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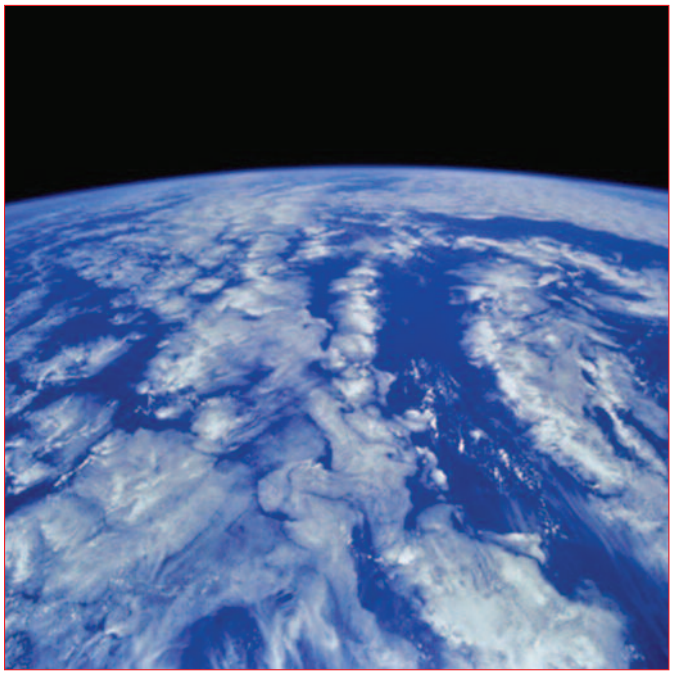
# Technical Briefing Note

# THE BUILDING REGULATIONS PART L (2010)

## England and Wales



## Introduction

The Government has updated Part L of the Building Regulations. The update is intended to improve the energy efficiency of new buildings by approximately 25% (compared with those that met the previous regulations), improve the correlation between the predicted and actual performance of new buildings, continue along the path towards zero-carbon new buildings within the next decade, and to promote improvement of the existing building stock. Guidance appears in four new editions of the Part L Approved Documents, which will come into force on 1 October 2010:

- Approved Document L1A - New Dwellings
- Approved Document L1B - Existing Dwellings
- Approved Document L2A - New Buildings Other Than Dwellings
- Approved Document L2B - Existing Buildings Other Than Dwellings

These are supplemented by two 'second tier' documents:

- The *Domestic Building Services Compliance Guide*
- The *Non-Domestic Building Services Compliance Guide*

And these are supported by 'third tier' documents, including standards, codes of practice, good practice guides and reports published by BRE, etc.

## Approved Document L1A New Dwellings

For new dwellings, Approved Document L1A retains the five criteria for demonstrating compliance with the new regulations, which were introduced in 2006.

**1. The Dwelling Carbon Dioxide Emissions Rate (DER) must not exceed the Target.**

Carbon Dioxide Emissions Rate (TER). The DER (in kg/m$^2$/yr) is calculated as part of a Standard Assessment Procedure (SAP 2009) energy rating calculation, for the dwelling as proposed.

The TER (also in kg/m$^2$/yr) is also calculated as part of the SAP 2009 energy rating, but for a notional dwelling of the same size and shape as the one proposed, with gas-fired central heating, and which is compliant with the Building Regulations, Part L1 (2002) by the Elemental Method (the specification of the notional dwelling is published in SAP 2009, Appendix R). To establish the TER, the calculated emissions rate is reduced by 20% (i.e. to the 2006 standard) and then by a further 25% (to bring it to the new 2010 standard), then adjusted by a fuel factor that raises the emissions target if the proposed dwelling uses a more carbon dioxide intensive fuel (e.g. grid electricity). This makes it easier for dwellings that use such fuels to comply, but for example an electrically heated dwelling will still require more insulation (or other energy efficiency features) than an identical dwelling that is heated by gas.

The 2010 TER is approximately equivalent to the minimum energy performance standard associated with the Code for Sustainable Homes, at Level 3.

The TER and the as-designed DER must be reported to the Building Control Body (BCB) or Approved Inspector (AI) before work commences on site. The as-built DER must be reported to the BCB or AI before compliance with Part L is certified.

**SAP 2009** is significantly different from the previous version, SAP 2005. SAP 2009 assessments take account of the thermal capacity of the building fabric ('thermal mass'), and of party wall heat losses. (See Table 1) Comfort cooling and air conditioning may be assessed, and assessments may take account of multiple heating and ventilation systems. The calculation of hot water demand and the treatment of thermal bridging have been improved, and the approach to low energy lighting is more flexible (low energy lamps may be freely 'traded' against other design features). The secondary heating defaults have been simplified, and the carbon dioxide emissions factors have been updated. BRE approved SAP 2009 software will be available by September 2010.

