

The Building Bye-Laws (Jersey) 2007

**TECHNICAL GUIDANCE DOCUMENT  
11.2B**

**PART 11  
CONSERVATION OF FUEL AND POWER  
IN EXISTING BUILDINGS  
OTHER THAN DWELLINGS**

2017  
EDITION

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## MAIN CHANGES IN THE 2011 EDITIONS

1. This Technical Guidance Document 11.2B comes into force on 01 January 2011 in support of the Building Bye-laws (Jersey) 2007 as amended. From that date the 2002 edition of Approved Document L2 will become obsolete. The main changes in the legal requirements and the supporting technical guidance in this edition of Technical Guidance Document 11.2B are as follows.

### Changes in the legal requirement

2. The main legal changes are reproduced at the front of this Technical Guidance Document and interleaved as well in the relevant text for ease of reference. In cases of doubt however refer to the SI itself.
3. Part 11 of schedule 2 has been consolidated into a single requirement 11.1, covering all types of building with no limits on application.
4. As well as changes to Part 11, there are changes to the definitions of building works and exempt works, and a new definition of “thermal element” is introduced to address more types of alteration and renovation work.
5. New requirements apply when providing or renovating thermal elements and the commissioning of heating, ventilation, and lighting systems.
6. A further new requirement requires the improvement of the energy performance of buildings with floor areas over 1000m<sup>2</sup> as a consequence whenever these building are subject to major works.

### Changes in the technical guidance

7. Four Technical Guidance Documents are published reflecting the specialisation in the construction market. In the new Technical Guidance Documents regulatory requirements are shown on a blue background and defined terms are highlighted. More use has been made of more comprehensive and detailed technical reference publications that therefore form part of the approved guidance. Commentary text has been added in places to explain, for instance the aims of the guidance and how outcomes are calculated.
8. In this Technical Guidance Document the guidance is based on an elemental approach to compliance. The main technical changes comprise a general improvement in the performance standards that are considered reasonable for thermal elements, windows, doors, heating, hot water, cooling, mechanical ventilation and lighting systems provided, or

replaced as part of work in existing buildings. As an exception to this the standards for replacement windows and rooflights are unchanged from those in ADL2 (2002).

9. A new section gives guidance on complying with the new requirement to make cost-effective consequential improvements whenever work is carried out on larger buildings.
10. More guidance is given enabling greater flexibility when building extensions including conservatories and other highly glazed designs.
11. A new section contains guidance on ways of complying with the new requirements for provisions and renovation of thermal elements. Cost-effectiveness for these purposes is defined as showing a simple payback period not exceeding 15 years. A cross-reference is given to Appendix A in TGD11.1B for examples of what can be achieved cost effectively.

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## Use of Guidance

### THE TECHNICAL GUIDANCE DOCUMENTS

This document is one of a series that has been approved and issued by the Minister for Planning and Environment for the purpose of providing practical guidance with respect to the requirements of Schedule 2 and Bye-law 7 of the Building Bye-laws (Jersey) 2007.

**A list of all technical guidance documents that have been approved and issued by the Planning and Environment Minister for this purpose can be obtained from the department.**

Technical Guidance Documents are intended to provide guidance for some of the more common building situations. However, there may well be alternative ways of achieving compliance with the requirements. Thus, there is no obligation to adopt any particular solution contained in a Technical Guidance Document if you prefer to meet the relevant requirement in some other way.

### OTHER REQUIREMENTS

The guidance contained in a Technical Guidance Document relates only to the particular requirements of the Bye-laws which the document addresses. The building work will also have to comply with the requirements of any other relevant parts in Schedule 2 to the Bye-laws.

There are Technical Guidance Documents which give guidance on each of the parts of Schedule 2 and on Bye-law 7.

### LIMITATION ON REQUIREMENTS

In accordance with Bye-law 8, the requirements in Parts 1 to 7, 10 and 12 (except for requirements 3.6 and 6.2) of the Second Schedule to the Building Bye-laws do not require anything to be done except for the purpose of securing reasonable standards of health and safety for persons in or about buildings (and any others who may be affected by buildings or matters connected with buildings). This is one of the categories of purpose for which Building Bye-laws may be made.

Requirements 3.6 and 6.2 are excluded from Bye-law 8 because they deal directly with prevention of the contamination of water. Parts 8 and 9 (which deal, respectively, with access to and use of buildings and resistance to the passage of sound, ) are excluded from Bye-law 8 because they address the welfare and convenience of building users. Part 11 is excluded from Bye-law 8 because it addresses the conservation of fuel and power. All these matters are amongst the purposes, other than health and safety, that may be addressed by Building Bye-laws.

### MATERIALS AND WORKMANSHIP

Any building work which is subject to the requirements imposed by Schedule 2 to the Building Bye-laws should, in accordance with Bye-law 7, be carried out with proper materials and in a workmanlike manner.

You may show that you have complied with Bye-law 7 in a number of ways. These include the appropriate use of a product bearing CE marking in accordance with the Construction Products Directive (89/106/EEC)<sup>1</sup>, the Low Voltage Directive (73/23/EEC and amendment 93/68/EEC)<sup>2</sup> and the EMC Directive (89/336/EEC)<sup>3</sup> as amended by the CE Marking Directive (93/68/EEC)<sup>4</sup> or a product complying with an appropriate technical specification (as defined in those Directives), a British Standard, or an alternative national technical specification of any state which is a contracting party to the European Economic Area which, in use, is equivalent, or a product covered by a national or European certificate issued by a European Technical Approval Issuing body, and the conditions of use are in accordance with the terms of the certificate. You will find further guidance in the Technical Guidance Document supporting Bye-law 7 on materials and workmanship

### INDEPENDENT CERTIFICATION SCHEMES

There are many UK product certification schemes. Such schemes certify compliance with the requirements of a recognised document which is appropriate to the purpose for which the material is to be used. Materials which are not so certified may still conform to a relevant standard.

Many certification bodies which approve such schemes are accredited by UKAS

### TECHNICAL SPECIFICATIONS

Building Bye-laws are made for specific purposes: health and safety, energy conservation and the welfare and convenience of disabled people. Standards and technical approvals are relevant guidance to the extent that they relate to these considerations. However, they may also address other aspects of performance such as serviceability, or aspects which although they relate to health and safety are not covered by the Bye-laws. .

<sup>1</sup> As implemented by the Construction Products Regulations 1991 (SI 1991/1620).

<sup>2</sup> As implemented by the Electrical Equipment (Safety Regulations 1994)

<sup>3</sup> As implemented by the Electromagnetic Compatibility Regulations 1992 (SI 1994/3260).

<sup>4</sup> As implemented by the Construction Products (Amendment) Regulation 1994 (SI 1994/3051) and The Electromagnetic Compatibility (amendment) Regulations 1994 (SI 1994/3080)

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When a Technical Guidance Document makes reference to a named standard, the relevant version of the standard is the one listed at the end of the publication. However, if this version has been revised or updated by the issuing standards body, the new version should be used as a source of guidance provided it continues to address the relevant requirements of the Bye-laws.

The appropriate use of a product which complies with a European Technical Approval as defined in the Construction Products Directive will meet the relevant requirements.

The Department intends to issue periodic amendments to its Technical Guidance Documents to reflect emerging harmonised European Standards. Where a national standard is to be replaced by a European harmonised standard, there will be a co-existence period during which either standard may be referred to. At the end of the co-existence period the national standard will be withdrawn.

## **MIXED USE DEVELOPMENT**

In mixed use developments part of a building may be used as a dwelling while another part has a non-domestic use. In such cases, if the requirements of this part of the Bye-laws for dwelling and non-domestic use differ, the requirements for non-domestic use should apply in any shared parts of the building.

## The Requirement

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This Technical Guidance Document, which takes effect on 01 January 2011, deals with the energy efficiency requirements in the Building Bye-laws (Jersey) 2007, as amended. The energy efficiency requirements are conveyed in Part 11 of schedule 2 to the Building Bye-laws and Bye-laws 5A, 5B and 17C as described below:

### Requirement

#### **Part 11 Conservation of Fuel and Power.**

- 11.1 Reasonable provision shall be made for the conservation of fuel and power in buildings by:
- a limiting heat gains and heat 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 and commissioning energy efficient fixed building services with effective controls; and
  - c in a case where building work is carried out in connection with a building that is (or any component of which is) required to comply with any provision of sub-paragraph (a) or (b), providing to the owner of the relevant building on completion of that building work 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 are reasonable in the circumstances.

## Other changes to the Bye-laws

There are new Bye-laws that introduce new energy efficiency requirements and other relevant changes to the existing bye-laws. For ease of reference the principal elements of the bye-laws that bear on energy efficiency are repeated below and, where relevant, in the body of the guidance in the rest of this Technical Guidance Document. However it must be recognised that the Statutory Instrument takes precedence if there is any doubt over interpretation.

