Approved Document L - Conservation of fuel and power and minimisation of greenhouse gas emissions

Volume 1: Dwellings

Consultation version – December 2023

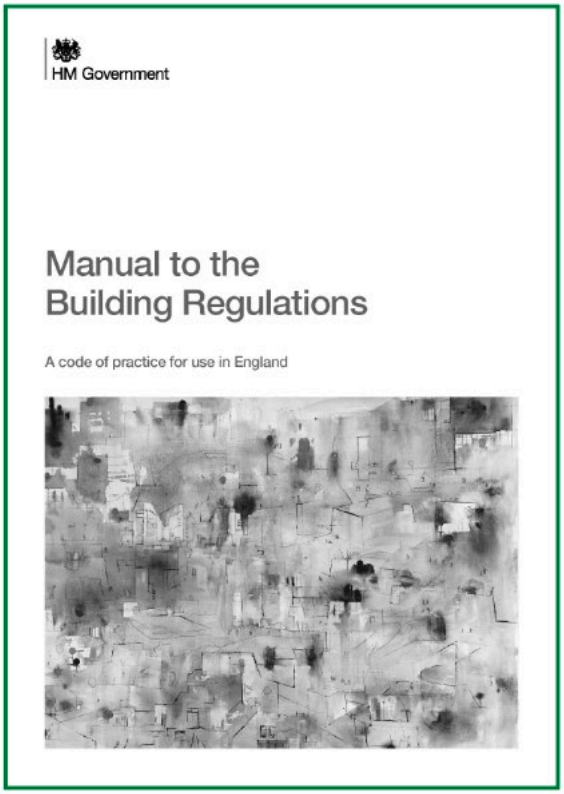
This draft guidance accompanies the December 2023 consultation ***The Future Homes and Buildings Standards****: 2023 consultation on changes to Part 6, Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for dwellings and non-domestic buildings and seeking evidence on previous changes to Part O (overheating)*. The Government is primarily seeking views on the standards for new dwellings and non-domestic buildings.

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.

NOTE FOR CONSULTATION: the current published version of the manual does not include recent changes to the building regulations and will be updated.

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.

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 three 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*).

c. The Building Safety Regulator

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.

NOTE FOR CONSULTATION: In this consultation version of the Approved Document L, Volume 1, paragraphs which have changed relative to the Approved Document L, Volume 1, 2021 edition incorporating 2023 amendments are highlighted in yellow. Both technical and editorial changes have been made. Changes should be reviewed alongside the current published version of the Approved Document L, Volume 1, 2021 edition incorporating 2023 amendments. Notes that apply for consultation only are shown in red text.

This text is subject to change before it becomes statutory guidance in 2025.

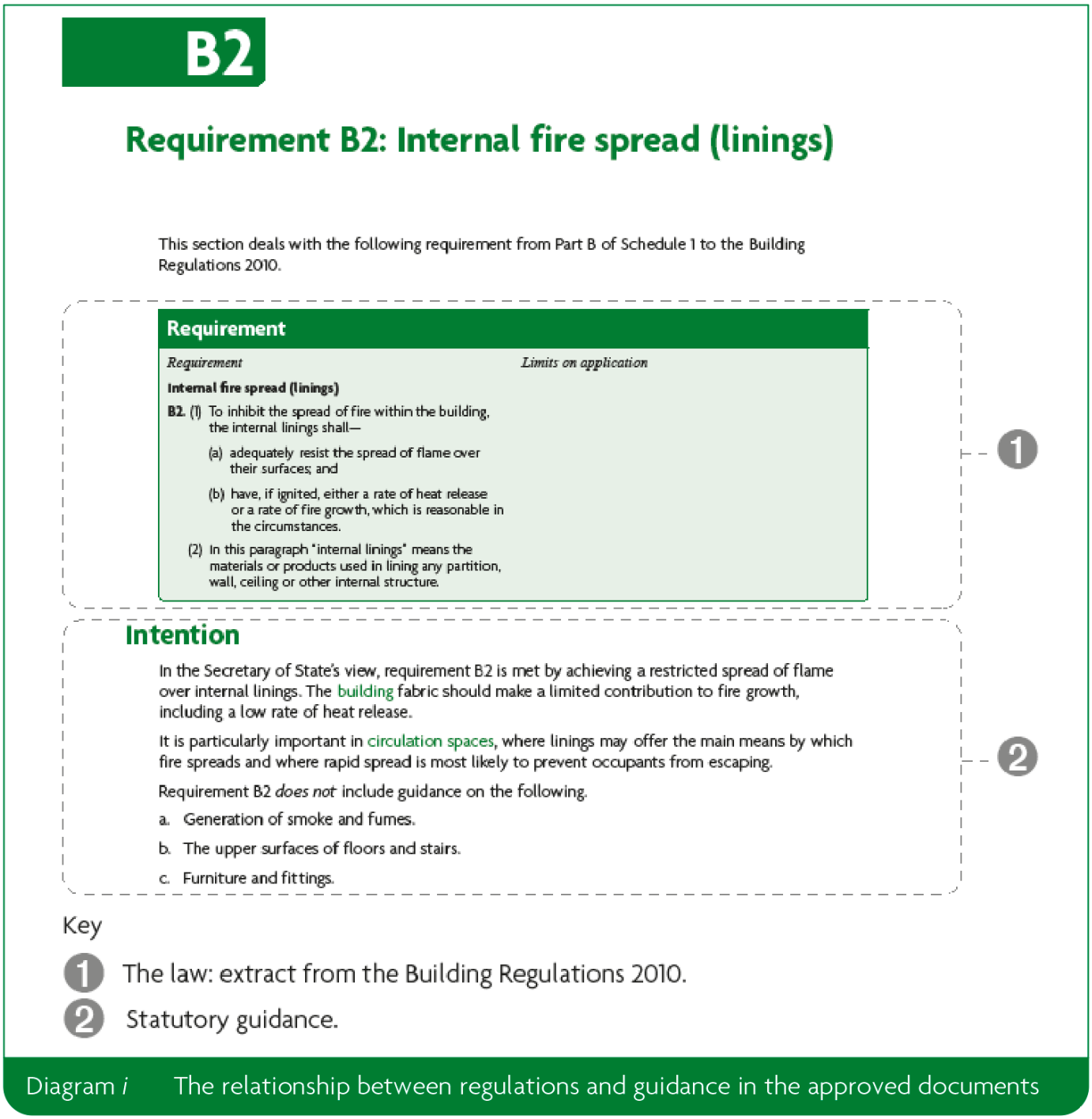


Diagram *i* The relationship between regulations and guidance in the approved documents

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.

Contents

NOTE FOR CONSULTATION: An asterix* indicates significant changes in those sections.

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 on non-domestic buildings, use Approved Document L, Volume 2: Buildings other than dwellings.

0.2 This approved document, Approved Document L, Volume 1, contains the following sections:

Approved document section	Related Building Regulations requirements
NOTE FOR CONSULTATION: An asterix* indicates significant changes in those sections.	
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, 26, 26A, 26C, 27, 27A and 27C
Section 2: Calculating the dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate*	
NOTE FOR CONSULTATION: Section 3 of this approved document on consideration of high-efficiency alternative systems has been removed in line with the proposal to revoke regulations 25A and 25B.	
Section 4: Limiting heat gains and losses*	Requirement L1(a) of Schedule 1
Section 5: Carbon and energy performance of building services – general guidance*	Requirements L1(b)(i), (ii), (iii) and L2 of Schedule 1
Section 6: Carbon and energy performance of building services - system specific guidance*	
Section 7: Air permeability and pressure testing	Regulation 43
Section 8: Commissioning fixed building services and on-site electricity generation systems	Regulations 44 and 44ZA and requirements L1(b)(iv) and L2(b) of Schedule 1
Section 9: Installation, certification, inspection and testing of heat pump systems*	Regulation 11F

Section 10: Providing information to the owner about the building, fixed building services and maintenance requirements*	Regulations 40 and 40A
Section 11: Replacing thermal elements and limiting heat gains and losses in existing dwellings, including extensions	Regulation 23(2) and requirement L1(a) of Schedule 1
Section 12: Work to thermal elements in existing dwellings	Regulations 6, 22 and 23(1) and requirement L1(a) of Schedule 1
Section 13: Consequential improvements to energy performance	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: Heat Network Sleeving*	n/a
Appendix E: Standards referred to	n/a
Appendix F: Documents referred to	n/a

Application

0.3 The guidance in Approved Document L, Volume 1 applies to dwellings only. For 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 in Section 4 of this approved document, Approved Document L, Volume 1.

New dwellings

0.5 For new dwellings, guidance is given in Sections 1 to 10 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 does not extend into the conservatory or porch.

If both (a) and (b) have been achieved, the conservatory or porch should be treated as an extension onto an existing dwelling. The guidance for new elements in existing dwellings in Section 11 of this approved document, Approved Document L, Volume 1, should be followed.

If either or both of (a) and (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 when calculating the dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate.

Extensions to and work on existing dwellings

0.7 Guidance for existing dwellings is given in this approved document, Approved Document L, Volume 1, 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 11.

d. Existing elements in existing dwellings, including renovating or retaining a thermal element, material change of use and change to energy status: Section 12.

NOTE: For building work in dwellings of over 1000m^2, consequential improvements may be required to improve the energy efficiency of the dwelling. Guidance is given in Section 13.

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 if 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 if this would not unacceptably alter the dwelling's character or appearance. The work should comply with standards in this approved document, Approved Document L, Volume 1, 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 dwellings built with wattle and daub, cob or stone, and those using lime render or mortar.

0.11 New extensions to historic and/or traditional dwellings should comply fully with the energy efficiency standards in this approved document, Approved Document L, Volume 1, 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 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 11 of this approved document, Approved Document L, Volume 1.

e. The heating system of the dwelling does not extend into the conservatory or porch.

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, the two volumes of Approved Document L should be referred to 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 B and P

0.20 This approved document, Approved Document L, Volume 1, provides guidance on on-site electricity generation and energy storage. Where on-site electricity generation or energy storage is installed, the fire safety and electrical requirements of the Building Regulations should be met. Approved Documents B and P should be followed.

Interaction with Part C

0.21 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. Approved Document C should be followed.

Interaction with Part E

0.22 This approved document, Approved Document L, Volume 1, provides guidance on insulation that is reasonably continuous and that 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

0.23 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, the air infiltration of a dwelling should be considered. Approved Document F should be followed.

Interaction with Part J

0.24 This approved document, Approved Document L, Volume 1, provides guidance on airtightness. For guidance on permanent ventilation openings for open flued appliances in airtight dwellings, Approved Document J should be followed.

Interaction with Part K and Part M

0.25 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. Approved Documents K and M should be followed.

Regulations 24, 25, 26, 26A, 26C, 27, 27A and 27C: Calculating the energy performance of dwellings

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

NOTE FOR CONSULTATION: It is proposed that regulations 25A and 25B are revoked. References to these regulations have been removed throughout the consultation versions of the approved documents and sections will be updated in the final statutory guidance.

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.

CO_2 emission rates for new buildings

26. Where a building is erected, it shall not exceed the target CO2 emission rate for the building that has been approved pursuant to regulation 25, applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24.

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.

CO_2 emission rate calculations

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

(2) The person carrying out the work must—

(a) where the new building is a higher-risk building, ensure the application for building control approval in relation to the work is accompanied by a notice which specifies—

(i) the target CO2 emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24,

(ii) the CO2 emission rate for the building as designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

(iii) a list of specifications to which the building is to be constructed;

(b) in any other case, not later than the day before the work starts, give the building control authority a notice which specifies the matters set out in paragraphs (i) to (iii) of sub-paragraph (a).

(3) The person carrying out the work must—

(a) where the new building is a higher-risk building, ensure the application for a completion certificate in relation to the work is accompanied by—

(i) a notice which specifies—

(aa) the target CO2 emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24,

(bb) the CO2 emission rate for the building as constructed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

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

(ii) a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in sub-paragraphs (aa) to (cc) of paragraph (i);

(b) in any other case, not later than five days after the work has been completed, give the building control authority a notice which specifies the matters mentioned in sub-paragraphs (aa) to (cc) of sub-paragraph (a)(i) or a certificate of the sort mentioned in sub-paragraph (a)(ii).

(4) A building control 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.

(4A) Where the regulator is the building control authority by virtue of section 91ZB of the Act (the regulator: building control authority for other work), it must send a copy of each notice or certificate it receives

under this regulation in relation to a building to the local authority for the area in which the building is situated.

(5) In this regulation, "specifications" means specifications used for the calculation of the CO2 emission rate.

