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HM Government

The Building Regulations 2010

Conservation of fuel and power

APPROVED DOCUMENT L

Volume 1: Dwellings

Requirement L1: Conservation of fuel and power

Requirement L2: On-site generation of electricity

Regulations: 6, 22, 23, 24, 25, 25A, 25B, 26, 26A, 26C, 27, 27A, 27C, 28, 40, 40A, 43, 44 and 44ZA

2021 edition incorporating 2023 amendments – for use in England

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2021 edition

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

This approved document takes effect on 15 June 2022 for use in England. It does not apply to work subject to a building notice, full plans application or initial notice submitted before that date, provided the work for each building is started before 15 June 2023. Full detail of the transitional arrangements can be found in Circular Letter 01/2021 published on gov.uk.

Main changes made by the 2023 amendments

The changes focus on the following provision:

District heat networks and community heating: Removal of primary energy factor as a performance standard for dwellings.

Introduction

What is an approved document?

Approved documents are approved by the Secretary of State and give practical guidance on common building situations about how to meet the requirements of the Building Regulations 2010 for England. Different approved documents give guidance on each of the technical parts of the regulations. These are all listed in the back of the approved documents. 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 are approved by the Secretary of State.

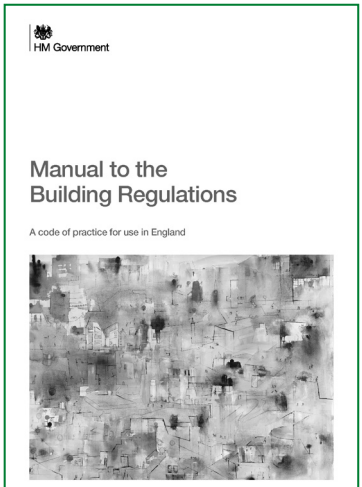
Each approved document covers the requirements of the Building Regulations 2010 relating to a different aspect of *building work*. *Building work* must also comply with all other applicable requirements of the Building Regulations 2010 and all other applicable legislation.

How is construction regulated in England?

Most *building work* being carried out in England must comply with the Building Regulations 2010. The Building Regulations are made under powers in the Building Act 1984.

Building Regulations protect the health and safety of people in and around buildings, they also provide for energy and water conservation and access to and use of buildings.

The *Manual to the Building Regulations* (references to this in the introduction are taken from the first edition) gives an overview of the building regulatory system in England. You can access the most recent version of the manual at: www.gov.uk/guidance/building-regulations-and-approved-documents-index.



How do you comply with the Building Regulations?

Building work must meet all relevant requirements of the Building Regulations. To comply with the Building Regulations, it is necessary both to follow the correct procedures and meet technical performance requirements.

The approved documents set out what, in ordinary circumstances, may be accepted as one way to comply with the Building Regulations. Note, however, that:

- Complying with the guidance in the approved documents does not guarantee that *building work* complies with the requirements of the regulations – the approved documents cannot cover all circumstances. Those responsible for *building work* must consider whether following the guidance in the approved documents is likely to meet the requirements in the particular circumstances of their case.
- There may be other ways to comply with the requirements than those described in an approved document. If those responsible for meeting the requirements prefer to meet a requirement in some other way than described in an approved document, they should seek to agree this with the relevant building control body at an early stage.

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Those responsible for *building work* include agents, designers, builders, installers and the building owner. For further information, see Chapter 7 in Volume 1 and paragraphs A26, B2 and F2 in Volume 2 of the *Manual to the Building Regulations*.

The Building Regulations can be contravened by not following the correct procedures or not meeting the technical performance requirements. If the building owner or those responsible for the works contravene the Building Regulations, the local authority may prosecute them in the magistrates' court. For further information on enforcement and sanctions in the existing system, see Chapter B in Volume 2 of the *Manual to the Building Regulations*.

What do the Building Regulations cover?

'*Building work*' is a legal term for work covered by the Building Regulations. Where a building is not exempt, the Building Regulations apply to all types of *building work* as defined in regulation 3 of the Building Regulations. For further information, what constitutes *building work* is covered in Chapter A, Volume 2 of the *Manual to the Building Regulations*.

The Building Regulations contain sections dealing with definitions, procedures and the expected technical performance of *building work*. For example, the Building Regulations:

a. define what types of building, plumbing and heating work is classed as *building work* in regulation 3 (for further information see paragraphs A14 to A16 in Volume 2 of the *Manual to the Building Regulations*).

b. specify types of building that are exempt from the Building Regulations (for further information see Table A1 and paragraph A11 in Volume 2 of the *Manual to the Building Regulations*).

c. set out the notification procedures to follow when undertaking *building work* (for further information see Figure 2.1 in Volume 1 of the *Manual to the Building Regulations*).

d. set out the technical requirements (see Table 7.1 in Volume 1 of the *Manual to the Building Regulations*) with which the individual aspects of building design and construction must comply in the interests of the health and safety of building users, of energy efficiency (for further information see paragraphs A12(d)–(f), A14(f)–(h), A22, A23, B2(c) and F24 in Volume 2 of the *Manual to the Building Regulations*), and of access to and use of buildings.

e. set out the standards for building materials and workmanship in carrying out *building work* (for further information see Chapter 7 in Volume 1, and paragraphs F8 to F11 in Volume 2 of the *Manual to the Building Regulations*).

When must a building control body be notified?

It is often necessary to notify a building control body of planned *building work*. To help ensure that work complies with the Building Regulations, those responsible for *building work* may need to use one of the two types of building control body listed below:

a. a local authority building control body (for further information see Chapter B in Volume 2 of the *Manual to the Building Regulations*)

b. an approved inspector (for further information see Chapter E in Volume 2 of the *Manual to the Building Regulations*).

If *building work* consists only of installing certain types of services or fittings (e.g. fuel-burning appliances or replacement windows) and the building owner employs an installer that is registered with a relevant competent person scheme designated in the regulations, a building control body does not need to be notified.

For further information about competent person schemes, see Chapter 5 in Volume 1 and Chapter C in Volume 2 of the *Manual to the Building Regulations*.

How to use this approved document

Each approved document contains:

- general guidance on the performance expected of materials and *building work* in order to comply with each of the requirements of the Building Regulations, and
- practical examples and solutions on how to achieve compliance for some of the more common building situations.

They may not provide appropriate guidance if the case is unusual in terms of its design, setting, use, scale or technology. Non-standard conditions may include any of the following:

- difficult ground conditions
- buildings with unusual occupancies or high levels of complexity
- very large or very tall buildings
- large timber buildings
- some buildings that incorporate modern construction methods.

Anyone using the approved documents should have sufficient knowledge and skills to understand the guidance and correctly apply it to the *building work*. This is important because simply following the guidance does not guarantee that your *building work* will comply with the legal requirements of the Building Regulations. Each approved document contains legal requirements (which you must follow) and guidance (which you may or may not choose to follow). The text in a box with a green background at the beginning of each section of an approved document is taken from the Building Regulations. This text sets out the legal requirements.

The explanation which follows the legal requirements is guidance (see Diagram *i* below). The guidance then explains one or more ways to demonstrate how *building work* can be shown to comply with the legal requirements in common circumstances. The terms in green lettering in an approved document are key terms, listed and explained in the appendix to that approved document. Guidance in the approved documents addresses most, but not all, situations that building owners will face. Situations may arise that are not covered. You or your advisers will need to carefully consider whether following the guidance will mean that the requirements of the Building Regulations will be met.

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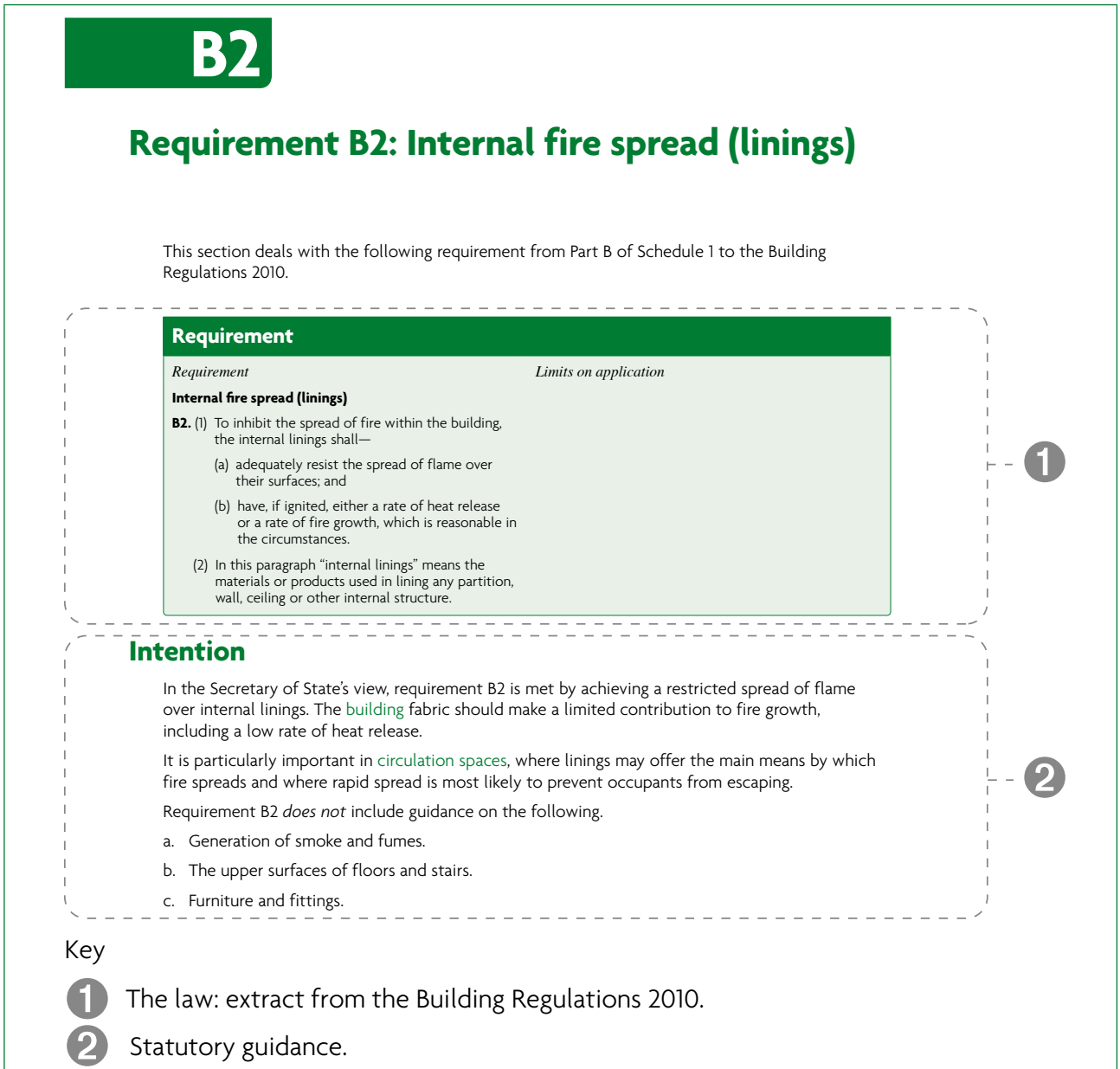

Diagram *i* The relationship between regulations and guidance in the approved documents

For further information about the use of technical guidance, see Chapter 7 in Volume 1 and Chapter F in Volume 2 of the *Manual to the Building Regulations*.

Where to get further help

If you are unsure whether you have the 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. Some sources of help are listed below.

a. Your building control body may be able to help in many cases.

b. If you are registered with a competent person scheme, the scheme operator should be in a position to help.

c. Suitably qualified and experienced construction professionals should also be engaged where necessary.