### Interpretation

**“building work” means –**

- (a) the erection or extension of a building;
- (b) the provision or extension of a controlled service or fitting in or in connection with a building;
- (c) a material alteration in relation to a building;
- (d) work required by bye-law 5A, 5B, 6, or 17C, in relation to a building;
- (e) work involving the underpinning of a building;
- (f) the provision, alteration or extension of an electrical installation in a building, including, where such an installation is altered or extended, any work on the existing electrical installation of the building;

**“change to a building’s energy status’** means a change to a building, being a change that has the result that the building becomes one to which any of the energy efficiency requirements applies where previously the requirement did not so apply;

**‘energy efficiency requirements’** means the requirements of –

- (a) bye-laws 5A and 5B;
- (b) Part 3A; and
- (c) Part 11 of Schedule 2;

**“fixed building service’** means –

- (a) a fixed internal or external lighting system (other than an emergency escape lighting system or a specialist process lighting system); or
- (b) a fixed system for heating, providing hot water, providing air conditioning or providing mechanical ventilation;

**‘technical guidance document’** means a technical guidance document published under Article 32 of the Law;

**‘thermal element’** has the meaning set out in bye-law 2A;

**‘thermally conditioned’** means capable of being maintained at or near a given temperature by the use of one or more mechanical devices.

Bye-law (2) is amended to include the following new definitions.

- (k) the building is used as an office, where previously it was not; or
- (l) in the case of a building that is or contains a dwelling or garage, part of the building is used as a habitable room where previously the part was not so used.

### A new Bye-Law 2A has been added as follows:

- (1) In these bye-laws, ‘thermal element’ means a wall, floor, or roof, that separates a thermally-conditioned part of a building from –
  - (a) part or all of the external environment; or
  - (b) in the case of a wall or floor, another part of the building, being a part that is –
    - (i) not thermally conditioned,
    - (ii) an extension falling within Class 6 in Schedule 1, or
    - (iii) where this clause applies, thermally conditioned to a different temperature, and includes all parts of the wall, floor, or roof, between the surface bounding the thermally-conditioned part of the building and the surface exposed to the external environment or to the other part of the building.
- (2) Paragraph (1)(b)(iii) only applies if –
  - (a) the relevant building is not a dwelling; and
  - (b) the other part of the relevant building is used for a purpose that is not similar or identical to the purpose for which the thermally-conditioned part is used.
- (3) In this bye-law –
  - (a) a reference to the external environment includes the ground;
  - (b) a reference to a wall, floor or roof does not include a window, door, roof-window or roof-light.

### Requirements relating to building work.

Bye-law 5 is amended as follows:

- (4) Despite paragraphs (1) and (2) and without affecting the operation of paragraph (3), if building work is only of a kind required by bye-law 5A, 5B or 17C and does not constitute a material alteration to a building, paragraphs (1)

and (2) shall not apply to or in relation to the building work so long as the requirements of bye-law 5A, 5B or 17C (as the case requires) are met in relation to the work.

## Requirements relating to thermal elements.

A new bye-law 5A is added as follows:

- (1) Where a thermal element is renovated, such building work shall be carried out as is necessary to ensure that the whole thermal element as so renovated complies with requirement 11.1(a)(i).
- (2) Where a thermal element is replaced, the replacement thermal element shall comply with requirement 11.1(a)(i).

## Requirements relating to a change to energy status.

A new bye-law 5B is added as follows:

- (1) Where there is a change to a building's energy status, such building work shall be carried out as is necessary to ensure that the building complies with the requirements of Part 11 of Schedule 2.
- (2) However, if the change concerns the energy status of only part of the building, being a part designed, or altered, to have fixed building services that are separate from those of other parts of the building, then it shall be sufficient compliance with paragraph (1) if the building work that is carried out ensures that the part complies with the requirements of Part 11 of Schedule 2.

## Requirements relating to a material change of use.

Bye-law 6 is updated to take account of the changes to Part 11.

## Application for a building permit.

Bye-law 10 is amended as follows:

For sub-paragraphs (a) and (b) of bye-law 10(1) the following sub-paragraphs have been substituted –

- (a) to carry out building work;
- (b) to replace or renovate a thermal element that forms part of a building in relation to which any of the energy efficiency requirements apply;
- (c) to make a change to a building's energy status; or
- (d) to make a material change of use.

## ENERGY PERFORMANCE OF BUILDINGS

New bye-laws are added as follows:

### 17A Interpretation

In this Part, 'building' means an entire building or such part of a building as is designed, or altered, to have fixed building services that are separate from those of other parts of the building.

### 17B New buildings

- (1) This bye-law applies where a new building is constructed.
- (2) The building, once constructed, shall not exceed the target rate of the energy performance for the building that has been specified in the relevant technical guidance document.
- (3) For the purposes of this bye-law, the relevant technical guidance document is one concerning minimum energy performance requirements for buildings and setting out a methodology of calculation for the energy performance of buildings.

### 17C Consequential improvements to energy performance

- (1) Paragraph (2) applies to an existing building with a total useful floor area over 1000m<sup>2</sup> in respect of which building work is proposed if the proposed building work consists of or includes –
  - (a) an extension of the building; or
  - (b) the initial provision of any fixed building services, or an increase to the installed capacity of any fixed building services, in relation to the building.
- (2) Subject to paragraph (3), such work, if any, shall be carried out as is necessary to ensure that the building complies with Part 11 of Schedule 2.
- (3) Nothing in paragraph (2) requires work to be carried out if it is not technically, functionally and economically feasible.

### 17D Notice of energy performance to Minister

- (1) This bye-law and bye-law 17E apply where a new dwelling is created by building work or by a material change of use in connection with which building work is carried out.
- (2) The person carrying out the relevant building work shall calculate a rating of the energy



- performance of the dwelling, once constructed, in accordance with the relevant technical guidance document and give notice of that rating to the Minister.
- (3) For the purposes of this bye-law, the relevant technical guidance document is one concerning minimum energy performance requirements for buildings and setting out a methodology of calculation for the energy performance of buildings.
- (4) The notice shall be given not later than –
- the date on which the notice required by bye-law 13(6) is given in relation to the building work; and
  - at least 5 days before occupation of the dwelling.

### 17E Notice of energy performance to occupant

- (1) The person carrying out the relevant building work shall affix, as soon as practicable, in a conspicuous place in the dwelling, a notice stating the rating of the energy performance of the dwelling, calculated as referred to in bye-law 17D.
- (2) The notice shall be affixed not later than –
- the date on which the notice required by bye-law 13(6) is given in relation to the building work; and
  - at least 5 days before occupation of the dwelling.
- (3) This bye-law shall not apply in a case where the person carrying out the relevant building work intends to occupy, or occupies, the dwelling as a residence.

### 17F Calculations and targets

- (1) This bye-law applies to a building in relation to which requirement 11.1(a)(i) applies.
- (2) A person carrying out building work to construct the building shall ensure that pressure testing is carried out on the building in such circumstances, and in accordance with such procedures, as are set out in the relevant technical guidance document.
- (3) The person carrying out the building work shall give notice of the results of the pressure testing to the Minister not later than 7 days after the testing is completed.
- (4) The notice shall set out the results of the testing and the data on which they are based in the manner set out in the relevant technical guidance document.

- (5) For the purposes of this bye-law, the relevant technical guidance document is one concerning pressure testing in a building in order to determine heat gains and losses in the building from its thermal elements and other parts of its building fabric.

### 17G Commissioning

- (1) This bye-law applies to a building in relation to which requirement 11.1(b) applies and building work is carried out, but does not apply where the building work consists only of exempt electrical certifiable work (within the meaning of bye-law 15).
- (2) The person carrying out the building work shall give to the Minister a notice confirming that the relevant fixed building services have been commissioned in accordance with the procedure set out in the relevant technical guidance document.
- (3) The notice shall be given not later than –
- in every case, the date on which the notice required by bye-law 13(6) in relation to the building work is given; and
  - in the case of certifiable building work (within the meaning of bye-law 15), not more than 30 days after completion of the work.
- (4) For the purposes of this bye-law, the relevant technical guidance document is one concerning pressure testing in a building in order to determine heat gains and losses in the building from its pipes, ducts, and vessels, used for space heating, space cooling and hot water services.

### 17H Energy performance rate calculations

- (1) A person carrying out building work to construct a new building shall give notice of the calculated energy performance rate for the building, as constructed, to the Minister.
- (2) The notice shall be given not later than –
- the date on which the notice required by bye-law 13(6) is given in relation to the building work; and
  - at least 5 days before occupation of the building.

### Exempt building and work.

Schedule 1 is altered as follows:

For Class 6(1)(c) and (d) of Schedule 1 to the principal bye-laws the following sub-paragraphs have been substituted –

- (c) its glazing satisfies requirement 10.1;
- (d) it does not cause a contravention of these bye-laws in respect of the dwelling or any service or fitting; and
- (e) in the case of an extension that is a conservatory –
  - (i) the extension is thermally separated from the dwelling with construction that achieves a maximum U-value of  $2.0 \text{ W/m}^2 \text{ K}$  (where U represents how much thermal energy in watts (W) is transmitted through one square metre ( $\text{m}^2$ ) of the construction at a temperature difference of one degree Kelvin (K) between the dwelling and the extension); and
  - (ii) the extension is constructed so that its external fabric achieves a maximum U-value of  $2.0 \text{ W/m}^2 \text{ K}$  (where U represents how much thermal energy in watts (W) is transmitted through one square metre ( $\text{m}^2$ ) of the external fabric at a temperature difference of one degree Kelvin (K) between the extension and the outside).

