States of Jersey

The Building Bye-Laws (Jersey) 2007

TECHNICAL GUIDANCE DOCUMENT 11.2A

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

2016 EDITION

Main Changes in the 2016 Edition

This technical guidance document, Technical Guidance Document 11.2A: Conservation of Fuel and Power in new buildings other than dwellings, supports the energy efficiency requirements of the Building Bye-laws. This technical guidance document takes effect on 18th July 2016 and applies to applications for building permission submitted on or after that date.

The main changes in this technical guidance document are that:

- The reference building used to determine the target energy rate is the same size and shape as the proposed building, constructed to a revised specification. The Part 11 2016 specifications have been strengthened to deliver a 34% improvement across an assumed build mix. This means that some will be required to improve by more than 34% and others by less.
- A wider set of notional buildings has now been defined for top-lit, side-lit(heated only) and side-lit (heated and cooled) buildings. The reference building air permeability has been further subdivided by size.
- A summary of the Part 11 reference buildings is given in Table 5 in the Technical Guidance Document. If the proposed building is constructed entirely to the reference building specifications it will meet the energy targets and the limiting fabric and building services parameters. Developers are, however, free to vary the specification, provided the same overall energy target is achieved or bettered.

WHAT IS A TECHNICAL GUIDANCE DOCUMENT?

The Minister for Environment has approved a series of documents that give practical guidance about how to meet the requirements of the Jersey Building Bye-laws. Technical guidance documents give guidance on each of the technical requirements of the Building Bye-laws and on Bye-law 7.

A list of all technical guidance documents that have been approved and issued by the Environment Minister can be obtained from the States of Jersey website: www.gov.je

Technical guidance documents set out what, in ordinary circumstances, may be accepted as reasonable provision for compliance with the relevant requirements of the Building Bye-laws to which they refer. If you follow the guidance in a technical guidance document, there will be a presumption of compliance with the requirements covered by the guidance. However, compliance is not guaranteed; for example, 'normal' guidance may not apply if the particular case is unusual in some way.

Note that there may be other ways to comply with the requirements – *there is no obligation to adopt any particular solution contained in a technical guidance document.* If you prefer to meet a relevant requirement in some other way than described in a technical guidance document, you should discuss this with the department.

In addition to guidance, some technical guidance documents include provisions that must be followed exactly, as required by Building Bye-laws or where methods of test or calculation have been prescribed by the Minister.

Each technical guidance document relates only to the particular requirements of the Building Bye-laws that the document addresses. However, building work must also comply with any other applicable requirements of the Building Bye-laws.

HOW TO USE THIS TECHNICAL GUIDANCE DOCUMENT

This document uses the following conventions.

a. Text against a blue background is an extract from the Building Bye-laws (Jersey) 2007, as amended. These extracts set out the legal requirements of the bye-laws.

b. **Key terms, printed in bold blue text** are defined in Appendix A.

c. When the technical guidance document refers to a named standard or other document, the relevant versions are listed in Appendix E (documents referred to) and Appendix F (standards referred to) respectively. However, if the issuing body has revised or updated the listed version of the standard, you should use the new version as guidance provided that it continues to address the relevant requirements of the Building Bye-laws.

d. Additional *commentary in italic* text appears after some numbered paragraphs. This commentary is intended to assist understanding of the immediately preceding paragraph or sub-paragraph, or to direct readers to sources of additional information, but is not part of the technical guidance itself.

Standards and technical approvals may also address aspects of performance or matters that are not covered by the Building Bye-laws, or they may recommend higher standards than required by the Building Bye-laws.

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

BUILDING WORK

Part 1 of the Building Bye-laws defines 'building work'. Building work includes:

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. The material alteration of a building or a controlled service or fitting

d. The renovation and or replacement of thermal elements.

Bye-law 5 states that building work should be carried out in such a way, that when work is complete:

a. For new buildings or work on a building that complied with the applicable requirements of the Building Bye-laws: the work and the building comply with the applicable requirements of the Building Bye-laws.

b. For work on an existing building that did not comply with the applicable requirements of the Building Bye-laws:

- The work itself must comply with the applicable requirements of the Building Bye-laws; **and**
- The building must be no more unsatisfactory in relation to the requirements than before the work was carried out.

MATERIAL CHANGE OF USE

Bye-law 2 defines a 'material change of use' in which a building or a part of a building that was previously used for one purpose will be used for another.

The Building Bye-laws set out requirements that must be met before a building can be used for a new purpose. To meet the requirements, the building may need to be upgraded in some way.

MATERIALS AND WORKMANSHIP

In accordance with Bye-law 7, building work must be carried out in a workmanlike manner using adequate and proper materials. Guidance on materials and workmanship is given in the Technical Guidance Document – Bye-Law 7.

ENERGY EFFICIENCY REQUIREMENTS

Part 3A of the Building Bye-laws imposes specific requirements for energy efficiency. If a building is extended or renovated, the energy efficiency of the existing building or part of it may need to be upgraded.

NOTIFICATION OF WORK

A building permit is normally required to undertake building work and material changes of use and the department needs to be notified at the time the work commences.

A building permit is not required for work:

a. that will be self-certified by a registered competent person and notified to the Department through an approved competent person scheme

b. that is exempt from the need to obtain a building permit under Bye-Law 3.

RESPONSIBILITY FOR COMPLIANCE

People who are responsible for building work (for example the agent, designer, builder or installer) must ensure that the work complies with all relevant requirements of the Building Bye-laws. The building owner may also be responsible for ensuring that work complies with the Building Bye-laws. If building work does not comply with the Building Bye-laws, the building owner may be served with an enforcement notice.

Contents

Summary

This technical guidance document is one of four approved documents that give guidance on how to comply with the energy efficiency requirements of the Building Bye-laws:

Technical Guidance Document 11.1A: Conservation of Fuel and Power in New Dwellings.

Technical Guidance Document 11.1B: Conservation of Fuel and Power in Existing Dwellings.

Technical Guidance Document 11.2A: Conservation of Fuel and Power in New Buildings Other Than Dwellings.

Technical Guidance Document 11.2B: Conservation of Fuel and Power in Existing Buildings Other Than Dwellings.

The technical guidance documents are supported by the:

Domestic Building Services Compliance Guide

Non-Domestic Building Services Compliance Guide

This technical guidance document contains the following sections:

Section 1 sets out the relevant legal requirements and provides an overview of the steps to demonstrate compliance.

Section 2 sets out the considerations that apply to demonstrating that the design of the building will meet the energy efficiency requirements.

Section 3 sets out the considerations that apply when demonstrating that the design has been appropriately translated into actual construction performance.

Section 4 describes the information that should be provided to occupiers to help them achieve reasonable standards of energy efficiency in practice.

Section 5 provides a pointer to some useful information on different design approaches to meeting the energy efficiency requirements.

Appendix A: Key terms and abbreviations.

Appendix B: Guidance on the types of building work covered by this technical guidance document.

Appendix C: Guidance on the types of buildings that are exempt from the energy efficiency requirements.

Appendix D: Reporting evidence of compliance.

Appendix E: Documents referred to.

Appendix F: Standards referred to.

Appendix G: Variations to NCM Modelling Guide.

Notice of Energy Performance

Bye-law 17D of the Building Bye-laws requires that when a building is newly constructed or a dwelling is created by a material change of use, the person carrying out the work must calculate the energy performance of the building at completion of the work in accordance with the relevant technical guidance document and give notice of it to the owner.

Section 1: The Requirements

1.1 This technical guidance document which takes effect on 18 July 2016, deals with the **energy efficiency requirements** of the Building Bye-laws 2007 as amended. The **energy efficiency requirements** are conveyed in Bye-laws 5A and 5B, Part 3A and Part 11 of Schedule 2 to the Building Bye-laws.