Fabric energy efficiency rate calculations

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

(2) The person carrying out the work must—

(a) where the dwelling is within a higher-risk building, ensure the application for building control approval in relation to the work is accompanied by 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 designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

(iii) a list of specifications to which the dwelling is to be constructed;

(b) in any other case, not later than the day before the work starts, give the building control authority a notice which specifies the matters set out in paragraphs (i) to (iii) of sub-paragraph (a).

(3) The person carrying out the work must—

(a) where the dwelling is within a higher-risk building, ensure the application for a completion certificate in relation to the work is accompanied by—

(i) a notice which specifies—

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

(bb) the fabric energy efficiency rate for the dwelling as constructed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

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

(ii) a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in sub-paragraphs (aa) to (cc) of paragraph (i);

(b) in any other case, not later than five days after the work has been completed, give the building control authority a notice which specifies the matters mentioned in sub-paragraphs (aa) to (cc) of sub-paragraph (a)(i) or a certificate of the sort mentioned in sub-paragraph (a)(ii).

(4) A building control 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.

(4A) Where the regulator is the building control authority by virtue of section 91ZB of the Act (the regulator: building control authority for other work), it must send a copy of each notice or certificate it receives under this regulation in relation to a building to the local authority for the area in which the building is situated.

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

Target primary energy rate calculations for new buildings

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

(2) The person carrying out the work must—

(a) where the new building is a higher-risk building, ensure the application for building control approval in relation to the work is accompanied by 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 designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

(iii) a list of specifications to which the building is to be constructed;

(b) in any other case, not later than the day before the work starts, give the building control authority a notice which specifies the matters set out in paragraphs (i) to (iii) of sub-paragraph (a).

(3) The person carrying out the work must—

(a) where the new building is a higher-risk building, ensure the application for a completion certificate in relation to the work is accompanied by——

(i) a notice which specifies—

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

(bb) 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

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

(ii) a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in sub-paragraphs (aa) to (cc) of paragraph (i);

(b) in any other case, not later than five days after the work has been completed, give the building control authority a notice which specifies the matters mentioned in sub-paragraphs (aa) to (cc) of sub-paragraph (a)(i) or a certificate of the sort mentioned in sub-paragraph (a)(ii).

(4) A building control 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.

(4A) Where the regulator is the building control authority by virtue of section 91ZB of the Act (the regulator: building control authority for other work), it must send a copy of each notice or certificate it receives under this regulation in relation to a building to the local authority for the area in which the building is situated.

(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

Regulation 24

Regulation 24 requires the Secretary of State to approve a methodology to calculate the energy performance of a building. For a new dwelling, the approved methodology is the Home Energy Model: Future Homes Standard assessment.

NOTE FOR CONSULTATION: The consultation tool for the Government's Home Energy Model: Future Homes Standard assessment is available at the following webpage: www.homeenergymodelconsultation.org.uk.

Calculation methodologies are set out in Section 1 and Section 2 of this approved document.

Regulation 25

Regulation 25 requires the Secretary of State to approve minimum energy performance requirements. These requirements are for 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 new dwelling must be shown to meet regulations 26, 26A and 26C: calculations should be provided 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.

How to produce these calculations is set out in Section 2 of this approved document.

Regulations 27, 27A and 27C

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

Section 1: Calculating the target primary energy rate, target emission rate and target fabric energy efficiency rate

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.

NOTE: How to calculate the dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate is set out in Section 2.

1.2 The notional dwelling is the same size and shape as the actual dwelling and has standardised properties for fabric and services.

1.3 The full properties of the main notional building and the fabric energy efficiency notional building are in Tables 1 and 3 of *The Future Homes Standard 2025: dwelling notional buildings for consultation*, available from: https://www.gov.uk/government/consultations/the-future-homes-and-buildings-standards-2023-consultation.

NOTE FOR CONSULTATION: Two options have been provided at consultation stage, see consultation document for more information.

1.4 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.

1.5 The target primary energy rate, target emission rate and target fabric energy efficiency rate for individual dwellings must be calculated using the approved calculation methodology. The approved methodology is the Government's Home Energy Model: Future Homes Standard assessment.

NOTE FOR CONSULTATION: The consultation tool for the Home Energy Model: Future Homes Standard assessment is available at the following webpage: www.homeenergymodelconsultation.org.uk. This provides the opportunity to interact with the model and understand whether different dwelling designs are likely to meet the minimum standard of total energy performance.

District heat networks and communal heat networks

1.6 For a dwelling that is connected to a district heat network or a communal heat network, the heat network notional dwelling specification should be used to calculate the target primary energy rate, target emission rate and the target fabric energy efficiency rate. The heat network notional dwelling specification and the fabric energy efficiency notional building are in Tables 2 and 3 of *The Future Homes Standard 2025: dwelling notional buildings for consultation*, available from: https://www.gov.uk/government/consultations/the-future-homes-and-buildings-standards-2023-consultation.

Buildings that contain multiple dwellings

1.7 For a building containing flats, an average target primary energy rate, average target emission rate and average target fabric energy efficiency rate may be calculated as an alternative to individual target rates for each dwelling.

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

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

1.8 The floor area weighted average of the target primary energy rates should be calculated using the following formula.

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

1.9 The average target emission rate should be calculated using the formula above in paragraph 1.8 but replacing target primary energy rate with target emission rate.

The average target fabric energy efficiency rate should be calculated using the formula above in paragraph 1.8 but replacing target primary energy rate with target fabric energy efficiency rate.

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

2.1 The same approved calculation tool should 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 should be calculated at both of the following points using the same approved 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 (see Section 7).

2.3 At both of the points in paragraphs 2.2(a) and (b), 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), which is a standardised output from the approved calculation methodology detailed in paragraph 1.5. 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.

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 can accept evidence of (a) to (d) above as reported in the completion stage BREL report, provided by an accredited energy assessor. The BREL report should be provided together with photographic evidence of compliance. For further details of the 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.

EITHER

a. Every individual dwelling meets 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 2.7, must not exceed the average target primary energy rate for the whole building.

ii. The average dwelling emission rate for the whole building, calculated in accordance with paragraph 2.7, must not exceed the average target emission rate for the whole building.

iii. The average dwelling fabric energy efficiency rate for the whole building, calculated in accordance with paragraph 2.7, must not exceed the average target fabric energy efficiency rate for the whole building.

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

2.7 The average dwelling primary energy rate, average dwelling emission rate and average dwelling fabric energy efficiency rate are the floor-area-weighted averages of the dwelling primary energy rates, dwelling emission rates and dwelling fabric energy efficiency rates of all the individual dwellings in the building.

The average dwelling primary energy rate, average dwelling emission rate and average dwelling fabric energy efficiency rate should be calculated using the same averaging methodology set out in paragraphs 1.8 and 1.9.

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

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

NOTE: Information and photographic evidence should be provided for each individual dwelling, as described in Section 10 and Appendix B.

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

Secondary heating

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 when calculating for the fraction of heat provided by the secondary heating system must be as defined by the Home Energy Model: Future Homes Standard assessment 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 when calculating the dwelling primary energy rate and dwelling emission rate.

NOTE FOR CONSULTATION: The Home Energy Model: Future Homes Standard assessment does not have an input for secondary heating. This will be available for the implementation of the Future Homes Standard.

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

District heat networks and communal heat networks

2.10 If thermal energy is supplied from a district heat network or communal heat network, CO_2 emission factors and primary energy factors should be determined by considering the details of the scheme and following all of the following guidance.

a. The CO_2 emission factor and primary energy factor for heat delivered to the dwelling are entered as inputs into the Home Energy Model: Future Homes Standard assessment for calculating the dwelling primary energy rate and dwelling emission rate.

NOTE FOR CONSULTATION: The PCDB for heat networks is not available for this consultation.

b. Calculations should take account of the performance of the whole system. This should be calculated for the diversified peak demand conditions as described under Objective 3.2 in CIBSE CP1 *Heat Networks: Code of Practice* (2020). This should include the performance of the distribution circuits, all heat generating plants, combined heat and power (CHP), storage, and any waste heat recovery or heat dumping. Other relevant guidance in CIBSE's CP1 should also be followed for these calculations.

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

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

e. When calculating the dwelling primary energy rate and dwelling emission rate for a dwelling connected to a district heat network, the calculation should include any significant changes to the planned heat supply as a result of the connection of any of the following sources to connect to the district heat network within 3 years of the 'as-built stage' assessment.

   i. Heat recovered from power stations

   ii. Heat recovered from industrial processes

   iii. Heat recovered from waste incineration plants

   NOTE: Additional planned heat supply to the district heat network provided by other means, including biomass boilers or heat pumps not associated with processes (i) to (iii) above, and which are not connected at the point of the as-built assessment should not be included in the calculation.

f. When there will be a change to the planned heat supply to the district heat network within 3 years of the 'as-built stage' assessment as described in 2.10e, a submission to the building control body should be made providing details of the additional source and showing both of the following:

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

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

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

   The primary energy factor for heat output should be calculated as:

   $1/H \times (F \times PE_F - E \times PE_E)$

   where:

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

   F is the fuel input in kWh

   PE_F is the primary energy factor for the input fuel in kWh_{PE}/kWh

   E is the electricity production from the scheme in kWh

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

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

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

where:

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

F is the fuel input in kWh

CO_{2F} is the emission factor for the input fuel in $kgCO_2/kWh$

E is the electricity production from the scheme in kWh

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

h. For district heat networks, the CO_2 emission factors and primary energy factors that are used to calculate the dwelling emission rate and dwelling primary energy rate should be calculated in accordance with the Product Characteristics Database (PCDB) methodology and application process.

NOTE: For new buildings connected to a district heat network the PCDB methodology and application process allows for emissions factors and primary energy factors to be calculated using either of:

i) all heat sources already connected to the district heat network

ii) new or unused low carbon heat sources connected to the district heat network following the sleeving methodology and auditing process described in Appendix D.

i. The dwelling primary energy rate and dwelling emission rate submitted to the building control body should be accompanied by a report, signed by a suitably qualified person, detailing how the CO_2 emission factors and primary energy factors were derived.

NOTE FOR CONSULTATION: A consultation prototype version of the approved spreadsheet tool to be used in support of this application by heat networks is available alongside this document to assist consultees in understanding this proposal.

Swimming pool basins

2.11 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. 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

2.12 When calculating the dwelling primary energy rate, dwelling emission rate and dwelling fabric energy efficiency rate, the HEM condition for the party wall should be selected from Table 2.1 for the type of construction adopted.

Table 2.1 HEM condition for party walls[1]	
Party wall construction	HEM condition
Solid	No heat loss
Unfilled cavity with no effective edge sealing	Heat loss
Unfilled cavity with effective sealing around all exposed edges and in alignment with insulation layers in abutting elements[2]	Heat loss
Unfilled cavity with effective sealing around all exposed edges and in alignment with insulation layers in abutting elements for a concrete frame construction in a building containing flats [2, 3]	No heat loss
A fully filled cavity with effective sealing at all exposed edges and in alignment with insulation layers in abutting elements[2, 3]	No heat loss

NOTE:

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

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

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

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

2.14 Provided the dwelling satisfies the minimum standards for fabric elements set out in Section 4, the target primary energy rate and the target emission rate can be achieved 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.

2.15 The target fabric energy efficiency rate can be achieved only through fabric energy efficiency, this includes U-values, thermal bridging and airtightness.

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

Section 3

NOTE FOR CONSULTATION: Section 3 of this approved document on considering high-efficiency alternatives has been removed in line with the proposal to revoke regulations 25A.

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 and minimisation of greenhouse gas emissions	
L1. Reasonable provision shall be made for the conservation of fuel and power and the minimisation of greenhouse gas emissions in buildings by—	
(a) limiting heat gains and losses—	
(i) through thermal elements and other parts of the building fabric; and	
(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;	
(b) providing fixed building services which—	
(i) are energy efficient to a reasonable standard;	
(ii) minimise greenhouse gas emissions;	
(iii) have effective controls; and	
(iv) 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 4.3, paragraph 4.7, and paragraphs 4.15 to 4.19.

ii. Airtightness – paragraphs 4.21 to 4.23.

iii. The pipework and services – paragraphs 4.25 to 4.30, paragraphs 4.32 to 4.35, and paragraphs 4.37 to 4.42.

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.

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 – paragraph 4.1, paragraphs 4.4 to 4.6, paragraphs 4.8 to 4.15, and paragraphs 4.17 and 4.20. Further guidance is given in the following sections.

- For new elements, replacement elements and extensions – Section 11.
- For renovated elements, retained elements, a change to energy status and a material change of use – Section 12.

ii. Any work that may result in making the building less airtight – paragraph 4.24.

b. Unwanted heat *gain*s from any pipework and services to which building work is being done are limited by following the guidance in paragraphs 4.25 to 4.29, paragraphs 4.31 to 4.34, paragraph 4.36, and paragraphs 4.38, 4.39 and 4.42.