## Section 0: General Guidance

### CONVENTIONS USED IN THIS DOCUMENT

**1** In this document the following conventions have been adopted to assist understanding and interpretation:

- a. Texts shown on a blue background are extracts from the Building Bye-laws as amended and convey the legal requirements that bear on compliance with Part 11. It should be remembered however that building works must comply with all the other relevant provisions.
- b. Key terms are printed in **bold italic text** and defined for the purposes of this Technical Guidance Document in Section 5 of this document.
- c. References given as footnotes and repeated as end notes are given as ways of meeting the requirements or as sources of more general information as indicated in the particular case. The Technical Guidance Document will be amended from time to time to include new references and to refer to revised editions where this aids compliance.
- d. Additional *commentary in italic text* appears after some numbered paragraphs. The commentary is intended to assist understanding of the immediately preceding paragraph or sub-paragraph, but is not part of the approved guidance.

### Types of work covered by this Technical Guidance Document

**2** This Technical Guidance Document gives guidance on what, in ordinary circumstances, will meet the requirements of Bye-law 5A, 18D and Part 11 when carrying out work on existing buildings that are not dwellings.

*It should be noted that dwellings refer to self-contained units. **Rooms for residential purposes are not dwellings, and so Technical Guidance Document 11.2B applies to them.***

**3** In particular, this Technical Guidance Document gives guidance relating to the following activities:

- a. Consequential improvements (see paragraphs 14 to 23)
- b. An extension (see paragraphs 24 to 32)
- c. A material change of use (see paragraphs 33 to 36)
- d. A material alteration (see paragraphs 37 to 38).

- e. The provision or extension of a controlled service or fitting (see paragraphs 39 to 77)
- f. The replacement or **renovation** of a **thermal element** (see paragraphs 78 to 87)

**4** In certain types of work in relation to an existing building, it may be more appropriate to utilise the guidance from the other Part 11 Technical Guidance Documents. The following sub-paragraphs identify some of the circumstances in which this might be appropriate.

- a. Large extensions (as defined in paragraph 25 of this Technical Guidance Document) should be carried out in accordance with the guidance in Technical Guidance Document 11.2A. However, Bye-law 17C (consequential improvements) would apply and the guidance set out in this Technical Guidance Document would be relevant.
- b. Where the work involves constructing an extension to an existing building using sub-assemblies that have been obtained from a centrally held stock or from the disassembly or relocation of buildings at other premises, the guidance in Technical Guidance Document 11.2A should be followed but Bye-law 17C (consequential works) would also apply.

*An example would be where a school is extended using prefabricated portable buildings*

- c. Where the work involves a building that either before the work or after the work is completed contains one or more dwellings, the guidance in Technical Guidance Document 11.1B would apply to each **dwelling**.

*It should be noted that dwellings refer to self-contained units. **Rooms for residential purposes are not dwellings, and so this Technical Guidance Document applies to them.***

**5** The **energy efficiency requirements**, apart from those in Bye-law 17B, apply to work in existing buildings. In most instances, this will require an application for building permission to be submitted to the Department. In certain situations however other procedures apply. These include where the work is being carried out under the terms of an approved Competent Persons (CP) scheme in accordance with Bye-law 15(6). In these cases, in accordance with Bye-law 15 (4) no advance notification to the Department is needed. At the completion of the work, the approved Competent Person provides the building owner with a certificate confirming that the installation has been carried out in accordance with the relevant requirements, and the scheme operator notifies the Department to that effect.

## TECHNICAL RISK

**6** Building work must satisfy all the technical requirements set out in Bye-laws 5A,5B,17B, 17C and Schedule 2 of the Bye-laws. Part 2 (Fire safety), Part 3 (Combustion appliances and fuel storage systems), Part 4 (Site preparation and resistance to moisture), Part 5 (Ventilation), Part 9 (Resistance to the passage of sound), and Part 12 (Electrical safety) are particularly relevant when considering the incorporation of energy efficiency measures.

**7** The inclusion of any particular energy efficiency measure should not involve excessive technical risk. BR 262<sup>5</sup> provides general guidance on avoiding risks in the application of thermal insulation.

## HISTORIC BUILDINGS

**8** Historic buildings are those registered on the Planning and Environment Ministers register of Buildings and Sites of Architectural, Archaeological and Historic importance.

**9** When undertaking work on historic buildings, the aim should be to improve energy efficiency where and to the extent that it is practically possible. This is provided that the work does not prejudice the character of the host building or increase the risk of long-term deterioration to the building fabric or fittings. The guidance given in the English Heritage publication<sup>6</sup> should be taken into account in determining appropriate energy performance standards for such building works. Particular issues relating to work in historic buildings that warrant sympathetic treatment and where advice from others could therefore be beneficial include:

- a restoring the historic character of a building that has been subject to previous inappropriate alteration, e.g. replacement windows, doors and rooflights;
- b rebuilding a former building (e.g. following a fire or filling a gap site in a terrace);
- c making provisions enabling the fabric of historic buildings to 'breathe' to control moisture and potential long term decay problems.

**10** In arriving at a balance between historic building conservation and energy efficiency improvements, it would be appropriate to take into account the advice of the Departments' historic buildings officer and building control surveyor.

## CALCULATION OF U-VALUES

**11** U-values shall be calculated using the methods and conventions set out in BR 443<sup>7</sup>, 'Conventions for U-value calculations'. The CAB/CWCT publication<sup>8</sup> gives guidance on the thermal performance of curtain walling.

**12** The U-values for roof windows and rooflights given in this Technical guidance Document are based on the particular U-value having been assessed with the roof window or rooflight in the vertical position. If a particular unit has been assessed in a plane other than the vertical, the standards given in this Technical Guidance Document should be modified by making a U-value adjustment following the guidance given in BR 443.

*The stated standard for a replacement plastic rooflight as given in Table 4 is  $2.2W/m^2 \cdot K$ . This is for the unit assessed in the vertical plane. If the performance of a triple skin rooflight was assessed in the horizontal plane, then based on the guidance given in BR 443, the standard would be adjusted by  $0.3W/m^2 \cdot K$  (the value from BR 443 for a horizontal triple skin rooflight), requiring the rooflight as assessed in the horizontal plane to achieve a standard of  $2.2 + 0.3 = 2.5W/m^2 \cdot K$ .*

## BUILDINGS THAT ARE EXEMPT FROM THE REQUIREMENTS IN PART 11

**13** The provisions for exempting buildings and building work from the Building Bye-laws are set out in Bye-law 3.

<sup>5</sup> BR 262 Thermal insulation: avoiding risks, BRE 2001.

<sup>6</sup> *Building Regulation and Historic Buildings*, English Heritage 2002, (revised 2004)

<sup>7</sup> BR 443 *Conventions for U-values calculations*, BRE 2006

<sup>8</sup> *The thermal assessment of windows assemblies, curtain walling and non-traditional envelopes*, CWCT, 2006 ISBN 1 87400 338 6

## Section 1: Consequential improvements

14 Bye-law 17C states:

### 17C Consequential improvements to energy performance

- (1) Paragraph (2) applies to an existing building with a total useful floor area over 1000m<sup>2</sup> in respect of which building work is proposed if the proposed building work consists of or includes –
  - (a) an extension of the building; or
  - (b) the initial provision of any fixed building services, or an increase to the installed capacity of any fixed building services, in relation to the building.
- (2) Subject to paragraph (3), such work, if any, shall be carried out as is necessary to ensure that the building complies with Part 11 of Schedule 2.
- (3) Nothing in paragraph (2) requires work to be carried out if it is not technically, functionally and economically feasible.

15 Bye-law 17A defines 'building' as follows:

### 17A Interpretation

In this Part, 'building' means an entire building or a part of a building, being a part designed, or altered, to have fixed building services that are separate from those of other parts of the building.

16 Where bye-law 17C applies, **consequential improvements**, in addition to the proposed building work (the **principal works**), should be made to ensure that the building complies with Part 11, to

the extent that such improvements are technically, functionally and economically feasible. Paragraphs 17 to 23 below set out guidance on what will constitute technically, functionally and economically feasible consequential improvements in various circumstances.

*The principal works must comply with the energy efficiency requirements in the normal way.*

17 Measures that achieve a **simple payback** not exceeding 15 years will be economically feasible unless there are unusual circumstances.