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Section 0: Introduction

Summary

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 relating to 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 primary energy rate, target emission rate and target fabric energy efficiency rate	Regulations 24, 25, 25B, 26, 26A, 26C, 27, 27A and 27C
Section 2: Calculating the dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate	
Section 3: Consideration of high-efficiency alternative systems	Regulation 25A
Section 4: Limiting heat gains and losses	Requirement L1(a) of Schedule 1
Section 5: Minimum building services efficiencies and controls – general guidance	Requirements L1(b)(i), (ii) and L2 of Schedule 1
Section 6: System specific guidance	
Section 7: Air permeability and pressure testing	Regulation 43
Section 8: Commissioning	Regulations 44 and 44ZA and requirements L1(b)(iii) and L2(b) of Schedule 1
Section 9: Providing information	Regulations 40 and 40A
Section 10: New elements in existing dwellings, including extensions	Regulation 23(2) and requirement L1(a) of Schedule 1
Section 11: Work to elements in existing dwellings	Regulations 6, 22 and 23(1) and requirement L1(a) of Schedule 1
Section 12: Consequential improvements	Regulation 28
Appendix A: Key terms	n/a
Appendix B: Reporting evidence of compliance	n/a
Appendix C: Work to thermal elements	n/a
Appendix D: Specification for a home built with a heat pump	n/a
Appendix E: Standards referred to	n/a
Appendix F: Documents referred to	n/a

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Application

0.3 The guidance in Approved Document L, Volume 1 applies to dwellings only.

In a mixed-use building, Approved Document L, Volume 2: Buildings other than dwellings should be consulted for building work in 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; Approved Document L, Volume 2: Buildings other than dwellings applies.

Common areas in buildings that contain multiple dwellings

0.4 For the common areas of buildings that contain more than one dwelling, the following guidance applies.

a. If the common areas are heated, the guidance in Approved Document L, Volume 2: Buildings other than dwellings should be followed.

b. If the common areas are unheated, individual fabric elements should meet the minimum standards set out in Section 4.

New dwellings

0.5 Guidance for new dwellings is given in Sections 1 to 9 of this approved document, Approved Document L, Volume 1.

0.6 For a conservatory or porch installed as part of the construction of a new dwelling, the treatment of the conservatory or porch depends on whether both of the following have been achieved.

a. There is adequate thermal separation between the dwelling and the conservatory or porch.

b. The dwelling's heating system is not extended into the conservatory or porch.

If both (a) and (b) have been achieved, the conservatory or porch should be treated as if it were an extension being added onto an existing dwelling. The guidance for new elements in existing dwellings in Section 10 should be followed.

If either or both of (a) or (b) has *not* been achieved, the conservatory or porch should be treated as a room in the new dwelling. The guidance for the whole new dwelling should be followed, including for dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate calculations.

Extensions to and work on existing dwellings

0.7 Guidance for existing dwellings is given in this approved document for the following.

a. Limiting heat gains and losses: Section 4.

b. Building services: Sections 5 and 6.

c. New elements in existing dwellings, including replacing a fabric element and constructing an extension: Section 10.

d. Existing elements in existing dwellings, including renovating or retaining a thermal element, material change of use and change to energy status: Section 11.

NOTE: For building work in very large dwellings of over 1000m^2, consequential improvements may be required to improve the energy efficiency of the dwelling. Guidance is given in Section 12.

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Exemptions for listed buildings, buildings in conservation areas and scheduled monuments

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

0.10 The energy efficiency of historic and traditional dwellings should be improved only if doing so will not cause long-term deterioration of the building's fabric or fittings. In particular, this applies to historic and traditional buildings with a vapour permeable construction that both absorbs moisture and readily allows moisture to evaporate. Examples include those built with wattle and daub, cob or stone and constructions using lime render or mortar.

0.11 New extensions to historic and traditional dwellings should comply fully with the energy efficiency standards in this approved document unless there is a need to match the external appearance or character of the extension to that of the host building. The work should comply with standards in this approved document to the extent that it is reasonably practicable.

0.12 In determining whether full energy efficiency improvements should be made, the building control body should consider the advice of the local authority's conservation officer.

0.13 Additional guidance 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.*

Exemptions for conservatories and porches

0.14 Where a dwelling is extended by adding a conservatory or porch, the work is exempt from the energy efficiency requirements, under regulation 21 of the Building Regulations, if all of the following apply.

a. The extension is at ground level.

b. The floor area of the extension does not exceed 30m^2.

c. The glazing complies with Part K of Schedule 1 to the Building Regulations.

d. Any wall, door or window that separates the extension from the dwelling has been retained or, if removed, has been replaced with a wall, door or window.

NOTE: Replacement walls, windows and doors should meet the requirement in regulation 23(2). See Section 10.

e. The heating system of the dwelling is not extended into the conservatory or porch.

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Exemptions for covered areas

0.15 Where a dwelling is extended by adding a carport that is open on at least two sides, a covered yard, a covered walkway or a covered driveway, the work is exempt from the energy efficiency requirements if both of the following apply.

a. The extension is at ground level.

b. The floor area of the extension does not exceed 30m^2.

Live/work units

0.16 A building that contains both living accommodation and space for commercial purposes (e.g. for a workshop or office) should be treated as a dwelling if the commercial part can be reverted to domestic use.

0.17 The commercial part of a building can be reverted to domestic use if all of the following apply.

a. There is direct access between the commercial space and the living accommodation.

b. The commercial space and the living accommodation are within the same thermal envelope.

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 by the building control body.

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

0.18 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: Dwellings.

b. For guidance on the non-dwelling parts of the building, such as heated common areas and any commercial or retail space, use Approved Document L, Volume 2: Buildings other than dwellings.

Selected key interactions with other parts of the Building Regulations

0.19 The approved documents set out what, in ordinary circumstances, may be accepted as one way to comply with the Building Regulations. Those designing or undertaking building work remain responsible for assessing, 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. Guidance on some key interactions is given below.

Interaction with Part C

0.20 This approved document, Approved Document L, Volume 1, provides guidance and examples on upgrading thermal elements. For interstitial and surface condensation, a lesser standard may be acceptable. Guidance in Approved Document C should be followed.

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Interaction with Part E

0.21 This approved document, Approved Document L, Volume 1, provides guidance on insulation that is reasonably continuous and limits thermal bridging. Construction junctions should limit noise transfer where Part E of the Building Regulations sets a requirement. Approved Document E should be followed.

Interaction with Part F

0.22 This approved document, Approved Document L, Volume 1, provides guidance on reducing unwanted heat loss, by achieving optimum airtightness. When specifying the minimum amount of purpose-provided ventilation, consider the air infiltration of a dwelling; follow Approved Document F.

Interaction with Part J

0.23 This approved document, Approved Document L, Volume 1, provides guidance on airtightness. For guidance on permanent ventilation openings for open flued appliances in very airtight dwellings, follow Approved Document J.

Interaction with Part K and Part M

0.24 This approved document, Approved Document L, Volume 1, provides guidance on controls for fixed building services and on-site electricity generation. Manual controls, where provided, should be within reasonable reach of the occupants. Follow the guidance in Approved Documents K and M.

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

This section deals with the requirements of regulations 24, 25, 25B, 26, 26A, 26C, 27, 27A and 27C of the Building Regulations 2010.

Regulations

Methodology of calculation of the energy performance

24. (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.

Minimum energy performance requirements for new buildings

25. Minimum energy performance requirements shall be approved by the Secretary of State, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, for—

(a) new buildings (which shall include new dwellings), in the form of target CO_2 emission rates;

(b) new dwellings, in the form of target fabric efficiency rates; and

(c) new buildings in the form of target primary energy rates.

Nearly zero-energy requirements for new buildings

25B. Where a building is erected, it must be a nearly zero-energy building.

CO_2 emission rates for new buildings

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

Fabric energy efficiency rates for new dwellings

26A. Where a dwelling is erected, it shall not exceed the target fabric energy efficiency rate for the dwelling 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.

Target primary energy rates for new buildings

26C. Where a building is erected it must not exceed the target primary energy rate for the building which has been approved pursuant to regulation 25(c), applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24.

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Regulation *continued*

CO_2 emission rate calculations

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

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

(a) the target CO_2 emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24,

(b) the CO_2 emission rate for the building as designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

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

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

(a) a notice which specifies—

(i) the target CO_2 emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24,

(ii) the CO_2 emission rate for the building as constructed, calculated and expressed in 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 are authorised to accept, as evidence that the requirements of regulation 26 have been satisfied, a certificate to that effect by an energy assessor who is accredited to produce energy performance certificates for that category of building.

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

Fabric energy efficiency rate calculations

27A. (1) This regulation applies where a dwelling is erected and regulation 26A 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 fabric energy efficiency rate for the dwelling, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;

(b) the fabric energy efficiency rate 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 shall give the local authority—

(a) a notice which specifies—

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

(ii) the fabric energy efficiency rate 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 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 fabric energy efficiency rate.

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Regulation *continued*

Target primary energy rate calculations for new buildings

27C. (1) This regulation applies where a building is erected.

(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 calculated target primary energy rate for the building as designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24; and

(c) the 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 target 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 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.

(5) In this regulation, "specifications" means specifications used for the calculation of the target primary energy rate.

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

Intention

The Secretary of State considers 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 the Secretary of State 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.

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Regulation 25

Regulation 25 requires the Secretary of State to approve minimum energy performance requirements. These requirements are in the form of a target primary energy rate, a target emission rate and a target fabric energy efficiency rate.

The targets are set out in Section 1 of this approved document.

Regulations 26, 26A and 26C

A newly constructed dwelling must be shown to meet regulations 26, 26A 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 energy efficiency rate.

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

Regulations 27, 27A 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.

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Section 1: Calculating the target primary energy rate, target emission rate and target fabric energy efficiency 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 'actual 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 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 Government's Standard Assessment Procedure (SAP) for energy rating of dwellings.

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

a. The target primary energy rate, in kWh_{PE}/m^2 per year: this is influenced by the fabric and fuel.

b. The target emission rate, in $kgCO_2/m^2$ per year: this is influenced by the fabric and fuel.

c. The target fabric energy efficiency rate, in kWh/m^2 per year: this is influenced by the fabric only.

1.3 The target primary energy rate, target emission rate and target fabric energy efficiency rate for individual dwellings must be calculated using the Government's Standard Assessment Procedure, Appendix R. The standardised properties are summarised in Table 1.1.

NOTE: For an up-to-date list of approved software, follow the link to SAP 10 at: https://www.gov.uk/guidance/standard-assessment-procedure.

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Buildings that contain multiple dwellings

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

$$\frac{[(\text{target primary energy rate}_1 \times \text{floor area}_1) + (\text{target primary energy rate}_2 \times \text{floor area}_2) + (\text{target primary energy rate}_3 \times \text{floor area}_3) + \ldots]}{(\text{floor area}_1 + \text{floor area}_2 + \text{floor area}_3 + \ldots)}$$

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

The average target fabric energy efficiency rate should be calculated using the formula above but replacing target primary energy rate with target fabric energy efficiency rate.

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

District heat networks

1.7 For a dwelling that is connected to an existing district heat network, the notional building used to calculate the target primary energy rate and target emission rate can use the same primary energy and CO_2 emission factors for the heat and hot water delivered to the dwelling as used in the calculation of the dwelling primary energy rate and dwelling emission rate. All other aspects of the notional building, except wastewater heat recovery, should remain as outlined in Table 1.1.

NOTE: For a dwelling that is connected to a new district heat network, the notional building used to calculate the target primary energy rate and target emission rate should follow the specification shown in Table 1.1.

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 Table 1.1.

Table 1.1 Summary of notional dwelling specification for new dwelling[1]

Element or system	Reference value for target setting
Opening areas (windows, roof windows, rooflights and doors)	Same as for actual dwelling not exceeding a total area of openings of 25% of total floor area[2]
External walls including semi-exposed walls	U = 0.18 W/(m²·K)
Party walls	U = 0
Floors	U = 0.13 W/(m²·K)
Roofs	U = 0.11 W/(m²·K)
Opaque door (less than 30% glazed area)	U = 1.0 W/(m²·K)
Semi-glazed door (30–60% glazed area)	U = 1.0 W/(m²·K)
Windows and glazed doors with greater than 60% glazed area	U = 1.2 W/(m²·K) Frame factor = 0.7
Roof windows	U = 1.2 W/(m²·K), when in vertical position (for correction due to angle, see specification in SAP 10 Appendix R)
Rooflights	U = 1.7 W/(m²·K), when in horizontal position (for correction due to angle, see specification in SAP 10 Appendix R)
Ventilation system	Natural ventilation with intermittent extract fans
Air permeability	5 m³/(h·m²) at 50 Pa
Main heating fuel (space and water)	Mains gas
Heating system	Boiler and radiators Central heating pump 2013 or later, in heated space Design flow temperature = 55 °C
Boiler	Efficiency, SEDBUK 2009 = 89.5%
Heating system controls	Boiler interlock, ErP Class V Either: – single storey dwelling in which the living area is greater than 70% of the total floor area: programmer and room thermostat – any other dwelling: time and temperature zone control, thermostatic radiator valves
Hot water system	Heated by boiler (regular or combi as above) Separate time control for space and water heating
Wastewater heat recovery (WWHR)	All showers connected to WWHR, including showers over baths Instantaneous WWHR with 36% recovery efficiency utilisation of 0.98
Hot water cylinder	If cylinder, declared loss factor = 0.85 × (0.2 + 0.051 $V^{2/3}$) kWh/day where V is the volume of the cylinder in litres
Lighting	Fixed lighting capacity (lm) = 185 × total floor area Efficacy of all fixed lighting = 80 lm/W
Air conditioning	None
Photovoltaic (PV) system	For houses: kWp = 40% of ground floor area, including unheated spaces / 6.5 For flats: kWp = 40% of dwelling floor area / (6.5 × number of storeys in block) System facing south-east or south-west

NOTE:
1. For a dwelling connected to an existing district heat network, an alternative notional building is used. See paragraph 1.8 and SAP 10.
2. See SAP 10 for details.

