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

## Volume 2: Buildings other than dwellings

## Consultation version – December 2023

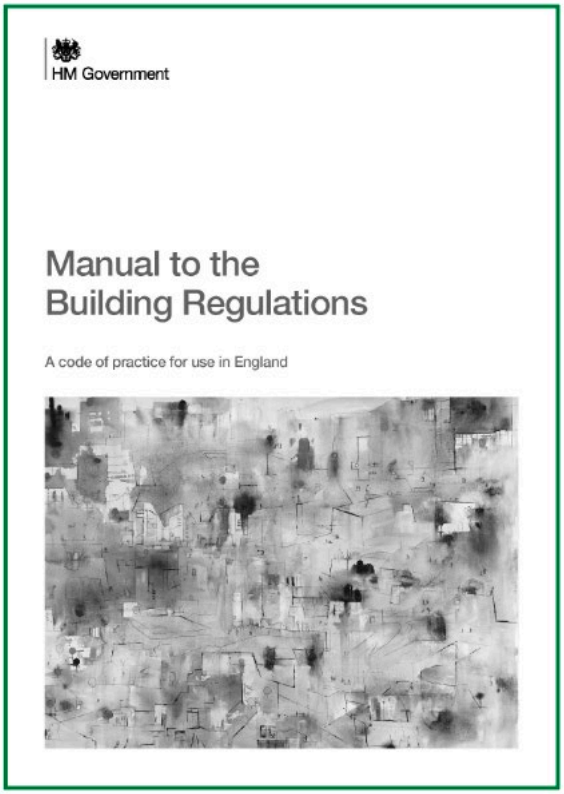
This draft guidance accompanies the December 2023 consultation ***The Future Homes and Buildings Standards****: 2023 consultation on changes to Part 6, Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for dwellings and non-domestic buildings and seeking evidence 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 2, paragraphs which have changed relative to the Approved Document L, Volume 2, 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 2, 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.

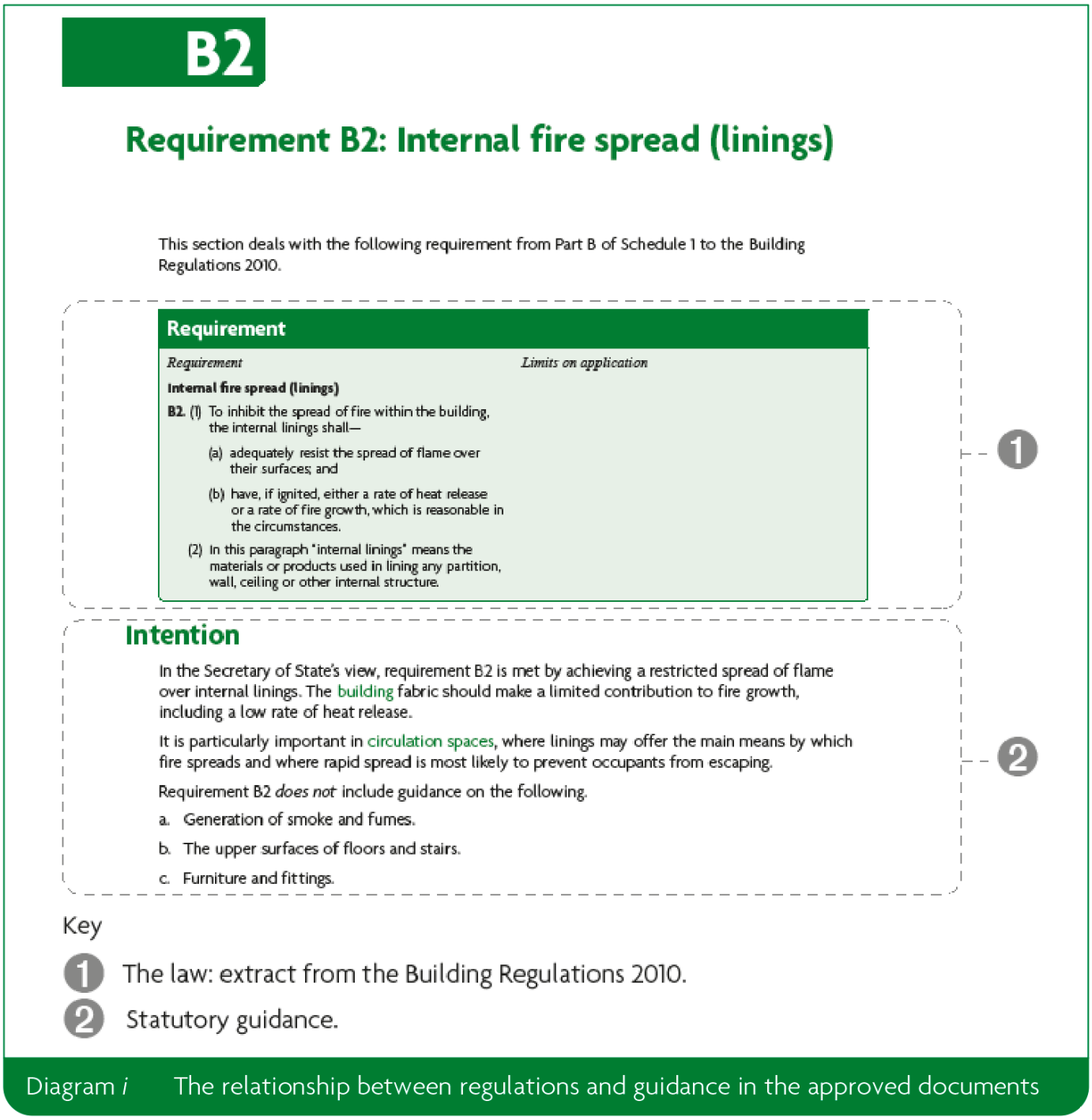



Diagram *i* The relationship between regulations and guidance in the approved documents

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.



**NOTE FOR CONSULTATION:** Section 3 on consideration of high-efficiency alternative systems has been removed.

# Section 0: Introduction

## Summary

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

0.2 This approved document 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 and target emission rate* | Regulations 24, 25, 26, 26C, 27 and 27C |
| Section 2: Calculating the building primary energy rate and building emission rate* | |
| **NOTE FOR CONSULTATION**: Section 3 of this approved document on consideration of high-efficiency alternatives 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: Providing information to the owner about the building, fixed building services and maintenance requirements | Regulations 40 and 40A |

| | |
|---|---|
| Section 10: Replacing thermal elements and limiting heat gains and losses in existing buildings, including extensions | Regulation 23(2) and requirement L1(a) of Schedule 1 |
| Section 11: Work to thermal elements in existing buildings | Regulations 6, 22 and 23(1) and requirement L1(a) of Schedule 1 |
| Section 12: Consequential improvements to energy performance | Regulation 28 |
| Appendix A: Key terms | n/a |
| Appendix B: Lighting Energy Numeric Indicator (LENI) | n/a |
| Appendix C: Reporting evidence of compliance | n/a |
| Appendix D: Measures for consequential improvements | n/a |
| Appendix E: Hierarchy for establishing seasonal efficiencies of existing boilers | n/a |
| Appendix F: Heat Network Sleeving | n/a |
| Appendix G: Standards referred to | n/a |
| Appendix H: Documents referred to | n/a |

## Application

0.3 The guidance in Approved Document L, Volume 2 applies only to buildings other than dwellings. For a mixed-use building, this document should be consulted for building work in those parts of the building that are not dwellings. This document gives guidance for building work in both new and existing buildings.

**NOTE:** Dwellings are self-contained units. This approved document applies to both of the following, which are not dwellings.

a. Rooms for residential purposes.

b. Buildings that contain only rooms for residential purposes.

For dwellings, Approved Document L, Volume 1: Dwellings applies.

0.4 In the Secretary of State's view, for the purposes of the energy efficiency requirements of the Building Regulations, a building means either of the following.

a. The whole of the building.

b. Part of a building designed or altered to be used as a separate premises.

## Common areas in buildings that contain multiple dwellings

0.5 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 this approved document, Approved Document L, Volume 2, should be followed.

b. If the common areas are unheated, individual fabric elements should meet the minimum standards in Section 4 of Approved Document L, Volume 1: Dwellings.

## New buildings

0.6 For new buildings, guidance is given in Sections 1 to 9 of this approved document, Approved Document L, Volume 2.

0.7 For a conservatory or porch installed as part of the construction of a new building, 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 building and the conservatory or porch.

b. The building'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 building. The guidance for new elements in existing buildings in Section 10 of this approved document, Approved Document L, Volume 2, 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 building. The guidance for the whole new building should be followed, including when calculating the building primary energy rate and building emission rate.

0.8 For the *first* fit-out works in buildings, such as shell-and-core office buildings, guidance for new buildings that covers first fit-out should be followed. For any *subsequent* fit-out works, the guidance for existing buildings should be followed.

0.9 For constructing a building from modular subassemblies, or for relocating a modular or portable building, the guidance for new buildings should be followed, taking note of the special considerations for these building types outlined in Section 2. If the building work extends an existing building, consequential improvements may also be required. Guidance is given in Section 12 of this approved document, Approved Document L, Volume 2.

## Extensions to and work on existing buildings

0.10 Guidance for existing buildings is given in this approved document, Approved Document L, Volume 2, for the following.

a. Limiting heat gains and losses: Section 4.

b. Building services: Sections 5 and 6.

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

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

e. Consequential improvements: Section 12.

## Exemptions

0.11 The following classes of buildings or parts of buildings other than dwellings are exempt from the energy efficiency requirements.

a. Places of worship: buildings or parts of a building that are used primarily or solely for formal public worship, plus adjoining spaces with a function directly linked to that use (e.g. a vestry in a church).

**NOTE:** Parts of the building that are designed to be used separately, such as offices, catering facilities, day centres, meeting halls and accommodation, are *not* exempt from the energy efficiency requirements.

b. Temporary buildings with a total planned time of use of two years or less.

c. Buildings with low energy demand which are industrial sites, workshops or non-residential agricultural buildings.

**NOTE:** Low energy demand only relates to the energy used by fixed heating or cooling systems, not to energy required for or created by process needs. Buildings with low energy demand include buildings or parts of buildings where the space is not generally heated or cooled other than by process heat, and buildings or parts of buildings that only require heating or cooling for short periods each year, such as during critical periods in the production cycle (e.g. for germinating seeds or hatching eggs) or during severe weather conditions.

**NOTE:** Portable or modular buildings with a planned service life of longer than two years, whether on one or more sites, are *not* exempt. See paragraphs 2.11 to 2.19.

d. New and existing stand-alone buildings other than dwellings, with a total useful floor area of less than 50m$^2$.

e. Carports, covered yards, covered ways and some conservatories and porches (see paragraphs 0.18 to 0.19).

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

0.12 Work to the following types of buildings does not need to comply fully with the energy efficiency requirements if to do so would unacceptably alter the building'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.

0.13 Work to a building in paragraph 0.12 must comply with the energy efficiency requirements if this would not unacceptably alter the building's character or appearance. The work should comply with standards in this approved document, Approved Document L, Volume 2, to the extent that it is reasonably practicable.

## Historic and traditional buildings

0.14 The energy efficiency of historic and traditional buildings 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 allow moisture to evaporate. Examples include buildings constructed with wattle and daub, cob or stone, and those using lime render or mortar.

0.15 New extensions to historic and/or traditional buildings should comply fully with the energy efficiency standards in this approved document, Approved Document L, Volume 2, 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.

0.16 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.

0.17 Additional guidance is available in Historic England's *Energy Efficiency in Historic Buildings: Application of Part L of the Building Regulations to Historic and Traditionally Constructed Buildings*.

## Exemptions for conservatories and porches

0.18 Where a building 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 building has been retained or, if removed, replaced with a wall, door or window.

**NOTE:** Replacement walls, windows and doors should meet the requirement in regulation 23(2). See Section 10 of this approved document, Approved Document L, Volume 2.

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

## Exemptions for covered areas

0.19 Where a building is extended by adding a carport that is open on at least two sides, a covered yard, covered walkway or 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

0.20 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. Guidance for dwellings is given in Approved Document L, Volume 1.

0.21 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

0.22 When constructing a building that contains dwellings and 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 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 this approved document, Approved Document L, Volume 2: Buildings other than dwellings.

## Selected key interactions with other parts of the Building Regulations

0.23 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 Part P

0.24 This approved document, Approved Document L, Volume 2, 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

0.25 This approved document, Approved Document L, Volume 2, 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

0.26 This approved document, Approved Document L, Volume 2, 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

0.27 This approved document, Approved Document L, Volume 2, 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 building should be considered. Approved Document F should be followed.

### Interaction with Part J

0.28 This approved document, Approved Document L, Volume 2, provides guidance on airtightness. For guidance on permanent ventilation openings for open flued appliances in airtight buildings, Approved Document J should be followed.

### Interaction with Part K and Part M

0.29 This approved document, Approved Document L, Volume 2, 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.

### Interaction with Part O

0.30 This approved document, Approved Document L, Volume 2, provides guidance on limiting heat losses from pipework, limiting solar gains and overheating mitigation. For guidance on overheating mitigation for new residential buildings, Approved Document O should be followed. Residential buildings within the scope of Part O are defined in Approved Document O. All other buildings should follow the guidance in this approved document, Approved Document L, Volume 2.

# Regulations 24, 25, 26, 26C, 27 and 27C: Calculating the energy performance of buildings

This section deals with the requirements of regulations 24, 25, 26, 26C, 27 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.

**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.

**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. Approved packages for implementing this methodology for new buildings other than dwellings are the Simplified Building Energy Model (SBEM) or other software packages approved under the Notice of Approval.

**NOTE FOR CONSULTATION**: The consultation version of the Simplified Building Energy Model, cSBEM, is available at the following webpage: *www.uk-ncm.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 and a target emission rate.

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

## Regulations 26 and 26C

A new building must be shown to meet regulations 26 and 26C: calculations should be produced to show that the building meets both of the following.

a. Target primary energy rate.

b. Target emission rate.

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

## Regulations 27 and 27C

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

# Section 1: Calculating the target primary energy rate and target emission rate

## Target primary energy rate and target emission rate

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

**NOTE**: How to calculate the building primary energy rate and building emission rate is set out in Section 2.

1.2 The notional building is the same size and shape as the actual building and has standardised properties for fabric and services. The full properties of the notional building are set out in the *National Calculation Methodology Modelling Guide*, available from www.uk-ncm.org.uk.

1.3 The energy performance of the notional building is described using the following metrics.

a. The target primary energy rate, in $kWh_{PE}/m^2$ per year.

b. The target emission rate, in $kgCO_2/m^2$ per year.

1.4 The target primary energy rate and target emission rate must be calculated using the approved calculation methodology. Software packages that implement this methodology can be either of the following.

a. The Simplified Building Energy Model (SBEM) [n.b. consultation version], for buildings with design features that can be adequately modelled by it.

b. Other software packages approved under the Notice of Approval.

The software package should be used in line with the version policy as stated in the *National Calculation Methodology Modelling Guide*.

As part of the submission to the building control body, it should be shown that the software package used is appropriate to the application.

**NOTE:** An up-to-date list of approved software packages is given on the UK-NCM website at: www.uk-ncm.org.uk.

**NOTE FOR CONSULTATION:** The consultation version of the Simplified Building Energy Model, cSBEM, is available at the following webpage: *www.uk-ncm.org.uk*. This provides the opportunity to interact with the model and understand whether different building designs are likely to meet the minimum standard of total energy performance.

# Section 2: Calculating the building primary energy rate and building emission rate

2.1 The same software package, implementing the same approved calculation methodology, should be used to calculate the target primary energy rate, the target emission rate, the building primary energy rate and the building emission rate.

2.2 The building primary energy rate and the building emission rate should be calculated at both of the following points using the same software package.

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 building primary energy rate and building emission rate must not exceed the target primary energy rate and the target emission rate, respectively.

The specification of the actual building may vary from that of the notional building if the building meets the target primary energy rate, target emission 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 of the following.

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

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

c. A list of specifications used in the calculations.

Items (a) to (c) above may be reported using the design stage Building Regulations UK Part L compliance report (BRUKL report), which is a standardised output from the BRUKL module within the approved software package detailed in paragraph 1.4. For further details of the design stage BRUKL report, see Appendix C.

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 building primary energy rate.

b. The as-built target emission rate and the as-built building emission rate.

c. 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 (c) above as reported in the as-built BRUKL report, provided by an accredited energy assessor. The BRUKL report is produced as a standardised output from the BRUKL module within the approved software package detailed in paragraph 1.4. For further details of the as-built BRUKL report, see Appendix C.

## Heating in the building primary energy rate and the building emission rate calculations

2.6 When systems can be powered by more than one fuel, the following applies, according to the fuel(s).

a. Biomass heating supplemented by an alternative appliance (e.g. electric heat pump): the $CO_2$ emission factor and primary energy factor should be based on a weighted average for the two fuels. The weighting should be based on the anticipated mean average usage of those fuels in kWh over a typical year. The building emission rate and building primary energy rate submitted to the building control body should be accompanied by a report, signed by a suitably qualified person, detailing how the combined emission factor was derived.

b. Appliances that can burn both biomass fuel and fossil fuel: the $CO_2$ emission factor and primary energy factor for dual-fuel appliances should be used, except where the building is in a smoke control area, when the anthracite figure should be used.

c. In all other cases, the calculation should use the fuel with the highest $CO_2$ emission factor from those used by the system.

### District heat networks and communal heat networks

2.7 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 building are entered as inputs into the software package implementing the approved calculation methodology (see paragraph 1.4) for calculating the building primary energy rate and building emission rate .