*For example, if the remaining life of the building is less than 15 years it would only be economic to carry out improvements with payback periods within that life.*

### Consequential improvements on extending a building

*Constructing a new free-standing building on an existing site (e.g. a new out-patients building at an existing hospital site, or a new classroom block at a school) is not an extension. These should be treated as new buildings.*

18 Where a building is extended, a way of complying with bye-law 17C would be to adopt measures such as those in Table 1 to the extent that their value is not less than 10% of the value of the principal works. The value of the **principal works** and the value of the **Consequential improvements** should be established using prices current at the date the proposals are made known to the Department. They should be made known by way of a report signed

Table 1 Improvements that in ordinary circumstances are practical and economically feasible

Items 1 to 7 will usually meet the economic feasibility criterion set out in paragraph 19. A shorter payback period is given in item 8 because such measures are likely to be more capital intensive or more risky than the others.

|   |  |
|---|--|
| 1 | Upgrading heating system more than 15 years old by the provision of new plant or improved controls   |
| 2 | Upgrading cooling systems more than 15 years old by the provision of new plant or improved controls  |
| 3 | Upgrading air-handling system more than 15 years old by the provision of new plant or improved controls  |
| 4 | Upgrading general lighting systems that have an average lamp efficiency of less than 40 lamps-lumens per circuit-watt and that serve greater than 100m <sup>2</sup> by provision of new luminaries controls or improved controls.  |
| 5 | Installing energy metering following the guidance given in CIBSE TM 39 <sup>9</sup>  |
| 6 | Upgrading <b>thermal elements</b> which have a U-value worse than those set out in column (a) of Table 7 following the guidance in paragraphs 86 and 87  |
| 7 | Replacing existing windows, roof windows or rooflights (but excluding <b>display windows</b> ) or doors (but excluding <b>high usage entrance doors</b> ) which have a U-value worse than 3.3W/m <sup>2</sup> .K following the guidance in paragraphs 74 to 77   |
| 8 | Increasing the on-site low and zero carbon (LZC) energy-generating systems, if the existing on-site system provides less than 10% of on-site energy demand, provided the increase would achieve a simple payback of seven years or less. The ODPM publication <sup>10</sup> gives advice on appraising the feasibility of such systems |

<sup>9</sup> TM 39 *Building energy metering*, CIBSE, 2010

<sup>10</sup> *Low or zero carbon Energy Source; Strategic Guide*, NBS, 2006. Bye-law 18D:

by a suitably qualified person as part of the building application submission.

*An example of a suitably qualified person would be a chartered quantity surveyor.*

## Consequential improvements on installing building services

**19** Where it is proposed to install a fixed building service as a first installation, or as an installation which increases the installed capacity per unit area of an existing service, reasonable provision would be to:

- a. firstly improve those parts of the building served by the service, where this is economically feasible; and

*This means for example that if heating systems are to be installed for the first time in a building or part thereof, or the installed heating capacity per unit area of an existing system is to be increased, the fabric should be improved. The aim in these cases is to make cost-effective improvements to the performance of the fabric so that the installed capacity (and the initial cost) of the fixed building services and their subsequent energy consumption are not excessive.*

- b. then, additionally, make improvements in line with the guidance in paragraph 18. The cost of any improvement made as a result of following the guidance set out in paragraph 19a) cannot be taken as contributing to the value of the consequential improvements specified in paragraph 16.

*If only the improvements under (a) were made, then the energy use might well increase as a result of the higher level of servicing. By also requiring the general improvements in (b), an overall improvement should be achieved.*

**20** For the purposes of these Bye-laws, the installed capacity of a fixed building service is defined as 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

*This means that if (e.g.) the size of central boiler plant is increased to serve a new extension rather than to increase the heating provision in the existing building, the consequential improvements required by paragraph 18 would be required but those required by the following paragraphs would not apply.*

**21** Reasonable provision for improving those parts of the building served by the service would be to follow the guidance in paragraphs 22 to 23 to the extent that the work is technically, functionally and economically feasible. The extent of such work is not limited by any 10% threshold. The following paragraphs give

guidance on what in normal circumstances would be economically feasible.

**22** Where the installed capacity per unit area of a heating system is increased:

- a. The **thermal elements** within the area served which have U-values worse than those set out in column (a) of Table 7, should be upgraded following the guidance in paragraphs 86 and 87; and
- b. Existing windows, roof windows or rooflights (but excluding **display windows**) or doors (but excluding **high usage entrance doors**) within the area served and which have U-values worse than  $3.3\text{W/m}^2\cdot\text{K}$  should be replaced following the guidance in paragraphs 74 to 77.

**23** Where the installed capacity per unit area of a cooling system is increased:

- a. **Thermal elements** within heated areas which have U-values worse than those set out in column (a) of Table 7, should be upgraded following the guidance in paragraphs 86 and 87; and
- b. If the area of windows, roof windows (but excluding **display windows**) within the area served exceeds 40% of the façade area or the area of rooflights exceeds 20% of the area of the roof and the design solar load exceeds  $25\text{W/m}^2$ , then the solar control provisions should be upgraded such that at least one of the following three criteria is met:
  - i. the design solar load is no greater than  $25\text{W/m}^2$ ;
  - ii. the design solar load is reduced by at least 20%;
  - iii. the effective g-value is no worse than 0.3; and

*This will reduce the solar gain and hence the space cooling demand. The calculation of effective g-value is explained in CIBSE TM 37<sup>11</sup>*

- c. Any lighting system within the area served by the relevant fixed building service which has an average lamp efficacy of less than 40 lamp-lumens per circuit watt, should be upgraded with new luminaires and/or controls following the guidance in paragraphs 53 to 62.

*This will reduce lighting load and hence the space cooling demand.*

<sup>11</sup>TM 37 Design for improved solar shading control, CIBSE 2006

## Section 2: Guidance relating to building work

### EXTENSIONS

**24** The construction of an extension triggers the requirement for a consequential improvement in buildings with a **total useful floor area** greater than 1000m<sup>2</sup>. In such cases, the guidance in Section 1 should be followed in addition to the following specific guidance.

#### Large extensions

**25** Where the proposed extension has a total useful floor area that is both:

- a Greater than 100m<sup>2</sup>; and
- b Greater than 25% of the **total useful floor area** of the existing building then the work should be regarded as a new building and the guidance in Technical Guidance Document 11.2A followed. The requirement for a consequential improvement should also be met by following the guidance in paragraph 16 of this Technical Guidance Document.

#### Other extensions

##### Fabric standards

**26** Reasonable provision would be for the proposed extension to achieve the following performance standards:

- a Controlled fittings that meet the standards set out in paragraphs 74 to 77 of this Technical Guidance Document.
- b Newly constructed **thermal elements** that meet the standards set out in paragraphs 78 to 83 of this Technical Guidance Document.
- c Existing opaque fabric that becomes part of the thermal envelope of the building whereas previously it was not should meet the standards in paragraphs 86 and 87.

**27** The area of windows and rooflights in the extension should not exceed the values given in Table 2, unless a greater proportion of glazing is present in the part of the building to which the extension is attached. In such cases, reasonable provision would be to limit the proportion of glazing in the extension so that it is no greater than the proportion that exists in the part of the building to which it is attached.

##### Building services systems in the extension

**28** Where **fixed building services** are provided or extended as part of constructing the extension, reasonable provision would be to follow the guidance in paragraphs 40 to 73.

##### Optional approaches with more design flexibility

**29** The U-values given in paragraph 26 and the opening areas given in paragraph 27 may be varied provided that:

*In industrial buildings, rooflights are a beneficial source of daylight, and so significant reductions in rooflight area could result in increased use of electric lighting. The NARM guidance<sup>12</sup> gives guidance on this issue.*

- a. the area weighted U-value of all the elements in the extension is no greater than that of an extension of the same size and shape that complies with the U-value standards referred to in paragraph 26 and the opening area in paragraph 27; and

*The area-weighted U-value is give by the following expression:*

$$\frac{\{(U_1 \times A_1) + (U_2 \times A_2) + (U_3 \times A_3) + \dots\}}{\{A_1 + A_2 + A_3 + \dots\}}$$

- b. the area weighted U-value for each element type is no worse than the value given in column (a) of Table 3; and

Table 2 Opening areas in the extension

| Building Type  | Windows and personnel door as % of exposed walls | Rooflights as % of area of roof |
|--|--|---------------------------------|
| Residential buildings where people temporarily or permanently reside | 30   | 20                              |
| Places of assembly, offices and shops                                | 40   | 20                              |
| Industrial and storage buildings                                     | 15   | 20                              |
| Vehicle access doors and <b>display windows</b> and similar glazing  | As required                                      | N/A                             |
| Smoke vents  | N/A  | As required                     |

<sup>12</sup> Use of rooflights to satisfy the 2002 Building Regulations for the Conservation of Fuel and Power NARM 2003

- c. the U-value of any individual element is no worse than the relevant value in column (b) of Table 3.

*To minimise condensation risk in localised parts of the envelope. An individual element is defined as those areas of the given element type that have the same construction details. In the case of windows, doors and rooflights, the assessment should be based on the whole unit (i.e. in the case of a window, the combined performance of the glazing and frame).*

**30** Where even greater design flexibility is required, reasonable provision would be to use an approved calculation tool to demonstrate that the calculated energy performance of the building and proposed extension is no greater than for the building plus a notional extension complying with the standards of paragraphs 26 and 27. In these cases the area-weighted average U-value of each element type should be no worse than the standards set out in column (a) of Table 3, and the U-value of any individual element should be no worse than the values in column (b) of Table 3. For this calculation, the building used in the calculation of both the notional and actual extension should incorporate the improvements proposed to meet the requirement for a consequential improvement (see paragraph 16).

**31** Where additional upgrades are proposed in the actual building to compensate for lower performance in the extension, then such upgrades should be implemented to a standard that is no worse than set out in the relevant guidance contained in this Technical Guidance Document. The relevant standards for upgrading retained thermal elements are as set out in column (b) of Table 7.