1.2 Relevant extracts from the Building Bye-laws (Jersey) 2007, as amended are set out using text against a blue background in the Technical Guidance Document. Where there is any doubt you should consult the full text of the Building Bye-laws, available at www.gov.je.

Part 11 of Schedule 2: conservation of fuel & power

Requirement	*Limits on application*
PART 11 – CONSERVATION OF FUEL AND POWER 11.1 Conservation of Energy Reasonable provision must be made for the conservation of fuel and power in a building 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 fixed building services which – i. are energy efficient; ii. have effective controls; and iii. are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances.	

Demonstrating compliance

1.3 In the Minister's view, compliance with the **energy efficiency requirements** will be demonstrated by meeting five separate criteria set out in the following paragraphs. Compliance software approved for this purpose must be used to produce an output report to show that compliance has been achieved.

1.4 **Criterion 1:** In accordance with Bye-law 17B the calculated energy performance of the building (the Building Energy Rate, **BER**) must not be greater than the Target Energy Rate (**TER**), which is determined using the procedures set out in paragraphs 2.7 to 2.28.

Criterion 1 is a Bye-law and is therefore mandatory, whereas the limits on design flexibility for Criterion 2 are statutory guidance. The calculations required as part of the procedure to show compliance with this Criterion can also be used to provide information about energy performance as required by Bye-law 17E.

1.5 **Criterion 2:** The performance of the individual fabric elements and the **fixed building services** of the building should achieve reasonable overall standards of energy efficiency, following the procedure set out in paragraphs 2.29 to 2.41.

Criterion 2 is intended to limit design flexibility, to discourage excessive and inappropriate trade-offs. For example, individual building fabric elements with poor insulation standards being offset by renewable energy systems with uncertain service lives.

1.6 **Criterion 3:** Demonstrate that the building has appropriate passive control measures to limit solar gains. The guidance given in paragraphs 2.42 to 2.45 of this technical guidance document provides a way of demonstrating that suitable provisions have been made.

The purpose is to limit solar gains to reasonable levels during the summer period, in order to reduce the need for, or the installed capacity of, air-conditioning systems.

1.7 **Criterion 4:** The performance of the building, as built, should be consistent with the **BER**. The guidance in Section 3 can be used to show that this criterion has been met. Extra credits will be given in the **TER/BER** calculation where builders can provide robust evidence of quality-assured procedures in the design and construction phases.

1.8 **Criterion 5:** The necessary provisions for enabling energy-efficient operation of the building should be put in place. One way to achieve this is to follow the guidance in Section 4.

Section 2: Designs Standards

Bye-laws: Part 3A

2.1 The **Energy Efficiency requirements** in Part 3A of the Building Bye-laws state that:

17B Energy performance rates for new buildings

1. This bye-law applies where a new building is constructed.
2. The energy performance rate of the building, once constructed, shall not exceed the target rate of the energy performance for the building specified in the relevant technical guidance document.
3. If the building is a dwelling, its fabric energy efficiency rate, once the dwelling is constructed, must not exceed the target fabric energy efficiency rate for the building that has been specified in the relevant technical guidance document.
4. For the purposes of this bye-law:
   a. energy performance rates and fabric efficiency rates must be calculated in accordance with the relevant technical guidance document.
   b. 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.

17H Energy rate calculations

1. This bye-law applies where a new building is constructed.
2. The person carrying out the work must provide a notice with the application for a building permit that specifies:
   a. the target energy rate for the building;
   b. in the case of a dwelling, the target fabric energy efficiency rate for the dwelling;
   c. the calculated energy rate for the building as designed,
   d. in the case of a dwelling, the calculated fabric energy efficiency rate for the dwelling as designed; and
   e. a list of specifications to which the building is to be constructed.
3. Not later than five days after the work has been completed, the person carrying out the work must give the Chief Officer a notice which specifies:
   a. the target energy rate for the building, and in the case of a dwelling, the target fabric energy efficiency rate;
   b. the calculated energy rate for the building as constructed,
   c. in the case of a dwelling, the calculated fabric energy efficiency rate for the dwelling as constructed; and
   d. whether the building has been constructed in accordance with the list of specifications referred to in paragraph (2)(e), and if not a list of any changes to those specifications.
4. For the purposes of this bye-law:
   a. ‘specifications’ means specifications used for the calculation of the energy rate in accordance with the relevant technical guidance document;
   b. the relevant technical guidance document is the one concerning minimum energy performance requirements for buildings and setting out a methodology of calculation for the energy performance of buildings.

Target Energy Rate (TER)

2.2 The Target Energy Rate (TER) is the minimum energy performance requirement for new buildings approved by the Minister in accordance with Bye-law 17B. It is expressed in terms of delivered energy in kilowatt-hours per square metre of the **total useful floor area** per year. (kWh/m^2/year)

2.3 The **TER** must be calculated using a calculation tool that has been approved for this purpose. For most buildings the approved tool is the latest available version of the UK Governments' Simplified Building Energy Model (SBEM).

2.4 For those buildings where it is considered the design features are not capable of being adequately modelled by SBEM, the Department should be contacted for advice.

2.5 As part of the submission for a building permit, the applicant must provide the building bye-law compliance output documents which are produced by the Simplified Building Energy Model tool, referred to in paragraph 2.3.

2.6 The **TER** is established by using the approved software to calculate the energy rate from a reference building of the same size and shape as the actual building, but with specified properties. These specified properties are automatically applied by the calculation tool. The key components of the reference building specification can be seen at Table 5. The **TER** is set equal to the energy rate from this reference building, with no further adjustment being made.

*Developers are still given the freedom to vary the specification, provided the **TER** is achieved or bettered.*

CRITERION 1 – ACHIEVING THE TER

2.7 Bye-law 17B states that:

> **Energy Performance Rates for New Buildings**
>
> 17B(2) The energy performance rate of the building, once constructed, must not exceed the target rate of the energy performance for the building that has been specified in the relevant technical guidance document.

Calculating the Energy Rate of the actual building

2.8 To demonstrate that the requirement in Bye-law 17B has been met, the actual Building Energy Rate (**BER**) must be no greater (no worse) than the **TER** calculated as set out in paragraphs 2.2 to 2.6.

2.9 The **BER** must be calculated using the same calculation tool as used for establishing the **TER**.

Energy rate calculations

2.10 Bye-law 17H states that:

> **17H Energy Rate Calculations**
>
> 1. This bye-law applies where a building is constructed.
> 2. The person carrying out the work must provide a notice with the application for a building permit which specifies:
>   a. the target energy rate for the building;
>   b. in the case of a dwelling, the target fabric energy efficiency rate for the dwelling;
>   c. the calculated energy rate for the building as designed,
>   d. in the case of a dwelling, the calculated fabric energy efficiency rate for the dwelling as designed; and
>   e. a list of specifications to which the building is to be constructed.
> 3. Not later than five days after the work has been completed, the person carrying out the work shall give the Chief Officer a notice which specifies:
>   a. the target energy rate for the building, and in the case of a dwelling, the target fabric energy efficiency rate;
>   b. the calculated energy rate for the building as constructed,
>   c. in the case of a dwelling, the calculated fabric energy efficiency rate for the dwelling as constructed; and
>   d. whether the building has been constructed in accordance with the list of specifications referred to in paragraph (2)(e), and if not a list of any changes to those specifications.
> 4. For the purposes of this bye-law-
>   a. 'specifications' means specifications used for the calculation of the energy rate in accordance with the relevant technical guidance document;
>   b. The relevant technical guidance document is the one concerning minimum energy performance requirements for buildings and setting out a methodology of calculation for the energy performance of buildings.

Energy Rate calculations at design stage

2.11 Bye-law 17H requires that, the **BER** of the building must be calculated at the design stage, to demonstrate that the **BER** rate is not greater than the **TER**. The designer must give this design-based calculation to the department, along with a list of specifications used in calculating the **BER**.

The SBEM tool produces a set of output documents that should be submitted with the building application.