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 building primary energy rate and building emission rate for a building 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 2.7e , 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 building emission rate and building 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 kg$CO_2$/kWh*

*E is the electricity production from the scheme in kWh*

*$CO_{2E}$ is the emission factor for district heat CHP generated electricity in kg$CO_2$/kWh.*

h. For district heat networks, the $CO_2$ emission factors and primary energy factors that are used to calculate the building emission rate and building 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) 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 and auditing process described in Appendix F.

i. The building primary energy rate and building 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:** See the *National Calculation Methodology Modelling Guide* for further information.

**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. .

## Management and control features in the building primary energy rate and the building emission rate calculations

2.8 Where enhanced management and control features are provided in the building, the building primary energy rate and building emission rate can be reduced. The appropriate adjustment factor in Table 2.1 should be applied to both of the following, for the system(s) to which the enhanced management and control feature is being used.

a. The $CO_2$ emissions.

b. The primary energy.

**Table 2.1 Enhanced management and control features**

| Feature | Adjustment factor |
|---|---|
| Automatic monitoring and targeting with alarms for out-of-range values[1] | 0.050 |
| Power factor correction to achieve a whole building power factor >0.90[1] | 0.010 |
| Power factor correction to achieve a whole building power factor >0.95[2] | 0.025 |

**NOTES:**

1. This means a complete system that measures, records, transmits, analyses, reports and communicates meaningful energy management information to enable the operator to manage the energy the system uses. A building automation and control system specified following paragraphs 6.78 to 6.84 would meet this definition.
2. The adjustment factor can be applied only if the whole building power factor is corrected to achieve the value in this table (>90 or >0.95). The two levels of power factor correction are alternative values, not additive.

**NOTE:** For example, if the $CO_2$ emissions due to electrical energy consumption were 70kg$CO_2$/(m$^2$·year) without enhanced management and control features, if power factor correction equipment were provided to achieve a power factor of greater than 0.95, the building emission rate could be reduced by 70 × 0.025 = 1.75kg$CO_2$/(m$^2$·year).

## Special considerations when calculating building primary energy rate and building emission rate

2.9 Special considerations may apply to certain classes of building. The building types include all of the following.

a. Modular and portable buildings with a planned service life of more than two years (at one or more sites): follow paragraphs 2.10 to 2.18.

b. Swimming pools: follow paragraph 2.19.

c. Shell and core developments: follow paragraphs 2.20 to 2.24.

d. Industrial sites, workshops and non-residential agricultural buildings: follow paragraph 2.25.

e. Buildings with low energy demand: follow paragraphs 2.26 to 2.31.

**NOTE:** Industrial sites, workshops and non-residential agricultural buildings with low energy demand and buildings with a planned service life of less than two years are exempt from the energy efficiency requirements. See paragraph 0.11.

### Modular and portable buildings with a planned service life of more than two years

2.10 An existing module placed on a new site is considered by the Building Regulations to be the construction of a new building.

2.11 Special considerations apply to modular and portable buildings with a planned service life of more than two years, as follows.

a. For modular and portable buildings at one location, follow paragraphs 2.12 to 2.14.

b. For modular and portable buildings intended for use at more than one location, for example under hire agreements, follow paragraphs 2.15 to 2.18.

### Buildings at one location

2.12 Modular and portable buildings with a planned service life of more than two years at one location should be shown to comply with the energy efficiency requirements.

2.13 If more than 70% of the external envelope of this type of building will be created from sub-assemblies manufactured before the date when this approved document came into force, the target primary energy rate and target emission rate should be multiplied by the relevant factors in Table 2.2.

**NOTE:** One way to show the date of manufacture of each sub-assembly is by relating the serial number to the manufacturer's records.

2.14 After a modular building is manufactured, any later work on the module should meet the standards in this document, treating it as work on an existing building as follows.

a. Fabric elements that will be refurbished or replaced in modular sub-assemblies should meet the minimum standards in Section 4.

b. Fixed building services elements that will be replaced in modular sub-assemblies should meet the minimum standards in Sections 5 and 6.

**Table 2.2 Multiplying factors for target primary energy rate and target emission rate for modular and portable buildings with a service life of more than two years at one location**

| Date of manufacture of 70% of modules making up the external envelope | Target primary energy rate multiplying factor | Target emission rate multiplying factor |
|---|---|---|
| After the date when this approved document came into force | 1.00 | 1.00 |
| Between 15 June 2022 and the date when this approved document came into force | 1.00 | 1.00 |
| Between 6 April 2014 and 14 June 2022 | 1.30 | 1.30 |
| Between 1 Oct 2010 and 5 April 2014 | 1.40 | 1.40 |
| Between 6 April 2006 and 30 Sept 2010 | 1.67 | 1.67 |
| Before 6 April 2006 | 1.67 | 1.67 |

### Buildings at more than one location

2.15 Modular and portable buildings with a planned service life of more than two years but with an intended time of use in one location of less than two years should be shown to comply with the energy efficiency requirements. An example of this type of building is a modular or portable building for short term hire to multiple locations.

**NOTE:** An example of evidence that the planned time of use in the given location is less than two years is the hire agreement for the unit.

2.16 For a modular or portable building of the type described in paragraph 2.15, the target primary energy rate, building primary energy rate, target emission rate and building emission rate should be calculated when the portable building or its modular components are first constructed. The calculation can be based on a standard generic configuration of modules.

When the building is moved to a new location in which its intended time of use is less than two years, these calculations can be provided as evidence that the energy efficiency requirements are met. The supplier should provide all of the following in writing.

a. Details of the calculation.

b. Confirmation that the modules as provided meet or exceed the energy standards of the elements of the generic module on which the calculation was based.

c. Confirmation that the activities assumed in the generic module are reasonably representative of the planned use of the actual module.

2.17 If the planned time of use of a modular or portable building in one location is less than two years, the only practical heating technology may be electric resistance heating. In such cases, the notional building should use electric resistance heating.

2.18 If more than 70% of the external envelope of this type of building will be created from sub-assemblies manufactured before the date when this approved document came into force, the target primary energy rate and target emission rate should be multiplied by the relevant factors in Table 2.3.

**NOTE:** One way to show the date of manufacture of each sub-assembly is by relating the serial number to the manufacturer's records.

**Table 2.3 Multiplying factors for target primary energy rate and target emission rate for modular and portable buildings with a planned service life of more than two years but intended time of use at one location of less than two years**

| Date of manufacture of 70% of modules making up the external envelope | Target primary energy rate multiplying factor | Target emission rate multiplying factor |
|---|---|---|
| After the date when this approved document came into force | 1.00 | 1.00 |

| | | |
|---|---|---|
| Between 15 June 2022 and the date when this approved document came into force | 1.00 | 1.00 |
| Between 6 April 2014 and 14 June 2022 | 1.30 | 1.30 |
| Between 1 Oct 2010 and 5 April 2014 | 1.40 | 1.40 |
| Between 6 April 2006 and 30 Sept 2010 | 1.67 | 1.67 |
| Before 6 April 2006 | 2.03 | 2.03 |

## Swimming pool basins

2.19 When calculating the building primary energy rate and building emission rate for a building with a swimming pool, the thermal performance of the pool basin should not be included. Instead, the building primary energy rate and building emission 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.

## Shell and core developments

2.20 If a building is offered to the market as a shell for fit-out work by the incoming occupier, the developer should calculate a design-stage target primary energy rate, building primary energy rate, target emission rate and building emission rate. These calculations should be submitted to the building control body. These calculations should be submitted to the building control body and be based on a realistic fit-out which achieves the energy efficiency requirements.

2.21 If some systems are not installed when a building is put on the market, reasonable assumptions should be made when calculating the building primary energy rate and building emission rate and in the model for the efficiencies of services that will be installed during first fit-out work. The specification provided to the building control body should be given all of the following.

a. Details of the services, including any on-site electricity generation, not provided in the base build.

b. The efficiency values assumed for these services.

c. A statement on how access will be provided to install any services, including on-site electricity generation, during first fit-out work.

2.22 When the base building in a shell and core development is completed, the as-built target primary energy rate, building primary energy rate, target emission rate and building emission rate should be calculated based only on the building and systems as constructed. The fit-out areas should be assumed to be conditioned to temperatures appropriate to their designated use, but no associated energy demand included.

2.23 If an incoming occupier does first fit-out work on all or part of a building in a shell and core development by providing or extending fixed services for any of the following:

a. heating

b. hot water

c. air-conditioning

d. mechanical ventilation

then a target primary energy rate, building primary energy rate, target emission rate and building emission rate should be submitted to the building control body when work is complete to show compliance with the energy efficiency requirements of the Building Regulations for the part of the building covered by the fit-out work.

2.24 If fit-out work does *not* include providing or extending any of the fixed services for any of the following:

a. heating

b. hot water

c. air-conditioning

d. mechanical ventilation

then any lighting systems that are installed should be at least as efficient as those assumed in the shell developer's initial submission.

**NOTE:** Paragraph 9.12 outlines requirements for the building log book to be completed for shell and core developments when first fit-out work takes place.

### Industrial sites, workshops and non-residential agricultural buildings other than those with low energy demand

2.25 Special considerations may apply to industrial sites, workshops and non-residential agricultural buildings if the *National Calculation Methodology Modelling Guide* cannot adequately account for the building's use – for example, if using the *National Calculation Methodology Modelling Guide* would lead to negative impacts on cost-effectiveness and/or significant technical risk.

## Buildings with low energy demand

2.26 Buildings with low energy demand are those buildings or parts of buildings which are not exempt from the energy efficiency requirements for reasons outlined in Section 0, where any of the following apply.

a. Fixed building services for heating and/or cooling are not provided.

b. Fixed building services for heating and/or cooling are provided only to heat or cool a localised area rather than the entire enclosed volume of the space concerned (e.g. localised radiant heaters at a workstation in a generally unheated space).

c. Fixed building services are used to heat space in the building to temperatures that are substantially lower than those normally provided for human comfort (e.g. to protect a warehouse from frost).

2.27 A target primary energy rate, target emission rate, building primary energy rate and building emission rate should be calculated for non-exempt buildings with low energy demand. Zones that correspond to the definitions in paragraph 2.26 should be modelled as outlined in the *National Calculation Methodology Modelling Guide* paragraph 122 as 'unconditioned', i.e. not served by a space heating or space cooling system.

2.28 For a building with low energy demand, both of the following apply.

a. Every fixed building service that is installed should meet the energy efficiency standards in Sections 5 and 6.

b. The building envelope should be insulated to a degree that is reasonable in the particular case. If some general heating is provided, as in paragraph 2.26(c), then no part of the opaque fabric should have a U-value higher than 0.7W/($m^2$·K).

2.29 If part of a building with low energy demand is both:

a. partitioned off

b. heated normally

(for example, an office area in an unheated warehouse), then the separately heated area should be treated as a separate building or zone and the normal procedures for demonstrating compliance with the energy efficiency requirements of the Building Regulations should be followed.

2.30 If a building that had low energy demand no longer has low energy demand, consequential improvements may be needed in some circumstances. See Section 12.

2.31 If a building or part of a building with low energy demand was designed as a shell and core building and first fit-out work results in it no longer being classed as having low energy demand (in line with paragraph 2.26), then normal procedures for demonstrating compliance with the energy efficiency requirements of the Building Regulations should be followed.

**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 and 25B.

# 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 building by achieving both of the following.

a. Unwanted heat *losses* from the building 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 4.7 and paragraphs 4.10 to 4.15.

ii. Airtightness – the required air permeability from Table 4.1.

iii. The pipework and services – paragraphs 4.19 to 4.27.

b. Unwanted heat *gains* to the building, throughout the year, through any of the routes listed in (a) above, are limited as set out in Section 4 and specifically for new buildings – paragraphs 4.17 to 4.18.

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

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

i. Any building fabric to which building work is being done, including walls, floors, roof, windows and openings – paragraphs 4.1 to 4.15. Further guidance is given in the following sections.

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

ii. Any work that may result in making the building less airtight – paragraph 4.16.

iii. Any pipework and services to which building work is being done – paragraphs 4.19 to 4.21 and paragraphs 4.23 to 4.27.

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

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

# 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 thermal element (e.g. in the case of a window, the combined performance of the glazing and the frame).

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

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

b. For windows in buildings similar to dwellings: calculated for a standard window 1.23m (±25%) wide × 1.48m (–25%) high and for the actual configuration of the window.

c. For windows in buildings similar to dwellings: calculated for a standard window 1.23m (±25%) wide × 1.48m (–25%) high and for one of the following standard configurations. Standard configurations should not be used for commercial windows.

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.

**NOTE:** For domestic-type windows in buildings similar to dwellings if there are no test data or calculated performance values, the default value from the Standard Assessment Procedure (Table 6e) may be used.

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

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

b. Calculated using one of the following standard sizes.

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

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

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

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

4.4 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:** These orientations should only be used when calculating U-values to check that they meet the limiting standards in paragraphs 4.6 to 4.9 below. They should not be used in the energy calculations in Sections 1 and 2 where the U-value of each element is calculated based on the plane in which it is constructed or installed.

## Limiting standards for new or replacement elements

4.6 New fabric elements should meet the limiting standards in Table 4.1. This includes all of the following.

a. Elements in new buildings.

b. New elements in extensions to existing buildings.

c. New or replacement elements in existing buildings.

Guidance on when a new or replacement element in an existing building must meet the requirements in Table 4.1 is given in Section 10.

4.7 If windows or fully glazed pedestrian doors cannot meet the requirements of Table 4.1 in an existing building because of the need to maintain the character of the building, either of the following should be met.

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

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

**Table 4.1 Limiting U-values for new or replacement elements in new and existing buildings and air permeability in new buildings**

| Element type | Maximum U-value[1] W/(m$^2$·K) |
|---|---|
| Roof | 0.18 |
| Wall[2,3] | 0.26 |
| Floor[4,5] | 0.18 |
| Swimming pool basin[6] | 0.25 |

| | |
|---|---|
| Windows in buildings similar to dwellings[7,8] | 1.6 or Window Energy Rating[9] Band B |
| All other windows,[8,10,11] roof windows, curtain walling | 1.6 |
| Rooflights[12,13] | 2.2 |
| Pedestrian doors (including glazed doors)[14] | 1.6 |
| Vehicle access and similar large doors | 1.3 |
| High-usage entrance doors | 3.0 |
| Roof ventilators (including smoke vents) | 3.0 |
| | Air permeability (for new buildings) $m^3/(h \cdot m^2)$ |
| At 50Pa | 8.0 |

**NOTES:**

1. Area-weighted average values, except for new windows, rooflights and doors in existing buildings.
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 in an existing building would reduce by more than 5% the internal floor area of the room bounded by the wall, a lesser provision may be appropriate.
4. The U-value of the floor of an extension may be calculated using the exposed perimeter and floor area of either the whole enlarged building or the extension alone.
5. If meeting such a standard in an existing building would create significant problems in relation to adjoining floor levels, a lesser provision may be appropriate.
6. The U-value of a swimming pool basin (walls and floor), calculated according to **BS EN ISO 13370**.
7. For example, student accommodation, care homes and similar uses where the occupancy levels and internal heat gains are essentially domestic in character.
8. 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.
9. The methods for calculating Window 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. No maximum U-value is set for display windows and similar glazing. For new buildings, however, the impact of display windows and similar glazing must be taken into account when calculating primary energy and $CO_2$ emissions.
11. In buildings with high internal heat gains, the average U-value for windows can be higher than the values given above if this can be shown to be an appropriate way of reducing overall $CO_2$ emissions and primary energy. However, individual values should be no higher than $2.7W/(m^2 \cdot K)$.
12. 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.
13. The limiting value for rooflights also applies to kerbs that are supplied as part of a single rooflight-and-kerb assembly sourced from the same supplier and for which the supplier can provide a combined $U_d$-value for the assembly. An upstand built on site should have a maximum U-value of $0.35W/m^2 \cdot K$.

14. For external fire doorsets, as defined in Appendix A of Approved Document B, Volume 2, in new and existing non-domestic buildings, a maximum U-value of 1.8W/(m$^2$·K) is permissible.

## Limiting standards for renovated and retained elements

4.8 Existing elements that are being renovated or retained may need to meet the limiting standards in Table 4.2. The following elements should meet the standards in Table 4.2.

a. Thermal elements that are being renovated in existing buildings. Renovated elements should achieve the U-values in Table 4.2, column (b). Renovation of a thermal element is defined in Section 11.

b. Elements that are being retained in existing buildings, following a material change of use or change to energy status (see Section 11). Retained elements with a U-value higher than the threshold value in Table 4.2, column (a), should be upgraded to achieve the U-values in Table 4.2, column (b).

Section 11 should also be referred to.

4.9 If achieving the U-value in Table 4.2, 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 this is necessary to comply with Part C of the Building Regulations on protection from the harmful effects of interstitial and surface condensation.

**Table 4.2 Limiting U-values for existing elements in existing buildings**

| Element | U-value[1] W/(m$^2$·K) | |
|---|---|---|
| | (a) Threshold | (b) Improved |
| All roofs[2,3,4] | 0.35 | 0.18 |
| Wall with cavity insulation[2,5] | 0.70 | 0.55 |
| Wall with external or internal insulation[2,6] | 0.70 | 0.30 |
| Floors[7,8] | 0.70 | 0.25 |

**NOTES:**

1. Area-weighted average values.
2. For dormer windows, 'roof' includes the roof parts of the window 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 suitable for cavity insulation. Where this is not the case, the wall should be treated as 'wall with external or internal 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 either the whole enlarged building or the extension alone.
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

4.10 In new and existing buildings, both of the following apply.

a. The insulation should be reasonably continuous across newly built elements.

b. Thermal bridging, including at the party wall, should be reasonably limited.