Section 2: Calculating the dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate

2.1 The same approved calculation tool must be used to calculate the target primary energy rate, target emission rate and target fabric energy efficiency rate and the dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate.

2.2 The dwelling primary energy rate, dwelling emission rate and dwelling energy efficiency rate 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, dwelling emission rate and dwelling fabric energy efficiency rate must not exceed the target primary energy rate, target emission rate and target fabric energy efficiency rate, respectively. The specification of the actual dwelling may vary from that of the notional dwelling if the dwelling meets the target primary energy rate, target emission rate, target fabric energy efficiency rate 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 the following.

a. The target primary energy rate and the dwelling primary energy rate (calculated using design values).

b. The target emission rate and the dwelling emission rate (calculated using design values).

c. The target fabric energy efficiency rate and the dwelling fabric energy efficiency rate (calculated using design values).

d. A list of specifications used in the calculations.

Items (a) to (d) above may be reported using the design stage Building Regulations England Part L compliance report (BREL report). For further details of the design stage BREL report, see Appendix B.

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

a. The as-built target primary energy rate and as-built dwelling primary energy rate.

b. The as-built target emission rate and as-built dwelling emission rate.

c. The as-built target fabric energy efficiency rate and as-built dwelling fabric energy efficiency rate.

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d. 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 (d) above as reported in the completion stage BREL report together with photographic evidence of compliance. For further details of the post-completion BREL report and photographic evidence, see Appendix B.

Buildings that contain multiple dwellings

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

a. Every individual dwelling complies with all of the following conditions.

i. The dwelling primary energy rate must not exceed the individual dwelling's target primary energy rate.

ii. The dwelling emission rate must not exceed the individual dwelling's target emission rate.

iii. The dwelling fabric energy efficiency rate must not exceed the individual dwelling's target fabric energy efficiency rate.

OR

b. All of the following are met.

i. The average dwelling primary energy rate for the whole building, calculated in accordance with paragraph 2.6, must not exceed the average target primary energy rate.

ii. The average dwelling emission rate for the whole building, calculated in accordance with paragraph 2.6, must not exceed the average target emission rate.

iii. The average dwelling fabric energy efficiency rate for the whole building, calculated in accordance with paragraph 2.6, must not exceed the average target fabric energy efficiency rate.

2.7 The average dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate are the floor-area-weighted averages of the individual dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate for all the dwellings in the building. The average dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate should be calculated using the same averaging methodology.

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

Guidance on how to calculate an average target primary energy rate is given in paragraph 1.5. Guidance on how to calculate an average target emission rate and average target fabric energy efficiency rate is given in paragraph 1.6.

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

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Special considerations when calculating the dwelling primary energy rate and dwelling emission rate

Secondary heating in the dwelling primary energy rate and dwelling emission rate calculation

2.8 When calculating the dwelling primary energy rate and dwelling emission rate 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 the dwelling primary energy rate and dwelling emission rate.

c. If a chimney or flue is provided but no appliance is installed, the following appliances should be assumed when calculating the dwelling primary energy rate and dwelling emission rate.

i. If a gas point is located next 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%
- 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%.

Community heating systems and district heat networks

2.9 If thermal energy is supplied from a district heat network, a CO_2 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 and dwelling emission rate.

2.10 The same CO_2 emission factors used to calculate the dwelling emission rate should be used to check against the minimum performance standards described in Section 6 of this approved document.

2.11 When calculating the dwelling primary energy rate and dwelling emission rate 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 dwellings that will be connected to the system in the first 12 months after the dwellings 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.

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2.12 When calculating the dwelling primary energy rate and dwelling emission rate for a dwelling connected to a new district heat network, the calculation should include all heat sources to be used up to 31 December 2027. In this way, any planned transition of the heat network to an alternative means of heat generation will be properly accounted for. When there will be a change in heat source up to 31 December 2027, a submission to the building control body should be made to show both of the following.

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

b. That the heat network will connect to the new source, with confirmation in the form of a signed contract to connect and supply heat.

NOTE: When calculating the dwelling primary energy rate and dwelling emission rate for a dwelling connected to an existing district heat network the calculation should not include the effect of any change in heat sources after the dwellings are connected.

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 dwellings connecting to an existing district heat network should follow the standards in Section 6.

Swimming pool basins

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

Table 2.1 U-values for party walls

Party wall construction	U-value W/(m²·K)
Solid	0.0
Unfilled cavity with no effective edge sealing	0.5
Unfilled cavity with effective sealing around all exposed edges and in alignment with insulation layers in abutting elements[1]	0.2
A fully filled cavity with effective sealing at all exposed edges and in alignment with insulation layers in abutting elements[1]	0.0

NOTE:

1. It is necessary to show that the edge sealing is likely to be robust under normal site conditions.

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

2.15 The calculations for both the dwelling primary energy rate and dwelling emission rate should account for the efficacy of lamps installed in the fixed lighting locations.

Achieving the target primary energy rate, target emission rate and target fabric energy efficiency rate

2.16 Provided the dwelling satisfies the minimum standards for fabric elements set out in Section 4, the designer can achieve the target primary energy rate and the target emission rate by using any combination of the following.

a. Fabric energy efficiency.

b. Efficient building services.

c. Low and zero carbon technologies integrated in an appropriate mix.

2.17 The designer can achieve the target fabric energy efficiency rate only through fabric energy efficiency.

NOTE: To meet the target fabric energy efficiency rate, the energy efficiency of some elements will need to be significantly better than the minimum standards for fabric elements set out in Section 4.

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Regulation 25A: Consideration of high-efficiency alternative systems

This section deals with the requirements of regulation 25A of the Building Regulations 2010.

Regulation

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.

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Regulation *continued*

(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 Secretary of State'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 or zero carbon systems are installed.

Section 3: Consideration of high-efficiency alternative systems

3.1 Before building work starts on a new dwelling, the person undertaking the building work must analyse the technical, environmental and economic feasibility of using high-efficiency alternative systems in the dwelling design. This analysis should be considered when designing the dwelling.

3.2 The building control body should be notified that the analysis of high-efficiency alternative systems has been undertaken, that it is documented and is available to be verified. The document should state whether high-efficiency alternative systems have been included in the dwelling design. The documented results of the analysis should be retained for the building control body to inspect upon request.

3.3 The analysis may be made for individual dwellings, groups of similar dwellings, or for common types of dwellings in the same area. Where a number of dwellings are connected to a district heat network or community heating system, a single analysis may be made for all dwellings connected to the network or system.

3.4 When a dwelling undergoes a major renovation, the technical, environmental and economic feasibility of installing high-efficiency alternative systems should be considered.

Requirement L1(a): Limiting heat gains and losses

This section deals with the requirements of Part L1(a) of Schedule 1 to the Building Regulations 2010.

Requirement

Requirement	*Limits on application*
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 to a reasonable standard;	
(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.	

Intention

In the Secretary of State's view, requirement L1(a) is met in a new dwelling by achieving both of the following.

a. Unwanted heat *losses* from the dwelling are limited 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 4.14 to 4.19.

   ii. Airtightness – paragraphs 4.20 to 4.22.

   iii. The pipework and services – paragraphs 4.24 and 4.26 to 4.32.

b. Unwanted heat *gains* to the dwelling, throughout the year, through any of the routes listed in (a) above, are limited as set out in Section 4.

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In the Secretary of State's view, requirement L1(a) is met for work on an existing dwelling by achieving both of the following, where relevant to the work being done.

a. Unwanted heat *losses* from the dwelling are limited by meeting the standards for all of the following.

   i. Any building fabric to which building work is being done, including walls, floors, roof, windows and openings – paragraphs 4.1 to 4.5 and paragraphs 4.7 to 4.14, 4.16 and 4.19. Further guidance is given in the following sections.

      - For new elements, replacement elements and extensions – Section 10.
      - For renovated elements, retained elements, a change to energy status and a material change of use – Section 11.

   ii. Any work that may result in making airtightness worse – paragraph 4.23.

b. Unwanted heat *gains* from any pipework and services to which building work is being done are limited by following the guidance in paragraphs 4.24 to 4.32.

NOTE: If work includes an extension to an existing dwelling, initial provision of fixed building services or an increase to the installed capacity of fixed building services, consequential improvements may be required – Section 12.

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Section 4: Limiting heat gains and losses

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 (±25%) wide × 1.48m (–25%) high and the actual configuration of the window.

c. Calculated for a standard window 1.23m (±25%) wide × 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 two opening lights.

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.

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

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

NOTE: When a single U-value is calculated for a product range of doors, the configuration of 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**.

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.

Limiting standards in new dwellings

4.6 Insulating fabric elements in new dwellings should meet the limiting standards in Table 4.1.

Table 4.1 Limiting U-values for new fabric elements and air permeability in new dwellings

Element type	Maximum U-value[1] W/(m²·K)
All roof types[2]	0.16
Wall[2]	0.26
Floor	0.18
Party wall	0.20
Swimming pool basin[3]	0.25
Window[4][5]	1.6
Rooflight[6][7]	2.2
Doors (including glazed doors)	1.6
Air permeability	8.0m³/(h·m²) @ 50Pa 1.57m³/(h·m²) @ 4Pa

NOTES:

1. Area-weighted average values.
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 performance requires 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 of 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 not exceed a U-value of 0.35W/(m²·K).

NOTE: To meet the target fabric energy efficiency rate set out in Section 1, the energy efficiency of some elements will need to be significantly better than the limiting standards in Table 4.1.

Limiting standards in existing dwellings

New and replacement elements

4.7 New fabric elements in existing dwellings should meet the limiting standards in Table 4.2.

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 4.2.

4.9 Guidance on when a new element must meet the standards in Table 4.2 is given in Section 10. Elements that should meet the standards include both of the following.

a. Elements in extensions to existing dwellings.

b. New or replacement elements in existing dwellings.

4.10 If windows or fully glazed external pedestrian doors cannot meet the requirements of Table 4.2 because of the need to maintain the character of the building, either of the following should be met.

a. These fittings should not exceed a centre pane U-value of 1.2W/(m²·K).

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

Table 4.2 Limiting U-values for new fabric elements in existing dwellings

Element type	Maximum U-value[1] W/(m²·K)
Roof[2]	0.15
Wall[2][3]	0.18
Floor[4][5]	0.18
Swimming pool basin[6]	0.25
Window[7][8][9]	1.4 or Window Energy Rating[10] Band B minimum
Rooflight[11][12]	2.2
Doors with >60% of internal face glazed[13]	1.4 or Doorset Energy Rating[10] Band C minimum
Other doors[13][14]	1.4 or Doorset Energy Rating[10] Band B minimum

NOTES:

1. Area-weighted average values, except for windows, doors, roof windows and rooflights.
2. For dormer windows, 'roof' includes the roof parts of the windows and 'wall' includes the wall parts (cheeks).
3. If meeting such a standard would reduce the internal floor area of the room bounded by the wall by more than 5%, a lesser provision may be appropriate.
4. If meeting such a standard would create significant problems in relation to adjoining floor levels, a lesser provision may be appropriate.
5. The U-value of the floor of an extension may be calculated using the exposed perimeter and floor area of the whole enlarged dwelling.
6. The U-value of a swimming pool basin (walls and floor) calculated according to **BS EN ISO 13370**.
7. If other performance (e.g. wind load, safety, security or acoustic attenuation) requires thicker glass to be used, an equivalent window unit with standard thickness (6mm) glazing should be shown to meet the required standard.
8. Including roof windows and curtain walling.
9. For timber windows, a maximum U-value of 1.6 W/(m²·K) or Window Energy Rating Band C is permissible until 14 June 2023. This is to give manufacturers time to transition to the standard in this Table 4.2. From 15 June 2023 the full standard of 1.4 W/(m²·K) or Window Energy Rating Band B applies.
10. 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.
11. U-values for rooflights or rooflight-and-kerb assemblies should be based on the outer developed surface area, 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.
12. 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 have a maximum U-value of 0.35W/(m²·K).
13. For timber doors, a maximum U-value of 1.8 W/(m²·K) or Doorset Energy Rating Band E is permissible until 14 June 2023. This is to give manufacturers time to transition to the standard in this Table 4.2. From 15 June 2023 the full standard of 1.4 W/(m²·K) applies.
14. 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.

