Approved Document L – Conservation of fuel and power

Volume 2: buildings other than dwellings

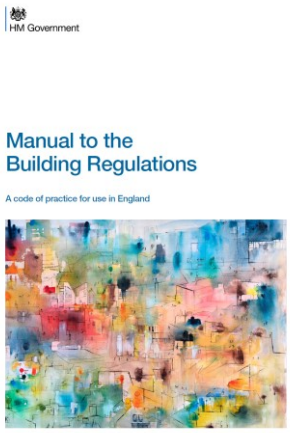
Consultation 2 version – January 2021

This draft guidance accompanies the January 2021 consultation on The Future Buildings Standard: Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for non-domestic buildings and dwellings; and overheating in new residential buildings. *The government is seeking views on the standards for work to buildings other than dwellings, and the structure of the draft guidance.*

Background

How is construction regulated in England?

The Manual to the Building Regulations gives an overview of the building regulatory system in England. You can access the most recent version of the manual here.



How do you comply with the Building Regulations?

The Building Regulations are made under powers provided in the Building Act 1984. This applies in England and Wales. The majority of building projects are required to comply with them. They exist to ensure the health and safety of people in and around all types of buildings (i.e. domestic, commercial and industrial). They also provide for energy conservation, and access to and use of buildings.

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

Building work

Building work is a legal term used to define the scope of the Building Regulations. For further information, see Volume 1 and paragraph A14 in Volume 2 of the **Manual to the Building Regulations.**

Material change of use

Building Regulations often apply when you change the use of a building, when it is a material change of use. This is discussed in paragraphs A14, A20 and Table A2 in Volume 2 of the **Manual to the Building Regulations.**

Materials and workmanship

Regulation 7 of the Building Regulations place requirements on materials and workmanship. Chapter 7 in Volume 1 and paragraphs F8 – F11 in Volume 2 of the **Manual to the Building Regulations** provides a summary of how to meet the regulations.

Independent third-party certification and accreditation

For information about Competent Persons Schemes, see Chapter 5 in Volume 1 and Chapter C in Volume 2 of the **Manual to the Building Regulations.**

Energy efficiency requirements

More information on energy efficiency requirements of the Building Regulations is given in paragraphs A12, A14 (f), A14 (g), A14 (h) A22, A23, B2 and F24 in Volume 2 of the **Manual to the Building Regulations.**

Notification of work

It is commonly necessary to notify a building control service of the work that you are to undertake. For further information on when to notify a building control service, see Chapter B in Volume 2 of the **Manual to the Building Regulations.**

Responsibility for compliance

Those responsible for carrying out building work (for example agents, designers, builders, installers and the building owner), must ensure that the work complies with all of the relevant requirements of the Building Regulations. For further information on this topic, see Chapter 7 in Volume 1 and paragraphs A26, B2 and F2 Volume 2 of the **Manual to the Building Regulations.**

How to use an approved document

The approved documents provide guidance to help you satisfy the Building Regulations in many common situations. Following the guidance in the approved documents does not guarantee compliance. It is important to understand, when carrying out building work, the need to meet all of the relevant requirements of the Building Regulations. For further information see Chapter 1 and Chapter 7 in Volume 1 and Chapter F in Volume 2 of the Manual to the Building Regulations.

In this consultation version of this approved document, technical differences to the Approved Document L2A 2013 edition incorporating 2016 amendments and L2B 2010 edition incorporating 2010, 2011, 2013 and 2016 amendments are generally highlighted in yellow, although editorial changes have been made to the whole document which may have changed the meaning of some guidance.

This text is subject to change before it becomes statutory guidance in 2021.

User requirements

The approved documents provide technical guidance. Users of the approved documents should have adequate knowledge and skills to understand and apply the guidance correctly to the building work being undertaken. Users should also understand that following the approved documents does not guarantee compliance with the Building Regulations.

Contents

Section 0: Introduction

Summary

0.1 This approved document is **Approved Document L, volume 2: buildings other than dwellings**. It gives guidance on how to comply with Part L of Schedule 1 of the Building Regulations and the associated energy efficiency requirements for buildings other than dwellings. For guidance for 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
Section 0: Introduction	N/A
Section 1: Calculating the Target Primary Energy Rate and Target Emission Rate	Regulations 24, 25, 25B, 26, 27 and new regulations for primary energy: Energy performance of buildings calculations
Section 2: Calculating the Building Primary Energy Rate and Building Emission Rate	
Section 3: Consideration of high efficiency alternative systems	[Regulation for the consideration of high efficiency alternative systems]
Section 4: Limiting heat gains and losses	Requirement L1(a) of Schedule 1
Section 5: Minimum building services efficiencies and controls – general guidance **Section 6: System specific advice**	Requirement L1(b)(i) and (ii) of Schedule 1, [regulation for building automation and control systems] and [regulation for Self-regulating devices]
Section 7: Air permeability and pressure testing	Regulation 43
Section 8: Commissioning	Regulation 44, and requirement L1(b)(iii) of Schedule 1
Section 9: Providing information	Regulation 40 and [the regulation for technical building systems]
Section 10: New elements in existing buildings, including extensions	23(2) and Requirement L1(a) of Schedule 1
Section 11: Work to existing buildings	Regulations 6, 22, 23(1) and Requirement L1(a) of Schedule 1
Section 12: Consequential improvements	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: Standards referred to	N/A
Appendix F: Documents referred to	N/A

Application

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

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

i. Rooms for residential purposes.
ii. Buildings that contain only rooms for residential purposes.
iii. Heated common areas of buildings containing more than one dwelling.

New buildings

0.4 Guidance for new buildings is given in **Sections 1** to **9** of this approved document**.**

0.5 For a conservatory or porch installed as part of the construction of a new building, if both the following apply:

a) there is adequate thermal separation between the building and the conservatory or porch

b) the building's heating system is not extended into the conservatory or porch

the conservatory or porch should follow the guidance in **Section 10**, treating the conservatory or porch as if it were an extension being added onto an existing building.

Where a conservatory or porch is provided in a new building and both a. and b. have not been achieved, the guidance for the whole new building should be followed, including for Primary Energy Rate and Building Emission Rate calculations, treating the conservatory or porch as a room in the new building.

0.6 For the *first* fit-out works in buildings, such as shell-and-core office buildings, guidance for new buildings covering first fit-out should be followed. (For any *subsequent* fit-out works the guidance for existing buildings should be followed.)

0.7 For constructing a building from modular subassemblies, or for relocating a modular or portable building, guidance for new buildings should be followed. If the work extends an existing building, consequential improvements may also be required - guidance is given in **Section 12**.

Extensions and work in existing buildings

0.8 Guidance on complying with the energy efficiency requirements is given for the following.

a. Limiting heat gains and losses: **Section 4.**
b. Building services: **Section 5** and **6.**
c. New elements in existing buildings, including replacement of 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

0.9 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 the function of which is 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, industrial sites, workshops and non-residential agricultural buildings with low energy demand;

   NOTE: Portable or modular buildings with a planned service life longer than two years, whether on one or more sites, are *not* exempt. See paragraphs 2.16 to 2.22.

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

d. Carports, covered yards, covered ways and some conservatories and porches (see paragraphs 0.16 to 0.17).

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

0.10 The following types of buildings do not need to comply fully with the energy efficiency requirements, where to do so would unacceptably alter their 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

0.11 Work to a building in paragraph 0.10 must comply with the energy efficiency requirements where this would not unacceptably alter the building's character or appearance. The work should comply with standards in this approved document to the extent that it is reasonably practicable.

Reasonable provision for historic and traditional buildings

0.12 Historic and traditional buildings should only have their energy efficiency improved to the extent that it does not risk the long-term deterioration of the building fabric or fittings, in particular those that have a vapour permeable construction that both absorb and readily allow moisture to evaporate. These include wattle and daub, cob, stone and constructions using lime render or mortar.

0.13 New extensions to historic or traditional buildings should comply fully with the standards of energy efficiency in this approved document unless there is a need to match the external appearance or character of the extension to that of the host building.

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

0.15 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 (2017).*

Exemptions for conservatories and porches

0.16 Where building work creates an extension to an existing building and the extension is a conservatory or porch, the extension is exempt from the energy efficiency requirements, under Regulation 21 of the Building Regulations, if all of the following criteria are met.

a. The extension is at ground level.
b. The floor area does not exceed 30 m^2.
c. The glazing complies with Part K of Schedule 1.
d. Any wall, door or window separating the conservatory or porch from the building has been retained, or if removed, replaced with a wall, door or window.

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

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

Exemptions for covered areas

0.17 Where a building is extended through the addition of a carport 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 are met.

a. It is at ground level.

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

Live–work units

0.18 A unit contains both living accommodation and space to be used for commercial purposes (e.g. as a workshop or office) should be treated as a dwelling, as long as the commercial part can revert to domestic use. Guidance for dwellings can be found in **Approved Document L, volume 1: dwellings.**

0.19 The commercial part of a building can revert to domestic use if all of the following apply.

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

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

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

a. For guidance on each individual dwelling, use **Approved Document L, volume 1: dwellings.**
b. For guidance on the non-dwelling parts of the building, such as heated common areas, and in the case of mixed-use developments, the 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

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

Interaction with Part C

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

Interaction with Part E

0.22 This Approved Document provides guidance on insulation that is reasonably continuous and limits thermal bridging. Construction junctions should have adequate edge sealing, following **Approved Document E.**

Interaction with Part F

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

Interaction with Part J

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

Interaction with Part K and M

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

Regulations 24, 25, 25B, 26, 27, new regulations for primary energy: Energy performance of building calculations

This approved document deals with the requirements of regulations 24, 25, 25B, 26 and 27 and new regulations for primary energy of the Building Regulations 2010.

[regulations will be amended as necessary in line with the performance sections below]

Methodology of calculation of the energy performance of buildings

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

[Regulation to be amended to add primary energy]

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; and

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

Nearly zero-energy requirements for new buildings

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

Interpretation

35(1). 'Energy performance of a building' means the calculated or measured amount of energy needed to

meet the energy demand associated with a typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting.

CO_2 emission rates for new buildings

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

Primary energy rates for new buildings

[New regulation for primary energy for new buildings]

CO_2 emission rate calculations

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

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

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

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

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

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

(a) a notice which specifies–

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

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

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

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

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

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

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

NOTE: Buildings meet the definition of nearly zero-energy buildings by both:

a. meeting the Target Emission Rate required under Regulation 26

b. undertaking an analysis of the technical, environmental and economic feasibility of using high-efficiency alternative systems, which include decentralised energy supply systems based on energy from renewable sources and taking this analysis into account as required by Regulation 25A.

Intention

Regulation 24 and 25

Regulations 24 and 25 of the Building Regulations set requirements for the Secretary of State to set a methodology for the energy performance of a building. For a new non-domestic building, the approved methodologies are the Simplified Building Energy Model or other software tools approved under the Notice of Approval.

Calculation methodologies are set out in **Section 1** and **Section 2**.

Regulation 26 and [the regulation for target primary energy]

A newly constructed building must be shown to meet regulation 26 and [the regulations for target primary energy] of the Building Regulations 2010 by producing calculations to show that the building meets both of the following.

a. Target Primary Energy Rate.
b. Target Emission Rate.

A newly constructed building must be shown to meet regulation 27 and [the regulations for building primary energy] of the Building Regulations 2010 by producing calculations to show that the building meets both of the following.

a. Building Primary Energy Rate.
b. Building Emission Rate.

Sections 1 and 2 set out both of the following.

a. The requirements for meeting the Target Primary Energy Rate and Target Emission Rate.
b. The approved methodologies for calculating a Building Primary Energy Rate and Building Emission Rate.

Section 1: Calculating the 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 calculations of the performance of the building against 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. The notional building is of the same size and shape as the actual building and has standardised properties for fabric and services. The properties of the notional building are set out in the Building Research Establishment's *National Calculation Methodology modelling guide.*

1.2 The energy performance of the notional building, which form the targets for the actual building, is described the using following metrics:

a. The Target Primary Energy Rate, in kWh_{PE}/m^2/year. This is the primary energy rate of the notional building.
b. The Target Emission Rate, in $kgCO_{2e}/m^2$/year. This is the CO_2 emission rate of the notional building.

1.3 The Target Primary Energy Rate and Target Emission Rate should be calculated using one of the calculation tools in the approved methodology. As part of the submission to the building control body, the applicant must show that the software tool used is appropriate to the application. These tools include either of the following:

a. The Simplified Building Energy Model (SBEM), version 6.0.b {n.b. consultation version}, for buildings with design features that are capable of being adequately modelled by the Simplified Building Energy Model.
b. other software tools approved under the Notice of Approval.

NOTE: An up-to-date list of approved software can be found on the Ministry of Housing, Communities and Local Government webpages.

Note for consultation period: *A consultation version of the Simplified Building Energy Model, is available at the following web page: https://www.uk-ncm.org.uk/. It is available for download via the "download-> consultation" option which is selectable from the side menu.*

1.4 The specification of the building may vary from that of the notional building, provided that the building meets the Target Primary Energy Rate, Target Emission Rate, and the guidance in this approved document.

Section 2: Calculating the Building Primary Energy Rate and Building Emission Rate

2.1 The same approved calculation tool, detailed in paragraph 1.3, must 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 must be calculated at both of the following points using the same calculation tool.

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

The Building Primary Energy Rate and Building Emission Rate must be no greater than the Target Primary Energy Rate and the Target Emission Rate respectively.

Building control notification

2.3 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, as calculated using design values.
b. The Target Emission Rate and the Building Emission Rate, as calculated using design values.
c. A list of specifications used in the calculations.

a. to c. can be reported using the design stage Building Regulations United Kingdom Part L Compliance report (BRUKL report) which is produced as a standardised output from the Approved Software. For further details of the design stage BRUKL report, see **Appendix C**.

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

a. The Target Primary Energy Rate and the Building Primary Energy Rate, as calculated using values for the building as constructed.
b. The Target Emission Rate and the Building Emission Rate, as calculated using

values for the building as constructed.

c. A list of specifications used in the calculations made for the building as constructed, and whether the specifications have changed from those provided at design stage.

Building control bodies are authorised to accept notification of a. to c. as reported in the after completion BRUKL report which is produced as a standardised output from the Approved Software. For further details of the BRUKL report calculated after completion see **Appendix C**.

Heating in the Building Primary Energy Rate and the Building Emission Rate

2.5 When systems are capable of being fired by more than one fuel, the following applies, according to the fuel(s).

a. Biomass heating supplemented by an alternative appliance (e.g. gas) - 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 usage of those fuels.
The Building Emission Rate submission should be accompanied by a report, signed by a suitably qualified person, detailing how the combined emission factor has been derived.

b. Appliances capable of burning 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 fuel with the highest CO_2 emission factor should be used.