*Where it is proposed to upgrade, then the standards set out in this Technical Guidance Document are cost effective and should be implemented in full. It will be worthwhile implementing them even if the improvement is more than necessary to achieve compliance. In some cases therefore, the standard of the extended building may be better than that required by paragraph 30 alone. Paragraph 31 ensures that no cost-effective improvement opportunities are traded away.*

## Conservatories

**32** Where the extension is a **conservatory** then reasonable provision would be to provide:

- a. Effective thermal separation from the heated area in the existing **building**. The walls, doors and windows between the **building** and the extension should be insulated and draught-stripped to at least the same extent as in the existing **building**.

*If a highly glazed extension is not thermally separated from the building, then it should be regarded as a conventional extension. Compliance in such cases could be demonstrated using the approach set out in paragraphs 26 to 31.*

- b. Independent temperature and on/off controls to any heating system. Any heating appliance should also conform to the standards set out in paragraph 40.
- c. Glazed elements should comply with the standards given in column (b) of Table 5 and any opaque elements should have U-values that are no worse than the standards given in column (b) of Table 3.

## MATERIAL CHANGE OF USE AND CHANGE OF ENERGY STATUS

**33** Material change of use is defined in Bye-law 2 as follows:

- a. material change of use of a building occurs if there is a change in the purposes for which or the circumstances in which a building is used, so that after that change:
- b. the building is used as a dwelling, where previously it was not;
- c. the building contains a flat, where previously it did not;
- d. the building is used as an hotel or a guest house, where previously it was not;
- e. the building is used as an institution, where previously it was not;
- f. the building is used as a public building, where previously it was not;
- g. the building is not a building described in Classes 1 to 7 in Schedule 1, where previously it was;

Table 3 Limiting U-value standards (W/m<sup>2</sup>.K)

| Element                              | (a) Area-weighted average U-value | (b) Limiting U-Value |
|--------------------------------------|-----------------------------------|----------------------|
| Wall                                 | 0.35                              | 0.70                 |
| Floor                                | 0.25                              | 0.70                 |
| Roof                                 | 0.25                              | 0.35                 |
| Windows, roof windows and rooflights | 2.2                               | 3.3                  |

**Note:**

1. See paragraph 14



- h the building, which contains at least one dwelling, contains a greater or lesser number of dwellings than it did previously;
- i the building contains a room for residential purposes, where previously it did not;
- j 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
- k the building is used as a shop where previously it was not;
- l the building is used as an office, where previously it was not;
- m in the case of a building that is or contains a dwelling or garage, part of the building is used as a habitable room where previously the part was not so used.

**34** When carrying out a material change of use or when the energy status of a building changes reasonable provision would be to follow the guidance in paragraph 35.

**35** In ordinary circumstances, reasonable provision would be:

- a. Where controlled services or fittings are being provided or extended, to meet the standards set out in paragraphs 39 to 75 of this Technical Guidance Document.
- b. Where the work involves the provision of a **thermal element**, to meet the standards set out in paragraphs 78 to 83 of this Technical Guidance Document.

*For the purposes of Building Bye-laws provision means both new and replacement elements.*

- c. Where **thermal elements** are being renovated, to meet the guidance in paragraphs 84 and 85 of this Technical Guidance Document.
- d. Any **thermal element** that is being retained should be upgraded following the guidance given in paragraphs 86 and 87 of this Technical Guidance Document.
- e. Any existing window (including roof window or rooflight) or door which separates a conditioned space from an unconditioned space or the external environment and which has a U-value that is worse than  $3.3\text{W}/\text{m}^2\cdot\text{K}$ , should be replaced following the guidance in paragraphs 74 to 77 unless they are **display windows** or **high usage entrance doors**. It would be reasonable in these latter cases to make some lesser provision for energy efficiency.

## Option providing more design flexibility

**36** To provide more design flexibility, an approved calculation tool can be used to demonstrate that the energy performance of the building as it will become is no worse than if the building had been improved following the guidance set out in paragraph 35. In these cases the U-values of any individual element should be no worse than the values in column (b) of Table 3.

## MATERIAL ALTERATION

**37** Material alterations are defined in Bye-law 1 as follows.

**“material alteration”** means any work done to a building, or to a controlled service or fitting, or to the fixed electrical installation of a building so that at any stage it could result in –

- a it no longer complying with requirements 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 3.3, 3.5, 3.6, 6.1, 6.2, 6.5, 8.1, 8.2 8.3, 8.4, or 12.1 where previously it did so; or
- b where it previously failed so to comply, its falling further short of compliance with such requirements;

**38** When carrying out a material alteration, reasonable provision would be:

- a. when the work involves the provision of a **thermal element**, to follow the guidance in paragraphs 78 to 83 of this Technical Guidance Document.

*For the purposes of the Building Bye-laws, provision means both new and replacement elements.*

- b. when renovating a thermal element, to follow the guidance in paragraphs 84 and 85 of this Technical Guidance Document.
- c. where an existing element becomes part of the thermal envelope of the building whereas previously it was not, to follow the guidance in paragraph 86 to 87. Any existing window (including a roof window or rooflight) or door which becomes part of the thermal envelope where previously it was not and which has a U-value that is worse than  $3.3\text{W}/\text{m}^2\cdot\text{K}$ , should be replaced following the guidance in paragraphs 74 to 77 unless they are **display windows** and **high usage entrance doors**. It would be reasonable in these latter cases to make some lesser provisions for energy efficiency.
- d. when providing a controlled fitting, to follow the guidance on controlled fittings given in paragraphs 74 to 77 of this Technical Guidance Document.

- e. when providing or extending a controlled service, to follow the guidance on controlled services given in paragraphs 39 to 73 of this Technical Guidance Document.

## WORK ON CONTROLLED SERVICES AND FITTINGS

**39** A controlled service or fitting is defined in Bye-law 1 as follows:

'controlled service or fitting' means a service or fitting in relation to which Part 3, 6, or 11 of Schedule 2 imposes a requirement;

### Controlled services

**40** Where the work involves the provision or extension of controlled services, reasonable provision would be to:

- a. Provide new **fixed building services** that meet reasonable standards of energy efficiency, which in normal circumstances would be an efficiency not less than the efficiencies set out in paragraphs 41 to 64.
- b. Provide new HVAC systems with appropriate controls to achieve reasonable standards of energy efficiency. In normal circumstances reasonable provision would be to provide the following control features on each system in addition to the system specific controls detailed in subsequent paragraphs.
  - i. The fixed building services systems should be sub-divided into separate control zones to correspond to each area of the building that has a significantly different solar exposure, occupancy period, or type of use.
  - ii. Each separate control zone should be capable of independent switching and control set-point.
  - iii. The provision of the service should respond to the requirements of the space it serves. If both heating and cooling are provided, they should be controlled so they do not operate simultaneously.
  - iv. Central plant serving the zone-based systems should only operate as and when required. The default condition should be off.
  - v. In addition to these general control requirements, the systems should meet specific control requirements and basic efficiency criteria as set out in the service-specific paragraphs beginning at paragraph 41.

- c. Provide new lighting systems with appropriate controls to achieve reasonable standards of energy efficiency. In normal circumstances, reasonable provision would be to provide controls in accordance with the guidance in paragraphs 53 to 65; and
- d. Demonstrate the new service has been effectively commissioned (see paragraphs 69 to 73); and
- e. Demonstrate that reasonable provision of energy meters has been made for effective monitoring of the performance of newly installed plant (see paragraphs 66 to 68); and
- f. Demonstrate that the relevant information has been recorded in a new log book or incorporated into an update of the existing one as described in paragraphs 88 to 91.

### Heating and hot water systems

**41** Reasonable provision for the performance of heating and hot water systems would be:

**42** The use of heat-raising appliance(s) with an efficiency not less than that recommended for their type in the Non-domestic Building Services Compliance Guide (NDBSC Guide)<sup>13</sup>, and

- a. the provision of controls that meet the minimum control requirements as given in the NDBSC Guide for the particular type of appliance and heat distribution system.

**43** The compliance checklists included in the NDBSC Guide are a useful tool in demonstrating that reasonable provision has been made.

### Cooling plant

**44** Where it is practical and cost effective to do so, measures to reduce cooling loads (e.g. through improved solar control or more efficient lighting) should be incorporated as part of any work to replace a chiller. BR 364<sup>14</sup> offers guidance on solar control strategies.

The cost of the improved solar control and/or lighting can be at least partially offset by the reduction in capital cost of the smaller chiller. Further savings will be made by reduced running costs.

**45** Reasonable provision for the performance of cooling plant would be:

- a. the use of equipment with an efficiency not less than that recommended for its type in the NDBSC Guide; and
- b. the provision of controls that meet the minimum control requirements as given in the NDBSC

<sup>13</sup> HM Government *Non-domestic Building Services Compliance Guide*, 2010 Edition

<sup>14</sup> BR 364 *Solar Shading of Buildings*, BRE 1999

Guide for the particular type of equipment and distribution system.

**46** The compliance checklists included in the NDBSC Guide are a useful tool in demonstrating that reasonable provision has been made.