Renovated and retained elements

4.11 The U-value of an existing thermal element that is being renovated should both:

a. be no worse than that of the element before it was renovated

b. meet the limiting standards in Table 4.3.

4.12 Guidance on when an existing element should meet the standards in Table 4.3 is given in Section 11. Elements that should meet the standards include both of the following.

a. Thermal elements being renovated in existing dwellings. Renovated elements should achieve the U-values in Table 4.3, column (b).

b. Elements being retained in existing dwellings, for example through a loft or garage conversion. Retained elements with a U-value that is higher than the threshold value in Table 4.3, column (a) should be upgraded to achieve the U-values in Table 4.3, column (b).

4.13 If achieving the U-value in Table 4.3, column (b) either:

a. is not technically or functionally feasible or

b. would not achieve a simple payback of 15 years or less

then the element should be upgraded to the lowest U-value that both:

a. is technically and functionally feasible and

b. can achieve a simple payback not exceeding 15 years.

Generally, a thermal element once upgraded should not have a U-value greater than 0.7W/(m^2·K). A lesser standard for the thermal element may be acceptable where work complies with Part C of the Building Regulations on protection from the harmful effects of interstitial and surface condensation.

NOTE: Examples are given in Appendix C.

NOTE: When renovating thermal elements, the work should comply with all the requirements in Schedule 1, but particular attention should be paid to Parts B, C, F and J.

Table 4.3 Limiting U-values for existing elements in existing dwellings

Element	U-value[1] W/(m^2·K)	
	(a) Threshold	(b) Improved
Roof[2][3][4]	0.35	0.16
Wall – cavity insulation[2][5]	0.70	0.55
Wall – internal or external insulation[2][6]	0.70	0.30
Floor[7][8]	0.70	0.25

NOTES:

1. Area-weighted average values.
2. For dormer windows, 'roof' includes the roof parts of the windows and 'wall' includes the wall parts (cheeks).
3. If meeting such a standard would limit head room, a lesser standard may be appropriate. In such cases, both of the following should be achieved.
   a. The depth of the insulation plus any required air gap should be at least to the depth of the rafters.
   b. The insulant should be chosen to achieve the lowest practicable U-value.
4. 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.
5. This applies only to a wall that is suitable for cavity insulation. Where this is not the case, it should be treated as 'wall – internal or external insulation'.
6. If meeting such a standard would reduce the internal floor area of the room bounded by the wall by more than 5%, a lesser standard may be appropriate.
7. The U-value of the floor of an extension may be calculated using the exposed perimeter and floor area of the whole enlarged dwelling.
8. If meeting such a standard would create significant problems in relation to adjoining floor levels, a lesser standard may be appropriate.

Continuity of insulation

4.14 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.

4.15 To ensure continuity of insulation in new dwellings, all of the following apply.

a. **Drawings** should identify the insulation layer. The designer and installer should review drawings to ensure the insulation layer is continuous, buildable and robust.

b. Before elements are concealed by subsequent work, an **on-site audit** should be undertaken to confirm that the designed details have been constructed. Photographs of the details should be taken in line with the guidance in Appendix B.

c. **Floors and foundations:** insulation should be installed tight to the structure, without air gaps between insulation panels and at edges.

   i. Perimeter insulation should be continuous and have a minimum thickness of 25mm.

   ii. Moisture-resistant insulation should be fitted below damp-proof course level and extend to the foundation block/structure.

d. **Windows and doors:** should be installed in such a way that the thermal integrity of the insulated plane is maintained.

   i. Tolerance around a window or door unit and the surrounding opening should be minimal and be in accordance with **BS 8213-4**.

   ii. Position: window or door units should be located with an overlap between the inner face of the unit and the inner face of the external leaf – for windows an overlap between 30mm and 50mm, and for doors 50mm – so that the window or door unit is contiguous with the insulation layer of the external wall.

   iii. Fully insulated and continuous cavity closers should be used, installed tight to the insulation and cavity apertures. For door units, install perimeter insulation within the threshold zone or use a reinforced cavity closure.

e. **Walls:** insulation should be fitted without any air gaps and tight to the structure, cavity closers, lintels and cavity trays. Mortar snots should be removed to ensure a tight fit with the structure and cavities cleared of all debris. Where fire-stopping socks are required, these should fully fill the areas where they are fitted, including at the heads of cavities.

f. **Roofs:** insulation should be installed tight to the structure, without air gaps, and should extend to the wall insulation. For roofs insulated at ceiling level, the long-term protection of the insulation layer should be considered: boarded areas should be provided above the insulation to give access for maintenance.

g. **Rigid insulation boards:** should only be used on flat surfaces. Boards should be fitted to the structure to avoid any gaps between board edges and between the board facings. The use of boards with lapped or tongue and groove edges should be considered. Any unavoidable gaps between boards should be infilled using compressible tape (e.g. for boards within roof rafters) or low expansion foam (e.g. for boards within wall cavities).

h. **Penetrating elements** include steel beams, incoming services, meter boxes and sub-floor vents. Designs should clearly indicate means to limit disruption to the insulation. For recessed meter boxes on the cold side of the construction, insulation should be installed behind the enclosure. For incoming services, insulation should fit tightly around ducts, pipes, etc.

Thermal bridging

4.16 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.

Thermal bridging in new dwellings

4.17 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 report in the Building Regulations England Part L compliance report (BREL 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.

   ii. Masonry construction: external or cavity wall insulation should extend below the damp-proof course (where applicable) and be at least the equivalent of one full block height (215mm) below the underside of the floor structure/slab and beyond the depth of the floor insulation.

   iii. Timber construction: insulation between boards/within sheathing should extend to the floor plate. The wall insulation and the floor perimeter insulation should abut.

g. **Intermediate floors:** floor-to-wall junctions should be 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.

NOTE: Any solution to edge sealing or thermal bridging in new dwellings should take account of Part E of the Building Regulations.

4.18 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, such as Local Authority Building Control's Construction Details library.

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 0.20W/(m^2·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

4.19 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 in paragraph 4.17 where appropriate.

Airtightness

Airtightness in new dwellings

4.20 The minimum standard for air permeability of a new dwelling is given in Table 4.1. When carrying out work in new dwellings, care should be taken to reduce unwanted heat loss through air infiltration.

4.21 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.

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

4.22 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.

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

Airtightness in existing dwellings

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

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

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

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

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

Limiting heat losses and gains from building services

Hot water and heating pipework

4.24 In a new system, all of the following new pipework should be insulated.

a. Primary circulation pipes for heating circuits where they pass outside the heated living space, including where pipework passes into voids.

b. All primary circulation pipes for domestic hot water.

c. All pipes that are connected to hot water storage vessels, for at least 1m from the point at which they connect to the vessel.

d. All secondary circulation pipework.

4.25 In an existing system, when a boiler or hot water storage vessel is replaced, any accessible pipes in the dwelling should be insulated.

4.26 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 4.4 is one way of demonstrating that heat losses will not exceed those given in **BS 5422**.

Table 4.4 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
Less than or equal to 10	5
Less than or equal to 25	10
Less than or equal to 50	15
Less than or equal to 100	20

NOTE:

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

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

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

b. An equivalent performance for conventionally insulated pipes.

4.28 Where pipework is 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

4.29 Vessels that store heated water for a heating or domestic hot water system should have standing losses that do not exceed the heat loss given in Table 4.5 for that system type.

Table 4.5 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 should not exceed $(16.66 + 8.33 \times V^{0.4})/(1000 \div 24)$, where V is the volume in litres.

4.30 Hot water storage vessels should comply with all of 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**.

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

Heat interface units

4.32 Vessels that store heated water for a heating or domestic hot water system should have standing losses that do not exceed the heat loss given in Table 4.5 for that system type.

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

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

Requirement

Requirement	*Limits on application*
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 to a reasonable standard;	
(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 Secretary of State'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
   ii. meet the system specific controls in Section 6.

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

In the Secretary of State'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: 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, the service should be shown to be 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.

a. The efficiency should be based on the appropriate test standard set out in Section 6.

b. 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 5.19 should be followed, in addition to the 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.

a. Use the same fuel as the service being replaced and have an efficiency that is not worse than that of the service being replaced.

b. Use a different fuel than the service being replaced. The system should both:

i. not produce more CO_2 emissions per kWh of heat than the appliance being replaced

ii. not have a higher primary energy demand per kWh of heat than the appliance being replaced.

Worked example

Replacing an old oil-fired boiler with emissions of 0.298kgCO_2/kWh and primary energy of 1.180kWh$_{PE}$/kWh at 85% efficiency with an LPG boiler with emissions of 0.241kgCO_2/kWh and primary energy of 1.141kWh$_{PE}$/kWh at 93% efficiency.

CO_2 emissions

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

Primary energy

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

The new LPG boiler has both lower CO_2 emissions and primary energy than the oil-fired boiler being replaced, and therefore complies. It is also at least as efficient as the minimum efficiency as set out in Section 6 of this guidance.

NOTE: If the efficiency of the appliance being replaced is not known, the Standard Assessment Procedure, Tables 4a and 4b, should be used but with no adjustments from Tables 4c and 4d. CO_2 emission factors and primary energy factors should be taken from the Standard Assessment Procedure Table 12.

NOTE: Where a heat pump is installed which meets the minimum efficiency standards in this approved document, it should be deemed to be compliant with paragraph 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/m^2 per year.

5.6 If renewable technology such as a wind turbine or photovoltaic array is replaced, the new system should have an electrical output that is at least the same as that of the original installation.

5.7 Facilitating future connection to any local district heat networks should be considered (e.g. 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 both of the following.

a. An appropriate heat loss calculation for the dwelling.

b. 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:

a. newly installed

b. fully replaced in an existing building, including 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 heating needs of the dwelling, at a maximum flow temperature of 55°C or lower.

Where it is not feasible to install a space heating system that can operate at this temperature (e.g. 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 that 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.

NOTE: For temperature limits to control legionella bacteria 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 150m^2 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 that is independent of space heating circuits.

b. Electronic temperature control.

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.

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a. Dwellings with very low heat demand (e.g. less than 10W/m^2).

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, the adjacent rooms 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 that 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 or 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 that 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 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 A gas-fired heating system should meet either of the following, in addition to the general requirements for heating and hot water systems in Section 5.

a. New dwellings should meet the minimum efficiencies in Table 6.1.

b. Existing dwellings should 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 and target primary energy rate 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.

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])

NOTE:

1. Energy-Related Products Directive. For Standard Assessment Procedure modelling, SEDBUK values should be used.

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[2], SEDBUK 2009 efficiencies as follows: • 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: • **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. Energy-Related Products Directive. For Standard Assessment Procedure modelling, SEDBUK values should be used.
2. Exceptional circumstances are defined in the ODPM's *Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings.*

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 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 as a conventional gas-fired boiler.

6.4 If a gas-fired warm air system is installed in an existing dwelling, all of 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 standards (i) to (iv) below.

i. **BS EN 1266**

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 standards (i) to (vi) below:

i. **BS EN 1266**

ii. **BS 7977-1**

iii. **BS EN 613**

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 of the following should be met.

a. The standards in **BS EN 509** should be met.

b. The number of appliances should not exceed one per 100m^2 of dwelling floor area.

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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 for heating and hot water systems 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 dwellings, 84% SEDBUK 2009
Wet heating – combi-boiler	86% (as defined in SEDBUK 2009)	Or, in exceptional circumstances[2] in existing dwellings, 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. Energy Related Products Directive. For Standard Assessment Procedure modelling, SEDBUK values should be used.
2. Exceptional circumstances are defined in the ODPM's *Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings.*

6.9 An oil-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 dwelling 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 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 appliance, 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 space 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 meet the guidance in 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 that 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 dwellings should have a minimum efficiency (gross calorific value) as given 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 controls 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. The appliance should be from categories D, F, G or J in Table 6.4.

b. The appliance should 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 3.5kW	55% (wood fuels)	Batch
G2	Cooker with heating boiler exceeding 3.5kW	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

NOTE:

1. These categories are set out in HETAS's *The HETAS Guide to Approved Solid Fuel, Wood and Biomass Products and Services.*

District heat networks and community heating systems

6.18 Paragraphs 6.19 to 6.25 apply when connecting dwellings to a district heat network or community heating system to which both of the following apply.

a. Has a central heat source, such as a boiler, combined heat and power unit or heat pumps.

b. Distributes heat to 15 or more dwellings.