2.6 If thermal energy is supplied from a district heat network or community heating system or community cooling system, CO_2 emission factors and primary energy factors should be determined by considering the details of the scheme and following the guidance in items a-e below.

a. Calculations should take account of the annual average performance of the whole system, including the distribution circuits, all heat generating plants, Combined Heat and Power (CHP), and any waste heat recovery or heat dumping.

b. The calculation should include the predicted effect of all buildings or parts of buildings that will be connected to the system in the first 12 months of operation. A change in the number of buildings or spaces within buildings connected to the system might affect the percentage of heat supplied from the communal system. The increased operation of any marginal plant (e.g. gas boilers) can then be properly accounted for.

c. The electricity generated by any combined heat and power (CHP) or trigeneration scheme should always be credited at a CO_2 emission factor and primary energy factor equal to the grid average.

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. The Building Primary Energy Rate and Building Emission Rate submission should be accompanied by a report, signed by a suitably qualified person, detailing how the CO_2 emission factors have been derived.

The Primary Energy factor for the heat output should be taken 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 emission factor for the input fuel in kWh_{PE}/kWh*
***E** is the electricity production from the scheme in kWh*
***PE_E** is the emission factor for grid electricity in kWh_{PE}/kWh.*

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

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

Where:
***H** is the useful heat (excluding heat rejected) in kWh*
***F** is the fuel input in kWh*
***CO_{2F}** is the emission factor for the input fuel in $kgCO_2/kWh$*
***E** is the electricity production from the scheme in kWh*
***CO_{2E}** is the emission factor for grid electricity in $kgCO_2/kWh$.*

NOTE: See the Building Research Establishment's *National Calculation Methodology Modelling Guide* for further information.

Management and control features in the Building Primary Energy Rate and the Building Emission Rate

2.7 Where enhanced management and control features are provided in the building, the Building Primary Energy Rate and Building Emission Rate can be reduced by applying the appropriate factor given in Table 2.1 to both of the following, for the system(s) to which the feature is being applied.

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[2]	0.010
Power factor correction to achieve a whole building power factor > 0.95[2]	0.025

NOTES:
1. This means a complete installation that measures, records, transmits, analyses, reports and communicates

meaningful energy management information to enable the operator to manage the energy it uses. A Building Automation and Control System specified to paragraphs 6.62 to 6.69 would meet this definition.

2. The power factor adjustment can be taken 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.

Achieving the Target Primary Energy Rate and Target Emission Rate

2.8 Provided the building satisfies the minimum standards for fabric set out in Section 4, the designer can achieve the Target Primary Energy Rate and Target Emission Rate by using any combination of the following.

a. Fabric energy efficiency.
b. Efficient building services.
c. Low and zero carbon technologies integrated in an appropriate mix.

NOTE: The Target Primary Energy Rate and Target Emission Rate are not likely to be met by using the minimum standards for fabric set out in **Section 4** alone**.**

Special considerations when calculating Building Primary Energy Rate and Building Emission Rate

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

a. Buildings with low energy demand, follow paragraphs 2.10 to 2.13.
b. Modular and portable buildings with a planned service life of more than two years (at one or more sites), follow paragraphs 2.14 to 2.22.
c. Swimming pools, follow paragraph 2.23.
d. Shell and core developments, follow paragraphs 2.24 to 2.28.
e. Industrial sites, workshops and non-residential agricultural buildings other than those with low energy demand, follow paragraph 2.29.

NOTE: Industrial sites, workshops and non-residential agricultural buildings with low energy demand are exempt from the energy efficiency requirements. See paragraph 0.9.

Buildings with low energy demand

2.10 Buildings with low energy demand are taken to be buildings or parts of buildings 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 less than those normally provided for human comfort (e.g. to protect a warehouse from frost).

2.11 In buildings with low energy demand, no Target Primary Energy Rate, Building Primary Energy Rate, Target Emission Rate or Building Emission Rate calculation is required, but both of the following apply:

a. Every fixed building service that is installed should meet the energy efficiency standards set out in **Section 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 2.10c, then no part of the opaque fabric should have a U-value worse than 0.7 W/(m^2·K).

2.12 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 and the normal procedures for demonstrating compliance (including a Target Primary Energy Rate and Building Primary Energy Rate calculation and a Target Emission Rate and Building Emission Rate calculation) followed.

2.13 If a building with low energy demand subsequently changes to a building that no longer has a low energy demand, consequential improvements may need to be made in some circumstances. See **Section 12**.

Alternatively, if the building was designed as a shell and core building, and first fit-out work is carried out, then a full Target Primary Energy Rate and Building Primary Energy Rate submission and a Target Emission Rate and Building Emission Rate submission would be required, following paragraphs 2.24 to 2.28.

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

NOTE: As specified in paragraph 0.9, buildings with a planned service life of less than two years are exempt from part L of the building regulations.

2.14 Special considerations apply to modular and portable buildings with a planned service life of more than two years.

a. For modular and portable buildings at a single location, follow paragraphs 2.16 to 2.18.
b. For modular and portable buildings intended for use at more than one location, for example under hire agreements, follow paragraphs 2.19 to 2.22.

2.15 Placing an existing module on a new site is considered by the Building Regulations to be the construction of a new building.

At a single location

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

2.17 If more than 70 per cent 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 adjusted by the relevant factors from Table 2.2.

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

2.18 After initial manufacture, any work on a module should meet the standards in this document, treating it as work on an existing building. Fabric elements that will be refurbished or replaced in modular sub-assemblies should meet the minimum standards given in **Section 4**. Fixed building services elements that will be replaced in modular sub-assemblies should meet the minimum standards in **Section 5** and **6**.

Table 2.2 Target Primary Energy Rate and Target Emission Rate multiplying factors for modular and portable buildings in a single location for more than 2 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 coming into force date	1.00	1.00
6 April 2014 – Coming into force date	1.30	1.30
1 Oct 2010 – 5 April 2014	1.40	1.40
6 April 2006 – 30 Sept 2010	1.67	1.67
Pre 6 April 2006	1.67	1.67

At more than one location

2.19 Modular and portable buildings with a planned service life of more than two years but with an intended time of use in a single location of less than two years should be shown to comply with the energy efficiency requirements. An example of this type of building, would be a modular or portable building intended 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.

2.20 For modular or portable buildings likely to be used in more than one location, a Target Primary Energy Rate and Building Primary Energy Rate calculation and Target Emission Rate and Building Emission Rate calculation should be carried out when the portable building or its modular components are first constructed. The calculation can be based on a standard generic configuration of modules.

Whenever 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 the following in writing.

a. Details of the calculation.
b. Confirmation that the modules as provided meet or exceed the elemental energy standards 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.

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

2.22 If more than 70 per cent 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 adjusted by the relevant factors from Table 2.3.

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

Table 2.3 Target Emission Rate multiplying factor for modular and portable buildings in a more than one location for less than 2 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 coming into force date	1.00	1.00
6 April 2014 – Coming into force date	1.30	1.30
1 Oct 2010 – 5 April 2014	1.40	1.40
6 April 2006 – 30 Sept 2010	1.67	1.67
Pre 6 April 2006	2.03	2.03

Swimming pool basins

2.23 When determining 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 in the calculation. 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

2.24 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. The submission should demonstrate how the building could reasonably meet the energy efficiency requirements after fit-out.

2.25 If some systems are not installed when a building is put on the market, reasonable assumptions should be made in the Building Primary Energy Rate and Building Emission Rate and model for the efficiencies of services that will be installed during first fit-out work.

The specification provided to the building control body should identify both of the following.

a. The services not provided in the base build.
b. The efficiency values assumed for these services.

2.26 At practical completion of the base building in a shell and core development, the as-built Target Primary Energy Rate, Building Primary Energy Rate, Target Emission Rate and Building Emission Rate calculations should be 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.

2.27 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 submission should be made to the building control body after completion to demonstrate compliance for the part of the building covered by the fit-out work.

2.28 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: A new Energy Performance Certificate is required for that part of the physical building covered by fit-out work.

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

2.29 Special considerations may apply for industrial sites, workshops and non-residential agricultural buildings, where 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.

In such cases, fixed building services should meet the standards set out in **Section 5** and **6** of this document as if they were installed in an existing building.

Regulation for the Consideration of high efficiency alternative systems

This approved document deals with the requirements of [the regulation for the consideration of high efficiency alternative systems as amended] of the Building Regulations 2010.

Regulation for the consideration of high efficiency alternative systems.

[Amended regulation for the consideration of high efficiency alternative systems]

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

Intention

When a new building is erected, the person carrying out the work must comply with [the regulation for the consideration of high efficiency alternative systems] of the Building Regulations 2010 by analysing the feasibility of installing high efficiency alternative systems.

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

Section 3 of this document provides more details.

Section 3: Consideration of high efficiency alternative systems

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

3.2 The analysis of high efficiency alternative systems must be documented and available for verification processes. The documentation should state whether high efficiency alternative systems have been included in the building design.

3.3 The analysis may be carried out for individual buildings, groups of similar buildings, or for common types of buildings in the same area. Where a number of buildings are connected to a district heat network or community heating system, a single analysis may be carried out for all the buildings connected to the network or system. The documented results of the analysis should be retained for the building control body to inspect upon request.

3.4 The analysis may also consider the issues of healthy indoor climate conditions, fire safety, and risks related to intense seismic activity.

3.5 When a building undergoes a major renovation, this may represent an opportunity to consider and take into account all of the following.

a. The technical, environmental and economic feasibility of installing high efficiency alternative systems.
b. Healthy indoor conditions, fire safety and risks related to intense seismic activity.

Requirement L1(a): Limiting heat gains and losses

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

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

Intention

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

a. Limiting unwanted heat *losses* from the building by meeting the standards for all of the following.
   i. The building fabric, including walls, floors, roof, windows and openings - paragraphs 4.1 to 4.6 and paragraphs 4.9 to 4.14.
   ii. Uncontrolled air loss - **Section 7** – paragraphs 7.4 and 7.5
   iii. The pipework and services – paragraphs 4.19 to 4.22.
b. Limiting unwanted heat *gains* to the building, throughout the year, through any of the routes listed in point a. as set out in **Section 4** and specifically for new buildings - paragraphs 4.16 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. Limiting unwanted heat *losses* from the building by meeting the standards for all of the following.
    i. Any building fabric to which building work is being carried out, including walls, floors, roof, windows and openings – paragraphs 4.1 to 4.14. 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 which might result in uncontrolled air loss – paragraph 4.15.

    iii. Any pipework and services to which building work is carried out following paragraphs 4.19 to 4.22.

b. Limiting unwanted heat *gains* to the building, throughout the year, through any of the routes listed in point a. as set out in **Section 4**.

NOTE: If work includes an extension to an existing building, consequential improvements may be required - **Section 12**.

Section 4: Limiting heat gains and losses

U-values

4.1 U-values should be calculated using the methods and conventions set out in the Building Research Establishment's *BR 443.* U-values should be 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 calculated for one of the following.

a. The specific size and configuration of the window.
b. The smaller of the two standard windows defined in **BS EN 14351-1**.
c. The standard window configuration set out in The Building Research Establishment's *BR 443.*

4.3 The U-value of a door should be calculated for either of the following.

a. The specific size and configuration of the door.
b. The standard size as laid out in **BS EN 14351-1**.

NOTE: For domestic-type window construction, the default value from the Standard Assessment Procedure may be used if there are no test data or calculated performance values.

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

Limiting standards for new and replacement elements

4.5 New insulating 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 element in an existing building must meet the requirements in this table is given in **Section 10**.

4.6 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 apply.

a. These fittings should have a maximum centre pane U-value of 1.2 W/(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 for new buildings

Element type	Maximum U-value[1] W/(m^2.K) or air permeability
Roof (flat roof)[2]	0.18
Roof (pitched roof)[2]	0.16
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 band[9] B
All other windows[8,10,11], roof windows, curtain walling	1.6
Rooflights[12]	2.2
Pedestrian doors (including glazed doors)	1.4
Vehicle access and similar large doors	1.3
High-usage entrance doors	3.0
Roof ventilators (inc. smoke vents)	3.0
Air Permeability (for new buildings)	8.0 m^3/ h.m^2 @ 50Pa 1.57 m^3/ h.m^2 @ 4Pa

NOTE:

1. Area-weighted average values.
2. For dormer windows, 'roof' includes the roof parts of the windows, and 'wall' includes the wall parts (cheeks).
3. If meeting such a standard 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 performance 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 *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. There are no limits on the design of display windows and similar glazing, but for new buildings their impact must be taken into account in the calculation of primary energy and CO2 emissions.
11. In buildings with high internal heat gains, the average U-value for windows can be relaxed from the values given above if this can be shown to be an appropriate way of reducing overall CO2 emissions and primary energy. However, values should be no higher than 2.7 W/(m^2.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 Manufacturer's *NTD 2.*

Limiting standards for renovated elements

4.7 Existing elements in existing buildings should meet the limiting standards in Table 4.2. Guidance on when an existing element must meet the requirements in this table is given in **Section 11**. This includes all of the following.

a. Thermal elements being renovated in existing buildings. Renovated elements should achieve the U-values in Table 4.2, column (b).
b. Elements being retained in existing buildings. Retained thermal elements whose U-value is worse than the threshold value in Table 4.2, column (a), should be upgraded to achieve the U-values in Table 4.2, column (b).

4.8 If achieving the U-value in Table 4.2, column (b) is either:

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

then the element should be upgraded to the best standard that both:

a. is technically and functionally feasible
b. can be achieved with a simple payback of no greater than 15 years.

Generally, a thermal element once upgraded should not be worse than 0.7 W/(m^2.K). A lesser standard than this may be acceptable, for example, in order to comply with Part C of the Building Regulations. In particular, the protection from the harmful effects of interstitial and surface condensation.

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

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

Element	U-value[1] W/(m^2.K)	
	(a) Threshold	(b) Improved
Pitched roof[2] – insulation at ceiling level[2]	0.35	0.16
Pitched roof – insulation at rafter level[2,3]	0.35	0.18
Flat roof or roof with integral insulation[2,4]	0.35	0.18
Wall[1] – cavity insulation[2]	0.70	0.55[5]
Wall[1] – external or internal insulation[2]	0.70	0.30[6]
Floors[7,8]	0.70	0.25

NOTES:

0 Area-weighted average values.

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

2 If meeting such a standard would create limitations on head room, a lesser provision may be appropriate. In such cases, both:
the depth of the insulation plus any required air gap should be at least to the depth of the rafters
the insulant should be chosen to achieve the best practicable thermal performance and U-value.