Energy Rate calculation when work is complete

2.12 When work is complete, the Department must be provided with calculation output documents that show the **TER** and **BER**, for the building as constructed.

*Information to support the values used in the **BER** calculation and the list of specifications may be required. For example, U-values may have been determined from a specific calculation, in which case the details should be provided, or from an accredited source, in which case a reference to that source is sufficient. Evidence that demonstrates that the building as designed satisfies the requirements of Criteria 2 and 3 may also be required.*

Achieving the TER

2.13 Certain management features offer improved energy efficiency in practice. Where these management features are provided in the actual building, the **BER** can be reduced by an amount equal to the product of the factor given in Table 1.

2.14 Provided the building satisfies the limits on design flexibility as set out in Criterion 2, the compliance procedure allows the designer full flexibility to achieve the **TER** utilising fabric and system measures and the integration of low and zero carbon (LZC) technologies in whatever mix is appropriate to the scheme. The approved compliance tool includes appropriate algorithms that enable the designer to assess the role LZC technologies can play in achieving the **TER**.

Special Considerations

2.15 Special considerations apply to certain classes of non-exempt building. These building types include:

a. non-exempt buildings with low energy demand; the guidance specific to such buildings is given in paragraphs 2.16 to 2.19;

b. modular and portable buildings with a planned service life of more than two years (at one or more sites); the guidance specific to such buildings is given in paragraphs 2.20 to 2.24;

c. shell and core developments; the guidance specific to such buildings is given in paragraphs 2.26 and 2.27.

Table 1 **Enhanced management and control features**

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

Notes:

1. Automatic monitoring and targeting with alarms for out-of-range values means a complete installation that measures, records, transmits, analyses, reports and communicates meaningful energy management information to enable the operator to manage the energy it uses.
2. The power factor adjustment can be taken only if the whole building power factor is corrected to the level stated. The two levels of power factor correction are alternative values, not additive.

Non-exempt buildings with low energy demand

2.16 For the purposes of this technical guidance document, non-exempt buildings with low energy demand are taken to be those buildings or parts thereof where:

a. **fixed building services** for heating and/or cooling are either not provided, or are provided only to heat or cool a localised area rather than the entire enclosed volume of the space concerned (e.g. localised radiant heaters at a workstation in a generally unheated space); or

b. **fixed building services** are used to heat space in the building to temperatures substantially less than those normally provided for human comfort (e.g. to protect a warehouse from condensation or frost).

2.17 In the situations described in paragraph 2.16 it is not reasonable to expect the entire building envelope to be insulated to the standard expected for more typical buildings. In such situations, no **TER/BER** calculation is required, but reasonable provision would be for every **fixed building service** that is installed to meet the energy efficiency standards set out in the Non-Domestic Building Services Compliance Guide. (2013 edition). In addition, the building envelope should be insulated to a degree that is reasonable in the particular case. If some general heating is provided (case b above), then it would be reasonable that no part of the opaque fabric had a U-value worse than 0.7 W/(m^2K).

2.18 If a part of a building with low energy demand is partitioned off and is heated normally (e.g. an office area in an unheated warehouse), the separately heated area should be treated as a separate 'building' and the normal procedures for demonstrating compliance (including a **TER/BER** calculation) should be followed to demonstrate the heated area complies with the **energy efficiency requirements**.

2.19 If a building with low energy demand subsequently changes such that the space is generally conditioned, then this is likely to involve the initial provision or an increase in the installed capacity of a **fixed building service**. Such activities are covered by Bye-law 5B. The guidance in Technical Guidance Document 11.2B would require the building envelope to be upgraded and a consequential improvement to be made, a process that is likely to be much more expensive than incorporating suitable levels of insulation at the new-build stage. Alternatively, if the building shell was designed as a building with low energy demand and the first occupier of the building wanted to install (e.g.) heating, this would be first **fit-out work**, and a full **TER/BER** submission would then be required (see Appendix B paragraph 1b).

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

2.20 Special considerations apply to modular and portable buildings. The following paragraphs detail what is considered as reasonable provision for a variety of different circumstances.

The placing of an existing module to a new site is considered to be the construction of a new building as far as the Building Bye-laws are concerned. In that context, it is not always appropriate to expect such a relocated unit to meet the new-build standards set out in this technical guidance document, especially as the embodied energy in an existing module is retained, a benefit that compensates for small differences in operating energy demand. Further, portable buildings are often 'distress purchases', and the constraints imposed by the time in which a working building must be delivered mean that additional considerations apply.

At given location

2.21 Portable buildings with a planned service life of more than two years at a given location are often new or re-sale units. In such cases, compliance with the **energy efficiency requirements** should be demonstrated by showing that satisfactory performance has been achieved against each of the five compliance criteria set out in this technical guidance document. However, if more than 70 per cent of the external envelope of the building is to be created from sub-assemblies manufactured prior to the date this technical guidance document comes into force, the **TER** should be adjusted by the relevant factor from Table 2. One way of demonstrating the date of manufacture of each sub-assembly is by relating the serial number to the manufacturer's records. If the units are to be refurbished as part of the process, then the guidance in Technical Guidance Document 11.2B should be followed in terms of the standards to be achieved, for example for replacement windows and new lighting.

At more than one location

2.22 Portable buildings with a planned service life of more than two years but with an intended time of use in a given location of less than two years are often 'distress purchases' (e.g. following a fire), and the buildings must be up and operational in a matter of days. In such cases, different arrangements for demonstrating compliance with Bye-law 17B apply, as set out in the following paragraphs. An example of the evidence that the planned time of use in the given location is less than two years would be the hire agreement for the unit.

2.23 In the case of a modular or portable building intended to be sited in a given location for less than two years, a **TER/BER** calculation should be carried out when the module is first constructed and can be based on a standard generic configuration. This calculation can then be provided as evidence of satisfying the requirements of Bye-law 17B whenever the building is moved to a new location, always provided its intended time of use in that new location is less than two years. In addition to the details of the calculation, the supplier should provide written confirmation that:

a. the modules as actually provided meet or exceed the elemental energy standards of the generic module on which the calculation was based; and

b. the activities assumed in the generic module are reasonably representative of the planned use of the actual module.

2.24 Post initial construction, any work on the module should meet the standards set out in Technical Guidance Document 11.2B. If a **TER/BER** calculation is not available for a module constructed prior to 18 July 2016, reasonable provision would be to demonstrate that the **BER** is not greater than the Part 11 2016 **TER** adjusted by the relevant factor from Table 2.

Table 2 **TER multiplying factor for modular & portable buildings**

Date of manufacture of 70% of modules making up the external envelope	TER multiplying factor
After 18 July 2016	1.00
1 Jan 2011 – 18 July 2016	1.10
1 July 2007 – 31 Dec 2010	1.47
1 March 2004 – 30 June 2007	1.93
Pre 1 March 2004	1.93 (2.59[1])

Notes:

1. For buildings with a planned time of use in a given location of less than two years, the figure in brackets is applicable.

Swimming pool basins

2.25 In terms of Criterion 1, the building should be assessed as if the pool basin were not there, although the pool hall should be included. The area covered by the pool should be replaced with the equivalent area of floor with the same U-value as the pool surround.

Shell and core developments

2.26 If a building is offered to the market for sale or let as a shell for specific **fit-out work** by the incoming occupier, the developer should demonstrate via the design-stage **TER/BER** submission how the building shell as offered could meet the **energy efficiency requirements**. For those parts of the building where certain systems are not installed at the point the building is to be offered to the market, the model that is used to derive the **BER** should assume efficiencies for those services that will be installed as part of the first **fit-out work**. The specification provided to the Department (see paragraph 2.11) should identify which services have not been provided in the base build, and the efficiency values assumed for each such system. This should enable the Department to ensure that the necessary infrastructure needed to deliver the assumed fit-out specification is provided as part of the base build. At practical completion of the base building, the as-built **TER/BER** calculation should be based only on the building and systems as actually constructed; the fit-out areas should be assumed to be conditioned to temperatures appropriate to their designated use, but no associated energy demand included.