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

4.11 To avoid air movement within thermal elements in new and existing buildings, either of the following measures should be implemented.

a. The insulation layer should abut the air barrier at all points across newly built elements.

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

4.12 Thermal bridging should be addressed in the design and construction of a building by one of the following.

a. Using construction joint details calculated by a person with suitable expertise and experience using both of the following.

i. The guidance set out in the Building Research Establishment's BR 497.

ii. A process flow sequence that has been provided to the building control body indicating the way in which the detail should be constructed.

Construction joint details can then be used to calculate the building primary energy rate and building emission rate.

**NOTE:** Evidence of suitable expertise and experience for calculating linear thermal transmittance would be to show that the person is trained in the software used, has applied that model to the example calculations in the Building Research Establishment's BR 497, and has achieved results within the stated tolerances.

b. Using construction joints without quantifying the thermal bridge values. The values for generic linear thermal bridges given in the Building Research Establishment's Information Paper 1/06, and increased by 0.04W/(m·K) or 50%, whichever is greater, should be used to calculate the building primary energy rate and building emission rate.

4.13 To calculate linear thermal transmittances and temperature factors for the approaches in paragraph 4.12(a), the guidance in the Building Research Establishment's BR 497 should be followed. The construction details specified should achieve a temperature factor that is greater than or equal to that set out in the Building Research Establishment's Information Paper 1/06.

4.14 For the approaches in paragraph 4.12(a), the building control body should be shown that an appropriate system of site inspection is in place to give confidence that construction procedures achieve the required standards.

4.15 When thermal elements are replaced or renovated, a report should be produced, signed by a suitably qualified person, which confirms all of the following.

a. That appropriate design details and building techniques have been specified.

b. That the specified details, as constructed, provide adequate protection against surface condensation, using the guidance in the Building Research Establishment's Information Paper 1/06 and BR 497.

## Airtightness in existing buildings

4.16 When carrying out work in existing buildings, 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 openings and service penetrations.

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

c. When installing controlled fittings, the controlled fitting should be well fitted and reasonably draught-proof.

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

## Limiting the effects of solar gains in summer

4.17 In new residential buildings, as defined in Table 0.1 of Approved Document O, solar gains should be limited in summer in line with the guidance in Approved Document O.

4.18 For all buildings not covered in paragraph 4.17, the following applies, irrespective of whether the building is air-conditioned. For each space in the building that is occupied or mechanically cooled, the solar gains through the glazing – aggregated from April to September inclusive – should be no greater than would occur through the relevant reference glazing systems in Table 4.3. The g-value should be calculated according to **BS EN 410**. In this context, occupied space means a space that is intended to be occupied by the same person for a substantial part of the day. This excludes circulation spaces and other areas of transient occupancy, such as toilets.

The intention is to limit solar gains during the summer, in order to either:

a. reduce the need for air-conditioning

b. reduce the capacity of any air-conditioning system that is installed.

**Table 4.3 Reference glazing systems for calculating solar gain**

| Type of space (as defined in the National Calculation Methodology) | Average zone height | Glazing location for reference space | Glazing area for reference space | Framing factor for reference space | Glazing g-value for reference space |
|---|---|---|---|---|---|
| Side-lit | Any | East-facing façade | Full-width to a height of 1000mm | 10% | 0.48 |
| Top-lit | ≤6m | Roof | 10% of roof area[1] | 25% | 0.48 |
| | >6m | Roof | 10% of roof area[1] | 15% | 0.42 |

**NOTE:**

1. Roof area determined from the inside of the space looking out.

## Limiting heat losses and gains from building services

### Direct hot water and heating pipework

4.19 Hot water and heating pipework should be insulated in all areas inside and outside the building unless it can be shown that the heat is 'always useful'. Insulation should be reasonably continuous including at bends, T-branches, wall brackets and around any obstruction.

4.20 Insulation should be designed so that the permissible heat losses given in **BS 5422**, for hot water and heating services in non-domestic buildings are not exceeded. For low temperature systems, meeting the standards in Table 4.4 is one way of demonstrating that heat losses will not exceed those given in **BS 5422**. For domestic hot water systems, meeting the standards in Table 4.5 is one way of demonstrating that heat losses will not exceed those given in **BS 5422**.

4.21 Insulation thickness should be calculated in accordance with **BS EN ISO 12241**.

**NOTE:** In most cases, manufacturers will be able to supply information and required thicknesses for their products to comply with heat loss standards in paragraph 4.20. However, Tables 4.4 and 4.5 give indicative thicknesses for typical applications.

4.22 Heating pipework insulation on building heat distribution systems should meet the standards in one of the following, as applicable.

a. For communal heat networks and new buildings that contain multiple dwellings that are connected to a district heat network, the minimum insulation thicknesses for building heat distribution systems should follow CIBSE CP1 *Heat Networks: Code of Practice*.

**NOTE**: The thicknesses given in CIBSE CP1 *Heat Networks: Code of Practice* are minimum thicknesses and project specific calculations should be carried out to justify the insulation specification, in accordance with CIBSE CP1 *Heat Networks: Code of Practice*.

b. For other types of new buildings, not covered by 4.21(a), connected to a district heat network, the insulation thicknesses on building heat distribution systems should follow **BS 5422**.

**Table 4.4 Minimum thickness of pipework insulation for low temperature hot water space heating applications in non-domestic buildings**

| Nominal internal pipe diameter (mm) | Minimum insulation thickness (mm) for low temperature hot water systems[1,2,3] | |
|---|---|---|
| | Thermal conductivity (λ) = 0.025W/m.K | Thermal conductivity (λ) = 0.035W/m.K |
| Less than or equal to 25 | 20 | 30 |
| Less than or equal to 40 | 25 | 35 |
| Less than or equal to 100 | 30 | 45 |

**NOTES:**

1. Thicknesses apply to low-emissivity faced insulation.
2. Base level insulation thicknesses designed to achieve permissible heat losses given in **BS 5422** for heating systems at 95°C or less.

3. For other circumstances (e.g. other thermal conductivities, other pipe diameters and hot water systems at other temperatures) refer to **BS 5422**.

**Table 4.5 Minimum thickness of pipework insulation for domestic hot water services in non-domestic buildings**

| Nominal internal pipe diameter (mm) | Minimum insulation thickness (mm) for domestic hot water services[1,2,3] | |
|---|---|---|
| | Thermal conductivity) λ = ( 0.025W/m·K | Thermal conductivity (λ) = 0.035W/m·K |
| Less than or equal to 10 | 15 | 25 |
| Less than or equal to 20 | 20 | 25 |
| Less than or equal to 40 | 25 | 30 |
| Less than or equal to 100 | 30 | 40 |

**NOTES:**

1. Base level insulation thicknesses designed to achieve permissible heat losses given in **BS 5422** for hot water services at 60°C.
2. Thicknesses for low-emissivity faced insulation.
3. For other circumstances (e.g. other thermal conductivities and other pipe diameters) refer to **BS 5422**.

## Cooling pipework

4.23 Cooling pipework should be insulated along its whole length. Control against heat gain should be maximised and heat gain to uninsulated pipes permitted only where the cooling load of the distribution pipework is less than 1% of the total load.

4.24 Insulation should be designed so that the maximum permissible heat gains in **BS 5422** are not exceeded.

4.25 Provision should also be made to control condensation, by following **BS 5422**.

## Insulating ductwork

4.26 Ductwork that carries warm or cold air should be insulated throughout its whole length to achieve heat transfer no greater than that given in Table 4.6. Meeting the indicative insulation thicknesses which are also given in Table 4.6 is one way of demonstrating that the heat transfer value has not been exceeded.

Condensation should also be controlled, by following **BS 5422**.

**Table 4.6 Maximum heat losses and gains for ducts delivering air for heating and/or cooling**

| | Heating duct[1a] | Cooling or dual-purpose duct[1b] |
|---|---|---|
| Heat transfer ($W/m^2$) | 16.34 | –6.45 |
| Indicative insulation thickness (mm)[2] | 29 | 50 |

**NOTES:**

1. Insulation thicknesses should be calculated according to **BS EN ISO 12241** using the following standardised assumptions.
   a. Horizontal duct at 35°C, with 600mm vertical sidewall in still air at 15°C.
   b. Horizontal duct at 13°C, with 600mm vertical sidewall in still air at 25°C.
2. Thicknesses apply to low-emissivity faced insulation with a thermal conductivity value of 0.035W/(m·K) or lower. For other insulation types, consult **BS 5422**.

## Domestic hot water storage vessels

4.27 Domestic hot water storage vessels should meet either of the following.

a. Maximum heat losses in Table 4.7.

b. Maintenance consumption values in **BS EN 89**, for gas-fired storage water heaters.

**Table 4.7 Maximum heat losses from domestic hot water storage vessels[1,2]**

| Nominal volume (litres) | Heat loss (kWh/24h) | Nominal volume (litres) | Heat loss (kWh/24h) |
|---|---|---|---|
| 200 | 2.1 | 900 | 4.5 |
| 300 | 2.6 | 1000 | 4.7 |
| 400 | 3.1 | 1100 | 4.8 |
| 500 | 3.5 | 1200 | 4.9 |
| 600 | 3.8 | 1300 | 5.0 |
| 700 | 4.1 | 1500 | 5.1 |
| 800 | 4.3 | 2000 | 5.2 |

**NOTES:**

1. For maximum heat losses from vessels with a storage volume less than 200 litres, see BS EN 15450.
2. The heat loss from electrically heated cylinders should not exceed either of the following, where V is volume in litres.
   a. Point-of-use electrically heated cylinders: $1.28 \times (0.2 + 0.051V^{2/3})$.
   b. Local electrically heated cylinders: $1.28 \times (0.2 + 0.051V^{2/3})$.

# 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 building by achieving all of the following.

a. Fixed building services that meet the minimum efficiencies in Section 6 are provided.

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

i. meet the general controls for heating systems in paragraphs 5.13, 5.14 and 5.16 to 5.18

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 existing buildings by achieving all of the following.

a. Any fixed building services meet the minimum efficiencies in Section 6 and the criteria in paragraph 5.4.

b. Any fixed building services have controls that both:

i. meet the standards for general controls for heating systems in paragraphs 5.8, 5.13, 5.14 and 5.16 to 5.18

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

c. Any on-site electricity generation is both appropriately sized 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 building, 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 5 or Section 6.

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

5.3 For heating systems and cooling systems, paragraphs 5.11 to 5.19 should be followed, in addition to the system specific advice in Section 6.

### New building services in new buildings

5.4 For heating and hot water systems in new buildings one of the following should apply.

a. The fuel used for each service should have both of the following.

i. A carbon emissions factor, as listed in the consultation National Calculation Methodology Modelling Guide, of less than or equal to 0.086 $kgCO_2/kWh$

ii. A primary energy factor, as listed in the consultation National Calculation Methodology Modelling Guide, of less than or equal to 1.969 kWhPE/kWh.

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.

5.5 Backup heating and hot water systems should meet the standard in paragraph 5.4(a) unless both of the following conditions are met.

a. There is no suitable low carbon alternative to provide backup heating or hot water.

b. The failure of primary heating or hot water systems would present either:

i. a significant life safety risk

ii. a significant risk to the operation of critical national infrastructure.

## Replacement building services in existing buildings

5.6 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 delivered energy than the service being replaced

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

**NOTE:** If the efficiency of the appliance being replaced is unknown, this should be established in line with the hierarchy in Appendix E.

### Worked example

Replacing an old fuel oil-fired boiler that has emissions of 0.319kg$CO_2$/kWh and primary energy of 1.180kWh$_{PE}$/kWh at 85% efficiency with an LPG boiler that has emissions of 0.240kg$CO_2$/kWh and primary energy of 1.104kWh$_{PE}$/kWh at 93% efficiency.

#### $CO_2$ emissions

Fuel oil-fired boiler: 0.319/0.85 = 0.375kg$CO_2$/kWh

LPG boiler: 0.240/0.93 = 0.258kg$CO_2$/kWh

#### Primary energy

Fuel oil-fired boiler: 1.180/0.85= 1.388kWh$_{PE}$/kWh

LPG boiler: 1.104/0.93 = 1.188kWh$_{PE}$/kWh

The new LPG boiler has both lower $CO_2$ emissions and primary energy than the fuel oil-fired boiler being replaced, and therefore complies with paragraph 5.4. The new boiler is also at least as efficient as the minimum efficiency set out in Section 6.

5.7 If renewable technology such as a wind turbine or photovoltaic array is being 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.

5.8 When a new heating appliance is installed in an existing building, the heating system after the work is complete should have the following controls.

a. Timing.

b. Temperature.

c. Where appropriate and technically feasible, weather compensation.

5.9 For heating systems that are being replaced, both of the following apply.

a. Paragraphs 5.11 to 5.14 should be followed in addition to system specific guidance in Section 6.

b. Facilitating future connection to any local district heat networks should be considered (e.g. providing capped off connections in pipework to allow later connection to a district heat network).

5.10 If work involves providing or extending fixed building services, both of the following apply.

a. Energy meters should be installed following paragraph 5.19.

b. Consequential improvements may be needed (see Section 12).

## Sizing new and replacement space heating systems

5.11 The specification of space heating systems should be based on an appropriate heat loss calculation for the building, based on **BS EN 12831-1** and CIBSE's Guide B1. Systems should not be significantly oversized.

5.12 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 building, at a maximum flow temperature of 55°C. To maximise the efficiency of a wet heating system, it is preferable to design to a lower flow temperature than 55°C.

In existing buildings, 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 building.

## Controls and zoning for new and replacement space heating systems

5.13 For heating systems, all of the following apply.

a. The systems should be subdivided into separate control zones for areas of the building in which any of the following are significantly different.

i. Solar exposure.

ii. Pattern of use.

iii. Type of use.

b. For each control zone it should be possible to control both of the following independently of other control zones.

   i. Timing.

   ii. Temperature.

c. The service should be appropriate to the requirements of the space. If both heating and cooling are provided, the controls should prevent both operating simultaneously.

d. Central plant should operate only when the zone systems require it. The default condition should be off.

e. Where appropriate and technically feasible, heating systems should have weather compensation.

5.14 System controls should be wired so that when there is no demand for space heating, the heating appliance and pump are switched off.

## System treatment for hot water systems for space and domestic hot water heating

5.15 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.

## Thermostatic room controls

5.16 For heating systems and cooling systems in a new non-domestic building, or when a heat generator such as a boiler is replaced in an existing non-domestic building, each room should be provided with thermostatic room controls. These controls should be capable of being used to separately adapt the heating or cooling output in each room served by the heating or cooling appliance, or, where justified in accordance with paragraph 5.17, in each heating zone.

**NOTE:** There is no need to install thermostatic room controls in rooms/zones without heating or cooling.

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

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

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

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

a. In open-plan spaces in which heating demand and patterns of use are similar across the whole space, sub-zoning of temperature control might not be appropriate. In such cases, the space should be considered as one heating zone.

b. Where two adjacent rooms have a similar function and heating or cooling 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 building, 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 building should be controlled using thermostatic room controls as described above.

5.18 The standards in paragraphs 5.16 and 5.17 may be satisfied by providing any of the following.

a. Both of the following.

i. A thermostat in a room that the heating or cooling circuit serves.

ii. An individual thermostatic room control for each emitter, such as a thermostatic radiator valve, on all emitters outside the room that contains the thermostat. Thermostatic radiator valves should not be used in the same room as the thermostat.

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

c. An individual networked heating or cooling emitter control for each emitter.

## Energy submeters

5.19 Energy submetering systems should be installed in new buildings or when fixed building services are provided or extended in an existing building. The system should meet all of the following requirements.

a. The various end-use categories, such as heating, lighting and cooling, should be submetered in such a way that at least 90% of the annual energy consumption of each fuel can be assigned to an end use. Detailed guidance on how to achieve this is given in CIBSE's TM39.

b. Metering should enable forecast energy use to be compared with in-performance energy, and should facilitate energy reporting. This requirement can be met by basing the submetering strategy on a design-stage energy forecast for the building, using one of the methodologies in paragraph 9.4.

c. Metering should measure the energy use of each tenant within the building.

d. The outputs of any renewable systems should be monitored separately.

e. In buildings with a total useful floor area greater than 1000m$^2$, automatic meter reading and data collection facilities should be installed.

# 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.

6.1 This section sets out minimum standards for specific types of building services. The minimum efficiencies are based on documented manufacturers' test data. Note that test results are always based on the equipment when operating under particular conditions. Equipment should be designed, specified and installed with the aim of maximising its efficiency as-installed.

## Heat pumps

6.2 All heat pumps, except those defined in paragraph 6.3 should meet Ecodesign product regulations. The applicable Ecodesign product regulations for different types of heat pump and uses are set out in Table 6.1.

6.3 The following types of heat pump should have a coefficient of performance (COP) of 2.5 or higher as rated at the applicable rating conditions below.

a. Heat pumps other than air-to-air with an output between 400 and 1000 kW as rated at the applicable conditions in **BS EN 14511-2**.

b. Heat pumps used for domestic hot water heating *only* as rated at the applicable conditions in **BS EN 16147**.

**Table 6.1 Ecodesign product regulations applicable to different types of heat pump installed in new buildings and new or replacement heat pumps in existing buildings**

| Heat pump type | Use | Output / kW | Reversible and/or non-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 | Air heating products, cooling products, high temperature process chillers, fan coil units | ≤ 12 kW | Reversible | No. 2016/2281 |
| Air-to-air, including exhaust air-to-air | Air heating products, cooling products, high temperature process chillers, fan coil units | > 12kW and ≤ 1000 kW | Reversible and non-reversible | No. 2016/2281 |
| All types | Domestic hot heating water only | ≤ 400 kW | | No. 814/2013 |

## Controls for heat pumps

6.4 For heat pump installations in which other heat sources are available to the same building, each of these heat sources should be appropriately incorporated into a single control system.

