



Llywodraeth Cymru
Welsh Government

The Building Regulations 2010

Approved Document

Volume 1 - Dwellings



Conservation of fuel and power

2022 edition - For use in Wales*

2022 edition

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

This approved document takes effect on 23 November 2022 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 23 November 2023 and it does not apply to sites where a building notice, initial notice or full plans application were submitted before 31 July 2014 and building work commenced before 31 July 2015. Full detail of the transitional arrangements can be found in Circular Letter 003/2022 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 23 November 2022, 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.

ADs**How to use this approved document**

This document uses the following conventions.

- a. Text against a grey background is an extract from the Building Regulations 2010 or the Building (Approved Inspectors etc.) Regulations 2010 (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 an approved inspector
- 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.

ADs

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

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 minimum energy efficiency rating.	Regulations 24, 25, 25B, 25C, 25D, 26, 26A, 26B, 26C, 27, 27A, 27B and 27C
Section 2: Calculating the dwelling CO₂ emissions and primary energy	
Section 3: Consideration of high-efficiency alternative systems	Regulation 25A
Section 4: Limiting heat losses and gains	Requirement L1(a) of Schedule 1
Section 5: Fixed building services efficiencies and controls – general guidance	Requirement L1(b)(i) and (ii) of Schedule 1 and L2 of Schedule 1
Section 6: System Specific Guidance	
Section 7: Air permeability and pressure testing	Regulation 43
Section 8: Commissioning	Regulation 44 and 44ZA, and Requirement L1(b)(iii) of Schedule 1 and L2(b) of Schedule 1
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

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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 efficiency 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.

Section 0

- 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 4**.

Extensions and work in existing dwellings

0.7 Guidance for building work on existing dwellings is given in the relevant paragraphs within **Sections 3 and 5 to 8** 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 with section 1 of the Planning (Listed Buildings and Conservation Areas) Act 1990.
- b. Those in a conservation area designated in accordance with section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990.
- c. Those included in the schedule of monuments maintained under section 1 of the Ancient Monuments and Archaeological Areas Act 1979.

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.

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- 0.12** Additional guidance on how to implement specific energy efficiency measures is available in Historic England’s *Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings (2017)*.
- 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 10 and 11**. 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 30 m²; 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.

Section 0

- 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 C

0.21 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

0.22 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.

Section 0

Interaction with Part F

0.23 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

0.24 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

0.25 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

0.26 This document provides guidance on conserving energy use and avoiding CO₂ 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.

Section 0

Regulations 24, 25, 25B, 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, 25B, 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 CO₂ emission rates, which shall be calculated and expressed in accordance with the methodology approved pursuant to regulation 24.

Regulation 25B – Nearly zero-energy requirements for new buildings

Where a building is erected, it must be a nearly zero-energy building.

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.

Section 0

Regulation 25D - Energy efficiency rating

Energy efficiency 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 – CO₂ emission rates for new buildings

Where a building is erected, it shall not exceed the target CO₂ 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 - Energy efficiency rating

Where a dwelling is erected, it must equal or exceed the energy efficiency 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 regulations 24 for new buildings.

Section 0

Regulation 27 - CO₂ 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 CO₂ emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;
 - b. the CO₂ emission 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 shall give the local authority—
 - a. a notice which specifies—
 - i. the target CO₂ emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;
 - ii. the CO₂ emission 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 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 CO₂ emission rate.

Section 0

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.

Section 0

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.”

Section 0

27C - Energy efficiency 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 efficiency 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 efficiency rating for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24,

(ii) the energy efficiency 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 an approved inspector, see regulation 20 of the Building (Approved Inspectors etc.) Regulations 2010 (as amended).

Intention

Welsh Ministers consider that a [dwelling](#) has a very high performance rate for the purposes of the definition of a nearly zero-energy building if both of the following are met.

- a. The [dwelling](#) meets the [target emission rate](#) required under regulation 26.
- b. Both:
 - i. An analysis is made of the technical, environmental and economic feasibility of using high- efficiency alternative systems, which include decentralised energy supply systems based on energy from renewable sources.
 - ii. This analysis is considered as required by regulation 25A.

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.

Section 0

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 [minimum energy efficiency rating](#).

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. [Minimum energy efficiency rating](#).

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 minimum energy efficiency rating.

Target emission rate and primary energy 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 **dwelling**s.

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

- a. The **Target Emission Rate**, in $\text{kgCO}_2\text{e}/\text{m}^2/\text{year}$: this is the minimum standard for CO_2 emissions from the **dwelling**, influenced by the fabric and the fuel choice.
- b. The **Target Primary Energy Rate**, in $\text{kWh}_{\text{PE}}/\text{m}^2/\text{year}$: this is the maximum **primary energy** used by the **dwelling**, influenced by the fabric and fuel choice.

1.3 The **Target Primary Energy Rate** and **Target Emission Rate** must be calculated using the UK Government's **Standard Assessment Procedure** for energy rating of **dwelling**s, version 10. The standardised properties are in Appendix R and summarised in Appendix E of this Approved Document.

Target fabric performance values and Minimum energy efficiency rating

1.4 A new **dwelling** must also meet the **Target Fabric Performance Values** for elements of the fabric and a **Minimum Energy Efficiency Rating** for fuel cost affordability. These requirements can be satisfied as follows.

- a. **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 4 (table 4.1); and
- b. **Minimum Energy Efficiency Rating** can be met by achieving a minimum SAP rating of 81.

Section 1

Buildings that contain multiple dwellings

- 1.5** For a building that contains more than one **dwelling**, for example a block of flats or a terrace of houses, an average **target emission rate** and **target primary energy rate** may be calculated as an alternative to an individual target for each dwelling. The floor-area-weighted average of the **target emission rates** and **target primary energy rate** for all the **dwellings** in the building should be calculated using the following formula:

$$\frac{\{(target\ emission\ rate_1 \times Floor\ area_1) + (target\ emission\ rate_2 \times Floor\ area_2) + (target\ emission\ rate_3 \times Floor\ area_3) + \dots\}}{(Floor\ area_1 + Floor\ area_2 + Floor\ area_3 + \dots)}$$

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

Calculating an average **target emission rate** or **target primary energy rate** for separate buildings on the same site is not considered to be a reasonable demonstration of compliance.

- 1.7** Each individual dwelling in a building that contains more than one **dwelling** should meet the **Target Fabric performance value**.

Notional dwelling specification

- 1.8** The full notional **dwelling** specification used in the **Standard Assessment Procedure** is given in Appendix R of SAP version 10: <https://www.bregroup.com/sap/sap10/> . The notional **dwelling** specification is summarised in Appendix E.

Section 2

Section 2

Calculating the dwelling primary energy rate, dwelling emission rate and dwelling energy efficiency rating

- 2.1** The approved calculation tool used to calculate the [target primary energy rate](#), and [target emission rate](#) must be the same as that used to calculate the [dwelling primary energy rate](#), [dwelling emission rate](#) and [dwelling energy efficiency rating](#).
- 2.2** The [dwelling primary energy rate](#), [dwelling emission rate](#) and [dwelling energy efficiency rating](#) must be calculated at both of the following points using the same calculation tool.
- a. Before work starts, using design values.
 - b. When work is complete, using figures for the building as constructed, and incorporating both of the 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](#) and [dwelling emission rate](#) must not exceed the [target primary energy rate](#) and [target emission rate](#). In addition the [dwelling energy efficiency rating](#) must equal or exceed a minimum SAP rating of 81 at both of these points. 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](#), [minimum energy efficiency rating](#), [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 [dwelling fabric performance values](#) (calculated using design values).
 - d. The [dwelling energy efficiency rating](#) (calculated using design values).
 - e. A list of specifications used in the calculations.

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- 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 emission rate** and as-built **dwelling emission rate**
 - b. the as-built **target primary energy rate** and as-built **dwelling primary energy rate**
 - c. the as-built **fabric performance values**
 - d. the as-built **energy efficiency rating**
 - 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 details of 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** has all of:
 - i. a **dwelling emission rate** that is no greater than the individual **dwelling’s target emission rate**
 - ii. a **dwelling primary energy rate** that is no greater than the individual **dwelling’s target primary energy rate**
 - iii. Each individual dwelling meets the **minimum energy efficiency rating** requirements in paragraph 1.4.
- OR
- b. all of the following are met:
 - i. the average **dwelling emission rate** for the whole building, calculated to paragraph 2.6, is no greater than the average **target emission rate**
 - ii. the average **dwelling primary energy rate** for the whole building is no greater than the average **target primary energy rate**
 - iii. the average **dwelling energy efficiency rate** must equal or exceed the **minimum energy efficiency rating** (a minimum SAP rating of 81)

Section 2

requirement in paragraph 1.4.

2.8 The average dwelling emission rate, dwelling primary energy rate and dwelling energy efficiency rate are the floor-area-weighted average of the individual dwelling emission rates, dwelling primary energy rate and dwelling energy efficiency rate for all the dwellings in the building. The average dwelling emission rate, dwelling primary energy rate and dwelling energy efficiency rate are calculated in the same way as the average target emission rate, in paragraphs 1.5 and 1.6.

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

Note: Information must be provided for each individual dwelling, as described in Section 9.