2.27 When an incoming occupier does first **fit-out work** on all or part of the building through the provision or extension of any of the fixed services for heating, hot water, air-conditioning or mechanical ventilation, then **TER/BER** submission should be made to the Department after completion to demonstrate compliance for the part of the building covered by the **fit-out work**. This submission should be based on the building shell as constructed and the **fixed building services** as actually installed. If the **fit-out work** does not include the provision or extension of any of the fixed services for heating, hot water, air-conditioning or mechanical ventilation, then reasonable provision would be to demonstrate that any lighting systems that are installed are at least as efficient as those assumed in the shell developer's initial submission.

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

2.28 Special considerations may apply in cases where industrial processes or agricultural use may not be adequately accounted when using the SBEM calculation method or the SBEM method may be impractical. In such cases, reasonable provision would be to **provide fixed building services** that satisfy the standards set out in Technical Guidance Document 11.2B.

CRITERION 2 – LIMITS ON DESIGN FLEXIBILITY

2.29 While the approach to complying with Criterion 1 allows design flexibility, paragraph 11.1(a)(i) of Schedule 2 to the Building Bye-laws requires that reasonable provision be made to limit heat gains and losses through the fabric of the building, and paragraph 11.1(b) requires that energy-efficient **fixed building services** with effective controls be provided.

2.30 One way of showing that the Part 11 requirement is satisfied is to demonstrate that the fabric elements and the **fixed building services** all meet the minimum energy efficiency standards specified in the following paragraphs.

*In order to satisfy the **TER**, the building specification needs to be considerably better than the stated limiting values in many aspects of the design. Table 5 provides a summary specification of the reference building and is a better indication of the standards required to meet the **TER**.*

Limiting fabric standards

2.31 Table 3 sets out the limiting standards for the properties of the fabric elements of the building. Each stated value represents the area-weighted average for all elements of that type. In general, to achieve the **TER**, a significantly better fabric performance than that set out in Table 3 is likely to be required.

2.32 U-values shall be calculated using the methods and conventions set out in BR 443 (*conventions for U-value calculations)*, and should be based on the whole unit (e.g. in the case of a window, the combined performance of the glazing and the frame).

The U-value of glazing can be calculated for:

a. the smaller of the two standard windows defined in BS EN 14351-1; **or**

b. the standard configuration set out in BR 443; **or**

c. the specific size and configuration of the actual window.

The U-value of the door can be calculated for:

a. the standard size as laid out in BS EN 14351-1; **or**

b. the specific size and configuration of the actual door.

For domestic-type construction, SAP 2012 Table 6e gives values for different window configurations, which can be used if there are no test data or calculated values.

2.33 The U-values for roof windows and roof-lights given in this technical guidance document are based on the U-value having been assessed with the roof window or roof-light 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 an adjustment that is dependent on the slope of the unit, following the guidance given in BR 443.

Table 3 **Limiting fabric parameters**

Roof	0.25W/(m²K)
Wall	0.35W/(m²K)
Floor	0.25W/(m²K)
Swimming pool basin[1]	0.25W/(m²K)
Windows, roof windows, glazed roof-lights[2], curtain walling and pedestrian doors [3,4]	2.2W/(m²K)
Vehicle access and similar large doors	1.5W/(m²K)
High-usage entrance doors	3.5W/(m²K)
Roof ventilators (inc. smoke vents)	3.5W/(m²K)
Air permeability	10.0m³/(h.m²)at 50Pa

Notes:

1. Where a swimming pool is constructed as part of a new building, reasonable provision should be made to limit heat loss from the pool basin by achieving a U-value no worse than 0.25 W/(m²K) as calculated according to BS EN ISO 13370.
2. For the purposes of checking compliance with the limiting fabric values for roof lights, the true U-value based on aperture area can be converted to the U-value based on the developed area of the roof-light. Further guidance on evaluating the U-value of out-of-plane roof-lights is given in Assessment of thermal performance of out-of-plane roof-lights, NARM Technical Document NTD 2 (2010).
3. Excluding display windows and similar glazing. There is no limit on design flexibility for these exclusions but their impact on the TER must be taken into account in calculations.
4. In buildings with high internal heat gains, a less demanding area-weighted average U-value for the glazing may be an appropriate way of reducing the need for cooling and hence the BER. If this case can be made, then the average U-value for windows can be relaxed from the values given above. However, values should be no worse than 2.7 W/(m² K).

Limiting System Efficiencies

2.34 This section sets out the design limits for **fixed building services** to meet the requirements of Part 11.1(b).

Controls

2.35 Systems should be provided with appropriate controls to enable the achievement of reasonable standards of energy efficiency in use. In normal circumstances, the following features would be appropriate for heating, ventilation and air-conditioning system controls:

a. The systems should be subdivided into separate control zones to correspond to each area of the building that has a significantly different solar exposure, or pattern or type of use; and

b. Each separate control zone should be capable of independent timing and temperature control and, where appropriate, ventilation and air recirculation rate; and

c. 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 as not to operate simultaneously; and

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

2.36 In addition to these general control provisions, the systems should meet specific control and efficiency standards as set out in the paragraphs below.

System Efficiencies

2.37 Each **fixed building service** should be at least as efficient as the minimum acceptable value for the particular type of service as set out in the Non-Domestic Building Services Compliance Guide. If the type of service is not covered by the Guide, then reasonable provision is to demonstrate that the proposed service is not less efficient than a comparable service that is covered by the Guide.

2.38 The efficiency claimed for the **fixed building service** should be based on the appropriate test standard set out in the Non-Domestic Building Services Compliance Guide and the test data should be certified by a notified body.

Energy Meters

2.39 Reasonable provision for energy meters would be to install energy metering systems that enable:

a. at least 90 per cent of the estimated annual energy consumption of each fuel to be assigned to the various end-use categories (heating, lighting etc.). Detailed guidance on how this can be achieved is given in CIBSE TM 39 *Building Energy Metering*; and

b. the output of any renewable system to be separately monitored; and

c. in buildings with a **total useful floor area** greater than 1000m^2, automatic meter reading and data collection facilities.

2.40 The metering provisions should be designed such as to facilitate the benchmarking of energy performance as set out in CIBSE TM 46 *Energy Benchmarks.*

Centralised Switching of Appliances

2.41 Consideration should be given to the provision of centralised switches to allow the facilities manager to switch off appliances when they are not needed (e.g. overnight and at weekends). Where appropriate, these should be automated (with manual override) so that energy savings are maximised.

A centralised switch would be more reliable than depending on each individual occupant to switch off their (e.g.) computer.

CRITERION 3 – LIMITING THE EFFECTS OF HEAT GAINS IN SUMMER

2.42 This section sets out the approach to limiting heat gains as required by paragraph 11.1(a)(i) of Schedule 2 to the Building Bye-laws.

Limiting the Effects of Solar Gains in Summer

2.43 The following guidance applies to all buildings, irrespective of whether they are air-conditioned or not. The intention is to limit solar gains during the summer period to either:

a. reduce the need for air-conditioning; or

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

2.44 If the criterion set out below is satisfied in the context of a naturally ventilated building, this is NOT evidence that the internal environment of the building will be satisfactory, since many factors that are not covered by the compliance assessment procedure will have a bearing on the incidence of overheating (incidental gains, thermal capacity, ventilation provisions etc.).

Therefore the developer should work with the design team to specify what constitutes an acceptable indoor environment in the particular case, and carry out the necessary design assessments to develop solutions that meet the agreed brief. Some ways of assessing overheating risk are given in CIBSE TM 37 Design for improved solar shading control and, for education buildings, in Building Bulletin 101 Ventilation of school buildings.