**NOTE**: Example sequencing control routines for systems consisting of multiple heat pumps can be found in CIBSE AM17: Heat pump installations for large non-domestic buildings.

## Controls for heat pumps in new buildings

6.5 For heat pumps in new buildings, in addition to meeting the general requirements for heating and hot water systems in Section 5, 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 buildings**

| 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.<br>b. The operation of any outdoor fans, including those in cooling towers or dry coolers, should be controlled.<br>c. The original equipment manufacturer controls should be the primary controls. Any additional controls should not reduce the functionality of the original manufacturer controls, including modulation. |
| Air-to-water | a. To protect against air flow failure.<br>b. To control outdoor fan operation.<br>c. To provide a defrost control for the external air-side heat exchanger.<br>d. To control internal water pump operation.<br>e. To control water temperature for the distribution system. |
| Air-to-air | a. To protect against air flow failure.<br>b. To control outdoor fan operation.<br>c. To provide a defrost control for the external air-side heat exchanger.<br>d. To control secondary heating (if fitted).<br>e. To control air temperature. |
| Ground-to-air and water-to-air | a. To protect against water flow failure.<br>b. To control external water pump operation.<br>c. To control air temperature. |

| | |
|---|---|
| Ground-to-water and water-to-water | a. To protect against water flow failure.<br>b. To control water pump operation (internal and external).<br>c. To control water temperature for the distribution system. |

### Controls for heat pumps in existing buildings

6.6 For heat pumps in existing buildings, in addition to the general guidance for controls and zoning in Section 5, any outdoor fans, including those in cooling towers or dry coolers, should be controlled.

## Boilers

**NOTE:** This subsection applies to wet central heating systems that use commercial boilers fired by natural gas, liquid petroleum gas, oil or biomass. Steam boilers are not covered. Electric boilers are dealt with in paragraph 6.19.

6.7 In addition to meeting the general requirements for heating systems in Section 5 and following paragraphs 6.12 and 6.13, a boiler should meet the following.

For a new boiler plant installed in existing buildings, the seasonal efficiencies, or the overall seasonal efficiency for multiple-boiler systems using non-identical boilers (i.e. non-identical in terms of capacity and efficiency), in Table 6.3.

**Table 6.3 Minimum heat generator seasonal efficiency for boiler systems in existing buildings[1,2]**

| Fuel type | System | Boiler seasonal efficiency (gross calorific value) |
|---|---|---|
| Natural gas | Single-boiler ≤400kW output | 91% |
| | Single-boiler 401kW–2MW output | 88% |
| | Single-boiler >2MW output | 84% |
| | Multiple-boiler[3] | 84% for any individual boiler<br>91% for overall multi-boiler system |
| LPG | Single-boiler ≤2MW output | 93% |
| | Single-boiler >2MW output | 88% |
| | Multiple-boiler[3] | 88% for any individual boiler<br>93% for overall multi-boiler system |

| | | |
|---|---|---|
| Oil | Single-boiler | 93% |
| | Multiple-boiler[3] | 88% for any individual boiler<br>93% for overall multi-boiler system |

**NOTES:**

1. Seasonal efficiencies should be calculated in line with paragraphs 6.8 to 6.11.
2. Non-condensing boilers should be fitted with a flue condensing kit where feasible and where the boiler is likely to be able to operate in condensing mode (e.g. variable temperature circuits).
3. Multiple-boiler systems refers to systems which contain multiple boilers with non-identical capacities and efficiencies.

## Single-boiler systems and multiple-boiler systems with identical boilers

6.8 The seasonal efficiency of the boiler should be determined using equation 6.1.

boiler seasonal efficiency = $0.81\eta_{30\%} + 0.19\eta_{100\%}$ equation 6.1

Where:

$\eta_{30\%}$ is the gross boiler efficiency measured at 30% load

$\eta_{100\%}$ is the gross boiler efficiency measured at 100% load.

**NOTE:** Efficiencies based on net calorific value should be converted to efficiencies based on gross calorific value, using the appropriate conversion factor in the Standard Assessment Procedure, version 10.2, Table E4.

**NOTE:** Equation 6.1 assumes that the efficiency at 15% load is the same as that at 30% load.

6.9 Equation 6.1 applies to both of the following.

a. Single-boiler systems that:
   i. produce low temperature hot water
   ii. have an output of 400kW or less.

b. Multiple-boiler systems that:
   i. produce low temperature hot water
   ii. comprise individual boilers with identical efficiencies
   iii. have an output of 400kW or less.

**NOTE:** For boilers with an output of more than 400kW, the manufacturer's declared efficiencies should be used.

## Multiple-boiler systems in new buildings

6.10 For multiple boilers in new buildings, the four-step method described below should be used to calculate the overall boiler seasonal efficiency.

a. Step 1: Determine the load *on each boiler* for each of the three system part load conditions of 15%, 30% and 100%.

For example, if the total system output is from three equally sized boilers, when only the lead boiler is switched on and the other two boilers are switched off, at 15% of system output the lead boiler operates at 45% of its rated output.

b. Step 2: Determine the efficiency of each boiler for the operating conditions in 6.10(a).

**NOTE:** Linear interpolation should be used to determine efficiencies between manufacturers' declared efficiencies at 30% and 100% load. If efficiencies at below 30% are required and unavailable, they may be taken as equal to that at 30% load.

c. Step 3: Calculate the overall operating efficiency at each system part load condition using equation 6.2.

$\eta_p = Q_p/\Sigma(q_{b,p}/\eta_{b,p})$ equation 6.2

Where:

$\eta_p$ is the system efficiency at part load condition p, that is at 15%, 30% and 100% of system rated output

$Q_p$ is the system heat output at part load condition p

$q_{b,p}$ is the individual boiler heat output at system part load condition p

$\eta_{b,p}$ is the individual boiler efficiency at system part load condition p.

d. Step 4: Calculate the overall boiler seasonal efficiency ($\eta_{OBSE}$) as the weighted average of the efficiencies at the three load conditions, using equation 6.3.

$\eta_{OBSE} = 0.36\eta_{15\%} + 0.45\eta_{30\%} + 0.19\eta_{100\%}$ equation 6.3

## Multiple-boiler systems with non-identical boilers replacing existing systems

6.11 In existing systems, if both of the following apply, equation 6.4 should be used to calculate the overall boiler seasonal efficiency ($\eta_{OBSE}$).

a. More than one boiler is installed on the same heating system.

b. The efficiencies of the boilers are not identical.

**NOTE:** All boilers should be used in the calculation, including any that are identical.

$$\eta_{OBSE} = \frac{\Sigma(\eta_{BSE} \times R)}{\Sigma R}$$ equation 6.4

Where:

$\eta_{OBSE}$ is the gross overall boiler seasonal efficiency

$\eta_{BSE}$ is the gross boiler seasonal efficiency of each individual boiler calculated using equation 6.1

R is the rated output in kW of each individual boiler (at 80/60°C flow/return temperature).

### Boiler controls

6.12 Boiler systems with an output of more than 100kW should have both of the following.

a. Optimum start or optimum stop control that either:

i. provides night setback

ii. provides frost protection outside occupied periods.

b. Either:

i. a two-stage high/low firing facility in the boiler

ii. multiple boilers with sequence control to provide efficient part-load performance.

6.13 Gas-fired boilers and multi-stage oil-fired boilers with an output of more than 500kW should have fully modulating burner controls.

### Biomass boilers

6.14 The efficiency of biomass boilers at their nominal load and tested to **BS EN 12809** should be no lower than the following.

a. For independent gravity-fed boilers with an output of less than 20.5kW: 65%.

b. For independent automatic pellet/woodchip boilers: 75%.

## Gas and oil-fired warm air heaters

6.15 In addition to meeting the general requirements for heating systems in Section 5 warm air systems in new and existing buildings should meet the heat generator seasonal efficiency in Table 6.4.

**Table 6.4 Minimum heat generator seasonal efficiency for gas and oil-fired warm air heaters**

| Warm air heater type | Heat generator seasonal efficiency) net calorific value/thermal efficiency( | Product standard |
|---|---|---|
| Gas-fired forced convection to assist transportation of combustion air and/or combustion products | 91% | **BS EN 621** for unfanned<br>**BS EN 1020** for fanned appliances |
| Direct gas-fired forced convection(1) | n/a | **BS EN 525** |
| Oil-fired forced convection | 91% | **BS EN 13842** |

**Note:**

1. For direct gas-fired forced convection air heaters, 100% of the net heat input is delivered to the space. Specific ventilation requirements as defined in **BS EN 525** should be met.

## Gas and oil-fired radiant heaters

6.16 In addition to meeting the general requirements for heating systems in Section 5, radiant heaters in new and existing buildings should meet the heat generator seasonal efficiency in Table 6.5.

6.17 For flued appliances, thermal efficiency (net calorific value) should be measured to either of the following test standards.

a. **BS EN 1020**

b. **BS EN 13842.**

The calculation of thermal efficiency should both:

a. exclude fans

b. take account of the radiant heater and associated flue pipe/tailpipe within the building envelope.

**Table 6.5 Minimum performance standards for radiant heaters**

| Appliance type | Heat generator seasonal efficiency (net calorific value) | |
|---|---|---|
| | Thermal | Radiant |
| Luminous radiant heater – unflued | 86% | 55% |
| Non-luminous radiant heater – unflued | 86% | 55% |
| Non-luminous radiant heater – flued | 86% | 55% |
| Multi-burner radiant heater | 91% | n/a |

## Electric space heating systems

**NOTE:** Electric resistance and radiant 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 of the guidance does not cover either of the following.

a. Electric heat pumps (guidance is provided in paragraphs 6.2 to 6.6).

b. Portable electric heating devices.

6.18 Electric space heating systems should meet the guidance in paragraphs 6.19 to 6.24, in addition to the general requirements for heating systems in Section 5.

6.19 Electric boiler systems should comply with all of the following.

a. Systems should both:

i. have flow temperature control

ii. be able to modulate the power input to the primary water depending on space heating conditions.

b. Timing and temperature control should be provided.

c. If the building has a floor area greater than 150m$^2$, heating should be split into different heating zones and each zone should have separate controls for timing and temperature demand.

6.20 Electric warm air systems should comply with both of the following.

a. Have timing and temperature demand control provided.

b. If the building has a floor area greater than 150m$^2$, heating should be split into different heating zones and each zone should have separate controls for timing and temperature demand.

6.21 Electric radiant heaters should have either automatic zone control (where electric radiant heaters provide zone heating) or automatic occupancy control, through occupant presence detection.

6.22 Electric panel or skirting heaters should have controls for timing and temperature demand.

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

a. The input charge should adjust automatically, based on the internal air temperature.

b. Manual control of heat released from the appliance should be possible.

6.24 Electric fan convectors should have switching to control both of the following.

a. The local fan.

b. The temperature of individual fan convectors.

## Combined heat and power systems

**NOTE:** This section of the guidance covers combined heat and power (CHP) systems that both:

a. have a total power capacity between 5kW$_e$ and 5MW$_e$

b. are used in commercial applications.

For systems with a total power capacity less than 5kW$_e$, follow the guidance in Approved Document L, Volume 1: Dwellings.

6.25 CHP plant should, under annual operation, have both of the following.

a. A minimum CHPQA quality index (QI) of 105.

b. Power efficiency greater than 20%.

6.26 CHP plant should have a control system that ensures that the CHP unit operates as the lead heat generator unless there is a lower carbon heat source supplying the same system. In this case, the control system should ensure the systems provides the lowest carbon intensity of delivered heat

6.27 Metering should be provided to measure all of the following.

a. Hours run.

b. Electricity generated.

c. Fuel supplied to the CHP unit.

## Dedicated domestic hot water heaters

6.28 The recommended minimum standards set out in this section apply only to dedicated water heaters.

Central heating boilers which provide space heating and domestic hot water should meet the minimum standards in paragraphs 6.7 to 6.14.

Heat pumps which provide domestic hot water should meet the minimum standards in paragraphs 6.2 to 6.6.

6.29 In addition to meeting the general requirements for heating systems in Section 5, domestic hot water systems in new and existing buildings should meet the minimum thermal efficiencies in Table 6.6. When considering thermal efficiency, both of the following apply.

a. Include the heat generator and any integral storage vessel.

b. Exclude the following, where present.

i. Secondary pipework.

ii. Fans and pumps.

iii. Diverter valves, solenoids, actuators.

iv. Supplementary storage vessels.

6.30 Domestic hot water systems should be sized for the anticipated domestic hot water demand of the building, based on **BS EN 12831-3**. Systems should not be significantly oversized.

**Table 6.6 Minimum thermal efficiencies for domestic hot water (DHW) systems**

| DHW system type | Fuel type | Heat generator seasonal efficiency (gross calorific value) | Product standard |
|---|---|---|---|
| Direct-fired: new and existing buildings | Natural gas | 91%(1) | **BS EN 15502-2** or **BS EN 89** or **BS EN 26** as appropriate |
| | LPG | 92%(1) | |
| Indirect-fired: new and existing buildings | Natural gas | 91% (boiler efficiency) | Use the equations (as appropriate) in paragraphs 6.8 to 6.11. If primary return temperature ≤55°C, use equation 6.1 ($0.81\eta_{30\%} + 0.19\eta_{100\%}$) to calculate boiler seasonal efficiency. |
| | LPG | 91% (boiler efficiency) | |
| | Oil | 91% (boiler efficiency) | |

| | | | |
|---|---|---|---|
| | | | If primary return temperature >55°C, use boiler full load efficiency (1.0$\eta_{100\%)}$ at 80/60°C flow/return temperatures.<br>If boiler seasonal efficiency values are obtained as net values, the factors in the Standard Assessment Procedure, version 10.2, Table E4 should be used to convert them to gross values. |
| Electrically-heated: new and existing buildings | | 100% assumed | |

**Note:**

1. In exceptional circumstances, where a condensing boiler cannot feasibly be fitted in an existing building (e.g. where there is insufficient space for a replacement flue system), a boiler with the following minimum seasonal efficiency may be used:
   a. 80% for natural gas
   b. 79% for LPG.

6.31 Where efficiency data is not readily available, efficiencies should be calculated using manufacturers' recovery rates and equations 6.5 and 6.6.

gross thermal efficiency = heater output / gross input equation 6.5

heater output = recovery rate of heater in litres/second × specific heat capacity of water × temperature rise of water equation 6.6

## Controls for combustion-heated domestic hot water systems

6.32 Domestic hot water systems should have both of the following.

a. Time control which is independent of space heating circuits.

b. Electronic temperature control.

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

6.34 Direct-fired circulator systems, direct-fired storage systems and indirect-fired circulator systems should have automatic thermostatic control to do both of the following.

a. Shut off the burner/primary heat supply when the desired water temperature is reached.

b. Shut off primary flow if the system temperature is too high.

6.35 Direct-fired continuous flow systems should include both of the following.

a. A flow sensor to control the rate at which water flows through the heat exchanger. This should both:

i. control outlet temperatures

ii. if the sensor detects insufficient flow, shut off the burner/heat input.

b. A high limit thermostat to shut off the primary flow if the system temperature is too high.

### Controls for electrically heated domestic hot water systems

6.36 Point-of-use electrically heated, local electrically heated, and centralised electrically heated domestic hot water systems should have automatic thermostatic control to interrupt the electrical supply when either of the following occurs.

a. The setpoint storage temperature is reached.

b. The system temperature gets too high.

Manual reset should be possible if there is an over-temperature trip.

6.37 Local and centralised electrically heated domestic hot water systems should have both of the following.

a. Seven-day time control.

b. The facility to increase the water temperature by using an immersion heater in the hot water cylinder.

6.38 Water heaters in instantaneous electrically heated domestic hot water systems should have both of the following.

a. A flow sensor to control the rate at which water flows through the heat exchanger. If the sensor detects insufficient flow, it should shut off the electrical input.

b. A high limit thermostat to shut off the primary flow if the system temperature is too high.

## Comfort cooling

**NOTE:** Evaporative cooling and desiccant cooling systems are not within the scope of this guidance.

6.39 In addition to cooling systems meeting the general requirements for building services in Section 5, the seasonal energy efficiency ratio (SEER) of each cooling unit should meet the minimum standards in Table 6.7.

6.40 The specification of comfort cooling systems should be based on an appropriate heat gain calculation for the building, based on CIBSE's Guide A.

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.

**Table 6.7 Minimum seasonal energy efficiency ratio (SEER)(1) for comfort cooling**

| Type | | Cooling unit SEER |
|---|---|---|
| Packaged air conditioners | Single-duct type | 3.0 |

| | | |
|---|---|---|
| | Other types | 3.0 |
| Split and multi-split air conditioners >12kW | | 5.0 |
| Split and multi-split air conditioners ≤12kW | | 5.0 |
| Variable refrigerant flow/volume (VRF/VRV) systems(2) | | 5.0 |
| Water-to-water chillers <400kW | | 5.0 |
| Water-to-water chillers 400–1500kW | | 6.0 |
| Water-to-water chillers ≥1500kW | | 6.5 |
| Vapour compression cycle chillers, air-cooled <400kW | | 4.0 |
| Vapour compression cycle chillers, air-cooled ≥400kW | | 4.5 |
| Absorption cycle chillers(3) | | EER 0.7 |
| Gas-engine-driven variable refrigerant flow | | 1.6 |

**NOTES:**

1. Seasonal space cooling energy efficiency as defined by the Ecodesign Commission Regulation No. 206/2012 Annex II, at average rating conditions where applicable.
2. For VRF/VRV systems, SEER is for the full system including indoor units.
3. For absorption chillers, an EER (energy efficiency ratio) is used instead of SEER. This EER should be determined according to **BS EN 14511-2**.