3 If there are problems with the load-bearing capacity of the frame or height of the upstand, a lesser provision may be appropriate.

4 This applies only in the case of a cavity wall capable of accepting insulation. Where this is not the case it should be treated as for 'wall – external or internal insulation.

5 If meeting such a standard would reduce the internal floor area of the room bounded by the wall by more than 5%, a lesser provision may be appropriate.

6 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.

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

Continuity of insulation

4.9 The building fabric should be constructed in new and existing building so that both of the following apply.

a. The insulation is reasonably continuous across new built elements.
b. Thermal bridging, including at the party wall, is reasonably limited.

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

4.10 Thermal bridging should be addressed in the design and construction of a building by either of the following means.

a. Using construction joint details calculated by a person with suitable expertise and experience, using all 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.
   iii. The calculated value can then be used in the Building Primary Energy Rate and Building Emission Rate calculation.
b. Using construction joints with no specific quantification of the thermal bridge values. In such cases, the generic linear thermal bridge values given in The Building Research Establishment's *Information Paper 1/06* and increased by 0.04 W/(m·K) or 50 per cent, whichever is greater, should be used in the Building Primary Energy Rate and Building Emission Rate calculation.

NOTE: Evidence of suitable expertise and experience for calculating linear thermal transmittance would be to demonstrate all of the following:

i. that the person has been trained in the software used to carry out the calculation
ii. that the person has applied that model to the example calculations in the Building Research Establishment's Report *BR 497*
iii. that the person has achieved results within the stated tolerances.

4.11 To avoid air movement within thermal elements in new and existing buildings, either:

a. the insulation layer should be against the air barrier at all points across new built elements
b. the space between the air barrier and insulation layer should be filled with solid material.

NOTE: Particular attention should be paid to **Approved Document F** (ventilation) and **Approved Document J** (combustion appliances and fuel storage systems).

4.12 To calculate linear thermal transmittances and temperature factors in support of the approaches in paragraph 4.10a, follow the guidance in the Building Research Establishment's Report *BR 497*. Specified construction details should achieve a temperature factor that is no worse than the performance set out in the Building Research Establishment's *Information Paper 1/06.*

4.13 To support the approaches in paragraph 4.10a, the builder should demonstrate that an appropriate system of site inspection is in place to give confidence that the construction procedures achieve the required standards.

4.14 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. Appropriate design details and building techniques have been specified.
b. 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

4.15 When carrying out work in existing buildings, care should be taken to reduce unwanted heat loss through air infiltration. This includes doing all of the following:

a. When installing pipework or services, sealing around services penetrations.
b. When installing or renovating thermal elements, draft-proofing the element being installed and filling air-leakage gaps in renovated thermal elements.
c. When installing controlled fittings, ensuring that the controlled fitting is well fitted and reasonably draft-proof.

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

Limiting the effects of solar gains in summer

4.16 In new residential buildings, solar gains should be limited in summer in accordance with [the approved document for overheating]. The buildings in scope are defined in table 0.1 of [the approved document for overheating].

4.17 The guidance in paragraph 4.18 applies to all other buildings not covered in paragraph 4.16, irrespective of whether they are air-conditioned.

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

a. reduce the need for air-conditioning; or
b. reduce the installed capacity of any air-conditioning system that is installed.

4.18 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 with a defined total solar energy transmittance (G-value) calculated according to **BS EN 410**. In this context, an 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.

Table 4.3 Reference glazing systems for solar gain calculation

Type of space (as defined in the National Calculation Methodology database)	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 1m	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

Notes:

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

Limiting heat losses from building services

Hot water pipework

4.19 Hot water pipework should be insulated in all areas inside and outside the building unless the heat can be demonstrated as ‘always useful’.

Insulation should be designed so that the permissible heat losses in **BS 5422** for hot water services in non-domestic buildings are not exceeded. Meeting the standards in Table 4.4 is one way of demonstrating that this has been achieved for low temperature systems.

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

Table 4.4 Minimum pipework insulation thicknesses for hot water services and space heating applications in low temperature hot water systems

Nominal internal pipe diameter (mm)	Minimum insulation thickness (mm) for low temperature hot water systems
≤ 15	15
≤ 32	20
≤ 80	25
≤ 100	30

Notes:
Thicknesses apply for low-emissivity faced insulation with a thermal conductivity of 0.025W/(m.K) or better. Otherwise consult **BS 5422**.
Insulation thicknesses designed to achieve permissible heat losses from **BS 5422** for heating systems ≤95°C

Insulating ductwork

4.21 Ductwork that carries warm or cold air should be insulated throughout its whole length to have a heat transfer of not more than that in Table 4.5. Table 4.5 also gives indicative insulation thicknesses; these offer one way of demonstrating that the heat transfer value has not been exceeded.

Condensation should also be controlled by following TIMSA's *HVAC Guidance for achieving compliance with Part L of the Building Regulations*.

Table 4.5 Recommended maximum heat losses and gains for ducts delivering air for heating and/or cooling

	Heating duct[1]	Cooling or dual-purpose duct[2]
Heat transfer (W/m^2)	16.34	-6.45
Indicative insulation thickness (mm)[3]	21	36

NOTES:
Insulation thicknesses should be calculated according to **BS EN ISO 12241** using the following standardised assumptions:

1. Horizontal duct at 35°C, with 600 mm vertical sidewall in still air at 15°C
2. Horizontal duct at 13°C, with 600 mm vertical sidewall in still air at 25°C

Thicknesses apply for low-emissivity faced insulation with a thermal conductivity of 0.025W/(m.K) or better. Otherwise consult **BS 5422**.

Domestic hot water

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

a. Maximum heat losses in Table 4.6.
b. maintenance consumption values in **BS EN 89**.

Table 4.6 Maximum heat losses from DHW storage vessels

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:

- For maximum heat losses from vessels with a storage volume less than 200 litres, see **BS EN 15450**.
- The heat loss from electrically-heated cylinders (volume V litres) should not exceed either of the following:

a. point-of-use: $1.28 \times (0.2 + 0.051V^{2/3})$
b. local: $1.28 \times (0.051V^{2/3})$.

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

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

[regulations will be amended as necessary in line with the intention sections below]

Schedule 1 – Part L Conservation of fuel and power

L1. Reasonable provision shall be made for the conservation of fuel and power in buildings by:

(a) limiting heat gains and losses–

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

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

(b) providing fixed building services which–

(i) are energy efficient;

(ii) have effective controls; and

(iii) 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(b) (i) and (ii) are met in a new building by providing:

a. fixed building services, including Building Automation and Control Systems and on-site electricity generation systems, which meet the minimum efficiencies in **Section 6.**
b. controls to fixed building services that both:
    i. meet the general controls for heating systems in paragraphs 5.8 to 5.13
    ii. meet system specific controls in **Section 6.**

In the Secretary of State's view, Requirement L1(b) (i) and (ii) is met for work in existing buildings by achieving all of the following.

a. Any fixed building services, including any Building Automation and Control Systems and on-site electricity generation systems, installed meet the minimum efficiencies in **Section 6** and meet the criteria in paragraph 5.4.
b. any fixed building services installed have controls to fixed building services that both:
    i. meet the general controls for heating systems in paragraphs 5.8 to 5.13
    ii. meet system specific controls in **Section 6**.

Regulation for building automation and control systems

This approved document deals with the requirements of [the regulation for building automation and control systems] of the Building Regulations 2010.

Building automation and control systems

[Regulation to align with the standards given in the Energy Performance of Buildings Directive Article 14(4):

> *Where technically and economically feasible, non-residential buildings with an effective rated output for heating systems or systems for combined space heating and ventilation of over 290kW are equipped with building automation and control systems …*
>
> *The building automation and control systems shall be capable of:*
>
> a. *Continuously monitoring, logging analysing and allowing for adjusting energy use;*
> b. *Benchmarking the building's energy efficiency, detecting losses in efficiency of technical building systems, and informing the person responsible for the facilities or technical building management about opportunities for energy efficiency improvement; and*
> c. *Allowing communication with connected technical building systems and other appliances inside the building, and being interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers]*

[Regulation to align with the standards given in the Energy Performance of Buildings Directive Article 15(4):

> *Where technically and economically feasible, non-residential buildings with an effective rated output for systems for air-conditioning or systems for combined air-*

conditioning and ventilation of over 290kW are equipped with building automation and control systems …

The building automation and control systems shall be capable of:

a. *Continuously monitoring, logging analysing and allowing for adjusting energy use;*
b. *Benchmarking the building's energy efficiency, detecting losses in efficiency of technical building systems, and informing the person responsible for the facilities or technical building management about opportunities for energy efficiency improvement; and*
c. *Allowing communication with connected technical building systems and other appliances inside the building, and being interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers]*

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 regulation for Building Automation and Control Systems] is met in a new building by achieving all of the following.

a. Assessing the effective rated output of the heating system of the building, following paragraphs 6.62 and 6.64 to 6.67.
b. Assessing the effective rated output of the air-conditioning system in the building, following paragraphs 6.62 and 6.64 to 6.67.
c. If the effective rated output of the heating or air conditioning system is 290kW or greater, providing a Building Automation and Control System, following paragraph 6.68 to 6.69.

In the Secretary of State's view, [the regulation for Building Automation and Control Systems] is met when a Building Automation and Control System is installed or replaced in an existing building by achieving all of the following.

a. Assessing the effective rated output of the heating system of the building, following paragraphs 6.63 to 6.67.
b. Assessing the effective rated output of the air-conditioning system in the building, following paragraphs 6.63 to 6.67.
c. If the effective rated output of the heating or air conditioning system is 290kW, the Building Automation and Control System being installed or replaced should follow paragraph 6.68 to 6.69.

Regulation for self-regulating devices

This approved document deals with the requirements of [the regulation for self-regulating devices] of the Building Regulations 2010.

Self-regulating devices

Regulation to transpose the requirement of Article 8(1) of the energy performance of buildings directive:

[Member states shall require new buildings, where technically and economically feasible, to be equipped with self-regulating devices for the separate regulation of the temperature in each room or, where justified, in a designated heated zone of the building unit. In existing buildings, the installation of self-regulating devices shall be required when heat generators are replaced, where technically and economically feasible].

Intention

In the Secretary of State's view [the regulation for self-regulating devices] is met in a new building by achieving both of the following.

a. Self-regulating devices are installed where technically and economically feasible, as set out in paragraphs 5.14, 5.16 and 5.17.
b. Self-regulating devices provide separate regulation of the temperature in either:
    i. each room
    ii. where justified in accordance with paragraph 5.16, in a designated heated zone of the building unit.

In the Secretary of State's view [the regulation for self-regulating devices] is met when a heat generator is replaced in an existing building by achieving both of the following.

a. Self-regulating devices are installed where technically and economically feasible, as set out in paragraphs 5.15 to 5.17.
b. Self-regulating devices provide separate regulation of the temperature in either:
    i. each room;
    ii. where justified in accordance with paragraph 5.16, in a designated heated zone of the building unit.

Section 5: Minimum building services efficiencies and controls – general guidance

New building services

5.1 Each new fixed building service, in a new or existing building, should be at least as efficient as the value set out in **Section 6**. If a proposed service is not covered in **Section 6**, it should be demonstrated that it is no less efficient than a comparable service that is covered.

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

a. The efficiency should be based on the appropriate test standard set out in **Section 5** or **6**.
b. The test data should be certified by a notified body.

5.3 For heating and cooling systems, paragraphs 5.8 to 5.17 should be followed, in addition to system specific advice in **Section 6**.

Replacement building services in existing buildings

5.4 A replacement fixed building service should be at least as efficient as the value set out in **Section 6** and should comply with either of the following.

a. Use the same fuel as the service being replaced and have a seasonal efficiency not worse than that of the service being replaced.
b. Use a different fuel than the service being replaced. The system should both:
    i. not produce more CO_2 emissions per kWh of heat than the appliance being replaced
    ii. not produce more primary energy per kWh of heat than the appliance being replaced.

For example:
Replacing an old LPG boiler of 70% efficiency with an oil-fired boiler at 90% efficiency.
CO_2 emissions
LPG boiler: 0.241/0.7 = 0.34 kgCO_2/kWh
Oil boiler: 0.298/0.9 = 0.33 kgCO_2/kWh
Primary energy
LPG boiler: 1.141/0.7 = 1.63 kgCO_2/kWh
Oil boiler: 1.18/0.9 = 1.31 kgCO_2/kWh
In this instance, the oil boiler has both lower CO_2 and primary energy than the LPG boiler

being replaced, and therefore complies.

NOTE: If the efficiency of the appliance being replaced is not known, the methodology outlined in the Non-Domestic Energy Performance Certificate (NDEPC) Conventions Group's *Non Domestic EPC Conventions for England & Wales Issue 7.1* should be followed. CO_2 emission factors and primary energy factors should be taken from Table 30 of the *National Calculation Methodology Modelling Guide.* For grid-supplied electricity use the figure in Table 12 of the Standard Assessment Procedure.

5.5 If renewable technology such as a wind turbine or photovoltaic array is being replaced, the new system should have an electrical output that is at least that of the original installation, except where it can be demonstrated that a smaller system would be more appropriate or effective (for example, replacing a CHP system with a system which is better matched to the building's energy demand

5.6 For heating systems replacements, paragraphs 5.8 to 5.13 should be followed, in addition to system specific guidance in **Section 6**. Consideration should be given to connect to any local heat networks (for example, providing capped off connections in pipework to allow subsequent connection to a local heat network).

5.7 If work involves providing or extending fixed building services, energy meters should be installed following paragraph 5.18.

Heating systems

Sizing space and heating systems

5.8 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 *Design Guide A.* Systems should not be significantly oversized. In most circumstances this means that the heating appliance should not be sized for more than 120 per cent of the design heating load.

5.9 Where a wet heating system is being newly installed or fully replaced in an existing building, including both the heating appliance and the emitters, the system should be sized to allow the space heating system to operate effectively, and in a manner which meets the heating needs of the dwelling, at a flow temperature of 55°C or lower. Where it is not feasible to install a space heating system which can operate at this temperature (for example, where there is insufficient space for larger radiators, or the existing distribution system is provided by higher temperature heat from a low carbon external heat network) the space heating system should be designed to the lowest design temperature possible which will still meet the heating needs of the building.

Controls and zoning

5.10 Heating systems should have all 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 it should be possible to control all of the following. (independent 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 them 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.

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

5.12 When installing a new heating appliance in an existing building, the heating system after the work is complete should have the following controls:

a. Time
b. Temperature
c. Where appropriate and technically feasible, weather compensation.

5.13 When installing a new heating system in an existing building with a floor area greater than 150m^2, heating should, where technically feasible, be split into separately controllable zones. Each heating zone should have separate time and temperature control.