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.

Connecting to a new district heat network or community heating 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 An existing district heat network that is being connected to a new dwelling should not have a CO_2 emission factor for delivered heat to the dwelling which is greater than 0.350kgCO_2/kWh. The CO_2 emission factor should be calculated using SAP 10 or taken from the Product Characteristics Database

NOTE: The same CO_2 emission factors used to calculate the dwelling emission rate described in paragraph 2.9 of this approved document should be used to check against the minimum performance standards described in paragraph 6.20.

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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.

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, heat dumping, and evidence of future changes to the heat source, for example, replacing or adding new heat generating equipment.

Minimising energy used by pumps

6.22 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

6.23 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.

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

Metering

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

Micro combined heat and power

6.26 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.

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

a. The method in DEFRA's *Method to Evaluate the Annual Energy Performance of Micro-cogeneration Heating Systems in Dwellings*.

b. The performance data for the micro-CHP packaged according to **BSI PAS 67**.

c. A plant size ratio that uses the nominal heat output of the heating plant divided by the average heat loss of the building when there is a temperature difference of 24.2°C.

Underfloor heating systems

Zoning and controls

6.28 New underfloor heating systems should meet all of the following, in addition to the general requirements for heating and hot water systems in Section 5.

a. All underfloor heating systems should have controls to adjust the operating temperature.

b. Room thermostats for electric underfloor heating systems should have a manual override.

c. Heating systems for screed floors that are greater than 65mm thick should automatically reduce the room temperature at night or when the room is unoccupied.

d. Heat loss should be minimised by following the guidance in paragraphs 6.29 to 6.32.

Minimising heat losses

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

6.30 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 insulation with a thermal resistance of at least 1.25(m^2·K)/W.

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

a. The performance in paragraph 6.29.

b. As specified in **BS EN 1264-4**, as follows.

i. For electric systems, not less than 0.5(m^2·K)/W.

ii. For wet systems, not less than 0.75(m^2·K)/W.

6.32 Distribution pipework which does not provide useful heat to a room should be insulated to the standards detailed in paragraph 4.26.

Specific standards for electric underfloor heating

6.33 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.

6.34 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 modify the input charge in response to both of the following.

i. The room thermostat.

ii. Floor temperature sensing.

6.35 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: For heat pumps that provide 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 12kW 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 be both of the following.

a. For space heating, a minimum of 3.0.

b. For heating domestic hot water, a minimum of 2.0.

6.38 The heat pump unit should include controls for all of the following, in addition to meeting the general requirements for heating and hot water systems in Section 5.

a. To control water pump operation (internal and external, as appropriate).

b. To control either of the following.

   i. For wet systems, water temperature.

   ii. For air systems, air temperature.

c. For air-to-water and air-to-air units, to control outdoor fan operation.

d. For air-to-water and air-to-air systems, to provide a defrost control for the external air-side heat exchanger.

e. For air-to-air systems, to control secondary heating (if fitted).

f. To protect against water flow failure.

g. To protect against high water temperature.

h. To protect against high refrigerant pressure.

i. For air-to-water and air-to-air units, to protect against air flow failure.

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 20m^2.

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

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.

a. Thermal performance.

b. Reporting and identification.

6.45 The electrical input power of the primary pump in the solar water heating system measured in watts should be less than the higher of the following.

a. 50W.

b. 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 0.1m^2 or equivalent of heat exchanger area should be provided for every 1m^2 of the net absorber area of the solar collector.

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

a. Maximise the useful energy gain from the solar collectors.

b. Minimise the accidental loss of stored energy.

c. Ensure that hot water produced by back-up sources is not used when adequate solar pre-heated water is available.

d. Provide a means to control the adverse effects of excessive temperatures and pressures.

e. Where a separate domestic hot water heating appliance is pre-heated by a solar system, the appliance should be controlled to add no extra heat if the target temperature is met from the solar pre-heated vessel.

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

a. A minimum volume of 25 litres for every 1m^2 of the net absorber area of the solar collector.

b. A volume equivalent to at least 80% 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's Guide A and the manufacturer's guidance should be followed. Systems should not be significantly oversized – in most circumstances, the cooling appliance should not be sized for more than 120% of the design cooling load.

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 both of the following controls.

a. For each control zone and for each terminal unit, independent control of both of the following should be possible.

   i. Timing.

   ii. Temperature.

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

6.52 For cooling systems that serve multiple dwellings, 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 ventilation needs of the dwelling, in accordance with Approved Document F, Volume 1: Dwellings. Systems should be designed so that they can be commissioned to suitable ventilation rates so that spaces are not significantly overventilated.

6.55 The specific fan power for mechanical ventilation systems should not exceed the following.

a. For intermittent extract ventilation systems: 0.5W/(l·s).

b. For continuous mechanical extract ventilation systems: 0.7W/(l·s).

c. For continuous supply ventilation systems: 0.5W/(l·s).

d. For continuous mechanical supply and extract ventilation systems: 1.5W/(l·s).

6.56 All ventilation systems which provide both supply and extract ventilation within the same unit should be fitted with all of the following.

a. A heat recovery system with a minimum efficiency of 73%.

b. A summer bypass facility (giving the ability to bypass the heat exchanger or to control its heat recovery performance).

c. A variable speed controller.

Lighting

6.57 Any fixed lighting should achieve lighting levels appropriate to the activity in the space and spaces 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 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 luminous efficacy is 75 light source lumens per circuit-watt or less, automatic controls which switch luminaires off after the area lit becomes unoccupied. If 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 photovoltaic panels or battery storage, systems should be an appropriate size 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 that 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 be no less than that of the existing system, except where a smaller system can be demonstrated to be more appropriate or effective (e.g. replacing an existing system with one which is better matched to the dwelling's energy demand).

6.67 On-site 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.

Regulation 43: Pressure testing

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

Regulation

Pressure testing

43. (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 regulation 26A 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 are 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 Testing and Measurement 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 Secretary of State'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 Secretary of State'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: 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.

a. The previous 12 months.

b. A period in accordance with 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.

The building control body should be provided with evidence that the person who pressure-tested the building meets both of the following.

a. Has received appropriate training.

b. Is registered to test the specific class of building.

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

Showing compliance and reporting pressure test results

7.5 The dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate, all calculated using the measured air permeability, must not be higher than the target primary energy rate, target emission rate and target fabric energy efficiency rate, respectively.

7.6 If the criteria in paragraphs 7.1 and 7.5 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 7.5.

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

Air pressure testing procedure

7.8 Air pressure tests should be performed following the guidance in the approved airtightness testing methodology, CIBSE's TM23. The procedures in that document have been approved by the Secretary of State.

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Regulations 44 and 44ZA and requirements L1(b)(iii) and L2(b): Commissioning

This section deals with the requirements of regulations 44 and 44ZA and Part L1(b)(iii) and L2(b) of Schedule 1 to the Building Regulations 2010.

Regulation

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.

ONLINE VERSION

R44, R44ZA, L1(b), L2(b)

Requirement

Requirement	*Limits on application*
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 to a reasonable standard;	
(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.	
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.	

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 Secretary of State'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 the 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 primary energy rate, dwelling emission rate and dwelling fabric 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.

The commissioning plan should identify the fixed building services and on-site electricity generation that do not need to be commissioned, and why they do not need to be commissioned.

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 the procedures in this section. The notice should confirm all of the following.

a. That the commissioning plan has been followed.

b. That all systems have been inspected in an appropriate sequence and to a reasonable standard.

c. That test results confirm that performance is reasonably in accordance with the design requirements.

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 within five days of the commissioning work being completed.

b. If the building control body is an approved inspector, the notice should 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 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 completion 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.

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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.

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 comissioned concentrations.

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**.

ONLINE VERSION

ONLINE VERSION

Regulations 40 and 40A: Providing information

This section deals with the requirements of regulations 40 and 40A of the Building Regulations 2010.

Regulations

Information about use of fuel and power

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

(2) The person carrying out the 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 Secretary of State's view, when a new building is erected, the requirements of regulations 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 and 9.2.

b. Other important documentation, as given in paragraphs 9.3 to 9.5.

In the Secretary of State's view, the requirements of regulations 40 and 40A are met when work is carried out on an existing dwelling by providing the owner with both of the following.

a. Operating and maintenance instructions for the work on 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.

ONLINE VERSION

ONLINE VERSION

Section 9: Providing information

Operating and maintenance instructions

9.1 For a new dwelling and for work to an existing dwelling, operating and maintenance instructions should be given 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 occupiers 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 For a new dwelling and for work to an existing dwelling, the operating and maintenance instructions should do all of the following.

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

i. What they are.

ii. What they are for.

iii. Where they are located, using a floor plan.

iv. How to operate them, including the location and operation of timers and sensors.

v. How to maintain them.

b. 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 England Part L compliance report (BREL 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 BREL report, which includes data used to calculate dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate.

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

ONLINE VERSION

9.5 For new dwellings, the operating and maintenance instructions should include a Home User Guide. The Home User 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.

A template for a Home User Guide can be viewed at https://www.gov.uk/government/publications/home-user-guide-template.

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 CO_2 emissions performance of the system, then the complete 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.

ONLINE VERSION

Regulation 23(2) and requirement L1(a): Replacement of thermal elements and limiting heat gains and losses

This section deals with the requirements of regulation 23(2) and Part L1(a) of Schedule 1 to the Building Regulations 2010.

Regulation

Requirements for the renovation or replacement of thermal elements

23. (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.

Requirement

Requirement	*Limits on application*
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 to a reasonable standard;	
(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.	

Intention

In the Secretary of State's view, the requirements of regulation 23(2) and requirement L1(a) are met for new or replacement elements in existing dwellings by following the standards in Section 10.

ONLINE VERSION

ONLINE VERSION

Section 10: New elements in existing dwellings, including extensions

General

10.1 This section provides guidance for *new* elements in existing dwellings, including all the following types of work.

a. Providing a new thermal element in an existing dwelling – follow paragraph 10.1.

b. Providing a replacement thermal element in an existing dwelling – follow paragraph 10.2.

c. Replacing windows, doors or rooflights (controlled fittings) in an existing dwelling – follow paragraphs 10.3 to 10.6.

d. Extending an existing dwelling – follow paragraphs 10.7 to 10.11.

e. Adding a conservatory or porch to an existing dwelling – follow paragraphs 10.12 and 10.13.

NOTE: Guidance for renovating elements in existing dwellings is given in Section 11.

New and replacement fabric elements

10.2 The minimum standards in paragraphs 4.7 and 4.8 and Table 4.2 should be met for both of the following.

a. New thermal elements installed in an existing dwelling.

b. Thermal elements constructed to replace existing thermal elements.

10.3 For new and replacement windows, roof windows, rooflights and doors (controlled fittings), if the *entire unit* of that fitting is provided, all the following apply.

a. Units should be draught-proofed.

b. Units should meet the minimum standards given in Table 4.2.

c. Insulated cavity closers should be installed where appropriate.

10.4 Building control bodies may accept, as evidence of compliance with the standards given in Table 4.2, a Window Energy Rating and/or Doorset Energy Rating from a certification scheme that provides a quality assured process and supporting audit trail from calculating the performance of the window through to the window being installed.

10.5 If a window is enlarged or a new one is created, either of the following should be met.

a. The area of windows, roof windows, rooflights and doors should not exceed 25% of the total floor area of the dwelling.

b. If the area of windows, roof windows, rooflights and doors exceeds 25% of the total floor area of the dwelling, compensating measures should be taken to improve the energy efficiency of the dwelling.

ONLINE VERSION

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10.6 The term controlled fitting refers to the entire unit of a window, roof window, rooflight or door, including the frame. Replacing glazing, or a window or door in its existing frame is not providing a controlled fitting. Such work does not need to meet the energy efficiency requirements.

Extension of a dwelling

10.7 When a dwelling is extended, elements should satisfy all of the following.

a. New thermal elements should meet the standards in Table 4.2 and paragraph 4.7.

b. Replacement thermal elements should meet the standards in Table 4.2 and paragraph 4.8.

c. New windows, roof windows, rooflights and doors should meet the standards in Table 4.2.

d. The total area of windows, roof windows, rooflights and doors in extensions should not exceed the sum of the following.

   i. 25% of the floor area of the extension.

   ii. The total area of any windows and doors which no longer exist or are no longer exposed due to the extension.

e. Existing fabric elements that will become thermal elements should meet the limiting standards in Table 4.3 by following the guidance in paragraphs 11.2 to 11.4.

