed.

Interaction with Part E

0.23 This Approved Document provides guidance on insulation that is reasonably continuous and limits thermal bridging. Construction junctions should limit noise transfer where Part E of the Building regulations sets a requirement. **Approved Document E** should be followed.

Interaction with Part F

0.24 This Approved Document provides guidance on reducing unwanted heat loss, by achieving optimum airtightness. The air infiltration of a dwelling should be considered when specifying the minimum amount of purpose-provided ventilation, following **Approved Document F**.

Interaction with Part J

0.25 This Approved Document provides guidance on airtightness. Guidance on permanent ventilation openings for open flued appliances in very airtight dwellings should be followed in **Approved Document J**.

Interaction with Part K and M

0.26 This Approved Document provides guidance on controls for fixed building services and on-site electricity generation. Where manual controls are provided, they should be within reasonable reach of the occupants. Guidance is provided in **Approved Documents K** and **M**.

Interaction with Part O

0.27 This document provides guidance on conserving energy use and avoiding CO_2 emissions associated with active cooling. Guidance on mitigating the risk of overheating in new dwellings in relation to the health and comfort risks to occupants is provided in **Approved Document O**.

Interaction with Part P

0.28 This Approved Document provides guidance for on-site electricity generation and energy storage. Where on-site electricity generation or energy storage is installed, the electrical safety requirements of the Building Regulations should be met, **Approved Document P** should be followed.

Regulations 24, 25, 25C(b), 25D 26, 26A, 26B, 26C, 27, 27A, 27B and 27C: Energy performance of dwellings calculations

This Approved Document deals with the requirements of regulations 24, 25, 25C(b), 25D, 26, 26A, 26B, 26C, 27, 27A,27B and 27C of the Building Regulations 2010 (as amended).

Regulation 24 - Methodology of calculation and expression of energy performance

(1) The Secretary of State shall approve–

(a) a methodology of calculation of the energy performance of buildings, including methods for calculating asset ratings and operational ratings of buildings; and

(b) ways in which the energy performance of buildings, as calculated in accordance with the methodology, shall be expressed.

(2) In this regulation–

'asset rating' means an energy performance indicator determined from the amount of energy estimated to meet the different needs associated with a standardised use of the building; and

'operational rating' means an energy performance indicator determined from the amount of energy consumed during the occupation of a building over a period of time and the energy demand associated with a typical use of the building over that period.

Regulation 25 - Minimum energy performance requirements for new buildings

The Secretary of State shall approve minimum energy performance requirements for new buildings, in the form of target CO_2 emission rates, which shall be calculated and expressed in accordance with the methodology approved pursuant to regulation 24.

Regulation 25C (b) – New Buildings: Minimum energy performance requirements
Minimum energy performance requirements must be approved by the Welsh Ministers, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, for-
new dwellings, in the form of target fabric performance values.

Regulation 25D - Energy use intensity rating

Energy use intensity ratings must be approved by the Welsh Ministers, applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulations 24 for new buildings.

Regulation 26 – CO_2 emission rates for new buildings
Where a building is erected, it shall not exceed the target CO_2 emission rate for the building that has been approved pursuant to regulation 25, applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24.

Regulation 26A - Primary energy rates for new buildings

Where a building is erected, it must not exceed the target primary energy rate for the building which has been approved pursuant to regulation 25C(a), applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24.

Regulation 26B – Fabric performance values for new dwellings
Where a dwelling is erected, it must not exceed the target fabric performance values for the dwelling which have been approved pursuant to regulation 25C (b), applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24.

Regulation 26C – Minimum energy use intensity rating
Where a dwelling is erected, it must equal or exceed the energy use intensity rating for the dwelling which has been approved pursuant to regulation 25D applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24 for new buildings.

Regulation 27 - CO_2 emission rate calculations

(1) This regulation applies where a building is erected and regulation 26 applies.

(2) Not later than the day before the work starts, the person carrying out the work shall give the local authority a notice which specifies–
a. the target CO_2 emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;
b. the CO_2 emission rate for the building as designed, calculated and expressed in and accordance with the methodology approved pursuant to regulation 24; and
c. a list of specifications to which the building is to be constructed.

(3) Not later than five days after the work has been completed, the person carrying out the work shall give the local authority–
a. a notice which specifies–
i. the target CO_2 emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;
ii. the CO_2 emission rate for the building as constructed, calculated and expressed in and accordance with the methodology approved pursuant to regulation 24; and
iii. whether the building has been constructed in accordance with the list of specifications referred to in paragraph (2) (c), and if not a list of any changes to those specifications; or
b. a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in sub-paragraph (a).

(4) A local authority is authorised to accept, as evidence that the requirements of regulation 26 have been satisfied, a certificate to that effect by an energy assessor who is accredited to produce energy performance certificates for that category of building.

(5) In this regulation ‘specifications’ means specifications used for the calculation of the CO_2 emission rate.

27A - Primary energy rate calculations.—
(1) This regulation applies where a building is erected and regulation 26A applies.
(2) Not later than the day before the work starts, the person carrying out the work must give the local authority a notice which specifies—
(a) the target primary energy rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;
(b) the primary energy rate for the building as designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24; and
(c) a list of specifications to which the building is to be constructed.
(3) Not later than five days after the work has been completed, the person carrying out the work must give the local authority—
(a) a notice which specifies—
(i) the target primary energy rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;
(ii) the calculated primary energy rate for the building as constructed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24; and
(iii) whether the building has been constructed in accordance with the list of specifications referred to in paragraph 2(c), and if not a list of any changes to those specifications; or (b) a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in subparagraph (a).
(4) A local authority is authorised to accept, as evidence that the requirements of regulation 26A have been satisfied, a certificate to that effect by an energy assessor who is accredited to produce energy performance certificates for that category of building.
(5) In this regulation, “specifications” means specifications used for the calculation of the primary energy rate.

Regulation 27B - Fabric performance values calculations

(1) This regulation applies where a dwelling is erected and regulation 26B applies.

(2) Not later than the day before the work starts, the person carrying out the work must give the local authority a notice which specifies—

(a) the target fabric performance values for the dwelling, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;

(b) the fabric performance values for the dwelling as designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24; and

(c) a list of specifications to which the dwelling is to be constructed.

(3) Not later than five days after the work has been completed, the person carrying out the work must give the local authority—

(a)a notice which specifies—

(i) the target fabric performance values for the dwelling, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;

(ii) the calculated fabric performance values for the dwelling as constructed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24; and

(iii) whether the dwelling has been constructed in accordance with the list of specifications referred to in paragraph 2(c), and if not a list of any changes to those specifications; or

(b) a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in sub-paragraph (a).

(4) A local authority is authorised to accept, as evidence that the requirements of regulation 26B have been satisfied, a certificate to that effect by an energy assessor who is accredited to produce energy performance certificates for that category of building.

(5) In this Regulation, “specifications” means specifications used for the calculation of the fabric performance values.”

27C – Minimum energy use intensity rating calculations

(1) This regulation applies where a dwelling is erected and regulation 26C applies.

(2) Not later than the day before the work starts, the person carrying out the work must give the local authority a notice which specifies—

(a) the energy use intensity rating for the dwelling as designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

(b) a list of specifications to which the dwelling is to be constructed.

(3) Not later than five days after the work has been completed, the person carrying out the work must give the local authority—

(a) a notice which specifies—

(i) the target energy use intensity rating for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24,

(ii) the energy use intensity rating of the building as constructed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

(iii) whether the building has been constructed in accordance with the list of specifications referred to in paragraph (2)(b), and if not, a list of any changes to those specifications, or

(b) a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in sub-paragraph (a).

(4) A local authority is authorised to accept as evidence that the requirements of regulation 26C have been satisfied, a certificate to that effect by an energy assessor who is accredited to produce energy performance certificates for that category of building.

Note: *Where the building control body is a registered building control approver, see regulation 5 of the Building (Registered Building Control Approvers etc.) (Wales) Regulations 2024.*

Regulation 24

Regulation 24 requires Welsh Ministers to approve a methodology of calculation of the energy performance of a building. For a new dwelling, the approved methodology is the Standard Assessment Procedure. Calculation methodologies are set out in Section 1 and Section 2 of this Approved Document.

Regulation 25

Regulation 25 requires Welsh Ministers to approve minimum energy performance requirements. These requirements are in the form of a target primary energy rate, a target emission rate, target fabric performance values and a target energy use intensity. The targets are set out in Section 1 of this Approved Document.

Regulations 26, 26A, 26B and 26C

A newly constructed dwelling must be shown to meet regulations 26, 26A, 26B and 26C by producing calculations to show that the dwelling meets all of the following.

a. Target primary energy rate.
b. Target emission rate.
c. Target fabric performance values.
d. Target Energy Use Intensity.

Section 2 of this approved document sets out how to produce these calculations.

Regulations 27, 27A, 27B and 27C

Both before and after a newly constructed dwelling is built, a notice must be given to the building control body of the calculations.

Section 1

Calculating the target emission rate, target primary energy rate, target fabric performance values and target energy use intensity rating.

Target primary energy rate, target emission rate and target energy use intensity rate

1.1 A new dwelling must be built to a minimum standard of total energy performance. This is evaluated by comparing calculations of the performance of the dwelling against calculations of the performance of a theoretical dwelling called the 'notional dwelling'. This must be carried out both at the design stage and when work is complete.

The notional dwelling is of the same size and shape as the actual dwelling and has standardised properties for fabric and services. The full properties of the notional dwelling are set out in the UK Government's Standard Assessment Procedure (SAP) for energy rating of dwellings.

1.2 The energy performance of the notional dwelling is described using following metrics.

a. The Target Primary Energy Rate, in kWh_{PE}/m^2/year: this is the maximum primary energy used by the dwelling.
b. The Target Emission Rate, in $kgCO_{2e}/m^2$/year: this is the minimum standard for CO_2 emissions from the dwelling.
c. The Target Energy Use Intensity, in kWh/m^2/yr: this is the maximum energy use by the dwelling.

1.3 The Target Primary Energy Rate, Target Emission Rate and Target Energy Use Intensity must be calculated using the UK Government's Standard Assessment Procedure for energy rating of dwellings, version 10.3. The standardised properties are in Appendix R and summarised in Appendix E of this Approved Document.

Target fabric performance values

1.4 A new dwelling must also meet the Target Fabric Performance Values for elements of the fabric. Target Fabric Performance Values can be met by adopting the mandatory minimum energy efficiency standards for the building fabric, which are set out in Section 3 (table 3.1).

Notional dwelling specification

1.5 The full notional dwelling specification used in the Standard Assessment Procedure is given in Appendix R of SAP version 10.3: Standard Assessment Procedure SAP 10 The notional dwelling specification is summarised in Appendix E.

District heat networks and communal heat networks – determining the target CO2 and Primary Energy (the notional dwelling)

1.6 For a dwelling connected to a district heat network the notional building will use primary energy and CO_2 emission factors for heat and hot water as listed in Table 1.1.

1.7 For a dwelling connected to a communal heat network the notional building will use the characteristics of the heat network and associated services as defined in Appendix R of the SAP 10.3 specification.

Note: *Software platforms, and interfaces relating to them which are approved for use with the approved methodology includes functionality to allow the notional dwellings to be modelled as connected to heat networks*

Table 1.1 Primary energy and CO_2 factors to be used for heating and hot water for dwellings connected to district heat networks

Heat network status(1)	Primary energy factors for notional building	CO_2 factors for notional building
Sleeved	Same as actual (as used in dwelling primary energy rate)	Same as actual (as used in dwelling emission rate)
Not sleeved	HEM= calculated in line with the specification in Part L Wales 2026 Standard: dwelling notional buildings	HEM= calculated in line with the specification in Part L Wales 2026 Standard: dwelling notional buildings
	SAP= calculated in line with the specification in Appendix R of the SAP 10.3 specification	SAP= calculated in line with the specification in Appendix R of the SAP 10.3 specification

Note:

1. The heat network status of 'sleeved' means that a declaration has been made as described in paragraphs 1.8 and 1.9

1.8 For a district heat network to have the status of 'sleeved' a declaration of sleeving capacity should be made to the building control body. The declaration should be signed by both of the following.

a. The body responsible for the operation of the district heat network.

b. A suitably qualified person.

Note: *Only district heat networks can be sleeved. Communal heat networks are not able to be sleeved.*

1.9 The declaration of sleeving capacity should state all of the following:

a. That the district heat network is providing both space heating and water heating to the dwelling.

b. The thermal energy (in kWh per year) that is required by the dwelling for space heating and hot water, as calculated using the same version of the approved methodology as used to calculate the dwelling emission rate.

c. The proportion of this thermal energy which will delivered by the district heat network to the dwelling.

d. That at least 90% of the thermal energy delivered by the district heat network to the dwelling will be provided by new or unused capacity of the types described in Table 1.2. Any temporary plant also needs to be of the types described in Table 1.2.

e. That the new or unused capacity which is being allocated to the dwelling through this process has not been declared to any building control body for any other applications which are ongoing, or which have received a completion certificate.

f. Any new capacity should be added to the district heat network within 5 years of the 'as-built stage' assessment. The change in capacity should be described and evidence of both of the following provided.

i. That planning permission, if required, has been granted for the new capacity.

ii. That the district heat network will connect to the new source. A signed contract to connect and supply heat should be provided.

Note: *Any new capacity which is to be added later than 5 years after the 'as-built stage' assessment should not be included in the declaration of sleeving capacity.*

Table 1.2 Low-carbon heat sources which can be included in a declaration of sleeving capacity(1)

Low-carbon heat sources
Electrically powered heat pumps
Waste heat (including from power stations)
Geothermal heat
Electric boiler
Solar thermal
Biofuels

Note

1. The declaration of low carbon thermal energy (kWh) from heat pumps to the dwelling should include both the 'source' thermal energy (e.g. heat from the air) and the electrical power consumed as an input to the heat pump.

Buildings that contain multiple dwellings

1.10 For a building containing flats, an average target primary energy rate, average target emission rate and average target energy use intensity may be calculated as an alternative to an individual target for each dwelling.

Calculating an average target primary energy rate, average target emission rate or average target energy use intensity for separate buildings on the same site is *not* considered a reasonable method to show compliance.

Calculating an average target primary energy rate, average target emission rate or average target energy use intensity for a row of terraced houses is *not* considered a reasonable method to show compliance.

1.11 The floor-area-weighted average of the target primary energy rate for all the dwellings in the building should be calculated using the following formula:

$$\frac{\{(\text{target primary energy rate}1 \times Floor\ area1) + (\text{target primary energy rate}2 \times Floor\ area2) + (\text{target primary energy rate}3 \times Floor\ area3) + \ldots\}}{(Floor\ area1 + Floor\ area2 + Floor\ area3 + \ldots)}$$

1.12 The average target emission rate should be calculated using the formula above, but replacing target primary energy rate with target emission rate.

The average target energy use intensity should be calculated using the formula above in paragraph 1.10 but replacing target primary energy rate with target energy use intensity.

1.13 Each individual dwelling in a building that contains more than one dwelling should meet the Target Fabric performance values.

Section 2

Calculating the dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity

2.1 The same approved methodology used to calculate the target primary energy rate, target emission rate and target energy use intensity must be the same as that used to calculate the dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity.

2.2 The dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity must be calculated at both of the following points using the same approved methodology:

a. Before work starts, using design values.
b. When work is complete, using figures for the building as constructed, and incorporating both ofthe following:
   i. Any changes that have been made during construction to the list of specifications.
   ii. The measured air permeability.

2.3 At both of these points the dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity must not exceed the target primary energy rate, target emission rate and target energy use intensity. The specification of the actual dwelling may vary from that of the notional dwelling if the dwelling meets the target primary energy rate, target emission rate, target energy use intensity, target fabric performance values and the guidance in this approved document.

Building control notification

2.4 The building control body must be notified before the work starts, of all of the following:

a. The target primary energy rate and the dwelling primary energy rate (calculated using design values).
b. The target emission rate and the dwelling emission rate (calculated using design values).
c. The target energy use intensity and the dwelling energy use intensity (calculated using design values).

d. The dwelling fabric performance values (calculated using design values).
e. A list of specifications used in the calculations.

2.5 Items (a) to (e) above may be reported using the 'design stage' Building Regulations Wales Part L compliance report (BRWL report). For further details of the design stage BRWL report, see Appendix B.

2.6 The building control body must be notified once the work is complete of all of the following.

a. the as-built target primary energy rate and as-built dwelling primary energy rate
b. the as-built target emission rate and as-built dwelling emission rate
c. the as-built target energy use intensity and as-built dwelling energy use intensity
d. the as-built dwelling fabric performance values
e. A list of specifications used in the as-built calculations, and whether the specifications have changed from those used in the design stage calculations.

Building control bodies are authorised to accept notification of (a) to (e) above as reported in the 'as-built' stage BRWL report together with photographic evidence of compliance. For further detailsof the post-completion BRWL report and photographic evidence, see Appendix B.

Note: *Developers may wish to provide building control bodies with the required photographs as the work progresses on site, however, photographs are not a replacement for site inspections by building control bodies.*

Buildings that contain multiple dwellings

2.7 Buildings that contain more than one dwelling must comply with one of the following.

a. every individual dwelling meets all of the following conditions:
   i. a dwelling primary energy rate that is no greater than the individual dwelling's target primary energy rate
   ii. a dwelling emission rate that is no greater than the individual dwelling's target emission rate
   iii. a dwelling energy use intensity that is no greater than the individual dwelling's target energy use intensity

Or

b. all of the following are met:

i. the average dwelling primary energy rate for the whole building, calculated in accordance with paragraph 2.8, is no greater than the average target primary energy rate for the whole building.

ii. the average dwelling emission rate for the whole building, calculated in accordance with paragraph 2.8, is no greater than the average target emission rate for the whole building.

iii. the average dwelling energy use intensity for the whole building, calculated in accordance with paragraph 2.8, is no greater than the average target energy use intensity for the whole building.

Note: *Guidance on how to calculate an average target primary energy rate, an average target emission rate and average target fabric energy efficiency rate is given in paragraph 1.7.*

2.8 The average dwelling primary energy rate, average dwelling emission rate, and average dwelling energy use intensity are the floor-area-weighted averages of the dwelling primary energy rates, dwelling emission rates and dwelling energy use intensities for all the individual dwellings in the building.

The average dwelling primary energy rate, average dwelling emission rate, and average dwelling energy use intensity should be calculated using the same averaging methodology set out in paragraphs 1.9 to 1.12.

An average dwelling primary energy rate, average dwelling emission rate or average dwelling energy use intensity should *not* be calculated across separate buildings on a site.

An average dwelling primary energy rate, average dwelling emission rate or average dwelling energy use intensity should *not* be calculated for a row of terraced houses.

Note: *Information and photographic evidence must be provided for each individual dwelling, as described in* ***Section 9*** *and* ***Appendix B****.*

Special considerations when calculating dwelling primary energy rate, dwelling primary energy rate and dwelling energy use intensity

Secondary heating

2.9 When calculating the dwelling primary energy rate, dwelling emission rate, and dwelling energy use intensity for a dwelling with a secondary heating appliance, all of the following apply.

a. The value used in the calculation for the fraction of heat provided by the secondary heating system must be as defined by the approved methodology for the particular combination of main heating system and secondary heating appliance.

b. The efficiency of the secondary heating appliance with its appropriate fuel should be used in the calculation of all of the dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity.

c. No chimney or flue should be provided when no appliance is installed.

Community heating systems and district heat networks

2.10 If thermal energy is supplied from a district heat network or communal heat network, CO_2 emission factors and primary energy factors for the heat delivered to the dwelling by the district heat network should be determined by considering the details of the scheme and all of the following guidance. These factors should be used in the calculations of the dwelling primary energy rate and dwelling emission rate.

a. The CO_2 emission factor and primary energy factor for heat delivered to the dwelling are entered as inputs into the approved methodology for calculating the dwelling primary energy rate and dwelling emission rate.

b. Calculations should take account of the performance of the whole system in all cases, including where a declaration of sleeving capacity has been made. This should include the performance of the distribution circuits, all heat generating plants, combined heat and power (CHP), storage, and any waste heat recovery or heat dumping.

Note: *If a declaration of sleeving is made, the CO_2 emission factor and primary energy factor are still required to be calculated*

c. The electricity generated by any CHP or trigeneration scheme should be credited using the appropriate CO_2 emission and primary energy factors.

d. CO_2 emissions and primary energy associated with the thermal energy streams of a trigeneration scheme should be attributed in proportion to the output energy streams.

e. When calculating the dwelling primary energy rate and dwelling emission rate for a dwelling connected to a district heat network, the calculation should include all of the following

i) heat sources already connected to the district heat network

ii) any significant changes to the planned heat supply as a result of the connection of new heat sources to the district heat network within 5 years of the 'as-built stage' assessment.

f. When there will be a change to the planned heat supply to the district heat network within 5 years of the 'as-built stage' assessment as described in (e)(ii) above, a submission to the building control body should be made providing details of the additional source(s) and showing both of the following.

i. That planning permission, if required, has been granted for the change.

ii. That the heat network will connect to the new source. A signed contract to connect and supply heat should be provided.

g. For communal heat networks, the CO_2 emission factors and primary energy factors that are used to calculate the dwelling emission rate and dwelling primary energy rate should be calculated as follows.

The primary energy factor for heat output should be calculated as: $1/H \times (F \times PE_F - E \times PE_E)$

where:

H is the useful heat (excluding heat rejected) in kWh

F is the fuel input in kWh

PE_F *is the primary energy factor for the input fuel in* kWh_{PE}/kWh *E is the electricity production from the scheme in kWh*

PE_E *is the primary energy factor for district heat CHP generated electricity in* kWh_{PE}/kWh.

The CO_2 emission factor for the heat output should be calculated as:

$1/H \times (F \times CO_{2F} - E \times CO_{2E})$

where:

H is the useful heat (excluding heat rejected) in kWh F is the fuel input in kWh

CO_{2F} is the emission factor for the input fuel in $kgCO_2/kWh$ E is the electricity production from the scheme in kWh

CO_{2E} is the emission factor for district heat CHP generated electricity in $kgCO_2/kWh$.

h. The dwelling primary energy rate and dwelling emission rate submitted to the building control body should be accompanied by a report, signed by the body responsible for the operation of the district heat network and a suitably qualified person, detailing how the CO_2 emission factors and primary energy factors were derived.

Swimming pool basins

2.11 When determining the dwelling primary energy rate, the dwelling emission rate and dwelling energy use intensity for a dwelling with a swimming pool, the thermal performance of the pool basin should not be included in the calculation. Instead, the dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity should be calculated as if the area covered by the pool were replaced with the equivalent area of floor with the same U-value as the pool surround.

Party walls

2.12 When calculating the dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate, one of the following should be followed.

a. If the approved methodology used in the calculation of the dwelling emission rate and dwelling primary energy rate is the Standard Assessment Procedure (SAP) version 10.3, use the values given in section 3.7 of the SAP version 10.3.

b. If the approved methodology used in the calculation of the dwelling emission rate and dwelling primary energy rate is the Home Energy Model (HEM), the HEM condition for the party wall should be selected from Table 2.1 for the type of construction adopted.

Table 2.1 HEM condition for party walls[1]

Party wall construction	HEM condition
Solid	No heat loss
Unfilled cavity with no effective edge sealing	Heat loss
Unfilled cavity with effective sealing around all exposed edges and in alignment with insulation layers in abutting elements[2]	Heat loss
Unfilled cavity with effective sealing around all exposed edges and in alignment with insulation layers in abutting elements for a concrete frame construction in a building containing flats [2, 3]	No heat loss
A fully filled cavity with effective sealing at all exposed edges and in line with insulation layers in abutting elements[2, 3]	No heat loss

Notes:

1. For the above purposes, a party wall is a wall between the dwelling and another heated space (for example another dwelling or a shared corridor in a building containing flats).
2. It is necessary to show that the edge sealing design adopted is likely to be robust under normal site conditions.
3. In concrete framed construction, walls can be sealed by abutting to the above slab.

Taking account of internal lighting when calculating dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity

2.13 The calculations of dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity should account for the efficacy of light sources installed in the fixed lighting locations.

Achieving the target primary energy rate, target emission rate, target energy use intensity and target fabric performance values

2.14 Provided the dwelling satisfies the minimum standards for fabric elements set out in **Section 3**, the target primary energy rate, target emission rate and target energy use intensity can be achieved by using any combination of the following.

a. fabric energy efficiency
b. efficient building services/systems
c. low and zero carbon technologies (including renewable energy generation) integrated in an appropriate mix.

2.15 The target fabric performance values can only be achieved through fabric energy efficiency as set out in **section 3**.

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Requirement L1(a): Limiting heat gains and losses

This Approved Document deals with the requirements of Part L1 of Schedule 1 to the Building Regulations 2010.

Requirement	Limits on application
Schedule 1 – Part L Conservation of fuel and power and the minimisation of greenhouse gas emissions **L1. Reasonable provision shall be made for the conservation of fuel and power and the minimisation of greenhouse gas emissions in buildings by—** **(a) limiting heat gains and losses–** **(i) through thermal elements and other parts of the building fabric; and** **(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;** (b) providing fixed building services which– (i) are energy efficient; (ai) minimise greenhouse gas emissions; (ii) have effective controls; and (iii)are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances. (c) for the purposes of this Part– "greenhouse gas" has the meaning given by section 37(1) of the Environment (Wales) Act 2016.	

Intention

In the Welsh Minister's view, Regulation L1(a) for new dwellings will be met where both of the following are achieved.

a. Limiting unwanted heat losses from the dwelling by meeting the standards for all of the following.
   i. the building fabric, including walls, floors, roof, windows and openings **paragraphs 3.1 to 3.3 and paragraphs 3.13 to 3.15.**
   ii. uncontrolled air loss – **paragraph 3.16.**
   iii. the pipework and services **paragraphs 3.18 to 3.22 and paragraphs 3.24 to 3.33.**
b. Limiting unwanted heat gains to the dwelling, throughout the year, through any of the routes listed in (a) above as set out in **Section 34**.