Self-regulating devices

5.14 For heating and cooling systems in new buildings, each room or, where justified in accordance with paragraph 5.16, a heating zone, must be provided with self-regulating devices for the separate control of heating in the room/zone. The installation of self-regulating devices should follow guidance in paragraph 5.17.

NOTE: There is no need to install self-regulating devices for rooms without heating.

5.15 For work in existing buildings, when a heat generator, such as a boiler, is replaced, self-regulating devices must be installed - where technically feasible and economically feasible for the separate control of heating in each room served by the heating appliance. Alternatively, where justified in accordance with paragraph 5.16, heating may be controlled for each heating zone rather than individual rooms. The installation of self-regulating devices should follow guidance in paragraph 5.17.

NOTE: Where it is not technically feasible or economically feasible to install self-regulating devices the requirement does not need to be met. Measures which are not technically feasible include, but are not limited to:

a. Buildings with very low heat demand (e.g. <10W/m^2).
b. Homes with buffer zones for heat absorption or dissipation with high thermal mass.

NOTE: In normal circumstances, the installation of thermostatic radiator valves in wet central heating systems is likely to be economically feasible.

5.16 It may be justified to control a heating zone rather than individual rooms where any of the following apply:

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 a single heating zone
b. where two adjacent rooms have a similar function and heating requirements (e.g. kitchen and utility room).

NOTE: It might not be possible to equip some heating system types with self-regulating devices for the control of individual rooms. Such systems should only be used where controlling a whole heating zone can be justified.

5.17 The requirement for self-regulating devices may be satisfied by providing any of the following.

a. An individual networked heat emitter control for each emitter.
b. Both of the following:
   i. a thermostat in a room that the heating circuit serves
   ii. an individual self-regulating device for each heat emitter, such as a thermostatic radiator valve, on all heat emitters outside the room which contains the thermostat. Thermostatic radiator valves should not be located in the same room as the thermostat.
c. An individual room/ heating zone thermostat or fan coil thermostat for each room/heating zone.
d. Any other controls which meet the function of [the regulation for self-regulating devices]

Energy submeters

5.18 Energy submetering systems should be installed and meet all of the following requirements.

a. The various end-use categories, such as heating, lighting, and cooling are sub-metered in such a way that at least 90 per cent 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 enables the comparison of forecast energy use and in-performance energy, and facilitates energy reporting. This can be demonstrated by basing the sub-metering strategy on either:
   i. an estimate of respective energy end-uses, using a representative building archetype.

ii. a design-stage energy forecast for the building, for example CIBSE's *TM54*.

c. Metering allows for the energy use of different tenants within the building to be separately monitored.
d. The output of any renewable systems are separately monitored.
e. In buildings with a total useful floor area greater than 1000 m^2, an automatic meter reading and data collection facilities are installed.

Section 6: System specific guidance

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 a separate subsection.

6.1 In addition to meeting the general requirements for heating systems in **Section 5** and following paragraphs 6.6 to 6.7, a boiler should either:

a. for new buildings, meet the seasonal efficiencies in Table 6.1.
b. for installing a boiler plant in existing buildings, meet the seasonal efficiencies, or the overall seasonal efficiency for multiple-boiler systems using non-identical boilers, in Table 6.2.

Table 6.1 Minimum heat generator seasonal efficiency for boiler systems in new buildings

Fuel type	System	Boiler seasonal efficiency (gross calorific value)
Natural gas	Single-boiler ≤ 2 MW output	93%
	Single-boiler > 2 MW output	88%
	Multiple-boiler	88% for any individual boiler 93% for overall multi-boiler system
LPG	Single-boiler ≤ 2 MW output	93%
	Single-boiler > 2 MW output	88%
	Multiple-boiler	88% for any individual boiler 93% for overall multi-boiler system
Oil	Single-boiler	93%
	Multiple-boiler	88% for any individual boiler 93% for overall multi-boiler system

Table 6.2 Minimum heat generator seasonal efficiency for boiler systems in existing buildings

Fuel type	System	Boiler seasonal efficiency (gross calorific value)
Natural gas	Single-boiler ≤ 400kW output	91%
	Single-boiler 401kW-2MW output	88%
	Single-boiler > 2 MW output	84%
	Multiple-boiler	84% for any individual boiler 91% for overall multi-boiler system
LPG	As in Table 6.1	
Oil	As in Table 6.1	

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

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

$$\text{Boiler seasonal efficiency} = 0.81\eta_{30\%} + 0.19\eta_{100\%} \qquad \text{Equation 6.1}$$

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 Table E4. Equation 6.1 assumes that the efficiency at 15% load is the same as that at 30% load.

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

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

Multiple-boiler systems in new buildings

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

a. *Step 1* - Determine the load *on each boiler* for each of the three system-part-load conditions of 15%, 30% and 100%.
b. *Step 2* - Determine the efficiency of each boiler for the above operating conditions.
c. *Step 3* - Calculate the overall operating efficiency at each system part load conditions using equation 6.2.

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

where:
η_p is the system efficiency at part load condition p, i.e. 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 as the weighted average of the efficiencies at the three load conditions, using equation 6.3.

$$\eta_{OBSE} = 0.36\,\eta_{15\%} + 0.45\,\eta_{30\%} + 0.19\,\eta_{100\%} \quad \text{Equation 6.3}$$

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

6.5 In existing systems, equation 6.4 should be used to calculate the overall boiler seasonal efficiency if both of the following apply.

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.

$$\eta_{OBSE} = \frac{\Sigma(\eta_{BSE} \times R)}{\Sigma R} \quad \text{Equation 6.4}$$

where:
η_{OBSE} is the gross overall boiler seasonal efficiency – an average, weighted by boiler output, of the individual seasonal boiler efficiencies
η_{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).

Boiler controls

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

a. Optimum start/stop control with either:
   i. night set-back
   ii. frost protection outside occupied periods.
b. Either:
   i. two-stage high/low firing facility in boiler
   ii. multiple boilers with sequence control to provide efficient part-load performance.

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

Biomass boilers

6.8 The efficiency of biomass boilers at their nominal load and tested to **BS EN 12809** should be at least:

a. for independent gravity-fed boilers of < 20.5 kW: 65%
b. for independent automatic pellet/woodchip boilers: 75%

Gas and oil-fired warm air heaters

6.9 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 6.3.

Table 6.3 Minimum heat generator seasonal efficiency for gas and oil-fired warm air heaters		
Warm air heater type	**Heat generator seasonal efficiency (net calorific value)**	**Product standard**
Gas-fired forced convection to assist transportation of combustion air and/or combustion products	91%	**BS EN 621** for unfanned appliances **BS EN 1020** for fanned appliances
Direct gas-fired forced convection	100%	**BS EN 525**
Oil-fired forced convection	91%	**BS EN 13842**
Notes. 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

6.10 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 6.4.

6.11 For flued appliances, thermal efficiency should be measured to either of the following test standards, as applicable:

a. **BS EN 1020**
b. **BS EN 13842**.

The calculation of the thermal efficiency (net calorific value) should both:

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

Table 6.4 Minimum performance standards for radiant heaters		
Appliance type	**Heat generator seasonal efficiency**	
	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 heating is assumed to be 100 per cent efficient, therefore no minimum efficiency is set for these types of system. This section of the guidance does not cover either of the following.

a. Electric heat pumps (guidance is provided in paragraphs 6.43 to 6.45).
b. Portable electric heating devices.

6.12 In addition to meeting the general requirements for heating systems in **Section 5**, electric space heating should follow paragraphs 6.13 to 6.18.

6.13 Electric boilers systems should comply with all of the following.

a. Systems should both:
   i. have flow temperature control
   ii. be capable of modulating the power input to the primary water depending on space heating conditions.
b. Timing and temperature demand 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.

6.14 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.

6.15 Electric radiant heaters should have automatic zone or occupancy control through presence detection and should be equipped with self-regulating temperature controls.

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

6.17 The input charge for electric storage heaters should be adjusted automatically, based on the internal air temperature. Manual control of heat release from the appliance should be possible.

6.18 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 and community heating systems

NOTE: This section of the guidance covers CHP systems that both:

a. have a total power capacity less than 5 MW_e
b. are used in commercial applications.

The CHP units may or may not supply community heating. For systems with a total power capacity less than 5 kW_e, follow the guidance in **Approved Document L, volume 1: dwellings.**

6.19 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 per cent.

6.20 CHP plant should have a control system that, as a minimum, ensures that the CHP unit operates as the lead heat generator. Metering should be provided that measures all of the following.

a. Hours run.
b. Electricity generated.
c. Fuel supplied to the CHP unit.

Domestic hot water

6.21 In addition to meeting the general requirements for heating systems in **Section 5**, domestic hot water systems should meet the minimum thermal efficiencies in Table 6.5. Thermal efficiency should include the heat generator and any integral storage vessel, but exclude the following, where present.

a. Secondary pipework.
b. Fans and pumps.
c. Diverter valves, solenoids, actuators.
d. Supplementary storage vessels.

6.22 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 6.5 Minimum thermal efficiencies for domestic hot water systems

DHW system type	Fuel type	Heat generator seasonal efficiency (gross)	Product standard
Direct-fired: new building	Natural gas > 30 kW output	91%	**BS EN 15502-2**; or **BS EN 89**; or **BS EN 26** As appropriate
	Natural gas ≤ 30 kW output	91%	
	LPG > 30 kW output	92%	
Direct-fired: existing buildings	Natural gas	91%	**BS EN 15502-2-1**; or **BS EN 89**; or **BS EN 26** As appropriate
	LPG	91%	
	Oil	91%	
Indirect-fired: new and existing buildings	Natural gas	91% (boiler efficiency)	Use Equations (as appropriate) in paragraphs 6.2 to 6.5. If primary return temperature ≤ 55°C, use Equation 6.1 ($0.81\eta_{30\%}+0.19\,\eta_{100\%}$) to calculate boiler seasonal efficiency. If primary return temperature > 55°C, Use boiler full load efficiency ($1.0\,\eta_{100\%}$)
	LPG	91% (boiler efficiency)	
	Oil	91% (boiler efficiency)	

			at 80/60°C flow/return temperatures. If boiler seasonal efficiency values are obtained as net values, the factors in **SAP 2012 Table E4** should be used to convert them to gross values
Electrically-heated: new and existing buildings		100% assumed	

6.23 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

6.24 All domestic hot water systems should have both of the following.

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

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

6.26 Direct-fired circulator systems, direct-fired storage systems and indirect-fired systems should have automatic thermostatic control to 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.

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

a. A flow sensor to control the rate of flow 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

6.28 Point-of-use, local and centralised 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.

6.30 Local and centralised domestic hot water systems should have both of the following.

a. 7-day time control.
b. The facility to boost the temperature by using an immersion heater in the cylinder.

6.31 Instantaneous water heaters should include both of the following.

a. A flow sensor to control the rate of flow 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.

6.32 In addition to meeting the general requirements for cooling systems in **Section 5**, the seasonal energy efficiency ratio (SEER) of each cooling unit should meet the minimum standards in Table 6.6.

6.33 The specification of space cooling systems should be based on an appropriate heat gain calculation for the building, based on CIBSE's *Design Guide A*. Systems should not be significantly oversized. In most circumstances this means that the cooling appliance should not be sized for more than 120% of the design cooling load.

Table 6.6 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 > 12 kW		5.0
Split and multi-split air conditioners ≤ 12 kW		5.0
Variable refrigerant flow/volume systems[2]		5.0
Water-to-water chillers < 400 kW		5.0
Water-to-water chillers 400 - 1500 kW		6.0
Water-to-water chillers ≥ 1500 kW		6.5
Vapour compression cycle chillers, air-cooled < 400 kW		4.0
Vapour compression cycle chillers, air-cooled ≥ 400 kW		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 *Eco design Commission Regulation No 206/2012*

Annex II, at average rating conditions where applicable.

2. For VRV/VRF systems, SEER is for the full system including indoor units.
3. For absorption chillers an EER (energy efficiency ratio) has been used instead. This should be determined according to **BS EN 14511**.

Controls

6.34 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, it should be possible to control both of the following (independent 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. Multiple cooling units should be provided with controls that 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 15232** Band C.

Calculating the seasonal energy efficiency ratio for SBEM

6.35 The value of the SEER and SCOP to be used in the SBEM tool should be determined using **BS EN 14825:2018** with average climate data; in conjunction with the *Ecodesign Commission Regulation (EU) 2016/2281.* The seasonal energy efficiency ratio of the cooling unit is given by equation 5.7.

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

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 6.7, if appropriate.
b. From 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 the system will work in.

Table 6.7 Standard cooling load factors for office accommodation

a	b	c	d
0.03	0.33	0.41	0.23

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

For applications where the load profile is not known but there is some data on chiller part load EER:

a. for chillers where the full and half load (50%) EERs are known: the SEER is the average of the full load and half load EERs
b. for chillers with four points of part load EER: the SEER is 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 are apportioned appropriately

6.37 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 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, e.g. parallel, sequential, dedicated low load unit
e. load profile of the proposed building
f. building location (which determines ambient conditions).

6.38 For systems that have the ability to use free cooling or heat recovery, the SEER should be derived 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.

6.39 For absorption chillers used in conjunction with on-site CHP or a district heat network or community heating system, the carbon dioxide emissions should be calculated in the same way as when using CHP for heating. The control system should ensure as far as possible that heat from boilers is not used to supply the absorption chiller. The minimum full load EER of the absorption chillers should be no worse than 0.7.

6.40 For district cooling schemes, the carbon dioxide content of the cooling energy supplied should be calculated. This value should be used to calculate the Building Emission Rate.

Heating and cooling system circulators and water pumps

6.41 On variable volume systems, variable speed glandless circulators should be used.

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

Heat Pumps

6.43 Air-to-air heat pumps with an output of less than or equal to 12 kW have either of the following.

a. A seasonal coefficient of performance (SCOP) rating for the median temperature range in **BS EN 14825** of at least D.
b. A coefficient of performance (COP) that is not less than the value in **Table 6.8.**

Table 6.8 Minimum COP for heat pumps in new and existing buildings

Heat pump type	Minimum COP (at rating conditions in BS EN 14511-2)
All types (except air-to-air with output ≤ 12 kW, absorption and gas-engine) for space heating	2.5
All types (except absorption and gas-engine) for domestic hot water heating	2.0
Absorption	0.5
Gas-engine	1.0

6.44 In addition to the general guidance for zoning and controls in **Section 5**, any outdoor fans, including those in cooling towers or dry coolers, should be controlled.

6.45 Heat pumps below should be designed and installed in accordance with the technical standards given in the Microgeneration Certification Scheme's *Microgeneration Installation Standard: MIS 3005,* subject to the limitations on scope as outlined in this Standard.