## Controls for comfort cooling

6.41 Comfort cooling/air-conditioning systems should have all of the following controls.

a. The systems should be subdivided into separate control zones for areas of the building for which any of the following are significantly different.

i. Solar exposure.

ii. Pattern of use.

iii. Type of use.

b. For each control zone and for each terminal unit (the point at which conditioned air is delivered to the space), it should be possible to control both of the following independently of other control zones.

i. Timing.

ii. Temperature.

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

d. Where a system has multiple cooling units, controls should be provided to ensure that the combined plant operates in its most efficient modes. Central plant should operate only when the zone systems require it. The default condition should be off.

e. Controls for comfort cooling systems should meet **BS EN ISO 52120** Class C.

f. Controls should meet the requirements for thermostatic room controls in paragraphs 5.16 to 5.18.

## Calculating the seasonal energy efficiency ratio

6.42 The values for the seasonal energy efficiency ratio (SEER) should be determined using **BS EN 14825** with average climate data, in conjunction with the Ecodesign Commission Regulation No. 2016/2281. The SEER of the cooling unit is given by equation 6.7.

$$SEER = a(EER_{100\%}) + b(EER_{75\%}) + c(EER_{50\%}) + d(EER_{25\%})$$ equation 6.7

Where:

$EER_x$ is the EER measured at the load conditions of 100%, 75%, 50% and 25% at the operating conditions detailed for the part load energy efficiency ratio.

a, b, c and d are the load profile weighting factors relevant to the proposed application. The load profile weighting factors can be taken from either of the following.

a. Table 6.8, for office-type accommodation.

b. A detailed simulation or prediction of the load profile of the building. The calculation should include the desired indoor condition as well as the ambient loads in which the system will work.

**Table 6.8 Standard cooling load profile weighting factors for office accommodation**

| a | b | c | d |
|---|---|---|---|
| 0.03 | 0.33 | 0.41 | 0.23 |

6.43 For cooling units for which there is no part load data, the value used for SEER is the full load EER.

6.44 For applications where the load profile is not known but there is some data on chiller part load EER, the following apply.

a. For chillers where the full and half load (50%) EERs are known: the value used for SEER is the average of the full load and half load EERs.

b. For chillers with four points of part load EER: the SEER should be calculated using equation 6.7 with each EER weighted equally.

c. If the chiller used does not have data for four steps of load: the weights should be apportioned appropriately.

6.45 For plants with multiple chillers, a plant seasonal energy efficiency ratio (SEER) should be calculated based on the sum of the energy consumption of all the operating chillers. All of the following factors should be included.

a. Degree of oversizing of the total installed capacity.

b. Sizes of individual chillers.

c. EERs of individual chillers in operating conditions.

d. Control mode used, for example parallel, sequential, or dedicated low load unit.

e. Load profile of the proposed building.

f. Building location (which determines ambient conditions).

6.46 For systems that can use free cooling or heat recovery, the SEER should be calculated for the specific application, including free cooling or heat recovery elements. For variable refrigerant flow (VRF) systems, any calculations must include indoor and outdoor conditions, the power input from controls, and indoor units.

6.47 For absorption chillers used in conjunction with on-site CHP, a district heat network or a communal heat network, the following apply.

a. The $CO_2$ emissions and primary energy should be calculated in the same way as when using CHP for heating.

b. The control system should ensure as far as possible that heat from boilers is not used to supply the absorption chiller.

c. The full load EER of the absorption chillers should be at least 0.7.

6.48 For district cooling schemes, the $CO_2$ factor and primary energy factor of the cooling energy supply should be calculated. These values should be used to calculate the building emission rate and primary energy rate.

## Heating and cooling system circulators and water pumps

6.49 In variable volume systems, variable speed glandless circulators should be used.

6.50 In any variable volume system, if a water pump is used on a closed loop circuit and the motor is rated at more than 750W, it should be fitted with or controlled by an appropriate variable speed controller.

6.51 In new buildings, pumps should be selected to minimise energy consumption following CIBSE Guide B1. Pumps should not be oversized.

## Mechanical ventilation

6.52 Ventilation systems should be specified based on the ventilation needs of the building, in accordance with Approved Document F, Volume 2: Buildings other than dwellings.

6.53 Air handling systems should be able to achieve a specific fan power (SFP) at 25% of design flow rate no greater than the SFP at 100% design flow rate.

6.54 Fans used for general air distribution that are rated at more than 1100W should be fitted with variable speed drives.

6.55 Ventilation ductwork should be made and assembled to be reasonably airtight. Ductwork should comply with the specifications in either of the following.

a. BESA's DW/144.

b. **BS EN 1507**, **BS EN 12237** and **BS EN 13403**.

6.56 Air handling units should be made and assembled to be reasonably airtight. Air handling units should comply with Class L2 air leakage given in **BS EN 1886**.

6.57 The specific fan power of air distribution systems at the design air flow rate should be no greater than the value in Table 6.9.

Specific fan power should be calculated in accordance with **BS EN 16798-3** at the full design load. For fan coil units, use **BS 8850**.

**Table 6.9 Maximum specific fan power (SFP) in air distribution systems in new buildings and existing buildings**

| System type[1] | SFP (W/(L·s))[2,3] | |
|---|---|---|
| | New buildings | Existing buildings |
| Central balanced mechanical ventilation system with heating and cooling | 2.0 | 2.6 |
| Central balanced mechanical ventilation system with heating only | 1.9 | 2.2 |
| All other central balanced mechanical ventilation systems | 1.5 | 2.0 |
| Zonal supply system where fan is remote from zone, such as ceiling void or roof-mounted units | 1.1 | 1.4 |
| Zonal extract system where fan is remote from zone | 0.5 | |
| Zonal balanced supply and extract ventilation units, such as ceiling void or roof units | 2.3 | |
| Local balanced supply and extract ventilation system, such as wall/roof units | 2.0 | |
| Local supply or extract ventilation units, such as window/wall/roof units (e.g. toilet extract) | 0.3 | 0.4 |
| Other local ventilation supply or extract units | 0.5 | |

| | |
|---|---|
| Fan assisted terminal variable air volume (VAV) unit | 0.5 |
| Fan coil unit (rating weighted average[4]) | 0.4 |
| Kitchen extract, fan remote from zone with grease filter | 1.0 |

**NOTES:**

1. A central system is one which serves the whole or major areas of the building. A zonal system is one which serves a group of rooms or areas in part of the building and requires ducting. A local system or unit is one which serves one room or area and does not require ducting.
2. For balanced supply and extract systems, the maximum SFP includes an allowance for heat recovery and return filter.
3. Where any of the following components are included in the system, the maximum SFP may be increased.
   a. High-efficiency particulate air (HEPA) filter: add 1.0W/(l·s).
   b. Humidifier/dehumidifier : add 0.1W/(l·s).
   c. Active chilled beams: add 0.3W/(l·s).
   d. Transpired solar collector: add 0.3W/(l·s).

   For example, for a central balanced mechanical ventilation system with heating and cooling, HEPA filter and humidifier, installed in a new building:

   SFP = 2.0 + 1.0 + 0.1
   = 3.1W/(l·s)
4. The rating weighted average is calculated using the following formula:

$$\frac{[(P_{mains,1} + P_{mains,2} + P_{mains,3} + \ldots]}{(\text{Flow rate}_1 + \text{Flow rate}_2 + \text{Flow rate}_3 + \ldots)}$$

where $P_{mains}$ is useful power supplied from the mains in W and flow rate is in l/s.

## Controls for mechanical ventilation

6.58 For mechanical ventilation systems, all of the following apply.

a. The systems should be subdivided into separate control zones for areas of the building for which any of the following are significantly different.

i. Solar exposure.

ii. Pattern of use.

iii. Type of use.

b. For each control zone it should be possible to control all of the following independently of other control zones.

i. Timing

ii. Where appropriate, temperature.

iii. Where appropriate, ventilation rate.

iv. Where appropriate, air recirculation rate.

c. Central plant should operate only when the zone systems require it. The default condition should be off.

6.59 System controls should be wired so that when there is no demand for space heating or hot water, the heating appliance, if appropriate, and pump are switched off.

6.60 Central mechanical ventilation systems should have both of the following.

a. Time control at room level.

b. On/off time control at air handler level.

6.61 Heat exchangers should have both of the following.

a. Defrost control to protect the heat exchanger.

b. Control to ensure that heat recovery can be stopped, modulated or bypassed when heat recovery is undesirable.

6.62 Supply temperature control should be provided via a variable set point with outdoor temperature compensation.

6.63 Local and zonal systems should have on/off air flow control at room level.

## Heat recovery

6.64 Ventilation systems that provide supply and extract ventilation should be fitted with a heat recovery system where technically feasible.

## Lighting

### Internal lighting

6.65 Any fixed internal lighting should achieve lighting levels appropriate to the activity in the space. Spaces should not be over-illuminated. Lighting should be designed based on CIBSE's *SLL Lighting Handbook* or an equivalent design guide.

**NOTE:** For smaller spaces where total lighting power is likely to be low (toilets, store rooms etc.) there is no expectation that lighting calculations should be produced.

6.66 Internal lighting should be as follows.

a. General lighting should either:

i. have an average luminaire efficacy of greater than 105 luminaire lumens per circuit-watt.

ii. have a Lighting Energy Numeric Indicator (LENI) calculated using the method in Appendix B and no greater than the applicable values set out in Table B1.

b. Display lighting should meet any one of the following:

i. have an average light source efficacy of greater than 95 light source lumens per circuit-watt.

ii. have a rated power use no greater than 0.3W/m$^2$ in each space

iii. have a LENI calculated using the method in Appendix B and no greater than the applicable values set out in Table B1.

c. High excitation purity light sources should have an average light source efficacy of greater than 65 light source lumens per circuit-watt.

**NOTE:** This approved document does not include minimum standards for specialist lighting, such as theatrical spotlights, stage lighting, gobo projectors or wall-washers.

6.67 Internal general lighting and display lighting should be metered by one of the following methods.

a. Dedicated lighting circuits with a kilowatt-hour meter for each circuit.

b. Local power meter coupled to or integrated in the lighting controllers of a lighting management system.

c. A lighting management system that can both:

i. calculate the consumed energy

ii. make this information available to a building management system.

6.68 Lift car lighting and display lighting in lift cars should achieve an average light source efficacy of greater than 105 luminaire lumens per circuit watt.

## Lighting controls for internal lighting

6.69 Lighting controls in new and existing buildings should follow the guidance in the Building Research Establishment's Digest 498.

6.70 Automatic controls to turn the general lighting off when the space is not in use (e.g. through presence detection) should be fitted in both of the following.

a. In all unoccupied spaces.

b. In occupied spaces where suitable for the use of the space.

6.71 Controls such as key-card switches and/or timer switches should be installed in hotel bedrooms to turn off internal lights during unoccupied periods.

6.72 General lighting in occupied spaces should have daylight controls (e.g. photo-switching and dimming) for parts of the space which are likely to receive high levels of natural light.

6.73 Display lighting should be controlled on dedicated circuits that can be switched separately from those for lighting for general illuminance.

## Fixed external lighting in new buildings

6.74 In new buildings, fixed external lighting should provide useful illuminance. Unnecessary façade or other types of decorative fixed external lighting should not be installed.

6.75 In new buildings, fixed external lighting levels should be appropriate to the activity in the space. External lighting should be designed based on CIBSE's *SLL Lighting Handbook*, or an equivalent design guide.

6.76 Illuminance from fixed external lighting in new buildings should be directed to where the light is needed using shields, reflectors and baffles. Light should be directed downwards where feasible. Light spill and wasted light to the sky should be kept to a minimum in line with the Institution of Lighting Professionals Guidance Note "*The Reduction of Obtrusive Light".*

### Lighting controls for fixed external lighting in new buildings

6.77 Fixed external lighting in new buildings should be fitted with automatic controls that switch off external lights during both of the following.

a. Daylight hours.

b. Periods of the night when the building is not in operational use.

unless either of the following apply.

i. Lighting in either period (a) or (b) is essential for safety or security purposes.

ii. The maximum power consumption of the luminaire (or group of luminaires to be controlled by a single sensor) is less than 4W.

**NOTE**: The maximum power consumption of the luminaire is to be determined based on the maximum power rating of lamp(s) which can be safely fitted into the luminaire.

## Building automation and control systems

6.78 If a new building has a space heating or air-conditioning system with an effective rated output greater than 180kW, a building automation and control system should be installed.

6.79 If an existing building has a space heating or air-conditioning system with an effective rated output greater than 180kW, and a building automation and control system is being replaced or installed, the building automation and control system should follow paragraphs 6.83 and 6.84.

**NOTE:** The requirements in paragraphs 6.78 and 6.79 also apply to buildings which contain heating and air-conditioning systems combined with ventilation systems.

6.80 For building systems that do not satisfy paragraph 6.78 or 6.79, the provision of centralised controls to allow the facilities manager to switch off appliances when they are not needed should be considered. Where appropriate, controls should be automatic (with manual override) to maximise energy savings. The power requirements of essential (e.g. life safety) systems should be considered.

### Determining the effective rated output

6.81 The effective rated output of a space heating or air conditioning system is the combined output of the equipment in the building which is provided for heating or cooling the internal space in normal operation for the comfort of occupants.

The effective rated output should be assessed based on the final installed capacity of the heating or air-conditioning system. When estimating the effective rated output at the design stage, designers should make allowances for the final installed capacity, including potential oversizing and equipment substitution.

When determining the effective rated output of air-conditioning systems, the combined maximum output of both of the following, as specified by the manufacturer, should be included.

a. Air-conditioning systems.

b. Air-conditioning systems combined with or as part of a ventilation system.

When determining the effective rated output of heating systems, the combined maximum output of all the following, as specified by the manufacturer, should be included.

a. Primary space heating systems.

b. Space heating systems combined with or as part of a ventilation system.

c. Secondary space heating systems.

**NOTE**: The effective rated output of a heating system does not include any of the following.

a. Heating or cooling equipment only intended for emergency or occasional backup use.

b. Heating equipment for frost protection.

c. Heating for domestic hot water.

d. Heating or cooling for industrial processes.

6.82 If the building is heated through a district heat network or communal heat network, the effective rated output should be based on the capacity of the equipment installed in the building, making reasonable assumptions for the operation of the district heat network or communal heat network, including flow temperatures.

## Building automation and control system specification

6.83 Where a building automation and control system is installed in a new or existing building, and the building meets the space heating or cooling criteria in paragraphs 6.80 and 6.81, the system should meet all of the following.

a. Fully comply with **BS EN ISO 16484**.

b. Continuously monitor, log, analyse and allow for adjusting energy use.

c. Benchmark the building's energy efficiency, detect losses in efficiency of heating, ventilation and air conditioning systems, and inform the person responsible for the facilities or building management about opportunities to improve energy efficiency.

d. Allow communication with connected fixed building services and other appliances inside the building and be interoperable with fixed building services across different proprietary technologies, devices and manufacturers.

**NOTE:** A **BS EN ISO 52120** Class A rated system meets these requirements.

6.84 Where a building automation and control system is installed, its control capabilities should be appropriate for the building, the building's expected usage and the building services specification.

## On-site electricity generation and storage

6.85 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.

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

6.87 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).

6.88 On-site electricity generation and storage systems should be provided with automated controls that support the design of the system and the intended use. This is particularly the case where storage systems, such as batteries are used.

## Lifts, escalators and moving walkways

6.89 The energy consumption of passenger lifts with a declared maximum load of less than or equal to 2,000kg, escalators and moving walkways in new buildings should be minimised by performing calculations for alternative designs using the methods described in **BS EN ISO 25745-2** or **BS EN ISO 25745-3**.

### Lifts

6.90 Passenger lifts in new buildings with a declared maximum load of less than or equal to 2,000kg should operate in a standby condition, where they remain stationary and at a reduced level of energy demand, during periods of low passenger demand.

6.91 Passenger lifts with a declared maximum load of less than or equal to 2,000kg in new buildings should operate using a Variable Voltage Variable Frequency (VVVF) drive.

6.92 Passenger lifts with a declared maximum load of less than or equal to 2,000kg in new buildings should achieve at least energy efficiency class A using the methodology described in **BS EN ISO 25745-2**.

### Escalators and moving walkways

6.93 Escalators and moving walkways in new buildings should vary the speed of operation, or operate in an automatic standby and start mode, using passenger load or presence sensing.

6.94 Escalators and moving walkways in new buildings should achieve at least energy efficiency class A+ using the methodology described in **BS EN ISO 25745-3**.

## Communal heat networks

6.95 The central heat source for a communal heat network should comply with the minimum standards in this section (Section 6) as relevant for the heat source.

# Regulation 43: Pressure testing

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

| Regulation |
| --- |
| **Pressure testing**<br><br>**Pressure testing**<br><br>**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.<br><br>(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—<br><br>(a) ensure that—<br><br>(i) pressure testing is carried out in such circumstances as are approved by the Secretary of State; and<br><br>(ii) the testing is carried out in accordance with a procedure approved by the Secretary of State; and<br><br>(b) subject to paragraph (5), give notice of the results of the testing to the local authority building control authority.<br><br>(3) The notice referred to in paragraph (2)(b) shall—<br><br>(a) record the results and the data upon which they are based in a manner approved by the Secretary of State; and<br><br>(b) be given to the local authority building control authority not later than seven days after the final test is carried out.<br><br>(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.<br><br>(5) Where such a certificate contains the information required by paragraph (3)(a), paragraph (2)(b) does not apply.<br><br>(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 building is erected, by air pressure testing in accordance with paragraphs 7.2 to 7.6. Paragraph 7.2 provides the approved procedure for commissioning 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. Regulation 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 7.7.