10.8 When a dwelling is extended, any fixed building services or on-site electricity generation that are provided or extended should comply with the guidance in Sections 5 and 6.

10.9 As an alternative approach to paragraph 10.7, the area-weighted U-value of all thermal elements in the extension should be shown to not exceed the area-weighted U-value of an extension of the same size and shape that complies with paragraph 10.7.

The area-weighted U-value is given by the following expression.

$$\frac{[(U_1 \times A_1) + (U_2 \times A_2) + (U_3 \times A_3) + \ldots]}{(A_1 + A_2 + A_3 + \ldots)}$$

Where:

U_1 = the U-value of element type 1

A_1 = the area of element type 1

and so on.

10.10 As an alternative approach to paragraphs 10.7 or 10.9, the Standard Assessment Procedure may be used to show that the dwelling primary energy rate, the dwelling emission rate and the dwelling fabric energy efficiency rate for the dwelling and proposed extension do not exceed those for the dwelling plus a notional extension. The notional extension should be the same size and shape as the proposed extension and comply with paragraph 10.7. The openings in the notional extension should conform with paragraph 10.7d, with the door area set as equal to the door area of the proposed extension and the remainder of the openings being classified as windows.

NOTE: Where the performance of elements of the existing dwelling is unknown, data in the Standard Assessment Procedure Appendix S should be used to estimate the performance.

ONLINE VERSION

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10.11 When extending an existing dwelling with a total useful floor area of over 1000m^2, consequential improvements may be required. Guidance in Section 12 should be followed.

Conservatories and porches

10.12 A conservatory or porch must have thermal separation from the existing dwelling. If the thermal separation is removed or the dwelling's heating system is extended into the conservatory or porch, the conservatory or porch should be treated as an extension and paragraphs 10.7 to 10.11 should be followed.

10.13 If the conservatory or porch is not exempt from the energy efficiency requirements (see paragraph 0.14), all the following elements should meet the minimum standards of paragraphs 4.7 and 4.8 and Table 4.2.

a. New thermal elements.

b. Replacement thermal elements.

c. New windows, roof windows, rooflights and doors. The limitations on area of windows, doors and rooflights in paragraph 10.7d do not apply.

In addition, both of the following should apply.

a. Any walls, doors and windows should be insulated and draught-proofed to at least the same extent as in the existing dwelling.

b. Fixed building services and/or on-site electricity generation within the conservatory or porch should both:

   i. meet the standards in Sections 5 and 6

   ii. have independent temperature and on/off controls.

ONLINE VERSION

ONLINE VERSION

Regulation 23(1) and requirement L1(a): Renovating elements in existing dwellings and limiting heat gains and losses

This section deals with the requirements of regulation 23(1) and Part L1(a) of Schedule 1 to the Building Regulations 2010.

Regulation

Requirements for the renovation or replacement of thermal elements

23. (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.

Requirement

Requirement	*Limits on application*
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 to a reasonable standard;	
(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.	

Intention

In the Secretary of State's view, the requirements of regulation 23(1) and requirement L1(a) are met for work to elements in existing dwellings by renovating a thermal element to the standards in Section 11.

ONLINE VERSION

Regulations 6 and 22: Material change of use and change to energy status

This section deals with the requirements of regulations 6 and 22 of the Building Regulations 2010.

Regulation

Requirements relating to material change of use

6. (1) Where there is a material change of use of the whole of a building, such work, if any, shall be carried out as is necessary to ensure that the building complies with the applicable requirements of the following paragraphs of Schedule 1—

(a) in all cases, B1 (means of warning and escape)
B2 (internal fire spread—linings)
B3 (internal fire spread—structure)
B4(2) (external fire spread—roofs)
B5 (access and facilities for the fire service)
C2(c) (interstitial and surface condensation)
F1 (ventilation)
G1 (cold water supply)
G3(1) to (3) (hot water supply and systems)
G4 (sanitary conveniences and washing facilities)
G5 (bathrooms)
G6 (kitchens and food preparation areas)
H1 (foul water drainage)
H6 (solid waste storage)
J1 to J4 (combustion appliances)
L1 (conservation of fuel and power)
P1 (electrical safety);
S2 (infrastructure for the charging of electric vehicles);

(b) in the case of a material change of use described in regulation 5(c), (d), (e) or (f), A1 to A3 (structure);

(c) in the case of a building exceeding fifteen metres in height, B4(1) (external fire spread—walls);

(d) in the case of a material change of use described in regulation 5(a), (b), (c), (d), (g), (h), (i) or, where the material change provides new residential accommodation, (f), C1(2) (resistance to contaminants);

(e) in the case of a material change of use described in regulation 5(a), C2 (resistance to moisture);

(f) in the case of a material change of use described in regulation 5(a), (b), (c), (g), (h) or (i), E1 to E3 (resistance to the passage of sound);

(g) in the case of a material change of use described in regulation 5(e), where the public building consists of or contains a school, E4 (acoustic conditions in schools);

(h) in the case of a material change of use described in regulation 5(a) or (b), G2 (water efficiency) and G3(4) (hot water supply and systems: hot water supply to fixed baths);

(i) in the case of a material change of use described in regulation 5(c), (d), (e) or (j), M1 (access to and use of buildings other than dwellings);

(j) in the case of a material change of use described in regulation 5(a), (b) or (g), Q1 (security).

Regulation *continued*

(2) Where there is a material change of use of part only of a building, such work, if any, shall be carried out as is necessary to ensure that—

(a) **that part complies in all cases with any applicable requirements referred to in paragraph (1)(a);**

(b) in a case in which sub-paragraphs (b), (e), (f), (g) or (h) of paragraph (1) apply, that part complies with the requirements referred to in the relevant sub-paragraph;

(c) in a case to which sub-paragraph (c) of paragraph (1) applies, the whole building complies with the requirement referred to in that sub-paragraph;

(d) in a case to which sub-paragraph (i) of paragraph (1) applies—

(i) that part and any sanitary conveniences provided in or in connection with that part comply with the requirements referred to in that sub-paragraph; and

(ii) the building complies with requirement M1(a) of Schedule 1 to the extent that reasonable provision is made to provide either suitable independent access to that part or suitable access through the building to that part;

(e) in a case to which subparagraph (j) applies in respect of a material change of use described in regulation 5(b) or (g), that part complies with the requirement referred to in that subparagraph.

(3) Subject to paragraph (4), where there is a material change of use described in regulation 5(k), such work, if any, shall be carried out as is necessary to ensure that any external wall, or specified attachment, of the building only contains materials of European Classification A2-s1, d0 or A1, classified in accordance with BS EN 13501-1:2007+A1:2009 entitled "Fire classification of construction products and building elements. Classification using test data from reaction to fire tests" (ISBN 978 0 580 59861 6) published by the British Standards Institution on 30th March 2007 and amended in November 2009.

(4) Paragraph (3) does not apply to the items listed in regulation 7(3).

Requirements relating to a change to energy status

22. 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.

Intention

Regulations 6 and 22 of the Building Regulations set requirements for buildings to comply with Schedule 1 to the Building Regulations when a material change of use or a change to energy status occurs.

In the Secretary of State's view, the requirements of regulations 6 and 22 are met by following the guidance in Section 11.

ONLINE VERSION

Section 11: Work to elements in existing dwellings

General

11.1 This section provides guidance for work to *existing* elements in dwellings, including all of the following types of work.

a. Renovating an existing thermal element in an existing dwelling – follow paragraphs 11.2 to 11.4.

b. Making a material change of use to a dwelling – follow paragraphs 11.5 to 11.8.

c. Making a change to a dwelling that constitutes a change to energy status – follow paragraphs 11.6 to 11.8.

NOTE: For new and replacement elements in existing dwellings, the guidance in Section 10 should be followed.

Renovating thermal elements

11.2 Renovation of a thermal element means one of the following.

a. Providing a new layer through cladding or rendering the external surface of a thermal element.

b. Providing a new layer through dry-lining the internal surface of a thermal element.

c. Replacing an existing layer through stripping down the element to expose basic structural components (e.g. bricks, blocks, rafters, joists, frame) and then rebuilding.

d. Replacing the waterproof membrane on a flat roof.

e. Providing cavity wall insulation.

11.3 If a thermal element is renovated and one of the following applies, then the whole of the thermal element should be improved to achieve at least the U-value given in Table 4.3, column (b).

a. More than 50% of the surface of the individual thermal element is renovated (see paragraph 11.4).

b. The work constitutes a major renovation. A major renovation is when more than 25% of the surface area of the external building envelope is renovated.

NOTE: If paragraph 4.13 applies, Appendix C provides examples of renovation of an existing thermal element that are technically, functionally or economically feasible.

11.4 When assessing the percentage area that will be renovated of an individual thermal element, consider whether the element is being renovated from the outside or the inside, following Diagram 11.1 and Diagram 11.2, respectively.

ONLINE VERSION

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For example, if external render is being removed from the outer side of a wall, the area of the thermal element is the area of the elevation in which that wall sits.

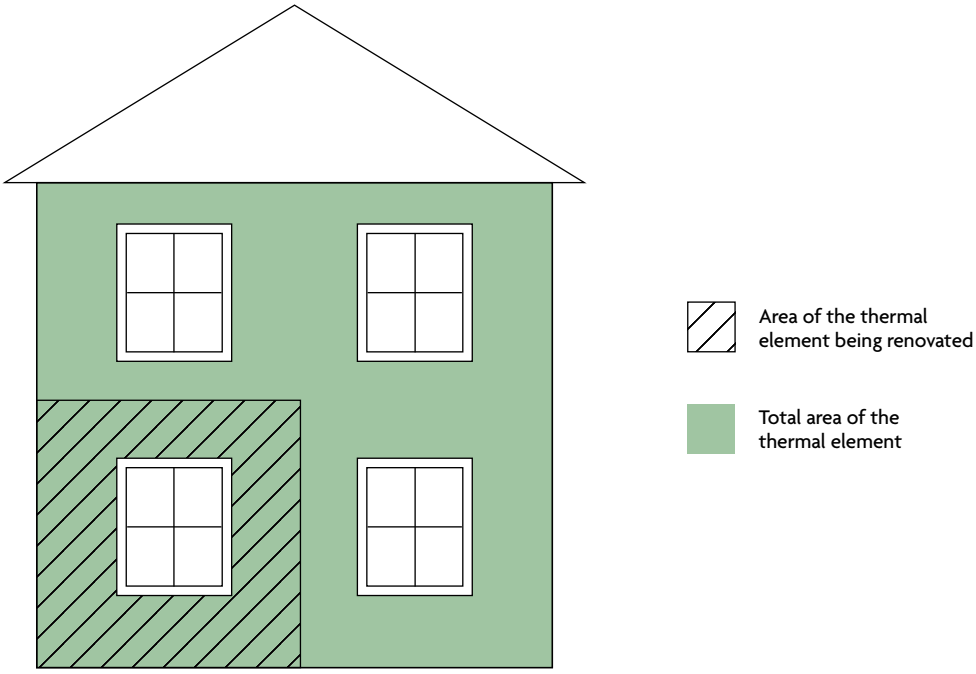

Diagram 11.1 Renovation of a thermal element from the outside

For example, if plaster is being removed from the inner side of a wall, the area of the thermal element is the area of external wall as viewed from inside the room.