Mechanical ventilation

6.46 The specification of ventilation systems should be based on the ventilation needs of the building, in accordance with **Approved Document F, volume 2: buildings other than dwellings.**

6.47 Air handling systems should be capable of achieving a specific fan power at 25 per cent of design flow rate no greater than the specific fan power achieved at 100 per cent design flow rate.

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

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

a. BESA's *DW/144.*

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

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

6.51 The specific fan power of air distribution systems at the design air flow rate should be no worse than in Table 6.9, as adjusted by the appropriate factors in Table 6.9.

SFP should be calculated in accordance with **BS EN 13779** Annex D.

Table 6.9 Maximum specific fan power in air distribution systems in new and existing buildings

System type	SFP (W/(l.s))[1,2]	
	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	0.5
Zonal supply and extract ventilation units, such as ceiling void or roof units serving single room or zone with heating and heat recovery	2.3	2.3
Local balanced supply and extract ventilation system, such as wall/roof units serving single area with heat recovery	2.0	2.0
Local supply or extract ventilation units, such as window/wall/roof units serving single area (e.g. toilet extract)	0.3	0.4
Other local ventilation supply or extract units	0.5	0.5
Fan assisted terminal Variable Air Volume (VAV) unit	0.5	0.5
Fan coil unit (rating weighted average[3])	0.3	0.3
Kitchen extract, fan remote from zone with grease filter	1.0	1.0

Notes:

1. For balanced supply and extract systems, the maximum SFP includes an allowance for heat recovery and return filter.
2. Where any of the following components are included in the installation, the maximum SFP may be increased.
   a. High-efficiency particulate air (HEPA) filter: add 1.0 W/(l.s).
   b. Humidifier/dehumidifier: add 0.1 W(l.s).
   c. Active chilled beams: add 0.3 W/(l.s).

For example, 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
= 3.1 W/(l.s)

3. The rating weighted average is calculated using the following formula:

$$\frac{P_{mains,1}\times SFP_1+P_{mains,2}\times SFP_2+P_{mains,3}\times SFP_3+\ldots}{}$$

$$P_{mains,1}+P_{mains,2}+P_{mains,3}+\ldots$$

where P_{mains} is useful power supplied from the mains in W.

Controls

6.52 Mechanical ventilation 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 it should be possible to control all of the following (independent of other control zones):

   i. timing
   ii. where appropriate, temperature
   iii. where appropriate, ventilation rate
   iv. where appropriate, air recirculation rate.

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

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

6.53 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.

6.54 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.

Heat exchangers should have both:

a. defrost control to protect the heat exchanger
b. control to ensure that heat recovery can be stopped, modulated or bypassed during periods where heat recovery is undesirable.

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

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

Heat recovery

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

NOTE: The EU Ecodesign regulation No 1253/2014 sets minimum requirements for heat recovery ventilation efficiency.

Calculating the specific fan power for SBEM

6.57 SBEM assumes a value of specific fan power for a fan coil system, so this figure should not be added to the specific fan power when entering the data into SBEM.

For HEPA filtration, the pressure drop can be specified or SBEM will assume a default value from the Building Research Establishment's *National Calculation Methodology activity database*.

Lighting

6.58 Lighting should be designed to achieve lighting levels appropriate to the activity in the space, based on the CIBSE's *SLL Lighting Handbook* or an equivalent design guide. Spaces should be within the recommended illuminance range and should not be over-illuminated.

6.59 Lighting should either:

a. If it is general lighting, either:
   i. have an average luminaire efficacy of 95 luminaire lumens per circuit-watt
   ii. demonstrate an equivalent efficacy using the Lighting Energy Numeric Indicator (LENI) method, following **Appendix B**.
b. If it is display lighting, have an average luminaire efficacy of 80 luminaire lumens per circuit-watt.

6.60 General lighting and display lighting should be metered by one of the following methods:

a. dedicated lighting circuits with kWh 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.

Lighting controls

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

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

Building automation and control systems

6.62 If a new building has a space heating or air-conditioning system with an effective rated output of greater than to 290 kW, a Building Automation and Control System must be installed.

6.63 If an existing building has a space heating or air-conditioning system with an effective rated output greater than 290kW, a Building Automation and Control System being replaced or installed should follow paragraphs 6.67 to 6.68.

NOTE: The requirements in paragraphs 6.62 and 6.63 also apply to buildings containing heating and air-conditioning systems which are combined with ventilation systems.

6.64 For building systems that do not satisfy paragraph 6.62 or 6.63, consideration should be given to providing centralised switches to allow the facilities manager to switch off appliances when they are not needed. Where appropriate, these should be automated (with manual override) so that energy savings are maximised. Consideration should be given to the power requirements of essential (e.g. life safety) systems.

Determining the effective rated output

6.65 The effective rated output 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.

For air-conditioning systems, the effective rated output should include the combined maximum output of both of the following, as specified by the manufacturer.

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

For heating systems, the effective rated output should include the combined maximum output of all the following, as specified by the manufacturer.

a. Primary space heating systems.
b. Space heating systems combined with or as part of a ventilation system.
c. Secondary space heating systems.

It 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.

6.66 If the building is heated through a district heat network or community heating system, 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 community heating system , including flow temperatures.

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

Building Automation and Control System specification

6.68 A Building Automation and Control System installed in a new or existing building, where the building meets the space heating or cooling criteria in paragraphs 6.62 and 6.63, must be capable of carrying out all of the following functions.

a. Fully complies with **EN ISO 16484.**
b. Continuously monitors, logs, analyses and allows for adjusting energy use.
c. Benchmarks the building's energy efficiency, detects losses in efficiency of technical building systems, and informs the person responsible for the facilities or building management about opportunities for energy efficiency improvement.
d. Allows communication with connected technical building systems and other appliances inside the building and be interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers.

NOTE: A **BS EN 15232** Class A Rated type system would meet these requirements.

6.69 Where a Building Automation and Control System is installed, as well as meeting the requirements of paragraph 6.68, its control capabilities should be appropriate for the building, its expected usage, and the building services specification. The system should be appropriately sized.

On-site electricity generation

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

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

6.72 If the installation is replacing an existing system, the installed generation capacity of the new system should not be smaller than the existing system, except where it can be demonstrated that a smaller system would be more appropriate or effective (for example, replacing a CHP system with a system which is better matched to the building's energy demand).

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

Regulation 43: Pressure testing

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

Pressure testing

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

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

(a) ensure that:

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

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

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

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

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

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

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

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

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

Intention

In the Secretary of State's view, regulation 43 is met when a building is erected by carrying out pressure testing in accordance with paragraphs 7.2 to 7.5 and 7.7 to 7.9.
In the Secretary of State's view, results from a pressure test must be used to demonstrate compliance with regulation 26 and 26A of the Building Regulations 2010 in accordance with paragraphs 7.6 to 7.8.

In the Secretary of State's view, results from a pressure test must be used to demonstrate compliance with L1(a)(i) of Schedule 1 of the Building Regulations 2010, 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 shown in Table 4.1 of **Section 4.**

7.2 The developer should provide a building control body with evidence that test equipment has been calibrated using a UKAS-accredited facility, either:

a. within the previous 12 months
b. at a period in accordance with manufacturer's guidance

7.3 Building control bodies may accept a pressure test certificate as evidence that the building complies with Regulation 43 of the Building Regulations.

The building control body should be provided with evidence that the person who pressure tested the building has both:

a. received appropriate training;
b. is registered to test the specific class of building.

7.4 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 types listed in paragraph 7.5.

7.5 The following buildings do not need to undergo pressure testing.

a. Buildings with less than 500 m^2 total useful floor area. In this case the developer may avoid a pressure test, provided that the air permeability used to calculate the Building Primary Energy Rate and Building Emission Rate is taken as 15 $m^3/(h \cdot m^2)$ at 50 Pa.
b. A factory-made modular building that meets the following criteria:
    i. the floor area is less than 500 m^2
    ii. the building has a planned service life of more than two years, where the intended time of use in a single 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, these 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 50 Pa or at 4 Pa. 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 50 Pa 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 7.5d. Any justification and strategy should be e in line with [the approved air tightness testing methodology, TM23, the final version of TM23 will be published in 2021].It would not be reasonable to claim that air permeability better than 5.0 $m^3/(h \cdot m^2)$ @ 50 Pa had been achieved.

e. Compartmentalised buildings. If buildings are compartmentalised into self-contained units with no internal connections, 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 area of the building fails the test, paragraph 7.6 applies, but 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.

Showing compliance, and reporting pressure test results

7.6 The Building Primary Energy Rate and Building Emission Rate calculated using the measured air permeability must not be worse than the Target Primary Energy Rate and Target Emission Rate respectively.

7.7 If the criteria in paragraphs 7.1 and 7.6 are not achieved, the building air permeability should be improved. New tests should be carried out until the building achieves the criteria in paragraphs 7.1 and 7.6.

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

Air pressure testing procedure

7.9 Air pressure tests should be performed following the guidance set out in [the approved air tightness testing methodology, TM23, the final version of TM23 will be published in 2021]. The procedures set out in that document have been approved by the Secretary of State.

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

This approved document deals with the requirements of Part L1(b)(iii) of Schedule 1 to the Building Regulations and regulation 44.

[regulations will be amended as necessary in line with the intention sections below]

Schedule 1 – Part L Conservation of fuel and power

L1. Reasonable provision shall be made for the conservation of fuel and power in buildings by:

(b) providing fixed building services which–

(i) are energy efficient;

(ii) have effective controls; and

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

Commissioning

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

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

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

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

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

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

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

Intention

In the Secretary of State's view, L1(b)(iii) and regulation 44 is met by commissioning fixed building services, Building Automation and Control Systems and on-site electricity generation in

accordance with **Section 8**.

Section 8: Commissioning

8.1 Fixed building services, Building Automation and Control Systems and on-site electricity generation should be designed and installed with sufficient means to allow them to be properly commissioned, including adequate access, and necessary commissioning devices or equipment.

8.2 When installing a fixed building service, Building Automation and Control Systems or 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. the systems to test;
b. the 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;

The building control body can then check that commissioning is being done as the work proceeds.

8.3 If the only controls for a fixed building service, Building Automation and Control Systems or on-site electricity generation are 'on' and 'off' switches, this service does not need to be commissioned.

8.4 Any commissioning should be carried out in accordance with all of the following procedures:

a. CIBSE's *Commissioning Code M*
b. either:
    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
c. the procedures for air leakage testing of ductwork given in paragraphs 8.8 to 8.11.

8.5 In addition to paragraph 8.4, heat pump heating and domestic hot water systems should be commissioned to the Microgeneration Certification Scheme's *Installation Standard: MIS 3005,* subject to the limitations on scope as outlined in this standard.

Notice of completion

8.6 A commissioning notice must be given to the relevant building control body and the building owner confirming that commissioning has been carried out for the installed fixed building services, Building Automation and Control Systems and on-site electricity generation according to a procedure approved by the Secretary of State. The notice should confirm that:

a. The commissioning plan has been followed.
b. That every system has been inspected in an appropriate sequence to a reasonable standard.
c. That the tests confirm that the performance of the system is reasonably in accordance with the actual building design, including written commentary on any areas where building services do not perform as well as intended.

8.7 The notice of completion of commissioning should be given as follows.

a. If a building notice or full plans have been given to a local authority building control body, the notice should be given within 5 days of the completion of the commissioning work.
b. If the building control body is an approved inspector, the notice should generally be given to the approved inspector within five days of the work being completed.
c. In other cases, for example where 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.

Where the installation of fixed building services, Building Automation and Control Systems and on-site electricity generation which require commissioning is carried out by a person registered with a competent person scheme, the notice of commissioning will be given by that person.

Air leakage testing of ductwork

8.8 For ducted systems that are served by fans with a design flow rate greater than 1 m^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.*

8.9 For low-pressure ductwork, if at least 10 per cent 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 Building Research Establishment's *National Calculation Methodology Modelling Guide*.

8.10 Membership of the BESA Specialist Ductwork Group or the Association of Ductwork Contractors and Allied Services (ADCAS) is one way of demonstrating suitable qualifications for ductwork pressure testing work.

8.11 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:

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

Duct 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	$0.001\ \Delta p^{0.65}$

Notes:
1. Δp is the differential pressure in pascals

Regulation 40: Providing Information and the regulation for energy performance of technical building systems

This approved document deals with the requirements of regulation 40 and [the regulation for technical building systems] of the Building Regulations 2010.

[regulations will be amended as necessary in line with the intention sections below]

Information about use of fuel and power

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

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

Technical building systems

Regulation to transpose the requirement of Article 8(9) of the energy performance of buildings directive:

[Member States shall ensure that, when a technical building system is installed, replaced or upgraded, the overall energy performance of the altered part, and where relevant, of the complete altered system, is assessed. The results shall be documented and passed on to the building owner, so that they remain available and can be used for the verification of compliance with the minimum requirements laid down pursuant to paragraph 1 of this Article and the issue of energy performance certificates. Without prejudice to Article 12, Member States shall decide whether to require the issuing of a new energy performance certificate.]

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

Intention

In the Secretary of State's view, Regulation 40 and [the regulation for energy performance of technical building systems] are met when a new building is erected by providing the owner of the building with all of the following.

a. Information in a building log book as detailed in paragraphs 9.1 to 9.2.
b. Operating and maintenance instructions for fixed building services in accordance with paragraph 9.3.

c. Energy benchmarking information as detailed in paragraph 9.4.
d. Other important documentation as detailed in paragraph 9.5.
e. Energy performance of Building Automation and Control Systems in accordance with paragraph 9.6.

In the Secretary of State's view, regulation 40 and [the regulation for energy performance of technical building systems] are met when work is carried out on an existing building by providing the owner with all of the following, where relevant to the work that has been done.

a. Information in a new or existing log book as detailed in paragraphs 9.1 to 9.2.
b. Operating and maintenance instructions for fixed building services, provided in accordance with paragraph 9.3.
c. Other important documentation as detailed in paragraph 9.7.
d. Relevant information for work on existing systems as detailed in paragraphs 9.8 to 9.11.

Section 9: Providing information

Operating and maintenance instructions

9.1 For new or existing buildings, information should be given to the owner of the building in a building log book. The log book should follow the guidance in CIBSE's *TM 31*.

9.2 Information in the log book should be presented in templates the same as or similar to those in CIBSE's *TM 31.*

NOTE: Information in the log book may draw on or refer to information available as part of other documentation, such as the Operation and Maintenance Manuals or the Health and Safety file. Further advice is provided in BSRIA's *BG 26/2011.*

9.3 For new buildings and for the work that has been carried out on existing buildings, the information provided should contain 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
   iii. the maintenance requirements of the fixed building services.

b. A copy of the completed commissioning sheet.