# Section 7: Air permeability and pressure testing

7.1 The minimum standard for air permeability of a new building 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 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's 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 Buildings that are not dwellings, including extensions that are being treated as new buildings to comply with Part L, must be pressure tested – except those buildings listed in paragraph 7.6.

7.6 The Secretary of State has approved that pressure testing does not need to be carried out in the following buildings.

a. Buildings with less than 500m$^2$ total useful floor area. A pressure test may be avoided provided that the air permeability used to calculate the building primary energy rate and building emission rate is taken as 15m$^3$/(h·m$^2$) at 50Pa.

b. A factory-made modular building that meets the following criteria:

i. the floor area is less than 500m$^2$

ii. the building has a planned service life of more than two years, but the intended time of use in one location is less than two years

iii. no site assembly work is needed other than linking standard modules using standard link details.

If the building as installed conforms to a standard configuration of modules and link details for which the installer has pressure test data, this test data may be used to estimate the air permeability. Test data must be from a minimum of five in-situ measurements of the same module types and link details as used in the actual building. Air permeability should be in $m^3/(h \cdot m^2)$ at 50Pa. When calculating the building primary energy rate and building emission rate for a factory-made modular building as described above, the value that should be used for design air permeability is the average air permeability test result at 50Pa plus $1.0 m^3/(h \cdot m^2)$.

c. Large extensions. If the building control body agrees that sealing off and testing the extension separately from the existing building is impractical, the extension should be treated as a large complex building – see paragraph 7.5(d).

d. Large complex buildings. If pressure testing is impractical due to the size or complexity of the building, the developer may produce both of the following.

i. A detailed justification of why pressure testing is impractical.

ii. A detailed strategy to give confidence that a continuous air barrier will be achieved.

It is reasonable for the building control body to accept this strategy in place of a pressure test to assess compliance.

The developer should seek expert advice to confirm the justification and strategy in paragraph 7.5(d). Any justification and strategy should be in line with the approved airtightness testing methodology, CIBSE's TM23 *Testing Buildings for Air Leakage*. It would not be reasonable to claim that air permeability lower than $5.0 m^3/(h \cdot m^2)$ at 50Pa had been achieved.

e. Compartmentalised buildings. If buildings are compartmentalised into self-contained units with no internal connecting openings, it is reasonable for the building control body to accept a pressure test carried out on a representative area of the building as evidence of the building's air permeability.

If the results of the pressure test on the representative area of the building do not meet the criteria in paragraphs 7.1 and 7.7, the building air permeability should be improved and retested until the criteria are achieved. The developer should also carry out a further test on another representative area to confirm that all parts of the building achieve the expected standard.

7.7 The building primary energy rate and building emission rate (detailed in Section 2) calculated using the measured air permeability must not be higher than the target primary energy rate and target emission rate, respectively.

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

7.9 The results of all pressure tests on buildings, 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<br>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.<br>(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.<br>(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.<br>(4) The notice must be given—<br>(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;<br>(b) in any other case, to the building control authority—<br>(i) not later than the date on which the notice required by regulation 16(4) is required to be given; or<br>(ii) where that regulation does not apply, not more than 30 days after completion of the work.<br>(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 loses— | |
| (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. 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.

If the only controls available to the building user for a fixed building service or on-site electricity generation are 'on' and 'off' switches, that service does not need to be commissioned.

8.2 Fixed building services should be commissioned with the aim of optimising their in-use performance. Reference should be made to Section 5 and Section 6 which provide further guidance on minimum efficiencies, controls and other relevant standards.

8.3 For large or complex projects, a commissioning manager should be appointed. In all other cases, appointing a commissioning manager should be considered on a case-by-case basis. The competence of the commissioning manager should meet the list of knowledge and skills set out in CIBSE's Commissioning Code M.

8.4 When installing a fixed building service or installing on-site electricity generation that is subject to the energy efficiency requirements, a commissioning plan should be prepared that identifies all of the following.

a. Which systems to test.

b. Which tests to complete.

c. Schedule of commissioning.

d. Roles and responsibilities.

e. Documentation requirements.

The building control body should be given all of the following.

a. The commissioning plan.

b. The design-stage target primary energy rate and building primary energy rate calculation.

c. The design-stage target emission rate and building emission rate calculation.

8.5 Any commissioning should involve testing and adjusting the fixed building services and on-site electricity generation in accordance with all of the following.

a. The manufacturer's instructions.

b. CIBSE's Commissioning Code M.

c. Any of the following.

i. The specific CIBSE Commissioning Codes relevant to each service being commissioned.

ii. The specific BSRIA Commissioning Guides relevant to each service being commissioned.

iii. A combination of (i) and (ii).

a. The procedures for air leakage testing of ductwork given in paragraphs 8.9 to 8.12.

b. The procedures for testing of the energy consumption of lifts, escalators and moving walkways given in paragraph 8.13 and 8.14.

## Notice of completion of commissioning

8.6 A notice of completion of commissioning must be given to the relevant building control body and the building owner to confirm that the installed fixed building services and on-site electricity generation 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 the performance of the system is reasonably in accordance with the actual building design. For any areas where building services do not perform as well as intended, written commentary should be included.

8.7 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 commissioning work being completed.

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

c. 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.

8.8 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.

## Air leakage testing of ductwork

8.9 For ducted systems that are served by fans with a design flow rate greater than 1m$^3$/s, ductwork leakage tests should be carried out. Tests should follow the procedures in the Building and Engineering Services Association (BESA) documents DW/143 and DW/144.

8.10 For low-pressure ductwork, if at least 10% of the ductwork is tested at random and achieves the low-pressure standard as defined by DW/143, a calculated improvement in both the building primary energy rate and building emission rate may be claimed. Details are given in the *National Calculation Methodology Modelling Guide*.

8.11 Membership of the BESA Specialist Ductwork Group or the Association of Ductwork Contractors and Allied Services (ADCAS) is one way to demonstrate that a contractor has suitable competency for ductwork pressure testing work.

8.12 Air leakage rates are given in Table 8.1. If a ductwork system fails to meet the air leakage limit in Table 8.1, both of the following apply.

a. Remedial work should be carried out to achieve satisfactory performance in retests.

b. Further ductwork sections should be tested as set out in DW/143.

**Table 8.1 Ductwork pressure classes**

| Ductwork pressure class | Design static pressure (Pa) | | Maximum air velocity (m/s) | Air leakage limit (l/(s·m2) of duct surface area)[1] |
|---|---|---|---|---|
| | Maximum positive | Maximum negative | | |
| Low pressure (class A) | 500 | 500 | 10 | 0.027 $\Delta p^{0.65}$ |
| Medium pressure (class B) | 1000 | 750 | 20 | 0.009 $\Delta p^{0.65}$ |
| High pressure (class C) | 2000 | 750 | 40 | 0.003 $\Delta p^{0.65}$ |
| High pressure (class D) | 2000 | 750 | 40 | 0.001 $\Delta p^{0.65}$ |

**NOTE:**

1. $\Delta p$ is the differential pressure in pascals.

## Testing of energy performance of lifts, escalators and moving walkways

8.13 The energy consumption of passenger lifts in new buildings with a declared maximum load of less than or equal to 2,000kg should be tested using the procedure in **BS EN ISO 25745-1**.

8.14 The power consumption of escalators and moving walkways in new buildings should be tested using the procedure in **BS EN ISO 25745-1**.

# Regulations 40 and 40A: Providing information to the owner 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 to 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 9.1 to 9.3.

b. Other important documentation, in accordance with paragraphs 9.4 to 9.6.

In the Secretary of State's view, when work is carried out on an existing building, 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 9.1 and 9.3.

b. Relevant information for work on existing systems, in accordance with paragraphs 9.7 to 9.12.

# Section 9: Providing information to owner about the building, fixed building services and maintenance requirements

## Operating and maintenance instructions

9.1 For a new building and for work to an existing building, operating and maintenance instructions should be given to the owner of the building in a building log book.

9.2 For new buildings and work on existing buildings, owners should be provided with operating and maintenance instructions.

**NOTE:** Information in the log book may draw on or refer to information available as part of other documentation, such as operation and maintenance manuals or the health and safety file. Further advice is given in BSRIA's BG 26/2011.

9.3 For new buildings and for work that has been carried out on existing buildings, the information provided should include all of the following.

a. Information so that the building can be operated in an energy efficient manner, including information about:

i. the building

ii. the fixed building services and on-site electricity generation

iii. the maintenance requirements of the fixed building services and on-site electricity generation.

b. A copy of the completed commissioning records.

c. The additional information specified below for new buildings (paragraphs 9.4-9.6) or existing buildings (paragraphs 9.7-9.12).

## Additional information for new buildings

9.4 For new buildings with a total useful floor area of over 1000m$^2$, the log book should include a forecast of the actual energy use of the building in kWh/year broken down by fuel type. The energy forecast should include all metered energy uses, including unregulated loads. The energy forecast may be determined using any combination of the following.

a. design calculations

b. energy benchmarks

c. an energy forecasting methodology such as CIBSE's TM54

d. other building modelling or spreadsheet tools

**NOTE:** The compliance outputs of SBEM (building primary energy rates and building emission rates) or other Building Regulations software packages are not suitable for direct use as energy forecasting estimates for any size of building.

9.5 For new buildings, the log book should also include all of the following.

a. Data on the inputs used to calculate target primary energy rate, target emission rate, building primary energy rate and building emission rate.

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

9.6 Where building automation and control systems are installed in a new building, information about their energy performance should also be given to the building owner.

## Additional information for work in existing buildings

9.7 For work that has been carried out in existing buildings, information added to a new or existing log book should also include information about all of the following.

a. Any new, renovated or upgraded thermal elements.

b. Any new or renovated windows, roof windows, rooflights or doors (controlled fittings).

c. Any newly installed energy meters.

9.8 For existing buildings, when any building work is carried out for which Section 5 and/or Section 6 sets a standard, the energy performance of the fixed building services and on-site electricity generation affected by the work should be assessed and documented.

9.9 For existing buildings, 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. A documented assessment using an approved methodology, such as a new energy performance certificate.

b. A documented assessment of the installed system, produced in accordance with Ecodesign and associated energy labelling requirements.

c. A documented assessment of a reasonably representative complete system, produced by the product manufacturer.

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

9.10 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 any of the following.

a. Product data sheets from the product manufacturer.

b. Other documented results of energy assessment of the product carried out in accordance with relevant test standards.

9.11 If work on an existing system alters the energy performance or $CO_2$ emissions performance of the system, then the complete altered system should be assessed and the guidance for new or replacement systems in paragraph 9.9 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.

9.12 Where building work is carried out on first fit-out (e.g. in shell and core buildings or partially occupied buildings) the building log book should be updated, following paragraphs 9.7-9.11.

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

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 buildings by following the standards in Section 10.

# Section 10: Replacing thermal elements and limiting heat gains and losses in existing buildings, including extensions

## General

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

a. Providing a new thermal element in an existing building – follow paragraph 10.2.

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

c. Replacing windows, doors or rooflights (controlled fittings) in an existing building – follow paragraphs 10.3 to 10.5.

d. Extending an existing building – follow paragraphs 10.6 to 10.11.

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

**NOTE:** Guidance for renovating or retaining elements in existing buildings is given in Section 11.

## New and replacement thermal elements

10.2 The minimum standards in paragraphs 4.6 and 4.7 and Table 4.1 should be met for both of the following.

a. New thermal elements installed in an existing building.

b. Replacement thermal elements in an existing building.

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

10.3 If the *entire unit* of a window, roof window, rooflight or door is replaced, all the following apply.

a. Units should be draught-proofed.

b. Units should meet the minimum standards in Table 4.1.

c. Insulated cavity closers should be installed where appropriate.

10.4 For windows in buildings similar to dwellings, building control bodies may accept, as evidence of compliance with the standards in Table 4.1, a Window Energy Rating from a certification scheme that provides a quality assured process and a supporting audit trail from calculating the performance of the window through to the window being installed.

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

a. The area of windows and pedestrian doors, or rooflights, as appropriate, should not exceed the relevant percentage from Table 10.1.

b. If the area of windows and pedestrian doors, or rooflights, exceeds the relevant percentage from Table 10.1, measures should be taken to improve the energy efficiency of the building.

## Extension of buildings other than dwellings

10.6 Constructing an extension in buildings with a total useful floor area greater than 1000m$^2$ triggers the requirement for consequential improvements. Section 12 should be followed.

10.7 If a proposed extension has a total useful floor area that is both of the following

a. Greater than 100m$^2$.

b. Greater than 25% of the total useful floor area of the existing building

that extension should be regarded as a new building, and guidance in Sections 1 to 9 should be followed.

If the proposed extension does not meet criteria (a) and/or (b) above, the guidance in paragraphs 10.8 to 10.12 should be met.

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

10.9 When a building is extended, elements should meet the standard in one of the following: paragraph 10.10, 10.11 or 10.12.

10.10 When a building is extended, elements should satisfy all of the following.

a. New thermal elements should meet the standards in Table 4.1.

b. Replacement thermal elements should meet the standards in Table 4.1.

c. New windows, roof windows, rooflights and doors (controlled fittings) should meet the standards in Table 4.1.

d. Existing fabric elements that will become thermal elements should meet the limiting standards in Table 4.2 by following the guidance in paragraphs 11.2 to 11.4.

In addition, if either of the following areas is greater than that of the existing building, the area of openings in the extension should not exceed that in Table 10.1.

a. Windows and pedestrian doors as a percentage of exposed wall

b. Rooflights as a percentage of area of roof

**Table 10.1 Maximum area of openings in the extension**

| Building type | Windows and pedestrian doors as % of exposed wall | Rooflights as % of area of roof |
|---|---|---|
| Residential buildings where people temporarily or permanently reside | 30 | 20 |
| Places of assembly, offices and shops | 40 | 20 |
| Industrial and storage buildings | 15 | 20 |

**NOTE:** Vehicle access doors, display windows and similar glazing, and smoke vents can be as large an area of wall or roof as required for the purpose.

10.11 As an alternative to paragraph 10.10, the area-weighted U-value of all thermal elements in the extension should be shown to not exceed the area-weighted U-value of an extension of the same size and shape that complies with paragraph 10.9. This includes the standards for areas of openings in Table 10.1.

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

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

Where:

$U_1$ = the U-value of element type 1

$A_1$ = the area of element type 1

and so on.

10.12 As an alternative to paragraphs 10.10 or 10.11, an approved software package may be used to demonstrate that the building primary energy rate and the building emission rate for the building plus proposed extension do not exceed those for the building plus a notional extension. The notional extension should be the same size and shape as the proposed extension and comply with paragraph 10.10.

All calculations should include all consequential improvements that may apply.

## Conservatories and porches

10.13 A conservatory or porch must have thermal separation from the existing building. If the thermal separation is removed or the existing building's heating system is extended into the conservatory or porch, the conservatory or porch should be treated as an extension, and paragraphs 10.6 to 10.12 followed.

10.13 If the conservatory or porch has thermal separation from the existing building, the existing building's heating system does not extend into it, and the conservatory or porch is not exempt from the energy efficiency requirements because of its size or another reason outlined in paragraph 0.18, all the following elements should meet the minimum standards in Table 4.1.

a. New thermal elements.

b. Replacement thermal elements.

c. New windows, roof windows, rooflights and doors. The limitations on area of windows, doors and rooflights in paragraph 10.10 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 building.

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 buildings

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 buildings by renovating a thermal element to the standards in Section 11.

# 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<br>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—<br>(a) in all cases, B1 (means of warning and escape)<br>B2 (internal fire spread—linings)<br>B3 (internal fire spread—structure)B4(2) (external fire spread—roofs)<br>B5 (access and facilities for the fire service) C2(c) (interstitial and surface condensation)<br>F1 (ventilation)<br>G1 (cold water supply)<br>G3(1) to (3) (hot water supply and systems)<br>G4 (sanitary conveniences and washing facilities)<br>G5 (bathrooms)<br>G6 (kitchens and food preparation areas)<br>H1 (foul water drainage)<br>H6 (solid waste storage)<br>J1 to J4 (combustion appliances)<br>**L1 (conservation of fuel and power and minimisation of greenhouse gas emissions)**<br>P1 (electrical safety);<br>S2 (infrastructure for the charging of electric vehicles);<br>(b) in the case of a material change of use described in regulation 5(c), (d), (e) or (f), A1 to A3 (structure);<br>(c) in the case of a building exceeding fifteen metres in height, B4(1) (external fire spread—walls);<br>(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 11.

# Section 11: Work to thermal elements in existing buildings

## General

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

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

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

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

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

## Renovating thermal elements

11.2 Renovating a thermal element means one of the following.

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

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

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

d. Replacing the waterproof membrane on a flat roof.

e. Providing cavity wall insulation.

11.3 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 4.2 column (b).