**2. Design limits for the building fabric and services must not be exceeded.**

For the building fabric, there are maximum thermal transmittances (U values) expressed as area-weighted averages for all the elements of each type. The maximum area-weighted average U values are: roofs 0.20 W/m$^2$K; walls 0.30 W/m$^2$K; floors 0.25 W/m$^2$K; party walls 0.20 W/m$^2$K; and windows and external doors 2.00 W/m$^2$K. The overall air permeability of the building fabric must not exceed 10m$^3$/m$^2$h, in a 50 Pa pressure test. (See Table 2)

The introduction of a maximum U value for party walls reflects research that shows that party walls with unsealed and/or unfilled cavities have significant convective heat loss into roofspaces. Default U values are provided for various party wall constructions, for use in SAP 2009 calculations.

For building services, the *Domestic Building Services Compliance Guide* sets out minimum standards for heating and hot water systems (including community systems), heat pumps, micro CHP, mechanical

ventilation, comfort cooling, solar water heating and fixed lighting. The guide defines minimum efficiencies for energy using appliances, minimum controls, and minimum insulation for primary pipework, warm air ducts and hot water storage cylinders. Minimum coefficients of performance (CoPs) are defined for heat pumps. For ventilation equipment, there are new design limits expressed in terms of maximum specific fan-power (including new standards for intermittent fans) and minimum heat recovery efficiency (if fitted).

75% of fixed internal lighting must be by means of energy efficient lamps (output > 400 lm and efficacy > 45 lm/W).

Fixed external lighting must have controls that switch off the lamps when there is sufficient daylight; if energy efficient lamps are not used then lamps must not exceed 100W per fitting and there must be controls that switch them off when they are not required.

In practice, building fabric and services with performance significantly better than the design limits will be required, in order to meet the carbon dioxide emissions target.

**Underfloor Heating (UFH) Requirements**

The *Domestic Building Services Compliance Guide* recommends that where under-floor heating is installed in a floor in contact with the ground or exposed to the air, insulation should be installed to limit downward heat loss to 10 W/m$^2$.

3. **There must not be a high risk of the dwelling overheating in summer.**

This is demonstrated by a check included in the SAP 2009 energy rating calculation, which grades the risk of summer overheating by means of a calculated 'threshold temperature' (i.e. the 24-hour mean internal temperature in warm weather). Designs with threshold temperatures above 23.5°C have a high risk of overheating and are deemed not to comply. The threshold temperature calculation ignores any installed comfort cooling or air conditioning, in order to promote designs that do not require such systems. Design features that can be used to reduce the threshold temperature include: the area, orientation and shading of glazed openings; the thermal capacity of the building fabric; and the provision of secure ventilation (especially at night).

4. **The dwelling as constructed should include no significant thermal bridges, and the as-built DER, including the tested air permeability, must not exceed the TER.**

To minimise thermal bridging, quality-assured accredited construction details should be used. Industry-based accreditation schemes are to be set up, and will include site inspection to ensure construction quality and to provide feedback to the design and accreditation processes. Alternatively, if the construction details are not accredited, their linear thermal transmittances ($\Psi$ values) may be calculated by persons with suitable expertise and experience, but the calculated values must be increased by 0.02W/mK or 25% (whichever is the greater) when used in DER calculations. If non-accredited details are used and $\Psi$ values are not calculated, a conservative default overall thermal bridging transmittance (y value) of 0.15 W/m$^2$K must be included in the DER calculation.

Three dwellings of each type must be pressure tested to confirm compliance with the design limit and establish the tested air permeability for incorporation in the as-built DER calculation. Tests must be carried out in accordance with the Air Tightness Testing and Measurement Association's Technical Standard L1 *Measuring air permeability in the envelopes of dwellings* (2010). If the tested air permeability exceeds the design limit of 10m$^3$/m$^2$h @ 50 Pa, or results in the as-built DER exceeding the TER, then remedial measures must be implemented in all dwellings of that type, the dwelling must be re-tested to confirm compliance, and an additional dwelling of the same type must be tested. For dwellings that are not included in the test sample, the air permeability used in the as-built DER calculation is the test result plus 2m$^3$/m$^2$h.

For developments of not more than two dwellings, the Building Control Body may accept a pressure test certificate for a dwelling of the same type, constructed within the previous twelve months. Alternatively, if no pressure testing is carried out, an air permeability of 15m$^3$/m$^2$h may be used in the calculation of the as-built DER (which still may not exceed the TER).

Building services must be commissioned by suitably qualified persons, and commissioning certificates provided.