2.45 For the purposes of Part 11, reasonable provision for limiting solar gain through the building fabric would be demonstrated by showing that, for each space in the building that is either occupied or mechanically cooled, the solar gains through the glazing aggregated over the period from April to September inclusive are no greater than would occur through one of the following reference glazing systems with a defined total solar energy transmittance (g-value) calculated according to BS EN 410:

a. For every space that is defined in the SBEM calculation tool database as being side lit, the reference case is an east-facing façade with full-width glazing to a height of 1.0 m having a framing factor of 10 per cent and a normal solar energy transmittance (g-value) of 0.68.

b. For every space that is defined in the SBEM calculation tool database as being top lit, and whose average zone height is not greater than 6 m, the reference case is a horizontal roof of the same total area that is 10 per cent glazed as viewed from the inside out and having roof-lights that have a framing factor of 25 per cent and a normal solar energy transmittance (g-value) of 0.68.

c. For every space that is defined in the SBEM calculation tool database as being top lit and whose average zone height is greater than 6 m, the reference case is a horizontal roof of the same total area that is 20 per cent glazed as viewed from the inside out and having roof-lights that have a framing factor of 15 per cent and a normal solar energy transmittance (g-value) of 0.46.

In double-height industrial-type spaces, dirt on the roof-lights and internal absorption within the roof-light reduce solar gains. These effects, combined with temperature stratification, will reduce the impact of solar gains in the occupied space and so increased roof-light area may be justified. In such situations, the developer should pay particular attention to the design assessments referred to in paragraph 2.45b.

d. For the purpose of this specific guidance, an occupied space means a space that is intended to be occupied by the same person for a substantial part of the day. This excludes circulation spaces and other areas of transient occupancy, such as toilets, as well as spaces that are not intended for occupation (e.g. **display windows**).

Section 3: Quality of Construction and Commissioning

CRITERION 4 – BUILDING PERFORMANCE CONSISTENT WITH THE BER

3.1 Buildings should be constructed and equipped so that performance is consistent with the calculated **BER**. As indicated in paragraph 2.12, a calculation of the **BER** is required to be submitted to the Department after completion to take account of:

a. any changes in performance between design and construction; and

b. the achieved **air permeability**, ductwork leakage and commissioned fan performance.

Note: The following paragraphs in this section set out what in normal circumstances would be reasonable provision to ensure that the actual performance of the building is consistent with the **BER**.

Building fabric

3.2 The building fabric should be constructed to a reasonable quality so that:

a. the insulation is reasonably continuous over the whole building envelope; and

b. the **air permeability** is within reasonable limits.

Continuity of insulation

3.3 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.

3.4 Reductions in thermal performance can occur where the air barrier and the insulation layer are not contiguous and the cavity between them is subject to air movement. To avoid this problem, either:

a. the insulation layer should be contiguous with the air barrier at all points in the building envelope; or

b. the space between the insulation layer and air barrier should be filled with solid material such as in a masonry wall.

3.5 Where linear thermal transmittances and temperature factors are calculated in support of the approaches set out in paragraph 3.7a, follow the guidance set out in BRE Report BR 497 *Conventions for calculating linear thermal transmittance and temperature factors*. Reasonable provision is to demonstrate that the specified details achieve a temperature factor that is no worse than the performance set out in BRE Information Paper IP 1/06 *Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings.*

3.6 Similarly, in support of the approaches set out in paragraph 3.7a, the builder would have to demonstrate that an appropriate system of site inspection is in place to give confidence that the construction procedures achieve the required standards of consistency.

3.7 Ways of demonstrating that reasonable provision has been made are:

a. To use construction joint details that have been calculated by a person with suitable expertise and experience following the guidance set out in BR 497 and following a process flow sequence that has been provided to the Department indicating the way in which the detail should be constructed. The calculated value can then be used in the **BER** calculation.

Evidence of suitable expertise and experience for calculating linear thermal transmittance would be to demonstrate that the person has been trained in the software used to carry out the calculation, has applied that model to the example calculations set out in BR 497 and has achieved results that are within the stated tolerances.

b. To use construction joints with no specific quantification of the thermal bridge values. In such cases, the generic linear thermal bridge values as given in IP 1/06 increased by 0.04 W/(m.K) or 50 per cent, whichever is greater, must be used in the **BER** calculation.

Air permeability and pressure testing

3.8 In order to demonstrate that an acceptable **air permeability** has been achieved, Bye-law 17F states:

17F Pressure Testing

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 Chief Officer 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.

3.9 The approved procedure for pressure testing is given in the Air Tightness Testing and Measurement Association (ATTMA) publication measuring **air permeability** of building envelopes and, specifically, the method that tests the envelope area. The preferred test method is that trickle ventilators should be temporarily sealed rather than just closed. The Department should be provided with evidence that test equipment has been calibrated within the previous 12 months using a UKAS-accredited facility. The manner approved for recording the results and the data on which they are based is given in Section 4 of that document.

3.10 It should be confirmed to the Department that the person who completed the testing has received appropriate training and is registered to test the specific class of building concerned.

3.11 The approved circumstances under which the Department requires pressure testing to be carried out are set out in paragraphs 3.12 to 3.14.

3.12 All buildings that are not dwellings (including extensions which are being treated as new buildings for the purposes of complying with Part 11) must be subject to pressure testing, with the following exceptions:

a. Buildings less than 500 m^2 **total useful floor area**; in this case the developer may choose to avoid the need for a pressure test provided that the **air permeability** used in the calculation of the **BER** is taken as 15 $m^3/(h.m^2)$ at 50 Pa.

*Compensating improvements in other elements of the building fabric and building services will be needed to keep the **BER** no worse than the **TER**.*

b. A factory-made modular building of less than 500m^2 floor area, with a planned service life of more than two years at more than one location, and where no site assembly work is needed other than making linkages between standard modules using standard link details. Compliance with bye-law 17F can be demonstrated by giving a notice to the Department confirming that the building as installed conforms to one of the standard configurations of modules and link details for which the installer has pressure test data from a minimum of five in-situ measurements incorporating the same module types and link details as utilised in the actual building. The results must indicate that the average test result is better than the **design air permeability** as specified in the **BER** calculation by not less than 1.0 $m^3/(h.m^2)$ at 50 Pa.

c. Large extensions (whose compliance with Part 11 is being assessed as if they were new buildings – see Technical Guidance Document 11.2B) where sealing off the extension from the existing building is impractical. The ATTMA publication gives guidance both on how extensions can be tested and on situations where pressure tests are inappropriate. Where it is agreed with the Department that testing is impractical, the extension should be treated as a large, complex building, with the guidance in paragraph 3.12d applying.

d. Large complex buildings, where due to building size or complexity it may be impractical to carry out pressure testing of the whole building. The ATTMA publication indicates those situations where such considerations might apply. Before adopting this approach developers must produce in advance of construction work in accordance with the approved procedure a detailed justification of why pressure testing is impractical. This should be endorsed by a suitably qualified person such as a competent person approved for pressure testing. In such cases, a way of showing compliance would be to appoint a suitably qualified person to undertake a detailed programme of design development, component testing and site supervision to give confidence that a continuous air barrier will be achieved. It would not be reasonable to claim **air permeability** better than 5.0$m^3/(h.m^2)$ at 50 Pa has been achieved.

One example of a suitably qualified person would be an ATTMA member. The 5.0m³/(h.m²)at 50 Pa limit has been set because at better standards the actual level of performance becomes too vulnerable to single point defects in the air barrier.

e. Compartmentalised buildings. Where buildings are compartmentalised into self-contained units with no internal connections it may be impractical to carry out whole building pressure tests. In such cases reasonable provision would be to carry out a pressure test on a representative area of the building as detailed in the ATTMA guidance. In the event of a test failure, the provisions of paragraphs 3.13 and 3.14 would apply, but it would be reasonable to carry out a further test on another representative area to confirm that the expected standard is achieved in all parts of the building.