In the Welsh Minister's view, Regulation L1(a) for existing dwellings will be met by meeting the standards in **paragraphs 3.8 to 3.10** and **Sections 10, 11** and **12**.

Regulation 25C(b) and 26B

Regulation 25C (b) – New Buildings: Minimum energy performance requirements
Minimum energy performance requirements must be approved by the Welsh Ministers, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, for-
new dwellings, in the form of target fabric performance values.

Regulation 26B – Fabric performance values for new dwellings
Where a dwelling is erected, it must not exceed the target fabric performance values for the dwelling which have been approved pursuant to regulation 25C (b), applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24.

Intention

In the Welsh Minister's view, Regulation 25C(b) and 26B will be met where the new dwelling meets or is better than the worst acceptable fabric values set out in **paragraph 3.7 Table 3.1.**

Section 3

Limiting heat losses and gains, and target fabric performance values

U-values

3.1 U-values should be assessed using the methods and conventions set out in the Building Research Establishment's BR 443. U-values should be assessed for the whole fabric element (e.g. in the case of a window, the combined performance of the glazing and the frame).

New Dwellings

3.2 For new dwellings, the U-value of a window or door should be determined using one of the following.

a. Measured using the hot-box method set out in BS EN ISO 12567-1 for windows or doors, and in BS EN ISO 12567-2 for roof windows.

b. Calculated using the actual size and configuration of the window in line with **BS EN ISO 10077-1** and **BS EN ISO 10077-2**.

3.3 For new dwellings, determination of a window or door U-value is to *include* all of the following where present.

a. Actual frame sections, e.g. different width outer frames.

b. Sills/thresholds.

c. Add-ons/frame extenders (any additional non-structural element that extends the size of the frame), e.g. 15mm, 30mm etc.

d. Dummy sashes (non-opening sash/vent fixed in place)

e. Dummy transoms/mullions

f. Decorative glazing bars within the glazing unit cavity, e.g. Georgian bars/duplex, both internal.

g. Non dead-load-bearing coupling components, e.g. PVC H-coupler.

For new dwellings, determination of a window or door U-value is to *exclude* the following where present.

h. Any dead-load-bearing component items, e.g. bay poles.

Existing dwellings

3.4 For existing dwellings, the U-value of a window should be determined using one of the following.

a. Calculated using the actual size and configuration of the window.

b. Calculated for a standard window 1.23m (±25%) wide × 1.48m (±25%) high and for the actual configuration of the window.

c. Calculated for a standard window 1.23m (±25%) wide × 1.48m (±25%) high and for one of the following standard configurations.

   i. For a casement window: a central vertical divider with one opening light and one fixed light.

   ii. For a vertical sliding sash window: a central horizontal divider with two opening lights.

   iii. For a roof window: no divider.

d. Measured using the hot-box method set out in **BS EN ISO 12567-1** for windows and in **BS EN ISO 12567-2** for roof windows.

e. Taken from the default values in the Standard Assessment Procedure, version 10.3, Table 6e.

3.5 For existing dwellings, the U-value of a door should be determined using one of the following.

a. Calculated using the actual size and configuration of the door.

b. Calculated using one of the following standard sizes.

   i. 1.23m (±25%) wide × 2.18m (±25%) high, for doors ≤ 3.6m2.

   ii. 2.00m (±25%) wide × 2.18m (±25%) high, for doors > 3.6m2.

Note: *When a single U-value is calculated for a product range of doors, the configuration of door chosen for the calculation should be the worst performing in the product range.*

c. Measured using the hot-box method in **BS EN ISO 12567-1**.

d. Taken from the default values in the Standard Assessment Procedure, version 10.3, Table 6e.

3.6 To correctly assess whether an element meets the limiting U-value, the U-value must be calculated for the element in the appropriate plane – horizontal or vertical. For windows and roof windows, U-values should be calculated based on a vertical position. For rooflights, U-values should be calculated based on a horizontal position. If the data available is for the element in the incorrect plane, it should be adjusted according to the guidance in the Building Research Establishment's BR 443.

Note: *Paragraph 3.6 does not apply to Home Energy Model or Standard Assessment Procedure calculations, where the U-value of each element is calculated based on the plane in which it is constructed or installed.*

Target performance values in new dwellings

3.7 For a new dwelling, it must be demonstrated that the target fabric performance values have been met. The calculated fabric performance values for the new dwelling must be entered into the approved methodology. For new dwellings, in order to demonstrate compliance with regulation 26B, the fabric performance values must be as good as or better than the worst acceptable values set out in Table 3.1.

Limiting standards in existing dwellings

New and replacement elements in existing dwellings

3.8 New fabric elements in existing dwellings (such as those constructed as part of an extension) should meet the limiting standards in Table 3.1.

3.9 The U-value of a replacement fabric element in an existing dwelling should both:

a. be no worse than that of the element being replaced

b. meet the limiting standards in Table 3.1.

3.10 Guidance on when a new element must meet the standards in Table 3.1 is given in Section 10. Elements that should meet the standards include both of the following.

a. Elements in extensions to existing dwellings.

b. New or replacement elements in existing dwellings.

3.11 If windows or fully glazed external pedestrian doors cannot meet the requirements of Table 3.1 because of the need to maintain the character of the building, as set out in paragraph 0.8, one of the following should be met.

a. These fittings should not exceed a centre pane U-value of 1.2W/(m^2·K).

b. Single glazing should be supplemented with low-emissivity secondary glazing.

Renovated and retained elements

3.12 Further guidance for existing dwellings in relation to renovated and retained thermal elements, extensions and consequential improvements is given in **Sections 10, 11** and **12**.

Table 3.1 Worst acceptable fabric performance values

Element type	Maximum U-value W/(m².K)[1]	
	In new dwellings	In existing dwellings
Roofs[2]	0.13	*0.13*[11]
Wall – Dwelling Houses	0.18	*0.18*[13]
Wall – Flats	0.21	*0.21*
Floor	0.15	*0.15*[10,12]
Party wall	0.20	*0.20*
Swimming pool basin[3]	0.25	*0.25*
Window or roof window [4,5]	1.4	*Refer to Table 11.1*
Roof-light [6,7]	2.2	*Refer to Table 11.1*
Doors: >60% internal face glazed All other doors	 1.4 1.4	*Refer to Table 11.1*
Air Permeability	8.0 m³/ (h·m2)@50Pa OR 1.57m³/(h·m2)@4Pa	*N/A*

Notes:

1. Area-weighted average values (except for windows, doors, roof windows and rooflights in existing dwellings).

2. For dormer windows, 'roof' includes the roof parts of the windows, and 'wall' includes the wall parts (cheeks).

3. The U-value of a swimming pool basin (walls and floor) calculated according to **BS EN ISO 13370**.

4. If other performance needs (e.g. wind load, safety, security or acoustic attenuation) requires thicker glass to be used, an equivalent window unit with standard thickness glazing should be shown to meet the required standard.

5. Including roof windows and curtain walling

6. U-values for rooflights or rooflight-and-kerb assemblies should be based on the developed surface area for the rooflight (U_d-values), which is often greater than the area of the roof opening. Further guidance on U_d-values is given in the Building Research Establishment's BR 443 and the National Association of Rooflight Manufacturers' Technical Document NTD02.1.

7. The limiting value for rooflights also applies to kerbs that are supplied as part of a single rooflight-and-kerb assembly sourced from the same supplier and for which the supplier can provide a combined Ud-value for the assembly. An upstand built on site should exceed a U-value of 0.35W/(m^2·K).

8. The methods for calculating Window Energy Rating and Doorset Energy Rating are set out in the Glass and Glazing Federation's Glazing Manual Data Sheet 2.3, Guide to the Calculation of Energy Ratings for Windows, Roof Windows and Doors.

9. For external fire doorsets, as defined in Appendix A of Approved Document B, Volume 1, a maximum U-value of 1.8W/(m2·K) is permissible.

10. The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged dwelling.

11. If there are problems with the load-bearing capacity of the frame or height of the upstand, for a flat roof or roof with integral insulation, a lesser standard may be appropriate.

12. If meeting such a standard would create significant problems in relation to adjoining floor levels, a lesser standard may be appropriate.

13. If, due to boundary constraints, meeting such a standard would reduce the internal floor area of the bounded room by more than 5%, a lesser thermal performance may be appropriate, provided the wall achieves the best practicable thermal performance.

Continuity of insulation

3.13 Gaps in insulation can have a significant impact on heat loss and thermal bypass and create a risk of condensation and mould. The building fabric should be constructed so that the insulation is reasonably continuous across newly built elements. To ensure continuity of insulation in new dwellings, the applicable guidance in **Appendix F** should be followed.

Thermal Bridging

3.14 Thermal bridges occur when an area of a building has significantly higher heat transfer than the surrounding parts. Breaks in insulation, reduced insulation or more conductive materials can contribute to thermal bridge effects. The building fabric should be constructed so that thermal bridging, including at the party wall, is reasonably limited.

3.15 To limit thermal bridging in new and existing dwellings, the applicable guidance in **Appendix G** should be followed.

Airtightness in new dwellings

3.16 For a new dwelling, the minimum standard for air permeability is given in Table 431. When carrying out work in new dwellings, care should be taken to reduce unwanted heat loss through air infiltration. To ensure airtightness in new dwellings, the applicable guidance in **Appendix H** should be followed.

Airtightness in existing dwellings

3.17 When carrying out work in existing dwellings, care should be taken to reduce unwanted heat loss through air infiltration by doing all of the following.

a. When installing pipework or services, taping and sealing around service penetrations.

b. When installing or renovating thermal elements, the element being installed should be draught-proofed, and air-leakage gaps should be filled.

c. When installing windows, roof windows, rooflights or doors (all of which are controlled fittings), the controlled fitting should be well fitted and reasonably draught-proof.

Note: *Particular attention should be paid to Approved Document F and Approved Document J when making an existing dwelling more airtight.*

Limiting heat losses and gains from building services

Hot water and heating pipework

Note: *In dwellings with low levels of fabric heat loss, including new dwellings, heat lost from pipework and hot water storage vessels may lead to overheating in the summer. Where overheating may be a risk, it is recommended that greater levels of insulation than given in paragraphs 3.25 to 3.34 are installed where practical.*

3.18 In a new system, all of the following new pipework should be insulated. This includes where pipework passes through a void outside the heated living space, such as a roof void or ground floor void.

a. All primary circulation pipework for both of the following.
   i. Heating circuits where pipework extends outside the heated living space.
   ii. Domestic hot water systems.

b. All hot water pipework connected to a hot water storage vessel. This includes pre-plumbed pipework. The insulation should extend to the greater of the following.
   i. The point at which the pipework first meets a building element (i.e. a wall, ceiling or floor).
   ii. At least 1m from the point at which the pipework connects to the hot water storage vessel.

c. All secondary circulation pipework for a domestic hot water system.

Note: *For minimum standards for insulation of district and communal heating see paragraphs 3.28 to 3.31.*

3.19 Any primary circulation pipework for heating or domestic hot water which passes through the thermal envelope should meet all of the following.

i. Outside the thermal envelope, insulation should be continuous up to the thermal envelope.

ii. Inside the thermal envelope, insulation should be continuous up to the thermal envelope.

iii. Interruptions to the thermal envelope should be as few as possible. Any interruptions should be airtight.

3.20 All pipework insulation should be reasonably continuous, including at bends, T-branches, wall brackets and around any obstructions including valves.

3.21 Refrigerant pipework for heat pumps in dwellings should be fully insulated. Refrigerant pipework should be insulated in accordance with paragraphs 3.18 to 3.20.

3.22 For new dwellings, heat pumps which serve individual dwellings should be located as close to the dwelling as practical and meet all of the following

a. Minimise the length of pipework required between the heat pump and dwelling
b. Ensuring sufficient airflow
c. Meeting requirements for safe operation
d. Allowing access for servicing.

Heat pumps that are part of a communal heat network should be located as close as practical to the building to minimise the length of pipework between the heat pump and the dwelling.

3.23 In an existing system, when a heating appliance or hot water storage vessel is replaced, all accessible pipes in the dwelling should be insulated as described in paragraphs 3.18 to 3.19.

3.24 Heat losses from insulated pipework should not exceed those given in **BS 5422** for base level thickness of insulation for hot water services at 60°C, regardless of the actual design temperature. Meeting the standards in Table 3.2 is one way of demonstrating that heat losses will not exceed those given in **BS 5422**.

Note: ***BS 5422*** *provides base level thicknesses and enhanced level thicknesses of insulation for domestic hot water and heating services. Adopting enhanced level thicknesses is encouraged where feasible to further reduce heat losses from hot water and heating pipework.*

Table 3.2 Minimum thicknesses of pipework insulation for hot water services and space heating applications

Nominal internal pipe diameter (mm)	Minimum insulation thickness[1] (mm) for low temperature hot water systems
Less than or equal to 25	20
Greater than 25 and less than or equal to 100	24
Notes: 1: Thicknesses apply for insulation with a thermal conductivity of 0.035W/m.K or better. For other circumstances consult **BS 5422**.	

Hot water storage vessels

3.25 Hot water storage vessels should comply with the following.

a. Copper hot water storage combination units should comply with **BS 3198**.
b. Vented cylinders should comply with the heat loss and heat exchanger requirements of **BS 1566-1** or **BS EN 12897** as appropriate.
c. Unvented hot water storage system products should comply with **BS EN 12897**.

3.26 Primary storage systems should meet the insulation requirements of the Hot Water Association's 'Performance Specification for Thermal Stores'.

3.27 Vessels that store heated water for a heating or domestic hot water system should have standing losses that do not exceed the heat loss given in Table 3.3.

Table 3.3 Maximum daily heat loss for a hot water storage vessels in dwellings(1)

Nominal volume (litres)	Heat loss (kWh/24h)	Nominal volume (litres)	Heat loss (kWh/24h)
50	1.03	400	2.59
100	1.49	500	2.80
150	1.88	600	2.98
200	2.06	700	3.14
250	2.22	800	3.29
300	2.36	900	3.44
350	2.48	1000	3.57

Note:
1. For sizes of vessel not listed, the maximum daily heat loss from the hot water storage vessel should not exceed $(16.66 + (8.33 \times V^{0.4}))/1000 \div 24)$, where V is the volume in litres.

Heat networks

External pipework for district heat networks

3.28 For new dwellings connected to a district heat network, the pipework of the primary heat network up to the point of connection with the building should be designed according to the minimum requirements in CIBSE *CP1 Heat Networks: Code of Practice*.

3.29 Pipework for district heat networks should be insulated to meet either of the following.

a. the standards in **BS EN 253** for pre-insulated pipes

b. an equivalent performance for conventionally heated pipes.

3.30 Where pipework is run above ground, the performance of the pipe insulation should be at least as high as the insulating performance of pipework in the buried part of the system.

Internal pipework for district heat networks

3.31 For new buildings that contains multiple dwellings, the building heat distribution should be insulated. The insulation thickness for the building heat distribution system in Approved Document L, Volume 2 should be followed.

Note: Where the building heat distribution system is external, paragraphs 3.28 to 3.30 should be followed

Heat interface units

3.32 In new dwellings, heat loss from the heat interface unit should not exceed 1.0 kWh/day, tested in accordance with the regime set out in CIBSE *CP1 Heat Networks: Code of Practice.*

3.33 Hot water storage vessels connected to a heat interface unit for a heating or domestic hot water system should have standing losses that do not exceed the heat losses given in Table 3.3.

Section 3

Requirement L1(b)(i), (ii), (iii) and L2: Fixed building services' energy efficiency and controls and on-site generation of electricity

This section deals with the requirements of Part L1(b)(i), (ii) and L2 of Schedule 1 to the Building Regulations 2010.

Schedule 1 – Part L Conservation of fuel and power and the minimisation of greenhouse gas emissions

L1. Reasonable provision shall be made for the conservation of fuel and power and the minimisation of greenhouse gas emissions in buildings by—

(a) limiting heat gains and losses–

(i) through thermal elements and other parts of the building fabric; and

(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;

(b) providing fixed building services which–

(i) are energy efficient;

(ai) minimise greenhouse gas emissions

(ii) have effective controls; and

(iii) are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances.

On-site generation of electricity

L2. Where a system for on-site electricity generation is installed—

(a) reasonable provision must be made to ensure that—

(i) the system and its electrical output are appropriately sized for the site and available infrastructure;

(ii) the system has effective controls; and

(b) it must be commissioned by testing and adjusting as necessary to ensure that it produces the maximum electricity that is reasonable in the circumstances.

On-site installation of renewable electricity generation	***Limits on application***
L2A (1) When a dwelling or a building containing a dwelling is erected, a system for renewable electricity generation must be installed on-site. (2) The system installed under sub-paragraph (1) must be– (a) designed to enable any electricity generated by it to be available for the use of residents of the buildings, and (b) capable of generating a reasonable output taking into account the design of the buildings and its surroundings.	Requirement L2A does not apply to– (a) a building which is a relevant building within the meaning of regulation 7(4); or (b) a building on which it is not possible to install a system for renewable electricity generation capable of generating a reasonable output on account of its design or surroundings.

Intention

In the Welsh Minister's view, requirements L1(b)(i),(ai), (ii), (iii) and L2 are met in a new dwelling by achieving all of the following.

a. Fixed building services that both:
   i. meet the minimum efficiencies in **Section 5**.
   ii. are appropriately sized, following paragraphs 4.9 to 4.10 and 4.12 to 4.15.

b. Controls to fixed building services are provided that both:
   i. meet the general controls for heating and hot water systems in paragraphs 4.16 to 4.24
   ii. meet the system specific controls in **Section 5**.

c. Any on-site electricity generation is both appropriately sized and has controls.

In the Welsh Ministers' view, requirement L2 is met, when a dwelling is erected, by following the guidance in paragraphs 4.68 to 4.79.

Requirement L2 does not apply to a building which is a relevant building for the purposes of regulation 7(4) of the Building Regulations 2010.

Requirement L2 does not apply to a building on which it is not possible to install a system for on-site renewable electricity generation capable of generating a reasonable output, taking account of the building's design and surroundings. The guidance in paragraphs 4.73 and 4.74 describes the reasonable output.

In the Welsh Minister's view, requirements L1(b)(i), (ii), (iii) and L2 are met in an existing dwelling by achieving all of the following.

a. Fixed building services that both:
   i. meet the minimum efficiencies in **Section 5** and the criteria in paragraphs 4.5 and 4.6
   ii. are appropriately sized, following paragraphs 4.9 to 4.14.

b. Any fixed building services installed have controls that both:
   i. meet the standards for general controls for heating and hot water systems in paragraphs 4.17 to 4.29
   ii. meet the standards for system specific controls in **Section 5**.

c. Any on-site electricity generation provided is both appropriately sized, following paragraph 4.8, and has controls.

In the Welsh Ministers' view, requirement L2A is met, when a dwelling is erected, by following the guidance in paragraphs 5.69 to 5.78. Requirement L2A does not apply to a building which is a relevant building for the purposes of regulation 7(4) of the Building Regulations 2010. Requirement L2A does not apply to a building on which is it not possible to install a system for on-site renewable electricity generation capable of generating a reasonable output taking account of the building's design and surroundings. The guidance in paragraphs 4.73 and 4.74 describes the reasonable/equivalent output.

Section 4

Carbon and energy performance of building services – general guidance

New building services

4.1 For each new fixed building service in a new or existing dwelling, the efficiency of the service should be no lower than the value set out in **Section 5.** If a proposed service is not covered in **Section 5**, it should be demonstrated that it is no less efficient than a comparable service that is covered.

4.2 Both of the following apply to the efficiency claimed for a fixed building service.

a. The efficiency should be based on the appropriate test standard set out in **Section 5**.
b. The test data should be certified by a conformity assessment body accredited by UKAS to carry out this work.

New building services in new dwellings

4.3 For heating and hot water systems in new dwellings, paragraphs 4.9 to 4.10, 4.12 to 4.15 and 4.16 to 4.24 should be followed, in addition to system specific guidance in **Section 5.**

4.4 For heating and hot water systems in new dwellings one of the following should apply for all services:

a. The service is limited to using fuels that meet both of the following:
   i. A CO_2 emissions factor, as listed in the Part L 2026 notional dwelling of less than or equal to 0.086 $kgCO_2/kWh$
   ii. A primary energy factor, as listed in the Part L 2026 notional dwelling of less than or equal to 1.969 kWh_{PE}/kWh.

b. The service is provided by a district heat network.

Note: *If a heating or hot water system is able to use more than one type of fuel, then the assessment in paragraph 4.4(a) should be made using the fuel with the greatest emissions factor.*

Replacement building services in existing dwellings

4.5 A replacement fixed building service should be at least as efficient as the value set out in **Section 5** and should comply with either of the following:

a. If the service uses the same fuel as the service being replaced, it should have an efficiency that is not lower than that of the service being replaced
b. If the service uses a different fuel than the service being replaced, it should both:
   i. not produce more CO_2 emissions per kWh of heat than the service being replaced
   ii. not have a higher primary energy demand per kWh of heat than the service being replaced.

Note: *If the efficiency of the appliance being replaced is not known, the Standard Assessment Procedure version 10.3, Tables 4a and 4b, should be used but with no adjustments from Tables 4c and 4d.*

Note: *CO_2 emission factors and Primary Energy Factors should be taken from the Standard Assessment Procedure version 10.3, Table 12.*

Note: Where a heat pump is installed which meets the minimum efficiency standards in this Approved Document, it should be deemed to be compliant with paragraph 4.5, without the need to carry out this calculation.

Worked example:

Replacing an old oil-fired boiler that has emissions of 0.298kgCO2/kWh and primary energy of 1.180kWhPE/kWh at 85% efficiency with an LPG boiler that has emissions of 0.241kgCO2/kWh and primary energy of 1.141kWhPE/kWh at 93% efficiency.

CO_2 emissions

Oil-fired boiler: 0.298/0.85 = 0.35 kgCO_2/kWh
LPG boiler: 0.241/0.93 = 0.26 kgCO_2/kWh

Primary energy

Oil-fired boiler: 1.180/0.85 = 1.39kWh$_{PE}$ /kWh
LPG boiler: 1.141/0.93 = 1.23kWh$_{PE}$ /kWh

The new LPG boiler has both lower CO_2 emissions and lower primary energy than the oil-fired boiler being replaced, and therefore complies with paragraph 4.5. The new boiler is also at least as efficient as the minimum efficiency set out in Section 5.

4.6 Where a replacement fixed building service uses a different fuel than the service being replaced in a home with very low heat loss, a higher primary energy demand for the new heating appliance may be acceptable. For example, a higher primary energy demand may be acceptable when replacing a gas boiler with direct electric heaters as part of a deep retrofit project, where the resulting heat loss of the dwelling is less than 25kWh/m2 per year.

4.7 Facilitating future connection to a district heat network should be considered - for example by providing capped off connections in pipework to allow later connection to a local district heat network).

Replacing on-site electricity generation in existing dwellings

4.8 If renewable technology such as a wind turbine or photovoltaic array is replaced, the new system should have a kWp capacity that is at least that of the original installation. For further guidance on replacing on-site electricity generation systems, see **Section 5**.

Sizing heating systems

Sizing space heating systems in new and existing dwellings

4.9 The size of space heating systems should be designed using both of the following.

a. The heat loss calculation in **BS EN 12831-1** for the dwelling.
b. A sizing methodology that takes account of the properties of the dwelling.

Systems should not be oversized.

Note: *Guidance for the appropriate design and sizing of different types of space heating system, in line with paragraph 4.9(a), is produced by a number of technical and professional bodies. These include the Chartered Institute of Plumbing and Heating Engineering, the Chartered Institution of Building Services Engineers, the Heat Pump Association and the Microgeneration Certification Scheme.*

Note: *When installing a new heating system including the heating appliance and/or emitters, a room-by-room heat loss calculation should be used. When only a heating appliance is being replaced, a whole dwelling heat loss calculation is appropriate. Sizing a replacement heating appliance using the heat output of the currently installed appliance is not appropriate*

4.10 Where a wet heating system is either:

a. newly installed or
b. fully replaced, including both the heating appliance, emitters, and associated pipework

all parts of the system (including pipework and emitters) should be sized to allow the space heating system to operate effectively and in a manner that meets the needs of the dwelling, at a maximum flow temperature of 45°C or lower.

In existing dwelling, where it is not technically or functionally feasible to install a space heating system which can operate at a maximum flow temperature of 45°C (for example, where there is not enough space for larger radiators, or the existing distribution system receives higher temperature heat from a low carbon district heat network), the space heating system should be designed to the lowest design temperature that will meet the heating needs of the dwelling.

Note: *Low temperature requirements apply to space heating only. Further guidance can be found in the Building Research Establishment's FB 59 Design of Low-temperature Domestic Heating Systems.*

4.11 In existing dwellings, where a gas combination boiler is used, the boiler type should be selected to modulate down to the typical mid-season heating load of the dwelling.

Sizing heat pump heating systems

4.12 Reversible heat pump systems (i.e. those that provide both cooling and heating) should be designed to be optimised for heating in most circumstances. A primary heating system containing heat pumps, i.e. heat pump only systems and hybrid systems, should be selected to meet the full space heating requirement at the design condition chosen for heat loss calculations in paragraph 4.9. It should not be assumed that any heat will be supplied by additional secondary heaters to meet the calculated design demand of a dwelling.

4.13 The space heating flow temperature of the heat emitter circuit(s) should be designed to optimise efficiency of the heat pump.

4.14 Air source heat pump systems should be inverter driven and selected to modulate to the typical mid-season heating load of the dwelling.

Sizing domestic hot water systems

Note: *For temperature limits to control legionella in domestic hot water systems, see **Approved Document G**. Guidance on commissioning hot water storage vessels can be found in **Section 7**.*

4.15 Domestic hot water systems should be sized for the anticipated demand for domestic hot water in the dwelling, based on BS EN 12831-3. Systems should not be significantly oversized.