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

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

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

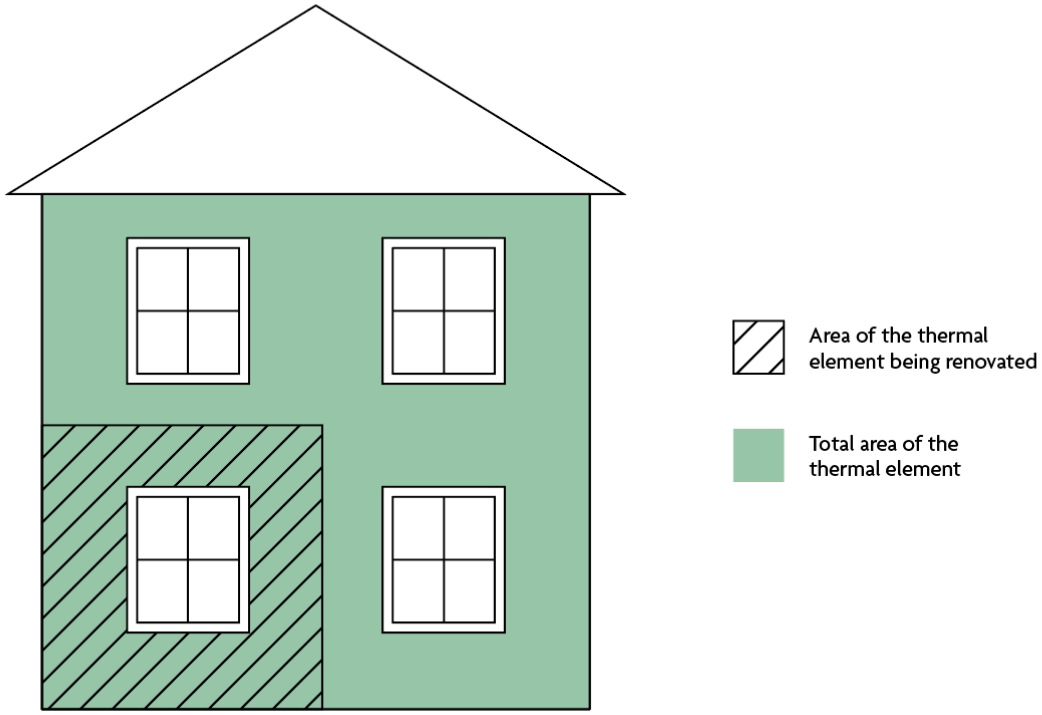



Diagram 11.1 Renovation of a thermal element from the outside

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

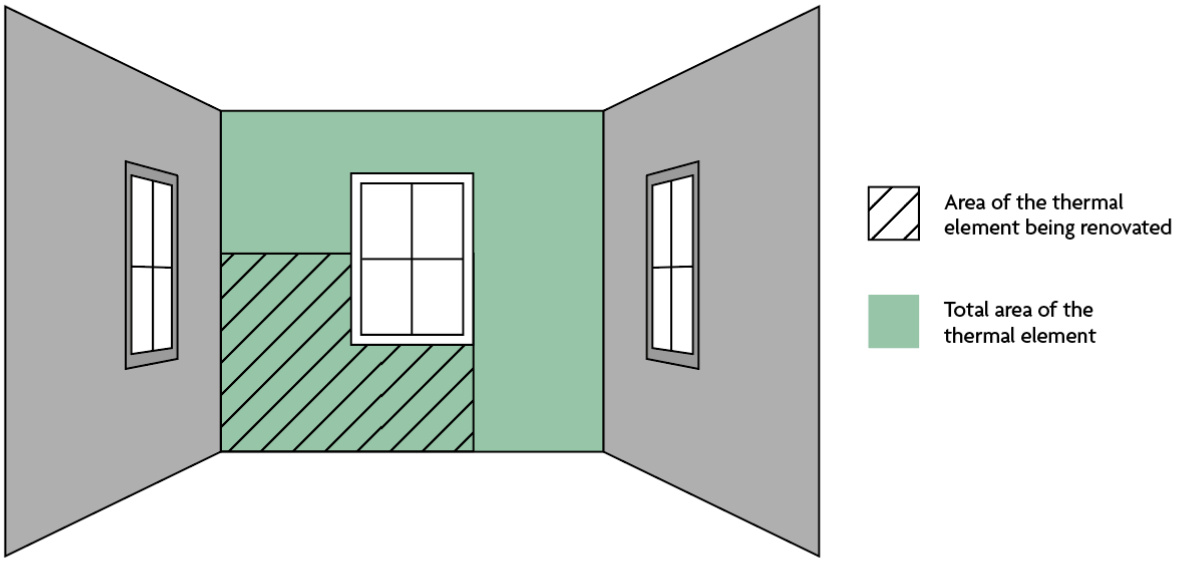



Diagram 11.2 Renovation of a thermal element from the inside

## Material change of use and change to energy status

11.5 A material change of use, in relation to buildings other than dwellings, is when a building satisfies any of the following.

a. The building is used as a hotel or a boarding house, where previously it was not.

b. The building is used as an institution, where previously it was not.

c. The building is used as a public building, where previously it was not.

d. The building is not described in classes 1 to 6 in Schedule 2 of the Building Regulations, where previously it was.

e. The building contains a room for residential purposes, where previously it did not.

f. The building contains more or fewer rooms for residential purposes than previously, but still contains at least one.

g. The building is used as a shop where previously it was not.

**NOTE:** A material change of use may result in a change to energy status.

11.6 A change to energy status is when a building 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 building, a change to energy status applies to that space.

11.7 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 standards as outlined in paragraphs 4.8 to 4.9.

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 4.1.

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 4.4.

**NOTE:** Paragraph 11.7b does not apply to display windows or high-usage entrance doors.

c. New or replacement thermal elements should meet the standards in Table 4.1.

d. New or replacement windows, roof windows, rooflights and doors (controlled fittings) should meet the standards in Table 4.1.

e. The area of openings in the newly created building should not be more than 25% of the total floor area. However, a larger area of openings may be achieved by following paragraph 11.8.

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

**NOTE:** Consequential improvements may be required when there is a material change of use or change to energy status and Section 12 should be followed.

11.8 As an alternative to paragraph 11.7, an approved software package may be used to demonstrate that the building primary energy rate and building emission rate from the building after the material change of use would be no greater than if the building had been improved following the guidance in paragraph 11.7.

# 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<br>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—<br>(a) an extension;<br>(b) the initial provision of any fixed building services; or<br>(c) an increase to the installed capacity of any fixed building services.<br>(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.<br>(3) Nothing in paragraph (2) requires work to be carried out if it is not technically, functionally or economically feasible. |

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

## Intention

In the Secretary of State's view, where regulation 28 applies, the requirements of this regulation are met for existing buildings with a total useful floor area over 1000m$^2$ by carrying out consequential improvements that are technically, functionally and economically feasible, by following the guidance in Section 12.

# Section 12: Consequential improvements to energy performance

12.1 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. Extending a building.

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

c. Increasing the capacity of any fixed building service.

NOTE: Photovoltaics or other microgeneration technology are generally not fixed building services

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

**NOTE:** If the building already complies with the current requirements of Part L of the Building Regulations, consequential improvements are not required.

12.2 Where work other than the items in paragraph 12.1 is planned as part of the principal works, if they improve the energy performance of the building, these are consequential improvements. Work carried out to compensate for the poorer standard of an extension, and using the alternative approach to demonstrating compliance described in paragraph 10.11, does not count as a consequential improvement.

## Consequential improvements when extending a building

**NOTE:** A new free-standing building constructed on an existing site is a new building, not an extension.

12.3 When an existing building with a total useful floor area of over 1000m$^2$ is extended or the habitable area is increased, consequential improvements should be made. The measures in Appendix D, Table D1, may be considered technically, functionally and economically feasible in normal circumstances.

12.4 For an extension or an increase in habitable area, the value of the principal works is used to determine the minimum value of the consequential improvement works. The value of the consequential improvement works should not be less than 10% of the value of the principal works.

12.5 As part of the initial notice or deposit of plans, a chartered quantity surveyor or other suitably qualified person should produce a signed report that gives the value of the principal works and the value of the consequential improvements. The prices used should be those at the date when the building control body is informed of the proposals.

## Consequential improvements on installing or extending the capacity of fixed building services

**NOTE:** Increasing the size of central boiler plant to serve a new extension does not generally increase the installed capacity of a fixed building service per unit area, unless the heating provision in the existing building is increased at the same time. Unless the heating provision in the existing building is increased at the same time as the size of the central boiler plant, paragraph 12.6 does not apply, but paragraphs 12.3 to 12.5 apply as a result of the extension.

12.6 If it is proposed to install a fixed building service in an existing building with a total useful floor area of over 1000m$^2$, either as a new fixed building service or to increase the installed capacity of a fixed building service per unit area, then both of the following consequential improvements should be made to meet the requirements of Part L, where this is practical and technically, functionally and economically feasible.

a. Energy efficiency improvements should be made to fixed building services. All of the following apply.

i. When installing or extending the capacity of fixed building services, the value of the principal works is used to determine the minimum value of the energy efficiency improvements made to fixed building services as consequential improvements. The value of consequential improvements should not be less than 10% of the value of the principal works, excluding the value of any work to improve other energy efficiency aspects of the building to meet paragraph 12.6(b).

ii. The measures in Appendix D, Table D1, relate to this requirement, 12.6(a), and may be considered technically, functionally and economically feasible in normal circumstances.

iii. As part of the initial notice or deposit of plans, a chartered quantity surveyor or other suitably qualified person should produce a signed report that gives the value of the principal works and the value of the consequential improvements. The prices used should be those at the date when the building control body is informed of the proposals.

b. Other energy efficiency aspects of those parts of the building served by the fixed building service should be improved. All of the following apply.

i. All technically, functionally and economically feasible measures to improve the fabric of the building should be made. The extent of improvements to the fabric should not be determined by the value of the principal works.

ii. The measures in Appendix D, Table D2 relate to this requirement, 12.6(b), and may be considered technically, functionally and economically feasible in normal circumstances.

# 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 2: Buildings other than dwellings.

**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.

- 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.

**Building automation and control system** A system comprising all products, software and engineering services that support energy efficient, economical and safe operation of heating, ventilation and air conditioning systems through automatic controls and by facilitating the manual management of those building systems.

**Building control body** A local authority building control department or an approved inspector.

**Building emission rate** The building's $CO_2$ emission rate expressed as $kgCO_2/(m^2 \cdot year)$.

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

**Building primary energy rate** The primary energy use per square metre of floor area per year of a new building other than a dwelling. Expressed as $kWh_{PE}/(m^2 \cdot year)$ and determined

using the approved methodology. The approved methodology is given in the *National Calculation Methodology Modelling Guide*.

**Building heat distribution system** The heat network distribution pipework for hot water and heating for a building connected to a heat network, between a central heat source and the connection with any dwelling or building. 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.

**Centralised electrically heated** A domestic hot water system in which the water is supplied to the draw-off points from a device in which water is heated by an electric element or elements immersed in the stored water. The water heater is situated centrally with a distribution system to supply water to the draw-off points and has a capacity greater than 300 litres.

**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.

**CHPQA quality index** An indicator of the energy efficiency and environmental performance of a combined heat and power scheme, certified by the Combined Heat and Power Quality Assurance Scheme.

**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.

**Control zone** The independent control of rooms or areas within buildings that need to be heated to different temperatures at different times.

***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.

**$CO_2$ 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.

**Direct-fired circulator** A domestic hot water system in which the water is supplied to the draw-off points from a hot water vessel in which water is heated by combustion gases from a primary energy source. The unit has no storage volume, as water is stored in a supplementary storage vessel.

**Direct-fired continuous flow** A domestic hot water system in which the water is supplied to the draw-off points from a device in which cold water is heated by combustion gases from a primary energy source as it flows through the water heater. The water heater is close to the draw-off points. The unit has no storage volume, as water is instantaneously heated as it flows through the device.

**Direct-fired storage** A domestic hot water system in which the water is supplied to the draw-off points from an integral hot water vessel in which water is heated by combustion gases from a primary energy source..

**Display lighting** Lighting to highlight displays of exhibits or merchandise, or lighting used in spaces for public leisure and entertainment, such as dance halls, auditoria, conference halls, restaurants and cinemas.

**Display window** An area of glazing, including glazed doors, to display products or services on offer to the public within a building, positioned as in all of the following.

- At the external perimeter of the building.
- At an access level.
- Immediately next to a pedestrian thoroughfare.

If a permanent workspace is within one glazing height of the window, the window cannot be considered to be a display window.

Glazing more than 3m above an access level should not be considered part of a display window, except where either of the following applies.

a. The products on display require a greater height of glazing.

b. Both of the following apply.

i. Building work involves changes to the façade and glazing that require planning consent.

ii. Planning requirements mean that a greater height of glazing is necessary, e.g. to fit with surrounding buildings or to match the character of the existing façade

**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, including a dwellinghouse and a flat.

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

- 7 years, for the installation of thermostatic controls.
- 7 years, for the extension of on-site low and zero carbon energy-generating systems which are required as consequential improvements (see Appendix D, Table D1).
- 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 ratio** (EER) In chillers, this is calculated by dividing the cooling energy delivered into the cooling system by the energy input to the chiller.

***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) Regulation 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.

**Fit-out work** The work to complete the partitioning and building services within the external fabric of the building (the shell) to meet the specific needs of incoming occupiers. Fit-out work can be carried out either:

- during the same project and time frame as the construction of the building shell
- at a later date, after the shell 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

d. 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.

**g-value** A measure of total solar energy transmittance through glazing.

**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 $CaCO_3$.

**Heat generator seasonal efficiency** The estimated seasonal heat output from the heat generator divided by the energy input during a period of one year.

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

**High excitation purity light sources** Colour-tuneable light sources that can be set to at least the colours listed in Table A1 and which have, for each of these colours, measured at the dominant wavelength, the minimum excitation purity shown. These light sources are intended for use in applications requiring high-quality coloured light.

**Table A1 High excitation purity light sources**

| Colour | Dominant wavelength (nm) | Minimum excitation of purity (%) |
|---|---|---|
| Blue | 440–490 | 90 |
| Green | 520–570 | 65 |
| Red | 610–670 | 95 |

**High-usage entrance door** A door to an entrance primarily for people, through which many people are expected to move. Robustness and/or powered operation are the main performance requirements. A high-usage entrance door has automatic closers and, except where operational requirements preclude it, is protected by a lobby.

**Indirect-fired circulator** A domestic hot water system in which the water is supplied to the draw-off points from a device in which water is heated by an element through which the heating medium is circulated so as not to mix with the hot water supply. In practice, the heat source is likely to be a boiler dedicated to the supply of domestic hot water..

**Installed capacity of a fixed building service per unit area** The design output of the distribution system's output devices (the terminal units) serving the space, divided by the total useful floor area of that space.

**Instantaneous electrically heated** A domestic hot water system in which the water is supplied to the draw-off points from a device in which cold water is heated by an electric element or elements as it flows through the water heater. The water heater is close to the draw-off points. The unit has no storage volume, as water is instantaneously heated as it flows through the device.

**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.

**Lighting Energy Numeric Indicator** (LENI) A measure of the performance of lighting in terms of energy per square metre per year (kWh/$m^2$ per year). See Appendix B.

**Local electrically heated** A domestic hot water system in which water is heated by an electric element or elements immersed in water stored in a device and supplied to the draw-off points. The device in which water is heated is near the draw-off points and has a storage capacity of between 100 and 300 litres.

**Luminaire lumens** The value of the lumen output of a luminaire, including any losses or inefficiencies of the luminaire.

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

***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.

**Modulating burner control** A boiler control that provides a continuously variable firing rate that is altered to match the boiler load over the whole turndown ratio.

**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.

**Optimum start** A control system or algorithm that starts plant operating at the latest time possible to achieve specified conditions at the start of the occupancy period.

**Optimum stop** A control system or algorithm that stops plant operating at the earliest time possible so that internal conditions will not deteriorate beyond present limits by the end of the occupancy period.

**Part load energy efficiency ratio** A ratio calculated by dividing the cooling energy delivered into the cooling system by the energy input to the cooling plant. Part load performance for individual chillers is determined assuming that chilled water is provided at 7°C out and 12°C in (at 100% load), under the conditions detailed in Table A2.

**Table A2 Partial load efficiency ratio**

| Percentage part load | 25% | 50% | 75% | 100% |
|---|---|---|---|---|
| Air-cooled chiller's ambient air temperature (°C) | 20 | 25 | 30 | 35 |
| Water-cooled chiller's entering cooling water temperature (°C) | 18 | 22 | 26 | 30 |

**Passenger lift** Lifting apparatus for the transportation of persons, or persons and goods, between fixed landing levels by means of an enclosed car. Excludes firefighting lifts installed for the exclusive use of the firefighting services and which are not intended for use by occupants of the building.

**Point-of-use electrically heated** A domestic hot water system in which the water is supplied to the draw-off points from a device in which water is heated by an electric element or elements immersed in the stored water. The water heater is close to the draw-off points and has a storage capacity no greater than 100 litres.

**Power efficiency** The total annual power output of a combined heat and power unit divided by its total annual fuel input.

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

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

**Principal works** The work necessary to achieve the client's purposes in extending the building and/or increasing the installed capacity of any fixed building services. The value of the principal works is the basis for determining a reasonable provision for some consequential improvements.

**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.

**Sequence control** A control that enables two or more heating boilers to be switched on or off in sequence when the heating load changes.

**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 *National Calculation Methodology Modelling Guide.*
- 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: www.gov.uk/government/collections/quarterly-energy-prices.

**Simplified building energy model (SBEM)** One of the current approved software packages for implementing the approved calculation methodology for assessing the energy performance of a building in line with this approved document. The SBEM User manual and software package is available at: .

**NOTE FOR CONSULTATION**: The consultation version of the Simplified Building Energy Model, cSBEM, is available at the following webpage: *www.uk-ncm.org.uk*. This provides the opportunity to interact with the model and understand whether different building designs are likely to meet the minimum standard of total energy performance.