Energy benchmarking information for new buildings

9.4 For new buildings over 1000m^2 the information to be handed over to the building owner should include a forecast of the actual energy use of the building in kWh and broken down by fuel type. kWh estimates should be produced for monthly intervals and should give a forecast for 'high' and 'low' energy use scenarios. The energy forecast should include all metered energy uses, including unregulated loads, and should be carried out in accordance with CIBSE's *TM 54.*

NOTE: The outputs of SBEM or other building regulations compliance tools are not suitable for use as energy forecasting estimates for any size of building. A specialist estimate should be carried out using appropriate modelling tools.

Additional information for new buildings

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

a. Data on the inputs used in the calculations of 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 the energy performance of the Building Automation and Control Systems must also be given to the building owner.

Additional information for work in existing buildings

9.7 For existing buildings, information added to a new or existing log book should satisfy paragraphs 9.1 to 9.3. This applies only in relation to the work that has actually been carried out. Information provided should also include all of the following, where relevant.

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 When any building work is carried out, in which **Section 5** and/or **Section 6** of this document sets a standard, the energy performance of the fixed building services, Building Automation and Control Systems and on-site electricity generation affected by the work must be assessed and documented.

9.9 When installing a complete new or replacement system (for example, replacing a heating system including the heating appliance, pipework and heat emitters) the energy performance of the whole system must be assessed, and the results documented and handed over to the building owner. This documentation may be in any of the following forms.

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 (for example, replacing a boiler but retaining the pipework and heat emitters) the energy performance of the new components must be assessed and documented and handed over to the building owner. This documentation may be in any of the following forms:

a. Product data sheets produced by the product manufacturer.
b. Other documented results of energy assessment of the product and details of the test standard used to make this assessment.

9.11 If carrying out work on an existing system fundamentally alters the energy or CO_2 performance of the system, including 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 per cent of its capacity before the work.

Then the complete altered system should be assessed and guidance for new or replacement systems in paragraph 9.7 should be followed.

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

This approved document deals with the requirements of regulation 23(2) and L1(a) of the Building Regulations 2010.

Requirements for the renovation or replacement of thermal elements

23. (2) Where the whole or any part of an individual 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	*Limits on application*
Schedule 1 – Part L Conservation of fuel and power **L1. Reasonable provision shall be made for the conservation of fuel and power in buildings by:** **(a) limiting heat gains and losses–** **(i) through thermal elements and other parts of the building fabric; and** **(ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;** (b) providing fixed building services which– (i) are energy efficient; (ii) have effective controls; and (iii) are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances.	

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

Intention

In the Secretary of State's view, regulation 23(2) and L1(a) is met for new elements in existing dwellings by replacing a thermal element to the standards in **Section 10**.

Section 10: New elements in existing buildings including extensions

General

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

a. Providing a new thermal element in an existing building – follow paragraph 10.2 to comply with requirement L1 of Schedule 1 of the Building Regulations.

b. Providing a replacement thermal element in an existing building – follow paragraph 10.2 to comply with regulation 23(2) of the Building Regulations.

c. Replacing windows, doors or rooflights (controlled fittings) in an existing building – follow paragraphs 10.3 to 10.6 to comply with requirement L1 of Schedule 1 of the Building Regulations.

d. Extensions of an existing building – follow paragraphs 10.7 to 10.12 to comply with requirement L1 of Schedule 1 of the Building Regulations.

e. Adding a conservatory or porch to an existing building – follow paragraphs 10.13 to 10.14 to comply with requirement L1 of Schedule 1 of the Building Regulations.

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

New and Replacement of thermal elements

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

a. New thermal elements in an existing building.

b. Thermal elements constructed as a replacement for existing thermal elements.

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

10.3 If the entire unit of windows, roof windows, rooflights or doors 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 Building control bodies may accept as evidence a Window Energy Rating from a certification scheme that provides a quality assured process and supporting audit trail from calculating the performance of the window through to the window being installed.

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

a. The areas of windows, roof windows, rooflights and pedestrian doors should not exceed the relevant percentage of the total floor area of the building from Table 10.1.
b. If the area of windows, roof windows, rooflights and pedestrian doors exceeds the relevant percentage from Table 10.1, compensating measures should be included elsewhere in the work to improve the energy efficiency of the building.

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

Extension of buildings other than dwellings

10.7 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.

10.8 An extension should be regarded as a new building, and guidance in **Sections 1** to **9** should be followed, if the proposed extension has a total useful floor area that is both:

a. greater than 100 m^2
b. greater than 25 per cent of the total useful floor area of the existing building.

If the proposed extension does not meet criteria a. or b, the guidance in paragraphs 10.9 to 10.12 should be met.

10.9 When a building is extended, the fixed building services, Building Automation and Control Systems or on-site electricity generation that are provided or extended should comply with the guidance in **Section 5** and **6.**

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

a. New thermal elements should meet standards in Table 4.1 and paragraph 4.9.
b. Replacement thermal elements should meet standards in Table 4.1.
c. New windows, roof windows, rooflights and doors (controlled fittings) should meet standards in Table 4.1.
d. Existing fabric elements that will become thermal elements should meet the limiting standards in Table 4.2, following paragraphs 11.2 to 11.5.

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

a. Window and pedestrian doors as 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 shop	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 areas of wall or roof as required for the purpose.

10.11 As an alternate approach to paragraph 10.10, the area-weighted U-value of all thermal elements in the extension should be demonstrated to be no greater than that of an extension of the same size and shape that complies with paragraph 10.10. This includes the opening area standards in Table 10.1.

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

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

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 approach to paragraphs 10.10 or 10.11, an approved calculation tool should be used to demonstrate that the Building Primary Energy Rate and the Building Emission Rate for the building and proposed extension is no greater than 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.

The Building Primary Energy Rate and Building Emission Rate for the building and proposed extension should include all consequential improvements that will be undertaken in the existing building. Upgrades over the minimum requirements of consequential improvements should meet the relevant standards in Table 4.2.

Conservatories and porches

10.13 If a newly constructed conservatory or porch is not thermally separated from the existing building, or the existing building's heating system is extended into it, it should be treated as an extension and the guidance in paragraphs 10.7 to 10.12 should be followed.

10.14 If a newly constructed conservatory or porch is thermally separated from the existing building, and the existing building's heating system does not extend into it, but it is not exempt from the energy efficiency requirements because of its size or another reason outlined in paragraph 0.16, new elements should satisfy all of the following:

a. New thermal elements should meet standards in Table 4.1.
b. Replacement thermal elements should meet standards in Table 4.1.
c. New windows, roof windows, rooflights and doors should meet the standards in Table 4.1. The limitations on area of windows, doors and rooflights in paragraph 10.10 do not apply.

In addition, both of the following should apply.

a. The thermal separation between the building and the conservatory or porch, i.e. 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, Building Automation and Control Systems or on-site electricity generation installed within the extension should meet the standards in **Section 5** and **6,** and should provide independent temperature and on/off controls.

Regulation 23 (1) and L1(a): Renovation of thermal elements and limiting heat gains and losses

This approved document deals with the requirements of regulation 23(1) and L1(a) to the Building Regulations 2010.

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

Intention

In the Secretary of State's view, regulation 23(1) and L1(a) is met 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 approved document deals with the requirements of regulation 6 and 22 of the Building Regulations 2010.

Requirements relating to material change of use

6.

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

   a) in all cases, B1 (means of warning and escape), B2 (internal fire spread—linings), B3 (internal fire spread—structure), B4(2) (external fire spread—roofs), B5 (access and facilities for the fire service), C2(c) (interstitial and surface condensation), F1 (ventilation), G1 (cold water supply), G3(1) to (3) (hot water supply and systems), G4 (sanitary conveniences and washing facilities), G5 (bathrooms), G6 (kitchens and food preparation areas), G2 (bathrooms), H1 (foul water drainage), H6 (solid waste storage), J1 to J4 (combustion appliances), **L1 (conservation of fuel and power)**, P1 (electrical safety);

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

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

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

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

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

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

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

   i) in the case of a material change of use described in regulation 5(c), (d), (e) or (j), M1 (access and use).

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; and

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.

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 to ensure that the building complies with the applicable requirements of Part L of Schedule 1.

Intention

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

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

Section 11: Work to existing buildings

General

11.1 This Section provides guidance for *existing* elements in existing buildings, which includes all of the following types of work.

a. Renovating an existing thermal element in an existing building – follow paragraphs 11.2 to 11.5 to comply with regulation 23(1) of the Building Regulations.

b. If a building is subject to a material change of use – follow paragraphs 11.6 to 11.9 to comply with regulation 6 of the Building Regulations.

c. If a building is subject to a change to energy status – follow paragraphs 11.6 to 11.9 to comply with regulation 22 of the Building Regulations.

NOTE: New and replacement elements in existing buildings should follow guidance in **Section 10.**

Renovating thermal elements

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

a. Providing a new layer through cladding or rendering the external surface of 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 element to expose the basic structural components (e.g. bricks, blocks, rafters, joists, frame etc.) 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 then the whole of the thermal element should be improved to achieve at least the U-value in Table 4.2, column (b), if one of the following applies.

a. More than 50 per cent of the surface of the individual thermal element will be renovated (see paragraph 11.4).
b. The work constitutes a major renovation as defined in paragraph 11.5.

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

11.5 A major renovation is when more than 25 per cent of the surface area of the external building envelope is renovated.

Figure 11.1. Renovation of a thermal element from the outside

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

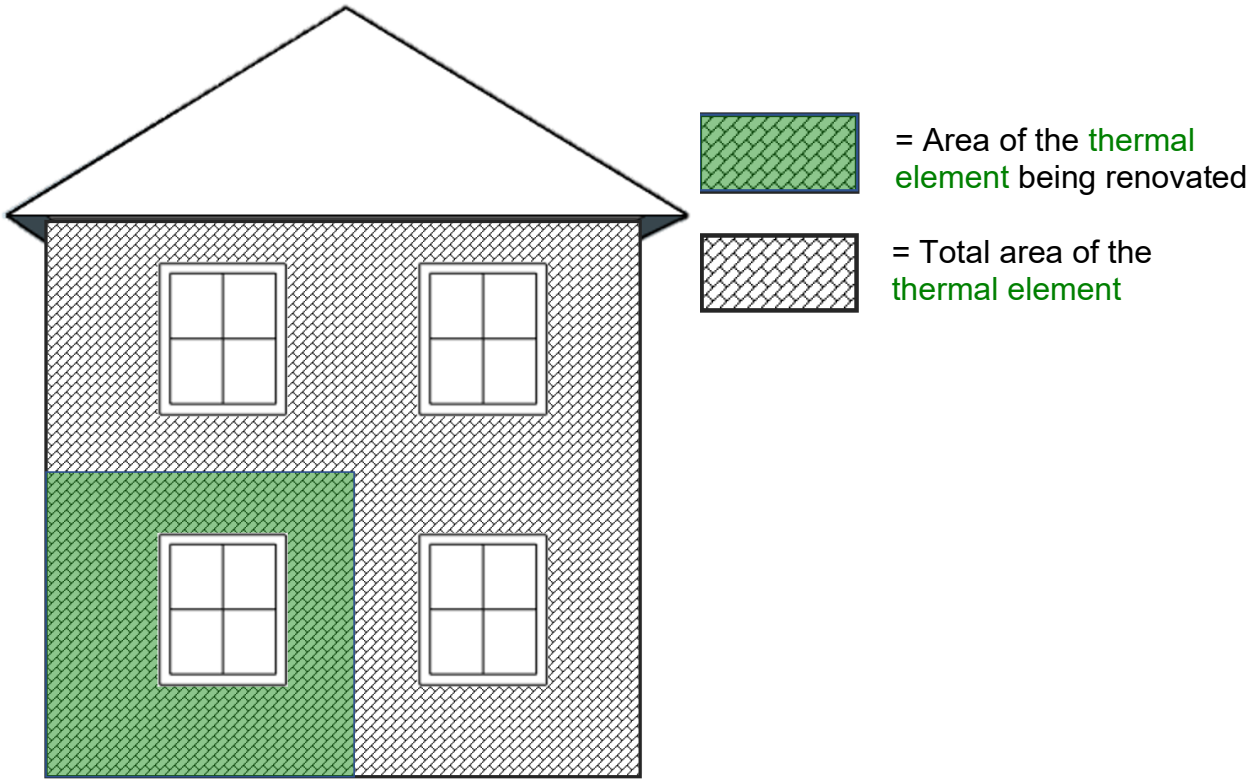
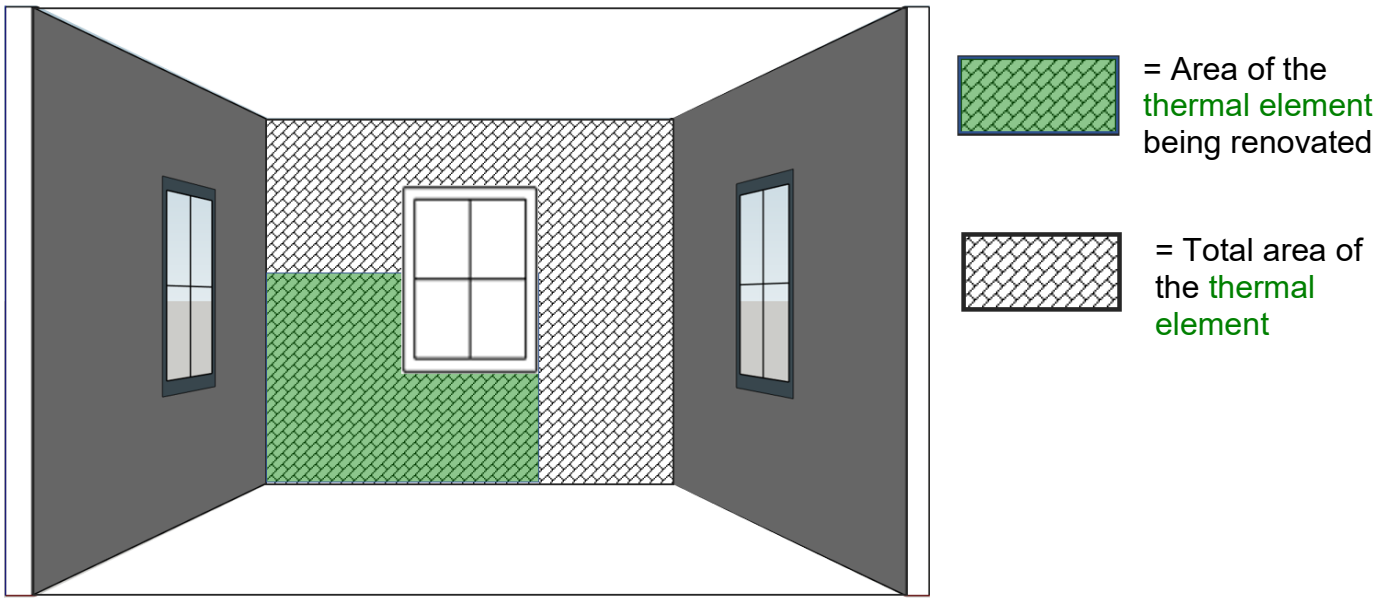


Figure 11.2. Renovation of a thermal element from the inside

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



Material change of use and change to energy status

11.6 A material change of use, relevant to buildings other than dwellings, is when a building:

a. is used as a hotel or a boarding house, where previously it was not
b. is used as an institution, where previously it was not
c. is used as a public building, where previously it was not
d. is not described in Classes I to VI in Schedule 2, where previously it was
e. contains a room for residential purposes, where previously it did not
f. contains at least one room for residential purposes, having previously had a greater or lesser number of rooms for residential purposes
g. is used as a shop where previously it was not.