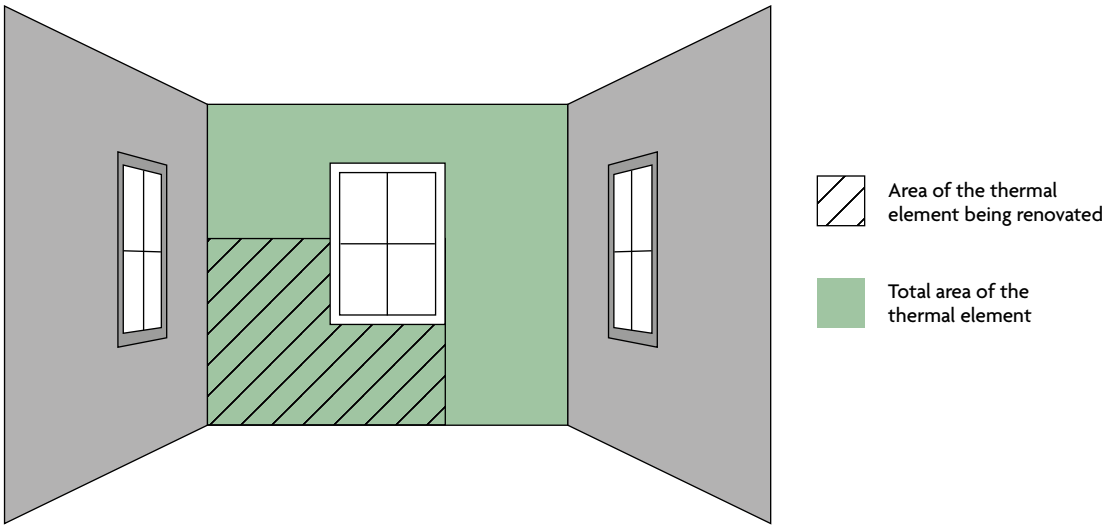

Diagram 11.2 Renovation of a thermal element from the inside

ONLINE VERSION

Material change of use and change to energy status

11.5 A material change of use, in relation to dwellings, is when a building satisfies any of the following:

a. is used as a dwelling, where previously it was not

b. contains a flat, where previously it did not

c. contains a greater or lesser number of dwellings than it did, having previously contained at least one dwelling.

11.6 A change to energy status is when a dwelling was previously exempt from the energy efficiency requirements but now is not. The change to energy status applies to the building as a whole or to parts of the building that have been designed or altered to be used separately. For example, when a previously unheated space becomes part of the heated dwelling in a garage or loft conversion, a change to energy status applies to that space.

NOTE: A material change of use may result in a change to energy status, for example if a previously unheated loft is converted into a flat.

11.7 If there is a material change of use and/or a change to energy status, elements should satisfy all of the following.

a. Existing thermal elements should meet the limiting standards in Table 4.3, following the guidance in paragraphs 4.11 and 4.12.

b. If both of the following apply to existing windows, roof windows, rooflights and doors (controlled fittings), they should be replaced to meet the limiting standards in Table 4.2.

   i. They separate a conditioned space from an unconditioned space or the external environment.

   ii. They have a U-value higher than either of the following.

   - For windows, roof windows and doors – 3.30W/(m^2·K).
   - For rooflights – 3.80W/(m^2·K), calculated by following paragraph 4.5.

In addition, all of the following should be met.

a. New or replaced thermal elements should meet the standards in Table 4.2, following the guidance in paragraphs 4.7 and 4.8.

b. New or replaced windows, roof windows, rooflights and doors (controlled fittings) should meet the standards in Table 4.2.

c. The area of openings in the newly created dwelling should not be more than 25% of the total floor area. In buildings that contain more than one dwelling a larger percentage area of openings may be achieved by following the guidance in paragraph 11.8.

d. Any fixed building services including building automation and control systems and/or on-site electricity generation that are provided or extended should meet the standards in Sections 5 and 6.

11.8 As an alternative to paragraph 11.7, in buildings that contain more than one dwelling, the Standard Assessment Procedure may be used to show that the dwelling primary energy usage and total CO_2 emissions from all dwellings in the building, after completion of the building work, would be no greater than if each dwelling had been improved following the guidance in paragraph 11.7.

ONLINE VERSION

ONLINE VERSION

Regulation 28: Consequential improvements to energy performance

This section deals with the requirements of regulation 28 of the Building Regulations 2010.

Regulation

Consequential improvements to energy performance

28. (1) Paragraph (2) applies to an existing building with a total useful floor area over 1,000m^2 where the proposed building work consists of or includes—

(a) an extension;

(b) the initial provision of any fixed building services; or

(c) an increase to the installed capacity of any fixed building services.

(2) Subject to paragraph (3), 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.

(3) Nothing in paragraph (2) requires work to be carried out if it is not technically, functionally or 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 Secretary of State's view, where regulation 28 applies, the requirements of this regulation are met for existing buildings with a total useful floor area over 1000m^2 by carrying out consequential improvements that are technically, functionally and economically feasible, by following the guidance in Section 12.

ONLINE VERSION

Section 12: Consequential improvements

12.1 For an existing dwelling with a total useful floor area of over 1000m^2, additional work may be required to improve the overall energy efficiency of the dwelling if proposed work consists of or includes any of the following.

a. An extension.

b. Providing any fixed building service in the dwelling for the first time.

c. Increasing the capacity of any fixed building service (which does not include doing so on account of renewable technology).

Consequential improvements should be carried out to ensure that the dwelling complies with Part L of the Building Regulations, to the extent that they are technically, functionally and economically feasible.

12.2 Technical guidance on consequential improvements is given in Approved Document L, Volume 2: Buildings other than dwellings.

ONLINE VERSION

Appendix A: Key terms

NOTE: Except for the items marked * (which are from the Building Regulations 2010), these definitions apply only to Approved Document L, Volume 1: Dwellings.

Air barrier An air barrier controls air leakage into and out of the building envelope. This is usually in the form of a membrane.

Air permeability The measure of airtightness of the building fabric. It is defined as the air leakage rate per hour per m^2 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 building emission rate and the building primary energy rate. The assessed air permeability is based on a measurement of the air permeability of the building 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 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 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 A local authority building control department or an approved inspector.

***Building envelope** (in relation to a building) Defined in regulation 35 as the walls, floor, roof, windows, doors, roof windows and rooflights.

Centre pane U-value 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** Defined in regulation 2(1) as 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.

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) 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 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. 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.

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For each system, commissioning includes all of the following.

- Setting to work.
- Regulation (that is, testing and adjusting repetitively) to achieve the specified performance.
- Calibration.
- Setting up and testing the associated automatic control systems.
- 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 Those energy efficiency improvements required by regulation 28.

***Controlled service or fitting** Defined in regulation 2(1) as a service or fitting in relation to which Part G [sanitation, hot water safety and water efficiency], H [drainage and waste disposal], J [combustion appliances and fuel storage systems], L [conservation of fuel and power] or P [electrical safety] 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 can be relatively local, supplying a small cluster of buildings.

Dwelling 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: Buildings other than dwellings applies.

Dwelling emission rate The dwelling CO_2 emission rate expressed as $kgCO_2/(m^2 \cdot year)$ and determined using the Standard Assessment Procedure.

Dwelling fabric energy efficiency rate Expressed as $kWh/(m^2 \cdot year)$ and determined using the Standard Assessment Procedure.

Dwelling primary energy rate Expressed as $kWh_{PE}/(m^2 \cdot year)$ and determined using the Standard Assessment Procedure.

Economically feasible The capital cost of a measure will be recouped in energy savings within a reasonable time. For the purposes of this document, economically feasible means that the measure would achieve a simple payback after one of the following.

- 7 years, for the installation of thermostatic room controls.
- 15 years, for any other measure.

Emergency escape lighting 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** Defined in regulation 2(1) as the requirements of regulations 23, 25A, 25B, 26, 26A, 26C, 28, 40 and 43 and Part L of Schedule 1.

Energy performance certificate 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;

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 of the Building Regulations 2010.

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Envelope area (the measured part of the building) The total area of all floors, walls and ceilings bordering the internal volume that is the subject of a pressure test. This includes walls and floors below external ground level. Overall internal dimensions are used to calculate this envelope area, and no subtractions are made for the area of the junctions of internal walls, floors and ceilings with exterior walls, floors and ceilings.

Existing district heat network A district heat network that is either in operation or is under construction on 15 June 2022. For these purposes, under construction means any of the following.

- The building to house the energy centre has been constructed.
- There is a heat offtake agreement signed between the heat network and a third party.
- Excavation for pipework has been completed.

***Fixed building services** 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 Lighting fixed to an external surface of the building 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 Water which has a high mineral content. For the purposes of this approved document, hard water is water that has a total water hardness of greater than 200ppm of $CaCO_3$.

Heating appliance or **heat generator** The part of a heating system that generates useful heat using one or more of the following processes.

- The combustion of fuels in, for example, a boiler.
- The Joule effect, taking place in the heating elements of an electric resistance heating system.
- Capturing heat from ambient air, ventilation exhaust air, or a water or ground heat source using a heat pump.

Heating plant emission rate The annual CO_2 emissions from the fuel and power consumed by the heating plant to deliver space heating and hot water, offset by the emissions saved as a result of any electricity generated by the heating plant, divided by the heat output over a year. Measured in kilograms of CO_2.

Heating zone A conditioned area of a building which is on a single floor and has the same thermal characteristics and temperature control requirements throughout.

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

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

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

Load compensation 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.

***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.

***Material change of use** Defined in regulation 5 as: Where there is a change in the purposes for which or the circumstances in which a building is used, so that after that change:

a. the building is used as a dwelling, where previously it was not;

b. the building contains a flat, where previously it did not;

c. the building is used as an hotel or a boarding house, where previously it was not;

d. the building is used as an institution, where previously it was not;

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e. the building is used as a public building, where previously it was not;

f. the building is not a building described in classes 1 to 6 in Schedule 2, where previously it was;

g. the building, which contains at least one dwelling, contains a greater or lesser number of dwellings than it did previously;

h. the building contains a room for residential purposes, where previously it did not;

i. the building, which contains at least one room for residential purposes, contains a greater or lesser number of such rooms than it did previously;

j. the building is used as a shop, where it previously was not; or

k. the building is a building described in regulation 7(4)(a), where previously it was not.

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 Energy, from renewable and non-renewable sources, that has not undergone any conversion or transformation process.

Renewable technology 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** 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) 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 A space heating appliance or system which operates separately from the main heating system in the dwelling and does not provide most of the heating in the dwelling – for example, a decorative fuel-effect fire in a room which also contains radiators for a central heating system.

SEDBUK (Seasonal Efficiency of Domestic Boilers in the UK) The methodology for determining boiler efficiency defined in the Standard Assessment Procedure, Appendix D.

Simple payback 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. The following guidance should be used.

- The marginal additional cost is the additional cost (materials and labour) of incorporating, for example, additional insulation – not the whole cost of the work.
- The cost of implementing the measure should be based on prices current at the date when the application is made to the building control body and be confirmed in a report signed by a suitably qualified person.
- The annual energy savings should be estimated using the Standard Assessment Procedure.

- The energy prices that are current when the application is made to the building control body should be used when evaluating energy savings. Current prices are given on the BEIS website, at: 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 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 The current approved procedure for assessing the performance of dwellings in line with this document (Approved Document L, Volume 1). The Standard Assessment Procedure is detailed in *The Government's Standard Assessment Procedure for Energy Rating of Dwellings version 10*.

Target emission rate The maximum CO_2 emission rate for the dwelling, expressed as $kgCO_2/(m^2 \cdot year)$ and determined using the Standard Assessment Procedure.

Target fabric energy efficiency rate The minimum dwelling fabric energy efficiency, expressed as $kWh/(m^2 \cdot year)$ and determined using the Standard Assessment Procedure.

Target primary energy rate The maximum primary energy use for the dwelling in a year, expressed as $kWh_{PE}/(m^2 \cdot year)$ and determined using the Standard Assessment Procedure.

Thermal bridging Occurs when part of a thermal element has significantly higher heat transfer than the materials surrounding it.

***Thermal element** Defined in regulation 2(3) and 2(4) as follows.

2(3) In these Regulations "thermal element" means a wall, floor or roof (but does not include windows, doors, roof windows or roof-lights) which separates a thermally conditioned part of the building ("the conditioned space") from—

a. the external environment (including the ground); or

b. in the case of floors and walls, another part of the building which is—

   i. unconditioned;

   ii. an extension falling within class 7 of 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 The combination of thermal elements of a building that enclose a particular conditioned indoor space or group of indoor spaces.

Thermal separation Occurs where a dwelling and a conservatory or porch are divided by walls, floors, windows and doors to which one of the following applies.

- The U-values are similar to, or in the case of a newly constructed conservatory or porch not exceeding, the U-values of the corresponding exposed elements elsewhere in the dwelling.

- In the case of a newly constructed conservatory or porch, windows and doors have similar draught-proofing provisions as the exposed windows and doors elsewhere in the dwelling.

Total useful floor area The total area of all enclosed spaces, measured to the internal face of the external walls. When calculating total useful floor area, both of the following should be taken into account.

- The area of sloping surfaces such as staircases, galleries, raked auditoria and tiered terraces should be taken as their area on plan.
- Areas that are not enclosed, such as open floors, covered ways and balconies, should be excluded.