Note: *The following design guides can be used to carry out this calculation.*

a. The Chartered Institution of Building Services Engineer's Domestic Heating Design Guide.

b. The Chartered Institute of Plumbing and Heating Engineering's Plumbing Engineering Services Design Guide – Heating and hot water systems design.

Controls for heating and domestic hot water systems

System controls and zoning

4.16 For wet heating systems in new dwellings with a floor area of 150m^2 or greater, a minimum of two independently controlled heating circuits should be provided.

4.17 System controls should be wired so that when there is no demand for space heating or hot water, the heating appliance and pump are either of the following.

a. Switched off.
b. Set back to a reduced output temperature.

4.18 Domestic hot water circuits that are supplied from a hot water store should have both of the following.

a. Time control which is independent of space heating circuits.
b. Electronic temperature control

4.19 Primary hot water circuits for domestic hot water or heating should have fully pumped circulation where this is compatible with the heat generator.

4.20 Wet heating systems should ensure a minimum flow of water to avoid short-cycling.

4.21 For space heating systems, temperature control should be installed for the heating appliance.

Thermostatic room controls

4.22 For heating systems in new dwellings, or when a heat generator such as a boiler is replaced in an existing dwelling, each room should be provided with thermostatic room controls. These controls should be able to separately adapt the heating output in each room served by the heating appliance, or, where justified in accordance with paragraph 4.23, in each heating zone.

Note: *There is no need to install thermostatic room controls in rooms/zones without heating in new or existing dwellings.*

Note: *Installing thermostatic room controls may not be technically feasible in some cases. These may include the following.*

a. Dwellings with low heat demand (e.g. less than 10W/m^2).
b. Dwelling with buffer zones for heat absorption or dissipation with high thermal mass.

4.23 It may be justified to control a heating zone rather than individual rooms in either of the following cases.

a. In single-storey open-plan dwellings in which the living area is greater than 70% of the total floor area. In such cases, the dwelling should be considered as one heating zone.
b. Where two adjacent rooms have a similar function and heating requirements (e.g. kitchen and utility room). In such cases, the adjacent rooms should be considered as one heating zone.

Note: *For exhaust air heat pump systems, which extract heat from the exhaust air of a dwelling, it may not be necessary to provide independent thermostatic control to individual rooms. Providing room/ zone control on this type of system is unlikely to be economically and/or technically viable. However, other space heating systems also in*

use in the same dwelling should be controlled using thermostatic room controls as described above.

Note: *Commissioning heating systems is covered in* ***Section 7***.

4.24 The standards in paragraphs 4.22 and 4.23 may be satisfied by providing any of the following.

a. Both of the following.
   i. A thermostat in a room that the heating circuit serves.
   ii. An individual thermostatic room control for each heat emitter, such as a thermostatic radiator valve, on all heat emitters outside the room which contains the thermostat. Thermostatic radiator valves should not be used in the same room as the thermostat. Heat emitters in the same room as the thermostat should have manual controls.

b. An individual room/heating zone thermostat or fan coil thermostat for each room/heating zone.

c. An individual networked heat emitter control for each emitter.

Controls in existing heating and domestic hot water systems

4.25 In addition to paragraphs 4.22 to 4.24, work on existing systems should incorporate the controls detailed in paragraphs 4.26 to 4.29.

4.26 If domestic hot water and space heating are controlled by a single time controller in the existing system, then these may continue to be controlled together after the work is complete. Otherwise, domestic hot water and space heating should each have separate time controls.

4.27 If work is carried out on a system which includes a boiler, a boiler interlock should be installed.

4.28 If a hot water storage vessel is replaced, the replacement hot water storage vessel should have an electronic temperature control, such as a cylinder thermostat.

4.29 If a boiler is replaced, the boiler controls should meet the standards in **Section 5** for the relevant wet heating system. (Boiler controls are considered to be part of the boiler installation.)

Smart meter readiness of new dwellings

Note: *It is recommended that new dwellings are designed and constructed to enable the installation and commissioning of smart meters. For good practice, see DESNZ guidance: Guidance on designing and constructing new builds to be smart-meter-ready.*

Section 5

Carbon and energy performance of building services - system specific guidance

Note: *This section sets out minimum Building Regulations standards for fixed building services and other systems. Best practice is to achieve higher efficiencies than these minimum standards.*

Note: *The Ecodesign for Energy-Related Products Regulations 2010 set the efficiencies and standards that must be met when introducing new energy-using products to the market. This approved document sets standards that should be met when installing fixed building services or on-site electricity generation. In cases where the Energy-Related Products Regulations and the Building Regulations both apply, both standards should be met.*

Heat pump heating systems

Note: *For heat pumps that provide comfort cooling, guidance is also given in paragraphs 5.48 to 5.52.*

5.1 All heat pumps should meet Ecodesign product regulations. The applicable Ecodesign Regulations for different types of heat pump and uses are set out in Table 5.1.

Note: *Table 5.1 references domestic size heat pumps. For larger heat output heat pumps and heat pumps used for domestic hot water heating only see **Section 5** of Approved Document L, Volume 2: Buildings other than dwellings.*

Table 5.1: Ecodesign Regulations applicable to different types of heat pump

Heat pump type	Use	Output (kW)	Reversible	Applicable Ecodesign regulation
Air-to-water, including exhaust air-to-water	Space heating or combined space and water heating	≤ 400 kW	Reversible and non-reversible	No. 813/2013
Ground source	Space heating or combined space and water heating	≤ 400 kW	Reversible and non-reversible	No. 813/2013
Water source	Space heating or combined space and water heating	≤ 400 kW	Reversible and non-reversible	No. 813/2013
Air-to-air	Heating products with no cooling function	≤ 12 kW	Non-reversible	No. 206/2012
Air-to-air, including exhaust air-to-air	Air heating products, cooling products, high temperature process chillers, fan coil units	> 12 kW and ≤ 1000 kW	Reversible and non-reversible	No. 2016/2281
All types	Domestic hot heating water only	≤ 400 kW	-	No. 814/2013

5.2 The heat pump unit should include all of the controls applicable to that type of heat pump set out in Table 5.2.

Table 5.2 Minimum requirements for controls for different types of heat pump units in new and existing dwellings

Heat pump type	Minimum requirements for controls
All types	a. Heat pumps should meet the general requirements for heating and hot water systems in Section 4. b. Additional controls should be designed to enhance functionality without reducing the capabilities of the original equipment manufacturer controls, including modulation.
Air-to-water	a. To protect against air flow failure. b. To control outdoor fan operation. c. To provide a defrost control for the external air-side heat exchanger. d. To control internal water pump operation. e. To control water temperature for the distribution system.
Air-to-air	a. To protect against air flow failure. b. To control outdoor fan operation. c. To provide a defrost control for the external air-side heat exchanger. d. To control secondary heating (if fitted). e. To control air temperature.
Ground-to-air and water-to-air	a. To protect against water flow failure. b. To control external water pump operation. c. To control air temperature.
Ground-to-water and water-to-water	a. To protect against water flow failure. b. To control water pump operation (internal and external). c. To control water temperature for the distribution system.

5.3 The heat pump should have controls that include both of the following.

a. Weather compensation or internal temperature control.

b. A timer or programmer for space heating.

5.4 When a heat pump is installed in a dwelling in which other heat sources are available, all heat sources should be controlled by one control system.

5.5 Heat pumps should be located and installed in line with the manufacturer's guidance. For air source heat pumps, this includes considering factors that may adversely affect their performance, for example not recirculating cold exhaust air, and the removal of condensation from the outdoor coil during a defrost cycle.

5.6 Heat pumps should not be sited next to sleeping areas or on materials that readily transmit vibration. Also, external fans and heat pump compressors should be appropriately selected to minimise disturbance to neighbours while remaining in compliance with planning requirements.

5.7 Anti-vibration instruments and flexible hose connections should be installed in line with the manufacturer's guidance in order to limit the effects of harmful vibrations on building structures.

Gas-fired heating systems

5.8 A gas-fired heating system in an existing dwelling should meet both of the following:

a. The minimum efficiencies in Table 5.3.

b. The general requirements for heating and hot water systems in **Section 4**.

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Table 5.3 Minimum efficiencies for gas-fired heating systems in existing dwellings

System type	Minimum efficiency	Notes
Wet Heating (e.g. radiators or underfloor heating)	92% (as defined in ErP[1])	Or, in exceptional circumstances in existing dwellings SEDBUK 2009 efficiencies as follows[2]: • 78% for natural gas • 80% for LPG Follow paragraph 5.9.
Range cooker with integral central heating boiler	75% (as defined in SEDBUK 2009)	Follow paragraph 5.10.
Warm air heating	**BS EN 17082**	If a gas-fired circulator is incorporated for domestic hot water, its full and part load efficiency should meet **BS EN 15502-2**. Follow paragraph 5.11.
Independent space heating appliance for primary and secondary space heating	63% gross 70% net	Gross efficiency using the following standards as appropriate: • **BS EN 1266** • **BS 7977-1** • **BS EN 613** • **BS EN 13278** Follow paragraph 5.12.
Inset live fuel-effect combined fire/back boiler	45% for natural gas 46% for LPG	Gross efficiency using **BS 7977-2** Follow paragraph 5.13.
All types except inset live fuel-effect combined fire/back boiler	63% for natural gas 64% for LPG	Gross efficiency using **BS 7977-2** as appropriate.

Notes:

1. Energy-Related Products Directive. For Standard Assessment Procedure modelling, SEDBUK values should be used.
2. Exceptional circumstances are defined in the ODPM's *Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings*.

5.9 If a gas-fired combination boiler is installed in an existing dwelling, at least one of the following energy efficiency measures, appropriate to the system, should be installed.

a. Flue gas heat recovery.
b. Weather compensation.
c. Load compensation.
d. Smart thermostat (with remote access) with automation and optimisation.

5.10 A gas-fired range cooker with an integral central heating boiler (within a single appliance body) that is either part of a new system or is a replacement component in an existing system should have two independently controlled burners (one for the cooking function, and one for the boiler).

Note: *This paragraph does not apply to appliances with fully independent boiler and cooker parts within a shared case. In this case, the boiler should be treated in the same way as a conventional gas-fired boiler.*

5.11 If a gas-fired warm air system is installed in an existing dwelling, all the following should be met.

a. The system should be installed in accordance with **BS 5864.**
b. All new or replacement ductwork should be insulated in accordance with **BS 5422.**
c. Where controls are external to the heater, the system should be provided with a time switch/programmer and room thermostat, or programmable room thermostat.
d. Where controls are integrated in the heater, the system should be provided with a time switch/programmer and room temperature sensor linked to heater firing and fan speed control.
e. Independent temperature control of the hot water circuit should be implemented with a cylinder thermostat and a timing device. When there is no demand for hot water both the pump and circulator should switch off.

5.12 A gas-fired fixed independent space heating appliance that is installed in an existing dwelling, should meet the applicable standard(s) as follows:

a. an appliance for primary space heating should meet the standards i to iv below,
   i. **BS EN1266**
   ii. **BS 7977-1**
   iii. **BS EN 613**
   iv. **BS EN 13278**

b. an appliance for secondary space heating should meet one or more of the standards below:
   i. **BS EN1266**
   ii. **BS 7977-1**
   iii. **BS EN 613**
   iv. **BS EN 13278**
   v. **BS EN 14829**
   vi. **BS EN 449.**

5.13 If a gas fire is provided as a secondary heat source as part of a combined fire and back boiler unit in an existing system, the standards in **BS 7977-2** should be met.

5.14 If a gas-fired fixed decorative fuel-effect fire is installed in an existing dwelling, both of the following should apply:

a. the standards in **BS EN 509** should be met
b. There should be a maximum of one appliance per 100 m^2 of dwelling floor area.

Oil-fired heating systems

5.15 An oil-fired heating system in an existing dwelling should meet both of the following.

a. The minimum efficiencies in Table 5.4.
b. The general requirements for heating and hot water systems in **Section 4**.

Table 5.4 Minimum efficiencies for oil-fired heating systems in existing dwellings

System type	Minimum efficiency	Notes
Wet heating – regular boiler	91% (as defined in ErP[1])	Or, in exceptional circumstances[2] in existing buildings 84% (SEDBUK 2009).
Wet heating – combi-boiler	86% (as defined in SEDBUK 2009)	Or, in exceptional circumstances[2] in existing buildings 82%.
Range cooker with integral central heating boiler	80%	Follow paragraph 5.16.
Fixed independent space heating	60% (converted using Table E4 of the Standard Assessment Procedure version 10.3)	

Notes:

1. Energy Related Products Directive. For Standard Assessment Procedure modelling, SEDBUK values should be used.
2. Exceptional circumstances are defined in the ODPM's *Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings*.

5.16 An oil-fired range cooker with an integral central heating boiler (within a single appliance body) is part of a new system or replacement component in an existing dwelling, the appliance should have two independently controlled burners (one for the cooking function, and one for the boiler).

Note: *This paragraph does not apply to appliances with fully independent boiler and cooker parts within a shared case. In this case, the boiler should be treated in the same way as a conventional oil-fired boiler.*

5.17 If a continuously burning oil-fired vaporising appliance is provided for secondary heating or hot water, one of the following should be met, depending on the type of appliance.

a. For a manually operated appliance, no further control is required above the integral manual controls that the appliance manufacturer provided.
b. For an electrically operated appliances, an integral remote or thermostatic control should be provided.

Note: *This guidance does not apply to appliances that have been converted from another fuel.*

Electric heating systems

Note: *Electric resistance heating is assumed to be 100% efficient, therefore no minimum efficiency is set for these types of system. Electric radiant heating systems should not be assumed to have an efficiency greater than 100%.*

Note*: This section of the guidance does not cover either of the following.*

a. Electric heat pumps (guidance is provided in paragraphs 5.1 to 5.7).
b. Portable electric heating devices.

5.18 Electric heating systems should follow paragraphs 5.19 to 5.21, in addition to the general requirements for heating and hot water systems in **Section 4**.

5.19 For electric storage heaters, both of the following apply.

a. Automatic control of input charge should be provided.
b. The rate of heat release from the appliance should be adjustable, using an adjustable damper or other thermostatically controlled method.

5.20 For electric panel heaters that are either part of a new system or replacement components, time and temperature control should be provided to allow separate control for either of the following.

a. Each room.
b. Each appliance, where this meets the guidance for thermostatic room controls in paragraphs 4.22 to 4.24.

5.21 For an electric warm air system that is either a new system or is a replacement component, both of the following should be provided.

a. A programmable room thermostat or a time switch and room thermostat.
b. Separately controllable heating zones which meet the guidance for thermostatic room controls in paragraphs 4.22 to 4.24.

Solid fuel heating systems

5.22 Solid fuel appliances in new and existing dwellings should have a minimum efficiency (gross calorific value) as specified in Table 5.5 for the category of appliance.

5.23 A solid fuel appliance belonging to category D1/2/3/4, F, G2, J2 or J5 of Table 5.5, that is used to deliver primary heating as part of a central heating system should comply with all of the following.

a. Meet the general requirements for heating and hot water systems in **Section 4**.
b. Have separate time control for space heating and hot water circuits.
c. Have automatic control of the burning rate.
d. Follow the manufacturer's instructions on the size and position of heat leek radiators designed to keep the system operating effectively by leaking heat.

5.24 A solid fuel appliance that is either part of a new central heating system or is a replacement component of a central heating system should meet both of the following.

a. The appliance should be from categories D, F, G and J in Table 5.5.
b. The appliance should have a ratio of room heat to water heat appropriate for the room and the total property.

Table 5.5 Solid fuel appliance categories and minimum efficiencies

Category[1]	Appliance description	Minimum efficiency (gross calorific value)[2,3]	Feed-type
D1/2/3/4	Open fire and high output boiler	63%	Batch
E1/2/3	Dry room heater – wood or multi-fuel	65%	Batch/auto
E4	Dry room heater – pellet stove	65% part load 70% nominal load	Auto
F	Room heater with boiler	67% (mineral fuels and wood logs) 70% (wood pellets – part load) 75% (wood pellets – nominal load)	Batch/Auto
G1	Cooker without boiler not exceeding 3.5 kW	55% (wood fuels)	Batch
G2	Cooker without heating boiler exceeding 3.5 kW	60% (wood fuels)	Batch
J2	Independent boiler – wood logs only	75%	Batch
J5	Independent boiler – wood/pellets/chips	75% nominal load 70% part load	Auto

Notes:

1. Refers to the categories as set out in HETAS's document; *The HETAS guide to Approved Solid Fuel, Wood and Biomass Products and Services.*
2. Efficiencies are measured at normal rated output and based on a gross calorific value (this takes into account energy that will be lost as latent heat in water vapour during combustion). Efficiencies should be determined using the appropriate efficiency test method from British Standards.
3. Efficiencies based on net calorific value can be converted to efficiencies based on gross calorific value using the appropriate conversion factor in the Standard Assessment Procedure version 10.3, Table E4.

District heat networks and communal heat networks

5.25 Paragraphs 5.26 to 5.31 apply where work involves connecting dwellings to a district heat network or communal heat network that achieves both of the following.

a. Has a central source such as a boiler, combined heat and power unit, or heat pumps.
b. Distributes heat to six or more dwellings.

Connecting to a new communal heat network

5.26 The central heat source in a new communal heat network should comply with the standards in **section 5** of **Approved Document L, Volume 2, buildings other than dwellings**.

Note: *Where a district heat network or communal heat network connects to fewer than six dwellings, the central heat source should meet the standards in this Approved Document*

Minimising energy used by pumps

5.27 New district heat networks or communal heat networks should meet both of the following.

a. The design temperature difference for the primary circuit of the district heat network or communal heat network should be a minimum of 20°C. Heat pump-led district heat networks or communal heat networks may, however, need to run at a lower temperature difference.
b. Variable volume control systems should be used to reduce the volume of water and the pressure difference required from the pumps under part load.

Controls for district heat networks and communal heat networks

5.28 For wet heating systems, the maximum design flow rate from a district heat network or communal heat network into the dwelling's heating system or into the hydraulic break between the dwelling's heating system and the network should be limited by suitable control and balancing valves to maintain the overall balance in the network and avoid excessive pumping energy.

5.29 For new district heat networks or communal heat networks, the domestic hot water system should have variable volume controls to maintain low return temperatures in the primary circuit of the network.

Heat interface units and hot water storage in new dwellings

5.30 Where domestic hot water is stored (either centralised or in individual dwellings), heat exchange between the heat interface unit supply and the hot water storage vessel should be provide through a direct plate heat exchanger to minimise the return temperature of the water.

Note: *Heat interface units and any dedicated ancillary products such as hot water storage vessels should meet minimum standards in* ***Section 3 and 4*** *for domestic hot water and heating systems.*

Metering for district heat networks and communal heat networks

5.31 District heat networks and communal heat networks should be designed to accommodate heat meter(s) for each dwelling.

Micro combined heat and power systems

5.32 The heating plant emission rate of a micro combined heat and power system (micro-CHP) should be no greater than the emission rate of a regular boiler using the same fuel.

5.33 The heating plant emission rate should be calculated using all of the following.

a. The method in DEFRA's *Method to Evaluate the Annual Energy Performance of Micro-cogeneration Heating Systems in Dwellings*.
b. The performance data for the micro-CHP packaged according to **BSI PAS 67**.
c. A plant size ratio that uses the nominal heat output of the heating plant divided by the average heat loss of the building when there is a temperature difference of 24.2°C.

Underfloor heating systems

Note: *Guidance on underfloor heating systems can be found in **BS EN 1264** and **BS EN ISO 11855**.*

Zoning and Controls

5.34 In addition to meeting the general requirements for heating and hot water systems in **Section 4,** new underfloor heating systems should meet all of the following.

a. All underfloor heating systems should have controls to adjust the operating temperature.
b. Room thermostats for electric underfloor heating systems should have a manual override.
c. Heating systems for screed floors greater than 65mm thick should automatically reduce the room temperature at night or when the room is unoccupied.
d. Heat loss should be minimised by following the guidance in paragraphs 6.35 to 6.39.

Note: *Standards on thermostatic room controls in paragraphs 4.22 to 4.24 apply to underfloor heating.*

Minimising heat losses

5.35 Ground floors and those in contact with the outside of the dwelling should be insulated to limit downwards heat losses to not more than 10 W/m^2.

5.36 Floors with underfloor heating should be insulated to reduce downwards heat transmission, providing a thermal conduction resistance of at least 1.25 (m^2.K)/W, if they are installed directly above any of the following.

a. An unheated space.
b. An intermittently heated space.
c. The ground.

5.37 The intermediate floor should have a layer of insulation to reduce downwards heat transmission with a thermal resistance of one of the following.

a. The performance in paragraph 5.35.
b. Thermal resistance of either of the following
   i. For electric systems, not less than 0.5 (m^2.K)/W.
   ii. For wet systems, not less than 0.75 (m^2.K)/W.

5.38 Underfloor systems should be designed to account for the thermal resistance of floor coverings in order to provide the heat output required.

Note: *Guidance on thermal resistance of floor coverings can be found in the Contract Flooring Association's Beyond Installation: Guidance on Underfloor Heating and BEAMA's BEAMA guide on the use of floor coverings with underfloor heating (UFH) systems.*

5.39 Distribution pipework which does not provide useful heat to a room should be insulated to the standards of paragraph 3.24.

Specific standards for electric underfloor heating

5.40 Electric cables for underfloor heating installed within screeds should meet the following.

a. For direct electric systems, within screeds not exceeding 60mm.
b. For night energy storage systems, within screeds of at least 65mm.

Note: *Screeds in this context include any wet applied material. This includes tile adhesive or levelling compound.*

5.41 Where electric cable underfloor heating systems that use night energy storage are used, both of the following should be met.

a. A minimum of 20% of the floor area of the dwelling should have fast-response systems such as panel heaters.
b. Controls should be installed which are designed to modify the input charge in response to both of the following.
   i. The room thermostat.
   ii. Floor temperature sensing.

5.42 Programmable room thermostats with an override feature should be provided for all direct electric zones of the electric underfloor heating system. Thermostats should have air and floor temperature sensing capabilities, which may be used individually or together.

Solar water heating systems

Note: *The guidance for solar water heating in this document applies to indirect solar systems that supply domestic hot water and have both of the following.*

a. A solar collector area of less than 20 m^2.
b. A solar heated water storage volume of less than 440 litres.

5.43 New solar hot water collectors should be independently certified as complying with all tests required by **BS EN 12975-1** and **BS EN ISO 9806** for both of the following.

a. Thermal performance.
b. Reporting and identification.

5.44 The electrical input power of the primary pump in the solar system should be less than the higher of the following.

a. 50W.
b. 2% of the peak thermal power of the collector.

5.45 For a heat exchanger between a solar primary and secondary system, a minimum of 0.1m^2 or equivalent of heat exchanger area should be provided or every 1m^2 of the net absorber area of the solar collector.

5.46 For work on new or existing solar domestic hot water heating system, controls should be fitted to or upgraded to do all of the following.

a. Maximise the useful energy gain from the solar collectors.
b. Minimise the accidental loss of stored energy.
c. Ensure that hot water produced by back-up sources is not used when adequate solar pre-heated water is available.
d. Provide a means to control the adverse effects of excessive temperatures and pressures.
e. Where a separate domestic hot water heating appliance is pre-heated by a solar system, the appliance should be controlled to add no extra heat if the target temperature is met from the solar pre-heated vessel.

5.47 The dedicated storage volume of solar heated water relative to the area of the collector should be either of the following.

a. A minimum volume of 25 litres for every 1m^2 of the net absorber area of the solar collector.
b. Equivalent to at least 80% of the daily hot water demand (as defined by the Standard Assessment Procedure for new and existing dwellings)

Note: *Domestic hot water storage vessels and pipework associated with the solar water heating system should follow the minimum standards in* ***Section 3*** *to minimise heat losses.*

Comfort cooling

5.48 The specification of comfort cooling systems should be based on a calculated heat gain for the dwelling. To calculate heat gain, both **CIBSE Guide A** and the manufacturer's guidance should be followed.
Systems should not be significantly oversized: in most circumstances, the cooling appliance should not be sized for more than 120% of the design cooling load.

5.49 The seasonal energy efficiency ratio of an air conditioner working in cooling mode should be one of the following.

a. For new dwellings, a minimum of 4.6.

b. For existing dwellings, a minimum of 4.0.

The seasonal energy efficiency ratio should be calculated according to **BS EN 14825**.

5.50 Comfort cooling systems should have all of the following controls.

a. For each control zone and for each terminal unit, it should be possible to independently control both of the following:
   i. Timing.
   ii. Temperature.

b. If both heating and cooling are provided in the same space, the controls should prevent them operating simultaneously.

5.51 For cooling systems that serve multiple dwellings, follow the guidance in Approved Document L, Volume 2: Buildings other than dwellings.

5.52 Exposed refrigeration pipework should be both of the following.

a. Insulated in accordance to paragraph 3.21.

b. Enclosed in protective trunking.

Mechanical ventilation

5.53 Ventilation systems should meet the ventilation needs of the dwelling, in accordance with **Approved Document F Volume 1: Dwellings**. Systems should be designed so that they can be commissioned to suitable ventilation rates so that spaces are not significantly overventilated.

5.54 The specific fan power for mechanical ventilation systems should be no greater than the values in Table 5.6.

Table 5.6 Maximum specific fan power (SFP) for mechanical ventilation systems in new and existing dwellings

Mechanical ventilation system type	Specific fan power (W/L.s)	
	New dwellings	Existing dwellings
Intermittent extract ventilation system	0.5	
Continuous decentralised mechanical extract ventilation system	0.3	
Continuous centralised mechanical extract ventilation system	0.5	0.7
Continuous supply ventilation system	-	0.5
Continuous mechanical supply and extract ventilation system	1.4	1.5

5.55 All ventilation systems providing both supply and extract ventilation should be fitted with all of the following.

a. A heat recovery system with a minimum efficiency of 73%.
b. A summer bypass facility (giving the ability to bypass the heat exchanger or to control its heat recovery performance).
c. A variable speed controller.