5. **Owners or occupants of dwellings must be provided with information to enable them to use their homes efficiently.**

The information provided should include: operating and maintenance instructions for the building services (heating and hot water systems, and any ventilation or air conditioning systems); copies of the data used to calculate the DERs and TERs; and copies of the recommendations reports associated with the Energy Performance Certificates (EPCs) for the dwellings.

## Approved Document L1B – Existing Dwellings

Approved Document L1B provides guidance about work to existing dwellings.

### Historic buildings

Historic buildings are divided into two categories. Listed buildings, buildings in Conservation Areas and Scheduled Monuments are 'exempt', but only to the extent that compliance would unacceptably alter their character or appearance. Other buildings of architectural or historic interest, including those in National Parks, Areas of Outstanding Natural Beauty and World Heritage Sites, are subject to 'special considerations', and energy efficiency should be improved as far as possible without prejudicing the buildings' character or increasing the risk of deterioration. Local historic buildings officers should be consulted about proposals, and guidance has been published by English Heritage.

### Thermal elements

'Thermal elements' are walls, roofs and floors that separate the internal, conditioned spaces from the exterior, or from unheated spaces. Reasonable provision for energy efficiency is required when thermal elements are provided (extensions), replaced, retained (in a material change of use) or renovated. 'Renovation' means adding or replacing a layer of the construction extending to more than 50% of the area of the element (or 25% of the area of the building envelope).

New (Improved) maximum thermal transmittances (U values) apply to the provision or replacement of thermal elements, as follows: walls 0.28 W/m²K; roofs 0.16-0.18 W/m²K (depending on construction type); and floors 0.22 W/m²K. (See Table 3)

Target 'improved' U values apply to retained thermal elements whose original U values are worse than specified 'threshold' values, but improvements are not expected to involve investments whose simple paybacks exceed 15 years. The threshold U values are 0.70 W/m²K for walls and floors, and 0.35 W/m²K for roofs. The improved U values are: walls with cavity insulation 0.55 W/m²K; other walls 0.30 W/m²K; floors 0.25 W/m²K; roofs 0.16-0.18 W/m²K (depending on construction type).

For renovation, Appendix A identifies potential improvement opportunities, standards (target U values) and technical considerations. Improvements are not expected to involve investments whose simple paybacks exceed 15 years.

### Controlled fittings

Controlled fittings are windows, roof windows and external doors. New maximum U values or minimum window energy ratings are specified for new and replacement fittings. The new standard for windows is an energy rating of C or better or a maximum U value of 1.6 W/m²K. The new standard for doors (irrespective of any glazing) is a maximum U value of 1.8 W/m²K.

If a window is enlarged or a new one is created then the total area of windows, roof windows and external doors should not exceed 25% of the floor area of the dwelling, unless compensating measures are included elsewhere in the work.

### Controlled services

Controlled services are heating, hot water, ventilation, comfort cooling, air conditioning, and fixed lighting (internal and external). The Domestic Building Services Compliance Guide defines minimum efficiencies for new or replacement heating appliances, minimum controls, and minimum insulation standards for primary pipework, warm air ducts and hot water storage cylinders, as well as commissioning requirements. The efficiency of a replacement heating appliance must meet the appropriate standard in the Guide and must not be significantly less than the efficiency of the appliance that it replaces. If a renewable energy generator is replaced, the new system should have an electrical output not less than that of the original installation.

For new or replacement ventilation equipment, there are design limits expressed in terms of maximum specific fan-power (including a new standard for intermittent fans) and minimum heat recovery efficiency (if fitted).

Where new fixed internal lighting (in extensions) or replacement lighting (in existing dwellings) is provided, 75% must be by means of energy efficient lamps (output > 400 lm and efficacy > 45 lm/W).

New fixed external lighting must have controls that switch off the lamps when there is sufficient daylight; if energy efficient lamps are not used then lamps must not exceed 100 W per fitting and there must also be controls that switch them off when they are not required.

### Extensions

There are three ways in which the compliance of an extension may be demonstrated. Under the ***reference method*** all the elements of the design must meet the guidance for the provision of new thermal elements, controlled fittings and controlled services. The area of glazed openings in an extension must not exceed 25% of the floor area, plus the area of any openings in the original dwelling that are covered by the extension.

Under the ***area-weighted U value method*** the thermal properties of exposed walls, roofs and floors, and the thermal properties and areas of glazed openings, may be traded-off against each other, provided that the area weighted average U value of the whole extension envelope is no greater than it would be if the extension complied by the reference method.

Under the ***whole dwelling calculation method*** SAP 2009 assessments may be used to show that the predicted carbon dioxide emissions of the

extended dwelling as proposed are no greater than they would be if the extension complied by the reference method. Improvements to the original dwelling may be traded-off against a lesser standard of performance in the extension, but they must meet the standards for thermal elements, controlled fittings and controlled services, as appropriate.