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 13.

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).

New dwellings

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

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

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

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

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

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

Existing dwellings

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

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

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

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

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

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

iii. For a roof window: no divider.

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

e. Taken from the default values in the Standard Assessment Procedure, version 10.2, Table 6e.

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

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

b. Calculated using one of the following standard sizes.

i. 1.23m (±25%) wide × 2.18m (±25%) high, for doors ≤ 3.6m^2.

ii. 2.00m (±25%) wide × 2.18m (±25%) high, for doors > 3.6m^2.

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

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

d. Taken from the default values in the Standard Assessment Procedure, version 10.2, Table 6e.

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

NOTE: Paragraph 4.6 does not apply to Home Energy Model: Future Homes Standard assessment or Standard Assessment Procedure calculations, where the U-value of each element is calculated based on the plane in which it is constructed or installed.

Limiting standards in new dwellings

4.7 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
	Maximum air permeability m³/(h·m²)
At 50Pa	8.0
At 4Pa	1.57

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 other performance (e.g. wind load, safety, security or acoustic attenuation) requires thicker glass to be used, an equivalent window unit with standard thickness glazing should be shown to meet the required standard.
5. Including roof windows and curtain walling.
6. U-values for rooflights or rooflight-and-kerb assemblies should be based on the developed surface area 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 NTD02.1.
7. The limiting value for rooflights also applies to kerbs that are supplied as part of a single rooflight-and-kerb assembly 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 greater than the limiting standards in Table 4.1.

Limiting standards in existing dwellings

New and replacement elements

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

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

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

b. meet the limiting standards in Table 4.2.

4.10 Guidance on when a new element must meet the standards in Table 4.2 is given in Section 11. 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.

4.11 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, as set out in paragraph 0.8, one of the following should be met.

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

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

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

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

10. 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 NTD02.1.
11. The limiting value for rooflights also applies to kerbs that are supplied as part of a single rooflight-and-kerb assembly 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/(m^2·K).
12. For external fire doorsets, as defined in Appendix A of Approved Document B, Volume 1, a maximum U-value of 1.8W/(m^2·K) is permissible.

Renovated and retained elements

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

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

b. meet the limiting standards in Table 4.3.

4.13 Guidance on when an existing element should meet the standards in Table 4.3 is given in Section 12. Elements that should meet the standards include both of the following.

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

b. Elements that are being retained in existing dwellings, for example during a loft or garage conversion. Retained elements with a U-value 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).

4.14 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 worse U-value 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 of work to thermal elements are given in Appendix C.

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

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

Element	U-value[1] W/(m²·K)	
	(a) Threshold	(b) Improved
Roof[2,3,4]	0.35	0.16
Wall with cavity insulation[2,5]	0.70	0.55
Wall with 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 worse U-value 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 for a flat roof or roof with integral insulation there are problems with the load-bearing capacity of the frame or height of the upstand, a worse U-value may be appropriate.
5. Values for 'wall with cavity insulation' apply only to a wall that is suitable for cavity insulation. Where this is not the case, the wall should be treated as 'wall with 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 worse U-value 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 worse U-value may be appropriate.

Continuity of insulation

4.15 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.

4.16 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 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 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, perimeter insulation should be installed within the threshold zone or a reinforced cavity closure used.

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 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 methods to limit disruption to the insulation. For recessed meter boxes on the cold side of the construction, insulation should be installed behind the enclosure. For incoming services, insulation should fit tightly around ducts, pipes, and other penetrating items or obstructions.

Thermal bridging

4.17 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

4.18 To limit thermal bridging in new dwellings, all of the following apply.

a. **Drawings** should be provided for junctions. The designer and installer should review drawings to check that junctions are buildable and to ensure the sequence of construction is carefully considered for each detail. Complex details should be avoided wherever possible.

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

c. **Product specification:** opportunities should be considered to use products that help to reduce thermal bridges. Options include 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 Home Energy Model: Future Homes Standard assessment calculation and reported 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 designed to achieve continuity of insulation.

   i. Perimeter floor insulation should abut or extend the full depth of the main floor insulation.

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

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

g. **Intermediate floors:** floor-to-wall junctions should be designed to ensure that insulation in the external wall is continuous. For a timber frame where the intermediate floor structure breaches the external wall insulation, further insulation – of the same thickness as the insulation used in the external wall – should be included within the depth of the intermediate floor structure.

h. **Windows:** designs should minimise thermal bridging.

i. Lintels: consider using independent lintels with an insulated cavity closure between the inner and outer lintel. For common leaf lintels, the base plate should not be continuous and the lintel core should be insulated.

ii. Insulated cavity closers should be used for all construction types. Additionally, insulated plasterboard should be used in reveals to abut jambs and should be considered within reveal soffits.

i. **Roofs:** continue the insulation across the wall-to-eaves and wall-to-gable junctions.

i. Wall insulation should be installed to the top of the wall plate; in some places, such as the eaves, this may be above the cavity closure or barrier. In all cases, roof insulation should be continuous with wall insulation.

ii. Roofs insulated at ceiling level: loft insulation at the eaves should extend beyond the wall insulation without any reduction in thickness due to the pitch of the roof. The roof insulation should be installed when the eaves are still accessible. At gables and party walls, insulation should extend to the wall; if the space between the wall and joist is less than 100mm, perimeter insulation may be required.

iii. Roofs insulated at rafter level: at the eaves, insulation should extend to the top of the external wall. Voids between insulation at the top of the external wall and the cavity wall/timber frame insulation should be fully filled with insulation.

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

4.19 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 that contains independently assessed thermal junction details, such as Local Authority Building Control's Registered Construction Details library.

c. Use the values in the Standard Assessment Procedure, version 10.2, Table K1. A mixture of known and default values may be used.

NOTE: A different approach may be used for different elements on the same dwelling.

NOTE: When using the approach in 4.19 (a) or (b) above, an appropriate system of site inspection should be in place.

Thermal bridging in existing dwellings

4.20 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 Registered Construction Details library. Follow the guidance in paragraph 4.18 where appropriate.

Airtightness

Airtightness in new dwellings

4.21 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.

4.22 To ensure airtightness in new dwellings, all of the following apply.

a. **Drawings:** all relevant drawings should be provided to clearly identify the position, continuity and extent of the air barrier. Drawings should be reviewed by the designer and installer and should include specifications for key materials.

b. **Incoming services:** ducts, and cables wherever possible, should be grouped to minimise how often the air barrier is penetrated, while ensuring sufficient space to allow adequate screed flow between ducts. (Use temporary supports for services during floor works.) Grommets or flexible collars should be used around incoming services and sealed to the air barrier with air-sealing tape or sealant.

c. **Internal building services:** where services penetrate the air barrier, holes should be as small as possible and should be core drilled to limit damage. The penetrating services should be sealed to the air barrier using proprietary grommets or collars with air-sealing tape or sealant. Where membranes are penetrated, careful detailing should be used to achieve a robust and durable seal.

d. **Structural penetrations** should be effectively sealed for airtightness. Timber joist hangers should be considered as an alternative to penetrating through the inner leaf.

e. **Masonry walls:** mortar joints should be fully filled and pointed to both sides of a solid wall, to the inner leaf including within the cavity of a cavity wall, and to the inner leaves including within the cavity of a party wall. Where dense aggregate blocks have been used, plaster, parge coat or liquid membranes should be applied internally to reduce air permeability. Internal plasterboard linings are not appropriate as an air barrier solution.

f. **Timber frame:** the vapour control layer should overlap at seams and junctions and be taped where it forms the airtightness barrier. Any damage, such as tears, should be repaired before boarding. Where sheathing board forms the air barrier, air-sealing tape should be applied at junctions and edges.

g. **Fixings:** care should be taken to ensure that fixings do not damage the airtightness barrier.

h. **Windows and doors:** to ensure continuity of the air barrier, window and door units should connect to the primary air barrier, and window and door frames should be taped to surrounding structural openings, using air sealing tape. Compressible seals or gun sealant may be used to supplement taping.

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

j. **Materials**: to ensure that airtightness lasts for a suitable amount of time, the airtightness strategy should be designed to use adequate and proper materials which deliver the required performance, in accordance with Regulation 7 of the Building Regulations.

4.23 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

4.24 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 should be applied around service penetrations.

b. When installing or renovating thermal elements, the thermal element 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

4.25 In a new system, the following new pipework described in (a)-(c) should be insulated.

a. All primary circulation pipework for both of the following.

i. Heating circuits where pipework extends outside the heated living space. This includes where pipework passes through a void outside the heated living space, such as a roof void or ground floor void.

ii. Domestic hot water systems.

b. All pipework connected to a hot water storage vessel. This includes pre-plumbed pipework.

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

NOTE: For minimum standards for insulation of heat network systems see paragraphs 4.37 to 4.40.

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

4.27 Hot water and heating pipework should be insulated to the extent described in paragraph 4.28.

4.28 In a new system, hot water and heating pipework insulation should comply with the following.

a. For primary circulation pipework for heating or domestic hot water as described in paragraph 4.25(a), the insulation should be in accordance with all of the following.

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

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

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

b. For pipework connected to a hot water storage vessel, the insulation should extend to the greater of the following.

i. The point at which the pipework first meets a building element (i.e. a wall, ceiling or floor).

ii. At least 1m from the point at which the pipework connects to the hot water storage vessel.

This includes where pipework passes through a void outside the heated living space, including the loft space.

4.29 Refrigerant pipework for heat pumps in dwellings should be fully insulated. Refrigerant pipework should be insulated in accordance with paragraphs 4.26 to 4.28.

4.30 For new dwellings, heat pumps which serve individual dwellings should be located no more than 1 metre from the dwelling to minimise the length of pipework required between the heat pump and dwelling, while ensuring sufficient airflow and access for servicing.

Heat pumps that are part of a community heating system should be located as close as possible to the building to minimise the length of pipework between the heat pump and the dwelling.

4.31 In an existing system, when a heating appliance or hot water storage vessel is replaced, all accessible pipework in the dwelling should be insulated as described in paragraphs 4.25 to 4.28.

4.32 Heat losses from insulated pipework should not exceed those given in **BS 5422** for base level thicknesses of insulation 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**.

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

Table 4.4 Minimum thicknesses of pipework insulation for hot water services and space heating applications

Nominal internal pipe diameter (mm)	Minimum insulation thickness[1] (mm) for low temperature hot water systems
Less than or equal to 25	20
Less than or equal to 100	24

NOTE:

1. Thicknesses apply for insulation with a thermal conductivity of 0.035W/(m.K) or better. For other circumstances, consult **BS 5422**,

Hot water storage vessels

4.33 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 copper cylinders should comply with the heat loss and heat exchanger requirements of **BS 1566-1** as appropriate.

c. Indirectly heated hot water storage system products should comply with **BS EN 12897**.

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

Hot water storage vessels in new dwellings

4.35 In new dwellings, hot water storage vessels for a heating or domestic hot water system should have standing losses that do not exceed the heat losses given in Table 4.5.

Table 4.5 Maximum daily heat loss for hot water storage vessels in new dwellings[1]

Nominal volume (litres)	Heat loss (kWh/24h)	Nominal volume (litres)	Heat loss (kWh/24h)
50	0.52	400	1.43
100	0.65	500	1.70
150	0.78	600	1.96
200	0.91	700	2.22
250	1.04	800	2.48
300	1.17	900	2.74
350	1.30	1000	3.01

NOTE:
1. For sizes of hot water storage vessel not listed, the maximum daily heat loss from the hot water storage vessel should be determined by interpolation or extrapolation up to 2000 litres.

Hot water storage vessels in existing dwellings

4.36 In existing dwellings, newly installed or replacement hot water storage vessels for a heating or domestic hot water system should have standing losses that do not exceed the heat losses given in Table 4.6.

Table 4.6 Maximum daily heat loss for hot water storage vessels in existing dwellings[1]

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

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

Heat Networks

External pipework for district heat networks

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

4.38 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.

4.39 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.

Internal pipework for district heat networks

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

NOTE: Where the building heat distribution system is external, paragraphs 4.37 to 4.39 should be followed.

Heat interface units

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

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

a. For new dwellings, Table 4.5.

b. For existing dwellings, Table 4.6.

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

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

Requirement	
Requirement	*Limits on application*
Schedule 1 – Part L Conservation of fuel and power and minimisation of greenhouse gas emissions	
L1. Reasonable provision shall be made for the conservation of fuel and power and the minimisation of greenhouse gas emissions in buildings by—	
(a) limiting heat gains and losses—	
(i) through thermal elements and other parts of the building fabric; and	
(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;	
(b) providing fixed building services which—	
(i) are energy efficient to a reasonable standard;	
(ii) minimise greenhouse gas emissions;	
(iii) have effective controls; and	
(iv) 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), (iii) and L2 are met in a new dwelling by achieving all of the following.

a. Fixed building services that both:

   i. meet the minimum efficiencies in Section 6.

   ii. are appropriately sized, following paragraphs 5.9 to 5.10 and 5.12 to 5.16.

b. Controls to fixed building services are provided that both:

   i. meet the general controls for heating and hot water systems in paragraphs 5.18 to 5.26.