**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**: A measure of energy efficiency for air distribution systems. Specific fan power (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 Approved Document L, Volume 1: Dwellings. 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 building, expressed as $kgCO_2/(m^2 \cdot year)$.

**Target primary energy rate** The maximum primary energy use for the building in a year, expressed as $kWh_{PE}/(m^2 \cdot year)$.

**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 groups of indoor spaces.

**Thermal separation** Occurs where a building 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 building.

- 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 building.

**Thermostatic room controls** A device or system that automatically controls the output of heating and/or cooling emitters to control the temperature in each room (or, where justified, each heating zone) independently where heating and/or cooling is provided by a fixed building service.

**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 1$m^2$ 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 building to heat emitters.

**>** 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: Lighting Energy Numeric Indicator (LENI)

B1 The Lighting Energy Numeric Indicator (LENI) method is one approach for complying with the standards for lighting given in Section 6.

B2 The LENI should not exceed the lighting energy limit in Table B1 for a given illuminance and number of hours run.

**Step 1: Determine the lighting energy limit** from Table B1.

For the specific illuminance and number of hours run, identify the LENI where the illuminance column and hours row intersect. For example, lighting which runs for a total of 3000 hours with a illuminance of 150 lux would have a LENI of 4.56 kWh per square metre per year.

**Step 2: Calculate the parasitic energy use ($E_p$).**

If the parasitic energy use is unknown, an allowance of 0.3W/$m^2$ should be made for any control system.

If no lighting control system is used, then $E_p = 0$.

**Step 3: Determine the total power of lighting ($P_l$).**

This is the total power in watts consumed by the luminaires within a space.

**Step 4: Determine the occupancy factor ($F_o$).**

If no automatic control is used, then $F_o = 1$.

If controls turn off the lights within 20 minutes of the room being empty, then $F_o = 0.8$.

**Step 5: Determine the factor for daylight ($F_d$).**

If no daylight-linked dimming system is used, then $F_d = 1$.

If the electric lighting dims in response to daylight being available, then in areas with adequate daylight $F_d = 0.8$. This may be taken as all areas within 6m of a wall with a window or in areas where 10% or more of the roof is translucent or made up of rooflights.

**Step 6: Determine the constant illuminance factor ($F_c$).**

Constant illuminance systems that control the lighting by under-running the lighting on day one, then slowly increase the power used by lighting until it reaches the point when maintenance is required have $F_c = 0.9$, and those that do not have $F_c = 1$.

**Step 7: Calculate the daytime energy use ($E_d$).**

The daytime energy use is:

$$E_d = \frac{P_l \times F_o \times F_d \times F_c \times T_d}{}$$

$$\frac{}{1000}$$

**Step 8: Calculate the night-time energy use ($E_n$).**

The night-time energy use is:

$$E_n = \frac{P_l \times F_o \times F_c \times T_n}{1000}$$

**Step 9: Calculate total energy (kWh) per square metre per year (LENI).**

The total energy per square metre per year is the sum of the parasitic, daytime and night-time energy uses per year divided by the area (A):

$$LENI = \frac{E_p + E_d + E_n}{A}$$

**Table B1 Recommended maximum LENI (kWh per square metre per year) in new and existing buildings**

**NOTE FOR CONSULTATION:** The values in this table will be populated at implementation stage to result in an equivalent energy efficiency than the standards given in **Section 5** and **6**.

| Hours | | | Illuminance (lux) | | | | | | | | Display lighting[1] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | Day | Night | 50 | 100 | 150 | 200 | 300 | 500 | 750 | 1000 | Normal | Shop window |
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**NOTE**:

1. If display lighting is used, the lighting energy limit may be increased by the value given for normal display lighting for the area of the room where display lighting is used.

# Appendix C: Reporting evidence of compliance

## BRUKL report

C1 The Building Regulations UK Part L (BRUKL) report should be provided to the building control body and to the building owner to show that building work complies with the energy efficiency requirements.

C2 The approved software package should be used to produce the BRUKL report for the building as a standard output option.

C3 Two versions of the BRUKL report should be produced, using the compliance outputs from the approved software package.

a. The design stage BRUKL report should be produced before works begin, to include all of the following.

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

ii. The target emission rate and building emission rate.

iii. A supporting list of specifications.

b. The as-built BRUKL report should include all of the following.

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

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

iii. 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.

C4 The as-built BRUKL report should be signed by the energy assessor to confirm that the as-built calculations are accurate.

C5 The as-built BRUKL report must be signed by the client (usually the developer or housebuilder) to confirm that the building has been constructed or completed according to the specifications in the report.

# Appendix D: Measures for consequential improvements

D1 For an existing building with a total useful floor area of over 1000m$^2$, additional work (consequential improvements) may be required to improve the overall energy efficiency of the building if proposed work consists of or includes any of the following.

a. Extending a building.

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

c. Increasing the capacity of any fixed building service (.

NOTE: Photovoltaics or other microgeneration technology are generally not fixed building services

Consequential improvements are described in detail in Section 12.

## Measures usually to be installed whenever consequential improvements are required

D2 Energy efficiency improvements to the building are required whenever consequential improvements apply. All technically, functionally and economically feasible energy efficiency improvements should be implemented. In some circumstances, the requirement for consequential improvements being met is based on the amount spent on the principal works. See Section 12.

D3 The energy efficiency improvements in Table D1 can be considered technically, functionally and economically feasible in normal circumstances. As such, these measures should usually be installed when consequential improvements are required. These should be installed at least to the extent outlined in Table D1, based on the amount spent on the principal works, as outlined in Section 12.

**Table D1 Energy efficiency improvements that are considered technically, functionally and economically feasible in normal circumstances and should usually be installed whenever consequential improvements are required**

| Item | Improvement measure |
|---|---|
| 1 | Upgrading heating systems that are more than 15 years old by providing new plant or improved controls. |
| 2 | Upgrading cooling systems that are more than 15 years old by providing new plant or improved controls. |

| | |
|---|---|
| 3 | Upgrading air-handling systems that are more than 15 years old by providing new plant or improved controls. |
| 4 | Upgrading general lighting systems that have an average lamp efficacy of less than 60 light source lumens per circuit-watt and that serve areas greater than 100m$^2$ by providing new luminaires and/or controls following the guidance in Section 6. |
| 5 | Installing energy metering following the guidance given in CIBSE's TM39. |
| 6 | Upgrading thermal elements that have U-values higher than those in Table 4.2, column (a), following the guidance in paragraphs 4.8 and 4.9. |
| 7 | Replacing existing windows, roof windows or rooflights (but excluding display windows) or doors (but excluding high-usage entrance doors) that have a U-value higher than the following.<br>a. For windows, roof windows and doors – 3.30W/(m$^2$·K)<br>b. For rooflights – 3.80W/(m$^2$·K), calculated by following paragraph 4.4. |
| 8 | If existing on-site low and zero carbon energy-generating systems provide less than 10% of on-site energy demand: increasing the capacity of on-site systems, provided the increase will achieve a simple payback of 7 years or less. |
| 9 | Measures specified in the recommendations report that accompanies a valid energy performance certificate, and which will achieve a simple payback of 15 years or less. |

**NOTE:**
Items 1 to 7 usually meet the economic feasibility criterion of a simple payback of 15 years. A shorter simple payback period of 7 years is given for item 8 because such measures are likely to be more capital intensive or more risky than the others.

## Additional measures usually to be installed when consequential improvements are required following changes to fixed building service provision

D4 When consequential improvements apply as a result of installing a fixed building service in the building for the first time or increasing the capacity of an existing fixed building service, additional energy efficiency improvements to those parts of the building served by the service should be made.

All technically, functionally and economically feasible consequential improvements to the parts of the building served by the service should be implemented to meet the requirements of Part L. The extent of these measures should *not* be based on the value of the principal works, as outlined in Section 12.

D5 The measures in Table D2 improve the energy efficiency of those parts of the building served by the service, and can be considered technically, functionally and economically feasible in normal circumstances.

**Table D2 Additional energy efficiency improvements that are considered technically, functionally and economically feasible in normal circumstances and should usually be made when a new fixed building service is installed or the capacity of an existing one is increased**

| Item | Improvement measure |
|---|---|
| 1 | If the installed capacity per unit area of a heating system is increased, both of the following apply.<br>a. Thermal elements within the area served that have U-values higher than those in Table 4.2, column (a), should be replaced or renovated following the guidance in Section 10 or Section 11.<br>b. Existing windows, roof windows or rooflights (but excluding display windows) or doors (but excluding high-usage entrance doors) within the area served should be replaced in line with the guidance in Section 10 if they have U-values higher than:<br>• for windows, roof windows and doors – 3.30W/($m^2$·K)<br>• for rooflights – 3.80W/($m^2$·K), calculated by following paragraph 4.4. |
| 2 | If the area-weighted installed capacity of a cooling system will be increased, both of the following apply.<br>a. Thermal elements within heated areas served that have U-values higher than those in Table 4.2, column (a), should be replaced or renovated following the guidance in Section 10 or Section 11.<br>b. The solar control system should be upgraded if either of the following criteria is met.<br>i. The area of windows and roof windows (but excluding display windows) within the area served exceeds 40% of the façade area.<br>ii. Both:<br>• the area of rooflights exceeds 20% of the area of the roof, and<br>• the design solar load exceeds 25W/$m^2$.<br>The upgraded system should meet at least one of the following four criteria.<br>i. The solar gain per unit floor area averaged over the period 06:30 to 16:30 GMT, and when the building is subject to solar irradiances for July as given in the table of design irradiancies in CIBSE's Guide A, should not be greater than 25W/$m^2$.<br>ii. The design solar load should be reduced by at least 20%.<br>iii. The effective g-value should be no higher than 0.3.<br>iv. The zone or zones should satisfy the solar gain check in paragraphs 4.17 to 4.19. |
| 3 | Any general lighting system within the area served by the relevant fixed building service that has an average efficacy of less than 60 light source lumens per circuit-watt should be upgraded with new luminaires and/or controls following the guidance in Section 6. |

# Appendix E: Hierarchy for establishing seasonal efficiencies of existing boilers

E1 When a heating system is being replaced in an existing building, paragraph 5.4 should be followed. The seasonal efficiency of the appliance being replaced, if unknown, should be established by following the hierarchy set out below. This is based upon the *Non Domestic EPC Conventions for England & Wales* Issue 7.1.

1. Use Energy Technology List (ETL) product list part load values at 30% and 100% load.
2. Use current Product Characteristics Database (PCDB) values where available.
3. Use either manufacturer's information, 'boiler plate' information or information from a manufacturer's technical helpdesk. Where a gross efficiency value is established for a non-condensing boiler, a deduction of 0.05 (i.e. 5%) should be made to convert the value to an appropriate seasonal efficiency.
4. Use Standard Assessment Procedure, version 10.2 tables (for boilers up to 70kW output).
5. Use suitable SBEM defaults.

# Appendix F: Heat Network Sleeving

For new buildings connecting to a district heat network, the emissions and primary energy factors used in the calculation of the Building Emission Rate and Building 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 any planned generation capacity that is intending to connect to the district heat network within 3 years of the types described in paragraph 2.7(e) of this document following the guidance on submission to the building control body in 2.7(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 'unusued 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 Building Emission Rate and Building 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 G: Standards referred to

**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 [2023]

**BS 8850** Fan coil unit performance. Determination of specific fan power. Test method [2020]

**BS EN 26** Gas-fired instantaneous water heaters for the production of domestic hot water [2015]

**BS EN 89** Gas-fired storage water heaters for the production of domestic hot water [2015]

**BS EN 308** Heat exchangers. Test procedures for establishing the performance of air to air and flue gases heat recovery devices [1997]

**BS EN 410** Glass in building. Determination of luminous and solar characteristics of glazing [2011]

**BS EN 525** Non-domestic direct gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW [2009]

**BS EN 621** Non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW, without a fan to assist transportation of combustion air and/or combustion products [2009]

**BS EN 1020** Non-domestic forced convection gas-fired air heaters for space heating not exceeding a net heat input of 300 kW incorporating a fan to assist transportation of combustion air or combustion products [2009]

**BS EN 1507** Ventilation for buildings. Sheet metal air ducts with rectangular section. Requirements for strength and leakage [2006]

**BS EN 1886** Ventilation for buildings. Air handling units. Mechanical performance [2007]

**BS 5266-1** Emergency lighting. Code of practice for the emergency lighting of premises [2016]

**BS EN 12237** Ventilation for buildings. Ductwork. Strength and leakage of circular sheet metal ducts [2003]**BS EN 12809** Residential independent boilers fired by solid fuel. Nominal heat output up to 50 kW. Requirements and test methods [2001 + A1: 2004]

> **BS EN 12831** Energy performance of buildings **BS EN 12831-1** Method for calculation of the design heat load. Space heating load, Module M3-3 [2017] **BS EN 12831-3** Method for calculation of the design heat load – Domestic hot water systems heat load and characterisation of needs, Module M8-2, M8-3. [2017]

**BS EN 13403** Ventilation for buildings. Non metallic ducts. Ductwork made from insulation ductboards [2003]

**BS EN 13842** Oil fired forced convection air heaters. Stationary and transportable for space heating [2004]

**BS EN 14351-1** Windows and doors. Product standard, performance characteristics. Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics [2006 + AMD 1: 2010]

**BS EN 14511-**2 Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors. Test conditions [2018]

**BS EN 14825** Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part load conditions and calculation of seasonal performance [2018]

**BS EN ISO 52120-1** Energy performance of buildings – Contribution of building automation, controls and building management [2022]

**BS EN 15450** Heating systems in buildings. Design of heat pump heating systems [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 16798-3** Energy performance of buildings. Ventilation for buildings. For non-residential buildings. Performance requirements for ventilation and room-conditioning systems [2017]

**BS EN ISO 12241** Thermal insulation for building equipment and industrial Installations. Calculation rules [2008]

> **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 16484** Building automation and control systems (BACS) [2017 + A1: 2020]

**BS EN ISO 25745 -1** Energy performance of lifts, escalators and moving walks. Energy measurement and verification (2023)

**BS EN ISO 25745 -2** Energy performance of lifts, escalators and moving walks. Energy calculation and classification for lifts (elevators) (2015)

**BS EN ISO 25745 -3** Energy performance of lifts, escalators and moving walks. Energy calculation and classification of escalators and moving walks (2015)

# Appendix H: 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. 206/2012

Ecodesign Commission Regulation No. 2016/2281

Ecodesign Commission Regulation No. 813/2013

Ecodesign Commissiong Regulation No. 814/2013

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

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

## Documents

**Building and Engineering Services Association (BESA)**

(www.thebesa.com)

DW/143 *A Practical Guide to Ductwork Leakage Testing* [2013]

DW/144 *Specification for Sheet Metal Ductwork* [2016]

**Building Research Establishment (BRE)**

(bregroup.com)

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

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

Digest 498 *Selecting Lighting Controls* [2014]

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

*National Calculation Methodology (NCM) Modelling Guide (for buildings other than dwellings in England)* [2013] Available at www.uk-ncm.org.uk

*National Calculation Methodology activity database.* Available at www.uk-ncm.org.uk

*Simplified Building Energy Model* (SBEM) User manual and software. Available at www.uk-ncm.org.uk

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

**Building Services Research and Information Association (BSRIA)**

(www.bsria.com)

BG 26/2011 *Building Manuals and Building User Guides – Guidance and worked examples* [2011]

BSRIA Commissioning Guides as follows:

- BG 2/2010 *Commissioning Water Systems* [2010]
- BG 29/2021 *Pre-Commission Cleaning of Pipework Systems*. Sixth Edition [2021]
- BG 49/2015 *Commissioning Air Systems* [2015]

**Chartered Institution of Building Services Engineers (CIBSE)**

(www.cibse.org)

CIBSE Commissioning Codes as follows:

- Commissioning Code A *Air Distribution Systems* [2006]
- Commissioning Code B *Boilers* [2002]
- Commissioning Code C *Automatic Controls* [2001]
- Commissioning Code L *Lighting* [2018]
- Commissioning Code M *Management* [2003]
- Commissioning Code R *Refrigeration* [2002]
- Commissioning Code W *Water Distribution Systems* [2010]

Guide A *Environmental Design* [2015]

Guide B1 *Heating* [2016]

*Society of Light and Lighting (SLL) Lighting Handbook* [2018]

TM23 *Testing Buildings for Air Leakage* [2022]

TM31 *Building Log Book Toolkit* [2006]

TM39 *Building Energy Metering* [2009]

TM54 *Evaluating Operational Energy Use at the Design Stage* [2022]

AM17 *Heat pump installations for large non-domestic buildings* [2022]

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

**Department for Energy Security & Net Zero (DESNZ)**

(www.gov.uk/desnz)

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

Current Energy Prices. Available at www.gov.uk/government/organisations/department-of-energy-climate-change/about/statistics#energy-price-statistics

Energy Technology List. Available at www.gov.uk/guidance/energy-technology-list

**Department for Levelling-Up, Housing and Communities**

(www.gov.uk/dluhc)

*Approved software for the production of non-domestic Energy Performance Certificates* (www.gov.uk/government/publications/department-for-communities-and-local-government-approved-software-for-the-production-of-non-domestic-energy-performance-certificates-epc)

*National Calculation Methodology Modelling Guide* (for buildings other than dwellings in England) [2021]. Available at: www.uk-ncm.org.uk

**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]

**Historic England**

(historicengland.org.uk)

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

**Ministry of Housing, Communities and Local Government (MHCLG)**

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

**National Association of Rooflight Manufacturers (NARM)**

(www.narm.org.uk)

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

**Non-Domestic Energy Performance Certificate (NDEPC) Conventions Group**

*Non Domestic EPC Conventions for England & Wales* Issue 7.1.