### Air handling plant

**47** Reasonable provision for the performance of air handling plant would be to follow the guidance in the Non-domestic Building Services Compliance Guide in providing:

- a suitably efficient air handling plant; and
- b energy-effective control systems.

**48** In addition, the system should be capable of achieving a specific fan power at 25% of design flow rate which is no greater than that achieved at 100% design flow rate.

**49** In order to aid commissioning and to provide flexibility for future changes of use, reasonable provision would be to equip with variable speed drives those fans that are rated at more than 1100W and which form part of the environmental control system(s). Smoke control fans and similar therefore fall outside this guidance

**50** In order to limit air leakage, ventilation ductwork should be constructed and assembled so as to be reasonably airtight. One way of achieving this is to comply with the specifications given in HVCA DW144<sup>15</sup>.

### Insulation of pipes, ducts and vessels

**51** Provision should be made for insulating hot and chilled water pipework and storage vessels, refrigerant pipework and ventilation ductwork to conserve energy and to maintain the temperature of the heating or cooling service.

**52** Reasonable provision would be demonstrated by following the guidance in the Non-domestic Building Services Compliance Guide.

*The TIMSA Guide<sup>16</sup> explains the derivation of the performance standards and how they can be interpreted in practice.*

### Fixed internal lighting

**53** Reasonable provision would be to install new systems that meet the criteria in paragraphs 54 to 65, depending on the use of the space.

## GENERAL LIGHTING EFFICACY IN OFFICE, INDUSTRIAL AND STORAGE AREAS IN ALL BUILDING TYPES

<sup>15</sup> DW/144 Specification for Sheet Metal Ductwork, HVCA 1998

<sup>16</sup> HVAC Guidance for Achieving Compliance with Part L of the Building Regulations, TIMSA 2006

**54** For the purposes of this Technical Guidance Document, 'office' includes those areas that involve predominantly desk-based tasks, including classrooms, seminar rooms and conference rooms, including those in schools.

**55** Reasonable provision would be to provide lighting with an average efficacy of not less than 45 luminaire-lumens/circuit-watt as averaged over the whole area of these space types in the building.

*This allows design flexibility to vary the light output ratio of the luminaire and the luminous efficacy of the lamp.*

**56** The average luminaire-lumens/circuit-watt is calculated by:

(Lamp-lumens x LOR) summed for all luminaires in the relevant areas of the building, divided by the total (circuit watts x control factor) for all the luminaires where:

- a Lamp-lumens = the sum of the average initial (100 hour) lumen output of all the lamp(s) in the luminaire; and
- b LOR = the light output ratio of the luminaire, which means the ratio of the total light output of a luminaire under stated practical conditions to that of the lamp or lamps contained in the luminaire under reference conditions.
- c Control factor = the factor applicable when automatic controls substantially reduce the power consumption of the luminaire when electric light is not required (see commentary at paragraph 61, which includes values of the control factor for use in the above formula).

*The controls factor is included in Technical Guidance Document 11.2B to allow greater flexibility and to encourage better controls.*

## GENERAL LIGHTING EFFICACY IN ALL OTHER TYPES OF SPACE

**57** For lighting systems serving other than office or storage space, it may be appropriate to provide luminaires for which photometric data is not available or luminaires that are lower powered and use less efficient lamps. For such spaces, the requirements would be met if the installed lighting has an average initial (100 hour) lamp plus ballast efficacy of not less than 50 lamp-lumens per circuit-Watt.

## LIGHTING CONTROLS FOR GENERAL LIGHTING IN ALL TYPES OF SPACE

**58** Lighting controls should be provided so as to avoid unnecessary lighting during the times when daylight levels are adequate or when spaces are unoccupied. However, the operation of automatically switched lighting systems should be the subject of a risk assessment for safety and suitability.

**59** Reasonable provision would be local switches in easily accessible positions within each working area or at boundaries between working areas and general

Table 4 **Luminaire control factors**

| Control function   | Control factor |
|--|----------------|
| (a) The luminaire is in a daylight space and its light output is controlled by photoelectric switching or dimming control, with or without manual override   | 0.90           |
| (b) The luminaire is in a space that is likely to be unoccupied for a significant proportion of working hours and where a sensor switches off the lighting in the absence of occupants but switching on is done manually, except where this would be unsafe. Central mechanical ventilation with heating and cooling | 0.90           |
| (c) Circumstances (a) and (b) combined   | 0.85           |
| (d) None of the above  | 1.00           |

circulation routes that are operated by the deliberate action of the occupants (referred to as occupant control), either manually or remotely.

*Manual switches include rocker switches, push buttons and pull cords. Remote switches include wireless transmitters and telephone handset controls. For the purposes of the Part 11 Technical Guidance Documents, reference to switches includes dimmer switches and switching includes dimming. As a general rule, dimming should be effected by reducing rather than diverting the energy supply.*

**60** The distance on plan from any local switch to any luminaire it controls should generally be not more than six metres, or twice the height of the light fitting above the floor if this is greater. Where a space is a **daylit space** served by side windows, the perimeter row of lighting should in general be separately switched.

**61** Occupant control of local switching can be supplemented by other controls such as automatic systems which:

- a switch the lighting off when they sense the absence of occupants; or
- b either dim or switch the lighting off when there is sufficient daylight.

Table 4 gives the control factors for such enhanced controls, which can be used as part of achieving the luminaire efficacy set out in paragraph 55.

*When installed in appropriate locations, such enhanced control systems will deliver an energy benefit that can be traded against other aspects of the lighting system using the factors listed in Table 4.*

**62** An alternative way of meeting the requirement would be to follow the recommendations in BRE Digest 498<sup>17</sup>.

## DISPLAY LIGHTING IN ALL TYPES OF SPACE

**63** Reasonable provision for display lighting would be to demonstrate that the installed display lighting has an average initial (100 hour) efficacy of not less than 15 lamp-lumens per circuit-Watt. In calculating this efficacy, the power consumed by any transformers or ballasts should be taken into account.

**64** Spaces where display lighting is present would normally be expected to also have general lighting for circulation and for purposes of cleaning and restocking outside public access hours. Paragraphs 54 to 62 apply to this general lighting, depending on the type of building.

## CONTROLS FOR DISPLAY LIGHTING IN ALL TYPES OF SPACE

**65** A way of meeting the requirement would be to connect display lighting in dedicated circuits that can be switched off at times when people will not be inspecting exhibits or merchandise or being entertained. In a retail store, for example, this could include timers that switch the display lighting off outside store opening hours, except for displays designed to be viewed from outside the building through **display windows**.

## ENERGY METERS

**66** The aim for buildings as a whole is to enable building occupiers to assign at least 90% of the estimated annual energy consumption of each fuel to the various end-use categories (heating, lighting etc).

**67** Reasonable provision for energy meters in existing buildings would be to install energy metering systems in the building service systems provided as part of the works in accordance with the recommendations in CIBSE TM 39.

**68** In addition to this:

- a. meters should be provided to enable the performance of any LZC system provided as part of the works to be separately monitored; and
- b. in buildings with a **total useful floor** area greater than 1000m<sup>2</sup>, the metering system should enable automatic meter reading and data collection.

## COMMISSIONING

**69** The building services systems should be commissioned so that at completion, the system(s) and their controls are left in working order and can operate efficiently for the purposes of the conservation of fuel and power. In order to

<sup>17</sup> BRE Digest 498 *Selecting Lighting Controls*, BRE, 2006

Table 5 Standards for controlled fittings (W/m<sup>2</sup>.K)

| Fitting   | (a) Standard for new fittings in extensions  | (b) Standard for replacement fitting in an existing building |
|---|--|--|
| Windows, roof windows and glazed rooflights <sup>1,4</sup> .  | 1.8 for whole unit OR<br>1.2 for centre pane | 2.2 for the whole unit OR<br>1.2 centre pane                 |
| Alternative option for windows in building that are essentially domestic in character <sup>2</sup> , a window energy rating <sup>3</sup> of | Band D                                       | Band E   |
| Pedestrian doors where the door has more than 50% of its internal face area glazed  | 2.2  | 2.2  |
| High usage entrance doors for people  | 6.0  | 6.0  |
| Vehicle access and similar large doors  | 1.5  | 1.5  |
| Roof ventilators (including smoke ventilators)  | 6.0  | 6.0  |

**Notes:**

- Display windows** are not required to meet the standards given in this table
- For example, student accommodation, care homes and similar uses where the occupancy level and internal gains are essentially domestic in character
- As defined in 'Windows for new and existing housing'. CE 66 EST. Controlled fittings
- See paragraph 14

demonstrate that the heating and hot water systems have been adequately commissioned, Bye-law 17G states that:

(1) This bye-law applies to a building in relation to which requirement 11.1(b) applies and building work is carried out, but does not apply where the building work consists only of exempt electrical certifiable work (within the meaning of bye-law 15).

(2) The person carrying out the building work shall give to the Minister a notice confirming that the relevant fixed building services have been commissioned in accordance with the procedure set out in the relevant technical guidance document.

(3) The notice shall be given not later than –

- in every case, the date on which the notice required by bye-law 13(6) in relation to the building work is given; and
- in the case of certifiable building work (within the meaning of bye-law 15), not more than 30 days after completion of the work.