Special considerations when calculating dwelling emission rate, dwelling primary energy rate and dwelling energy efficiency rating

Secondary heating in the dwelling emission rate, primary energy rate calculation and dwelling energy efficiency rating

2.10 When calculating the dwelling emission rate, dwelling primary energy rate and minimum energy efficiency rating 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 Standard Assessment Procedure 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 emission rate and dwelling primary energy rate.
- c. If a chimney or flue is provided but no appliance is installed, the presence of the following appliances should be assumed when calculating of all of the dwelling emission rate and dwelling primary energy rate.
 - i. if a gas point is located adjacent to the hearth, assume a decorative fuel-effect gas fire open to the chimney or flue with an efficiency of 20%;
 - ii. if there is no gas point, assume one of the following:
 - if the dwelling is *not* in a smoke control area, an open fire, in a grate, burning multi-fuel with an efficiency of 37%.

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- if the **dwelling** is in a smoke control area, an open fire, in a grate, burning smokeless solid mineral fuel with an efficiency of 37%.
- d. If no **secondary heating appliance** is installed and there is no chimney or flue provided, then no secondary heating system should be assumed in the calculation.

Community heating systems and district heat networks

- 2.11** If thermal energy is supplied from a **district heat network**, a CO₂ emission factor and **primary energy** factor for the heat delivered to the **dwelling** by the **district heat network** should be calculated. These factors should be used in the calculations of the **dwelling primary energy rate**, **dwelling emission rate** and **dwelling energy efficiency rating**.
- 2.12** When calculating the **dwelling primary energy rate**, **dwelling emission rate** and **dwelling energy efficiency rating** for a dwelling connected to a community heating system or district heat network, the following should all apply.
- a. The annual percentage of heat supplied from each heat source should be the same for each newly connected **dwelling**.
 - b. The calculation should account for the predicted effect of all **dwelling**s that will be connected to the system in the first 12 months after the **dwelling**s are connected.
 - c. A submission to the **building control body** should be made to show that the **community heating system** or **district heat network** has the capacity to provide the percentage of heat that is assumed.

Note: An **existing district heat network** is defined in Appendix A. A new **district heat network** should be taken as meaning any other **district heat network**.

Note: New **dwelling**s connecting to an **existing district heat network** should follow the standards in **Section 6**.

Swimming pool basins

- 2.13** When determining the **dwelling emission rate** and the **dwelling primary energy rate** for a **dwelling** with a swimming pool, the thermal performance of the pool basin should not be included in the calculation. Instead, the **dwelling emission rate** and **dwelling primary energy rate** 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

- 2.14** When calculating the **dwelling emission rate**, **dwelling primary energy rate** and **dwelling energy efficiency rating** for a **dwelling**, a party wall **U-value** for the type of construction adopted as set out in Table 2.1 should be applied.

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Table 2.1 U-values for party walls

Party wall construction	U-value W/(m ² .K)
Solid ¹	0.0
Unfilled cavity with no effective edge sealing	0.5
Unfilled cavity with effective sealing around all exposed edges and in line with insulation layers in abutting elements ¹	0.2
A fully filled cavity with effective sealing at all exposed edges and in line with insulation layers in abutting elements	0.0
NOTES	
1. In order to claim a reduced U-value (0.2 or 0.0), it is necessary to demonstrate that the edge sealing is likely to be robust under normal site conditions.	

Internal lighting in the dwelling emission and dwelling primary energy rate calculations

2.15 Both the [dwelling emission rate](#), [dwelling primary energy rate](#) and [dwelling energy efficacy rating](#) calculations should allow for the proportion of low-energy lamps installed in the fixed lighting locations.

Achieving the target emission rate, target primary energy rate, target fabric performance values and minimum energy efficiency rating.

2.16 Provided the [dwelling](#) satisfies the minimum standards for fabric set out in **Section 4**, the designer can achieve all of the [target emission rate](#), [target primary energy rate](#) and the [minimum energy efficiency rating](#) by using any 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.

2.17 The designer can only achieve the [target fabric performance values](#) through fabric energy efficiency as set out in **section 4**.

Section 2

Regulation for the Consideration of high-efficiency alternative systems

This approved document deals with the requirements of regulation 25A of the Building Regulations 2010 (as amended).

Consideration of high-efficiency alternative systems for new buildings

25A. (1) Before construction of a new building starts, the person who is to carry out the work must analyse and take into account the technical, environmental and economic feasibility of using high-efficiency alternative systems (such as the following systems) in the construction, if available—

- (a) decentralised energy supply systems based on energy from renewable sources;
- (b) cogeneration;
- (c) district or block heating or cooling, particularly where it is based entirely or partially on energy from renewable sources; and
- (d) heat pumps.

(2) The person carrying out the work must—

(a) not later than the beginning of the day before the day on which the work starts, give the local authority a notice which states that the analysis referred to in paragraph (1)—

- (i) has been undertaken;
- (ii) is documented; and
- (iii) the documentation is available to the authority for verification purposes; and

(b) ensure that a copy of the analysis is available for inspection at all reasonable times upon request by an officer of the local authority.

(3) An authorised officer of the local authority may require production of the documentation in order to verify that this regulation has been complied with.

(4) The analysis referred to in paragraph (1)—

- (a) may be carried out for individual buildings or for groups of similar buildings or for common typologies of buildings in the same area; and
- (b) in so far as it relates to collective heating and cooling systems, may be carried out for all buildings connected to the system in the same area.

(5) In this regulation—

(a) “*cogeneration*” means simultaneous generation in one process of thermal energy and one or both of the following—

- (i) electrical energy;
- (ii) mechanical energy;

(b) “*district or block heating or cooling*” means the distribution of thermal energy in the form of steam, hot water or chilled liquids, from a central source of production through a network of multiple buildings or sites, for the use of space or process

heating or cooling;

- (c) “*energy from renewable sources*” means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases; and
- (d) “*heat pump*” means a machine, a device or installation that transfers heat from natural surroundings such as air, water or ground to buildings or industrial applications by reversing the natural flow of heat such that it flows from a lower to a higher temperature. (For reversible heat pumps, it may also move heat from the building to the natural surroundings.)

Note: Where the [building control body](#) is an approved inspector, see regulation 20 of the Building (Approved Inspectors etc.) Regulations 2010 (as amended).

Intention

In the Welsh Minister’s view, regulation 25A is met in a new [dwelling](#) by analysing the feasibility of installing high-efficiency alternative systems, following Section 3.

The Building Regulations do not require that high-efficiency alternative systems or other low and zero carbon systems are installed.

Section 3

Section 3

Consideration of high efficiency alternative systems

- 3.1** Before building work starts on a new **dwelling**, the person undertaking the work must analyse the technical, environmental and economic feasibility of using high-efficiency alternative systems in the **dwelling** design. This analysis should be taken into account when designing the **dwelling**.
- 3.2** The analysis of high-efficiency alternative systems must be documented and available for verification processes. The documentation should state whether high-efficiency alternative systems have been included in the building design.
- 3.3** The analysis may be carried out for individual **dwellings**, groups of similar **dwellings**, or for common types of **dwelling** in the same area. Where a number of **dwellings** are connected to a community energy system, a single analysis may be carried out for all the **dwellings** connected to the system.
- 3.4** The documented results of the analysis should be retained for the **building control body** to inspect upon request.
- 3.5** When an existing **dwelling** 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.

Section 3

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
<p>Schedule 1 – Part L Conservation of fuel and power</p> <p>L1. Reasonable provision shall be made for the conservation of fuel and power in buildings by:</p> <p style="padding-left: 20px;">(a) limiting heat gains and losses–</p> <p style="padding-left: 40px;">(i) through thermal elements and other parts of the building fabric; and</p> <p style="padding-left: 40px;">(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;</p> <p style="padding-left: 20px;">(b) providing fixed building services which–</p> <p style="padding-left: 40px;">(i) are energy efficient;</p> <p style="padding-left: 40px;">(ii) have effective controls; and</p> <p style="padding-left: 40px;">(iii) are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances.</p>	

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 4.1 to 4.6 and paragraphs 4.10 to 4.12**
 - ii. uncontrolled air loss – **paragraphs 4.13 to 4.14**
 - iii. the pipework and services **paragraphs 4.15 to 4.23**
- 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 4**.

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In the Welsh Minister's view, Regulation L1(a) for existing dwellings will be met by meeting the standards in **paragraphs 4.7 to 4.9** 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 4.6 Table 4.1**.

Section 4

Limiting heat losses and gains, and target fabric performance values

U-values

4.1 **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).

4.2 The **U-value** of a window should be assessed using one of the following methods.

- a. Calculated using the actual size and configuration of the window.
- b. Calculated for a standard window 1.23m ($\pm 25\%$) wide \times 1.48m (-25%) high and the actual configuration of the window.
- c. Calculated for a standard window 1.23m ($\pm 25\%$) wide \times 1.48m (-25%) high and 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 one opening light and one fixed light.
 - iii. For a **roof window**, no divider.
- d. Measured using the hot-box method as set out in **BS EN ISO 12567-1** for windows and **BS EN ISO 12567-2** for **roof windows**.
- e. Calculated using the standard window size, depending on the overall product area, and methodology as defined in **BS EN 14351-1**.