### Conservatories

A conservatory is *exempt* if: it is at ground level; it has floor area less than 30m$^2$; it is separated from the dwelling by the original external walls, windows and doors (or, if they are replaced, by new ones that meet the standards for replacement thermal elements and controlled fittings); and the dwelling's heating system is not extended into the conservatory. Conservatories that do not meet all of these conditions are not exempt.

Non-exempt conservatories are treated as extensions, except that the maximum area of glazed openings does not apply. In addition the conservatory must be separated from the dwelling by the original external walls, windows and doors (or, if they are replaced, by new ones that meet the standards for replacement thermal elements and controlled fittings); and any fixed heating must have independent on/off and temperature control, and meet the guidance for controlled services.

An attached structure that is not separated from the dwelling to which it is attached is treated as an extension, and the maximum area of glazed openings applies.

### Material changes of use

A material change of use (where a dwelling is created by conversion of another type of building) must include reasonable provision for energy efficiency, in accordance with the guidance for thermal elements, controlled fittings and controlled services. Existing windows, external doors and roof windows with U values worse than 3.30 W/m$^2$K should be replaced by new fittings that meet the standards for replacement controlled fittings. Alternatively, SAP 2009 assessments may be used to show that the predicted carbon dioxide emissions for the converted building are no greater than they would be if all the dwellings in the building complied with the guidance for individual thermal elements, controlled fittings and controlled services.

### Change of energy status

A change of energy status occurs if a building becomes one to which Part L of the Building Regulations applies, where previously it did not. For example, a change of energy status would occur if: a previously unheated building has heating installed; a previously exempt building is no longer exempt; or the separation between a dwelling and a conservatory is removed. In these cases the same standards apply as for material changes of use.

## Approved Document L2A – New Non-Domestic Buildings

For new buildings other than dwellings, Approved Document L2A sets out five criteria for demonstrating compliance with the new regulations.

1. **The Building Carbon Dioxide Emissions Rate (BER) must not exceed the Target Carbon Dioxide Emissions Rate (TER).**

   The BER (in kg/m$^2$/yr) must be calculated for the building as proposed by an 'accredited model' using the National Calculation Methodology (NCM), one implementation of which is the Simplified Building Energy Model (SBEM). Some dynamic simulation models (DSMs) that incorporate the NCM may also be used. The assessments must be made by an accredited energy assessor and the results presented to the Building Control Body both on submission of a full plans application and on completion of the project, with the energy performance certificate. The assessor should demonstrate that the model used for the calculations is appropriate and can adequately reflect the design approach taken to the building.

   The TER is also calculated using the NCM (SBEM), but for a notional building, of the same size and shape as the one proposed, using a set of reference standards for the building's fabric and fixed services. The target is set to achieve an aggregate 25% improvement, compared with the 2006 standards across the new non-domestic stock. The reference standards have been derived from an analysis of the most cost effective measures to deliver the required reduction in carbon dioxide emissions. This means that the approximate cost of meeting the standard across the building stock will be broadly similar, but that some buildings will deliver more than the 25% improvement and others less.

   To set the target three notional building types have been defined:

   - Side-lit through vertical windows (offices, halls of residence etc.)
   - Top-lit through rooflights (warehouses and industrial buildings), and
   - No glazing (theatres and cinemas)

   In practice the target will be derived from a combination of notional specifications for different zones of the building, for example a large distribution warehouse will use the top-lit specification for the main warehouse area and the side-lit specification for the office areas.

2. **Design Limits for the building fabric and services must not be exceeded.**

   For the building fabric, there are maximum U values expressed as

area-weighted averages for all the elements of each type. (The individual worst case values have been moved to Approved Document C as they are associated with minimising the risk of surface condensation.) The assumed 'design air permeability' of the building fabric must not exceed 10$m^3/m^2hr$ at 50 Pa excess pressure.

For building services, the updated and broadened *Non-Domestic Building Services Compliance Guide* sets out minimum efficiencies and controls for conventional fixed building services, including space heating, hot water, mechanical ventilation, comfort cooling and interior lighting. In addition, it now covers low carbon methods of power and heat generation using heat pumps and combined heat and power, and renewable energy systems including wind turbines and solar photovoltaic panels.

Fixed internal lighting must achieve an average efficacy of at least 55 luminaire lumens per circuit Watt in offices, industrial and storage areas (in all building types) and at least 55 lamp lumens per circuit Watt in all other areas. Display lighting must achieve an average efficacy of at least 22 lamp lumens per circuit Watt and have dedicated circuits that can be switched off when people are not inspecting the display.

Energy meters and sub-meters must be installed to account for at least 90% of the use of each fuel, assigned by end-use. 'Low and zero carbon' (LZC) systems should be separately metered. Buildings of more than 1,000$m^2$ floor area should have facilities for automatic meter reading and data collection.