(4) For the purposes of this bye-law, the relevant technical guidance document is one concerning pressure testing in a building in order to determine heat gains and losses in the building from its pipes, ducts, and vessels, used for space heating, space cooling and hot water services.

**70** The procedure approved by the Minister is set out in:

- CIBSE Commissioning Code M on Commissioning Management<sup>18</sup>; and

*This provides guidance on the overall process and includes a schedule of all the relevant guidance documents relating to the commissioning of specific building services systems.*

- The procedures for leakage testing of ductwork set out in paragraphs 72 and 73

**71** The notice should include a declaration signed by a suitably qualified person confirming that:

- a commissioning plan has been followed so that every system has been inspected and commissioned in an appropriate sequence and to a reasonable standard.
- the results of tests confirm that the performance is reasonably in accordance with the proposed building designs, including written commentaries where deviations are proposed to be accepted.

*Membership of the Commissioning Specialists Association or the Commissioning group of the HVCA may be a way of demonstrating suitability to sign the report in respect of the HVAC systems. For lighting control systems, suitability may be demonstrated by accreditation under the Lighting Industry Commissioning Scheme.*

**72** Ductwork leakage testing should be carried out in accordance with the procedures set out in HVCA DW/143<sup>19</sup> on systems served by fans with a design flow rate greater than 1m<sup>3</sup>/s and for those sections of ductwork where the pressure class is such that DW/143 recommends testing. Low pressure ductwork should be tested using the DW/143 testing provisions for medium pressure ductwork.

<sup>18</sup> CIBSE Commissioning Code M: *Commissioning Management* CIBSE, 2003

<sup>19</sup> DW/143 *A practical Guide to Ductwork Leakage Testing*, HVCA, 2000

*Membership of the HVCA specialist ductwork group or the Association of Ductwork Contractors and Allied Services could be a way of demonstrating suitable qualifications for this testing work.*

**73** If a ductwork system fails to meet the leakage standard, remedial work should be carried out as necessary to achieve satisfactory performance in re-tests and further ductwork sections should be tested as set out in DW/143.

## Controlled fittings

**74** Where windows, roof windows, rooflights or doors are to be provided, reasonable provision would be draught-proofed units whose area-weighted average performance is no worse than that given in Table 5. Column (a) applies to fittings provided as part of constructing an extension. Column (b) applies to replacement fittings or new fittings installed in an existing building.

**75** The U-value or Window Energy Rating for windows can be taken as that for:

- a the standard configuration referred to in BR 443; or
- b for the specific size and configuration of the actual window.

*SAP 2005<sup>20</sup> Table 6e gives values for different window configurations that can be used in the absence of test data or calculated values*

**76** In certain classes of building with high internal gains, a less demanding U-value for glazing may be an appropriate way of reducing overall energy use. If this case can be made, then the average U-value for windows, doors and rooflights can be relaxed from the values given in Table 5, but the value should not exceed  $2.7\text{W/m}^2\cdot\text{K}$ .

**77** The overall U-value of curtain walling should be no greater than  $0.9 + 1.3X$ , where X is the fraction of the curtain wall that is glazed.

*This means that if the area of curtain walling is to be 60% glazed and 40% opaque, the U-value standard should be  $0.9 + 1.3 \times 0.6 = 1.7\text{W/m}^2\cdot\text{K}$ .*

<sup>20</sup> The UK Government's Standard Assessment Procedure for the energy rating of dwellings, SAP 2005, Defra.

## Section 3: Guidance on thermal elements

### THE PROVISION OF THERMAL ELEMENTS

**78** New thermal elements must comply with requirement 11.1(a) (i). Work on existing thermal elements is covered by bye-law 5A which states:

5A. (1) Where a thermal element is renovated, such building work shall be carried out as is necessary to ensure that the whole thermal element as so renovated complies with requirement 11.1(a)(i).

(2) Where a thermal element is replaced, the replacement thermal element shall comply with requirement 11.1(a)(i).

**79** Where **thermal elements** are newly constructed or replaced, reasonable provision to limit heat gains and losses through the elements must be made.

**80** Reasonable provision for newly constructed **thermal elements** such as those constructed as part of an extension would be to meet the standards set out in column (a) of Table 6. In addition, no individual element should have a U-value worse than those set out in column (b) of Table 3.

**81** Reasonable provision for those **thermal elements** constructed as replacements for existing elements would be to meet the standards set out in column (b) of Table 6. In addition, no individual element should have a U-value worse than those set out in column (b) of Table 3.

*Curtain walling is treated as a controlled fitting and guidance is given in paragraph 77.*

### Continuity of insulation

**82** The building fabric should be constructed so that there are no reasonably avoidable thermal bridges in the insulation layers caused by gaps within the various elements, at the joints between elements and at the edges of elements such as those around window and door openings. Reasonable provision should also be made to reduce unwanted air leakage through the new envelope parts.

**83** A suitable approach to showing the requirement has been achieved would be to submit a report signed by a suitably qualified person confirming that appropriate design details and building techniques have been specified, and that the work has been carried out in ways that can be expected to achieve reasonable conformity with the specifications. Reasonable provision would be:

- a. For domestic style construction, to adopt design details such as those set out in the TSO Robust Details catalogue<sup>21</sup>; or

- b. For cladding systems, to adopt the guidance given in the MCRMA Technical Note<sup>22</sup>.
- c. An alternative would be to demonstrate, using the guidance in BRE IP 1/06<sup>23</sup>, that the proposed details deliver an appropriate level of performance.

### RENOVATION OF THERMAL ELEMENTS

**84** Where a **thermal element** is being renovated reasonable provision in most cases would be to achieve the standard set out in column (b) of Table 7. Where the works apply to less than 25% of the surface area however reasonable provision could be to do nothing to improve energy performance.

**85** If such an upgrade is not technically or functionally feasible or would not achieve a simple payback of 15 years or less, the element should be upgraded to the best standard that is technically and functionally feasible and which can be achieved within a simple payback of no greater than 15 years. Guidance on this approach is given in Appendix A in TGD 11.1B.

### RETAINED THERMAL ELEMENTS

**86** Part 11 applies to **thermal elements** in the following circumstances:

- a. where an existing thermal element is part of a building subject to a material change of use;
- b. where an existing element is to become part of the thermal envelope and is to be upgraded;
- c. where an existing element is being upgraded as a consequential improvement (bye-law 17C) in accordance with paragraphs 14 to 23.

**87** Reasonable provision would be to upgrade those **thermal elements** whose U-value is worse than the threshold value in column (a) of Table 7 to achieve the U-value given in column (b) of Table 7, provided this is technically, functionally and economically feasible. A reasonable test of economic feasibility is to achieve a **simple payback** of 15 years or less. Where the standard given in column (b) is not technically, functionally or economically feasible, then the element should be upgraded to the best standard that is technically and functionally feasible

<sup>21</sup> *Limiting thermal bridging and air leakage: Robust construction details for dwellings and similar buildings*, Amendment 1, TSO 2002, See [www.est.org.uk](http://www.est.org.uk)

<sup>22</sup> Technical Note 14: *Guidance for the design of metal cladding and roofing to comply with Approved Document L2*, MCRMA. [www.mcra.co.uk](http://www.mcra.co.uk)

<sup>23</sup> IP 1/06 *Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings*, BRE, 2006

and which meets a simple payback criterion of 15 years.

Examples of where lesser provision than column (b) might apply are where the thickness of the

additional insulation might reduce usable floor area by more than 5% or create difficulties with adjoining floor levels, or where the weight of the additional insulation might not be supported by the existing structural frame.

**Table 6 Standards for thermal elements (W/m<sup>2</sup>.K)**

| Element <sup>1</sup>                       | Standards for new thermal elements | Standards for replacement thermal elements |
|--|------------------------------------|--|
| Wall                                       | 0.30                               | 0.35 <sup>2</sup>                          |
| Pitched roof – insulation at ceiling level | 0.16                               | 0.16                                       |
| Pitched roof – insulation at rafter level  | 0.20                               | 0.20                                       |
| Flat roof or roof with integral insulation | 0.20                               | 0.25                                       |
| Floors <sup>3</sup>                        | 0.22 <sup>4</sup>                  | 0.25 <sup>4</sup>                          |

**Notes:**

1. 'Roof' includes the roof parts of dormer windows and 'wall' includes the wall parts of dormer windows
2. A lesser provision may be appropriate when meeting such a standard would result in reduction of more than 5% in the internal floor area of the room bounded by the wall
3. The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.
4. A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.

**Table 7 Upgrading retained thermal elements**

| Element <sup>1</sup>                       | (a) Threshold U-values (W/m <sup>2</sup> .K) | (b) Improved U-value (W/m <sup>2</sup> .K) |
|--|--|--|
| Cavity wall                                | 0.70   | 0.35 <sup>2</sup>                          |
| Other wall types                           | 0.70   | 0.35 <sup>3</sup>                          |
| Pitched roof – insulation at ceiling level | 0.35   | 0.16                                       |
| Pitched roof – insulation at rafter level  | 0.35   | 0.20                                       |
| Flat roof or roof with integral insulation | 0.35   | 0.25                                       |
| Floors                                     | 0.35   | 0.25 <sup>5</sup>                          |

**Notes:**

1. 'Roof' includes the roof parts of dormer windows and 'wall' includes the wall parts of dormer windows
2. This only applies in the case of a cavity wall capable of accepting insulation. Where this is not the case it should be treated as for 'other wall types'
3. A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.
4. The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building
5. A lesser provision may be appropriate where meeting such a standard would create significant problems relating to adjoining floor levels



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## Section 4: Providing information

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**88** In accordance with Requirement 11.1(c), the owner of the building should be provided with 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.