4.3 The **U-value** of a door should be assessed using one of the following methods.

- a. Calculated using the actual size and configuration of the door.
- b. Calculated using one of the following standard sizes.
 - i. 1.23m ($\pm 25\%$) wide \times 2.18m ($\pm 25\%$) high for doors $\leq 3.6\text{m}^2$.
 - ii. 2.00m ($\pm 25\%$) wide \times 2.18m ($\pm 25\%$) high, for doors $> 3.6\text{m}^2$.

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

- c. Measured using the hot-box method as set out in **BS EN ISO 12567-1**.
- d. Calculated using the standard door size, depending on the overall product area, and methodology as defined in **BS EN 14351-1**.

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- 4.4** Alternatively, for doors or windows, the default value from the [Standard Assessment Procedure](#) Table 6e can be used.
- 4.5** To correctly assess whether an element meets the limiting [U-value](#), the [U-value](#) must be calculated for the element in the appropriate plane – either 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 for the element is in the incorrect plane, it should be adjusted according to the guidance in the Building Research Establishment’s BR 443.

Note: This does not apply to [Standard Assessment Procedure](#) calculations, where the [U-value](#) of each element is calculated based on the plane in which it is constructed or installed.

New dwellings – Target fabric performance values

- 4.6** 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 [Standard Assessment Procedure](#). 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 4.1.

Existing dwellings

- 4.7** New fabric elements in existing [dwellings](#) (such as those constructed as part of an extension) should meet the limiting standards in Table 4.1.
- 4.8** 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 4.1.
- 4.9** 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.**

Section 4

Table 4.1 Worst acceptable fabric performance values

Element type	Maximum U-value W/(m ² .K) ¹	
	In <u>new</u> dwellings	In <u>existing</u> dwellings
Roofs ²	0.13	0.13 ¹³
Wall – Dwelling Houses	0.18	0.18
Wall – Flats	0.21	0.21
Floor	0.15	0.15 ^{10,14}
Party wall	0.20	0.20
Swimming pool basin ³	0.25	0.25
Window or roof window ^{4,5}	1.4	1.4 ¹¹ or minimum WER ⁸ Band B
Roof-light ^{6,7}	2.2	2.2
Doors: >60% internal face glazed All other doors	1.4 1.4	1.4 ¹² or minimum DER ⁸ Band C 1.4 ^{9,12} or minimum DER ⁸ Band B
Air Permeability	8.0 m ³ / (h·m2) @50Pa OR 1.57m ³ /(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 require thicker glass to be used, an equivalent window unit with standard thickness (6mm) 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.
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 U_d-value for the assembly. An upstand built on site should exceed a U-value of 0.35W/(m²·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. For timber windows, a maximum U-value of 1.6 W/(m²·K) or Window Energy Rating Band C is permissible where a building notice or an initial notice has been given to, or full plans have been deposited with, a local authority, in respect of that building, before 23 November 2023, to allow manufacturers additional time to transition to the full standard of 1.4 W/(m²·K) or Window Energy Rating Band B.
12. For timber doors, a maximum U-value of 1.8 W/(m²·K) or Doorset Energy Rating Band E is permissible where a building notice or an initial notice has been given to, or full plans have been deposited with, a local authority, in respect of that building, before 23 November 2023, to allow manufacturers time to transition to the full standard of 1.4 W/(m²·K).
13. 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.
14. If meeting such a standard would create significant problems in relation to adjoining floor levels, a lesser standard may be appropriate.

Continuity of insulation

- 4.10** 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

- 4.11** 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.

- 4.12** To limit [thermal bridging](#) in new and existing dwellings, the applicable guidance in **Appendix G** should be followed.

Airtightness in new dwellings

- 4.13** For a new dwelling, the minimum standard for [air permeability](#) is given in Table 4.1. When carrying out work in new dwellings, care should be taken to reduce

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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

- 4.14** 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.

Section 4

Limiting heat losses and gains from building services

Hot water pipework

- 4.15** In a new system, all of the following new pipework should be insulated.
- Primary circulation pipes for heating circuits where they pass outside the heated living space, including where pipework passes into voids.
 - All primary circulation pipes for domestic hot water.
 - All pipes that are connected to hot water storage vessels, for at least 1 metre from the point at which they connect to the vessel.
 - All secondary circulation pipework.
- 4.16** In an existing system whenever a boiler or hot water storage vessel is replaced, any accessible pipes in the dwelling, should be insulated.
- 4.17** Heat losses from insulated pipework should not exceed those given in **BS 5422** for hot water services at 60°C, regardless of the actual design temperature. Meeting the standards in Table 4.2 is one way of demonstrating that heat losses will not exceed those given in **BS 5422**.

Table 4.2 Minimum thicknesses of pipework insulation for hot water services and space heating applications using high performance insulation

Nominal internal pipe diameter (mm)	Minimum insulation thickness ¹ (mm) for low temperature hot water systems
≤ 10	5
≤ 25	10
≤ 50	15
≤ 100	20
Notes:	
1: Thicknesses apply for insulation with a thermal conductivity of 0.025W/m.K or better. For other circumstances consult BS 5422 .	

External pipework for district heat networks

- 4.18** Pipework for district heat networks should be installed to either of the following.
- the standards in **BS EN 253** for pre-insulated pipes
 - an equivalent performance for conventionally heated pipes.

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4.19 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.

Heated water storage for space or domestic hot water

4.20 Vessels that store heated water for a heating or domestic hot water system should have standing losses that are a maximum of the heat loss given in Table 4.3 for that system type.

Table 4.3 Maximum daily heat loss for a hot water cylinder⁽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 cylinder not listed, the heat loss from the cylinder larger should not exceed $(16.66 + 8.33 \times V^{0.4}) / (1000 \div 24)$, where V is the volume in litres.

- 4.21** 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**.
- 4.22** Primary storage systems should meet the insulation requirements of the Hot Water Association’s ‘Performance Specification for Thermal Stores’.

Heat interface units

4.23 Vessels that store heated water for a heating or domestic hot water system should have standing losses that are a maximum of the heat loss given in Table 4.3 for that system type.

Section 4

Requirement L1(b)(i) and (ii): Fixed building services efficiency and controls, 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

L1. Reasonable provision shall be made for the conservation of fuel and power 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;

(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.

Intention

In the Welsh Minister's view, requirements L1(b)(i), (ii) 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 6
 - ii. are appropriately sized, following paragraphs 5.8, 5.9 and 5.11 to 5.13
- b. Controls to **fixed building services** are provided that both:
 - i. meet the general controls for heating and hot water systems in paragraphs 5.14 to 5.22

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- ii. meet the system specific controls in Section 6.
- c. Any on-site electricity generation is both appropriately sized and has controls.

In the Welsh Minister's view, requirements L1(b)(i), (ii) 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 6 and the criteria in paragraphs 5.4 and 5.5
 - ii. are appropriately sized, following paragraphs 5.8 to 5.13.
- 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 5.14 to 5.27
 - ii. meet the standards for system specific controls in Section 6.
- c. Any on-site electricity generation provided is both appropriately sized, following paragraph 5.6, and has controls.

Section 5

Section 5

Minimum building services efficiencies and controls – general guidance

New building services

- 5.1** 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 6**. If a proposed service is not covered in **Section 6**, it should be demonstrated that it is no less efficient than a comparable service that is covered.
- 5.2** Both of the following apply to the efficiency claimed for a **fixed building service**.
- The efficiency should be based on the appropriate test standard set out in **Section 6**.
 - The test data should be certified by a notified body.
- 5.3** For heating and hot water systems in new **dwellings**, paragraphs 5.8 to 5.22 should be followed, in addition to system specific guidance in **Section 6**.

Replacement building services in existing dwellings

- 5.4** A replacement **fixed building service** should be at least as efficient as the value set out in **Section 6** and should comply with either of the following:
- use the same fuel as the service being replaced and have an efficiency not worse than that of the service being replaced
 - use a different fuel than the service being replaced. The system should both:
 - not produce more CO₂ emissions per kWh of heat than the appliance being replaced
 - not have a higher **primary energy** demand per kWh of heat than the appliance being replaced.

Worked example:

Replacing an old LPG boiler with emissions of 0.34kgCO₂/kWh and primary energy of 1.63kWhPE/kWh at 70% efficiency with a wood pellet boiler with emissions of 0.06kgCO₂/kWh and primary energy of 1.56kWhPE/kWh at 85% efficiency.

CO₂ emissions - LPG boiler: $0.241/0.7 = 0.34 \text{ kgCO}_2/\text{kWh}$ – Wood-pellet boiler: $0.053/0.85 = 0.06 \text{ kgCO}_2/\text{kWh}$

Primary energy - LPG boiler: $1.141/0.7 = 1.63 \text{ kgCO}_2/\text{kWh}$ – Wood-pellet boiler: $1.325/0.85 = 1.56 \text{ kgCO}_2/\text{kWh}$

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In this instance, the wood-pellet boiler has both lower CO₂ and primary energy than the LPG boiler being replaced (despite the primary energy factor of the wood-pellet fuel being higher than that of LPG), and therefore complies.

Note: If the efficiency of the appliance being replaced is not known, Tables 4a and 4b from the [Standard Assessment Procedure](#) should be used but with no adjustments from tables 4c and 4d. CO₂ emission factors and [Primary Energy Factors](#) should be taken from Table 12 of the [Standard Assessment Procedure](#).

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 5.4, without the need to carry out this calculation.