11.7 A change to energy status is when a building was previously exempt from the energy efficiency requirements but now is not. It applies to the building as a whole or parts of the building that have been designed or altered to be used separately. For example, when a previously un-heated space becomes part of the heated building.

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

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

a. Existing thermal elements should meet the limiting standards in Table 4.2, following paragraphs 4.7 to 4.8.
b. Existing windows, roof windows, rooflights and doors (controlled fittings) should be replaced to meet the limiting standards in Table 4.1 if they satisfy both of the following.
   NOTE: This does not apply to display windows or high-usage entrance doors.
   i. Separate a conditioned space from an unconditioned space or the external environment.
   ii. Have a U-value worse than either:
      i. for windows, roof windows and doors – 3.30 W/(m^2.K)
      ii. for rooflights – 3.80 W/(m^2.K) following paragraph 4.4.

In addition, all of the following should be satisfied.

a. New or replaced thermal elements should meet standards in Table 4.1.
b. New or replaced windows, roof windows, rooflights and doors (controlled fittings) should meet standards in Table 4.1.
c. The area of openings in the newly created building should not be more than 25 per cent of the total floor area. A large area of openings may be achieved following paragraph 11.9.
d. Fixed building services, Building Automation and Control Systems or on-site electricity generation provided or extended should meet the standards in **Section 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.

11.9 As an alternative to paragraph 11.8, an approved calculation tool 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 11.8.

Regulation 28: Consequential improvements

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

Consequential improvements to energy performance

28.

(1) Paragraph (2) applies to an existing building with a total useful floor area over 1000 m^2 where the proposed building work consists of or includes–

(a) an extension;

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

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

(2) Subject to paragraph (3), where this paragraph applies, such work, if any, shall be carried out as is necessary to ensure that the building complies with the requirements of Part L of Schedule 1.

(3) Nothing in paragraph (2) requires work to be carried out if it is not technically, functionally or economically feasible.

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

Intention

In the Secretary of State's view, regulation 28 is met for existing building with a total useful floor area over 1,000 m^2 by carrying out consequential improvements that are technically, functionally and economically feasible, following **Section 12.**

Section 12: Consequential improvements

12.1 For an existing building with a total useful floor area of over 1,000 m^2, additional work may be required to improve the overall energy efficiency of the building if proposed work consists of or includes any of the following.

a. An extension.
b. Providing any fixed building service in the building for the first time.
c. Increasing the capacity of any fixed building service.

12.2 If work is carried out which meets the criteria in paragraph 12.1, consequential improvements should be carried out so that the entire building complies with the energy efficiency requirements to the extent that the improvements 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.

12.3 In the circumstances outlined in 12.6 and 12.8, regulation 28 is met as long as at least 10 per cent of the value of the principal works are spent on consequential improvement work.

12.4 Where work other than the items listed 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 using the alternative approach to demonstrating compliance described in paragraph 10.12 does not count as a consequential improvement.

Consequential improvements which apply when extending a building

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

12.5 When an existing building with a total useful floor area of over 1,000 m^2 is being extended or the habitable area is being increased, consequential improvements should be installed. The measures listed in Appendix D, Table D.1, may be considered technically, functionally and economically feasible in normal circumstances.

12.6 For an extension or increase in habitable area, regulation 28 is considered to have been met if the value of the consequential improvement work constitutes not less than 10 per cent of the value of the principal works.

12.7 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 establishes the value of the principal works and the value of the consequential improvements using prices current at the date when the building control body is informed of the proposals.

Consequential improvements on installing fixed building services

NOTE: Increasing the size of central boiler plant to serve a new extension would not generally increase the installed capacity of a fixed building service per unit area, unless the heating provision in the existing building was also increased at the same time. In these circumstances, paragraph 12.8 would not apply, but paragraphs 12.5 to 12.7 would continue to apply as a result of the extension.

12.8 If it is proposed to install a fixed building service in an existing building with a total useful floor area of over 1,000 m^2 either as a first installation, or as an installation that increases the installed capacity of a fixed building service per unit area, then both of the following should be implemented as consequential improvements:

a. make energy efficiency improvements to the fixed building service to meet the requirements of Part L, where this is practical and technically, functionally and economically feasible
    i. Regulation 28 is considered to have been met if the value of the consequential improvements work, excluding any work undertaken in meeting requirement 12.1b, constitutes not less than 10 per cent of the value of the principal works.
    ii. The measures listed in Appendix D, Table D.1 relate to this requirement, 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 establishes the value of the principal works and the value of the consequential improvements using prices current at the date when the building control body is informed of the proposals.
b. improve the fabric of those parts of the building served by the service to meet the requirements of Part L, where this technically, functionally and economically feasible.
    i. Regulation 28 is considered to have been met if not determined by the value of the principal works. All technically, functionally and economically feasible measures to improve the fabric of the building served by the service to meet the requirements of Part L should be implemented.
    ii. The measures in Appendix D, Table D.2 relate to this requirement, and may be considered technically, functionally and economically feasible in normal circumstances.

NOTE: Increasing the size of central boiler plant to serve a new extension would not generally increase the installed capacity of a fixed building service per unit area, unless the heating provision in the existing building was also increased at the same time. In these circumstances, paragraph 12.8 would not apply, but paragraphs 12.5 to 12.7 would continue to apply as a result of the extension.

Appendix A: Key terms

Air permeability is the physical property used to measure airtightness of the building fabric. It is defined as air leakage rate per hour per square metre of envelope area at the test reference pressure differential of 50 pascals (50 N/m^2) or 4 pascals (4 N/m^2).

The limiting air permeability is the worst allowable air permeability.

The design air permeability is the target value set at the design stage.

The assessed air permeability is the value used in establishing the Building Emission Rate and the Building Primary Energy Rate. The assessed air permeability is based on a measurement of the air permeability of the building concerned.

Building Automation and Control System means a system comprising all products, software and engineering services that can support energy efficient, economical and safe operation of technical building systems through automatic controls and by facilitating the manual management of those building systems.

Building Control Body is either a local authority building control department or an approved inspector.

Building Envelope in relation to a building is defined in regulation 35 as:

> the walls, floor, roof, windows, doors, roof windows and rooflights.

Building Emission Rate is the building's CO_2 emission rate expressed as kgCO_2/(m^2·year).

Building Primary Energy Rate is expressed as kWh/(m^2·year) and determined using the approved methodology.

Centralised electrically heated is 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 means the U-value determined in the central area of the glazing unit, making no allowance for edge spacers or the window frame.

Change to energy status is defined in regulation 2(1) as:

> Any change which results in a building becoming a building to which the energy efficiency requirements of those Regulations apply, where previously it was not.

CHPQA quality index is an indicator of the energy efficiency and environmental performance of a CHP scheme, certified by the Combined Heat and Power Quality Assurance scheme.

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

Coefficient of performance (COP) is a measure of the efficiency of a heat pump at specified source and sink temperatures, measured using the procedures in **BS EN 14511-2**:

Heating COP = heat output / power input

% COP (COP×100) is the heat generator efficiency.

Commissioning is the advancement of a fixed building service after all or part of the system has been installed, replaced or altered. The system is taken from a state of static completion to working order. Testing and adjusting, as necessary, ensure that the system as a whole uses no more fuel and power than is reasonable in the circumstances, without compromising the need to comply with health and safety requirements

For each system, commissioning includes all of the following:

a. setting-to-work
b. regulation (that is, testing and adjusting repetitively) to achieve the specified performance
c. calibration
d. setting up and testing the associated automatic control systems
e. recording the system settings and the performance test results that have been accepted as satisfactory.

Community heating systems are systems that supply heat from a central source within a single building.

Consequential improvements mean those energy efficiency improvements required by regulation 28.

Control Zone means independent control of rooms or areas within buildings that need to be heated to different temperatures at different times.

Controlled service or fitting is defined in Regulation 2(1) as:

> a service or fitting in relation to which Part G (sanitation, hot water safety and water efficiency), H (drainage and waste disposal), J (combustion appliances and fuel storage systems), L (conservation of fuel and power) or P (electrical safety) of Schedule 1 to the Building Regulations imposes a requirement.

Display window means 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:

a. at the external perimeter of the building
b. at an access level
c. immediately adjacent to a pedestrian thoroughfare.

If there is a permanent workspace within one glazing height of the window, this cannot be considered to be a display window. Glazing more than 3 m above an access level should not be considered part of a display window except:

a. where the products on display require a greater height of glazing
b. where building work involves changes to the façade and glazing that require planning consent, and 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 heating networks are systems that supply heat from a central source to consumers, via a network of underground pipes carrying hot water. Heat networks can cover a large area or even an entire city, or be fairly local supplying a small cluster of buildings.

Direct-fired circulator is 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 storage is 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.

Direct-fired continuous flow is 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.

Display lighting means 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.

Dwelling means a self-contained unit designed to accommodate a single household, including a dwelling-house and a flat.

Economically feasible means that the capital cost of the measure will pay back in energy savings in a reasonable time period. For the purposes of this document, economically feasible means that the measure would achieve a simple payback of either:

a. 7 years for the installation of self-regulating devices;
b. 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 D.1);
c. 15 years for any other measure.

Emergency escape lighting means the emergency lighting that illuminates an area for the safety of people leaving that area or for people attempting to terminate a dangerous process before leaving that area.

Energy efficiency ratio (EER) for chillers is calculated by dividing the cooling energy delivered into the cooling system by the energy input to the chiller.

Energy Efficiency requirements are defined in Regulation 2(1) as:

the requirements of regulations 23, 25A, 25B, 26, 26A, 28,40 and 43 of, and Part L of Schedule 1 to, the Building Regulations.

Energy Performance Certificate is defined in the Energy Performance of Buildings Directive as:

a certificate which—

a) in the case of a certificate entered on the register before 9th January 2013 complied with the requirements of regulation 11(1) of the Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007(d);

b) in the case of a certificate entered on the register on or after 9th January 2013 complies with the requirements of regulation 9(1) of these Regulations; or

c) complies with the requirements of regulation 29(e) of the Building Regulations 2010.

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

Fit-out work means 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:

a. during the same project and time frame as the construction of the building shell;
b. at a later date after the shell has been completed.

Fixed building services are defined in Regulation 2(1) as:

any part of, or any controls associated with—

a) fixed internal or external lighting systems (but not including emergency escape lighting or specialist process lighting);

b) fixed systems for heating, hot water, air conditioning or mechanical ventilation; or

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

Fixed external lighting means lighting fixed to an external surface of the building and supplied from the occupier's electrical system. It excludes lighting in common areas of blocks of flats and in other communal accessways.

G-value is a total solar energy transmittance.

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

Heat generator seasonal efficiency means the estimated seasonal heat output from the heat generator divided by the energy input.

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

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

High-usage entrance door means 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 will have automatic closers and, except where operational requirements preclude it, be protected by a lobby.

Indirect-fired circulator is 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 is the design output of the distribution system output devices (the terminal units) serving the space in question, divided by the total useful floor area of that space.

Instantaneous electrically heated is 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.

Lamp lumens means the sum of the average initial (100 hour) lumen output of all the lamps in the luminaire and do not include any losses or inefficiencies of the luminaire.

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

Local electrically heated is 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 near the draw-off points and has a storage capacity of between 100 and 300 litres.

LOR is the light output ratio of the luminaire. This is the ratio of output of the luminaire at stated practical conditions to that of the lamp(s) contained in the luminaire under reference conditions.

Luminaire lumens is equal to (lamp lumens x LOR) and represents the output of the luminaire.

Major renovation is 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 is defined in Regulation 5 as:

> Where there is a change in the purposes for which or the circumstances in which a building is

used, so that after that change-

a) The building is used as a dwelling, where previously it was not;
b) The building contains a flat, where previously it did not;
c) The building is used as an hotel or a boarding house, where previously it was not;
d) The building is used as an institution, where previously it was not;
e) The building is used as a public building, where previously it was not;
f) The building is not a building described in classes 1 to 6 in Schedule 2, where previously it was;
g) The building, which contains at least one dwelling, contains a greater or lesser number of dwellings than it did previously;
h) The building contains a room for residential purposes, where previously it did not;
i) The building, which contains at least one room for residential purposes, contains a greater or lesser number of such rooms than it did previously; or
j) The building is used as a shop, where it previously was not; and
k) The building is a building described in regulation 7(4)(a), where previously it was not.

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

Multi-stage burner control is a type of boiler control that offers more than two distinct firing rates, but without continuous adjustment between firing rates.

Optimum start is 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 is 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 is 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 A.2.

Table A.2 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

Point-of-use electrically heated is 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 is the total annual power output of a CHP unit divided by its total annual fuel

input.

Primary energy means energy from renewable and non-renewable sources which has not undergone any conversion or transformation process.

Principal works means 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 means 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.

Room for residential purposes is defined in Regulation 2(1) as:

> a room, or a suite of rooms, which is not a dwelling-house or a flat and which is used by one or more persons to live and sleep and includes a room in a hostel, an hotel, a boarding house, a hall of residence or a residential home, but does not include a room in a hospital, or other similar establishment, used for patient accommodation.

Seasonal coefficient of performance (SCOP) is a measure of the efficiency of a heat pump over the designated heating season, measured using the procedures in **BS EN 14825**.

Seasonal energy efficiency ratio (SEER) is the total amount of cooling energy provided divided by the total energy input to a single cooling unit, summed over the year.

Secondary Heating means a space heating appliance or system which operates separately to the main heating system in the building, and does not provide the majority of heating in the building. For example, a decorative fuel-effect fire in a room which also contains radiators for a central heating system.