### Building log-book

**89** A way of showing compliance would be to produce the necessary information following the guidance in CIBSE TM 31 Building Log Book Toolkit<sup>24</sup>, or to add it to the existing Log Book where this already exists. If an alternative guidance document is followed in preparing the logbook, then the information conveyed and the format of presentation should be equivalent to TM 31.

**90** The information should be presented in templates as or similar to those in the TM. The information should be provided in summary form, suitable for day-to-day use. It could draw on or refer to information available as part of other documentation, such as the Operation and Maintenance Manuals and the Health and Safety file required by the CDM Regulations<sup>25</sup>.

**91** The new or updated logbook should provide details of:

- a Any newly provided, renovated or upgraded **thermal elements** or controlled fittings;
- b any newly provided **fixed building services**, their method of operation and maintenance;
- c any newly installed energy meters; and
- d any other details that collectively enable the energy consumption of the building and building services comprising the works to be monitored and controlled.

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<sup>24</sup> TM 31 *Building Log Book Toolkit*, CIBSE 2006

<sup>25</sup> The construction (Design and Management) Regulation 1994, Statutory Instrument SI 199/3140

## Section 5: Definitions

**92 Consequential improvement** means those energy efficiency improvements required by bye-law 17C

**93 A conservatory** is an extension to a building which:

- a has not less than three quarters of its roof area and not less than one half of its external wall area made from translucent material and,
- b is thermally separated from the building by walls, windows and doors with the same U-value and draught-stripping provisions as provided elsewhere in the building.

**94 Daylit space** means any space:

- a within 6m of a window wall, provided that the glazing area is at least 20% of the internal area of the window wall.
- b below rooflights and similar provided that the glazing area is at least 10% of the floor area. The normal light transmittance of the glazing should be at least 70%, or, if the light transmittance is reduced below 70%, the glazing area could be increased proportionately.

**95 Display window** means an area of glazing, including glazed doors, intended for the display of products or services on sale within the building, positioned at the external perimeter of the building, at an access level and immediately adjacent to a pedestrian thoroughfare. There should be no permanent workspace within one glazing height of the perimeter. Glazing that extends beyond 3m above such an access level is not part of a **display window** except:

- a where the products on display require a greater height of glazing;
- b in existing buildings, when replacing **display windows** that already extend to a greater height.
- c in cases of building work involving changes to the façade and glazing and requiring planning consent, where planners have discretion to require a greater height of glazing, e.g. to fit in with surrounding buildings or to match the character of the existing façade. It is expected that display windows will be found in buildings in use classes A1, A2, A3 and D2 as detailed in Table 8.

**96 Dwelling** means a self-contained unit designed to be used separately to accommodate a single household.

**97 Emergency escape lighting** means that part of emergency lighting that provides illumination for

the safety of people leaving an area or attempting to terminate a dangerous process before leaving an area.

**98 Energy efficiency requirements** means the requirements of Bye-laws 5A, 5B Part 3A and Part 11 of Schedule 2.

**99 Fitout work** means that work needed to complete the internal layout and servicing of the building shell to meet the specific needs of an incoming occupier. The building shell is the structural and non-structural envelope of a building provided as a primary stage (usually for a speculative developer) for a subsequent project to fit out with internal accommodation works.

**100 Fixed building services** means:

- (a) a fixed internal or external lighting system (other than an emergency escape lighting system or a specialist process lighting system); or
- (b) a fixed system for heating, providing hot water, providing air conditioning or providing mechanical ventilation;

**101 High usage entrance door** means a door to an entrance that is expected to experience large traffic volumes, and where robustness and/ or powered operation is the primary performance requirement. To qualify as a **high usage entrance door**, the door should be equipped with automatic closers, and except where operational requirements preclude, be protected by a lobby.

**102 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 of **Consequential improvements**.

**103 Renovation** in relation to a thermal element means the provision of a new layer in the thermal element or the replacement of an existing layer, but excludes decorative finishes, and 'renovate' shall be construed accordingly;.

*Examples of decorative finishes are paint and wall paper etc that add no appreciable thermal resistance. Dry-lining and external renders are not decorative finishes because they add thermal resistance.*

**98 Room for residential purposes** means a room, or suite of rooms –

- (a) that is not a dwelling house or flat; and
- (b) that is used by one or more persons to live and sleep in, and includes rooms in hotels,

hostels, guest houses, halls of residence and residential homes but does not include rooms in hospitals, or similar establishments, used for patient accommodation;

**105 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 GST.

- a The marginal **additional** cost is the additional cost (materials and labour) 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 Department and be confirmed in a report signed by a suitably qualified person
- c the annual energy savings should be estimated using an energy calculation tool approved by the Minister
- d for the purposes of this Technical Guidance Document, the following energy prices should be used when evaluating the value of the annual energy savings:
  - i. Gas – 8.93p/KWh
  - ii. Electricity – 8.51p/KWh
  - iii. Heating oil – 4.45p/kWh

*For example if the additional cost of implementing a measure was £4300 and the value of the annual energy savings was £384/year, the simple payback would be (4300/384) = 11.2 years.*

*Energy prices are increasing significantly so building owners may wish to use higher values such as those prevailing when they apply for Building Bye-law approval.*

**106 Specialist process lighting** means lighting intended to illuminate specialist tasks within a space rather than the space itself. It 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.

**107 Thermal element** is defined in Bye-law 2A as follows.

- (1) In these bye-laws, 'thermal element' means a wall, floor, or roof, that separates a thermally-conditioned part of a building from –
  - (a) part or all of the external environment; or
  - (b) in the case of a wall or floor, another part of the building, being a part that is –
    - (i) not thermally conditioned,
    - (ii) an extension falling within Class 6 in Schedule 1, or
    - (iii) where this clause applies, thermally conditioned to a different temperature, and includes all parts of the wall, floor, or roof, between the surface bounding the thermally-conditioned part of the building and the surface exposed to the external environment or to the other part of the building.
- (2) Paragraph (1)(b)(iii) only applies if –
  - (a) the relevant building is not a dwelling; and
  - (b) the other part of the relevant building is used for a purpose that is not similar or identical to the purpose for which the thermally-conditioned part is used.
- (3) In this bye-law –
  - (a) a reference to the external environment includes the ground;
  - (b) a reference to a wall, floor or roof does not include a window, door, roof-window or roof-light.

**108 Total useful floor area is the total area** of all enclosed spaces measured to the internal face of the external walls. The area of sloping surfaces such as staircases, galleries, raked auditoria, and tiered terraces should be taken as their area on plan. It includes the areas occupied for example by partitions, columns, chimney breasts and internal structural or party walls. It excludes areas that are not enclosed such as open floors, covered ways and balconies.

*This equates to the gross floor area as measured in accordance with the guidance issued to surveyors by the RICS.*

Table 8 **Building classes**

| Class | Use  |
|-------|--|
| A1    | Shops including retail-warehouse, undertakers, showrooms, post offices, hairdressers, shops for sale of cold food for consumption off the premises |
| A2    | Financial and professional services, banks, building societies, estate and employment agencies, betting offices                                    |
| A3    | Food and drink restaurants, pubs, wine bars, shops for sale of hot food for consumption off premises   |
| D2    | Assembly and leisure cinemas, concert halls, bingo halls, casinos, sports and leisure uses   |

## Documents referred to

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*Simplified Building Energy Model (SBEM) user manual and Calculation Tool*.  
(Available at [www.odpm.gov.uk](http://www.odpm.gov.uk).)

### **Centre for Window and Cladding Technology** **www.cwct.co.uk**

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(Download from Energy Saving Trust (EST) website on <http://portal.est.org.uk/housingbuildings/calculators/robustdetails/>.)

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### **Heating and Ventilating Contractors Association**

DW/143 *A practical guide to ductwork leakage testing*, HVCA 2000. ISBN 0 90378 330 4

DW/144 *Specification for sheet metal ductwork*, HVCA 1998. ISBN 0 90378 327 4

### **Metal Cladding and Roofing Manufacturers Association** **www.mcrma.co.uk**

*Guidance for design of metal cladding and roofing to comply with Approved Document L2*.

### **National Association of Rooflight Manufacturers** **www.narm.org.uk**

*Use of rooflights to satisfy the 2002 Building Regulations for the Conservation of Fuel and Power*.

### **NBS (on behalf of ODPM)** **www.thebuildingregs.com**

*Low or Zero Carbon Energy Sources: Strategic guide*, 2006. ISBN 1 85946 224 3

*HM Government Non-domestic Building Services Compliance Guide*, 2010 Edition

### **Thermal Insulation Manufacturers and Suppliers Association (TIMSA)** **www.timsa.org.uk**

*HVAC Guidance for Achieving Compliance with Part L of the Building Regulations*, 2006.