   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), (iii) and L2 are met in an existing dwelling by achieving all of the following.

a. Fixed building services that both:

   i. meet the minimum efficiencies in Section 6 and the criteria in paragraphs 5.4 and 5.5

   ii. are appropriately sized, following paragraphs 5.9 to 5.14 and 5.17.

b. Any fixed building services have controls that both:

   i. meet the standards for general controls for heating and hot water systems in paragraphs 5.19 to 5.31.

   ii. meet the standards for system specific controls in Section 6.

c. Any on-site electricity generation is both appropriately sized, following paragraph 5.8, and has controls.

Section 5: Carbon and energy performance of building services – 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 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 in Section 6.

b. The test data should be certified by a conformity assessment body accredited by UKAS to carry out this work.

New building services in new dwellings

5.3 For heating and hot water systems in new dwellings, paragraphs 5.9 to 5.10, 5.12 to 5.16 and 5.18 to 5.26 should be followed, in addition to the system specific guidance in Section 6.

5.4 For heating and hot water systems in new dwellings one of the following should apply:

a. The fuel used for each service should have both:

i. A carbon emissions factor, as listed in *The Future Homes Standard 2025: dwelling notional buildings for consultation*, of less than or equal to 0.086 $kgCO_2/kWh$

ii. A primary energy factor, as listed in *The Future Homes Standard 2025: dwelling notional buildings for consultation*, of less than or equal to 1.969 kWhPE/kWh.

NOTE FOR CONSULTATION: *The Future Homes Standard 2025: dwelling notional buildings for consultation* is available from : https://www.gov.uk/government/consultations/the-future-homes-and-buildings-standards-2023-consultation.

b. The service should be provided by a district heat network.

NOTE: If a heating or hot water system is able to use more than one type of fuel, then the assessment in paragraph 5.4(a) should be made using the fuel with the greatest emissions factor.

Replacement building services in existing dwellings

5.5 A replacement fixed building service should be at least as efficient as the value in Section 6, and should comply with either of the following.

a. If the service uses the same fuel as the service being replaced: it should have an efficiency that is not lower than that of the service being replaced.

b. If the service uses a different fuel than the service being replaced: it should both:

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

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

NOTE: If the efficiency of the appliance being replaced is not known, the Standard Assessment Procedure version 10.2, Tables 4a and 4b, should be used but with no adjustments from Tables 4c and 4d.

NOTE: CO_2 emission factors and primary energy factors should be taken from the Standard Assessment Procedure version 10.2, Table 12.

NOTE: Where a heat pump is installed which meets the minimum efficiency standards in this approved document, it should be deemed to comply with paragraph 5.5 without the need to carry out this calculation.

Worked example

Replacing an old oil-fired boiler that has emissions of 0.298kgCO_2/kWh and primary energy of 1.180kWh$_{PE}$/kWh at 85% efficiency with an LPG boiler that has 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 with paragraph 5.5. The new boiler is also at least as efficient as the minimum efficiency set out in Section 6.

5.6 Where a replacement fixed building service uses a different fuel than the service being replaced in a home with very low heat loss, a higher primary energy demand for the new heating appliance may be acceptable. For example, a higher primary energy demand may be acceptable when replacing a gas boiler with direct electric heaters as part of a deep retrofit project where the resulting heat loss of the dwelling is less than 25kWh/m^2 per year.

5.7 Facilitating future connection to any local district heat networks should be considered – for example by providing capped off connections in pipework to allow later connection to a local district heat network.

Replacing on-site electricity generation in existing dwellings

5.8 If renewable technology such as a wind turbine or photovoltaic array is replaced, the new system should have a kWp output that is at least that of the original installation. For further guidance on replacing on-site electricity generation systems, see Section 6.

Sizing heating systems

Sizing space heating systems in new and existing dwellings

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

a. The heat loss calculation in **BS EN 12831-1** for the dwelling.

b. A sizing methodology that takes account of the properties of the dwelling.

Systems should not be oversized.

NOTE: The following methods can be used to design the space heating system following the design procedure in 5.9(a).

i. The sizing methodology in the Chartered Institute of Plumbing and Heating Engineering's Plumbing Engineering Services Design Guide.

ii. For systems that include heat pumps, the MCS space heating design procedure in MIS 3005-D.

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

5.10 Where a wet heating system is either:

a. newly installed

b. fully replaced, 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 to meet the heating needs of the dwelling, at a maximum flow temperature of 55°C.

In existing dwellings, where it is not feasible to install a space heating system that can operate at a maximum flow temperature of 55°C (e.g. where there is not enough space for larger radiators, or the existing distribution system receives higher temperature heat from a low carbon district heat network) the space heating system should be designed to the lowest design temperature that will meet the heating needs of the dwelling.

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

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

Sizing heat pump heating systems

5.12 Usually, heat pumps will be sized based on the space heating demand, not the domestic hot water demands. Reversible heat pump systems (i.e. those that provide both cooling and heating) should be designed to be optimised for heating. A primary heating system containing heat pumps, i.e. heat pump only systems and hybrid systems, should be selected to meet the full space heating requirement at the design condition chosen for heat loss calculations in paragraph 5.9. It should not be assumed that any heat will be supplied by additional secondary heaters to meet the calculated design demand of a dwelling.

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

5.14 Heat pump systems should be inverter driven and selected to modulate to the typical mid-season heating load of the dwelling.

Sizing domestic hot water systems

NOTE: For temperature limits to control legionella bacteria in domestic hot water systems, see Approved Document G. Guidance on commissioning hot water storage vessels can be found in Section 8.

Sizing domestic hot water systems in new dwellings

NOTE: The electricity tariff is an important consideration when hot water is produced using electricity and is stored. Using an off-peak time-of-use tariff (such as Economy 7) with a hot water storage vessel sized using the method set out in paragraph 5.15 will generally mean lower fuel costs and lower carbon emissions compared to using a standard electricity tariff. The hot water system should be set-up to heat the water at off-peak times. On an off-peak tariff, charging periods throughout the day can still provide additional heat to the hot water storage vessel if required.

5.15 In new dwellings, domestic hot water storage vessels used with heat pumps and electric immersion heaters should be sized based on the domestic hot water usage of the dwelling using the approved calculation methodology (the Home Energy Model: Future Homes Standard assessment). The Home Energy Model: Future Homes Standard assessment will output the volume of the notional hot water storage vessel, which is the recommended size of hot water storage vessel to install.

NOTE: The notional hot water storage vessel is sized using the 75th percentile of daily hot water demands over one year. This is called the daily hot water usage for hot water storage vessel sizing. The daily hot water usage and corresponding hot water storage vessel sizes are in Table 5.1.

Systems should not be oversized.

NOTE: The hot water storage vessel sizing calculation is based on a standard occupancy of a dwelling. In some situations, it may be appropriate to install a larger or smaller hot water storage vessel than that in the Home Energy Model: Future Homes Standard assessment.

Example situations include where the actual occupancy or hot water demand of a dwelling is known and differs from the standard occupancy or hot water demands of the Home Energy Model: Future Homes Standard assessment. A Home Energy Model calculation using non-standardised occupancy can be used to produce an alternative daily hot water usage for hot water storage vessel sizing.

NOTE FOR CONSULTATION: The Home Energy Model consultation tool does not allow for the Home Energy Model to be run without the Future Homes Standard assessment wrapper. An 'open' version of the Home Energy Model will be available in the future, where inputs can be varied.

5.16 In new dwellings, the heating appliance and the heat exchanger within the hot water storage vessel should ensure a reheat time of 60 minutes or less from a setback temperature of 52 °C to the setpoint temperature of 60 °C. Reheat time can be determined using the following equation from **BS 8558**.

$$M = \frac{(V \times T)}{(14.3 \times P)}$$

where M is reheat time in minutes, V is volume of water heated in litres, T is temperature rise in degrees Celsius and P is the rate of heat input to the hot water in storage vessel kilowatts.

Table 5.1 Sizes of domestic hot water storage vessel used with heat pumps for new dwellings with standard occupancy

Daily hot water usage for hot water storage vessel sizing (kWh)	Hot water storage vessel size[1] (litres)
11.1	415
10.3	390
9.6	365
8.9	340
8.1	315
7.4	290
6.7	265
5.9	240
5.2	215
4.4	190
3.7	165

NOTE:

1. If the size of hot water storage vessel size is unavailable, the next largest size available should be selected.

NOTE FOR CONSULTATION: The consultation tool for the Government's Home Energy Model: Future Homes Standard assessment is available at the following webpage: www.homeenergymodelconsultation.org.uk. The domestic hot water storage vessel sizing function will not be available in the consultation tool.

Sizing domestic hot water systems in existing dwellings

5.17 In existing dwellings, domestic hot water systems should be sized for the anticipated demand for domestic hot water in the dwelling, based on **BS EN 12831-3**. Systems should not be significantly oversized.

NOTE: The Chartered Institute of Plumbing and Heating Engineering's *Plumbing Engineering Services Design Guide* can be used to carry out this calculation.

Controls for heating and domestic hot water systems

System controls and zoning

5.18 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.

5.19 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.

5.20 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.

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

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

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

Thermostatic room controls

5.24 For heating systems in new dwellings, or when a heat generator such as a boiler is replaced in an existing dwelling, each room should be provided with thermostatic room controls. These controls should be able to separately adapt the heating output in each room served by the heating appliance, or, where justified in accordance with paragraph 5.25, in each heating zone.

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

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

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

b. Dwellings with buffer zones for heat absorption or dissipation with high thermal mass.

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

a. In single-storey open-plan dwellings in which the living area is greater than 70% of the total floor area. In such cases, the dwelling should be considered as one heating zone.

b. Where two adjacent rooms have a similar function and heating requirements (e.g. kitchen and utility room). In such cases, the adjacent rooms should be considered as one heating zone.

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

NOTE: Commissioning heating systems is covered in Section 8.

5.26 The standards in paragraphs 5.24 and 5.25 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. Heat emitters in the same room as the thermostat should have manual controls.

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

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

Controls in existing heating and domestic hot water systems

5.27 In addition to paragraphs 5.24 to 5.26, work on existing systems should incorporate the controls detailed in paragraphs 5.28 to 5.31.

5.28 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.

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

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

5.31 If a boiler is replaced, the boiler controls should meet the standards in Section 6 for the relevant wet heating system. (Boiler controls are considered to be part of the boiler installation.)

Metering in new dwellings

NOTE: It is recommended that smart meters are installed in new dwellings in line with the DESNZ guide on installing and commissioning smart meters: *Smart meter installations in domestic new build premises*.

Section 6: Carbon and energy performance of building services - System specific guidance

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

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

Heat pump heating systems

NOTE: For heat pumps that provide comfort cooling, guidance is also given in paragraphs 6.48-6.52.

6.1 All heat pumps should meet Ecodesign product regulations. The applicable Ecodesign Regulations for different types of heat pump and uses are set out in Table 6.1.

NOTE: Table 6.1 references domestic size heat pumps. For larger heat output heat pumps and heat pumps used for domestic hot water heating *only* see Section 6 of Approved Document L, Volume 2: Buildings other than dwellings.

Table 6.1 Ecodesign Regulations applicable to different types of heat pump

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

6.2 The heat pump unit should include all of the controls applicable to that type of heat pump set out in Table 6.2.

Table 6.2 Minimum requirements for controls for different types of heat pump units in new and existing dwellings

Heat pump type	Minimum requirements for controls
All types	a. Heat pumps should meet the general requirements for heating and hot water systems in Section 5. b. The original equipment manufacturer controls should be the primary controls. Any additional controls should not reduce the functionality of the original equipment manufacturer controls, including modulation.
Air-to-water	a. To protect against air flow failure. b. To control outdoor fan operation. c. To provide a defrost control for the external air-side heat exchanger. d. To control internal water pump operation. e. To control water temperature for the distribution system.
Air-to-air	a. To protect against air flow failure. b. To control outdoor fan operation. c. To provide a defrost control for the external air-side heat exchanger. d. To control secondary heating (if fitted). e. To control air temperature.
Ground-to-air and water-to-air	a. To protect against water flow failure. b. To control external water pump operation. c. To control air temperature.
Ground-to-water and water-to-water	a. To protect against water flow failure. b. To control water pump operation (internal and external). c. To control water temperature for the distribution system.