Lighting

5.56 Any fixed lighting should achieve lighting levels appropriate to the activity in the space. Spaces should not be over-illuminated.

Note: *In many cases, householders will be able to choose the lamp installed in the individual space*.

5.57 Where installed in a new or existing dwelling, each internal luminaire should have light sources with one of the following.

a. A minimum luminous efficacy of 105 light source lumens per circuit-watt.
b. For non-standard specialist light sources, a minimum luminous efficacy as listed in Table 5.7.

5.58 Where installed in a new or existing dwelling, internal luminaires should have local controls to allow for the separate control of lighting in each space or zone. Controls may be either manual, automatic or a combination of both.

5.59 Where fixed external lighting is installed in a new or existing dwelling, each external luminaire should have light sources with either of the following.

a. A minimum luminous efficacy of 105 light source lumens per circuit-watt.
b. For non-standard specialist light sources, a minimum luminous efficacy as listed in Table 5.7.

Table 5.7 Minimum luminous efficacies for specialist light sources

Specialist light source type	Minimum luminous efficacy of specialist light source (light source lumens per circuit-watt)
High excitation purity light source	65
Tuneable LED devices Light source with colour rendering index greater than or equal to 95	80

5.60 Where installed in a new or existing dwelling, fixed external lighting should have both of the following controls.

a. Automatic controls which switch the luminaire off in response to daylight.
b. Controls which switch the luminaire off after the area lit becomes unoccupied as follows.
    i. For a luminaire with a total luminous flux of greater than 1200lm, automatic proximity sensors should be used.
    ii. For a luminaire with a total luminous flux of 1200lm or less, manual control is acceptable.

Building Automation and Control Systems

5.61 Where a building automation and control system is installed, it should have appropriate control capabilities for the dwelling, based on the type of building, its expected use and potential energy savings.

5.62 The building automation and control system should be specified and installed according to the manufacturer's instructions to ensure that its overall performance meets a reasonable standard.

5.63 For large or complex buildings, the guidance in **Approved Document L, Volume 2: buildings other than dwellings** should be followed.

On-site electricity generation and storage

5.64 Where on-site electricity generation (including renewable electricity) and storage is installed, such as photovoltaic panels or battery storage, systems should be an appropriate size for the site, available infrastructure and on-site energy demand.

5.65 On-site electricity generation and storage systems should be specified, installed and commissioned according to the manufacturer's instructions to ensure that the overall performance of the system meets a reasonable standard and to maximise the generating or storage capacity.

Note: *Guidance for commissioning for on-site electricity generation systems is also given in* ***Section 7****.*

5.66 When replacing an existing on-site electricity generation system, the installed generation capacity of the new system should be no less than that of the existing system, except where a smaller system can be shown to be more appropriate (e.g. replacing an existing system with one which is better matched to the dwelling's energy demand).

5.67 On-site electricity generation and storage systems should be provided with controls to allow proper operation of the system without the need for user intervention. This is particularly relevant where storage systems, such as batteries, are used.

5.68 On-site renewable electricity can be generated by photovoltaic panels, or another renewable technology. Where another renewable technology is used to generate electricity, the amount produced by all technologies should be equivalent to the output of the standards in paragraphs 5.70 and 5.71.

Systems for on-site renewable electricity generation on dwellinghouses and buildings containing one or more dwellings

5.69 When a new dwellinghouse or a building containing one or more dwellings is erected, the following paragraphs 5.72 to 5.73 provide guidance on how to meet requirement L2A.

5.70 When a dwellinghouse or a building containing one or more dwellings is erected and a system for renewable electricity generation is required to be installed on-site, the minimum amount produced by renewable technologies should be equivalent to the output described in paragraph 5.73 (dwellings) or paragraph 5.74 (buildings containing dwellings).

5.71 Paragraph 5.70 does not require off-site renewable technologies (e.g. microgrids) to meet requirement L2A, however, these may be used as an alternative option to meet the requirement, if an equivalent renewable electricity generation output as described in paragraph 5.73 (dwellings) or paragraph 5.74 (buildings containing dwellings) is directly available and prioritised for the use of residents of the dwellings.

5.72 The calculations in paragraphs 5.73 to 5.74 should use the same version of the approved methodology as used to calculate the dwelling emission rate and dwelling primary energy rate.

5.73 Roof-mounted photovoltaic arrays on dwellinghouses should be designed to achieve a reasonable output using one of the following.

a. An annual output (in kWh) for the dwellinghouse as calculated using the approved methodology of at least equal to that of a photovoltaic array with all of the following characteristics.

   i. Installed peak power (kWp) equal to photovoltaic panels with an efficiency of 0.22kWp per m2 installed over an area equivalent to 40% of the dwellinghouse's ground floor area (see Equation 1).
   ii. Orientated south-east to south-west.
   iii. Pitch of 45 degrees.
   iv. Not overshaded.

b. An annual output (in kWh) for the dwelling as calculated using the approved methodology at least equal to that of a photovoltaic array covering the reasonably practicable roof area with a panel efficiency of 0.22 kWp/m^2.

Equation 1: *An appropriate level of installed peak power (PPDWELLING) in kWp for an individual dwellinghouse can be calculated using the following.*

$$PPDWELLING = APVD \times EFFPV$$

where:
EFFPV = PV Panel Efficiency (kWp/m2) of 0.22kWp/m^2 or higher
APVD = area available for photovoltaic panels (m^2) equivalent to at least 40% of the ground floor area.

5.74 Roof-mounted photovoltaic arrays on buildings containing one or more dwellings should be designed to achieve one of the following.

a. An annual output (in kWh) for the building as calculated using the approved methodology of at least equal to that of a photovoltaic array with all of the following characteristics.
   i. Installed peak power (kWp) equal to photovoltaic panels with an efficiency of 0.22kWp per m^2 installed over an area equivalent to 40% of the building's ground floor area (see Equation 2).
   ii. Orientated south-east to south-west.
   iii. Pitch of 45 degrees.
   iv. Not overshaded.

b. An annual output (in kWh) for each dwelling within the building as calculated using the approved methodology of at least equal to that of a photovoltaic array with all of the following characteristics.
   i. Installed peak power (kWp) equal to photovoltaic panels with an efficiency of 0.22kWp per m^2 installed over an area equivalent to 40% of the individual dwelling's ground floor area (see Equation 3).
   ii. Orientated south-east to south-west.
   iii. Pitch of 45 degrees.
   iv. Not overshaded.

c. An annual output (in kWh) for the building as calculated using the approved methodology at least equal to that of a photovoltaic array covering the reasonably practicable roof area with a panel efficiency of 0.22 kWp/m^2.

Equation 2: *For buildings with multiple storeys, the ground floor area (AGRND) in m^2 of the building can be calculated using the following.*

AGRND = ATOTAL / Number of Storeys

where:

ATOTAL = total floor area of all spaces within the building (m^2)

Equation 3: *For buildings containing dwellings, the ground floor area allocated to an individual dwelling*

(AGRNDDWELL) in m^2 can be calculated using the following.

AGRNDDWELL = (ADWELL / ATOTAL) × AGRND

where:

ADWELL = floor area of dwelling (m^2)

ATOTAL = total floor area of all spaces within the building (m^2)

AGRND = building ground floor area from Equation 2 (m^2).

Note for equations 1, 2 and 3:

- *0.22kWp/m^2 is the photovoltaic panel power output in kWp/m^2 with an efficiency of 1kWp per 4.5m^2.*
- *Ground floor area does include certain unheated spaces within dwellings, which is defined in section 8.05 of SAP 10 conventions.*
- *The floor area of a building is measured to the internal face of the external perimeter wall.*
- *The total floor area of all spaces within the building is the gross internal area (GIA).*
- *The number of storeys in the building is defined in section 2.08 of SAP 10 conventions.*

5.75 The system for renewable electricity generation should be designed so that generated electricity is available to residents of the dwellings. In buildings containing dwellings, this could be to individual dwellings and communal spaces where the electricity can be used for the benefit of the residents of the dwellings.

Note: *Where on-site electricity generation or energy storage is installed, the fire safety (including means of escape) and electrical requirements of the Building Regulations should be met.* ***Approved Documents B and P*** *should be followed. Manufacturer instructions should also be followed.*

5.76 Where the standards in paragraphs 5.73(a) and 5.74(a) and (b) cannot be met, efforts should be made to maximise the generation output where it is possible. This should include modifying designs to specify higher performance panels, alternative orientations of panels and other modifications (for example, positions of roof vents or architectural features) to accommodate additional photovoltaic panels where possible. Examples of layouts which maximise the reasonably practicable area available for roof-mounted photovoltaic arrays for a variety of roof types are given in Appendix B.

5.77 In exceptional circumstances it may not be possible to install a system for on-site renewable electricity generation on a dwellinghouse or a building containing dwellings which is capable of a reasonable output. These circumstances include the following.

a. Dwellinghouses where it can be demonstrated by following the guidance in paragraph 5.73 and Appendix B that there is insufficient roof area available to install photovoltaic arrays capable of generating an annual output of 720kWh (calculated using the Approved methodology).

b. Buildings containing dwellings where it can be demonstrated by following the guidance in paragraph 5.74 and Appendix B that there is insufficient roof area available to install photovoltaic array capable of generating an annual output for each dwelling of 720kWh (calculated using the Approved methodology) divided by the number of storeys.

5.78 Any photovoltaic arrays which do not achieve either of the standards in paragraphs 5.73(a) and 5.74(a) and (b) will be highlighted in the BRWL report. Evidence to support the reasonably practicable area of roof available for photovoltaic array or lower provision should be provided to the relevant building control body as outlined in Appendix B.

Regulation 43: Pressure testing

This Approved Document deals with the requirements of regulation 43 of the Building Regulations 2010.

Regulation 43 - Pressure testing

(1) This regulation applies to the erection of a building in relation to which paragraph L1(a)(i) of Schedule 1 imposes a requirement.

(2) Where this regulation applies, the person carrying out the work shall, for the purpose of ensuring compliance with regulation 26 and paragraph L1(a)(i) of Schedule 1:

(a) ensure that:

i. pressure testing is carried out in such circumstances as are approved by the Secretary of State; and

ii. the testing is carried out in accordance with a procedure approved by the Secretary of State; and

(b) subject to paragraph (5), give notice of the results of the testing to the local authority.

(3) The notice referred to in paragraph (2)(b) shall:

(a) record the results and the data upon which they are based in a manner approved by the Secretary of State; and

(b) be given to the local authority not later than seven days after the final test is carried out.

(4) A local authority is authorised to accept, as evidence that the requirements of paragraph (2)(a)(ii) have been satisfied, a certificate to that effect by a person who is registered by Elmhurst Energy Systems Limited or the Air Tightness and Testing and Measuring Association in respect of pressure testing for the air tightness of buildings.

(5) Where such a certificate contains the information required by paragraph (3)(a), paragraph (2)(b) does not apply.

Note: *Where the building control body is a registered building control approver, see regulation 5 of the Building (Registered Building Control Approvers etc.) (Wales) Regulations 2024(as amended).*

Intention

In the Welsh Minister's view, the requirements of regulation 43 are met, when a dwelling is erected, by carrying out pressure testing in accordance with paragraphs 6.2 to 6.5 and 6.7 to 6.8.

In the Welsh Minister's view, results from a pressure test must be used to show that work complies with both of the following.

a. Regulations 26 and 26A of the Building Regulations, in accordance with paragraphs 6.6 to 6.8.
b. The requirements of Part L1(a)(i) of Schedule 1 to the Building Regulations, in accordance with paragraphs 6.1 and 6.6.

Section 6

Air permeability and pressure testing

6.1 The minimum standard for air permeability of a new dwelling is given in Table 3.1 of **Section 3.** Measured air permeability is established by an air pressure test.

Air pressure testing procedure

6.2 Air pressure tests should be performed following the guidance in the approved air tightness testing methodology, CIBSE's TM23 *Testing Buildings for Air Leakage*. The procedures for testing and reporting in that document have been approved by Welsh Ministers.

Showing compliance, and reporting pressure test results

6.3 The building control body should be given provided with evidence that pressure testing equipment has been calibrated using a UKAS-accredited facility or by the original manufacturer with all of the following.

a. A period in accordance with the manufacturer's guidance.
b. At least once every 24 months.
c. CIBSE TM23 *Testing Buildings for Air Leakage.*

6.4 Building control bodies may accept a pressure test certificate from a person registered by any organisation listed in Regulation 43(4) as evidence that the testing has been carried out in accordance with the approved procedure in paragraph 6.2.

The building control body should be given evidence that the person who provides the pressure test certificate meets both of the following.

a. Has received appropriate training
b. Is registered to test the specific class of building.

6.5 An air pressure test should be carried out on every new dwelling.

6.6 The dwelling primary energy rate, dwelling emission rate, and dwelling energy use intensity (detailed in **Section 2**), all calculated using the measured air permeability, must not be higher than the target primary energy rate, target emission rate, and target energy use intensity, respectively.

6.7 If a dwelling does not achieve the criteria in paragraphs 6.1 and 6.6, the dwelling air permeability should be improved and retested until the criteria are achieved.

6.8 The results of all pressure tests on dwellings, including any test failures, should be reported to the building control body.

Requirement L1(b)(iii) and L2(b) and Regulation 44 and 44ZA: Commissioning

This Approved Document deals with the requirements of Part L1 of Schedule 1 to the Building Regulations 2010 and Regulation 44.

Schedule 1 – Part L Conservation of fuel and power and the minimisation of greenhouse gas emissions

L1. Reasonable provision shall be made for the conservation of fuel and power and the minimisation of greenhouse gas emissions in buildings by—

(b) providing fixed building services which–

(iii) are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances.

L2. Where a system for on-site electricity generation is installed—

(b) it must be commissioned by testing and adjusting as necessary to ensure that it produces the maximum electricity that is reasonable in the circumstances.

Commissioning

44.—(1) This regulation applies to building work in relation to which paragraph F1(2) of Schedule 1 imposes a requirement, but does not apply to the provision or extension of any fixed system for mechanical ventilation or any associated controls where testing and adjustment is not possible.

(2) This regulation applies to building work in relation to which paragraph L1(b) of Schedule 1 imposes a requirement, but does not apply to the provision or extension of any fixed building service where testing and adjustment is not possible or would not affect the energy efficiency of that fixed building service.

(3) Where this regulation applies the person carrying out the work shall, for the purpose of ensuring compliance with paragraph F1(2) or L1(b) of Schedule 1, give to the local authority a notice confirming that the fixed building services have been commissioned in accordance with a procedure approved by the Secretary of State.

(4) The notice shall be given to the local authority –

(a) not later than the date on which the notice required by regulation 16(4) is required to be given; or

(b) where that regulation does not apply, not more than 30 days after completion of the work.

Commissioning in respect of a system for on-site electricity generation

44ZA. (1) This regulation applies to building work in respect of a building in relation to which paragraph L2 of Schedule 1 imposes a requirement, but does not apply to the provision or extension of any system for on-site electricity generation where testing and adjustment is not possible.

(2) Where this regulation applies the person carrying out the work must, for the purpose of ensuring compliance with paragraph L2 of Schedule 1, give to the local authority a notice confirming that the system for on-site electricity generation has been commissioned.

(3) The notice must be given to the local authority—

(a) not later than the date on which the notice required by regulation 16(4) is required to be given; or

(b) where that regulation does not apply, not more than 30 days after completion of the work.

Note: *Where the building control body is a registered building control approver, see regulation 5 of the Building (Registered Building Control Approvers etc.) (Wales) Regulations 2024(as amended).*

Intention

In the Welsh Minister's view, requirements L1(b)(iii) and L2(b) and the requirements of regulations 44 and 44ZA are met by commissioning fixed building services and on-site electricity generation in accordance with **Section 7**.

Section 7

Commissioning fixed building services and on-site electricity generation systems

7.1 Both of the following must be commissioned.

a. Fixed building services must be commissioned to ensure that they use no more fuel and power than is reasonable in the circumstances.
b. On-site electricity generation systems must be commissioned to ensure that they produce as much electricity as is reasonable in the circumstances.

A fixed building service, or on-site electricity generation that, by design, cannot be adjusted, or for which commissioning would not affect energy use, does not need to be commissioned.

7.2 The commissioning process should involve testing and adjusting the fixed building services and on-site electricity generation as necessary and in accordance with the manufacturer's instructions.

7.3 A commissioning plan should be produced that identifies the following.

a. Which systems to test.
b. How these systems will be tested.
c. The fixed building services and on-site electricity generation that do not need to be commissioned and why they do not need to be commissioned.

For new dwellings, the commissioning plan should be given to the building control body with calculations of the design stage dwelling primary energy rate, dwelling emission rate, and dwelling energy use intensity.

Notice of completion of commissioning

7.4 A notice of completion of commissioning must be given to the relevant building control body to confirm that the installed fixed building services and on-site electricity generation systems were commissioned according to the procedure in **Section 7**.

The notice should confirm all of the following.

a. That the commissioning plan was followed.
b. That all systems have been inspected in an appropriate sequence and to a reasonable standard.
c. That test results confirm that performance is reasonably in accordance with the design requirements.

The notice of completion of commissioning should be given the following number of days after commissioning work is completed.

a. If a building notice or full plans have been given to a local authority building control body, the notice of completion of commissioning should be given within five days of the work being completed.
b. If the building control body is a registered building control approver, the notice should generally be given to the registered building control approver within five days of the work being completed.
c. If the building work is higher-risk building work that requires a completion certificate, the notice must be given to the local authority with the application for a completion certificate.
d. In other cases - for example, if the work is carried out by a person registered with a competent person scheme - the notice must be given to the building control body within 30 days of the work being completed.

7.5 Where any fixed building services and on-site electricity generation systems that require commissioning are installed by a person registered with a competent person scheme, that person may give the notice of completion of commissioning.

7.6 Until the building control body receives the notice of completion of commissioning, it may decide not to give a completion/final certificate.

System specific guidance for commissioning

Hot water systems for space and domestic hot water heating

7.7 Before a new heating appliance is installed, it should be commissioned as follows.

a. all central heating and primary hot water circuits should be thoroughly cleaned and flushed out.
b. A suitable chemical inhibitor should be added to the primary heating circuit to protect against scale and corrosion.
c. In hard water areas, suitable measures should be taken to treat the feed water to water heaters and the hot water circuit of combination boilers to reduce limescale accumulation.
d. Domestic central heating systems should be prepared and commissioned to **BS 7593**.

Note: *The Benchmark commissioning checklist can be used to show that commissioning has been carried out satisfactorily for the heating and hot water system and its heat generation source.*

7.8 Hot water storage vessels should be commissioned in accordance with the manufacturer's instructions.

Note: *An example commissioning checklist can be found in the Microgeneration Certification Scheme's MIS 3005-I:The Heat Pump Standard (Installation).*

Note: *For guidance on temperature control of hot water storage vessels see Health and Safety Executive guidance, including L8 Legionnaire's disease. The control of legionella bacteria in water systems. Approved code of practice and HSG 274 Legionnaire's disease. Part 2: The control of legionella bacteria in hot and cold water systems.*

Heat pump heating systems

7.9 Heat pumps and any dedicated ancillary products, e.g. integrated hot water cylinders, should be commissioned in accordance with both the manufacturer's instructions and the appropriate system design parameters.

7.10 The notice of commissioning given to the local authority should include a checklist to confirm that the relevant commissioning steps have been carried out. This should be provided in one of the following formats.

a. The Commissioning Checklist in Appendix A of MIS 3005-I:2025.
b. The Heat Pump Association's Air to Water Heat Pump Commissioning Checklist.
c. An equivalent commissioning checklist.

7.11 The person carrying out commissioning should be a member of an organisation which regularly and independently verifies their competence, training and performance. This should be demonstrated by any of the following.

a. Membership of a relevant competent person scheme that is designated in the regulations.

b. Membership of the Microgeneration Certification Scheme.

c. Evidence showing an equivalent level of competency to (a) or (b).

7.12 A ground source heat pump should be commissioned as follows.

a. Ground arrays, including header pipes and manifolds, should be flushed as one system to remove all debris and purged to remove all air. Vertical, horizontal and slinky ground arrays in particular should be flushed in both directions. During this process, the heat pump (along with its accompanying pipework) should be isolated from the ground heat exchanger to avoid damage to the internal heat exchanger inside the heat pump.

b. The heat pump and its accompanying pipework should be flushed and purged as a separate system while isolated from the ground array system.

c. In a closed-loop ground source heat pump installation, after the complete purging of micro air bubbles, a pressure test (in accordance with **BS EN 805**, section 11.3.3.4) should be conducted to prove the integrity of the systems. This test should be conducted on the entire system, which typically comprises the heat pump, header pipes, manifold and all ground arrays.

d. Antifreeze and biocide should be added to ground heat exchangers as appropriate, in line with the manufacturer's instructions.

7.13 Commissioning information provided to the dwelling owner should include details of the fluids used and their commissioned concentrations.

District heat networks and communal heat networks

7.14 For district heat networks and communal heat networks, both of the following apply.

a. Systems should be commissioned to optimise the use of energy for pumping.

b. Flow rates in individual heat emitters should be balanced using either of the following.

   i. appropriate return temperatures.

   ii. calibrated control valves.

Underfloor heating

7.15 All installed equipment in underfloor heating systems should be commissioned in accordance with **BS EN 1264-4.**

On-site electricity storage systems

7.16 On-site electricity storage and battery systems that are connected to on-site electricity generation should be designed, installed and commissioned in accordance with both of the following.

a. the manufacturer's instructions.

b. A commissioning procedure such as the commissioning requirements of Microgeneration Certification Scheme's MIS 3012: *The Battery Standard (Installation*).

Regulation 11W: Competence: general requirement

This section deals with the requirements of regulation 11W of the Building Regulations 2010 (as amended).

Regulation 11W

11W.—
(1) Any person carrying out any building work or any design work must have—
(a) where the person is an individual, the skills, knowledge, experience and behaviours necessary; (b) where the person is not an individual, the organisational capability, to carry out—
(i) the building work in accordance with all relevant requirements;
(ii) the design work so that the building work to which the design relates, if built, would be in accordance with all relevant requirements.

(2) Any person carrying out any building work as a contractor or any design work as a designer must have—
(a) where the person is an individual, the skills, knowledge, experience and behaviours necessary,
(b) where the person is not an individual, the organisational capability, to fulfil the duties of a contractor or designer, under these Regulations in relation to the work.

(3) The requirements in paragraphs (1) and (2) do not apply to an individual (T) who is in training to fulfil those requirements.

(4) The person who asked T to carry out any building work or, any design work must ensure T is adequately supervised when carrying out the work.

(5) A person who is in training to fulfil the requirements of a principal contractor or a principal designer may not be appointed as a principal contractor or a principal designer.

In the Welsh Ministers' view, the requirements of regulation 11W are met for the installation of heat pumps in new and existing dwellings by following the procedures for installation, certification, inspection and testing of heat pump systems in Section 8 of this Approved Document.

Section 8

Installation, certification, inspection and testing of heat pump systems

General

8.1 For the installation of systems which use heat pumps as a heating source, extra care should be taken to ensure both of the following.

a. The person carrying out the work is suitably competent (for example, they are a registered competent person).
b. The work meets the requirements of the Building Regulations.

8.2 For heat pump installation work, one of the following two procedures must be used to certify that the work complies with the requirements set out in the Building Regulations.

a. Self-certification by a registered competent person.
b. Certification by a building control body.

8.3 To verify that the design, installation and commissioning of heat pumps meets the energy efficiency requirements of the Building Regulations, the heat pump installation work should be inspected and tested to show that it meets all of the following:

a. heat losses from hot water and heating pipework are limited, following paragraph 3.18 to 3.24.
b. heat losses from hot water storage vessels are limited, following paragraph 3.25 to 3.27.
c. heat pump systems have been sized appropriately, following paragraphs 4.9 to 4.14.
d. new hot water storage vessels in dwellings have been appropriately sized, following paragraph 4.15.
e. the system has adequate controls, following paragraphs 4.16 to 4.29.
f. the heat pump system meets the system requirements set out in 5.1 to 5.7.

Self-certification by a registered competent person

8.4 Heat pump installers who are registered competent persons should do both of the following.

a. Install and commission the system to the standards set out in this Approved Document.
b. Give notice to the building control body that commissioning has been carried out in accordance with this approved document.

Note: *Using an installation checklist of the standards in paragraph 8.3 is recommended to make sure that the relevant standards have been met.*

8.5 The heat pump installer or the installer's registration body must within 30 days of the work being completed do both of the following.

a. Give a copy of the Building Regulations compliance certificate to the occupier.
b. Give the certificate, or a copy of the information on the certificate, to the building control body.

Certification by a building control body

8.6 If a heat pump installer is not a registered competent person, then before work begins the installer must notify an appropriate building control body to oversee the work.

8.7 The building control body will determine the extent of inspection and testing needed for it to establish that the work is compliant with the Building Regulations requirements, based on the nature of the heat pump installation work and the competence of the installer. The building control body should be given notice of when the work has reached relevant stages. The building control body will set out the notification procedure.

8.8 Once an appropriate building control body has decided that, as far as can be ascertained, the work meets all the Building Regulations requirements, it will issue a Building Regulations completion certificate (if a local authority) or a final certificate (if a registered building control approver).

Note: *Using an installation checklist of the standards in paragraph 8.3 is recommended to make sure that the relevant standards have been met.*

Regulation 40: Providing information

This Approved Document deals with the requirements of regulation 40 and 40A of the Building Regulations 2010.

Information about use of fuel and power

40. (1) This regulation applies where paragraph L1 of Schedule 1 imposes a requirement relating to building work.

(2) The person carrying out the building work shall not later than five days after the work has been completed provide to the owner sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.