- 5.5** Where a replacement [fixed building service](#) involves a fuel-switch in a home with very low heat loss a higher [primary energy](#) for the new [heating appliance](#) may be acceptable. For example, 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.
- 5.6** If [renewable technology](#) such as a wind turbine or photovoltaic array is being replaced, the new system should have an electrical output that is at least that of the original installation.
- 5.7** Facilitating future connection to any local [district heat networks](#) should be considered (for example, providing capped off connections in pipework to allow later connection to a local [district heat network](#)).

Sizing heating and hot water systems

Sizing space heating systems

- 5.8** The specification of space heating systems should be based on an appropriate heat loss calculation for the dwelling, and a sizing methodology that takes account of the properties of the [dwelling](#), such as the Chartered Institute of Plumbing and Heating Engineering's *Plumbing Engineering Services Design Guide*. Systems should not be significantly oversized.
- 5.9** Where a gas combination boiler is used, the boiler type should be selected to modulate down to the typical heating load of the [dwelling](#).
- 5.10** Where a [wet heating system](#) is either:
- newly installed or
 - fully replaced in an existing [dwelling](#), 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 55°C or lower. Where it is not technically or

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functionally feasible to install a space heating system which can operate at this temperature (for example, where there is insufficient space for larger radiators, or the existing distribution system is provided with higher temperature heat from a low carbon [district heat network](#)), the space heating system should be designed to the lowest design temperature possible which will still 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*.

Sizing domestic hot water systems

5.11 Domestic hot water systems should be sized for the anticipated domestic hot water demand of the [dwelling](#), based on **BS EN 12831-3** or the Chartered Institute of Plumbing and Heating Engineering's *Plumbing Engineering Services Design Guide*. Systems should not be significantly oversized. Systems should not be significantly oversized.

Note: For temperature limits to control legionella in domestic hot water systems, see **Approved Document G**.

Sizing heat pump heating systems

5.12 Heat pumps should be selected to meet the full space heating requirement at the design condition chosen for heat loss calculations. This selection should account for the space heating flow temperature assumed in the heat emitter circuit(s), and not assume any heat will be supplied by additional electric heaters within the design external temperature range.

5.13 Reversible heat pump systems (i.e. those that provide both cooling and heating functions) should be designed such that they are optimised for heating.

Controls

System controls and zoning

5.14 For [wet heating systems](#) in new [dwellings](#) with a floor area of 150m² or greater, a minimum of two independently controlled heating circuits should be provided.

5.15 System controls should be wired so that when there is no demand for space heating or hot water, the [heating appliance](#) and pump are switched off.

5.16 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.

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5.17 Primary hot water circuits for domestic hot water or heating should have fully pumped circulation where this is compatible with the [heat generator](#).

5.18 [Wet heating systems](#) should ensure a minimum flow of water to avoid short-cycling.

5.19 For space heating systems, temperature control should be installed for the [heating appliance](#).

Thermostatic room controls

5.20 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 should be capable of being used to separately adapt the heating output in each room served by the [heating appliance](#). Where justified in accordance with paragraph 5.21, heating may be controlled for each [heating zone](#) rather than individual rooms.

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 very low heat demand (e.g. less than 10W/m²).
- b. Dwelling with buffer zones for heat absorption or dissipation with high thermal mass.

5.21 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 a single [heating zone](#).
- b. Where two adjacent rooms have a similar function and heating requirements (e.g. kitchen and utility room). In such cases, should be considered as a single [heating zone](#).

Note: Exhaust air heat pump systems, which extract heat from the exhaust air of a [dwelling](#), may not need 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 8**.

5.22 The standards in paragraphs 5.20 and 5.21 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

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contains the thermostat. Thermostatic radiator valves should not be used in the same room as the thermostat.

- 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

5.23 In addition to **paragraphs 5.20 to 5.22**, work on existing systems should incorporate the controls detailed in **paragraphs 5.24 to 5.27**.

5.24 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.

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

5.26 If replacing a hot water cylinder, the replacement cylinder should have an electronic temperature control, such as a cylinder thermostat.

5.27 If replacing a boiler, the boiler controls should therefore meet the standards in **Section 6** for the relevant [wet heating system](#). (The boiler controls are considered to be part of the boiler installation.)

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Section 6

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.

Gas-fired heating systems

- 6.1** In addition to meeting the general requirements for heating and hot water systems in **Section 5**, a gas-fired heating system should meet either of the following:
- a. for new [dwellings](#), meet the minimum efficiencies in Table 6.1
 - b. for existing [dwellings](#), meet the minimum efficiencies in Table 6.2.

Note: The minimum system efficiency in Table 6.1 might need to be improved upon to meet the [target emission rate](#), [target primary energy rate](#) and the [minimum energy efficiency rating](#) for the [dwelling](#).

Table 6.1 sets out minimum standards for services that are likely to be installed in new [dwellings](#). If a service is not covered in Table 6.1 then it should meet either the efficiencies set out in Table 6.2 or an equivalent standard.

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Table 6.1 Minimum efficiencies for gas-fired heating systems in new dwellings

System type	Minimum efficiency
Wet Heating (e.g. radiators or underfloor heating)	92% (as defined in ErP ¹)
<p>Note:</p> <p>1. Energy-Related Products Directive. For Standard Assessment Procedure modelling, SEDBUK values should be used</p>	

Table 6.2 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 : <ul style="list-style-type: none"> • 78% for natural gas • 80% for LPG Follow paragraph 6.2.
Range cooker with integral central heating boiler	75% (as defined in SEDBUK 2009)	Follow paragraph 6.3.
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 6.4.
Independent space heating appliance for primary and secondary space heating	63% gross 70% net	Gross efficiency using the following standards as appropriate: <ul style="list-style-type: none"> • BS EN 1266 • BS 7977-1 • BS EN 613 • BS EN 13278 Follow paragraph 6.5.
Inset live fuel-effect combined fire/back boiler	45% for natural gas 46% for LPG	Gross efficiency using BS 7977-2 Follow paragraph 6.6.
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. 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*.

- 6.2** 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.

- 6.3** 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.

- 6.4** 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.

- 6.5** 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**

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- iv. **BS EN 13278**
- v. **BS EN 14829**
- vi. **BS EN 449.**

6.6 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.

6.7 If a gas-fired fixed decorative fuel-effect fire is installed in an existing **dwelling**, both 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 m² of **dwelling** floor area.

Oil-fired heating systems

6.8 An oil-fired heating system that is either part of a new system or is a replacement component in an existing **dwelling** should meet the minimum efficiencies in Table 6.3, in addition to the general requirements in **Section 5**.

Table 6.3 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 6.9.
Fixed independent space heating	60% (converted using Table E4 of the Standard Assessment Procedure)	
NOTES:		
1. For Standard Assessment Procedure modelling, SEDBUK values should be used.		
2. Exceptional circumstances are defined in the ODPM's <i>Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings</i> .		

6.9 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

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same way as a conventional oil-fired boiler.

6.10 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.

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

- a. Electric heat pumps (guidance is provided in paragraphs 6.36 to 6.43).
- b. Portable electric heating devices.

6.11 Electric heating systems should follow paragraphs 6.12 to 6.14, in addition to the general requirements for heating and hot water systems in **Section 5**.

6.12 For electric storage heaters, both of the following should be met.

- 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.

6.13 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 5.20 to 5.22.

6.14 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 5.20 to 5.22.

Solid fuel heating systems

6.15 Solid fuel appliances in new and existing **dwelling**s should have a minimum

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efficiency (gross calorific value) as specified in Table 6.4 for the category of appliance.

- 6.16** A solid fuel appliance belonging to category D1/2/3/4,F,G2,J2 or J5 of Table 6.4, 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 5**.
 - 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 leak radiators designed to keep the system operating effectively by leaking heat.
- 6.17** 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. be from categories D, F, G and J in table 6.4.
 - b. have a ratio of room heat to water heat appropriate for the room and the total property.

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Table 6.4 Solid fuel appliance categories and minimum efficiencies

Category ¹	Appliance description	Minimum efficiency (gross calorific value)	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; <i>The HETAS guide to Approved Solid Fuel, Wood and Biomass Products and Services</i> .			

District heat networks and community heating systems

6.18 Paragraphs 6.19 to 6.26 apply where work involves connecting **dwelling**s to a **district heat network** or **community heating scheme** 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 15 or more **dwelling**s.

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Connecting to a new district heat network or community system

6.19 The central heat source should comply with the standards in section 6 of **Approved Document L, Volume 2, buildings other than dwellings**.

Connecting to an existing district heat network or community heating system

New dwellings

6.20 When connecting a new **dwelling** to an existing district or **community heating system**, the carbon intensity and **primary energy** of the system should be assessed. Emission factors and **primary energy** factors should be determined by a suitably qualified person, based on the particular details of the system, and taking account of the annual average performance of the whole system, including distribution circuits and all the heat generating plant, combined heat and power, waste heat recovery and heat dumping.

Existing dwellings

6.21 When connecting an existing dwelling to an existing **district heat network** or **community heating system**, the carbon intensity and primary energy of the system should be assessed and the guidance in paragraphs 5.4 and 5.5 should be followed.

6.22 Emission factors and **primary energy** factors should be determined by a qualified person, based on the details of the system and taking account of the annual average performance of the whole system, including distribution circuits and all the heat generating plant, combined heat and power, waste heat recovery, and heat dumping.