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

a. Weather compensation or internal temperature control.

b. A timer or programmer for space heating.

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

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

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

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

Gas-fired heating systems

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

a. The minimum efficiencies in Table 6.3.

b. The general requirements for heating and hot water systems in Section 5.

Table 6.3 Minimum efficiencies for gas-fired heating systems in existing dwellings

System type	Minimum efficiency	Notes
Wet heating (e.g. radiators or underfloor heating)	92% (as defined in ErP[1])	Or, in exceptional circumstances in existing dwellings[2], SEDBUK 2009 efficiencies as follows: • 78% for natural gas • 80% for LPG Follow paragraph 6.9
Range cooker with integral central heating boiler	75% (as defined in SEDBUK 2009)	Follow paragraph 6.10
Warm air heating	**BS EN 17082**	If a gas-fired circulator is incorporated for domestic hot water, its full and part load efficiency should meet **BS EN 15502-2** Follow paragraph 6.11
Independent space heating appliance for primary and secondary space heating	63% gross 70% net	Gross efficiency using the following standards as appropriate: • **BS EN 1266** • **BS 7977-1** • **BS EN 613** • **BS EN 13278** Follow paragraph 6.12
Inset live fuel-effect combined fire/back boiler	45% for natural gas 46% for LPG	Gross efficiency using **BS 7977-2** Follow paragraph 6.13
All types except inset live fuel-effect combined fire/back boiler	63% for natural gas 64% for LPG	Gross efficiency using **BS 7977-2** as appropriate

NOTES:

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

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

a. Flue gas heat recovery.

b. Weather compensation.

c. Load compensation.

d. Smart thermostat with automation and optimisation.

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

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

6.11 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.

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

a. An appliance for primary space heating should meet 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**.

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

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

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.

Oil-fired heating systems

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

a. The minimum efficiencies in Table 6.4.

b. The general requirements for heating and hot water systems in Section 5.

Table 6.4 Minimum efficiencies for oil-fired heating systems in existing dwellings

System type	Minimum efficiency	Notes
Wet heating – regular boiler	91% (as defined in ErP[1])	Or, in exceptional circumstances[2] in existing 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 6.16
Fixed independent space heating	60% (converted using Table E4 of the Standard Assessment Procedure version 10.2)	

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*.

6.16 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.

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

a. For a manually operated appliance, no further control is required above the integral manual controls that the appliance manufacturer provided.

b. For an electrically operated 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. Electric radiant heating systems should not be assumed to be have an efficiency greater than 100%.

NOTE: This section does not cover either of the following.

a. Electric heat pumps (guidance is provided in paragraphs 6.1 to 6.7).

b. Portable electric heating devices.

6.18 Electric heating systems should meet the guidance in paragraphs 6.19 to 6.21, in addition to the general requirements for heating and hot water systems in Section 5.

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

a. Automatic control of input charge should be provided.

b. The rate of heat release from the appliance should be adjustable, using an adjustable damper or other thermostatically controlled method.

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

a. Each room.

b. Each appliance, where this meets the guidance for thermostatic room controls in paragraphs 5.24 to 5.26.

6.21 For an electric warm air system that is either a new system or 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 5.24 to 5.26.

Solid fuel heating systems

6.22 Solid fuel appliances for primary and secondary heating in new and existing dwellings should have a minimum efficiency (gross calorific value) as given in Table 6.5 for the category of appliance.

6.23 A solid fuel appliance in category D1/2/3/4, F, G2, J2 or J5 of Table 6.5 that is used to deliver primary heating as part of a central heating system should comply with all of the following.

a. Meet the general requirements for heating and hot water systems in Section 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.

6.24 A solid fuel appliance used to deliver primary heating that is either part of a new central heating system or is a replacement component in a central heating system should meet both of the following.

a. The appliance should be from category D, F, G or J in Table 6.5.

b. The appliance should have a ratio of room heat to water heat appropriate for the room and the total property.

Table 6.5 Solid fuel appliance categories and minimum efficiencies

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

NOTES:

1. These categories are set out in *The HETAS Guide to Approved Solid Fuel, Wood and Biomass Products and Services.*
2. Efficiencies are measured at normal rated output and based on a gross calorific value (this takes into account energy that will be lost as latent heat in water vapour during combustion). Efficiencies should be determined using the appropriate efficiency test method from British Standards.
3. Efficiencies based on net calorific value can be converted to efficiencies based on gross calorific value using the appropriate conversion factor in the Standard Assessment Procedure version 10.2, Table E4.

District heat networks and communal heat networks

6.25 Paragraphs 6.26 to 6.31 apply when connecting dwellings to a district heat network or communal heat network 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 6 or more dwellings.

Connecting to a new communal heat network

6.26 The central heat source in a new communal heat network should comply with the standards in Section 6 of Approved Document L, Volume 2: Buildings other than dwellings.

NOTE: Where a district heat network or communal heat network connects to fewer than 6 dwellings, the central heat source should meet the standards in this Approved Document.

Minimising energy used by pumps

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

a. The design temperature difference for the primary circuit of the district heat network or communal heat network should be a minimum of 20°C. Heat pump-led district heat networks or communal heat network may, however, need to run at a lower temperature difference.

b. Variable volume control systems should be used to reduce the volume of water and the pressure difference required from the pumps under part load.

Controls for district heat networks and communal heat networks

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

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

Heat interface units and hot water storage in new dwellings

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

NOTE: Heat interface units and any dedicated ancillary products such as hot water storage vessels should meet minimum standards in Section 4 and 5 for domestic hot water and heating systems.

Metering for district heat networks and community heating systems

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

Micro combined heat and power systems

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

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

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

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

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

Underfloor heating systems

Zoning and controls

6.34 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 6.35 to 6.39.

NOTE: Standards on thermostatic room controls in 5.24 – 5.26 apply to underfloor heating.

Minimising heat losses

6.35 Ground floors and those in contact with the outside of the dwelling should be insulated to limit downwards heat losses to no 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.

6.36 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 to limit heat losses.

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

a. The performance in paragraph 6.35.

b. Thermal resistance of either of the following

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

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

6.38 In new dwellings, the total thermal resistance of all floor coverings used above underfloor heating systems should be 0.15 (m^2.K)/W or less. This means that some types of carpet floor coverings may be unsuitable for use with underfloor heating systems.

6.39 Distribution pipework which does not provide useful heat to a room should be insulated to the standards in paragraph 4.32.

Specific standards for electric underfloor heating

6.40 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.

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

a. A minimum of 20% of the floor area of the dwelling should have fast-response systems, such as panel heaters.

b. Controls should be installed which modify the input charge in response to both of the following.

i. The room thermostat.

ii. Floor temperature sensing.

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

Solar water heating systems

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

a. A solar collector area of less than 20m^2.

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

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

a. Thermal performance.

b. Reporting and identification.

6.44 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.

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

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

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

b. Minimise the accidental loss of stored energy.

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

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

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

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

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

b. Equivalent to at least 80% of the daily hot water demand (as defined by the Standard Assessment Procedure for existing dwellings or the Home Energy Model: Future Homes Standard assessment for new dwellings).

NOTE: Domestic hot water storage vessels and pipework associated with the solar water heating system should follow the minimum standards in Section 4 to minimise heat losses.

Comfort cooling

6.48 The specification of comfort cooling systems should be based on a calculated heat gain 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.

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

a. For new dwellings, a minimum of 5.1.

b. For existing dwellings, a minimum of 4.0.

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

6.50 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.

6.51 For cooling systems that serve multiple dwellings, the guidance in Approved Document L, Volume 2: Buildings other than dwellings should be followed.

6.52 Exposed refrigeration pipework should be both of the following.

a. Insulated in accordance with paragraph 4.29.

b. Enclosed in protective trunking.

Mechanical ventilation

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

6.54 The specific fan power for mechanical ventilation systems should not exceed the values in Table 6.6.

Table 6.6 Maximum specific fan power (SFP) for mechanical ventilation systems in new and existing dwellings

Mechanical ventilation system type	Specific fan power (W/L.s)	
	New dwellings	Existing dwellings
Intermittent extract ventilation system	0.5	
Continuous decentralised mechanical extract ventilation system	0.2	
Continuous centralised mechanical extract ventilation system	0.5	0.7

Continuous supply ventilation system	-	0.5
Continuous mechanical supply and extract ventilation system	1.4	1.5

6.55 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

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

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

6.57 Where installed in a new or existing dwelling, each internal luminaire should have light sources with a minimum luminous efficacy of 105 light source lumens per circuit-watt.

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

6.59 Where fixed external lighting is installed in a new or existing dwelling, each external luminaire should have a minimum luminous efficacy of 105 light source lumens per circuit-watt.

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 the luminaire off in response to daylight.

b. Controls which switch the luminaire off after the area lit becomes unoccupied as follows.

i. For luminaires with a total luminous flux of greater than 1200lm, automatic proximity sensors should be used.

ii. For luminaires with a total luminous flux of 1200lm or less, 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 building automation and control system should be specified and installed according to the manufacturer's instructions to ensure that its overall performance meets a reasonable standard.

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

6.66 When replacing an existing on-site electricity generation system, the installed generation capacity of the new system should be no less than that of the existing system, except where a smaller system can be shown to be more appropriate 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 and storage systems should be provided with controls to allow proper operation of the system without the need for user intervention. This is particularly the case where storage systems such as batteries are used.

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 building control 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 building control authority not later than seven days after the final test is carried out.

(4) A local authority building control 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.

(6) Where the regulator is the building control authority by virtue of section 91ZB of the Act (the regulator: building control authority for other work), it must send a copy of each notice or certificate it receives under this regulation in relation to a building to the local authority for the area in which the building is situated.

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 air pressure testing in accordance with paragraphs 7.2 to 7.5 and 7.7 to 7.8. Paragraph 7.2 provides the approved procedure for testing and reporting to meet Regulation 43.

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 7.6 to 7.8.

b. The requirements of Part L1(a)(i) of Schedule 1 to the Building Regulations, in accordance with paragraphs 7.1 and 7.6.

Section 7: Air permeability and pressure testing

7.1 The minimum standard for air permeability of a new dwelling is given in Section 4, Table 4.1. Measured air permeability is established by an air pressure test.

Air pressure testing procedure

7.2 Air pressure tests should be performed following the guidance in the approved airtightness testing methodology, CIBSE's TM23 *Testing Buildings for Air Leakage*. The procedures for testing and reporting in that document have been approved by the Secretary of State.

Showing compliance and reporting pressure test results

7.3 The building control body should be given evidence that pressure testing equipment was calibrated using a UKAS-accredited facility or by the original manufacturer in accordance with all of the following.

a. A period in accordance with manufacturer's guidance.

b. At least once every 24 months.

c. CIBSE TM23 *Testing Buildings for Air Leakage*.

7.4 Building control bodies may accept a pressure test certificate from a person registered by any organisation listed in Regulation 43(4) as evidence that the testing has been carried out in accordance with the approved procedure in paragraph 7.2.

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

a. Has received appropriate training.

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

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

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

7.7 If a dwelling does not achieve the criteria in paragraphs 7.1 and 7.6, the dwelling air permeability should be improved and retested, until the criteria are achieved.

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

Regulations 44 and 44ZA and requirements L1(b)(iv) and L2(b): Commissioning fixed building services and on-site electricity generation systems

This section deals with the requirements of regulations 44 and 44ZA and Part L1(b)(iv) 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 also 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 building control 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 must be given— (a) in the case where the building work is higher-risk building work for which an application for a completion certificate is required, to the regulator with the application; (b) in any other case, to the building control authority— (i) not later than the date on which the notice required by regulation 16(4) is required to be given; or (ii) where that regulation does not apply, not more than 30 days after completion of the work. (5) Where the regulator is the building control authority by virtue of section 91ZB of the Act (the regulator: building control authority for other work), it must send a copy of each notice it receives under this regulation in relation to a building to the local authority for the area in which the building is situated.

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 building control authority a notice confirming that the system for on-site electricity generation has been commissioned.

(3) The notice must be given—

(a) in the case where the building work is higher-risk building work for which an application for a completion certificate is required, to the regulator with the application;

(b) in any other case, to the building control authority—

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

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

(4) Where the regulator is the building control authority by virtue of section 91ZB of the Act (the regulator: building control authority for other work), it must send a copy of each notice it receives under this regulation in relation to a building to the local authority for the area in which the building is situated.

Requirement

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

(iii) have effective controls; and

(iv) 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)(iv) 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 of this approved document. Section 8 provides approved procedures for commissioning to meet Regulations 44 and 44ZA.

Section 8: Commissioning fixed building services and on-site electricity generation systems

8.1 Both of the following must be commissioned.

a. Fixed building services must be commissioned to ensure that they use no more fuel and power than is reasonable in the circumstances.

b. On-site electricity generation systems must be commissioned to ensure that they produce as much electricity as is reasonable in the circumstances.