Information about systems for on-site generation of electricity

40A. (1) This regulation applies to building work in respect of a building in relation to which paragraph L2 of Schedule 1 applies.

(2) The person carrying out the work must, not later than five days after the work has been completed, provide to the owner sufficient information about the system for on-site electricity generation in respect of its operation and maintenance requirements so that the system may be operated and maintained in such a manner as to produce the maximum electricity that is reasonable in the circumstances and delivers this electricity to the optimal place for use.

Intention

In the Welsh Minister's view, when a new dwelling is erected, the requirements of regulation 40 and 40A are met by providing the owner with information about all of the following.

a. Operating and maintenance instructions for fixed building services and on-site electricity generation, in accordance with paragraphs 9.1 to 9.3.
b. Other important documentation as detailed in paragraphs 9.4 to 9.8.

In the Welsh Minister's view, the requirements of regulation 40 and 40A are met for when work is carried out on an existing dwelling by providing the owner with information about both of the following.

a. Operating and maintenance instructions for the work on any fixed building services and on-site electricity generation that has been carried out, in accordance with paragraphs 9.1 to 9.3.
b. Relevant information for work on existing systems as detailed in paragraphs 9.9 to 9.12.

Section 9

Providing information to owners about the building, fixed building services and maintenance requirements

Operating and Maintenance instructions

9.1 For a new dwelling and for work to an existing dwelling, operating and maintenance instructions for any fixed building services and any on-site electricity generation installed as part of the work installed as part of the work should be given to the dwelling owner.

The instructions should be sufficient to help occupiers achieve the expected level of energy efficiency and to verify that any fixed building services and any (where applicable) on-site electricity generation complies with the energy performance requirements of the Building Regulations.

The documentation should be all of the following.

a. easy to understand,
b. specific to the dwelling
c. specific to the model of services and controls installed.
d. durable
e. in an accessible format.

9.2 The operating and maintenance instructions should do all of the following in a user focused manner.

a. Explain the following for the fixed building services any on-site electricity generation and any other technologies.

   i. what they are
   ii. what they are for
   iii. where they are located, using a floor plan
   iv. how to operate them efficiently, including the location and operation of timers and sensors and any tariff considerations.
   v. how to maintain them

b. Identify where to find other important documentation, such as appliance manuals.
c. Include a completed commissioning sheet, where relevant.
d. Include the additional information specified below for new dwellings (paragraphs 9.4 to 9.5), newly erected dwellings (paragraphs 9.6 to 9.8) or for work in existing dwellings (paragraphs 9.9 to 9.12).

9.3 For a newly erected dwelling and for work on an existing dwelling, the operating and maintenance instructions should also do all of the following.

a. Explain the following for on-site electricity generation and any other technologies.
   i. What they are.
   ii. What they are for.
   iii. Where they are located, using a floor plan.
   iv. How to operate them, including the location and operation of timers and sensors.
   v. How to maintain them.
b. Identify where to find other important documentation, such as appliance manuals.
c. Include a completed commissioning sheet, where relevant.
d. Include the additional information specified below for newly erected dwellings (paragraphs 9.6 to 9.8) or for work in existing dwellings (paragraphs 9.9 to 9.12).

Additional information for new dwellings

9.4 For a new dwelling, the operating and maintenance instructions should include a Home Energy Guide. The Home Energy Guide should contain non-technical advice on how to operate and maintain the dwelling in a healthy and energy efficient manner. The guide should advise on the following.

a. Heating and domestic hot water.
b. Any on-site electricity generation system (if applicable).
c. Ventilation (see Approved Document F).
d. Staying cool in hot weather (newly erected dwellings) (see Approved Document O).

A paper copy of the Home Energy Guide should be provided, and a digital copy made available. A template for a Home User Guide can be viewed at Building regulations guidance: part L (conservation of fuel and power) | GOV.WALES

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Note: *There is no requirement to follow the layout, format or example text used in the template.*

9.5 For heat pump heating systems installed in a new dwelling, operating and maintenance information provided to the dwelling owner should include all of the following.

a. Details of the heat loss calculation carried out for the heat pump heating system. Details should include all of the following.
   i. Design internal room temperature(s).
   ii. Design external air temperature.
   iii. Date of calculation.
b. Design flow temperature of the heat pump heating system.
c. Confirmation of whether the person carrying out commissioning is registered with a competent person scheme. If so, the name of that scheme should be provided.
d. Size of emitter circuit.
e. Minimum setback temperatures.

The maintenance and operating information in (a) to (e) should be fixed to or as close as practical to the heat pump unit or the hot water storage vessel, for example on a sticker or information plate, for future heating engineers to use. This information should be in a shielded location if outside, for example on the rear of the heat pump unit.

Additional information for newly erected dwellings

9.6 For a newly erected dwelling, the Home Energy Guide should also advise on on-site electricity generation (if applicable).

9.7 For a newly erected dwelling. both of the following should be given to the dwelling owner.

a. a signed copy of the Building Regulations Wales Part L compliance report (BRWL report)

b. photographic evidence of the build quality

9.8 For a newly erected dwelling, the operating and maintenance instructions should direct readers to both of the following.

a. The as-built BRWL report, which includes data used to calculate dwelling primary energy rate, dwelling emission rate and dwelling energy use intensity.

b. The recommendations report generated with the 'on-construction' energy performance certificate.

Additional information for work in existing dwellings

9.9 For an existing dwelling, when building work is carried out for which **Section 4** and/or **Section 5** sets a standard, the energy performance of the fixed building services and/or on-site electricity generation affected by the work should be assessed and documented.

9.10 For an existing dwelling, when installing a complete new or replacement system (e.g. replacing a heating system including the heating appliance, pipework and heat emitters), the energy performance of the whole system should be assessed. The results should be recorded and given to the dwelling owner with the manufacturer's supporting literature. The record of energy performance results may be any of the following.

a. Full records of commissioning the system in accordance with **Section 7**.

b. A documented assessment using the approved methodology, such as a new energy performance certificate.

c. Another equivalent assessment carried out by a suitably qualified person.

9.11 For an existing dwelling, when carrying out work on an existing system, such as installing or replacing components (e.g. replacing a boiler but retaining the pipework and heat emitters), the energy performance of the new components should be assessed. The results should be recorded and given to the dwelling owner. The record of energy performance results may be in either of the following forms.

a. Product data sheets from the product manufacturer.
b. Other documented results of energy assessment of the product carried out in accordance with relevant test standards.

9.12 For an existing dwelling, if work on an existing system alters the energy performance or CO2 emissions performance of the system, then the complete altered system should be assessed and the guidance for new or replacement systems in paragraph 9.11 should be followed. Such work may include the following:

a. A change in heating fuel for a space heating or domestic hot water system.
b. Extending or expanding the capacity of a space heating, comfort cooling or ventilation system by over 25% of its previous capacity.

Requirement L1(a): Limiting heat gains and losses

This Approved Document deals with the requirements of Part L1 of Schedule 1 to the Building Regulations 2010.

Requirement	*Limits on application*
Schedule 1 – Part L Conservation of fuel and power and the minimisation of greenhouse gas emissions **L1. Reasonable provision shall be made for the conservation of fuel and power and the minimisation of greenhouse gas emissions in buildings by— (a) limiting heat gains and losses–** **(i) through thermal elements and other parts of the building fabric; and** **(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;…**	

Intention

In the Welsh Minister's view, requirement L1(a) is met for new elements in existing dwellings by following the standards in **section 10**.

Section 10

New elements in existing dwellings, including extensions

General

10.1 This section provides guidance for the following types of work on existing dwellings.

a. For extensions or new thermal elements in existing dwellings – follow paragraphs 10.2 to 10.8.

b. For new and replacement windows and doors – follow paragraphs 10.9 to 10.15 (for extensions) and 10.20 to 10.29 (for windows in an existing dwelling)

c. For conservatories and porches - follow paragraphs 10.30 to 10.36

d. For indoor swimming pools – follow paragraphs 10.37 to 10.39

New and replacement thermal elements

10.2 The minimum standards in paragraphs 3.7 and 3.8 and Table 3.1 should be met for both of the
following.

a. New thermal elements installed in an existing dwelling.

b. Replacement thermal elements in an existing dwelling.

Extensions

10.3 In this Approved Document, extension describes when new building fabric is added to an existing dwelling to create an extra room or rooms.

10.4 Adding an extension to increase the habitable volume of an existing dwelling triggers a requirement for additional energy efficiency improvements – consequential improvements – that are set out in **Section 12**.

10.5 Two alternative optional approaches to the guidance below, that offer more design flexibility by allowing some elements of the design to be relaxed if compensated for elsewhere, are set out in **Section 13**.

Building Fabric

10.6 New thermal elements constructed as part of an extension should achieve or better the U-values set out in the final column of Table 3.1 (existing dwellings).

10.7 Thermal element is used in the Building Regulations to describe a wall, floor or roof, which separates a heated space from the external environment, the ground, and any parts of the building which are not heated or, where another part of the building which is not a dwelling, is heated to a different temperature.

10.8 If an extension incorporates a part of the existing structure, which previously was not subject to the energy efficiency requirements, for example if the extension is built against a garage, this part should be treated as a retained thermal element and follow the guidance set out in **Section 11**, paragraphs 11.7-11.11.

Windows and Doors

10.9 New windows and doors installed as part of an extension should be draughtproofed units that achieve or better the U-values set out in the column (a) of Table 10.1. Insulated cavity closers should be installed around the windows and doors where appropriate.

Table 10.1 Windows and doors

Controlled fittings	(a) Maximum Uvalues[1] for new and replacement windows and doors	(b) Alternative maximum U-values[1] for replacement[3] windows and doors	(c) Threshold U-values[1] for retained windows and doors
Windows, roof windows	1.4 or WER Band B	1.2 centre pane or low-e secondary glazing	3.3
Rooflight	2.2	N/A	3.8
Doors: >60% glazed Other doors[2]	 1.4 or DSER Band C 1.4 or DSER Band B	 1.2 centre pane N/A	 3.3 3.3

Notes:

1. U-values should be calculated as in paragraphs 3.1 to 3.5.
2. For external fire doorsets, as defined in Appendix A of Approved Document B, Volume 1, a maximum U-value of 1.8W/(m2·K) is permissible.
3. See paragraphs 10.10 and 10.25 for instances where column 'b' could apply.

10.10 In this Approved Document, windows and doors refers to windows and external doors that separate a heated space from the external environment, the ground, and any parts of the building which are not heated or, where another part of the building which is not a dwelling, is heated to a different temperature. Windows and doors are described as controlled fittings in the Building Regulations, i.e. windows and doors on which various parts of the Building Regulations impose a requirement.

10.11 In the case of dwellings of architectural and historic interest where special consideration applies or in other cases where there is a need to maintain the character of a façade, if the windows or doors are unable to achieve the U-values set out in column (a) of Table 10.1, then they should achieve or better the lesser U-values set out in column (b) of Table 10.1.

10.12 The total area of windows and doors in the extension should not exceed the sum of:

a. 25% of the internal floor area of the extension; plus
b. the total area of any windows and doors which, as a result of the new extension, no longer exist or are no longer exposed.

10.13 It is advisable to ensure that the total area of windows and doors in the extension is not less than 20% of the internal floor area of the extension, as this would mean that the extension and the part of the existing building that it abuts are likely to experience low levels of daylight, resulting in increased use of electric lighting and consumption of fuel and power. For further guidance see; **BS 8206-2:2008** Lighting for buildings. Code of practice for daylighting.

10.14 In the case of dwellings of architectural and historic interest where special consideration applies, a greater total area of windows and doors may be acceptable. For example, there may be a need for the extension to be consistent with the character of the existing building. In such cases, where practicable, the performance of the windows and doors should be improved or other compensating improvements undertaken following either of the alternative approaches set out in **Section 13**.

10.15 Where low-e secondary glazing is installed, the edge of the secondary glazing element should be fully air sealed to the existing window frame or reveal to minimise the risk of condensation forming between the primary and secondary glazing.

Building Services

10.16 Where an extension to an existing dwelling includes the provision, extension, alteration or replacement of any fixed building services systems, those systems should comply with the appropriate standards in **Sections 4, 5** and paragraphs 3.18 to 3.33, and commissioned according to **Section 7**.

Design and Installation Standards

10.17 When extending an existing dwelling, new, upgraded and renovated building fabric should be carefully designed, detailed and constructed to:

a. avoid gaps in the insulation; and
b. minimise air leakage; and
c. limit reasonably avoidable thermal bridges.

10.18 Particular attention should be paid around window and door openings, to junctions between building elements, such as between the walls and roof, and at changes of geometry, for example a corner in a wall or a hip in a roof.

10.19 Thermal bridges are instances where heat loss is worse than through the main building fabric. They allow heat to flow between the outer and inner skins of a wall, floor or roof by bridging the insulation.

Windows and doors

10.20 This Section of the Approved Document gives guidance for the following building works to an existing dwelling:

a. installing replacement windows and doors; and/or
b. enlarging existing windows and doors; and/or
c. creating new windows and doors.

10.21 In this Approved Document, windows and doors refers to windows and external doors that separate a heated space from the external environment, the ground, and any parts of the building which are not heated or, where another part of the building which is not a dwelling, is heated to a different temperature. Windows and doors are described as controlled fittings in the Building Regulations, i.e. windows and doors on which various parts of the Building Regulations impose a requirement.

10.22 Separate guidance is given in other parts of **Section 10** and in **Section 11** for windows and doors in extensions, conversions (also known as a change of energy status), material changes of use and conservatories and porches.

10.23 Two alternative optional approaches to the guidance below, that offer more design flexibility by allowing some elements of the design to be relaxed if compensated for elsewhere, are set out in **Section 13**.

Window and Door standards

10.24 For new or replacement windows and doors, if the entire unit of that fitting is provided, all of the following apply

a. Units should be draughtproofed
b. Units should achieve or better the U-values set out in column (a) of Table 10.1.
c. Insulated cavity closers should be installed around the windows and doors where appropriate.

10.25 Windows and doors refer to the whole units, i.e. including the frames. Consequently replacing just the glazing or door leaf while retaining an existing frame is not building work and so does not have to meet the energy efficiency requirements. However, in such cases it would be sensible to upgrade the

window or door to as close to the U-values set out in column (a) of Table 10.1 as is practicably possible.

10.26 Building control bodies may accept, as evidence of compliance with the standards given in Table 10.1, a Window Energy Rating and/or Doorset Energy Rating from a certification scheme that provides a quality assured process and a supporting audit trail from calculating the performance of the window or door through to the window or door being installed.

10.27 Where an existing window or door is enlarged or a new one created, either of the following should be met.

a. The total area of windows, roof windows, rooflights and doors should not exceed 25% of the total floor area of the dwelling.
b. If the area of windows, roof windows, rooflights and doors exceeds 25% of the total floor area of the dwelling, measures should be taken to improve the energy efficiency of the dwelling.

Note: *Where the area of windows, roof windows, rooflights and doors exceeds 25%, consideration may also be needed to mitigate the risk of summertime overheating. Please see Approved Document O for further guidance.*

10.28 In the case of dwellings of architectural and historic interest where special consideration applies or in other cases where there is a need to maintain the character of a façade, if the windows or doors are unable to achieve the U-values set out in column (a) of Table 10.1, then they should achieve or better the lesser U-values set out in column (b) of Table 10.1.

10.29 Where low-e secondary glazing is installed, the draughtproofing should be on the secondary glazing to minimise the risk of condensation forming between the primary and secondary glazing.

Conservatories and porches

10.30 Conservatories and porches are exempt from the energy efficiency requirements if they fulfil all of the following requirements:

a. be at ground level; and
b. have an internal floor area that is less than 30 m^2; and
c. be thermally separate from the heated area of the dwelling, and
d. the conservatory or porch contains no fixed heating appliance or the buildings heating system is not extended into the conservatory or porch.

New conservatories or porches

10.31 A conservatory or porch is considered as thermally separate where the existing walls, windows and doors between the dwelling and the conservatory or porch are left in place or if they are removed, they are replaced by walls that achieve or

better U-values given in column (a) of Table 10.1. The U-values for windows and doors should be calculated as Paragraphs 3.1 to 3.5.

a. Glazed and opaque elements should meet the standards set out in the final column of Table 3.1 (The limitations on the total area of windows, roof windows and doors as set out in paragraph 10.12 of Extensions do not apply here); and

b. be thermally separate from the heated area of the dwelling (see paragraph 11.29); and
c. any fixed space heating installed in the conservatory or porch should comply with **Sections 4, 5** and **7**.

10.32 Adding a non-exempt conservatory to increase the habitable volume of an existing dwelling triggers a requirement for additional energy efficiency improvements – consequential improvements – that are set out in **Section 12**.

10.33 Two alternative optional approaches that offer more design flexibility by allowing some elements of the design to be relaxed if compensated for elsewhere are set out in **Section 13**.

10.34 If the proposed addition is not thermally separated from the dwelling and therefore does not meet all of the requirements in paragraphs 10.30 and 10.31, it should be treated as an extension and follow the guidance set out in paragraphs 10.2 to 10.19 including the limitation on the total area of windows and doors.

Existing conservatories or porches

10.35 An existing conservatory or porch ceases to be exempt if:

a. any or all of the walls, windows and doors that thermally separate an existing exempt conservatory or porch from the dwelling are removed (and not replaced); or
b. the conservatory or porch is provided with a fixed heating appliance or the buildings heating system is extended into the conservatory or porch.

10.36 In such situations, this constitutes a change in energy status and the previously exempt conservatory or porch should be treated as a conversion and the guidance set out in **Section 11** paragraphs 11.2 to 11.11 should be followed.

Indoor Swimming Pools

10.37 New indoor swimming pool basins (walls and floors) should achieve or better a U-value of 0.25 W/m^2.K.

10.38 Two alternative optional approaches that offer more design flexibility by allowing some elements of the design to be relaxed if compensated for elsewhere are set out in **Section 13**.

10.39 Design consideration should be taken with regards to compressive creep, insulation boards not fully supported and the effects of point loading. Care should be taken to avoid thermal bridging particularly around basin wall and floor junctions with foundations.

Regulation 22: Change to energy status and 23: Requirements for the renovation or replacement of thermal elements

This Approved Document deals with the requirements of regulation 22 and 23 to the Building Regulations 2010.

Regulation 22 - Requirements relating to a change to energy status

Where there is a change to a building's energy status, such work, if any, shall be carried out as is necessary to ensure that the building complies with the applicable requirements of Part L of Schedule 1.

Regulation 23 - Requirements for the renovation or replacement of thermal elements

(1) Where the renovation of an individual thermal element—

(a) constitutes a major renovation; or

(b) amounts to the renovation of more than 50% of the element's surface area;

the renovation must be carried out so as to ensure that the whole of the element complies with paragraph L1(a)(i) of Schedule 1, in so far as that is technically, functionally and economically feasible.

(2) Where the whole or any part of an individual thermal element is proposed to be replaced and the replacement—

(a) constitutes a major renovation; or

(b) (in the case of part replacement) amounts to the replacement of more than 50% of the thermal element's surface area;

the whole of the thermal element must be replaced so as to ensure that it complies with paragraph L1(a)(i) of Schedule 1, in so far as that is technically, functionally and economically feasible."

Regulation 2(1) - Interpretation

"change to a building's energy status" means any change which results in a building becoming a building to which the energy efficiency requirements of these Regulations apply, where previously it was not

Intention

In the Welsh Minister's view, the requirements of L1(a) in relation to regulations 22 and 23 are met by following the guidance in **Section 11** for renovation or replacement of a thermal element and a change to energy status.

Section 11

Work to thermal elements in existing dwellings

General

11.1 This section covers the following building works.

a. For conversions (change of energy status) – follow paragraphs 11.2 to 11.13
b. For renovations – following paragraphs 11.14 to 11.25
c. For material change of use - follow paragraphs 11.26 to 11.45
d. For replacement thermal elements – follow paragraph 11.46

Conversions (change of energy status)

11.2 In this Approved Document, conversion describes when part of a dwelling, which previously was not subject to the energy efficiency requirements, is converted into a heated space, for example a loft or garage conversion where the space is now to be heated. This is described as a change of energy status in the Building Regulations.

11.3 In the case of a conversion, a retained thermal element is an existing element that becomes a thermal element where previously it was not, for example the gable wall in a loft conversion.

11.4 Thermal element is used in the Building Regulations to describe a wall, floor or roof, which separates a heated space from the external environment, the ground, and any parts of the building which are not heated or, where another part of the building which is not a dwelling, is heated to a different temperature.

11.5 Converting part of an existing dwelling to increase the habitable volume triggers a requirement for additional energy efficiency improvements – consequential improvements – that are set out in **Section 12**.

11.6 Two alternative optional approaches to the guidance below, that offer more design flexibility by allowing some elements of the design to be relaxed if compensated for elsewhere, are set out in **Section 13**.

Building Fabric

11.7 Retained thermal elements should be upgraded to achieve or better U-values set out in column (a) of Table 11.1.

Table 11.1: Standards for retained fabric elements

Elements[1]	(a) Maximum U-values for retained fabric[2]	(b) Limiting U-values for retained fabric[2]
Walls – cavity insulation[3, 4]	0.55	0.70
Walls – internal[5] or external[6] insulation	0.30[9]	0.70
Floors[7]	0.25[10]	0.70
Roofs[8]	0.16[11]	0.35

1 For dormer windows, 'roof' includes the roof parts of the windows and 'wall' includes the wall parts (cheeks).

2 Area-weighted average U- values.

3 Where existing wall cavities are unfilled, they should be insulated (where suitable) to achieve the maximum U-value in column (a). Prior to installing cavity wall insulation, the wall should be assessed to ensure its condition, construction type, and location are suitable for insulating by this method. Where the assessment identifies a significant risk (e.g. for sites exposed to driving rain) the wall is exempt from meeting the maximum U-value in column (a) using only this method. In such cases, other methods of insulation should be considered, e.g. internal or external wall insulation.

4 Where existing wall cavities are partially insulated, they are exempt from meeting the maximum U-value in column (a). The air gap on the cold side of the existing insulation should not be compromised through the application of additional insulation (unless expert advice is sought) as this may present a moisture risk.

5 Where internal wall insulation is intended, the maximum U-value in column (a) should be achieved. The wall should be assessed to ensure it is suitable for insulating by this method, which should include a moisture risk assessment.

6. If a wall is suitable for the application of external wall insulation, the maximum U-value in column (a) should be achieved provided suitable specifications have been followed, such as those published by SWIGA (Solid Wall Insulation Guarantee Agency): External wall insulation specification for weathering and thermal bridge control. A wall may be suitable to receive external wall insulation if it is of solid construction or has fully filled and insulated cavities. Cavity walls that are uninsulated or partially insulated should be assumed as not suitable for the application of external wall insulation (unless expert advice is sought).

7. The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged dwelling.

8. If meeting such a standard would limit headroom, a worse U-value may be appropriate. In such cases, both the following should be achieved.
a. The depth of the insulation plus any required air gap should be at least to the depth of the rafters.
b. The insulant should be chosen to achieve the lowest practicable U-value

9. If meeting such a standard would reduce the internal floor area of the room bounded by the wall by more than 5%, a lesser provision may be appropriate.

10. If meeting such a standard would create significant problems in relation to adjoining floor levels, a lesser standard may be appropriate.

11. If for a flat roof or roof with integral insulation there are problems with the load-bearing capacity of the frame or height of the upstand, a higher U-value may be appropriate.

11.8 Where the U-value set out in column (a) of Table 11.1 is not economically, functionally or technically feasible, the thermal element should be upgraded as close as is practicably possible to the U-values in column (a) of Table 11.1. Generally, the U-value of the thermal element should not be worse than the limiting U-values set out in column (b) of Table 11.1 to minimise the risk of surface condensation and mould growth.

Note: *Where the suitability of an element needs to be assessed prior to the application of insulation, or where it is recommended that expert advice be sought in Table 11.1, the person carrying out this work should be appropriately trained in risk assessment and management (for example a Retrofit Coordinator as identified in PAS 2035). Following the procedures given in 'PAS 2030/2035: 2019 - Retrofitting dwellings for improved energy efficiency. Specification and guidance' is one way of demonstrating to the Building Control Body that the suitability of an element has been adequately considered.*

11.9 The test of the economic feasibility of an energy efficiency measure is to calculate if the measure achieves a payback of the initial cost within 15 years through energy savings. This is calculated by dividing the cost of implementing the measure (not the whole cost of the project) by the annual energy saving achieved by that measure, estimated using the latest version of SAP, taking account of VAT in both the cost and the saving.

11.10 An energy efficiency measure is not deemed to be functionally or technically feasible if the thickness of insulation needed to achieve the U-values set out in column (a) of Table 11.1 would:

a. reduce the internal floor area of a room by more than 5%; or
b. cause significant problems with adjoining floor levels; or
c. create insufficient headroom; or
d. could not be supported by the existing structure.

11.11 In such cases, the choice of insulation should be based on achieving a U-value as close as is practicably possible to the U-values in column (a) of Table 11.1.

11.12 If any new or replacement thermal elements are constructed as part of a conversion the guidance for new thermal elements set out in paragraphs 3.8 and 3.9, should be followed.

Windows and Doors, Building Services, Design and Installation Standards

11.13 Paragraphs 11.36 to 11.42 should be followed in relation to windows and doors. Paragraph 11.43 should be followed in relation to building services, and paragraphs 11.44 to 11.46 should be followed in relation to Design and Installation Standards.

Renovations

11.14 Renovating a thermal element means one of the following.

a. Providing a new layer through cladding or rendering the external surface of a thermal element.

b. Providing a new layer through dry-lining the internal surface of a thermal element.

c. Replacing an existing layer through stripping down the thermal element to expose basic structural components (e.g. bricks, blocks, rafters, joists, frame) and then rebuilding.

d. Replacing the waterproof membrane on a flat roof.

e. Providing cavity wall insulation.