In practice building fabric and services with performance significantly better than the design limits will be required, in order to meet the carbon dioxide emissions target.

3. **There must not be a high risk of solar overheating.**

   The guidance now applies to all buildings, regardless of whether they are designed to use air-conditioning, and has the twin aims of reducing the need for air-conditioning and (where it is installed) ensuring that it is appropriately sized to the cooling load. To demonstrate compliance for occupied spaces or spaces that are mechanically cooled the amount of solar gain for the period April to September should not exceed the solar gains through a reference glazing system as follows:

   - For side-lit buildings the reference case is an east facing facade with full width glazing to a height of one metre and a solar energy transmittance value (g-value) of 0.68.
   - For top-lit buildings where the average zone is less than 6m high the reference case is a horizontal roof, 10% glazed with rooflights that have a solar energy transmittance value (g-value) of 0.68.
   - For top-lit buildings where the average zone is more than 6m high the reference case is a horizontal roof, 20% glazed with rooflights that have a solar energy transmittance value (g-value) of 0.46.

4. **The building as constructed should perform as well as or better than predicted.**

   The building fabric must include no significant thermal bridges, and the 'as-built' BER, including the tested air permeability, ductwork leakage rate and commissioned fan performance must not exceed the TER.

   To demonstrate compliance with the requirement to reduce the heat losses associated with thermal bridges the builder may use details from a quality-assured accredited construction details scheme; or demonstrate by calculation that the details used provide equivalent or better thermal performance using the calculation procedures in BRE 497, with a 'workmanship' factor of 25% applied to the calculated values; or use unaccredited details, in which case the default values given in BRE's Information Paper IP1/06, increased by a 'workmanship' factor of 50%, should be taken in the calculation of the BER. The Building Control Body must be provided with details of the site inspection system that the builder proposes to use to ensure construction quality.

   The Building Control Body must also be provided with a report confirming the results of a pressure test to confirm that the air permeability standard has been achieved. Pressure tests must be carried out by suitably qualified persons and in accordance with the Air Tightness Testing and Measurement Association's Technical Standard L2 *Measuring Air Permeability of Building Envelopes* (2010). If the tested air permeability exceeds the design air permeability then the building must be re-tested after remedial work has been carried out. However, the design air permeability may be adjusted provided that it does not exceed the design limit and the as-built BER incorporating the tested air permeability does not exceed the TER. For small buildings of less than 500$m^2$ floor area, if no pressure testing is carried out, an air permeability of 15$m^3/m^2h$ may be used in the as-built BER calculation (which, nevertheless, may not exceed the TER).

   Ductwork must be air-leakage tested in accordance with the Heating Ventilating and Air Conditioning Association's guide DW143, to demonstrate that it achieves the minimum standard

assumed in the BER calculation. Ductwork that fails to meet the standard must be subjected to remedial work and re-tested.

To assist the BCB a commissioning plan should be prepared and submitted with the calculation of the TER and BER, setting out the systems installed and the tests that will be carried out. Completed heating, hot water, ventilation and air conditioning systems must be commissioned by competent persons to appropriate standards, and a commissioning notice provided stating that the building services have been commissioned in accordance with the commissioning plan and that the results of the tests are reasonable.

5. **The building owner or occupants must be provided with a building log-book.**

   The log book must identify: the installed building services and their controls; the intended method of operation and maintenance; details of the installed energy metering and monitoring systems; and the data used to calculate the TER and BER. In addition, the owner should be provided with the Energy Performance Certificate and the associated recommendations report.

## Approved Document L2B – Existing Non-Domestic Buildings

Approved Document L2B provides guidance about work to existing buildings other than dwellings and the requirements for 'consequential improvements' in energy efficiency of buildings with more than 1,000m$^2$ of useful floorspace, when other work is carried out. The Approved Document also provides guidance when a change in energy status occurs, for example when a building (or part) that was previously designed to be unheated becomes heated (e.g. on subsequent fit-out).

### Historic buildings

Historic buildings are not exempt from these requirements, but improvements in energy efficiency should not prejudice the character of the building or increase the risk of deterioration; local historic buildings officers should be consulted about proposals.

### Thermal elements

Thermal elements are walls, roofs and floors that separate the internal, conditioned spaces from the exterior, or from adjacent unheated spaces. Reasonable provision for energy efficiency is required when thermal elements are provided (in an extension), replaced, retained (in a material change of use) or renovated. 'Renovation' means adding or replacing a layer of the construction extending to more than 50% of the area of the individual element or 25% of the total building envelope. Maximum U values apply to the provision and replacement of thermal elements. Target 'improved' U values apply to retained thermal elements whose original U values are worse than specified 'threshold' values, but improvements are not expected to involve investments whose simple paybacks exceed 15 years. For renovation similar standards are required as for retained elements; however, where these are not technically viable Approved Document L2B refers to Appendix A of Approved Document L1B, which identifies potential improvement opportunities, standards and considerations. Again, improvements are not expected to involve investments whose simple paybacks exceed 15 years.