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

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

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

a. Which systems to test.

b. How these systems will be tested.

c. The fixed building services and on-site electricity generation systems that do not need to be commissioned, and why they do not need to be commissioned.

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

Notice of completion of commissioning

8.4 A notice of completion of commissioning must be given to the relevant building control body to confirm that the installed fixed building services and on-site electricity generation systems were commissioned according to the procedures in Section 8.

The notice should confirm all of the following.

a. That the commissioning plan was followed.

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

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

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

a. If a building notice or full plans have been given to a local authority building control body, the notice of completion of commissioning should be given within five days of the work being completed.

b. If the building control body is an approved inspector, the notice should generally be given to the approved inspector within five days of the work being completed.

c. If the building work is higher-risk building work that requires a completion certificate, the notice must be given to the Building Safety Regulator with the application for a completion certificate.

d. In other cases – for example, if the work is carried out by a person registered with a competent person scheme – the notice must be given to the building control body within 30 days of the work being completed.

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

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

System specific guidance for commissioning

Hot water systems for space and domestic hot water heating

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

a. All central heating and primary hot water circuits should be thoroughly cleaned and flushed out.

b. A suitable chemical inhibitor should be added to the primary heating circuit to protect against scale and corrosion.

c. In hard water areas, suitable measures should be taken to treat the feed water to water heaters and the hot water circuit of combination boilers to reduce limescale accumulation.

d. Domestic central heating systems should be prepared and commissioned to **BS 7593**.

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

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

NOTE: An example commissioning checklist can be found in MCS' MIS 3005-I:*The Heat Pump Standard (Installation)*.

NOTE: For guidance on temperature control of hot water storage vessels see HSE guidance, including *Legionnaire's disease. The control of legionella bacteria in water systems. Approved code of practice* (L8) and *Legionnaire's disease. Part 2: The control of legionella bacteria in hot and cold water systems* (HSG274).

Heat pump heating systems

8.10 Heat pumps and any dedicated ancillary products such as integrated hot water storage vessels should be commissioned in accordance with both the manufacturer's instructions and the appropriate system design parameters.

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

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

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

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

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

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

Communal heat network

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

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

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

i. Appropriate return temperatures.

ii. Calibrated control valves.

Underfloor heating systems

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

On-site electricity storage systems

8.15 On-site electricity storage and battery systems that are connected to on-site electricity generation should be commissioned in accordance with the commissioning requirements of MCS' MIS 3012: *The Battery Standard (Installation*).

Regulation 11F: Competence: general requirement

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

Regulation
Competence: general requirement **11F.**—(1) Any person carrying out any building work or any design work must have— (a) where the person is an individual, the skills, knowledge, experience and behaviours necessary, (b) where the person is not an individual, the organisational capability, to carry out— (i) the building work in accordance with all relevant requirements; (ii) the design work so that the building work to which the design relates, if built, would be in accordance with all relevant requirements. (2) Any person carrying out any building work as a contractor or any design work as a designer must have— (a) where the person is an individual, the skills, knowledge, experience and behaviours necessary, (b) where the person is not an individual, the organisational capability, to fulfil the duties of a contractor or designer, as the case may be, under these Regulations in relation to the work. (3) The requirements in paragraphs (1) and (2) do not apply to an individual (T) who is in training to fulfil those requirements. (4) The person who asked T to carry out any building work or, as the case may be, any design work must ensure T is adequately supervised when carrying out the work. (5) A person who is in training to fulfil the requirements of a principal contractor or a principal designer may not be appointed as a principal contractor or a principal designer.

Section 9: Installation, certification, inspection and testing of heat pump systems

General

9.1 For the installation of systems which use heat pumps as a heating source, extra care should be taken to make sure that both:

a. the person carrying out the work is suitably competent (for example, they are a registered competent person).

b. the work meets the requirements of the Building Regulations.

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

a. Self-certification by a registered competent person.

b. Certification by a building control body.

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

a. heat losses from hot water and heating pipework are limited, following paragraph 4.25 to 4.32.

b. heat losses from hot water storage vessels are limited, following paragraph 4.35 to 4.36.

c. heat pump systems have been sized appropriately, following paragraphs 5.9 to 5.14.

d. new hot water storage vessels in dwellings have been appropriately sized, following paragraphs 5.15 to 5.17.

e. the system has adequate controls, following paragraphs 5.18 to 5.31.

f. the heat pump system meets the efficiencies set out in 6.1 to 6.7.

Self certification by a registered competent person

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

a. Install and commission the system to the standards set out in this approved document.

b. Give notice to the building control body that commissioning has been carried out in accordance with this approved document.

NOTE: Using an installation checklist of the standards in paragraph 9.3 is recommended to make sure that the relevant standards have been met.

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

a. Give a copy of the Building Regulations compliance certificate to the occupier.

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

Certification by a building control body

9.6 If a heat pump installer is not a registered competent person, then before work begins the installer must either notify the local authority or arrange for a Registered Building Control Approver to oversee the work.

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

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

NOTE: Using an installation checklist of the standards in paragraph 9.3 is recommended to make sure that the relevant standards have been met.

Regulations 40 and 40A: Providing information to owners about the building, fixed building services and maintenance requirements

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 both of the following.

a. Operating and maintenance instructions for fixed building services and on-site electricity generation, in accordance with paragraphs 10.1 and 10.2.

b. Other important documentation, in accordance with paragraphs 10.3 to 10.6.

In the Secretary of State's view, when work is carried out on an existing dwelling, the requirements of regulations 40 and 40A are met 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 10.1 and 10.2.

b. Relevant information for work on existing systems, in accordance with paragraphs 10.7 to 10.10.

Section 10: Providing information to owners about the building, fixed building services and maintenance requirements

Operating and maintenance instructions

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

The instructions should be sufficient to help 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.

10.2 For a new dwelling and for work on 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. Identify where to find other important documentation, such as appliance manuals.

c. Include a completed commissioning sheet, where relevant.

d. Include the additional information specified below for new buildings (paragraphs 10.3-10.6) or for work in existing dwellings (paragraphs 10.7-10.10).

Additional information for new dwellings

10.3 For new dwellings, both of the following should be given to the homeowner.

a. A signed copy of the Building Regulations England Part L compliance report (BREL report).

b. Photographic evidence of the build quality.

10.4 For new dwellings, the operating and maintenance instructions should direct readers to 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.

10.5 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 advise 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.

NOTE FOR CONSULTATION: The Home User Guide template will be updated following feedback from the consultation.

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

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

a. Details of the heat loss calculation carried out for the heat pump heating system. Details should include all of the following.

i. Design internal room temperature(s).

ii. Design external air temperature.

iii. Date of calculation.

b. Design flow temperature of the heat pump heating system.

c. Confirmation of whether the person carrying out commissioning is registered with a competent person scheme. If so, the name of that scheme should be provided.

d. Size of emitter circuit.

e. Minimum set back temperatures.

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

Additional information for work in existing dwellings

10.7 For existing dwellings, when building work is carried out for which Section 5 and/or Section 6, set 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.

10.8 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 any of the following.

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.

10.9 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.

10.10 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 10.8 should be followed. Such work may include the following.

a. A change in heating fuel for a space heating or domestic hot water system.

b. Extending or expanding the capacity of a space heating, comfort cooling or ventilation system by over 25% of its previous capacity.

Regulation 23(2) and requirement L1(a): Replacing thermal elements and limiting heat gains and losses in existing dwellings

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 and minimisation of greenhouse gas emissions	
L1. **Reasonable provision shall be made for the conservation of fuel and power and the minimisation of greenhouse gas emissions in buildings by**—	
(a) limiting heat gains and losses—	
(i) through thermal elements and other parts of the building fabric; and	
(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;	
(b) providing fixed building services which—	
(i) are energy efficient to a reasonable standard;	

(ii) minimise greenhouse gas emissions;

(iii) have effective controls; and

(iv) 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 11.

Section 11: Replacing thermal elements and limiting heat gains and losses in existing dwellings, including extensions

General

11.1 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 11.2.

b. Providing a replacement thermal element in an existing dwelling – follow paragraph 11.2.

c. Replacing windows, doors or rooflights (controlled fittings) in an existing dwelling – follow paragraphs 11.3 to 11.6.

d. Extending an existing dwelling – follow paragraphs 11.7 to 11.11.

e. Adding a conservatory or porch to an existing dwelling – follow paragraphs 11.12 and 11.13.

NOTE: Guidance for renovating elements in existing dwellings is given in Section 12.

New and replacement thermal elements

11.2 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. Replacement thermal elements in an existing dwelling.

New and replacement windows, roof windows, rooflights and doors (controlled fittings)

11.3 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 in Table 4.2.

c. Insulated cavity closers should be installed where appropriate.

11.4 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 a supporting audit trail from calculating the performance of the window or door through to the window or door being installed.

11.5 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, measures should be taken to improve the energy efficiency of the dwelling.

11.6 The term controlled fitting refers to the entire unit of a window, roof window, rooflight or door, including the frame. Replacing glazing or replacing 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

11.7 When a dwelling is extended, compliance can be demonstrated by using one of the following methods.

a. The elemental method in paragraph 11.8.

b. The area-weighted method in paragraph 11.9.

c. The Standard Assessment Procedure method in paragraph 11.10.

11.8 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 both 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.

11.9 As an alternative to paragraph 11.8, 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 11.7.

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.

11.10 As an alternative to paragraphs 11.8 or 11.9, the Standard Assessment Procedure may be used to show that the dwelling primary energy rate, the dwelling emission rate and dwelling fabric energy efficiency rate for the dwelling plus 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 11.8. The openings in the notional extension should conform with paragraph 11.8(d), with the door area set as equal to the door area of the proposed extension and other openings being classified as windows.

NOTE: Where the performance of elements of the existing dwelling is unknown, data in the Standard Assessment Procedure version 10.2, Appendix S should be used to estimate the performance.

11.11 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 .

11.12 When an existing dwelling with a total useful floor area of over 1000m^2 is extended, consequential improvements may be required. Section 12 should be followed.

Conservatories and porches

11.13 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 11.7 to 11.12 should be followed.

11.14 If the conservatory or porch is not exempt from the energy efficiency requirements (see paragraph 0.14), all of the following elements should meet the minimum standards in 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 11.8(d) do not apply.

In addition, both of the following 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 control and on/off controls.

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

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 and minimisation of greenhouse gas emissions	
L1. Reasonable provision shall be made for the conservation of fuel and power and the minimisation of greenhouse gas emissions in buildings by—	
(a) limiting heat gains and losses—	
(i) through thermal elements and other parts of the building fabric; and	
(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;	
(b) providing fixed building services which—	
(i) are energy efficient to a reasonable standard;	
(ii) minimise greenhouse gas emissions;	
(iii) have effective controls; and	

(iv)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 12.

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 and minimisation of greenhouse gas emissions)

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).

(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 12.

Section 12: Work to thermal elements in existing dwellings

General

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

a. Renovating an existing thermal element in an existing dwelling – follow paragraphs 12.2 to 12.4.

b. Making a material change of use to a dwelling – follow paragraphs 12.5 to 12.8.

c. Making a change to a dwelling that constitutes a change to energy status – follow paragraphs 12.6 to 12.8.

NOTE: For new and replacement elements in existing dwellings, the guidance in Section 11 should be followed.

Renovating thermal elements

12.2 Renovating a thermal element means one of the following.

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

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

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

d. Replacing the waterproof membrane on a flat roof.

e. Providing cavity wall insulation.

12.3 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 in Table 4.3, column (b).

a. More than 50% of the surface of the thermal element is renovated (see paragraph 12.4).

b. The work constitutes a major renovation, because 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 renovating an existing thermal element that are technically, functionally or economically feasible.

12.4 When assessing the percentage area that will be renovated of a thermal element, consider whether the element is being renovated from outside or inside the dwelling, following Diagram 12.1 and Diagram 12.2, respectively.

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.