11.15 In this Approved Document, where a thermal element is subject to a renovation the performance of the whole of the thermal element should be improved provided the area to be renovated is:

a. greater than 50% of the surface of the individual thermal element or
b. constitutes a major renovation where more than 25% of the surface area of the building envelope undergoes renovation.

***Note**: When a building undergoes a major renovation this may represent an opportunity to consider and take into account the technical, environmental and economic feasibility of installing high-efficiency alternative systems (**see section 3**).*

***Note**: When thermal elements are being renovated, the work should comply with all the requirements in Schedule 1, but particular attention should be paid to Parts B, C, F and J.*

11.16 Thermal element is used in the Building Regulations to describe a wall, floor or roof, which separates a heated space from the external environment, the ground, and any parts of the building which are not heated or, where another part of the building which is not a dwelling, is heated to a different temperature.

11.17 The provision of a new layer means cladding or rendering the external surface or dry lining the internal surface. The replacement of an existing layer means either stripping down the element to its basic structural components (masonry, timber frame, steel frame, etc.) and then rebuilding or replacing the waterproof membrane of a flat roof.

11.18 When assessing the proportion of the area to be renovated in paragraph 11.15 the area of the element to be renovated should be taken as that of the individual element, not all the elements of that type in the building. For example, if stripping down the roof of an extension the area of the element is the area of the extension roof, not the total roof area of the dwelling. The area of the element also differs

whether the element is being renovated from the inside or the outside. For example, if removing all the plaster finish from the inside of a wall, the area of the element is the area of the wall in the room, however, if removing the external render, it is the area of the elevation in which that wall sits.

11.19 Two alternative optional approaches to the guidance below, that offer more design flexibility by allowing some elements of the design to be relaxed if compensated for elsewhere, are set out in **Section 13**.

Building Fabric

11.20 Where a thermal element is renovated through the provision of a new layer or the replacement of an existing layer, as described in paragraph 12.15, the performance of the whole element should be improved to achieve or better the U-values set out in column (a) of Table 11.1 including any risk assessments specified in the table are undertaken.

11.21 Where the U-value set out in column (a) of Table 11.1 is not economically, functionally or technically feasible, then the thermal element should be upgraded as close as is practicably possible to the U-values in column (a) of Table 11.1. Generally, the U-value of the thermal element should not be worse than the limiting U-values set out in column (b) of Table 11.1 to minimise the risk of surface condensation and mould growth.

Note: *Where the suitability of an element needs to be assessed prior to the application of insulation, or where it is recommended that expert advice be sought in Table 11.1, the person carrying out this work should be appropriately trained in risk assessment and management (for example a Retrofit Coordinator as identified in PAS 2035). Following the procedures given in 'PAS 2030/2035: 2019 - Retrofitting dwellings for improved energy efficiency. Specification and guidance' is one way of demonstrating to the Building Control Body that the suitability of an element has been adequately considered.*

11.22 The test of the economic feasibility of an energy efficiency measure is to calculate if the measure achieves a payback of the initial cost within 15 years through energy savings. This is calculated by dividing the cost of implementing the measure (not the whole cost of the project) by the annual energy saving achieved by that measure, estimated using the latest version of SAP, taking account of VAT in both the cost and the saving.

Note: *For the purposes of determining whether a measure is economically, functionally or technically feasible, the criteria set out in paragraphs 11.9, 11.10 and 11.11 should be applied.*

Design and Installation Standards

11.23 When renovating part of an existing dwelling, renovated building fabric should be carefully designed, detailed and constructed to:

a. avoid gaps in the insulation; and
b. minimise air leakage; and
c. limit reasonably avoidable thermal bridges.

11.24 Particular attention should be paid around window and door openings, to junctions between building elements, such as between the walls and roof, and at changes of geometry, for example a corner in a wall or a hip in a roof.

11.25 Thermal bridges are instances where heat loss is worse than through the main building fabric. They allow heat to flow between the outer and inner skins of a wall, floor or roof by bridging the insulation.

Material Change of Use

11.26 A material change of use, in relation to dwellings, is any of the following.:

a. the building is now used as a dwelling, where previously it was not; or
b. the building now contains a flat, where previously it did not; or
c. The building contains a greater or lesser number of dwellings than it did, having previously contained at least one dwelling.

Note: *The following standards apply if either the whole building or part of a building is undergoing a material change of use.*

11.27 Where a previously unheated building is converted into a dwelling, it is described as a “change in energy status” in the Building Regulations and paragraphs 11.2 to 11.12 should be followed.

11.28 Thermal element is used in the Building Regulations to describe a wall, floor or roof, which separates a heated space from the external environment, the ground, and any parts of the building which are not heated or, where another part of the building which is not a dwelling, is heated to a different temperature.

11.29 Two alternative optional approaches to the guidance below, that offer more design flexibility by allowing some elements of the design to be relaxed if compensated for elsewhere, are set out in **Section 13**.

Building Fabric

11.30 Existing thermal elements in a building subject to a material change of use should be upgraded to achieve or better the U-values set out in column (a) of Table 11.1 including any risks assessments specified in the table are undertaken.

11.31 Where the U-value set out in column (a) of Table 11.1 is not economically, functionally or technically feasible, then the thermal element should be upgraded as close as is practicably possible to the U-values in column (a) of Table 11.1. Generally, the U-value of the thermal element should not be worse than the limiting U-values set out in column (b) of Table 11.1 to minimise the risk of surface condensation and mould growth.

Note: *Where the suitability of an element needs to be assessed prior to the application of insulation, or where it is recommended that expert advice be sought in table 11.1, the person carrying out this work should be appropriately trained in risk assessment and management (for example a Retrofit Coordinator as identified in PAS 2035). Following the procedures given in 'PAS 2030/2035: 2019 - Retrofitting dwellings for improved energy efficiency. Specification and guidance' is one way of demonstrating to the Building Control Body that the suitability of an element has been adequately considered.*

11.32 The test of the economic feasibility of an energy efficiency measure is to calculate if the measure achieves a payback of the initial cost within 15 years through energy savings. This is calculated by dividing the cost of implementing the measure (not the whole cost of the project) by the annual energy saving achieved by that measure, estimated using the latest version of SAP, taking account of VAT in both the cost and the saving.

11.33 An energy efficiency measure is not deemed to be functionally or technically feasible if the thickness of insulation needed to achieve the U-values in column (a) of Table 11.1 would:

a. reduce the internal floor area of a room by more than 5%; or
b. cause significant problems with adjoining floor levels; or
c. create insufficient headroom; or
d. could not be supported by the existing structure.

11.34 In such cases, the choice of insulation should be based on the best thermal performance that is practicable to achieve a U-value as close as is practicably possible to the U-values in column (a) of Table 11.1. In cases of insufficient headroom, the depth of the insulation plus any required air gap should be at least equal to the depth of the rafters.

11.35 If any new or replacement thermal elements are constructed as part of a material change of use, the guidance for new thermal elements set out in paragraphs 3.7 and 3.8 should be followed.

Windows and Doors

11.36 If an existing window or door has a U-value worse than the threshold U-values set out in column (c) of Table 10.1, then it should be replaced with draught-proofed units that achieve or better the U-values set out in column (a) of Table 10.1. Insulated cavity closers should be installed around the windows and doors, where appropriate.

11.37 New and replacement windows and doors should be draught-proofed units that achieve or better the U-values set out in column (a) of Table 10.1. Insulated cavity closers should be installed around the windows and doors, where appropriate.

11.38 In this Approved Document, windows and doors refers to windows and external doors that separate a heated space from the external environment, the ground, and any parts of the building which are not heated or, where another part of the building which is not a dwelling, is heated to a different temperature. Windows and doors refer to the whole units, i.e. including the frames.

11.39 Consequently replacing just the glazing or door leaf while retaining an existing frame is not building work and so does not have to meet the energy efficiency requirements. However, in such cases it would be sensible to upgrade the window or door to as close to the U-values set out in column (a) of Table 10.1 as is practicably possible. Windows and doors are described as controlled fittings in the Building Regulations, i.e. windows and doors on which various parts of the Building Regulations impose a requirement.

11.40 Where an existing window or door is enlarged or a new one created the total area of windows and doors should not exceed 25% of the total floor area of the dwelling.

11.41 In the case of dwellings of architectural and historic interest where special consideration applies or in other cases where there is a need to maintain the character of a façade, if replacement windows or doors are unable to achieve the U-values set out in column (a) of Table 10.1, then they should achieve or better the lesser U-values set out in column (b) of Table 10.1.

11.42 Where low-e secondary glazing is installed, the draughtproofing should be on the secondary glazing to minimise the risk of condensation forming between the primary and secondary glazing.

Building Services

11.43 Where a material change of use of a building to become a dwelling includes the provision, extension, alteration or replacement of any fixed building services systems, those systems should comply with the appropriate standards in **Sections 4, 5** and paragraphs 3.15 to 3.32, and commissioned according to **Section 7.**

Design and Installation Standards

11.44 When undertaking a change of use, the building fabric should be carefully designed, detailed and constructed to:

a. avoid gaps in the insulation; and
b. minimise air leakage; and
c. limit reasonably avoidable thermal bridges.

11.45 Particular attention should be paid around window and door openings, to junctions between building elements, such as between the walls and roof, and at changes of geometry, for example a corner in a wall or a hip in a roof.

11.46 Thermal bridges are instances where heat loss is worse than through the main building fabric. They allow heat to flow between the outer and inner skins of a wall, floor or roof by bridging the insulation.

Replacement thermal element in an existing dwelling

11.47 Replacement thermal elements constructed in an existing dwelling should achieve the minimum standards in paragraphs 3.8 and the final column of table 3.1. If minimum standards are not technically feasible, they should be constructed to as close to the minimum standards as is practicably possible.

Note: *A thermal element does not include windows, doors, roof windows or roof-lights.*

Regulation 28: Consequential improvements

This Approved Document deals with the requirements of regulation 28 of the Building Regulations 2010 (as amended).

Regulation 28 - Consequential improvements to energy performance

(1) Paragraph (3) applies to an existing building with a total useful floor area over 1000m^2 where the proposed building work consists of or includes—
(a) the initial provision of any fixed building services; or
(b) an increase to the installed capacity of any fixed building services.

(2) Paragraph (3) applies to an existing building where the proposed building work consists of or includes--
(a) an extension; or
(b) the extension of the building's heating system or the provision of a fixed heating appliance, to heat a previously unheated space.

(3) Subject to paragraph (4), where this paragraph applies, such work, if any, shall be carried out as is necessary to ensure that the building complies with the requirements of Part L of Schedule 1.

(4) Nothing in paragraph (3) requires work to be carried out if it is not technically, functionally and economically feasible.

Note: *Where the building control body is a registered building control approver, see regulation 5 of the Building (Registered Building Control Approvers etc.) (Wales) Regulations 2024(as amended).*

Intention

In the Welsh Minister's view, where regulation 28 applies, the requirements of this regulation are met for existing dwellings by carrying out consequential improvements that are technically, functionally and economically feasible, by following the guidance in **Section 12**.

Section 12

Consequential improvements

What are consequential improvements?

12.1 Consequential improvements (see regulation 28) describes additional energy efficiency improvements that should be undertaken where an existing dwelling is extended or part of the dwelling is converted increasing the habitable volume. The dwelling could be extended by means of a conventional extension or a non-exempt conservatory or porch. A conversion (also known as a change of energy status) is where there is an extension of the building's heating system or the provision of a fixed heating appliance in a previously unheated space, e.g. a garage or loft conversion.

12.2 Where consequential improvements are triggered by extensions (including non-exempt conservatories or porches) and conversions, the work should still comply with the relevant guidance: see **Section 10** for guidance on extensions; see **Section 11** for guidance on conversions and on conservatories and porches.

12.3 Where consequential improvements are undertaken they should only be undertaken where they are technically, functionally or economically feasible. Those improvement measures identified here should typically be feasible.

Note: *The test of the economic feasibility of an energy efficiency measure is to calculate if the measure achieves a payback of the initial cost within 15 years through energy savings. This is calculated by dividing the cost of implementing the measure (not the whole cost of the project) by the annual energy saving achieved by that measure, estimated using the latest version of SAP, taking account of VAT in both the cost and the saving.*

Consequential improvement measures: energy efficiency

12.4 Where an existing dwelling is extended or converted, as a result increasing the habitable area by no more than 10m^2, if there is no loft insulation or it is less than 200 mm thick, provide 250 mm of loft insulation or increase it to 250 mm (figures are based on mineral wool/or equivalent insulation).

12.5 Where an existing dwelling is extended or converted, as a result increasing the habitable area by more than 10m^2, the following energy efficiency improvements should be undertaken:

a. if the dwelling has uninsulated cavity walls, fill with insulation where suitable (cavity wall insulation may not be suitable in some circumstances, such as sites exposed to driving rain)[1]; and

b. if there is no loft insulation or it is less than 200 mm thick, provide 250 mm insulation or increase it to 250 mm (figures are based on mineral wool/or equivalent insulation); and

c. upgrade any hot water cylinder insulation as follows:

   i. if the hot water cylinder is uninsulated, provide a 160 mm insulated jacket; or
   ii. if the hot water cylinder has insulated jacket less than 100 mm thick, add a further insulated jacket to achieve a total thickness of 160 mm; or
   iii. if the hot water cylinder has factory-fitted solid foam insulation less than 25 mm thick, add an 80 mm insulated jacket.

12.6 Where the consequential improvement to increase the thickness of the loft insulation to 250 mm is triggered by a loft conversion, the consequential improvement will still be necessary if there are some areas of the loft floor remaining around the new heated volume, for example near the eaves.

[1] A wall cavity should be assessed prior to the application of cavity wall insulation by a person competent to do so. Following the Path A procedures identified in 'PAS 2035/2030: 2019, Retrofitting dwellings for improved energy efficiency (specification and guidance)', is one way of demonstrating to the building control body that the suitability of an element has been adequately considered.

12.7 Care should be taken when installing insulation to avoid any gaps and not compromise the existing ventilation requirements. Particular attention should be paid around window and door openings, to junctions between building elements, such as between the walls and roof, and at changes of geometry, for example a corner in a wall or a hip in a roof.

Consequential improvement measures: Significant extensions

12.8 Where a significant extension is proposed for an existing dwelling, consequential improvements should be provided to the existing dwelling and/or extension following the simplified approach in paragraph 12.9 or the alternative approach in paragraph 12.10.

Note: *For the purposes of paragraph 12.8, an extension is classed as a significant extension where it involves new construction that increases the footprint of the dwelling, and where:*

(a) the total gross internal floor area of the extension (including conditioned and unconditioned spaces, e.g. such as a garage, but excluding rooms in the roof space) is 40 m² or greater; and

(b) the extension has at least the same number of storeys (excluding room in the roof storeys) as the existing dwelling.

Simplified Approach

12.9 Installation of one of the following renewable technology's:

a. Photovoltaic installation following the system specific guidance in paragraphs 5.64 to 5.67 with an array at least 2.0 kWp.
b. Solar water heating system that serves both the existing dwelling and extension by following the system specific guidance in paragraphs 5.43 to 5.47.

Note: *Electrical generation systems using renewable technology on dwellings connected to the electricity distribution network will generally require either Distribution Network Operator (DNO) notification for smaller systems, or DNO connection approval for larger systems. Further guidance and information should be obtained from the relevant DNO.*

Note: *Renewable technology systems should be compatible with energy storage systems to maximise self-consumption by storing site-generated energy during periods when renewable generation is inactive.*

Note: *Where the work involves a significant change in the applied loading to an existing roof, the structural integrity of the roof structure and the supporting structure should be checked to ensure that upon completion of the work the building is not less compliant with Requirement A1 than the original building. Approved Document A (Structure) should be followed.*

Alternative Approach

12.10 As an alternative to the simplified approach, alternative energy efficiency improvements should be provided following either paragraph 12.11 or 12.12.

12.11 Heat pump technology should be designed and installed to provide space heating and/or domestic hot water to the dwelling and extension, following the system specific guidance in paragraphs 4.9 to 4.24 and 5.1 to 5.7.

12.12 The 'Equivalent Primary Energy and Carbon Emissions Target' approach as set out in **section 13** may be used with the following limits applied to the benchmark.

a. The proposed extension benchmark should include a 2.0 kWp solar photovoltaic system and
b. The array modelled with the following inputs:
    i. Orientation: south-facing
    ii. Overshading: none or very little
    iii. Roof pitch: 35°

12.13 The 'Equivalent Primary Energy and Carbon Emissions Target' approach offers greater design flexibility and allows other renewable or low and zero carbon technologies and/or enhanced fabric/service efficiencies, to contribute toward the reduction of the primary energy and carbon emissions of the dwelling and proposed significant extension.

Note: *Non-renewable technology and fabric improvement measures may be used to meet the primary energy and carbon emissions target for a dwelling where the provision of renewable technology is not chosen.*

Note: *Fabric improvement measures used to meet the primary energy and carbon emissions target should be additional to the measures identified in paragraphs 12.4 to 12.7.*

Exemptions for significant extensions

12.14 A significantly extended dwelling is exempt from the requirements in paragraph 12.8 where the dwelling:

a. Already has renewable technology installed that has a capacity equivalent to or better than the sizes set out in paragraph 12.9.
b. Already has a heat pump that serves the dwelling and can be extended to serve the proposed extension.
c. Meets the exemption guidance in paragraphs 0.8 to 0.15.
d. cannot reasonably accommodate the renewable technologies in paragraph 12.9 because they are not technically, functionally or economically feasible (see paragraph 12.3).

Note: *Where a dwelling is considered unsuitable for solar renewable technology following paragraph 12.9, evidence of the technical or economic constraints should be submitted to the building control body, unless the alternative approach described in paragraphs 12.10 to 12.13 is followed.*

Note: *Evidence of technical or economic constraints may include for example an MCS-accredited installer feasibility report or equivalent.*

Note: *Where a DNO does not approve a connection, this should be treated as not technically feasible as described in paragraph 12.14 d. Evidence in the form of a DNO refusal letter should be submitted to the building control body.*

Section 13

Optional approaches for more Design Flexibility

Introduction

13.1 This Section of the Approved Document outlines two optional alternative approaches to the standards based approach set out in the preceding Sections of this Approved Document: the 'U-value trade-off approach' and 'equivalent primary energy / carbon emissions target approach', which offer more design flexibility by allowing some elements of the design to be relaxed if compensated for elsewhere. Consequential improvements set out in **Section 12** and standards for fixed building services set out in **Sections 4, 5** and paragraphs 3.15 to 3.32 may not be relaxed.

13.2 The 'U-value trade-off approach' requires the calculation of an area-weighted average U-value and the 'equivalent primary energy/carbon emissions target approach' requires SAP 10 energy rating assessment to calculate primary energy use and carbon emissions. Both approaches require two comparable calculations: the proposal should be gauged by a benchmark proposal that complies with the relevant requirements set out in the preceding Sections of this Approved Document.

U-value trade-off Approach

13.3 The 'U-value trade-off approach' allows some of the U-value standards and/or limit on the total area of windows and doors, set out in the relevant preceding Sections of this Approved Document, to be relaxed if other U-values are improved to compensate. For example: in an extension poor performance of one wall may be traded for better performance of another wall; in a conversion poor performance of one wall may be traded for a compensatory insulation improvement elsewhere in the existing dwelling; exceeding the limit on the total area of windows and doors may be traded for better performance of the additional windows.

13.4 The area-weighted average U-value for all of the fabric, windows and doors in the proposal should be no greater than that of a fully compliant benchmark. Note that using the area-weighted average U-value of the existing dwelling as a benchmark does not demonstrate compliance.

The area-weighted average U-value shall be calculated using the following equation:

$$\{(U1 \times A1) + (U2 \times A2) + (U3 \times A3) + \ldots\} \div \{A1 + A2 + A3 + \ldots\}$$

Where:
U = the U-value of each individual thermal element in $W/m^2.K$
A = the area of each individual thermal element in m^2

13.5 The benchmark should comply with the relevant U-value standards and limit on the area of window and doors where work to the existing dwelling/building is proposed as set out in Sections 10-11. If there are other parts of the existing dwelling where work is not proposed, the U-values for the existing fabric, windows and doors should be used in the area-weighted average U-value calculation.

13.6 In the case of an extension or a conversion: the benchmark extension/conversion should be of the same size and shape as the proposed extension/conversion. If compensatory insulation improvements to the existing dwelling are not proposed, the area-weighted average U-value should be calculated for the proposed extension/conversion and the benchmark extension/conversion only; if compensatory insulation improvements to the existing dwelling are proposed, the average U-values should be calculated for the proposed extension/conversion plus the dwelling including improvements and the benchmark extension/conversion plus the existing dwelling (including any consequential improvements).

13.7 In all cases except extensions: if the proposal does not exceed the limit on the total area of window and doors of 25% of the total floor area of the dwelling, the total area of windows and doors in the benchmark should be equal to that in the proposal. If the proposal does exceed the limit on the total area of windows and doors, the total area of windows and doors in the benchmark should be 25% of the total floor area of the dwelling.

13.8 In the case of an extension: if the proposal does not exceed the limit on the total area of window and doors set out in paragraph 10.11, the total area of windows and doors in the benchmark should be equal to that in the proposal. If the proposal does exceed the limit on the total area of windows and doors, the total area of windows and doors in the benchmark should be 25% of the total floor area of the dwelling plus the total area of any windows and doors which, as a result of the new extension, no longer exist or are no longer exposed.

13.9 Although U-value requirements may be relaxed, the U-value of any individual thermal element (wall, floor or roof) should not be worse than the limiting U-values set out in column (b) of Table 11.1 to ensure resistance to surface condensation and mould growth.

13.10 If compensatory insulation improvements are proposed to other parts of the dwelling fabric, windows or doors, such improvements should achieve or better the U-value standards set out in the relevant Sections of this Approved Document. This means that the area-weighted average U-value of the proposal may be better that of the benchmark.

Equivalent Primary Energy and Carbon Emissions Target Approach

13.11 The 'Equivalent Primary Energy and Carbon Emissions Target' approach allows some of the U-value standards and/or limit on the total area of windows and doors, set out in the preceding Sections of this Approved Document, to be relaxed if other U-values and/or the performances of fixed building services are improved to compensate. For example: in a renovation poor performance of one wall may be traded for better efficiency of a heating boiler.

13.12 The primary energy and carbon emissions rate, calculated using SAP 10, from the proposal should be no greater than that of a fully compliant benchmark. Note that using the calculated carbon emissions from the existing dwelling as a benchmark does not demonstrate compliance.

13.13 The benchmark should comply with the relevant U-value and fixed building services standards and limit on the area of window and doors where work to the existing dwelling /building is proposed as set out in **Sections 11 and 12**. If there are other parts of the existing house where work is not proposed, the U-values for the existing fabric, windows and doors and building service efficiencies should be used in the SAP assessment.

13.14 In the cases of an extension or a conversion: the benchmark extension/conversion should be of the same size and shape as the proposed extension/conversion. If compensatory insulation improvements to the existing dwelling are not proposed, the area-weighted average U-value should be calculated for the proposed extension/conversion and the benchmark extension/conversion only; if compensatory insulation improvements to the existing dwelling are proposed, the average U-values should be calculated for the proposed extension/conversion plus the dwelling including improvements and the benchmark extension/conversion plus the existing dwelling (including consequential improvements).

13.15 In all cases except extensions: if the proposal does not exceed the limit on the total area of window and doors of 25% of the total floor area of the dwelling, the total area of windows and doors in the benchmark should be equal to that in the proposal. If the proposal does exceed the limit on the total area of windows and doors, the total area of windows and doors in the benchmark should be 25% of the total floor area of the dwelling.

13.16 In the case of an extension: if the proposal does not exceed the limit on the total area of window and doors set out in paragraph 10.12, the total area of windows and doors in the benchmark should be equal to that in the proposal. If the proposal does exceed the limit on the total area of windows and doors, the total area of windows and doors in the benchmark should be 25% of the total floor area of the dwelling plus the total area of any windows and doors which, as a result of the new extension, no longer exist or are no longer exposed.

13.17 Although U-value requirements may be relaxed, the U-value of any individual thermal element (wall, floor or roof) should not be worse than the limiting U-values set out in column (b) of Table 11.1 to ensure resistance to surface condensation and mould growth.

13.18 If compensatory insulation improvements are proposed to other parts of the dwelling fabric, windows or doors, such improvements should achieve or better the U-value standards set out in the relevant Sections of this Approved Document. This means that the primary energy target of the proposal may be better that of the benchmark.

13.19 SAP 10 energy rating assessments should be carried out by a qualified On Construction Domestic Energy Assessor (OCDEA). Where the thermal characteristics of elements of the existing building are unknown, the data in SAP 10 Appendix S should be used in both assessments. The two assessments should only differ in as much as the proposal differs from the benchmark – all other SAP variables (for example, air permeability, thermal bridging factors, etc.) should be the same in both assessments, in order to provide a fair comparison.

Appendix A

Key terms

Note: *Except for the items marked * (which are from the Building Regulations 2010), these definitions apply only to Approved Document L, Volume 1: Dwellings.*

Air barrier An air barrier controls air leakage into and out of the building envelope. This is usually in the form of a membrane.

Air permeability The measure of airtightness of the building fabric. It is defined as the air leakage rate per hour per square metre of envelope area at the test reference pressure differential of 50Pa or 4Pa.

-The limiting air permeability is the worst allowable air permeability.

-The design air permeability is the target value set at the design stage.

-The assessed air permeability is the measured air permeability of the building concerned. The assessed air permeability is the value used to establish the dwelling primary energy rate, the dwelling emission rate and the dwelling energy use intensity.

Airtightness The resistance of the building envelope to infiltration when ventilators are closed. The greater the airtightness at a given pressure difference across the envelope, the lower the infiltration.

Approved methodology The methodology approved by Welsh Ministers under regulation 24 of the Building Regulations. Regulation 24 requires Welsh Ministers to approve a methodology to calculate the energy performance of a building. For a new dwelling, there is one methodology which has been developed for this purpose.