Minimising energy used by pumps

6.23 New **district heat networks** or **community heating systems** should meet both of the following.

- a. The design temperature difference for the community heating primary circuit should be a minimum of 20°C. Heat pump-led **community heating systems** 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

6.24 For **wet heating systems**, the maximum design flow rate into the **dwelling's** heating system should be limited by suitable control and balancing valves to maintain the overall balance in the network and to avoid excessive pumping energy.

6.25 For new **district heat networks** or **community heating systems**, the domestic hot water system should have variable volume controls designed to maintain low return temperatures in the primary community heating circuit.

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Metering

6.26 District heat networks and community heating systems should be designed to accommodate heat meter(s) for each dwelling.

Micro combined heat and power

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

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

- The method in DEFRA's *Method to Evaluate the Annual Energy Performance of Micro-cogeneration Heating Systems in Dwellings*.
- The performance data for the micro-CHP packaged according to **BSI PAS 67**.
- 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

Zoning and Controls

6.29 In addition to meeting the general requirements for heating and hot water systems in **Section 5**, new underfloor heating systems should meet all of the following.

- All underfloor heating systems should have controls to adjust the operating temperature.
- Room thermostats for electric underfloor heating systems should have a manual override.
- Heating systems for screed floors greater than 65mm thick should automatically reduce the room temperature at night or when the room is unoccupied.
- Heat loss should be minimised by following the guidance in paragraphs 6.30 to 6.33.

Minimising heat losses

6.30 Ground floors and those in contact with the outside of the dwelling should be insulated to limit heat losses to not more than 10 W/m². The heat loss from the floor should be calculated using the sum of the thermal resistance of the floor finish and the underlying heated layer, multiplied by 10.

6.31 Underfloor heating systems intended for intermittent or cyclical operation and/or installed over unheated rooms should be separated from the structural floor by a layer of thermal insulation of at least 1.25 (m².K)/W.

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- 6.32** The **intermediate floor** should have a layer of insulation to reduce downward heat transmission with a thermal resistance of one of the following.
- a. As in paragraph 6.29.
 - b. As specified in **BS EN 1264-4**, as follows.
 - i. For electric systems, of not less than 0.5 (m².K)/W.
 - ii. For wet systems, of not less than 0.75 (m².K)/W.

- 6.33** Distribution pipework which does not provide useful heat to a room should be insulated to the standards of paragraph 4.17.

Specific standards for electric underfloor heating

- 6.34** Electric cables for underfloor heating should be installed within screeds as follows.

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

- 6.35** Where electric cable underfloor heating night energy storage systems 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.

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 in combination.

Heat pump heating systems

Note: Where the heat pump provides comfort cooling, guidance is also given in paragraphs 6.49 to 6.53.

- 6.36** Electrically driven air-to-air heat pumps with an output of 12 kW or less should follow the Ecodesign Commission Regulation No. 2016/2281 for air heating products, cooling products, high temperature process chillers and fan coil units.
- 6.37** For other types of heat pump, not defined in paragraph 6.36, the **coefficient of performance** should meet both of the following.
- a. For space heating, a minimum of **3.0**.
 - b. For heating domestic hot water, a minimum of **2.0**.

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- 6.38** In addition to meeting the general requirements for heating and hot water systems in **Section 5**, the heat pump unit should include controls to do all of the following.
- a. To control water pump operation (internal and external as appropriate).
 - b. To control both of the following.
 - i. Water temperature for wet systems.
 - ii. Air temperature for air systems.
 - c. Control outdoor fan operation for air-to-water and air-to-air units.
 - d. Provide defrost control of external airside heat exchanger for air-to-water and air-to-air systems.
 - e. Control **secondary heating** (if fitted) on air-to-air systems.
 - f. To protect against water flow failure.
 - g. To protect against high water temperature.
 - h. To protect for high refrigerant pressure.
 - i. To protect against air flow failure on air-to-water and air-to-air units.
- 6.39** The heat pump should have external controls that include both of the following.
- a. **Weather compensation** or internal temperature control.
 - b. Timer or programmer for space heating.
- 6.40** For heat pump installations in which there are other heat sources available to the same building, each of these heat sources should be appropriately incorporated into a singular control system.
- 6.41** Heat pumps should be located and installed subject to the manufacturer's guidance. In regard to air source heat pumps, this includes the consideration of factors that may adversely affect their performance, e.g. the avoidance of cold exhaust air recirculation and the removal of condensation from the outdoor coil during a defrost cycle.
- 6.42** Heat pumps should not be sited adjacent to sleeping areas, nor should they be located on materials that can readily transmit vibrations. Additionally, the location of external fans and heat pump compressors should be appropriately selected to minimise disturbance to neighbours, while remaining in compliance with planning requirements.
- 6.43** The installation of anti-vibration instruments and flexible hose connections should be in accordance with the manufacturer's guidance in order to limit the effects of harmful vibrations on building structures.

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 m².
- b. A solar heated water storage volume of less than 440 litres.

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- 6.44** 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.
- Thermal performance.
 - Reporting and identification.
- 6.45** The electrical input power of the primary pump in the solar system should be less than the higher of the following.
- 50W.
 - 2% of the peak thermal power of the collector.
- 6.46** For a heat exchanger between a solar primary and secondary system, a minimum of 0.1m² or equivalent of heat exchanger area should be provided or every 1m² of the net absorber area of the solar collector.
- 6.47** For work on new or existing solar water heating system, controls should be fitted or upgraded to solar domestic hot water systems to do all of the following.
- Maximise the useful energy gain from the solar collectors.
 - Minimise the accidental loss of stored energy.
 - Ensure that hot water produced by back-up sources is not used when adequate solar pre-heated water is available.
 - Provide a means to control the adverse effects of excessive temperatures and pressures.
 - 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.
- 6.48** The dedicated storage volume of solar heated water relative to the area of the collector should be either of the following.
- A minimum volume of 25 litres for every 1m² of the net absorber area of the solar collector.
 - A volume equivalent to at least 80 per cent of the daily hot water demand (as defined by the [Standard Assessment Procedure](#)).

Comfort cooling

- 6.49** The specification of comfort cooling systems should be based on a heat gain calculation 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 this means that the cooling appliance should not be sized for more than 120% of the design [cooling load](#).

Section 6

- 6.50** The **seasonal energy efficiency ratio** of an air conditioner working in cooling mode should be a minimum of 4.0.
- 6.51** 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.
- 6.52** For cooling systems that serve multiple **dwelling**s, follow the guidance in Approved Document L, Volume 2: Buildings other than dwellings.
- 6.53** Exposed refrigeration pipework should be both of the following.
- a. Insulated.
 - b. Enclosed in protective trunking.

Mechanical ventilation

- 6.54** Ventilation systems should meet the 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.
- 6.55** The specific fan power for mechanical ventilation systems should not exceed the following.
- a. for intermittent extract ventilation systems: 0.5 W/(l.s)
 - b. for continuous mechanical extract ventilation systems: 0.7 W/(l.s)
 - c. for continuous supply ventilation systems: 0.5 W/(l.s)
 - d. for continuous mechanical supply and extract ventilation systems: 1.5 W/(l.s).
- 6.56** 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.

Section 6

Lighting

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

Note: In many cases, it is likely that householders will be able to choose the lamp installed in the individual space.

6.58 Where installed in a new or existing **dwelling**, each internal **light fitting** should have lamps with a minimum luminous efficacy of **75 light source lumens per circuit-watt**.

6.59 Where installed in a new or existing **dwelling**, internal **light fittings** 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.

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

- a. Automatic controls which switch luminaires off in response to daylight.
- b. If the luminous efficacy is **75 light source lumens per circuit-watt** or less, automatic controls which switch luminaires off after the lit area becomes unoccupied. If the luminous efficacy is greater than **75 light source lumens per circuit-watt**, manual control is acceptable.

Building Automation and Control Systems

6.61 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.

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

6.63 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

6.64 Where on-site electricity generation and storage is installed, such as photovoltaics or battery storage, systems should be sized appropriately for the site, available infrastructure and on-site energy demand.

6.65 The system should be specified and installed according to the manufacturer's instructions to ensure the overall performance of the system meets a reasonable standard.

6.66 When replacing an existing system, the installed generation capacity of the new system should not be smaller than the existing system, except where it can be demonstrated that a smaller system would be more appropriate or effective (e.g. replacing an existing system with one which is better matched to the **dwelling's** energy demand).

Section 6

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

Section 6

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 an approved inspector, see regulation 20 of the Building (Approved Inspectors etc.) Regulations 2010 (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 7.2 to 7.4 and 7.6 to 7.8.

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 7.5 to 7.7.
- b. The requirements of Part L1(a)(i) of Schedule 1 to the Building Regulations, in accordance with paragraphs 7.1 and 7.5.

Section 7

Section 7

Air permeability and pressure testing

- 7.1 The minimum standard for **air permeability** of a new dwelling is given in Table 4.1 of **Section 4**.
- 7.2 The **building control body** should be provided with evidence that test equipment has been calibrated using a UKAS-accredited facility or by the original manufacturer within either of the following periods.
- The previous 12 months.
 - A period in accordance with the manufacturer's guidance.