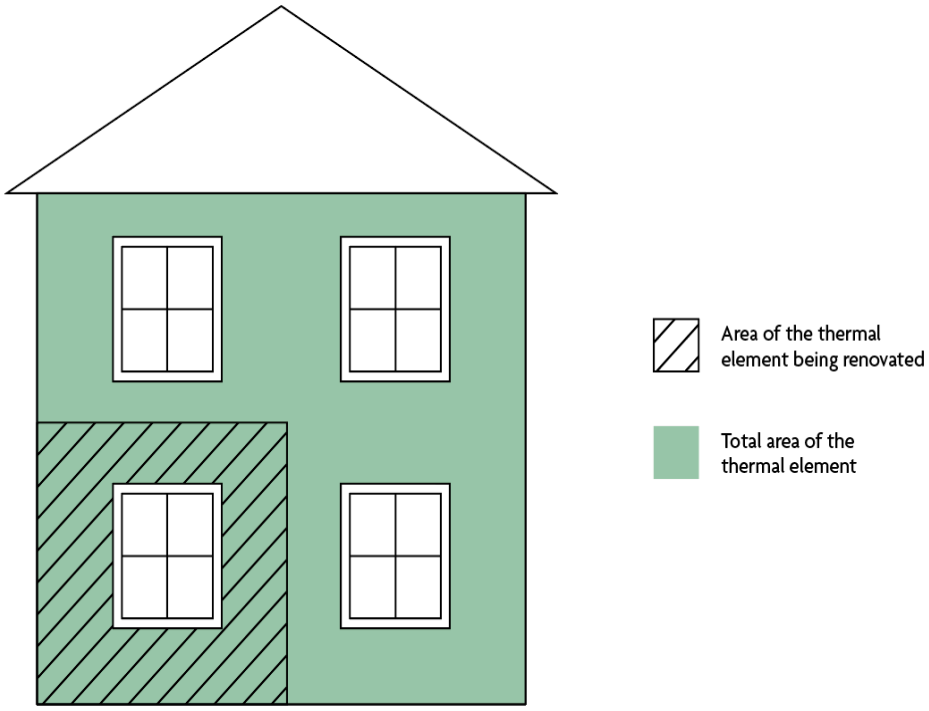


Diagram 12.1 Renovation of a thermal element from the outside

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.

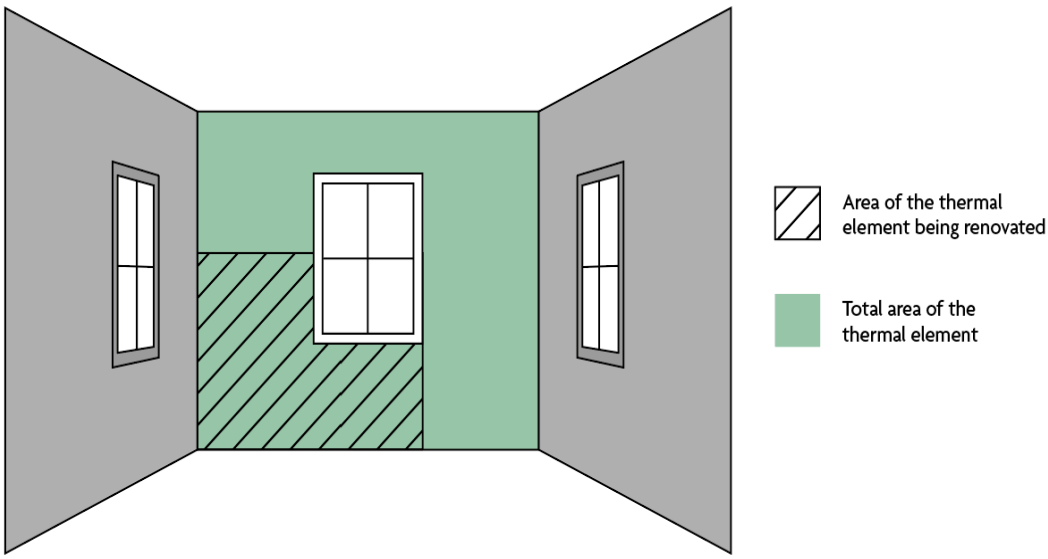


Diagram 12.2 Renovation of a thermal element from the inside

Material change of use and change to energy status

12.5 A material change of use, in relation to dwellings, is any of the following.

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

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.

NOTE: A building is defined as a whole building or part of a building. The following standards apply if both the whole building or part of a building is undergoing a material change of use.

12.6 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 whole building 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.

12.7 If there is a material change of use and/or a change to energy status, all of the following should be met.

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 as in paragraph 4.5.

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

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

e. 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 12.8.

f. Any fixed building services and/or on-site electricity generation, that are provided or extended should meet the standards in Sections 5 and 6.

12.8 As an alternative to paragraph 12.7 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 building work is complete, would be no greater than if each dwelling had been improved following the guidance in paragraph 12.7.

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 1,000m2 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 13.

Section 13: Consequential improvements to energy performance

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

a. An extension.

b. Providing any fixed building service in the building 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 building complies with Part L of the Building Regulations, to the extent that they are technically, functionally and economically feasible.

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

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 measured air permeability of the building concerned. The assessed air permeability is the value used to establish the building emission rate and the building primary energy rate.

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, an approved inspector or the Building Safety Regulator for higher-risk buildings.

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

Building heat distribution system The heat network distribution pipework for hot water and heating for a building connected to a heat network. Building distribution pipework may be internal or external. For blocks of flats it does not include heat distribution within individual dwellings, for example the heat interface unit and space heating and hot water systems within dwellings. Also sometimes referred to as secondary heat network.

Building Regulations compliance certificate A certificate issued by an installer registered with an authorised competent person self-certification scheme, or be a certifier registered with an authorised third-party certification scheme stating that the work described in the certificate complies with regulations 4 and 7 of the Building Regulations 2010 (that is, the work complies with all applicable requirements of the Building Regulations).

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 The power consumed in lighting circuits by light sources and, where applicable, their associated control gear (including transformers and drivers) and power factor correction equipment.

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.

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.

Communal heat network A heat network by means of which heating, cooling or hot water is supplied only to a single building divided into separate premises, for example to both dwellings and non-dwellings in a mixed-use building or a building divided into separate premises.

Conformity assessment body An organisation which is responsible for carrying out activities such as testing, inspection and certification (conformity assessment) which provides assurance that what is being supplied meets the expectations specified or claimed. In the UK, the United Kingdom Accreditation Service (UKAS) is the sole organisation which grants accreditation to a conformity assessment body to carry out conformity assessment activities.

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 and minimisation of greenhouse gas emissions] 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.

CO_2 emission factor An estimate of CO_2 equivalent emissions produced by the use of different fuels per kWh of delivered energy.

Critical national infrastructure. Critical elements of infrastructure (namely assets, facilities, systems, networks or processes and the essential workers that operate and facilitate them), the loss or compromise of which could result in:

a) Major detrimental impact on the availability, integrity or delivery of essential services - including those services whose integrity, if compromised, could result in significant loss of life or casualties - taking into account significant economic or social impacts; and/or

b) Significant impact on national security, national defence, or the functioning of the state.

District heat networks Systems that supply heat from a central source(s) to consumers in two or more buildings, via a network of pipes carrying hot/warm liquids (generally water). Heat networks can cover a large area or even an entire city, or can be relatively local, supplying a small cluster of buildings.

Dwelling A self-contained unit designed to accommodate one 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 greenhouse gas emission rate expressed as $kgCO_2e/(m^2 \cdot year)$ and determined using the Home Energy Model: Future Homes Standard assessment.

Dwelling fabric energy efficiency rate The normalised space heating and cooling requirements per square metre of floor area per year of a new dwelling. Expressed as $kWh/(m^2 \cdot year)$ and determined using the Home Energy Model: Future Homes Standard assessment.

Dwelling primary energy rate The primary energy use per square metre of floor area per year of a new dwelling. Expressed as $kWh_{PE}/(m^2 \cdot year)$ and determined using the Home Energy Model: Future Homes Standard assessment.

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 within a reasonable time after one of the following.

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

Emergency lighting Lighting for use when the power supply to the normal lighting fails.

Escape lighting The part of the emergency lighting that is provided to ensure that the escape route is illuminated at all material times.

***Energy efficiency requirements** Defined in regulation 2(1) as the requirements of regulations 23, 26, 26A, 26C, 28, 40 and 43 and Part L of Schedule 1.

Energy performance certificate As defined in the Energy Performance of Buildings (England and Wales) Regulations 2012.

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 was under construction on [at the implementation date of this standard]. 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). 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

c. fixed lifts, escalators or moving walkways in new buildings (but not in individual dwellings) or

c. any combination of systems of the kinds referred to in paragraph (a) , (b) or (c).

NOTE FOR CONSULTATION: Final legal drafting for the fixed building services definition will be confirmed after consultation.

Fixed external lighting Lighting fixed to an external surface of the building and supplied from the building'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.

- Combusting fuels in, for example, a boiler.
- The Joule effect in the heating elements of an electric resistance heating system, where the Joule effect is the process by which an electric current passing through a conductor produces heat.
- 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, and 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 one floor and has the same thermal characteristics and temperature control requirements throughout.

Home Energy Model: Future Homes Standard The approved procedure for calculating the performance of dwellings in line with this document (Approved Document L, Volume 1).

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

Lamp A device which converts electricity into light. This is commonly referred to as a light bulb. In this approved document, this does not include a lamp holder.

Light source lumens The value of the lumen output of a light source. If the light source is contained within a luminaire all losses due to the luminaire are excluded.

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

Luminaire A lighting product which distributes, filters or transforms the light from one or more light sources and includes all the parts necessary for supporting, fixing and protecting the light sources and, where necessary, circuit auxiliaries together with the means for connecting them to the electricity supply. In this approved document, the luminaire includes the light source(s).**Luminous efficacy** A measure of how efficiently the light source or luminaire converts electricity into light, expressed in lumens per watt (lm/W).

Luminous flux A measure of luminous energy emitted by a light source or luminaire, expressed in lumens (lm).

***Major renovation** Defined in regulation 35 as the renovation of a building where more than 25% of the surface area of the building envelope undergoes renovation.

***Material change of use** Defined in regulation 5 as 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;

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 of the Building Regulations, 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.

Notice of approval This is the formal notice by which the Secretary of State confirms their approval of the calculation methodologies for the purposes of regulations 24 and 25 of the Building Regulations. The Notice of approval for calculation methodologies is published with a circular letter on the GOV.UK website.

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.

Primary energy factor An estimate of the primary energy from different fuels per kWh of delivered energy.

Registered Competent Person A competent person registered with a competent person self-certification scheme, who meets the technical competencies for the work that they are carrying out.

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 one cooling unit over a year, divided by the total energy input to that single cooling unit over the same year.

Secondary circulation An assembly of water fittings in which a continuous flow of hot water circulates in supply pipes or distributing pipes of hot water storage systems, providing a continuous supply of hot water to outlets. This is uncommon in dwellings.

Secondary heating 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 version 10.2, Appendix D.

Short-cycling The boiler cycles through switching on and off as a result of the changing temperature in the heat exchanger despite the temperature in the building not changing.

Simple payback The amount of time it will take to recover the initial investment through energy savings. It is 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 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 when the application is made to the building control body should be used when evaluating energy savings. Current prices are given by the Department for Energy Security and Net Zero and available at: https://www.gov.uk/government/collections/quarterly-energy-prices.

Smart home controls Control systems that interact via communication interfaces with building services and on-site electricity generation/consumption, storage and grid import/grid

export, and which optionally use other externally provided inputs (e.g. temperature, cost of energy etc.), in order to optimise energy consumption.

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.

Specific fan power (SFP) A measure of energy efficiency for air distribution systems. SFP is the power required by a fan to move air through the air distribution system, expressed as W/(L.s).

Standard Assessment Procedure The current approved procedure available for use as a route for compliance for the performance extensions 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 10.2*.

Target emission rate The maximum CO_2 emission rate for the dwelling, expressed as $kgCO_2/(m^2 \cdot year)$ and determined using the Home Energy Model: Future Homes Standard assessment.

Target fabric energy efficiency rate The minimum dwelling fabric energy efficiency, expressed as $kWh/(m^2 \cdot year)$ and determined using the Home Energy Model: Future Homes Standard assessment.

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 Home Energy Model: Future Homes Standard assessment.

Thermal bridging Heat transfer that 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 of the Building Regulations; 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 or the boiler accesses online weather information. 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 A system in which a heating appliance (usually a boiler) produces hot water which is distributed around the dwelling to heat emitters.

y-value The total thermal bridging heat loss of a dwelling taking account of all the thermal bridges.

> Symbol which means greater than, for example > 3.6 m^2 means greater than 3.6 m^2.

< Symbol which means less than, for example < 400 kW means less than 400 kW.

≥ Symbol which means greater than or equal to, for example ≥ 400 kW means greater than or equal to 400 kW.

≤ Symbol which means less than or equal to, for example ≤ 3.6 m^2 means less than or equal to 3.6 m^2.

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 An approved software package for the Home Energy Model: Future Homes Standard assessment should be used to produce the BREL report for the dwelling.

NOTE FOR CONSULTATION: The consultation tool for the Home Energy Model: Future Homes Standard assessment is available at the following webpage: www.homeenergymodelconsultation.org.uk. The consultation tool does not produce a BREL report as an output.