### Controlled fittings

Controlled fittings are windows, (including curtain walling) roof windows and external doors (including high usage entrance doors and vehicle access doors). Maximum U values (area-weighted averages) are specified for new and replacement fittings in existing buildings. Less demanding U values may be acceptable in buildings with high internal heat gains. A new procedure is provided for calculating the overall U-value for curtain walling systems based on the glazing fraction and fraction of opening lights.

### Controlled services

Controlled services are heating, hot water, ventilation, air conditioning, internal lighting and renewable energy systems. The *Non-Domestic Building Services Compliance Guide* sets out minimum efficiencies for new or replacement plant, minimum controls, and minimum insulation for pipework, air ducts and hot water storage cylinders, as well as commissioning requirements. The efficiency of replacement plant must meet the standard in the *Guide* and must not be worse than the efficiency of the plant that it replaces. Cooling loads should be reduced, if possible, before cooling plant is provided or replaced.

For new or replacement ventilation equipment, there are design limits expressed in terms of worst acceptable specific fan-power and minimum heat recovery efficiency.

New internal lighting (in extensions) and replacement lighting (in existing buildings) must achieve average efficacy of at least 55 luminaire lumens per circuit Watt in offices, industrial and storage areas (in buildings of any type) or at least 50 lamp lumens per circuit Watt in all other types of space. Display lighting must achieve an average efficacy of at least 22 lm/W and have dedicated circuits that can be switched off when people are not inspecting the display. Emergency lighting and process lighting are not subject to control under Part L.

Where a controlled service is provided, controls should be upgraded, energy meters should be provided and the plant should be commissioned, as required by the Non-Domestic Building Services Compliance Guide. As with new buildings a commissioning notice should be provided to the BCB

confirming the commissioning has been successfully carried out. The building logbook should be updated, or a new logbook provided.

### Extensions

An extension that exceeds 100m$^2$ of floorspace *and* exceeds 25% of the floor area of the original building is treated as a new building. Other extensions must meet the requirements for the provision of new thermal elements, controlled fittings and services. There are maximum areas for glazed openings (except for vehicle entrance doors and display windows). The thermal properties of exposed walls, roofs and floors, and the thermal properties and areas of glazed openings may be traded-off against each other, subject to design limits. Accredited construction details, or other details with equivalent or better thermal performance as demonstrated by calculation using the methods in BR 497 or BRE IP 1/06, should be used.

An SBEM assessment may be used to show that the carbon dioxide emissions of the extended building are no greater than they would have been if all the elemental standards had been applied to the extension, but required improvements to the original building (e.g. the improved efficiency of a replacement boiler) may not be traded off against a lesser standard of performance in the extension.

### Conservatories

A conservatory is *exempt* if: it is at ground level; it has floor area less than 30m$^2$; it is separated from the building by the original external walls, windows and doors (or, if they are replaced, by new ones that meet the standards for replacement thermal elements and controlled fittings); and the building's heating system is not extended into the conservatory. Conservatories that do not meet all of these conditions are not exempt.

A non-exempt conservatory is treated as an extension, but the maximum glazed areas do not apply; it must also be separated from the building by the original external walls, windows and doors (or, if they are replaced, by new ones that meet the standards for replacement thermal elements and controlled fittings); and any fixed heating must have independent on/off and temperature control, and meet the guidance for controlled services. An attached structure that is not separated from the building to which it is attached is treated as an extension, and the maximum glazed areas do apply.

### Material changes of use and changes of energy status

A material change of use occurs when a building is converted to one use from a different use. A change of energy status occurs if a building becomes one to which Part L of the Building Regulations applies, where previously it did not. For example, a change of energy status would occur if: a previously unheated building has heating installed; a previously exempt building is no longer exempt; or the separation between a building and a conservatory is removed.

Material changes of use and changes of energy status must include reasonable provision for energy efficiency, in accordance with the requirements for thermal elements, controlled fittings and controlled services. Existing windows, external doors and roof windows with U values worse than 3.30 W/m$^2$K should be replaced by new fittings that meet the requirements for replacement controlled fittings. The total area of openings in the converted building should be limited to 25% of the total floor area, or compensating measures should be applied elsewhere in the design to improve energy efficiency. Alternatively, an SBEM assessment may be used to show that the predicted carbon dioxide emissions of the building as proposed are no greater than they would be if the individual standards for thermal elements, controlled fittings and controlled services were applied to the conversion.