- The Governments Standard Assessment Procedure for the Energy Rating of Dwellings (Standard Assessment Procedure or SAP).

Automation means a control function which automatically adjusts time and temperature settings based on occupancy detection and/or stored data from user adjustments over time.

Benchmark Commissioning Checklist A checklist that can be used to show that commissioning has been carried out satisfactorily. (Benchmark is registered as a European Collective Mark by the Heating and Hot Water Industry Council, and the content is copyright.)

Building automation and control system means a system comprising all products, software and engineering services that can support energy efficient, economical and safe operation of heating, ventilation and air conditioning systems and on-site electricity generation through automatic controls and by facilitating the manual management of those building systems.

Building control body means a local authority building control department or a registered building control approver.

***Building Envelope** (in relation to a building) is defined in Regulation 35 as: the walls, floor, roof, windows, doors, roof windows and rooflights.

Building heat distribution system The heat network distribution pipework for hot water and heating for a building connected to a heat network. Building distribution pipework may be internal or external. For blocks of flats it does not include heat distribution within individual dwellings, for example the heat interface unit and space heating and hot water systems within dwellings. Also sometimes referred to as secondary heat network.

Building Regulations compliance certificate A certificate issued by an installer registered with an authorised competent person self-certification scheme, or by a registered third-party certifier registered with an authorised third-party certification scheme stating that the work described in the certificate complies with regulations 4 (requirements relating to building work) and 7 (materials and workmanship).

Centre pane (U-value) means the U-value determined in the central area of the glazing unit, making no allowance for edge spacers or the window frame.

***Change to energy status** is defined in Regulation 2(1) as: any change which results in a building becoming a building to which the energy efficiency requirements of the Building Regulations apply, where previously it was not.

Circuit-watt refers to the power consumed in lighting circuits by light sources and, where applicable, their associated control gear (including transformers and drivers) and power factor correction equipment.

CO_2 emission factor An estimate of CO_2 equivalent emissions produced by the use of different fuels per kWh of delivered energy.

Coefficient of performance (COP) is a measure of the efficiency of a heat pump at specified source and sink temperatures, measured using the procedures in **BS EN 14511-2**.

-Heating COP = heat output / power input

-% COP (COP×100) is the heat generator efficiency.

Commissioning is when after all or part of a fixed building service or on-site electricity generation system has been installed, replaced or altered, the system is taken from a state of static completion to working order. Testing and adjusting are carried out for fixed building services, as necessary, to ensure that the whole system uses no more fuel and power than is reasonable in the circumstances, without compromising the need to comply with health and safety requirements. Testing and adjusting are carried out for on-site electricity generation systems, as necessary, to ensure that the whole system produces the maximum amount of electricity that is reasonable in the circumstances.

For each system, commissioning includes the following:

- setting-to-work;
- regulation (that is, testing and adjusting repetitively) to achieve the specified performance;
- calibration;
- setting up and testing of the associated automatic control systems; and
- recording the system settings and the performance test results that have been accepted as satisfactory.

Communal heat network Means a heat network by means of which heating, cooling or hot water is supplied only to a single building divided into separate premises, for example to both dwellings and non-dwellings in a mixed-use building or a building divided into separate premises.

Conformity assessment body means an organisation that is responsible for carrying out activities such as testing, inspection and certification (conformity assessment) which provides assurance that what is being supplied meets the expectations specified or claimed. In the UK, the United Kingdom Accreditation Service (UKAS) is the sole organisation that grants accreditation to a conformity assessment body to carry out conformity assessment activities.

Consequential improvements means those energy efficiency improvements required by regulation 28.

***Controlled service or fitting** is defined in Regulation 2(1) as: a service or fitting in relation to which Part G, H, J, L or P of Schedule 1 imposes a requirement

Cooling load The rate at which heat is removed from the space to maintain a desired air temperature.

District heat network System that supplies heat from a central source(s) to consumers in two or more buildings, via a network of pipes carrying hot/water liquids (generally water). Heat networks can cover a large area or even an entire city, or can be relatively local, supplying a small cluster of buildings.

Dwelling. A self-contained unit designed to accommodate a single household, including a dwellinghouse and a flat.

Note: *Buildings exclusively containing rooms for residential purposes, such as nursing homes, student accommodation and similar, are not dwellings. In such cases, Approved Document L volume 2 applies.*

Dwelling energy use intensity is the energy use per square metre of floor area per year of a new dwelling. Expressed as kWh/m^2/yr and determined using the Standard Assessment Procedure.

Dwelling emission rate is the dwelling greenhouse gas emission rate expressed as kgCO_2/(m^2·year) and determined using the Standard Assessment Procedure.

Dwelling fabric performance values are the u-values and air permeability for the thermal envelope of a new dwelling.

Dwelling primary energy rate is the primary energy use per square metre of floor area per year of a new dwelling. Expressed as kWh$_{PE}$/(m^2·year) and determined using the Standard Assessment Procedure.

Economically feasible means that the capital cost of the measure will be recouped in energy savings within a reasonable time period. For the purposes of this document, economic

ally feasible means that the measure would achieve a simple payback of either of the following:

a. 7 years for the installation of thermostatic room controls.

b. 15 years, for any other measure.

Emergency escape lighting means the emergency lighting that illuminates an area for the safety of people leaving that area or for people attempting to stop a dangerous process before leaving that area.

Energy assessor An individual who is a member of an accreditation scheme approved by the Secretary of State in accordance with regulation 22 of the Energy Performance of Buildings (England and Wales) Regulations 2012.

***Energy efficiency requirements** are defined in Regulation 2(1) as: the requirements of regulations 23, 25D, 26, 26A, 26B, 26C, 28 and 40, 40A and Part L of schedule 1.

Energy performance certificate is as defined in the Energy Performance of Buildings (England and Wales) Regulations 2012.

Envelope area (the measured part of the building), is the total area of all floors, walls and ceilings bordering the internal volume that is the subject of the pressure test. This includes walls and floors below external ground level. Overall internal dimensions are used to calculate this envelope area and no subtractions are made for the area of the junctions of internal walls, floors and ceilings with exterior walls, floors and ceilings.

***Fixed building services** are defined in Regulation 2(1) as: any part of, or any controls associated with—

a. fixed internal or external lighting systems (but not including emergency escape lighting or specialist process lighting);

b. fixed systems for heating, hot water, air conditioning or mechanical ventilation;

(ba) fixed lifts, escalators or moving walkways in new buildings that are not in an individual dwelling; or" .

or

c. any combination of systems of the kinds referred to in paragraph (a) or (b)

Fixed external lighting means lighting fixed to an external surface of the dwelling and supplied from the building's electrical system. It excludes lighting in common areas of blocks of flats and in other communal accessways.

Greenhouse gas Greenhouse gas has the same meaning as it does in section 92 of the Climate Change Act 2008

Hard water means water which has a high mineral content. For the purposes of this approved document, hard water is water that has a total water hardness of greater than 200ppm of $CaCO_3$.

Heating appliance, or **heat generator**, means the part of a heating system that generates useful heat using one or more of the following processes.

a. The combustion of fuels in, for example, a boiler.

b. The Joule effect in the heating elements of an electric resistance heating system, where the Joule effect is the process by which an electric current passing through a conductor produces heat

c. Capturing heat from ambient air, ventilation exhaust air, or a water or ground heat source using a heat pump.

Heating plant emission rate The annual CO_2 emissions from the fuel and power consumed by the heating plant to deliver space heating and hot water, offset by the emissions saved as a result of any electricity generated by the heating plant, divided by the heat output over a year. Measured in kilograms of CO_2.

Heating zone is a conditioned area of a building which is on a single floor and has the same thermal characteristics and temperature control requirements throughout.

Home Energy Model: Part L 2025 Wales Standard An approved procedure for calculating the performance of dwellings in line with this document (Approved Document L, Volume 1).

Intermediate floor A floor in a building above the ground floor.

Lamp means a device which converts electricity into light. This is commonly referred to as a light bulb. In the approved document, this does not include a lamp holder.

Light source lumens The value of the lumen output of a light source. If the light source is contained within in a luminaire, all losses due to the luminaire are excluded.

Load compensation means a control function that maintains internal temperature of the dwelling by varying the flow temperature from the heat generator relative to the measured response of the heating system.

Luminaire A lighting product which distributes, filters or transforms the light from one or more light sources and includes all the parts necessary for supporting, fixing and protecting the light sources and, where necessary, circuit auxiliaries together with the means for connecting them to the electricity supply. In this approved document, the luminaire includes the light source(s).

Luminous efficacy A measure of how efficiently the light source or luminaire converts electricity into light, expressed in lumens per watt (lm/W).

Luminous flux A measure of luminous energy emitted by a light source or luminaire, expressed in lumens (lm).

***Major renovation** Defined in regulation 35 as the renovation of a building where more than 25% of the surface area of the building envelope undergoes renovation.

Primary circulation An assembly of water fittings in which water circulates between a heat source and a primary heat exchanger inside a hot water storage vessel, including any space heating system.

Primary energy means energy from renewable and non-renewable sources which has not undergone any conversion or transformation process.

Primary energy factor An estimate of the primary energy from different fuels per kWh of delivered energy.

Appendix A

Registered Competent Person A competent person registered with a competent person self-certification scheme, who meets the technical competencies for the work that they are carrying out (see Schedule 3 to the Building Regulations 2010).

Renewable technology that relies wholly or mainly on energy from renewable non-fossil fuel sources to produce electricity. Examples include wind, wave, marine, hydro and solar.

Rooflight A glazed unit installed out of plane with the surface of the roof on a kerb or upstand. Also sometimes referred to as a skylight.

Roof window A window installed in the same orientation as, and in plane with, the surrounding roof.

***Room for residential purposes** is defined in Regulation 2(1) as: a room, or a suite of rooms, which is not a dwelling-house or a flat and which is used by one or more persons to live and sleep and includes a room in a hostel, a hotel, a boarding house, a hall of residence or a residential home, but does not include a room in a hospital, or other similar establishment, used for patient accommodation**Seasonal energy efficiency ratio** (SEER) The total amount of cooling energy provided by a single cooling unit over a year, divided by the total energy input to that single cooling unit over the same year.

Secondary circulation an assembly of water fittings in which a continuous flow of hot water circulates in supply pipes or distributing pipes of hot water storage systems, providing a continuous supply of hot water to outlets. This is uncommon in dwellings.

Secondary heating means a space heating appliance or system which operates separately to the main heating system in the dwelling and does not provide the majority of heating in the dwelling. For example, a decorative fuel-effect fire in a room which also contains radiators for a central heating system.

Seasonal efficiency of domestic boilers in the UK (SEDBUK) is the methodology for determining boiler efficiency defined in the Standard Assessment Procedure, Appendix D.

Short-cycling the boiler cycles through switching on and off as a result of the changing temperature in the heat exchanger despite the temperature in the building not changing.

Significant extension an extension is classed as a significant extension where it involves new construction that increases the footprint of the dwelling, and where:

(a) the total gross internal floor area of the extension (including conditioned and unconditioned spaces, e.g. such as a garage, but excluding rooms in the roof space) is 40 m² or greater; and

(b) the extension has at least the same number of storeys (excluding room in the roof storeys) as the existing dwelling.

Simple payback means the amount of time it will take to recover the initial investment through energy savings, calculated by dividing the marginal additional cost of implementing an energy efficiency measure by the value of the annual energy savings achieved by that measure, taking no account of VAT. When making this calculation, the following guidance should be used:

a. the marginal additional cost is the additional cost (materials and labour) of incorporating, for example, additional insulation, not the whole cost of the work;

b. the cost of implementing the measure should be based on prices when the application is made to the building control body and be confirmed in a report signed by a suitably qualified person;

c. the annual energy savings should be estimated using the Standard Assessment Procedure;

d. The energy prices when the application is made to the building control body should be used when evaluating energy savings. Current prices can be obtained from the following website: https://www.gov.uk/government/collections/quarterly-energy-prices

Space cooling system A system for cooling the temperature of the air in a space.

Specialist process lighting to illuminate specialist tasks within a space rather than the space itself. Specialist process lighting includes theatre spotlights, projection equipment, lighting in TV and photographic studios, medical lighting in operating theatres and doctors' and dentists' surgeries, illuminated signs, coloured or stroboscopic lighting, and art objects with integral lighting, such as sculptures, decorative fountains and chandeliers.

Standard Assessment Procedure (SAP) An approved methodology for assessing the performance of dwellings in line with this Approved Document. The Standard Assessment Procedure is detailed in The Government's Standard Assessment Procedure for Energy Rating of Dwellings, version 10.3.

System for on-site electricity generation A system that produces electricity and has a direct electrical connection to the building in question

System for on-site renewable electricity generation A system for on-site electricity generation which in generating electricity relies wholly or mainly on energy from renewable sources

Target emission rate is the maximum CO_2 emission rate for the dwelling, expressed as $kgCO_2/(m^2 \cdot year)$, and determined using the Standard Assessment Procedure.

Target energy use intensity is the maximum energy use intensity for the dwelling in a year, expressed as $kWh/m^2/yr$, and determined using the Standard Assessment Procedure.

Target Fabric Performance Values are worst acceptable values for the thermal envelope of a new dwelling as set out in Table 4.1 of this approved document.

Target primary energy rate is the maximum primary energy use for the dwelling in a year, expressed as $KWh_{PE}/(m^2 \cdot year)$ and determined using the Standard Assessment Procedure.

Thermal bridging Heat transfer that occurs when part of a thermal element has significantly higher heat transfer than the materials surrounding it.

***Thermal element** is defined in regulation 2(3) and 2(4) of the Building Regulations as follows:

2(3) In these Regulations 'thermal element' means a wall, floor or roof (but does not include windows, doors, roof windows or roof-lights) which separates a thermally conditioned part of the building ('the conditioned space') from:

a. the external environment (including the ground); or

b. in the case of floors and walls, another part of the building which is:

   i. unconditioned;

   ii. an extension falling within class VII in Schedule 2; or

   iii. where this paragraph applies, conditioned to a different temperature,

and includes all parts of the element between the surface bounding the conditioned space and the external environment or other part of the building as the case may be.

2(4) Paragraph 2(3)(b)(iii) only applies to a building which is not a dwelling, where the other part of the building is used for a purpose which is not similar or identical to the purpose for which the conditioned space is used.

Thermal envelope is the combination of thermal elements of a building that enclose a particular conditioned indoor space or group of indoor spaces.

Total useful floor area the total area of all enclosed spaces, measured to the internal face of the external walls.

When calculating total useful floor area, both of the following should be taken into account.

- The area of sloping surfaces such as staircases, galleries, raked auditoria and tiered terraces should be taken as their area on plan.

- Areas that are not enclosed, such as open floors, covered ways and balconies, should be excluded.

Note: *This area is the gross internal floor area as measured in accordance with the Code of Measuring Practice by the Royal Institution of Chartered Surveyors (RICS).*

U-value is a measure of the ability of a building element or component to conduct heat from a warmer environment to a cooler environment. It is expressed as the quantity of heat (in watts) that will flow through one square metre of area divided by the difference in temperature (in degrees K) between the internal and external environment. The unit is $W/m^2.K$.

Weather compensation A system which enables the operating flow temperature of a heating system to be varied. An external sensor communicates with one inside the boiler or the boiler accesses online information. The temperature is varied by either of the following.

a. Modulating the heat generator output (direct acting).
b. Using a mixing valve to adjust the flow temperature to the heat emitters.

Wet heating system When a heating appliance (usually a boiler) produces hot water which is distributed around the dwelling to heat emitters.

Appendix B

Reporting evidence of compliance

B.1 The Buildings Regulations Wales Part L (BRWL) report and photographic evidence should be provided to the building control body and to the building owner to show that building work complies with energy efficiency requirements.

B.2 Approved software (SAP 10) should produce this BRWL report as a standard output option.

B.3 Two versions of the BRWL report may be produced by the compliance software.

- the first, a 'design stage' BRWL report, before commencement of building work, to include all of the following.
  - the target primary energy rate and dwelling primary energy rate.
  - the target emission rate and dwelling emission rate.
  - the target energy use intensity and the dwelling energy use intensity.
  - a supporting list of design specifications
- the second, an 'as-built' BRWL report, to include all of the following.
  - the target primary energy rate and 'as-built' dwelling primary energy rate.
  - the target emission rate and 'as-built' dwelling emission rate.
  - the target energy use intensity and the 'as-built' dwelling energy use intensity.
  - a supporting list of 'as-built' specifications and any changes to the list that was provided at design stage.

These reports can then be used by the building control body to assist checking that what has been designed is actually built.

B.4 The 'as-built' BRWL report should be signed by the person carrying out the SAP assessment to confirm that the as-built calculations are accurate and that the supporting documentary evidence and photographs have been reviewed (see paragraphs B6 and B7).

B.5 The 'as-built' BRWL report should be signed by the client/developer to confirm that the dwelling has been constructed or completed according to the specifications used in the report.

Photographic evidence

B.6 Photographs should be taken during the construction of each dwelling on a development. The photographs should be made available to the energy assessor (before the energy assessor finalises the as-built SAP) and the building control body. Anyone may take the photographs.

Note: *Developers may wish to provide Building Control Bodies with the required photographs as the work progresses on site, however, photographs are not a replacement for site inspections by Building Control Bodies.*

Construction Stages:

B.7 At least one photograph should be taken of each detail at an appropriate stage of construction before closing-up works. Typical details are listed below. Additional photographs, such as a close-up detail, should be provided only when necessary (see below). Photographs should be unique to each property.

1. Foundations/substructure and ground floor, to show thermal continuity and quality of insulation in the following places.
   a. At ground floor perimeter edge insulation.
   b. At external door threshold.
   c. Below damp-proof course on external walls.
2. External walls: for each main wall type, to show thermal continuity and quality of insulation for the following.
   a. Ground floor to wall junction.
   b. Structural penetrating elements.

Note: *where suitable insulating materials are proposed to be inserted after the external wall has been constructed (i.e. blown-in insulation products) the photos should show clean cavities and clean brick ties with very limited mortar droppings.*

Note: *guidance in paragraph B9 should additionally be followed where off-site manufactured elements are used.*

3. Roof: for each main roof type, to show thermal continuity and quality of insulation at the following.
   a. Joist/rafter level.
   b. Eaves and gable edges.

Note: *guidance in paragraph B9 should additionally be followed where off-site manufactured elements are used.*

4. Openings: for each opening type (one image per wall or roof type is sufficient), to show thermal continuity and quality of insulation with photographs of the following.
    a. Window positioning in relation to cavity closer or insulation line.
    b. External doorset positioning in relation to cavity closer or insulation line
5. Airtightness: additional photographs for all details 1–4 to show airtightness details (only if not included or visible in image showing continuity of insulation).
6. Building services: for all plant associated with space heating, hot water, ventilation and low or zero carbon technology equipment within or on the building, to show the following.
    a. Plant/equipment identification label(s), including make/model and serial number.
    b. Continuity of insulation of primary pipework.
    c. Where a heat pump is installed, continuity of insulation of the primary pipework up to the thermal element of the dwelling i.e. where primary pipework from the heat pump enters the building
    d. Where a hot water storage vessel is installed, the hot water storage vessel space, including at least 1 metre of pipework insulation of sufficient quality from the hot water storage vessel towards the water outlets.
    e. Continuity of insulation of mechanical ventilation ductwork (for duct sections outside the heated living space).

B.8 Photographs should be digital and of sufficient quality and high enough resolution to allow a qualitative audit of the subject detail. Geo-location should be enabled to confirm the location, date and time of each image.

Each image file name should include a plot number and detail reference according to the numbers used in paragraph B7. For example, a typical eaves detail on Plot 1 would be P1/3b.

B.9 For off-site construction (e.g. alternative modern methods of construction) photographs taken during factory manufacture or other assembly stages may be used provided they include the relevant junctions and interfaces detailed in B7, are specific to the dwelling or plot, and are taken prior to the elements being closed up or concealed.

Renewable electricity generation

B10 Evidence should be provided to the building control body in the following circumstances.

a. To support the need for lower output on-site renewable electricity generation than the standards in paragraphs 5.73(a), 5.74(a) and 5.74(b).

b. In the exceptional circumstances where it is not possible to install any on-site electricity that would meet the standards given in paragraph 5.77.

This should include the following as appropriate.

a. Roof diagrams with and without proposed photovoltaic panels clearly demonstrating any design restriction on panels. Examples of roof diagrams are provided in paragraph B11.

b. A statement outlining why lower provision is being installed and why any modification to designs cannot be made.

c. Any calculations made in support of paragraph 5.73(a), 5.74(a) and 5.74(b), signed by a suitably qualified person. A suitably qualified person includes a qualified On Construction Domestic Energy Assessor.

B11 Individual roof layout, including pitch, windows, architectural features, HVAC plant and maintenance access routes, may limit the installation of sufficient photovoltaic panels to meet the outputs required in paragraphs 5.70 and 5.71. In these circumstances it will be necessary to demonstrate that the installation provides the maximum capacity (kWp) and annual generation (kWh) possible for the roof layout and orientation.

Tables B1, B2 and B3 provide details of the minimum offsets and access space required for roof-mounted photovoltaic arrays.

Table B1: General roof offsets

Item	Minimum offset distance to roof feature (mm)
Pitch top or ridge	400
Roof edge (eves, verge, parapet)	500
Party wall (measured from the centre line)	750
Vent or flue	300
Window or door	500
Automatic opening vent	1000

Appendix B

Table B2: Flat roof offsets

Item	Minimum offset distance to roof feature (mm)
Soil vent pipe	100
Lift overrun	1000
HVAC plant	1000
Rainwater pipes	100
Guttering	200
Cable tray	200
Access hatch	1000

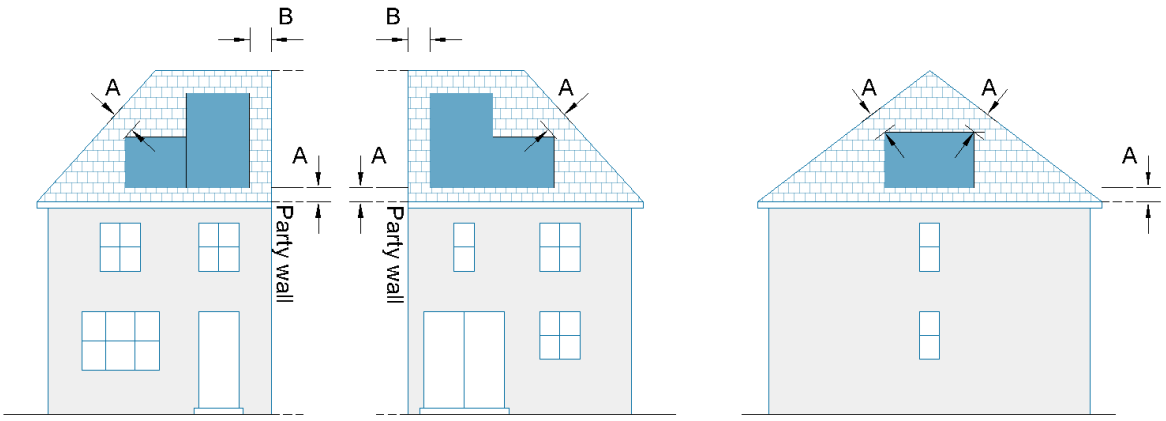
Table B3: Maintenance access route requirements

Item	Minimum offset distance to roof feature (mm)
No edge protection	2000
Parapet	500
Man-safe system	300
Railings	300

B12 Diagrams B1, B2 and B3 provide examples of layouts which maximise the area available for standard photovoltaic array installation where reasonably practicable on a variety of roof types. The capacity available (kWp) is given based on the use of photovoltaic panels with a capacity of 0.22kWp/m2. The estimated annual generation (kWh) for each building will depend on the orientation of the building and should be calculated using the approved methodology.