B3 Two versions of the BREL report should be produced.

a. The design stage BREL report should be produced 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 as-built BREL report should 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. The supporting list of specifications and any changes to the list 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 Home Energy Model: Future Homes Standard 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.

Photographic evidence

B6 Photographs should be taken as each dwelling is constructed on a development. The photographs should be made available to the energy assessor and the building control body. Anyone may take the photographs.

B7 One photograph should be taken of each detail at an appropriate stage of construction before closing-up works. Typical details are listed below. Additional photographs, such as close-up detail, should be provided only where necessary (see below). Photographs should be unique to each property.

1. Foundations/substructure and ground floor, to show thermal continuity and quality of insulation in the following places.
    a. At ground floor perimeter edge insulation.
    b. At external door threshold.
    c. Below damp-proof course on external walls.
2. External walls: for each main wall type, to show thermal continuity and quality of insulation for the following.
    a. Ground floor to wall junction.
    b. Structural penetrating elements.

    NOTE: For blown fill, photographs 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 image showing continuity of insulation).
6. Building services: for all plant associated with space heating, hot water, ventilation and low or zero carbon technology equipment within or on the building, to show the following.
    a. Plant/equipment identification label(s), including make/model and serial number.
    b. Continuity of insulation of primary pipework.
    c. Where a heat pump is installed, continuity of insulation of the primary pipework up to the thermal envelope of the dwelling i.e. where primary pipework from the heat pump enters the dwelling.

d. Where a hot water storage vessel is installed, the hot water storage vessel space, including at least 1 metre of pipework insulation of sufficient quality from the hot water storage vessel towards the water outlets.

e. Continuity of insulation of mechanical ventilation ductwork (for duct sections outside the heated living space).

B8 Photographs should be digital and of sufficient quality and high enough resolution to allow a qualitative audit of the subject detail. Geo-location should be enabled to confirm the location, date and time of each image.

Each image file name should include a plot number and detail reference according to the numbers used in paragraph B7. For example, Plot 1 eaves detail would be P1/3b.

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 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 the 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, for the proposed works, account should be taken 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 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 in relevant British Standards.

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

Proposed works	Target U-value W/(m^2·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
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	Assess condensation risk and make appropriate provision in accordance with the requirements of Part C relating to the

		constructions, as appropriate	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
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 is an important issue (e.g. where insulation is returned at party walls), a worse 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	0.30	External insulation system with rendered finish or	Assess technical risk and impact of increased wall thickness on adjoining buildings

a finish or cladding for the first time		cladding to give target U-value	
Ground floor constructions			
Renovating 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, U-values of existing uninsulated floor are already relatively low when compared with U-values of wall and roof. Where the existing floor U-value is greater than 0.70W/(m^2·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/(m^2·K) is appropriate, subject to other technical constraints (adjoining floor levels, etc.)

Appendix D: Heat Network Sleeving

For new dwellings connecting to a district heat network, the emissions and primary energy factors used in the calculation of the Dwelling Emission Rate and Dwelling Primary Energy Rate may be calculated using either of:

i) the heat sources already connected to the district heat network

ii) new or unused low carbon heat sources to connected to the district heat network following the sleeving methodology outlined below.

Sleeving enables carbon savings delivered from either of the following to be attributed directly to new connections to a heat network.

a. newly installed low carbon plant or
b. existing plant, which is demonstrably unused

This could be, for example, through the integration of a heat pump into an existing CHP heat network. In this case, the heat generated by the heat pump could be directly attributed, i.e. sleeved, to a new development connecting to the network.

This sleeved approach will be implemented through entries on the Products Characteristics Database (PCDB) (or its successor to be built through the Home Energy Model project) managed by the Department of Energy Security and Net Zero (DESNZ). To apply the sleeving approach a district heat network should make and maintain entries in the PCDB system using the approved spreadsheet tool. All applications will be audited by an approved body.

NOTE FOR CONSULTATION: A consultation prototype version of the approved spreadsheet tool to be used in support of this application by heat networks is available alongside this document to assist consultees in understanding this proposal.

Under a sleeving approach the person applying to the PCDB should follow the following two stages:

Stage A. During the initial application to the PCDB: Calculation of current used and unused capacity. The person applying to the PCDB should:

1. Declare each heating generation technology connected to the district heat network and calculate the heating generation capacity of each technology in kW.

2. Calculate the sum of the diversified peak demand in kW for heating and hot water of all buildings connected to the heat network. Calculations should take account of the performance of the whole system. This should be calculated for the diversified peak demand conditions as described under Objective 3.2 in CIBSE CP1 *Heat Networks: Code of Practice* (2020). This should include the performance of the distribution circuits, all heat generating plants, combined heat and power (CHP), storage, and

any waste heat recovery or heat dumping. Other relevant guidance in CIBSE's CP1 should also be followed as appropriate.

3. Allocate the diversified peak demand calculated in Step 2 to the generation capacities declared in Step 1.

4. Identify which heating technologies declared in Step 1 are currently unused (i.e. are not allocated any demand under Step 3) and suitable for any future sleeving application for connection to new buildings. The unused generation capacity of these technologies is the 'unused sleeving capacity'.

NOTE: Declarations of technologies as unused and suitable for sleeving applications will be subject to audit and verification.

Part B: Subsequent applications to allow connection of new buildings to existing heat network The person applying to the PCDB should:

5. Declare any new heating generation technology added to the heat network, and suitable for sleeving, since the previous PCDB declaration. Calculate the 'total available sleeving capacity' as the sum of:
    a. the 'unused sleeving capacity' (calculated in Step 4)
    b. the generation capacity of the newly added technologies.

    New technologies may include planned generation capacity that is intending to connect to the district heat network within 3 years of the types described in paragraph 2.10(e) of this document, following the guidance on submission to the building control body in 2.10(f).

6. Calculate the increase in diversified peak demand in kW of all new buildings planned to be connected to the district heat network, to be covered by the application. Calculations should take account of the performance of the whole system. This should be calculated for the diversified peak demand conditions as described under Objective 3.2 in CIBSE CP1 *Heat Networks: Code of Practice* (2020). This should include all of the following.
    a. the performance of the distribution circuits
    b. all heat generating plants
    c. any combined heat and power (CHP)
    d. any storage
    e. any waste heat recovery or heat dumping.

    Other relevant guidance in CIBSE's CP1 should also be followed as appropriate.

7. Allocate the diversified peak demand of the new buildings calculated in Step 6 to the 'total available sleeving capacity' declared in Step 1.

8. Calculate the $kgCO_2$/kWh and PE/kWh for delivered heat which is needed to satisfy the diversified peak demand of the new buildings (as calculated in step 6) for the technologies allocated to provide this demand (allocated under Step 7). These

estimates should be made for heat delivered to the buildings (i.e. after primary distribution losses).

9. Values for kgCO2/kWh and PE/kWh should be entered as the performance of the heat network into the approved calculation tools[1].

10. The capacity allocated to all new buildings under Step 7 will be recorded and assessed as part of the auditing process and it will not be possible to reallocate to different buildings in future compliance checks[2].

NOTE: Auditing will assess that these technologies are used in practice to meet the demand of the new buildings. High carbon technologies should not be used to satisfy the heat demand of new buildings.

11. Calculate the updated 'unused sleeving capacity' of the heat network in kW by subtracting the estimate of the increase in heating and hot water diversified peak demand for all buildings to be connected to the heat network (as calculated for step 6) from the 'total available sleeving capacity' (step 5)

12. Identify which technologies the 'unused sleeving capacity' represents. This capacity is suitable for any subsequent sleeving application for connection to new buildings .

[1] To achieve compliance with Part L of the building regulations, the Dwelling Emission Rate and Dwelling Primary Energy Rate must be equal to, or lower than, the Target Emissions Rate and Target Primary Energy Rate. For new buildings connected to heat networks, the Target Rates are calculated assuming buildings are connected to a new heat network with a specification as defined in the notional building for district heat networks.

[2] At 'design stage' generation capacity can be provisionally allocated to multiple new prospective connections (and this provisionally allocated generation can be greater than 'spare' capacity). This is in the acknowledgement that for district heat networks there might be multiple potential connections to buildings that a heat network wants to progress in the knowledge that not all of these connections may ultimately connect and buy heat from that heat network. However, at 'as-built' stage the generation allocated to the new buildings/dwellings must equal the available spare generation capacity of the district heat network. The risk that these generation figures do not match sits with building developers and the district heat network project.

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 8558 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within building and their curtilages [2015]

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]

BS EN 14829 Independent gas-fired flueless space heaters for nominal heat input not exceeding 6 kW [2007]

BS EN 15502-2-1 Gas-fired central heating boilers. Specific standard for type C appliances and type B2, B3 and B5 appliances of a nominal heat input not exceeding 1 000 kW [2012 + A1: 2016]

BS EN 15502-2-2 Gas-fired central heating boilers. Specific standard for type B1 appliances [2014]

BS EN 17082 Domestic and non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW [2019]

BS EN ISO 9806 Solar energy. Solar thermal collectors. Test methods [2017]

BS EN ISO 12567 Thermal performance of windows and doors. Determination of thermal transmittance by the hot-box method

BS EN ISO 12567-1 Complete windows and doors [2010]

BS EN ISO 12567-2 Roof windows and other projecting windows [2005]

BS EN ISO 13370 Thermal performance of buildings. Heat transfer via the ground. Calculation methods [2007 incorporating corrigendum March 2009]

BS EN ISO 13788 Hygrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation methods [2012]

BSI PAS 67 Laboratory tests to determine the heating and electrical performance of heat-led micro-cogeneration packages primarily intended for heating dwellings [2013]

Appendix F: Documents referred to

Legislation

Ancient Monuments and Archaeological Areas Act 1979, c. 46

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

Building Regulations 2010, SI 2010/2214

Ecodesign Commission Regulation No. 2016/2281

Ecodesign Commission Regulation No. 813/2013

Ecodesign Commission Regulation No. 814.2013

Ecodesign Commission Regulation No. 206/2012

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

Energy-Related Products Directive 2009/125/EC

European Commission Delegated Regulation 2019/2015

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

Documents

Building Research Establishment (BRE)

(www.bre.co.uk)

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

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

BR 497 *Conventions for Calculating Linear Thermal Transmittance and Temperature Factors*. Second Edition [2016]

Information Paper 1/06 *Assessing the Effects of Thermal Bridging at Junctions and around Openings in the External Elements of Buildings* [2006]

FB 59 *Design of Low-temperature Domestic Heating Systems: A Guide for System Designers and Installers* [2013]

Products Characteristics Database (PCDB). Available at www.ncm-pcdb.org.uk

Chartered Institute of Plumbing and Heating Engineering (CIPHE)

(www.ciphe.org)

Plumbing Engineering Services Design Guide [2002]

Chartered Institution of Building Services Engineers (CIBSE)

(www.cibse.org)

Guide A *Environmental Design* [2015]

TM23 *Testing Buildings for Air Leakage* [2022]

CP1 *Heat Networks: Code of Practice* [2020]

Department for Energy Security & Net Zero (DESNZ)

(www.gov.uk/desnz)

The Home Energy Model: Future Homes Standard assessment

NOTE FOR CONSULTATION: The Government will publish a draft Home Energy Model: Future Homes Standard assessment at consultation stage. A consultation tool to interact with the draft model is available at the following web page [insert URL].

The Government's Standard Assessment Procedure for Energy Rating of Dwellings, SAP 10.2. Available at www.bregroup.com/sap/sap10/

Smart meter installations in domestic new build premises [draft]

Department for Environment, Food and Rural Affairs (DEFRA)

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

Glass and Glazing Federation (GGF)

(ggf.org.uk)

Glazing Manual Data Sheet 2.3, Guide to the Calculation of Energy Ratings for Windows, Roof Windows and Doors [2016]

HETAS

(www.hetas.co.uk)

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

Historic England

(historicengland.org.uk)

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

Hot Water Association

(www.hotwater.org.uk)

Performance Specification for Thermal Stores [2010]

Local Authority Building Control

(www.labc.co.uk)

Construction Details, available at: www.labc.co.uk/business/construction-details

Department for Levelling Up, Housing and Communities (DLUHC)

Manual to the Building Regulations: A Code of Practice for Use in England [2020]

Microgeneration Certification Scheme (MCS)

(www.mcscertified.com)

MIS 3005-D: *The Heat Pump Standard (Design)* [2021]

MIS 3005-I: *The Heat Pump Standard (Installation)* [2021]

MIS 3012: *The Battery Standard (Installation)* [2021]

Office of the Deputy Prime Minister (ODPM)

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

National Association of Rooflight Manufacturers (NARM)

(www.narm.org.uk)

Technical Document NTD02.1 *Assessment of Thermal Performance of Out-of-plane Rooflights* [2022]