3.13 Compliance with the requirement in paragraph 11.1(a)(i) of Schedule 2 to the Building Bye-laws would be demonstrated if:

a. the measured **air permeability** is not worse than the limiting value of 10 m³/(h.m²) at 50 Pa; and

b. the **BER** calculated using the measured **air permeability** is not worse than the **TER**.

*If it proves impractical to meet the **design air permeability**, any shortfall must be compensated through improvements to subsequent fit-out activities. Builders may therefore wish to schedule pressure tests early enough to facilitate remedial work on the building fabric, e.g. before false ceilings are up.*

Consequences of failing a pressure test

3.14 If satisfactory performance is not achieved, then remedial measures should be carried out on the building and new tests carried out until the building achieves the criteria set out in paragraph 3.13.

*If the measured **air permeability** on retest is greater than the **design air permeability** but less than the limiting value of 10 m³/(h.m²) then other improvements may be required to achieve the **TER**. This means that builders would be unwise to claim a **design air permeability** better than 10m³/(h.m²) unless they are confident of achieving the improved value.*

Commissioning of the building services systems

3.15 Requirement 11.1(b)(iii) of Schedule 2 to the Building Bye-laws requires **fixed building services** to be commissioned by testing and adjustment as necessary to ensure that they use no more fuel and power than is reasonable in the circumstances. In order to demonstrate that the heating and hot water systems have been adequately commissioned, Bye-law 17G states:

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 Chief Officer 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:
   i. in every case, the date on which the notice required by byelaw 13(6) in relation to the building work is given; and
   ii. 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.

3.16 To assist compliance with bye-law 17G a **commissioning** plan, identifying the systems that need to be tested and the tests that will be carried out should be provided with the design stage **TER/BER** calculation so that the Department can check that the **commissioning** is being done as the work proceeds.

*The use of the templates in the Model **Commissioning** Plan (BSRIA BG 8/2009) is a way of documenting the process in an appropriate way.*

3.17 Not all **fixed building services** will need to be commissioned. With some systems it is not possible as the only controls are 'on' and 'off' switches. Examples of this would be some mechanical extraction systems or single fixed electrical heaters. In other cases **commissioning** would be possible but in the specific circumstances would have no effect on energy use.

***Fixed building services** which do not require **commissioning** should be identified in the **commissioning** plan, along with the reason for not requiring **commissioning**.*

3.18 Where **commissioning** is carried out, it should be done in accordance with the procedures approved by the department comprising:

a. the CIBSE **Commissioning** Code M: **Commissioning** management; 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.*

b. the procedures for air leakage testing of ductwork given in paragraphs 3.24 and 3.25.

3.19 **Commissioning** must be carried out in such a way as not to prejudice compliance with any applicable health and safety requirements.

3.20 **Commissioning** is often carried out by the person who installs the system. Sometimes it may be carried out by a subcontractor or even by a specialist firm. It is important that whoever carries it out follows the relevant approved procedure.

Notice of completion

3.21 Building Bye-law 17G requires a notice be given to confirm that **commissioning** has been carried out.

3.22 The notice should include a declaration 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; and

b. the results of tests confirm that the performance is reasonably in accordance with the actual building design, including written commentaries where deviations are proposed to be accepted.

*Such declarations should be signed by someone suitably qualified by relevant training and experience. A way of achieving this would be to employ a member of the **Commissioning** Specialists Association or the **Commissioning** Group of the Building and Engineering Services Association (B&ES) in respect of heating, ventilation and air-conditioning (HVAC) systems, or a member of the Lighting Industry **Commissioning** Scheme in respect of fixed internal or external lighting. The use of the templates in the Model **Commissioning** Plan is a way of documenting the process in an appropriate way.*

3.23 Until the Department receives a satisfactory **commissioning** notice, it may not consider it appropriate to give a completion certificate.

Air leakage testing of ductwork

3.24 Ductwork leakage testing should be carried out where required by and in accordance with the procedures set out in B&ES DW/143 and B&ES DW/144 on systems served by fans with a design flow rate greater than 1 m^3/s.

*DW/143 does not call for any testing of low-pressure (class A) ductwork. However, where at least 10 per cent of low-pressure ductwork is tested at random and achieves the low-pressure standard as defined by DW/143 the SBEM calculation tool recognises an improvement in the **BER**. A decision to test low-pressure ductwork should be made at the initial design phase prior to commencement on site.*

Membership of the B&ES specialist ductwork group or the Association of Ductwork Contractors and Allied Services (ADCAS) could be a way of demonstrating suitable qualifications for this testing work.

Table 4 **Ductwork pressure classes**

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

Notes:

1. where p is the differential pressure in pascals

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

Section 4: Providing Information

CRITERION 5 – PROVISIONS FOR ENERGY-EFFICIENT OPERATION OF THE BUILDING

4.1 In accordance with Bye-law 17E 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.

17E Information about use of Fuel and Power

1. This bye-law applies where requirement 11.1 applies in relation to building work.
2. The person carrying out the work must, not later than 5 days after the work has been completed, provide to the owner sufficient information about the building, the fixed building services and their maintenance requirements, for the building to be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.

Building log book

4.2 A way of showing compliance with bye-law 17E would be to produce information following the guidance in CIBSE TM 31 Building log book toolkit. The information should be presented in templates as or similar to those in TM 31. The information 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 Social Security Department's approved Code of Practice 11. (ACoP11).

4.3 The data used to calculate the **TER** and the **BER** should be included with the log book.

*It would also be sensible to retain an electronic copy of the **TER**/**BER** input file for the energy calculation to facilitate any future analysis that may be required by the owner when altering or improving the building.*

Section 5: Model Designs

5.1 The **TER** is based on a building of the same size and shape as the actual building, constructed to a reference building specification based on the England 2013 NCM Modelling Guide. If the actual building is constructed entirely to this specification it will meet the **TER** and therefore pass Criterion 1. Table 5 provides a summary of the reference building specifications for each category of building. Further detail can be found in the NCM Modelling Guide.

5.2 It should be noted, however, that the reference building specifications are not prescriptive and may not be the most economic specification in every case. Designers are free to explore the most economic specification to meeting the **TER** in each case, provided that this specification meets all other provisions within this technical guidance document, in particular the limiting fabric parameters in Table 3.

5.3 Some builders may prefer to adopt model design packages rather than to engage in design for themselves. Such model packages of fabric U-values, boiler seasonal efficiencies, window opening allowances etc should, if suitably robust, help the builder achieve compliance. The construction industry may develop model designs for this purpose.

5.4 It will still be necessary to demonstrate compliance in the particular case by going through the procedures described in paragraphs 2.2 to 2.12.

5.5 The compliance software iSBEM which has been approved for the purpose of calculating the **TER** uses modified versions of Tables 7, 8 and 26 of England's NCM Modelling Guide. In the event that the iSBEM compliance software is considered unsuitable for a particular project the Department should be contacted for advice.