It may also be the case that the building works carried out are one of the triggers for consequential improvements. In this event the energy efficiency of the building as a whole must be improved in line with the guidance described below.

### Consequential improvements

Consequential improvements apply only to buildings with total useful floor areas greater than 1,000m$^2$. In these cases improvement of the energy efficiency of the whole building must be made if: the floorspace is increased; or the capacity of any fixed building service is increased; or a new fixed building service is provided where it was not provided before. Consequential improvements might include: upgrading thermal elements in line with the requirements for retained thermal elements; replacement of windows, doors and roof windows that have U values worse than 3.30 W/m$^2$K; replacement of heating, air handling or cooling plant that is more than fifteen years old; upgrading of any lighting system that serves an area of more than 100m$^2$ and has an average efficacy less than 40 lm/W; or increasing the provision of energy from on-site low- or zero-carbon technologies, if it is less than 10%.

Consequential improvements should achieve a simple payback of capital cost (via fuel cost savings) within fifteen years, and the expected capital investment is at least 10% of the cost of the principal works that trigger the requirement. However, this 10% rule does *not* apply where a new service is added to a building or its existing capacity is increased: in these cases all of the thermal elements enclosing the newly-treated areas should be improved in accordance with the requirements for retained thermal elements; windows or doors with U values worse than 3.30 W/m$^2$K should be replaced; and (in the case of new or extended cooling systems) the cooling load should be reduced.

# Tables

| Table 1 U-values for party walls | |
|---|---|
| Party wall construction | |
| Solid | 0.0 W/m²K |
| Unfilled cavity with no effective edge sealing | 0.5 W/m²K |
| Unfilled cavity with effective sealing around all exposed edges and in line With insulation layers in abutting elements | 0.2 W/m²K |
| A fully filled cavity with effective sealing at all exposed edges and in line With insulation layers in abutting elements | 0.0 W/m²K |

| Table 2 Limiting fabric parameters | |
|---|---|
| Roof | 0.020 W/m²K |
| Wall | 0.030 W/m²K |
| Floor | 0.025 W/m²K |
| Party Wall | 0.020 W/m²K |
| Windows, roof windows, rooflights, curtain walling and pedestrian doors | 2.00 W/m²K |
| Air permeability | 10m³/h.m² at 50 Pa |

| Table 3 Extensions - provision of new element | | |
|---|---|---|
| Element | Max U-Value 2006 | Max U-Value 2010 |
| Walls | 0.30 W/m²K | 0.28 W/m²K |
| Roofs (Insulation at ceiling level) | 0.16 W/m²K | 0.16 W/m²K |
| Roofs (Insulation in pitched roof plane) | 0.20 W/m²K | 0.18 W/m²K |
| Roof (Flat) | 0.20 W/m²K | 0.18 W/m²K |
| Floors | 0.22 W/m²K | 0.22 W/m²K |
| Swimming pool basin | - | 0.25 W/m²K |

## Glossary

**α value** - the additional thermal transmittance of the envelope of a non-domestic building due to heat loss via non-repeating thermal bridges, in W/m²K (as used in SBEM).

**Air permeability** - the air leakage rate per unit area of the building fabric measured in m³/m²/hr at 50 Pa excess pressure.

**BER** - the Building (carbon dioxide) Emissions Rate in kg/m²/yr, as calculated by the National Calculation Methodology (NCM), one implementation of which is the Simplified Building Energy Model (SBEM)

**Building Control Body** - a local authority or improved inspector licensed to control compliance with the Building Regulations.

**Change of energy status** - any circumstance in which a building becomes one to which Part L of the Building Regulations applies, where previously it did not.

**Consequential improvement** - improvement of the energy efficiency of a building (or part of a building) as a consequence of other work being carried out, as required by Building Regulation 17D.

**Conservatory** - a structure that has at least 75% of its roof and at least 50% of its walls made of translucent material, and is thermally separated from the building to which it is attached.

**Controlled fittings** - windows, roof windows and external doors (including vehicle doors and high usage entrance doors) in existing buildings.

**Controlled services** - fixed heating, hot water, ventilation, air conditioning and lighting systems in existing buildings.

**DER** - Dwelling (carbon dioxide) emissions rate in kg/m²/yr, as calculated by the Standard Assessment Procedure (SAP) energy rating 2005.

**Design air permeability** - the assumed air permeability included in the calculation of the DER of an unbuilt dwelling, or the BER of an unbuilt non-domestic building, at the design stage.

**Design limits** - the worst acceptable U values and air permeability of the building fabric, the worst acceptable efficiencies of space and water heating appliances, the worst acceptable specific fan power and heat recovery efficiencies of ventilation systems, and the minimum provision and/or efficacy of fixed internal and external lighting systems, in new buildings.