Calibration should be carried out in accordance with CIBSE's TM23. It is recommended that test equipment is recalibrated at least every 24 months.

- 7.3 **Building control bodies** may accept a pressure test certificate as evidence that the **dwelling** complies with Regulation 43 of the Building Regulations.
- 7.4 The **building control body** should be provided with evidence that the person who pressure-tested the building meets both of the following.
- has received appropriate training
 - is registered to test the specific class of building.
- 7.5 An air pressure test should be carried out on every **dwelling**.

Showing compliance, and reporting pressure test results

- 7.6 The **dwelling emission rate**, **dwelling primary energy rate** and the **energy efficiency rate** calculated using the measured **air permeability** must not be worse than the **target emission rate**, **target primary energy rate**, and the **minimum energy efficiency rating**.
- 7.7 If the criteria in paragraphs 7.1 and 7.6 are not achieved, the dwelling **air permeability** should be improved. New tests should be carried out until the **dwelling** achieves the criteria in paragraphs 7.1 and 7.6.
- 7.8 The results of all pressure tests on **dwellings** should be reported to the **building control body**, including any test failures.

Air pressure testing procedure

- 7.9 Air pressure tests should be performed following the guidance set out in the approved air tightness testing methodology, CIBSE's TM23. The procedures set out in that document have been approved by Welsh Ministers.

Section 7

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

L1. Reasonable provision shall be made for the conservation of fuel and power 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 an approved inspector, see regulation 20 of the Building (Approved Inspectors etc.) Regulations 2010 (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 8**.

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Section 8

Commissioning

8.1 **Fixed building services** must be commissioned to ensure that they use no more fuel and power than is reasonable in the circumstances. On-site electricity generation systems must be commissioned to ensure that they produce as much electricity as is reasonable in the circumstances. The **commissioning** process should involve testing and adjusting any **fixed building services** and on-site electricity generation as necessary and in accordance with the manufacturer's instructions.

8.2 A **commissioning** plan should be produced, identifying both of the following.

- a. Systems that need to be tested.
- b. How these systems will be tested.

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

8.3 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.

Fixed building services and on-site electricity generation that do not require **commissioning** should be identified in the **commissioning** plan, along with the reason for them not requiring **commissioning**.

Notice of completion

8.4 A **commissioning** notice must be given to the relevant **building control body** confirming that **commissioning** has been carried out for the installed **fixed building services** and on-site electricity generation according to a procedure approved by the Secretary of State. The notice should confirm all of the following.

- a. That the **commissioning** plan has been followed.
- b. That every system has been inspected in an appropriate sequence and to a reasonable standard.
- c. That the test results confirm that performance is reasonably in accordance with the design requirements.

8.5 The notice of completion of **commissioning** should be given as follows.

- a. If a building notice or full plans have been given to a local authority **building control body**, the notice should be given to that **building control body** within five days of the **commissioning** work being completed.
- b. If the **building control body** is an approved inspector, the notice should

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generally be given to the approved inspector within five days of the work being completed.

- c. 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.

8.6 Where any [fixed building services](#) and on-site electricity generation that require [commissioning](#) are installed by a person registered with a competent person scheme, that person may give the notice of [commissioning](#).

8.7 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

8.8 Before a new [heating appliance](#) is installed, all central heating and primary hot water circuits should be thoroughly cleaned and flushed out. A suitable chemical inhibitor should be added to the primary heating circuit to protect against scale and corrosion. 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. 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.

Heat pump heating systems

8.9 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.

- 8.10** If using a ground source heat pump the [commissioning](#) procedure for the ground array should be 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 such that damage to the internal heat exchanger inside the heat pump is avoided.
 - b. The heat pump – along with its accompanying pipework – should be flushed and purged as a separate system while isolated from the ground array system.

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- c. Following the complete purging of micro air bubbles, a pressure test (in accordance with **BS EN 805**, section 11.3.3.4) should be conducted on all closed-loop ground source heat pump installations 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 manufacturer's instructions.

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

District heat networks and community heating systems

8.12 For **district heat networks** and **community heating systems**, both of the following should be done.

- 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

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

Section 8

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 9.2.
- b. Other important documentation as detailed in paragraph 9.3 to 9.5.

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 and 9.2.
- b. Relevant information for work on existing systems as detailed in paragraphs 9.6 to 9.9.

Section 9

Section 9

Providing information

Operating and Maintenance instructions

9.1 Operating and maintenance instructions should be provided to the owners of the [dwelling](#) for any [fixed building services](#) and on-site electricity generation installed as part of the work. The instructions should contain sufficient information to help the owner/occupier achieve the expected level of energy efficiency, and to verify that any [fixed building services](#) and on-site electricity generation comply 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. durable
- d. in an accessible format.

9.2 The operating and maintenance instructions should achieve all of the following.

- a. Explain the following for the [fixed building services](#), on-site electricity generation and any other technologies.
 - i. what they are
 - ii. what they are for
 - iii. where they are located, (including using a floor plan in new dwellings)
 - iv. how to control them, including the location and operation of timers and sensors
 - v. how to maintain them
- b. Signpost other important documentation, such as appliance manuals.
- c. Include a completed [commissioning](#) sheet, where relevant.

Additional information for new dwellings

9.3 For new [dwellings](#), a signed copy of the Building Regulations Wales Part L compliance report (BRWL report) and photographic evidence of the build quality should be provided to the homeowner.

9.4 For new [dwellings](#), the operating and maintenance instructions should signpost 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 efficiency rate](#).

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- b. The recommendations report generated with the 'on-construction' [energy performance certificate](#).

9.5 For new [dwellings](#), 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 contain advice on the following.

- a. Ventilation.
- b. Heating and domestic hot water.
- c. On-site electricity generation (if applicable).
- d. Staying cool in hot weather.

Note: A template with example text for a Home Energy Guide can be viewed at

[Building regulations guidance: part L \(conservation of fuel and power\) | GOV.WALES](#)

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

Additional information for work in existing buildings

9.6 For existing [dwellings](#), when any building work is carried out for which Section 5 and/or Section 6 of this approved document 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.

9.7 For existing [dwellings](#), 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 building owner with the manufacturer's supporting literature. The record of energy performance results may be in any of the following forms.

- a. Full records of [commissioning](#) the system in accordance with **Section 8**.
- b. A documented assessment using the [Standard Assessment Procedure](#), such as a new [energy performance certificate](#).
- c. Another equivalent assessment carried out by a suitably qualified person.

9.8 For existing [dwellings](#), 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 building 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.

9.9 For existing [dwellings](#), if work on an existing system alters the energy performance or CO2 emissions performance of the system, then the complete

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altered system should be assessed and the guidance for new or replacement systems in paragraph 9.7 should be followed. Such work could 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.

<i>Requirement</i>	<i>Limits on application</i>
<p>Schedule 1 – Part L Conservation of fuel and power</p> <p>L1. Reasonable provision shall be made for the conservation of fuel and power in buildings by:</p> <p style="padding-left: 20px;">(a) limiting heat gains and losses–</p> <p style="padding-left: 40px;">(i) through thermal elements and other parts of the building fabric; and</p> <p style="padding-left: 40px;">(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;...</p>	

Intention

In the Welsh Minister’s view, requirement L1(a) is met for new elements in existing **dwelling**s 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 – follow paragraphs 10.2 to 10.7
 - b. For new and replacement windows and doors – follow paragraphs 10.8 to 10.14 (for extensions) and 10.18 to 10.26 (for windows in an existing dwelling)
 - c. For conservatories and porches - follow paragraphs 10.27 to 10.34
 - d. For indoor swimming pools – follow paragraphs 10.35 to 10.37

Extensions

Introduction

- 10.2** In this Approved Document, extension describes when new building fabric is added to an existing dwelling to create an extra room or rooms.
- 10.3** 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**.
- 10.4** 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

- 10.5** New thermal elements constructed as part of an extension should achieve or better the U-values set out in the final column of Table 4.1 (existing buildings).
- 10.6** 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.
- 10.7** 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 11.7-11.10.

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Windows and Doors

10.8 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 U-values 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 ⁴	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 ^{2,5}	1.4 or DSER Band C 1.4 or DSER Band B	1.2 centre pane N/A	3.3 3.3
NOTES:			
<ol style="list-style-type: none"> U-values should be calculated as in paragraphs 4.1 to 4.5. 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. See paragraphs 10.10 and 10.25 for instances where column 'b' could apply. For timber windows, a maximum U-value of 1.6 W/(m²·K) or Window Energy Rating Band C is permissible where a building notice or an initial notice has been given to, or full plans have been deposited with, a local authority, in respect of that building, before 23 November 2023, to allow manufacturers additional time to transition to the full standard of 1.4 W/(m²·K) or Window Energy Rating Band B. For timber doors, a maximum U-value of 1.8 W/(m²·K) or Doorset Energy Rating Band E is permissible where a building notice or an initial notice has been given to, or full plans have been deposited with, a local authority, in respect of that building, before 23 November 2023, to allow manufacturers time to transition to the full standard of 1.4 W/(m²·K). 			

10.9 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.

10.10 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-

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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.

- 10.11** The total area of windows and doors in the extension should not exceed the sum of:
- a. 25 per cent 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.
- 10.12** It is advisable to ensure that the total area of windows and doors in the extension is not less than 20 per cent 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.
- 10.13** In the case of **dwelling**s 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**.
- 10.14** 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

- 10.15** 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 5, 6** and paragraphs 4.11 to 4.19, and commissioned according to **Section 8**.