Appendix B

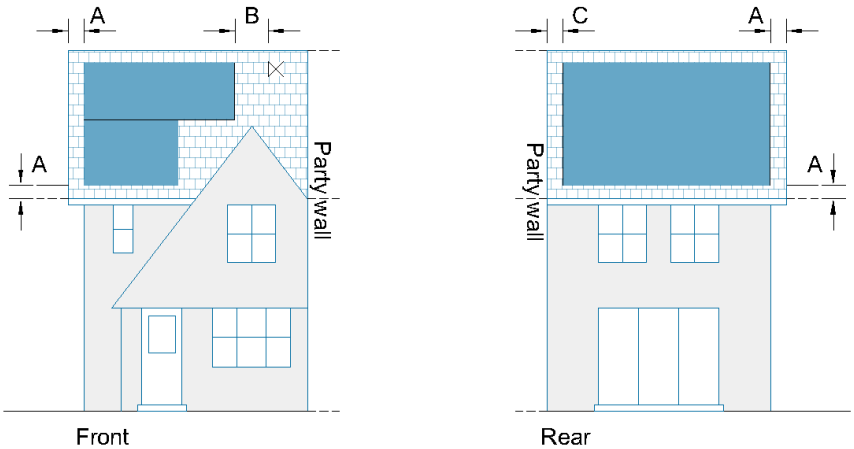
Diagram B1 Semi-detached or end of terrace hipped roof



A distance between panels and closest edge of roof (mm)
B distance between panel and face of party wall (mm)

Ground floor area	39m2
Photovoltaic area	16m2
Installed capacity	3.52kWp

Diagram B2 Semi-detached or end of terrace pitched roof with gable

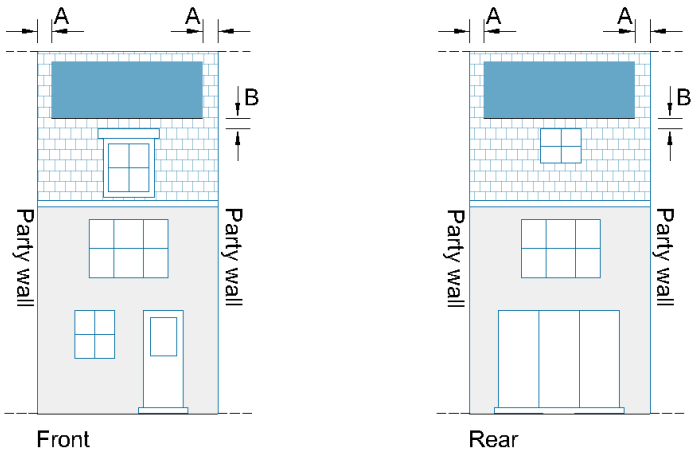


A distance between panels and closest edge of roof (mm)
B distance between panel and roof vent (mm)
C distance between panel and face of party wall (mm)

Ground floor area	39m2
Photovoltaic area	20m2
Installed capacity	4.4kWp

Appendix B

Diagram B3 Mid-terrace pitched roof with dormer windows



A distance between panels and closest edge of roof (mm)
B distance between panel and window (mm)

Ground floor area	35m2
Photovoltaic area	8m2
Installed capacity	1.76kWp

Appendix C

Documents referred to

Legislation

Ecodesign Commission Regulation No. 2016/2281

Ecodesign Commission Regulation No. 813/2013

Ecodesign Commission Regulation No. 814/2013

Ecodesign Commission Regulation No. 206/2012

Ecodesign for Energy-Related Products Regulations 2010, SI 2010/2617

Energy-Related Products Directive 2009/125/EC

Historic Environment (Wales) Act 2023

The Building Regulations 2010, SI 2010/2214

The Building (Registered Building Control Approvers etc.) (Wales) Regulations 2024, SI 2024/1268

Documents

BEAMA

(www.beama.org.uk)

BEAMA *guide on the use of floor coverings with underfloor heating (UFH) systems* [2024]

Building Research Establishment (BRE)

(www.bregroup.com)

BR 262 *Thermal Insulation: Avoiding Risks*. Third Edition [2002]

BR 443 *Conventions for U-value Calculations* [2022]

BR 497 *Conventions for Calculating Linear Thermal Transmittance and Temperature Factors.* Second Edition [2016]

Information Paper 1/06 *Assessing the Effects of Thermal Bridging at Junctions and around Openings in the External Elements of Buildings* [2006]

FB 59 *Design of Low-temperature Domestic Heating Systems: A Guide for System Designers and* Installers [2013]

Product Characteristics Database (PCDB). Available at www.ncm-pcdb.org.uk

Appendix C

Cadw

Managing Change in World heritage Sites in Wales

43720 How to improve Energy Efficiency in Historic Buildings in Wales

Chartered Institute of Plumbing and Heating Engineering (CIPHE)

(www.ciphe.org)

Plumbing Engineering Services Design Guide [2002]

Chartered Institution of Building Services Engineers (CIBSE)

(www.cibse.org)

Domestic Heating Design Guide [2026]

Guide A *Environmental Design* [2021]

TM23 *Testing Buildings for Air Leakage* [2022]

CP1 *Heat Networks: Code of Practice* [2020]

Society of Light and Lighting *SLL Code for Lighting* [2022]

Contract Flooring Association (CFA)

(www.cfa.org.uk)

Beyond Installation: Guidance on Underfloor Heating [2024]

Department for Energy Security and Net Zero (DESNZ)

(www.gov.uk/desnz)

The Home Energy Model: Future Homes Standard assessment

The Government's Standard Assessment Procedure for Energy Rating of Dwellings, SAP versions 10.2 and 10.3. Available at Available at www.bregroup.com/sap/sap10/

Guidance on designing and constructing new builds to be smart-meter-ready [2025]

Department for Environment, Food and Rural Affairs (DEFRA)

Method to Evaluate the Annual Energy Performance of Micro-cogeneration Heating Systems in Dwellings [2008]

Appendix C

Glass and Glazing Federation (GGF)

(ggf.org.uk)

Glazing Manual Data Sheet 2.3, Guide to the Calculation of Energy Ratings for Windows, Roof Windows and Doors [2016]

Health and Safety Executive (HSE)

(hse.gov.uk)

L8 *Legionnaire's disease. The control of legionella bacteria in water systems. Approved code of practice* [2013]

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Appendix C

Microgeneration Certification Scheme (MCS)

(www.mcscertified.com)

MIS 3005-D: *The Heat Pump Standard (Design)* [2024]

MIS 3005-I: *The Heat Pump Standard (Installation)* [2025]

MIS 3012: *The Battery Standard (Installation)* [2021]

National Association of Rooflight Manufacturers (NARM)

(www.narm.org.uk)

Technical Document NTD02.01 *Assessment of Thermal Performance of Out-of-plane Rooflights* [2022]

Office of the Deputy Prime Minister (ODPM)

Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings [2005]

Appendix D

Standards referred to

BS 1566-1
Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods [2002 + A1: 2011]

BS 3198
Specification for copper hot water storage combination units for domestic purposes [1981]

BS 5250
Management of moisture in buildings. Code of practice [2021]

BS 5422
Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C [2009]

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 [2019]

BS 6229
Flat roofs with continuously supported flexible waterproof coverings. Code of practice [2018]

BS 7593
Code of practice for the preparation, commissioning and maintenance of domestic central heating and cooling water systems [2019]

BS 7977
Specification for safety and rational use of energy of domestic gas appliances

BS 7977-1
Radiant/convectors [2009 + A1: 2013]

BS 7977-2
Combined appliances. Gas fire/back boiler [2003]

BS 8213-4
Windows and doors. Code of practice for the survey and installation of windows and external doorsets [2016]

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BS EN 253
District heating pipes. Bonded single pipe systems for directly buried hot water networks. Factory made pipe assembly of steel service pipe, polyurethane thermal insulation and a casing of polyethylene [2019]

BS EN 449
Specification for dedicated liquefied petroleum gas appliances. Domestic flueless space heaters (including diffusive catalytic combustion heaters) [2002 + A1: 2007]

BS EN 509
Decorative fuel-effect gas appliances [2024]

BS EN 613
Independent gas-fired convection heaters [2021]

BS EN 805
Water supply. Requirements for systems and components outside buildings [2025]

BS EN 1264
Water based surface embedded heating and cooling systems. [2021]

BS EN 1264-4
Installation [2021]

BS EN 1266
Independent gas-fired convection heaters incorporating a fan to assist transportation of combustion air and/or flue gases [2002]

BS EN 12831-1
Energy performance of buildings. Method for calculation of the design heat load. Domestic hot water systems heat load and characterisation of needs [2017]

BS EN 12831-3
Energy performance of buildings. Method for calculation of the design heat load. Domestic hot water systems heat load and characterisation of needs [2017]

BS EN 12897
Water supply. Specification for indirectly heated unvented (closed) storage water heaters [2016 + A1: 2020]

BS EN 12975-1
Thermal solar systems and components. Solar collectors – General requirements [2022]

BS EN 13278
Open fronted gas-fired independent space heaters [2013]

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BS EN 14511-2
Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors. Test conditions [2022]

BS EN 14825
Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part load conditions and calculation of seasonal performance [2022]

BS EN 14829
Independent gas-fired flueless space heaters for nominal heat input not exceeding 6 kW [2007]

BS EN 15502-2-1
Gas-fired central heating boilers. Specific standard for type C appliances and type B2, B3 and B5 appliances of a nominal heat input not exceeding 1 000 kW [2022 + A1: 2023]

BS EN 15502-2-2
Gas-fired central heating boilers. Specific standard for type B1 appliances [2014]

BS EN 17082
Domestic and non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW [2019]

BS EN ISO 9806
Solar energy. Solar thermal collectors. Test methods [2017]

BS EN ISO 10077
Thermal performance of windows, doors and shutters. Calculation of thermal transmittance

BS EN ISO 10077-1
General [2017]

BS EN ISE 10077-2
Numerical method for frames [2017 + A1: 2025]

BS EN ISO 11855
Building environment design. Embedded radiant heating and cooling systems [2023]

BS EN ISO 12567
Thermal performance of windows and doors. Determination of thermal transmittance by the hot-box method

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BS EN ISO 12567-1
Complete windows and doors [2010]

BS EN ISO 12567-2
Roof windows and other projecting windows [2005]

BS EN ISO 13370
Thermal performance of buildings. Heat transfer via the ground. Calculation methods [2017]

BSI PAS 67
Laboratory tests to determine the heating and electrical performance of heat-led micro-cogeneration packages primarily intended for heating dwellings [2013]

Appendix E

Elemental specification for the TPER/TER/TEUI

1. A summary of the specification used to calculate the TPER, TER and TEUI of a new dwelling is given in the table below. By using this specification, the dwelling should pass the target primary energy rate, target emission rate and target energy use intensity, when calculated using an approved methodology. The full properties of the notional dwelling can be found in the following.

    a. For the HEM methodology: Table REF of the Part L 2026 Wales dwelling notional building.
    b. For the SAP methodology: Appendix R of the SAP 10.3 specification.

2. Note that the elemental specification states an airtightness of 4.0 $m^3/h.m^2$ at 50Pa. The elemental specification is not prescriptive and alternative specifications (including air tightness and associated ventilation provisions) can be adopted as long as they meet the requirements set out in this approved document.

Table E1 Elemental Specification

Element or system	Specification
Opening areas (windows and doors)	Same as actual dwelling up to a maximum proportion of 25% of total floor area [1]
External Wall U-value (W/m²K)	0.13
Corridor Wall U-value (W/m²K)	0.18
Party Wall U-value (W/m²K)	0.20[2]
Roof U-value (W/m²K)	0.11
Floor U-value (W/m²K)	0.11
Windows, Roof Windows and Glazed Door U-value (W/m²K)	1.2 (whole window u-value)
Rooflight U-value (W/m²K)	1.6 (whole window u-value)
Windows, Roof Windows, Glazed Rooflights and Glazed Door g-value	Same as actual dwelling [3]
Opaque and Semi-glazed Door U-value (W/m²K)	1.0
Psi values (W/mK)	Based on the psi values in: HEM methodology: Table REF of the Part L 2026 Wales dwelling notional building. SAP methodology: Appendix R of the SAP 10.3 specification.

Element or system	Specification
Ventilation System Type	Decentralised Mechanical Extract Ventilation with Specific fan power of 0.15W/l/s, background ventilator equivalent area to meet AD F requirements
Air Permeability ($m^3/h \cdot m^2$ at 50 Pa)	4.0
Air Conditioning	Same as actual dwelling[4] Seasonal Energy Efficiency Ratio = 5.1
Heating System	Mains Electricity
	Air Source Heat Pump[5] with Energy Related Product Rating of A++
	Low temperature radiators (design flow temperature = 45°C)
Space Heating Controls	Time and temperature zone control with weather compensation (Class II)
Hot Water System	Hot water cylinder, heated by ASHP
	Separate time control for space and water heating
	Cylinder volume calculated based on BS EN 12831-3.
	Daily heat loss rate for cylinder calculated as per approach contained within: HEM methodology: Table (TBC) of the Part L 2026 Wales dwelling notional building. or SAP methodology: Appendix R of the SAP 10.3 specification.
Shower Flow Rate	8 l/min
Waste Water Heat Recovery (WWHR)	Efficiency of 50% at a flow rate of 8l/min Utilisation of 0.98
Secondary Space Heating	None
Fixed Lighting Capacity (lm)	185 x Total Floor Area
Lighting Efficacy (lm/W)	105
Thermal Mass	Same as actual dwelling
PV System	PV system characteristics to meet functional requirement L2[6]
	String inverter with maximum AC output of 16 amps per supply phase
[1] The Building Regulations do not specify minimum daylight requirements. However, reducing window area produces conflicting impacts on the predicted CO2 emissions: reduced solar gain but increased use of electric lighting. As a general guide, if the area of glazing is much less than 20% of the total floor	

Element or system	Specification
area, some parts of the dwelling may experience poor levels of daylight, resulting in increased use of electric lighting. [2] Assumes no heat loss through party wall. U-value used for calculating rate of heat flow into and out of the thermal mass of party walls. [3] Designers should be aware of the impact of g-value on the risk of overheating and optimise their choice accordingly, the notional dwelling g-value will match the actual dwelling, it is assumed that the g-value will be suitable to comply with AD O. [4] Cooling system nominal capacity within the notional dwelling will be equal to the actual dwelling system nominal capacity. Therefore, the notional dwelling will only have cooling where it is specified in the actual dwelling. Note that AD O will not permit the use of active cooling unless it is required to mitigate overheating risk. [5] Although the notional dwelling specification includes a hydronic ASHP for the purposes of calculating the primary energy and carbon emission targets, other heat pump technologies such as air-to-air systems, ground source and water source heat pumps will offer near equivalent or better efficiencies. [6] The Building Regulations Part L requirement L2A, approved by the building control body, should be taken as the maximum amount of the solar provision in the notional building, up to a maximum of 40% of the ground floor area orientated SE to SW 45 degree pitch and no to little overshading, hence if more solar provision than this is installed in the actual building, it will improve upon this element of the notional building.	

Alternative compliant specification for homes built with mechanical ventilation and heat recovery (MVHR).

3. This table E2 provides an alternative specification for a typical dwelling built with MVHR.

4. By using this specification, the dwelling should pass the target primary energy rate, target emission rate and target energy use intensity. However, this should be checked through software which implements the approved methodology.

Table E2 Elemental Specification

Element or system	Specification
Opening areas (windows and doors)	Same as actual dwelling up to a maximum proportion of 25% of total floor area [1]
External Wall U-value (W/m²K)	0.18
Corridor Wall U-value (W/m²K)	0.18
Party Wall U-value (W/m²K)	0.20[2]
Roof U-value (W/m²K)	0.11
Floor U-value (W/m²K)	0.13
Windows, Roof Windows and Glazed Door U-value (W/m²K)	1.4 (whole window u-value)
Windows, Roof Windows, Glazed Rooflights and Glazed Door g-value	Same as actual dwelling [3]
Opaque and Semi-glazed Door U-value (W/m²K)	1.4
y-value (W/m²K)	Based on the psi values in Table R2 of SAP 10.2
Ventilation System Type	Balanced Mechanical Supply and Extract Ventilation with Specific fan power of 0.50W/l/s and 89% heat recovery efficiency.
Air Permeability	1.5

Element or system	Specification
($m^3/h \cdot m^2$ at 50 Pa)	
Air Conditioning	Same as actual dwelling[4] Seasonal Energy Efficiency Ratio = 5.1
Heating System	Mains Electricity
	Air Source Heat Pump[5] with Energy Related Product Rating of A++
	Low temperature radiators (design flow temperature = 45°C)
Space Heating Controls	Time and temperature zone control with weather compensation (Class II)
Hot Water System	Hot water cylinder, heated by ASHP
	Separate time control for space and water heating
	Cylinder volume calculated based on BS EN 12831-3.
	Energy related Products (ErP) hot water cylinder rating of B.
Shower Flow Rate	8 l/min
Waste Water Heat Recovery (WWHR)	None
Secondary Space Heating	None
Lighting Efficacy (lm/W)	105
PV System	PV system characteristics to meet functional requirement L2[6]
	String inverter with maximum AC output of 16 amps per supply phase

[1] The Building Regulations do not specify minimum daylight requirements. However, reducing window area produces conflicting impacts on the predicted CO2 emissions: reduced solar gain but increased use of electric lighting. As a general guide, if the area of glazing is much less than 20% of the total floor area, some parts of the dwelling may experience poor levels of daylight, resulting in increased use of electric lighting.
[2] Assumes no heat loss through party wall. U-value used for calculating rate of heat flow into and out of the thermal mass of party walls.
[3] Designers should be aware of the impact of g-value on the risk of overheating and optimise their choice accordingly, the notional dwelling g-value will match the actual dwelling, it is assumed that the g-value will be suitable to comply with AD O.
[4] Cooling system nominal capacity within the notional dwelling will be equal to the actual dwelling system nominal capacity. Therefore, the notional dwelling will only have cooling where it is specified in the actual dwelling. Note that AD O will not permit the use of active cooling unless it is required to mitigate overheating risk.
[5] Although the notional dwelling specification includes a hydronic ASHP for the purposes of calculating the primary energy and carbon emission targets, other heat pump technologies such as air-to-air systems, ground source and water source heat pumps will offer near equivalent or better efficiencies.
[6] The Building Regulations Part L requirement L2, approved by the building control body, should be taken as the maximum amount of the solar provision in the notional building, up to a maximum of 40% of the ground floor area orientated SE to SW 45 degree pitch and no to little overshading, hence if

Element or system	Specification
more solar provision than this is installed in the actual building, it will improve upon this element of the notional building.	

Appendix F

Continuity of insulation

To ensure continuity of insulation in new dwellings, all of the following apply.

a. **Drawings** should identify the insulation layer. The designer and installer should review drawings to ensure the insulation layer is continuous, buildable and robust.

b. Before elements are concealed by subsequent work, an **on-site audit** should be undertaken to confirm that the designed details have been constructed. Photographs of the details should be taken in line with the guidance in Appendix B.

c. **Floors and foundations:** insulation should be installed tight to the structure, without air gaps between insulation panels and at edges.

    i. Perimeter insulation should be continuous and have a minimum thickness of 25mm.

    ii. Moisture-resistant insulation should be fitted below damp-proof course level and extend to the foundation block/structure.

d. **Windows and doors:** should be installed in such a way that the thermal integrity of the insulated plane is maintained.

    i. Tolerance around a window or door unit and the surrounding opening should be minimal and be in accordance with **BS 8213-4**.

    ii. Position: window or door units should be located with an overlap between the inner face of the unit and the inner face of the external leaf – for windows an overlap between 30mm and 50mm, and for doors 50mm – so that the window or door unit is contiguous with the insulation layer of the external wall.

    iii. Fully insulated and continuous cavity closers should be used, installed tight to the insulation and cavity apertures. For door units, install perimeter insulation within the threshold zone or use a reinforced cavity closure.

e. **Walls:** insulation should be fitted without any air gaps and tight to the structure, cavity closers, lintels and cavity trays. Mortar snots should be removed to ensure a tight fit with the structure and cavities cleared of all debris. Where fire-stopping socks are required, these should fully fill the areas where they are fitted, including at the heads of cavities.

f. **Roofs:** insulation should be installed tight to the structure, without air gaps, and should extend to the wall insulation. For roofs insulated at ceiling level, the long-term protection of the insulation layer should be considered: boarded areas should be provided above the insulation to give access for maintenance.

g. **Rigid insulation boards:** should only be used on flat surfaces. Boards should be fitted to the structure to avoid any gaps between board edges and between the board facings. The use of boards with lapped or tongue and groove edges should be considered. Any unavoidable gaps between boards should be infilled using compressible tape (e.g. for boards within roof rafters) or low expansion foam (e.g. for boards within wall cavities).

h. **Penetrating elements** include steel beams, incoming services, meter boxes and sub-floor vents. Designs should clearly indicate means to limit disruption to the insulation. For recessed meter boxes on the cold side of the construction, insulation should be installed behind the enclosure. For incoming services, insulation should fit tightly around ducts, pipes, and other penetrating items or obstructions.

Appendix G

Thermal Bridging

Thermal bridging in new dwellings

G.1 To limit thermal bridging in new dwellings, all of the following apply.

a. **Drawings** should be provided for junctions. The designer and installer should review drawings to check that junctions are buildable and to ensure the sequence of construction is carefully considered for each detail. Complex details should be avoided wherever possible.

b. Before elements are concealed by subsequent work, an **on-site audit** should be undertaken to confirm that the designed details have been constructed. Photographs of the details should be taken in line with **Appendix B**.

c. **Product specification:** opportunities should be considered to use products that help to reduce thermal bridges. Options include both of the following.

   i. Masonry construction: lightweight blockwork in the inner leaf of a cavity wall or both leaves of a party wall can help to reduce thermal transmittance, particularly at junctions, such as the ground floor to wall junction.

   ii. Timber construction: the use of insulated plasterboard on the inside of the frame can help to reduce bridging at various junctions.

d. **Product substitution:** the products used should be those shown in the original design. If a product is substituted, the revised specification should be reflected in the SAP calculation and reported in the 'as-built' Building Regulations Wales Part L compliance report (BRWL report).

e. **Foundations:** wherever possible, blocks below the damp-proof course should be the same as those specified in the design for the above-ground main wall element (in masonry construction).

f. **Ground floors and external walls:** the wall-to-floor junctions should be designed to achieve continuity of insulation.

   i. Perimeter floor insulation should abut or extend the full depth of the main floor insulation.

ii. Masonry construction: external or cavity wall insulation should extend below the damp-proof course (where applicable) and be at least the equivalent of one full block height (215mm) below the underside of the floor structure/slab and beyond the depth of the floor insulation.

iii. Timber construction: insulation between boards/within sheathing should extend to the floor plate. The wall insulation and the floor perimeter insulation should abut.

g. **Intermediate floors:** floor-to-wall junctions should be designed to ensure that insulation in the external wall is continuous. For a timber frame where the intermediate floor structure breaches the external wall insulation, further insulation – of the same thickness as the insulation used in the external wall – should be included within the depth of the intermediate floor structure.

h. **Windows:** designs should minimise thermal bridging.

i. Lintels: consider using independent lintels with an insulated cavity closure between the inner and outer lintel. For common leaf lintels, the base plate should not be continuous and the lintel core should be insulated.

ii. Insulated cavity closers should be used for all construction types. Additionally, insulated plasterboard should be used in reveals to abut jambs and should be considered within reveal soffits.

i. **Roofs:** continue the insulation across the wall-to-eaves and wall-to-gable junctions.

i. Wall insulation should be installed to the top of the wall plate; in some places, such as the eaves, this may be above the cavity closure or barrier. In all cases, roof insulation should be continuous with wall insulation.

ii. Roofs insulated at ceiling level: loft insulation at the eaves should extend beyond the wall insulation without any reduction in thickness due to the pitch of the roof. The roof insulation should be installed when the eaves are still accessible. At gables and party walls, insulation should extend to the wall; if the space between the wall and joist is less than 100mm, perimeter insulation may be required.

iii. Roofs insulated at rafter level: at the eaves, insulation should extend to the top of the external wall. Voids between insulation at the top of the external wall and the cavity wall/ timber frame insulation should be fully filled with insulation.

Note: *Any solution to edge sealing or thermal bridging in new dwellings should take account of Part E of the Building Regulations.*

G.2 Thermal bridges should be assessed in a new dwelling using one of the following methods.

a. Use construction joint details calculated by a suitably competent person following the guidance in the Building Research Establishment's BR 497 and the temperature factors set out in the Building Research Establishment's Information Paper 1/06.

b. Use junction details from a reputable non-government database containing independently assessed thermal junction details.

c. Use the values in the Standard Assessment Procedure, version 10.3, Table K1. A mixture of known and default values may be used.

Note: *A different approach may be used for different elements on the same dwelling. When using the approach in (a) or (b) above, an appropriate system of site inspection should be in place.*

Thermal bridging in existing dwellings

G.3 When carrying out work in existing dwellings, care should be taken to reduce unwanted heat loss through thermal bridging. Thermal bridges can be limited in an existing dwelling by following the junction details from a reputable non-government database containing independently assessed thermal junction details, such as Local Authority Building Control's Construction Details library. Follow the guidance for new dwellings where appropriate.

Appendix H

Airtightness in new dwellings

H.1 To ensure airtightness in new dwellings, all of the following apply.

a. **Drawings:** all relevant drawings should be provided to clearly identify the position, continuity and extent of the air barrier. Drawings should be reviewed by the designer and installer and should include specifications for key materials.

b. **Incoming services:** ducts, and cables wherever possible, should be grouped to minimise how often the air barrier is penetrated, while ensuring sufficient space to allow adequate screed flow between ducts. (Use temporary supports for services during floor works.) Grommets or flexible collars should be used around incoming services and sealed to the air barrier with air-sealing tape or sealant.

c. **Internal building services:** where services penetrate the air barrier, holes should be as small as possible and should be core drilled to limit damage. The penetrating services should be sealed to the air barrier using proprietary grommets or collars with air-sealing tape or sealant. Where membranes are penetrated, careful detailing should be used to achieve a robust and durable seal.

d. **Structural penetrations** should be effectively sealed for airtightness. Timber joist hangers should be considered as an alternative to penetrating through the inner leaf.

e. **Masonry walls:** mortar joints should be fully filled and pointed to both sides of a solid wall, to the inner leaf including within the cavity of a cavity wall, and to the inner leaves including within the cavity of a party wall. Where dense aggregate blocks have been used, plaster, parge coat or liquid membranes should be applied internally to reduce air permeability. Internal plasterboard linings are not appropriate for use as an air barrier solution.

f. **Timber frame:** the vapour control layer should overlap at seams and junctions and be taped where it forms the airtightness barrier. Any damage, such as tears, should be repaired before boarding. Where sheathing board forms the air barrier, air-sealing tape should be applied at junctions and edges.

g. **Fixings:** care should be taken to ensure that fixings do not damage the airtightness barrier.

h. **Windows and doors:** to ensure continuity of the air barrier, window and door units should connect to the primary air barrier and window and door frames should be taped to surrounding structural openings, using air sealing tape. Compressible seals or gun sealant may be used to supplement taping.

i. **Loft hatches:** where the roof is insulated at ceiling level, hatches should be suitably designed and installed to ensure optimum airtightness.

j. **Materials:** to ensure that airtightness lasts for a suitable amount of time, the airtightness strategy should be designed to use adequate and proper materials which deliver the required performance and which meet the requirements of Regulation 7 (materials and workmanship) of the Building Regulations 2010.

H.2 To avoid air movement within thermal elements, either of the following measures should be implemented.

a. The insulation layer should about the air barrier at all points in the building envelope.

b. The space between the air barrier and the insulation layer should be filled with solid material.

Appendix H

Approved Documents

This approved document is one of a suite of approved documents that have been published to give guidance on how to meet the Building Regulations. You can find the date of the edition approved by Welsh Ministers at https://gov.wales/building-regulations-approved-documents