NOTE: This area is the gross internal floor area as measured in accordance with the Code of Measuring Practice by the Royal Institution of Chartered Surveyors (RICS).

U-value 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 1m^2 of area divided by the difference in temperature (in degrees K) between the internal and external environment. The unit is W/(m^2·K).

Weather compensation A system which enables the operating flow temperature of a heating system to be varied. An external sensor communicates with one inside the boiler. The temperature is varied by either of the following.

- Modulating the heat generator output (direct acting).
- 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.

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Appendix B: Reporting evidence of compliance

BREL report

B1 The Buildings Regulations England Part L (BREL) 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.

B2 SAP 10 will produce the BREL report for the building as a standard output option.

B3 Two versions of the BREL report should be produced, using the approved software.

a. The first, the design stage BREL report, before works begin, to include all of the following.

   i. The target primary energy rate and dwelling primary energy rate.

   ii. The target emission rate and dwelling emission rate.

   iii. The target fabric energy efficiency rate and dwelling fabric energy efficiency rate.

   iv. A supporting list of specifications.

b. The second, the as-built BREL report, to include all of the following.

   i. The target primary energy rate and as-built dwelling primary energy rate.

   ii. The target emission rate and as-built dwelling emission rate.

   iii. The target fabric energy efficiency rate and as-built dwelling fabric energy efficiency rate.

   iv. A supporting list of specifications and any changes to the list of specifications that was provided at design stage.

The building control body can then use these reports to help check that what was designed has been built. The software includes a facility to compare the design stage and as-built data input files and automatically produce a schedule of changes.

B4 The as-built BREL 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).

B5 The as-built BREL report should be signed by the developer to confirm that the dwelling has been constructed or completed according to the specifications in the report.

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Photographic evidence

B6 Photographs 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 and the building control body. Anyone may take the photographs.

B7 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 for each detail when completed, but prior to closing-up works.

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: For blown fill, photos should show clean cavities and clean brick ties with very limited mortar droppings.

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.
4. Openings: for each opening type (one image per wall or roof type is sufficient), to show thermal continuity and quality of insulation with photographs of the following.
    a. Window positioning in relation to cavity closer or insulation line.
    b. External doorset positioning in relation to cavity closer or insulation line
5. Airtightness: additional photographs for all details 1–4 to show airtightness details (only if not included or visible in 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).

B8 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. 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, Plot 1 eaves detail would be P1/3b.

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Appendix C: Work to thermal elements

C1 This appendix provides guidance on the cost-effectiveness of insulation measures during various types of work on a thermal element. Table C1 sets out target U-values that would be considered to represent reasonable improvements in ordinary cases and examples of construction that may be used to achieve the proposed performance.

C2 If it is not reasonable to meet the target U-values in Table C1, considering technical risk and practicality of the work in relation to the dwelling and impacts on adjoining buildings, then the U-value should be as close to the target value as practically possible.

C3 The final column in Table C1 provides guidance on specific issues that may need to be considered to determine an appropriate course of action. In general, the proposed works should take account of all of the following.

a. The requirements of any other relevant parts of Schedule 1 to the Building Regulations.

b. The general guidance on technical risk relating to insulation improvements contained in the Building Research Establishment's BR 262.

c. For buildings falling within the categories set out in paragraphs 0.8 to 0.13, Historic England's *Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings*.

C4 General guidance is available from relevant British Standards.

Table C1 Cost-effective U-value targets when undertaking renovation works to thermal elements

Proposed works	Target U-value W/(m²·K)	Typical construction	Comments (reasonableness, practicability and cost-effectiveness)
Pitched roof constructions			
Renewal of roof covering: No living accommodation in the roof void. Existing insulation (if any) at ceiling level, less than 50mm, in poor condition, and/or likely to be significantly disturbed or removed as part of the planned work	0.16	Provide loft insulation – 250mm mineral fibre or cellulose fibre as a quilt laid between and across ceiling joists or loose fill or equivalent	Assess condensation risk in roof space and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**). Additional provision may be required to provide access to and insulation of services in the roof void
Renewal of roof covering: Existing insulation in good condition and will not be significantly disturbed by proposed works. Existing insulation thickness between 50mm and 100mm	0.16	Top up loft insulation to at least 250mm mineral fibre or cellulose fibre as quilt laid between and across ceiling joists or loose fill or equivalent. This may be boarded out	Assess condensation risk in roof space and make appropriate provision in line with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**). Additional provision may be required to provide insulation and access to services in the roof void Where the loft is already boarded and the boarding will not be removed as part of the work, the practicality of insulation works needs to be considered

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Table C1 Continued

Proposed works	Target U-value W/(m²·K)	Typical construction	Comments (reasonableness, practicability and cost-effectiveness)
Renewal of the ceiling to cold loft space. Existing insulation at ceiling level will be removed as part of the works	0.16	Provide loft insulation – 250mm mineral fibre or cellulose fibre as a quilt laid between and across ceiling joists or loose fill or equivalent. This may be boarded out	Assess condensation risk in roof space and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**). Additional provision may be required to provide insulation and access to services in the roof void Where the loft is already boarded and the boarding will not be removed as part of the work, insulation may be installed from the underside; however, the target U-value may not be achievable
Renewal of roof covering: Living accommodation in roof space (room-in-the-roof arrangement), with or without dormer windows	0.16	Cold structure – insulation (thickness dependent on material) placed between and below rafters Warm structure – insulation placed between and above rafters	Assess condensation risk (particularly interstitial condensation) and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**) Where there is an increase in structural thickness (particularly in terraced dwellings), practical considerations may necessitate a lower performance target
Dormer window constructions			
Renewal of cladding to side walls	0.30	Insulation (thickness dependent on material) placed between and/or fixed to outside of wall studs, or fully external to existing structure, depending on construction	Assess condensation risk and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**)
Renewal of roof covering	–	Follow the guidance on pitched or flat roof constructions, as appropriate	Assess condensation risk and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**)
Flat roof constructions			
Renewal of roof covering: Existing insulation, if any, less than 100mm, mineral fibre (or equivalent resistance) or in poor condition, and likely to be significantly disturbed or removed as part of the planned work	0.16	Insulation placed between and over joists as required to achieve the target U-value	Assess condensation risk and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**). Also see **BS 6229** for design guidance

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Table C1 Continued

Proposed works	Target U-value W/(m²·K)	Typical construction	Comments (reasonableness, practicability and cost-effectiveness)
Renewal of the ceiling to flat roof area. Existing insulation removed as part of the works	0.16	Insulation placed between and to underside of joists to achieve target U-value	Assess condensation risk and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**). Also see **BS 6229** for design guidance. Where insulation would unacceptably reduce ceiling height, a lower performance target may be appropriate
Solid wall constructions			
Renewal of internal finish to external wall or applying a finish for the first time	0.30	Dry-lining to inner face of wall – insulation between studs fixed to wall to achieve target U-value (thickness dependent on insulation and stud material used) Insulated wall board fixed to internal wall surface to achieve target U-value (thickness dependent on material used)	Assess the impact on internal floor area. In general it is reasonable to accept a reduction not exceeding 5% in the area of a room. However, the use of the room, and the space needed for people to move around and for fixtures, fittings and furniture should be assessed If acoustic attenuation issues are particularly important (e.g. where insulation is returned at party walls) a less demanding U-value may be more appropriate – the target U-value may have to be increased to 0.35 or above, depending on the circumstances Assess condensation and other moisture risks and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**). This will usually require the provision of vapour control and damp protection of components. Guidance on the risks involved is provided in the Building Research Establishment's BR 262 and, on the technical options, in Energy Saving Trust publications
Renewal of finish or cladding to external wall area or elevation (render or other cladding) or applying a finish or cladding for the first time	0.30	External insulation system with rendered finish or cladding to give target U-value	Assess technical risk and impact of increased wall thickness on adjoining buildings

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Table C1 Continued

Proposed works	Target U-value W/(m²·K)	Typical construction	Comments (reasonableness, practicability and cost-effectiveness)
Ground floor constructions			
Renovation of a solid or suspended floor involving the replacement of screed or a timber floor deck	See comment	Solid floor – replace screed with an insulated floor deck to maintain existing floor level Suspended timber floor – fit insulation between floor joists before replacing floor deck	The cost-effectiveness of floor insulation is complicated by the impact of the size and shape of the floor (ratio of perimeter to area). In many cases, existing uninsulated floor U-values are already relatively low when compared with wall and roof U-values. Where the existing floor U-value is greater than 0.70W/(m²·K), added insulation is likely to be cost-effective. Analysis shows that the cost–benefit curve for the thickness of added insulation is flat; therefore, a target U-value of 0.25W/(m²·K) is appropriate, subject to other technical constraints (adjoining floor levels, etc.)

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Appendix D: Specification for a home built with a heat pump

D1 This appendix provides a good practice specification for a dwelling built with a heat pump.

D2 By using this specification, the dwelling should pass the target primary energy rate and target emission rate. However, this should be checked through energy calculations.

Table D1 Summary of notional dwelling specification for new dwellings

Element or system	Reference value for target setting[1]
Opening areas (windows, roof windows, rooflights and doors)	Same as for actual dwelling not exceeding a total area of openings of 25% of total floor area[2]
External walls including semi-exposed walls	U = 0.18 W/(m²·K)
Party walls	U = 0
Floors	U = 0.13 W/(m²·K)
Roofs	U = 0.11 W/(m²·K)
Opaque door (less than 30% glazed area)	U = 1.0 W/(m²·K)
Semi-glazed door (30–60% glazed area)	U = 1.0 W/(m²·K)
Windows and glazed doors with greater than 60% glazed area	U = 1.2 W/(m²·K) Frame factor = 0.7
Roof windows	U = 1.2 W/(m²·K), when in vertical position (for correction due to angle, see specification in SAP 10 Appendix R)
Rooflights	U = 1.7 W/(m²·K), when in horizontal position (for correction due to angle, see specification in SAP 10 Appendix R)
Ventilation system	Natural ventilation with intermittent extract fans
Air permeability	5 m³/(h·m²) at 50 Pa
Main heating fuel (space and water)	**Mains electricity**
Heating system	**Air source heat pump** and radiators Design flow temperature = 45°C
Heat pump[3]	Space heating efficiency = 250% Water heating efficiency = 250%
Heating system controls	**Weather compensation** Either: – single storey dwelling in which the living area is greater than 70% of total floor area: programmer and room thermostat – any other dwelling: time and temperature zone control, thermostatic radiator valves

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Table D1 Continued

Hot water system	**Stored hot water in cylinder, heated by air source heat pump with back-up immersion heating** Separate time control for space and water heating
Wastewater heat recovery (WWHR)	**None**
Hot water cylinder	If cylinder, declared loss factor = 0.85 × (0.2 + 0.051 $V^{2/3}$) kWh/day where V is the volume of the cylinder in litres
Lighting	Fixed lighting capacity (lm) = 185 × total floor area Efficacy of all fixed lighting = 80 lm/W
Air conditioning	None
Photovoltaic (PV) system	**None**

NOTES:
1. Changes from the notional dwelling specification (Table 1.1) are in **bold**.
2. See SAP 10 for details.
3. Space heating and water heating efficiencies as calculated in SAP 10; this is different from the COP.

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Appendix E: 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]

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 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]

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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]

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Appendix F: Documents referred to

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List of Approved Documents

The following documents have been published to give guidance on how to meet the Building Regulations. You can find the date of the edition approved by the Secretary of State at www.gov.uk.

Approved Document A
Structure

Approved Document B
Fire safety
Volume 1: Dwellings

Approved Document B
Fire safety
Volume 2: Buildings other than dwellings

Approved Document C
Site preparation and resistance to contaminants and moisture

Approved Document D
Toxic substances

Approved Document E
Resistance to the passage of sound

Approved Document F
Ventilation
Volume 1: Dwellings

Approved Document F
Ventilation
Volume 2: Buildings other than dwellings

Approved Document G
Sanitation, hot water safety and water efficiency

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Drainage and waste disposal

Approved Document J
Combustion appliances and fuel storage systems

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Protection from falling, collision and impact

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Conservation of fuel and power
Volume 1: Dwellings

Approved Document L
Conservation of fuel and power
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Access to and use of buildings
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Electrical safety – Dwellings

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Approved Document R
Infrastructure for electronic communications
Volume 1: Physical infrastructure and network connection for new dwellings

Approved Document R
Infrastructure for electronic communications
Volume 2: Physical infrastructure for high-speed electronic communications networks

Approved Document S
Infrastructure for the charging of electric vehicles

Approved Document 7
Materials and workmanship

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