Design and Installation Standards

- 10.16** 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.
- 10.17** 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.

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10.18 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

Introduction

10.19 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.

10.20 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.

10.21 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.

10.22 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

10.23 New or replacement windows and doors should be draughtproofed 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.

10.24 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.

10.25 Where an existing window or door is enlarged or a new one created the total area of windows and doors should not to exceed 25 per cent of the total floor area of the [dwelling](#).

10.26 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

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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.

10.27 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

Introduction

10.28 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 m²; 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

10.29 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 4.1 to 4.5.

10.30 Where a conservatory or porch is not exempt, it should fulfil the following requirements:

- a. Glazed and opaque elements should meet the standards set out in the final column of Table 4.1 (The limitations on the total area of windows, roof windows and doors as set out in paragraph 10.11 of Extensions do not apply here); and
- b. be thermally separate from the heated area of the dwelling (see paragraph 10.28); and
- c. any fixed space heating installed in the conservatory or porch should comply with **Sections 5, 6 and 8**.

10.31 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.

10.32 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.

10.33 If the proposed addition is not thermally separated from the **dwelling** and therefore does not meet all of the requirements in paragraphs 10.27 and 10.28, it should be treated as an extension and follow the guidance set out in

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paragraphs 10.2 to 10.17 including the limitation on the total area of windows and doors.

Existing conservatories or porches

10.34 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.

10.35 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

Introduction

10.36 New indoor swimming pool basins (walls and floors) should achieve or better a U-value of 0.25 W/m².K.

10.37 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**.

10.38 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.

Section 10

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)

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 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 11.11
- b. For renovations – following paragraphs 11.12 to 11.22
- c. For material change of use - follow paragraphs 11.23 to 11.39
- d. For replacement thermal elements – follow paragraph 11.40

Conversions (change of energy status)

Introduction

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.

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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 ³	0.70
Floors ⁷	0.25	0.70
Pitched roofs – insulation at ceiling level	0.16	0.35
Pitched roofs – insulation between the rafters	0.16	0.35
Flat roofs or roofs with integral insulation	0.16	0.35

¹ 'Roofs' include the roofs of dormer windows and 'walls' include the walls or cheeks of dormer windows

² U- values should be calculated using the methods set out in Table 4.1

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.

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 to as close to the maximum U-value as is practicably possible. 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,*

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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:
- reduce the internal floor area of a room by more than 5 per cent; or
 - cause significant problems with adjoining floor levels; or
 - create insufficient headroom; or
 - could not be supported by the existing structure.
- 11.11** 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 possible to the U-values given in column (a). 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.
- 11.12** If any new or replacement **thermal elements** are constructed as part of a conversion the guidance for new **thermal elements** set out in paragraphs 4.7 and 4.8, should be followed.

Renovations

Introduction

- 11.13** Work on existing **thermal elements** must comply with regulation – requirements for the renovation or replacement of **thermal elements**.
- 11.14** 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 greater than 50% of the surface of the individual **thermal element** or 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).*

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- 11.15** **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.
- 11.16** 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.
- 11.17** When assessing the proportion of the area to be renovated in paragraph 11.13, 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.
- 11.18** 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

- 11.19** Where a **thermal element** is renovated through the provision of a new layer or the replacement of an existing layer, as described in paragraph 11.15, 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 are undertaken as specified in the table.
- 11.20** 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 to the best standard that is economically, functionally and technically feasible. 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.*

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11.21 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.

Design and Installation Standards

11.22 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.

11.23 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.

11.24 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

Introduction

11.25 In this Approved Document, a material change of use describes when:

- 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 at least one **dwelling**, contains greater or lesser number of dwellings than it did previously.

11.26 Where a previously unheated building is converted into a **dwelling**, it is described as a “change in energy status” in the Building Regulations and **Section 3** should be followed.

11.27 **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.

11.28 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

11.29 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

Section 11

Table 11.1 including any risks assessments are undertaken as specified in the table.

11.30 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 to as close to the maximum **U-value** as is practicably possible. 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.*

11.31 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.

11.32 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:

- reduce the internal floor area of a room by more than 5 per cent; or
- cause significant problems with adjoining floor levels; or
- create insufficient headroom; or
- could not be supported by the existing structure.

11.33 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 possible to the U-values given in column (a). 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.

11.34 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 4.7 and 4.8 should be followed.

Windows and Doors

11.35 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

Section 11

10.1. Insulated cavity closers should be installed around the windows and doors, where appropriate.

11.36 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.

11.37 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. 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.

11.38 Where an existing window or door is enlarged or a new one created the total area of windows and doors should not exceed 25 per cent of the total floor area of the [dwelling](#).

11.39 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.

11.40 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

11.41 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 5, 6 and paragraphs 4.11 to 4.19, and commissioned according to Section 8.

Design and Installation Standards

11.42 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.

Section 11

11.43 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.

11.44 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

11.45 Replacement [thermal elements](#) constructed in an existing dwelling should achieve the minimum standards in paragraphs 4.7 and final column of table 4.1. 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.

Section 11

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 1000m² 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 an approved inspector, see regulation 20 of the Building (Approved Inspectors etc.) Regulations 2010 (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) describe 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

- 12.4** Where an existing **dwelling** is extended or converted, as a result increasing the habitable area by no more than 10m², 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 10m², the following energy efficiency improvements should be undertaken:

Section 12

- 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.

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.

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.

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 5, 6** and paragraphs 4.15 to 4.23 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:

$$\frac{\{(U1 \times A1) + (U2 \times A2) + (U3 \times A3) + \dots\}}{\{A1 + A2 + A3 + \dots\}}$$

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Where:

U = the U-value of each individual thermal element in W/m².K

A = the area of each individual thermal element in m²

- 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 per cent 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 than that of the benchmark.

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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 10-11**. 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 per cent 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 10.11, 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.
- 13.17** 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-

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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 than 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 is the physical property used to measure airtightness of the building fabric. It is defined as 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 value used in establishing the **dwelling emission rate** and the **dwelling primary energy rate**. The assessed **air permeability** is based on a measurement of the **air permeability** of the **dwelling** concerned.

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.

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 an approved inspector.

***Building Envelope** (in relation to a building) is defined in Regulation 35 as: the walls, floor, roof, windows, doors, roof windows and rooflights.

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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 those Regulations apply, where previously it was not.

Circuit-watt refers to the power consumed in lighting circuits by lamps and, where applicable, their associated control gear (including transformers and drivers) and power factor correction equipment.

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.

Community heating system A system that supplies heat from a central source to more than one dwelling or premises within a single building.

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 networks supply heat from a central source to consumers, via a network of underground pipes carrying hot water. Heat networks can cover a large area or even an entire city, or be fairly local supplying a small cluster of buildings.

Appendix A

Dwelling emission rate is the dwelling CO₂ emission rate expressed as kgCO₂/(m²·year) and determined using the [Standard Assessment Procedure](#).

Dwelling energy efficiency rate is the dwelling SAP rating determined using the [Standard Assessment Procedure](#).

Dwelling primary energy rate is expressed as kWh_{PE}/(m²·year) and determined using the [Standard Assessment Procedure](#).

Dwelling means a self-contained unit designed to accommodate a single household.

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.

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, economically 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 efficiency requirements** are defined in Regulation 2(1) as: the requirements of regulations 23, 25A, 25B, 26, 26A, 26B, 26C 28 and 40, 40A and Part L of schedule 1.

Energy performance certificate is defined in the Energy Performance of Buildings (England and Wales) Regulations 2012 as: a certificate which—

- a in the case of a certificate entered on the register before 9th January 2013 complied with the requirements of regulation 11(1) of the Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007(d);
- b in the case of a certificate entered on the register on or after 9th January 2013 complies with the requirements of regulation 9(1) of these Regulations; or
- c complies with the requirements of regulation 29(e) of the Building Regulations 2010;

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

Appendix A

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; 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 occupier's electrical system. It excludes lighting in common areas of blocks of flats and in other communal accessways.

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 CaCO₃.

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.

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, taking place in the heating elements of an electric resistance heating system. 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 CO₂ 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 CO₂.

Intermediate floor A floor in a building above the ground floor.

Light fitting means a fixed light or a lighting unit, which can comprise one or more lamps and lampholders, control gear and an appropriate housing. The control gear may be integrated in the lamp or located elsewhere, in or near the fixed light.

Load compensation means a control function that maintains internal temperature by varying the flow temperature from the heat generator relative to the measured response of the heating system.

Light source lumens The sum of the average initial (100 hour) lumen output of all light sources in a luminaire.

***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.

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Minimum Energy Efficiency Rating is the minimum permissible SAP rating for the dwelling, calculated using the [Standard Assessment Procedure](#).

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.

Renewable technology that uses renewable resources, which are naturally replenished on a human timescale, to produce electricity. Resources include wind, wave, marine, hydro, biomass 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, an 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 coefficient of performance (SCOP) is a measure of the efficiency of a heat pump over the designated heating season, measured using the procedures in **BS EN 14825**.

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 water circulates in supply pipes or distributing pipes of hot water storage systems.

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.