**Display lighting** - lighting that is intended to highlight exhibits or displays of merchandise, or used in places of public entertainment.

**Display window** - an area of glazing intended for the display of products or services at the external perimeter of a building and adjacent to (and extending not more than 3m above) a pedestrian thoroughfare.

**Dwelling** - a self-contained unit of residential accommodation designed to accommodate a single household.

**Dwelling type** - a set of dwellings of the same built form in which the same construction methods are used for each of the main elements, irrespective of small variations in floor area.

**Effective heat generating seasonal efficiency** - the sum of the Heating Efficiency Credits and the Heat Generator Seasonal Efficiency.

**Emergency escape lighting** - lighting that provides illumination for the safety of people leaving an area or attempting to terminate a dangerous process before leaving an area.

**Fit out work** - work to complete the internal partitioning and building services within the external envelope (shell) of a building to meet the specific needs of incoming occupants.

**Fixed building services** - any part of or any controls associated with fixed systems for heating, hot water, air conditioning, mechanical ventilation or internal or external lighting (excluding emergency escape lighting and specialist process lighting).

**Heat generator** - a device for converting fuel and/or electricity into heat.

**Heat generator efficiency** - the ratio of useful heat output to energy input in the fuel (based on gross calorific value) or electricity delivered to the heat generator.

## Glossary

**Heat generator seasonal efficiency** - the estimated seasonal ratio of heat input to heat output from the heat generator, which depends on the Heat Generator Efficiency and the operating mode over the heating season.

**Heating efficiency credits** - credits applied to the Heat Generator Seasonal Efficiencies of heating and hot water systems to account for measures such as improved control.

**High usage entrance door** - an external door (equipped with closers) at a building entrance (with a lobby) that is expected to experience a large traffic volume, and where robustness and/or powered operation is the primary performance requirement.

**Historic building** - a building that is officially 'listed' as of special architectural or historic interest, or which is located in a Conservation Area, a National Park, an Area of Outstanding Natural Beauty or a World Heritage Site.

**Material change of use** - the conversion of a building into a dwelling or dwellings, or the addition of a dwelling to a building that already contains dwellings; or the conversion of a building to a hotel, boarding house, institution or public building, where previously it was not.

**Minimum controls package** - a package of controls specific to each technology that represents the minimum provision for controls to reduce carbon dioxide emissions associated with space heating, water heating or cooling.

**National Calculation Methodology (NCM)** - the UK national methodology, under the EPBD, for calculation of the energy performance of buildings; one implementation of the NCM is SBEM.

**Principal works** - works to an existing building that give rise to a requirement for consequential improvement of the energy efficiency of the building.

**$\Psi$ value** the linear thermal conductivity of a construction detail, in W/mK.

**Renovation (of a thermal element)** - provision of a new layer, or replacement of an existing layer, in the construction of a thermal element of an existing building.

**Room for residential purposes** - a room or a suite of rooms that is not a dwelling and that is used by one or more persons to live and sleep, (including rooms in hostels, hotels, boarding houses, halls of residence and residential homes) and which is separated from the rest of the building by a lockable door but not designed to be occupied by a single household.

**SAP** - the Standard Assessment Procedure for the energy rating of dwellings (i.e. The National Calculation Methodology for domestic buildings in England, Wales and Northern Ireland).

**SBEM** - the Simplified Building Energy Model (i.e. The National Calculation Methodology for non-domestic buildings).

**Seasonal efficiency** - the estimated ratio of the heat input (based on the gross calorific value of the fuel) to the heat output of a heat generating appliance, (e.g. a boiler) over the heating season.

**Simple payback** - the amount of time taken to recover an initial investment in improved energy efficiency through fuel cost savings (excluding VAT).

**Space heating system** - the complete system that is installed to provide heating to a space, including the heating appliance or plant and the heat distribution and emission mechanism.

**Specialist process lighting** - lighting that is intended to illuminate specialist tasks within a space, rather than the space itself.

**TER** - the Target (carbon dioxide) Emissions Rate in kg/m$^2$/yr, as calculated by SAP (for dwellings) or by SBEM (for all other buildings).

**Thermal bridge** - an area of reduced insulation within the construction of a wall, roof or floor, at the junction of a wall with another wall or a roof or a floor, or around an opening such as a window, roof window or external door.

**Thermal element** - a wall, floor or roof of an existing building that separates the internal conditioned space from the external environment or from an unheated space.

**Total useful floor area** - the total floor area of all enclosed spaces in a building measured to the internal faces of the external walls.

**y value** - the additional thermal transmittance of the envelope of a domestic building due to heat loss via non-repeating thermal bridges, in W/m$^2$K (as used in SAP).


Apartment


Semi


Mid terrace


Detached

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