5.6 Modifications made to Tables 7, 8 and 26 of the NCM Modelling Guide are shown in Appendix G.

Table 5 **Reference Building Specification**

Element	Side lit or unlit (where HVAC specification is heating only)	Side lit or unlit (where HVAC specification includes cooling)	Top lit
Roof U-value (W/(m^2.K))	0.18	0.18	0.18
Wall U-value (W/(m^2.K))	0.26	0.26	0.26
Floor U-value (W/(m^2.K))	0.22	0.22	0.22
Window U-value (W/(m^2.K))	1.6(10%FF)	1.6(10%FF)	N/A
G-value (%)	40	40	N/A
Light transmittance (%)	71	71	N/A
Roof-light U-value (W/(m^2.K))	N/A	N/A	1.8(15%FF)
G-value (%)	N/A	N/A	55
Light transmittance (%)	N/A	N/A	60
Air permeability (m^3/(m^2.hour)) Gross internal area less than or equal to 250 m^2	5	5	7
Air permeability (m^3/(m^2.hour)) Gross internal area greater than 250 m^2 and less than 3500 m^2	3	3	7
Air permeability (m^3/(m^2.hour)) Gross internal area greater than or equal to 3500 m^2 and less than 10,000 m^2	3	3	5
Air permeability (m^3/(m^2.hour)) Gross internal area greater than or equal to 10,000 m^2	3	3	3
Lighting luminaire (lm/circuit watt)	60	60	60
Occupancy control (Yes/No)	Yes	Yes	Yes
Daylight control (Yes/No)	Yes	Yes	Yes
Maintenance factor	0.8	0.8	0.8
Constant illuminance control	No	No	No
Heating efficiency (heating and hot water)(%)	91	91	91
Central ventilation SFP (W/(l.s))	1.8	1.8	1.8
Terminal unit SFP (W/(l.s))	0.3	0.3	0.3
Cooling (air-conditioned) (SEER/SSEER)	N/A	4.5 / 3.6	4.5 / 3.6
Cooling (mixed mode) (SSEER)[1]	N/A	2.7	2.7
Heat recovery efficiency (%)	70	70	70
Variable speed control of fans and pumps, controlled via multiple sensors	Yes	Yes	Yes
Demand control (mechanical ventilation only). Variable speed control of fans via CO_2 sensors	Yes	Yes	Yes

Notes:

1. Mixed mode assumed to be cooled by DX unit where SSEER includes indoor and outdoor units and fans, pumps and losses.

Appendix A: Key terms and abbreviations

Key terms

The following are key terms used in this document:

Air permeability is the physical property used to measure airtightness of the building fabric. It is defined as air leakage rate per hour per square metre of envelope area at the test reference pressure differential of 50 pascals (50N/m^2). The envelope area, or measured part of the building, is the total area of all floors, walls and ceilings bordering the internal volume that is the subject of the pressure test. This includes walls and floors below external ground level. Overall internal dimensions are used to calculate this envelope area and no subtractions are made for the area of the junctions of internal walls, floors and ceilings with exterior walls, floors and ceilings.

The **limiting air permeability** is the worst allowable **air permeability**.

The **design air permeability** is the target value set at the design stage, and must always be no worse than the limiting value.

The **assessed air permeability** is the value used in establishing the **BER** and is based on a specific measurement of the building concerned.

BER is the Building Energy Rate expressed as kWh/m^2/year).

Commissioning is the advancement of a **fixed building service** after all or part of the system has been installed, replaced or altered. The system is taken from a state of static completion to working order. Testing and adjusting, as necessary, ensure that the whole system uses no more fuel and power than is reasonable in the circumstances, without compromising the need to comply with health and safety requirements. For each system, **commissioning** includes the following: setting-to-work; regulation (that is, testing and adjusting repetitively) to achieve the specified performance; calibration, setting up and testing of the associated automatic control systems; and recording of the system settings and the performance test results that have been accepted as satisfactory.

Controlled service or fitting means a service or fitting in relation to which Part 3 (combustion appliances and fuel storage systems) Part 6 (drainage, sanitation, hot water safety and water efficiency), or Part 11 (conservation of fuel and power) of Schedule 2 to the Building Bye-laws imposes a requirement.

Display window means an area of glazing, including glazed doors, intended for the display of products or services on offer within the building, positioned:

a. at the external perimeter of the building; and

b. at an access level; and

c. immediately adjacent to a pedestrian thoroughfare.

There should be no permanent workspace within one glazing height of the perimeter. Glazing more than 3 m above such an access level should not be considered part of a **display window** except:

a. where the products on display require a greater height of glazing;

b. in cases where building work involving changes to the façade and glazing requiring planning consent, where planners require a greater height of glazing, e.g. to fit with surrounding buildings or to match the character of the existing façade.

It is expected that **display windows** will be found in the types of building as detailed in the table below.

Buildings likely to have display windows

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

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

Dwelling includes a **dwelling**-house and a flat and means a self-contained unit designed to accommodate a single household. Buildings exclusively containing **rooms for residential purposes** such as nursing homes, student accommodation and similar are not **dwellings**, and in such cases, this Technical Guidance Document 11.2A applies.

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.

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

Fit-out work means that work needed to complete the partitioning and building services within the external fabric of the building (the shell) to meet the specific needs of incoming occupiers.

Fit-out work can be carried out in whole or in parts:

a. in the same project and time frame as the construction of the building shell; or

b. at some time after the shell has been completed.

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.

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

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.

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.

TER is the Target Energy Rate expressed as kWh/m^2/year.

Total useful floor area is the total area of all enclosed spaces measured to the internal face of the external walls. In this convention:

a. the area of sloping surfaces such as staircases, galleries, raked auditoria and tiered terraces should be taken as their area on plan; and

b. areas that are not enclosed such as open floors, covered ways and balconies are excluded.

Abbreviations

UKAS:	The United Kingdom Accreditation Service
HVAC:	Heating, Ventilation and Air-conditioning
LZC:	Low and Zero Carbon
SFP:	Specific Fan Power
SEER:	Seasonal Energy Efficiency Ratio
SSEER:	Seasonal System Energy Efficiency Ratio
FF:	Frame Factor
DX:	Direct Exchange

Appendix B: Types of Work covered by this Technical Guidance Document

1. This technical guidance document gives guidance on what, in ordinary circumstances, may be considered reasonable provision to comply with the requirements of Bye-laws 5, 5A, Part 3A and Part 11 of Schedule 2 to the Building Bye-laws, in relation to works comprising:
   a. The construction of new buildings other than **dwellings**.
   b. **Fit-out work** where the work is either part of the construction of a new building, or is the first fit-out of a shell and core development where the shell is sold or let before the **fit-out work** is carried out. (Technical guidance Document 11.2B applies to **fit-out work** in other circumstances.)
   c. The construction of extensions to existing buildings that are not **dwellings** where the **total useful floor area** of the extension is greater than 100 m^2 and greater than 25 per cent of the **total useful floor area** of the existing building.
2. When a building that contains **dwellings** is being constructed, account should also be taken of the guidance in Technical Guidance Document 11.1A. In most instances, use Technical Guidance Document 11.1A for guidance relating to the work on the individual **dwellings**, and this Technical Guidance Document 11.2A for guidance relating to the parts of the building that are not a **dwelling**, such as heated common areas and, in the case of mixed-use developments, the commercial or retail space.

Dwelling *includes a* ***dwelling****-house and a flat and means self-contained units designed to accommodate a single household. For new guest houses, hostels and student accommodation blocks that contain* ***rooms for residential purposes*** *this technical guidance document applies.*

3. If a building contains both living accommodation and space to be used for commercial purposes (e.g. as a workshop or office), the whole building should be treated as a **dwelling** as long as the commercial part can revert to domestic use. This can be the case if, for example:
   a. there is direct access between the industrial or commercial space and the living accommodation; and
   b. both are contained within the same thermal envelope; and
   c. the living accommodation occupies a substantial proportion of the total area of the building.