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

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

Simplified Building Energy Model is one of the current approved procedures for assessing the performance of a building, in line with this document.

Specialist process lighting means lighting to illuminate specialist tasks within a space rather than the space itself. Specialist process lighting could include theatre spotlights, projection equipment, lighting in TV and photographic studios, medical lighting in operating theatres and doctors' and dentists' surgeries, illuminated signs, coloured or stroboscopic lighting, and art objects with integral lighting, such as sculptures, decorative fountains and chandeliers.

Standard Assessment Procedure is the current approved procedure for assessing the performance of dwellings in line with **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 10.1.*

Simple payback means the amount of time it will take to recover the initial investment through energy savings, and 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. When making this calculation the following guidance should be used:

a. the marginal additional cost is the additional cost (materials and labor of incorporating (e.g) additional insulation, not the whole cost of the work
b. the cost of implementing the measure should be based on prices current at the date the proposals are made known to the building control body and be confirmed in a report signed by a suitably qualified person
c. the annual energy savings should be estimated using the *Building Research Establishment's National Calculation Methodology Modelling Guide*
d. for the purposes of this document, the energy prices that are current at the time of the application to building control should be used when evaluating energy savings. Current prices can be found in the Quarterly Energy Prices publication on the **BEIS website.**

Target emission rate is the maximum CO_2 Emission Rate for the building, expressed as $kgCO_2/(m^2 \cdot year)$.

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

Technical Building Systems means any of the following systems:

a. Space heating
b. Space cooling
c. Ventilation
d. Domestic hot water
e. Lighting
f. Building Automation and control Systems
g. On-site electricity generation

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

Thermal element is defined in regulation 2(3) of the Building Regulations as follows:

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

a) the external environment (including the ground); or
b) in the case of floors and walls, another part of the building which is:
    i. unconditioned;
    ii. an extension falling within class VII in Schedule 2; or

iii. where this paragraph applies, conditioned to a different temperature,

and includes all parts of the element between the surface bounding the conditioned space and the external environment or other part of the building as the case may be.

2(4) Paragraph 2(3)(b)(iii) only applies to a building which is not a dwelling, where the other part of the building is used for a purpose which is not similar or identical to the purpose for which the conditioned space is used.

Thermal envelope is the combination of thermal elements of a building which enclose a particular conditioned indoor space or groups of indoor spaces.

Thermal separation between a building and a conservatory means that they are divided by walls, floors, windows and doors for which i) the U-values are similar to, or in the case of a newly-constructed conservatory not greater than, the U-values of the corresponding exposed elements elsewhere in the building; ii) in the case of a newly constructed conservatory, windows and doors have similar draught-proofing provisions as the exposed windows and doors elsewhere in the dwelling.

Total useful floor area is the total area of all enclosed spaces, measured to the internal face of the external walls. When calculating total useful floor area, both:

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

NOTE: This area is the gross floor area as measured in accordance with the guidance issued to surveyors by the Royal Institution of Chartered Surveyors (RICS).

Two-stage burner control is a type of boiler control that offers two distinct boiler firing rates.

U-value is the rate of transfer of heat through a structure (which can be a single material or a composite), divided by the difference in temperature across that structure.

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

a. Modulating the heat generator output (direct acting).
b. Using a mixing valve to adjust the flow temperature to the heat emitters.

Appendix B: Lighting Energy Numeric Indicator (LENI)

B.1 The Lighting Energy Numeric Indicator (LENI) method is an alternative approach for complying with the standards for lighting given in **Section 6** of this document.

B.2 The LENI should not exceed the lighting energy limit specified in Table B.1 for a given illuminance and number of hours run.

Step 1: Determine the lighting energy limit from Table B.1.

If display lighting is used, then 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.

Step 2: Calculate the parasitic energy use (E_p). If the parasitic energy use is unknown, an allowance of 0.3 W/m^2 should be made for any control system. If no lighting control system is used, then $Ep = 0$.

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

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 6 m of a window wall 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). Systems that control the lighting in this way 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:

$$E_d\ \% = \frac{P_l \times F_o \times F_d \times F_c \times T_d}{1000}$$

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 daytime, night-time and parasitic energy uses per year divided by the area (A), as set out in the formula below:

$$\text{LENI \%} = \frac{E_p + E_d + E_n}{A}$$

Table B.1 Recommended maximum LENI (kWh per square metre per year) in new and existing buildings

***[Note for consultation:** the values in this table will need to be revised to result in an equivalent energy efficiency than the standards given in **Section 5 and 6**]*

Hours			Illuminance (lux)								Display lighting	
Total	Day	Night	50	100	150	200	300	500	750	1000	Normal	Shop window
1000	821	179										
1500	1277	223										
2000	1726	274										
2500	2164	336										
3000	2585	415										
3700	3133	567										
4400	3621	779										
5400	4184	1216										
6400	4547	1853										
8760	4380	4380										

Appendix C: Reporting evidence of compliance

BRUKL report

C.1 The standardised Buildings Regulations UK Part L (BRUKL) report should be provided to the building control body and homeowner to demonstrate compliance with the energy efficiency requirements.

C.2 The Simplified Building Energy Model (SBEM), will produce the BRUKL report for the building as a standard output option.

C.3 Two versions of the BRUKL should be produced by the approved software.

a. The first design stage BRUKL, before commencement of works, to include all of the following.
   i. The target and Building Primary Energy Rate.
   ii. The target and Building Emission Rate.
   iii. A supporting list of specifications.
b. The second, as-constructed BRUKL report, to include all of the following.
   i. The target and as-constructed Building Primary Energy Rate.
   ii. The target and as-constructed Building Emission Rate.
   iii. A supporting list of specifications and any changes to the list of specifications provided at design stage.

These reports can then be used by the building control body to assist checking that what has been designed is actually built. The software includes a facility to compare the 'as designed' and 'as built' data input files and automatically produces a schedule of changes.

C.4 The as-constructed BRUKL report must be signed by the energy assessor to confirm that the as-constructed calculations are accurate.

C.5 The as-constructed 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 set out in the report.

Appendix D: Measures for consequential improvements

D.1 For an existing building with a total useful floor area of over 1,000 m^2, additional work may be required to improve the overall energy efficiency of the building if proposed work consists of or includes any of the following.

a. An extension.
b. Providing any fixed building service in the building for the first time.
c. Increasing the capacity of any fixed building service.

D.2 Additional works to improve energy efficiency as required in these circumstances are known as consequential improvements and described in detail in **Section 12**.

Measures usually to be installed whenever consequential improvements are required

D.3 Energy efficiency improvements to the rest of the building are required whenever consequential improvements apply. All technically, functionally and economically feasible measures should be implemented, with the requirement for consequential improvements being met based on the value of the principal works. This is outlined in **Section 12.**

D.4 The energy efficiency improvements in Table D.1 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, based on the value of the principal works, as outlined in **Section 12.**

Table D.1 Energy efficiency measures which should usually be installed whenever consequential improvements are required.

These measures are considered technically, functionally and economically feasible in normal circumstances.

These should be installed at least to the extent outlined to meet the reasonable provision criterion, based on the value of the principal works, as outlined in **Section 12**.

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 lamp lumens per circuit-watt and that serve areas greater than 100 m^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 *TM 39*
6	Upgrading thermal elements that have U-values worse than those in Table 4.2, column (a) following the guidance in paragraphs 4.7 and 4.8.
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 worse than the following: i. for windows, roof windows and doors – 3.30 W/(m^2.K) ii. for rooflights – 3.80 W/(m^2.K) 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 which will achieve a simple payback of 15 years or less
NOTES: *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

When consequential improvements apply as a result of the provision of a fixed building service in the building for the first time, or increasing the capacity of any fixed building service, additional energy efficiency improvements are required. These measures shall not meet the requirements for consequential improvements based on the value of the principal works as outlined in **Section 12.** All technically, functionally and economically feasible measures to improve the fabric of the building served by the service to meet the requirements of Part L should be implemented.

The measures in Table D.2 improve the fabric of those parts of the building served by the service, and can be considered technically, functionally and economically feasible in normal circumstances whenever these additional measures are required.

Table D.2 Additional energy efficiency measures which should usually be installed whenever consequential improvements apply as a result of:

- **the provision of a fixed building service in the building for the first time, or**
- **or increasing the capacity of any fixed building service.**

These measures are considered technically, functionally and economically feasible in normal circumstances.

These measures shall not meet the requirements for consequential improvements based on the value of the principal works, as outlined in **Section 12**, and should be installed in so far as they are technically, functionally and economically feasible.

1.	If the installed capacity per unit area of a heating system is increased: a. thermal elements within the area served that have U-values worse than those in Table 4.2, column (a), should be replaced or renovated following the guidance in **Section 10** or **11** of this document; and 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 worse than i. for windows, roof windows and doors – 3.30 W/(m^2.K) ii. for rooflights – 3.80 W/(m^2.K) following paragraph 4.4.
2.	If the area-weighted installed capacity of a cooling system will be increased, both of the following apply: a. Thermal elements within heated areas that have U-values worse than those set out in Table 4.2, column (a), should be replaced or renovated following the guidance in **Section 10** or **11** of this document; b. The solar control provisions should be upgraded if either of the following criteria are met then.

	i. the area of windows and roof windows (but excluding display windows) within the area served exceeds 40 per cent of the façade area; or ii. both of: a. the area of rooflights exceeds 20 per cent of the area of the roof, and; b. the design solar load exceeds 25 W/m^2 The upgraded system should meet at least one of the following four criteria: a. the solar gain per unit floor area averaged over the period 0630 to 1630 GMT, and when the building is subject to solar irradiances for July as given in the table of design irradiancies in CIBSE's *Design Guide A* should not be greater than 25 W/m^2 b. the design solar load should be reduced by at least 20 per cent c. the effective g-value should be no worse than 0.3 d. the zone or zones should satisfy the solar gain check in paragraphs 4.16 to 4.18
3.	Any general lighting system within the area served by the relevant fixed building service that has an average efficacy of less than 60 lamp lumens per circuit-watt should be upgraded with new luminaires and/or controls following the guidance in **Section 6**.

Appendix E: 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 (2009)

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 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 12831-1 *Energy performance of buildings. Method for calculation of the design heat load. Space heating load, Module M3-3* (2017)

BS EN 12831-3 *Energy performance of buildings - method for calculation of the design heat load. Part 3 - 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 13779 Ventilation for non-residential buildings. Performance requirements for ventilation and room-conditioning systems (2007)

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 with electrically driven compressors for space heating and cooling. Test conditions. (2013)

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 15232 Energy performance of buildings. Impact of Building Automation, Controls and Building Management (2017)

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 ISO 12241 Thermal insulation for building equipment and industrial Installations. Calculation rules (2008)

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

EN ISO 16484 Building Automation and control systems (BACS) (2017)

Appendix F: Documents referred to

Legislation

Ancient Monuments and Archaeological Areas Act 1979

Planning (Listed Buildings and Conservation Areas) Act 1990

The Building Regulations 2010, SI 2010/2214

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

The EU Ecodesign Commission Regulation No 206/2012

The EU Ecodesign Commission Regulation No 1253/2014

The Ecodesign Commission Regulation (EU) 2016/2281

Documents

Building and Engineering Services Association (BESA)

DW/143 *A practical guide to Ductwork Leakage Testing* (2013)

DW/144 *Specification for Sheet Metal Ductwork* (2013)

Building Research Establishment

BR 443 *Conventions for U-value calculations* (2019) Available at: https://www.brebookshop.com/details.jsp?id=328041

Digest 498 *Selecting lighting controls* (2006)

BR 497 *Conventions for calculating linear thermal transmittance and temperature factors* (2007 and 2010 amendment and conventions). ISBN 978 1 86081 986 5

Information Paper 1/06 *Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings* (2006). ISBN 978 1 86081 904 9

National Calculation Methodology Modelling Guide (for buildings other than dwellings in England) [2013]. (www.ncm.bre.co.uk)

National Calculation Methodology activity database

Simplified Building Energy Model (SBEM) User manual and software. Available at www.ncm.bre.co.uk.

Building Services Research and Information Association

BG 26/2011 Building manuals and building user guides.

BSRIA Commissioning Guides as follows:

BG49/2015 *Commissioning Air Systems*

BG2/2010 *Commissioning Water Systems*

BG29/2012 *Pre-Commission Cleaning of Pipework Systems*

Chartered Institution of Building Services Engineers (CIBSE)

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)

Design Guide A: Environmental Design (2015)

TM 23 Testing buildings for Air Leakage (2000)

TM 31 Building Log Book Toolkit (2006). ISBN 978 1 90328 771 2

TM 39 Building energy metering (2009). ISBN 978 1 90684 611 4

TM 54 Evaluating Operational Energy Performance of Buildings at the Design Stage (2013)

Department for Business Energy and Industrial Strategy (BEIS)

The Government's Standard Assessment Procedure for energy rating of dwellings, SAP 10. Available at www.bregroup.com/sap/sap10/.

Current Energy Prices (www.gov.uk/government/organisations/department-of-energy-climate-change/about/statistics#energy-price-statistics)

Glass and Glazing Federation (GGF)

Guide to the Calculation of Energy Ratings for Windows, Roof Windows and Doors. (2013)

Historic England

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

Approved software for the calculation of the energy performance of buildings in England under the Notice of Approval (www.gov.uk/government/publications/department-for-communities-and-local-government-approved-software-for-the-production-of-non-domestic-energy-performance-certificates-epc)

Approved Document F, Volume 2: Buildings other than Dwellings [available at implementation stage]

Approved Document L, Volume 1: Buildings other than Dwellings [available at implementation stage]

Approved Document J [available at https://www.gov.uk/government/publications/combustion-appliances-and-fuel-storage-systems-approved-document-j]

The Approved Document for Overheating [full title available at implementation stage]

Manual to the Building Regulations: A Code of Practice for Use in England (2020). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/901517/Manual_to_building_regs_-_July_2020.pdf

Microgeneration Certification Scheme

Microgeneration Installation Standard: MIS 3005, issue 5.0 (2017)

National Association of Rooflight Manufacturers (NARM)

Technical Document NTD 2 *Assessment of thermal performance of out-of-plane rooflights* (2010).

Non-Domestic Energy Performance Certificate (NDEPC) Conventions Group

Non Domestic EPC Conventions for England & Wales Issue 7.1. Available at: https://www.cibsecertification.co.uk/CIBSECertification/media/QA-Portal/Conventions/EPC/Commercial-EPC-EW-Conventions-Issue-7-1-v2-0-(17092018).pdf

Thermal Insulation Manufacturers and Suppliers Association (TIMSA)

HVAC guidance for achieving compliance with Part L of the Building Regulations (2006).

Index

*[**Note for consultation:** The index will be provided at implementation stage]*