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:

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- 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 current prices at the time the **building control body** is told of the proposals, 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. for the purposes of this Approved Document, the current energy prices at the time the building control body is told of the proposals should be used when evaluating the annual energy savings. Current energy 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 is the current approved procedure 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.

Target emission rate is the maximum CO₂ emission rate for the dwelling, expressed as kgCO₂/(m²·year), 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}/(m²·year) and determined using the **Standard Assessment Procedure**.

Thermal bridging 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) 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:

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- 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 which enclose a particular conditioned indoor space or groups of indoor spaces.

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 enables the operating flow temperature of a heating system to be varied. An external sensor communicates with one inside the boiler. 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 [minimum energy efficiency rating](#) and the [dwelling energy efficiency rating](#).
 - 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 [minimum energy efficiency rating](#) and the ‘as-built’ [dwelling energy efficiency rating](#).
 - a supporting list of ‘as-built’ specifications

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 of typical details should be taken for each dwelling on a development as a record during the construction of a property. The photographs should be made available to the energy assessor (before the

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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 Photographs should be taken of typical details as listed below and should be unique to each property. One photograph per detail should be recorded. Additional images, such as a close-up detail, should be provided only when necessary (see below). Photographs should be taken at appropriate construction stages where applicable (e.g. stage 1a may not be applicable for an above ground floor flat) for each detail when completed, but prior to closing-up works. *(In total, an estimated 20 to 30 photographs would be expected per dwelling house.)*

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.

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- 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 continuity of insulation image).
 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, show the following.
 - a. Plant/equipment identification label(s), including make/model and serial number.
 - b. Primary pipework continuity of insulation.
 - c. Mechanical ventilation ductwork continuity of insulation (for duct sections outside the [thermal envelope](#)).
- B.8** Photographs should be digital and of sufficient quality and high enough resolution to allow a qualitative audit of the subject detail. Close-up photographs may be needed where a long shot image provides insufficient detail, therefore, more than one image of each detail may be needed. 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) wall and roof elements, alternative construction stage photographs may be used provided they include the junctions and interfaces detailed in B7.

Appendix C

Documents referred to

Legislation

The Building Regulations 2010, SI 2010/2214

Building (Approved Inspectors etc.) Regulations 2010, SI 2010/2215

Ecodesign Commission Regulation No. 2016/2281

Ecodesign for Energy-Related Products Regulations 2010, SI 2010/2617

Energy-Related Products Directive 2009/125/EC

Planning (Listed Buildings and Conservation Areas) Act 1990, c. 9

Documents

Building Research Establishment (BRE)

(www.bre.co.uk)

BR 262 *Thermal Insulation: Avoiding Risks*. Third Edition [2002]

BR 443 *Conventions for U-value Calculations* [2019]

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]

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)

Guide A *Environmental Design* [2015]

TM23 *Testing Buildings for Air Leakage* [2000]

Appendix C

Department for Business, Energy and Industrial Strategy (BEIS)

(www.gov.uk/beis)

The Government's Standard Assessment Procedure for Energy Rating of Dwellings, SAP 10. Available at www.bregroup.com/sap/sap10/

Department for Environment, Food and Rural Affairs (DEFRA)

Method to Evaluate the Annual Energy Performance of Micro-cogeneration Heating Systems in Dwellings [2008]

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]

HETAS

(www.hetas.co.uk)

The HETAS Guide to Approved Solid Fuel, Wood and Biomass Products and Services. List no. 26 [2020]

Historic England

(historicengland.org.uk)

Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings [2017]

Hot Water Association

(www.hotwater.org.uk)

Performance Specification for Thermal Stores [2010]

Office of the Deputy Prime Minister (ODPM)

Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings [2005]

Appendix C

National Association of Rooflight Manufacturers (NARM)

(www.narm.org.uk)

Technical Document NTD02 *Assessment of Thermal Performance of Out-of-plane Rooflights* [2010]

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]

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]

Appendix D

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 [2000]

BS EN 613

Independent gas-fired convection heaters [2001]

BS EN 805

Water supply. Requirements for systems and components outside buildings [2000]

BS EN 1264-4

Water based surface embedded heating and cooling systems. 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 12831-3

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 [2006 + A1: 2010]

BS EN 13278

Open fronted gas-fired independent space heaters [2013]

BS EN 14351-1

Windows and doors. Product standard, performance characteristics. Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics [2006 (+AMD 1:2010)].

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 [2018]

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 [2018]

Appendix D

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 [2012 + A1: 2016]

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 12567

Thermal performance of windows and doors. Determination of thermal transmittance by the hot-box method

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 [2007 incorporating corrigendum March 2009]

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

Appendix E

Elemental specification for the TPER/TER

1. The elemental specification which is used to calculate the TPER and TER of a new dwelling is given in SAP Appendix R. A summary is given in the table below.
2. Note that the elemental specification states an airtightness of 5.0 m³/h.m² 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/m ² K)	0.13
Corridor Wall U-value (W/m ² K)	0.18
Party Wall U-value (W/m ² K)	0
Roof U-value (W/m ² K)	0.11
Floor U-value (W/m ² K)	0.11
Windows, Roof Windows and Glazed Door U-value (W/m ² K)	1.3 (whole window u-value)
Rooflight U-value (W/m ² K)	1.6 (whole window u-value)
Windows, Roof Windows, Glazed Rooflights and Glazed Door g-value	0.63 ³
Opaque and Semi-glazed Door U-value (W/m ² K)	1.0
y-value (W/m ² K)	Based on the 'Option 2' psi values in Table R2 of SAP 10.1 except use of y=0.05 W/m ² K if the default value of y=0.20 W/m ² K is used in the actual building
Ventilation System Type	Intermittent extract fans with trickle vents
Air Permeability (m ³ /h.m ² at 50 Pa)	5
Air Conditioning	None
Heating system	Mains Gas
	If gas or oil combi boiler performing space heating in actual dwelling, instantaneous combi boiler; otherwise regular boiler

Element or system	Specification
	Low temperature radiators (design flow temperature = 55°C)
	Room sealed
	Fan flue
	SEDBUK 2009 89.5% efficient
Space Heating Controls	<p>1. For a single storey dwelling in which the living area is greater than 70% of total floor area, programmer and room thermostat;</p> <p>2. For any other dwelling, time and temperature zone control, TRVs;</p> <p>And in all cases: Modulating burner control Boiler interlock ErP Class V</p>
Hot Water System	<p>Heated by boiler (regular or combi as above)</p> <p>Separate time control for space and water heating</p> <p>If cylinder specified in actual dwelling: volume of cylinder in actual dwelling If combi boiler: no cylinder Otherwise: 150 litres</p> <p>If cylinder, declared loss factor = $0.85 \times (0.2 + 0.051 V^{2/3})$ kWh/day, where V is the volume of the cylinder in litres Cylinder in heated space Thermostat controlled Fully insulated primary pipework</p>
Shower Flow Rate	8 l/min
Waste Water Heat Recovery (WWHR)	Efficiency of 55% Utilisation of 0.98
Secondary Space Heating	None
Fixed Lighting Capacity (lm)	185 x Total Floor Area
Lighting Efficacy (lm/W)	80
Thermal Mass Parameter	Same as actual dwelling
PV System	<p>For houses kWp = 40% of ground floor area, including unheated spaces / 6.5</p> <p>For flats kWp = 40% of dwelling floor area / (6.5 × number of storeys in block)</p> <p>SE/SW facing, 45° pitch</p> <p>No/very little overshadowing</p>

Element or system	Specification
	<p>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 per cent of the total floor area, some parts of the dwelling may experience poor levels of daylight, resulting in increased use of electric lighting.</p> <p>² The orientation of the elemental building is the same as the actual building. See SAP 10 Appendix R for treatment of curtain walling (an allowance of +0.1W/m²K is made on the window U-value for thermal bridging within the curtain wall). The treatment of roof windows is also detailed in SAP 10 Appendix R (an adjustment factor of +0.3W/m²K is applied).</p> <p>³ Higher g-values would also comply with the recipe as increasing solar gains reduced the space heat load. However, designers should be aware of the impact of g-value on the risk of overheating and optimise their choice accordingly.</p>

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.
 - i. 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**.
 - i. 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.
 - ii. 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.

Appendix F

- 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, etc.

Appendix G

Thermal Bridging

- 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 construction sequencing 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 detailed to achieve continuity of insulation.
 - i. Perimeter floor insulation should abut or extend the full depth of the main floor insulation.

Appendix G

- i. 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.
 - ii. 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 detailed 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.

Appendix G

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, Table K1. A mixture of known and default values may be used.
 - d. Use a default y -value of $0.20\text{W}/(\text{m}^2\cdot\text{K})$.

Note: A mix of approaches 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 at these penetrations.
- d. **Structural penetrations** need to be effectively sealed for airtightness. Timber joist hangers should be considered as an alternative to penetrating through the inner leaf.
- e. **Cavity walls:** the inner block leaf mortar joint should be fully filled and pointed within the cavity. 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.

Appendix H

- i. **Loft hatches:** where the roof is insulated at ceiling level, hatches should be suitably designed and installed to ensure optimum airtightness.

H.2 To avoid air movement within thermal elements, either of the following measures should be implemented. a. The insulation layer should abut the air barrier at all points in the building envelope.

- a. The space between the air barrier and the insulation layer should be filled with solid material.

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>