Sub-paragraph (c) means that, for example, the presence of a small flat for a manager in a large non-domestic building does not result in the whole building being treated as a ***dwelling****. Similarly, if a room is used as an office or utility space within a* ***dwelling*** *that does not mean that the building should not be treated as a* ***dwelling****.*

Appendix C: Buildings that are exempt from the energy efficiency requirements

1. New buildings other than **dwellings** which are roofed constructions having walls and which use energy to condition the indoor climate must comply with the **energy efficiency requirements** unless they are exempt as set out Bye-law 17A. For the purposes of the **energy efficiency requirements** of the Building Bye-laws a building means the whole of a building or parts of it designed or altered to be used separately. The following classes of new buildings or parts of new buildings other than **dwellings** are exempt:
   a. buildings which are used primarily or solely as places of worship;
   b. temporary buildings with a planned time of use of two years or less, industrial sites, workshops and non-residential agricultural buildings with low energy demand;
   c. stand-alone buildings other than **dwellings** with a **total useful floor area** of less than 50m^2;
   d. some conservatories and porches.
2. The following paragraphs give guidance on those exemptions that relate to new buildings that are not **dwellings**.
   a. **Places of worship**: For the purposes of the **energy efficiency requirements**, places of worship are those buildings or parts of a building that are used for formal public worship, plus adjoining spaces whose function is directly linked to that use (for example, a vestry in a church). Traditional, religious or cultural constraints often make it impossible for buildings or parts of buildings that are used for public worship to comply with the **energy efficiency requirements**. Parts of the building that are designed to be used separately, such as offices, catering facilities, day centres, meeting halls and accommodation, are not exempt from the **energy efficiency requirements**.
   b. **Temporary buildings**: For the purpose of the **energy efficiency requirements**, a temporary building with a planned time of use of two years or less is exempt. Portable or modular buildings, whether on one or more sites, which have a planned service life longer than two years, are not exempt.
   c. **Industrial sites, workshops and non-residential agricultural buildings with low energy demand:** In relation to this category of exempt building, the low energy demand only relates to the energy used by fixed heating or cooling systems, NOT to energy required for or created by process needs. The following are examples of buildings in the above categories that have low energy demand:
      i. buildings or parts of buildings where the space is not generally heated or cooled other than by process heat;
      ii. buildings or parts of buildings that only require heating or cooling for short periods each year, such as during critical periods in the production cycle (e.g. plant germination, egg hatching) or during very severe weather conditions.

   Industrial sites, workshops and non-residential agricultural buildings are exempt only if they meet the low energy demand criterion. In other cases, such buildings must comply with **energy efficiency requirements**. Other buildings which have a low energy demand but do not fall into one of the above categories are not exempt.

Appendix D: Reporting evidence of compliance

Reporting Evidence of Compliance

1. To facilitate effective communication between the designer, builder and the department, a standardised format for presenting the evidence that demonstrates compliance with the **energy efficiency requirements** needs to be adopted. (Other than the energy and fabric energy efficiency targets, which are mandatory, the limiting values for individual fabric elements and building services represent reasonable provision in normal circumstances. In unusual circumstances, alternative limits may represent reasonable provision, but this would have to be demonstrated in the particular case.)
2. In normal circumstances the iSBEM compliance software should be used to demonstrate compliance and the output reports produced by that tool provided at the time the application for building permission is made.
3. An important part of demonstrating compliance is to make a clear connection between the product specifications and the data inputs required by the compliance software. Two versions of output reports need to be produced: the first at the building application stage to include the **TER/BER** calculation plus supporting schedule to the **TER/BER** calculation, and the second after completion to include the as-built **TER/BER** calculation plus the supporting schedule to the revised calculation. The first design-stage report and schedule giving a list of specifications are used by the department to assist checking that what has been designed is actually built.
4. The output report referred to in paragraph 3 will highlight items where the specification is better than typically expected, to draw attention to 'key features', that may be critical in achieving the **TER**. It is expected that low and zero carbon technologies will increasingly be employed for compliance, particularly where the average performance of elements in the actual building is worse than the reference building specification. The report will highlight where these low and zero carbon technologies have been used and the Department will give particular attention to their installation.

The Department will give particular attention to those aspects where the claimed specification delivers an energy efficiency standard in advance of that defined in the following schedule.

Parameter	
Wall U-value	0.23 W/(m^2.K)
Roof U-value	0.15 W/(m^2.K)
Floor U-value	0.20 W/(m^2.K)
Window/door U-value	1.5 W/(m^2.K)
Design air permeability	5.0 m^3/(h.m^2) at 50 Pa
Fixed building service efficiency more than 15% better than that recommended for its type in the *Non-Domestic Building Services Compliance Guide.*	

Appendix E: Documents referred to

Air Tightness Testing and Measurement Association (ATTMA)
www.attma.org

Technical Standard L2 Measuring air permeability of building envelopes [2010].

Building and Engineering Services Association (B&ES)
www.b-es.org

DW/143 A practical guide to Ductwork Leakage Testing [2013].

DW/144 Specification for Sheet Metal Ductwork [2013].

BRE
www.bre.co.uk

BR 443 Conventions for U-value calculations [2006]. (www.bre.co.uk/uvalues)

BRE Report BR 497 Conventions for calculating linear thermal transmittance and temperature factors [2007 and 2010 amendment and conventions].

ISBN 978 1 86081 986 5

Information Paper IP 1/06 Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings [2006].

ISBN 978 1 86081 904 9

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

BSRIA
www.bsria.co.uk

BSRIA BG 8/2009 Model Commissioning Plan.

Chartered Institution of Building Services Engineers (CIBSE)
www.cibse.org

Commissioning Code M Commissioning Management [2003].

ISBN 978 1 90328 733 0

TM 31 Building Log Book Toolkit [2006].

ISBN 978 1 90328 771 2

TM 37 Design for improved solar shading control [2006].

ISBN 978 1 90328 757 6

TM 39 Building energy metering [2009].

ISBN 978 1 90684 611 4

TM 46 Energy benchmarks [2008].

ISBN 978 1 90328 795 8

Department for Communities and Local Government
www.communities.gov.uk

Non-Domestic Building Services Compliance Guide [2013].

Department for Education (DfE)
www.education.gov.uk

Building Bulletin 101 Ventilation of School Buildings, School Building and Design Unit [2006].

National Association of Rooflight Manufacturers (NARM)
www.narm.org.uk

Technical Document NTD 2 Assessment of thermal performance of out-of-plane rooflights [2010].

Appendix F: Standards referred to

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

BS EN 410 Glass in building. Determination of luminous and solar characteristics of glazing [2011].

BS EN 14351-1 Windows and doors. Product standard, performance characteristics. Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics [2006(+AMD 1:2010)].

Appendix G: Variations to NCM Modelling Guide

Table 26 Fuel CO_2 emission and primary energy factors for non-domestic buildings - Adapted for Jersey

	Jersey 2007		Jersey 2016	
Fuel Type	$kgCO_2/kWh$	kWh/kWh	$kgCO_2/kWh$	kWh/kWh
Natural gas	0.194	1.10	0.241	1.09
LPG	0.234	1.10	0.241	1.09
Biogas	0.025	1.10	0.098	1.10
Fuel oil	0.265	1.10	0.298	1.10
Coal	0.291	1.10	0.394	1.00
Anthracite	0.317	1.10	0.394	1.01
Manufactured smokeless fuel (inc. coke)	0.392	1.20	0.433	1.21
Dual fuel (mineral + wood)	0.187	1.10	0.226	1.02
Biomass	0.025	1.10	0.031	1.01
Grid supplied electricity	0.080	2.70	0.101	1.40
Grid displaced electricity	0.080	2.70	0.101	1.40
Waste heat	0.018	1.05	0.058	1.34

Table 7 Heating system SCoP and emission factors for side-lit (whether HVAC specification is heating only or heating and cooling) and unlit activities in the Jersey 2016 Reference Building

Heating fuel used in the Actual building	Space heating	Hot water	Heating fuel emission factor in the Reference building ($kgCO_2/kWh$)
Bio-fuels (i.e., whose emission factor < emission factor of natural gas)	63.00%	66.50%	The factor for the particular bio-fuel
Natural gas	81.90%	86.45%	0.241
LPG			0.241
Dual fuel (Mineral + Wood)			0.226
Fuel oil			0.298
Electric heat pump	243.00%	256.50%	0.101
Non-electric heat pump	126.00%	133.00%	The factor for the particular fuel
Electricity (direct)	90.00%	95.00%	0.101
Other fuels (i.e., whose emission factor > emission factor of fuel oil)	81.90%	86.45%	0.298

Table 8 Heating system SCoP and emission factors for top-lit activities in the Jersey 2016 Reference building

Heating fuel used in the Actual building	Space heating	Hot water	Heating fuel emission factor in the Reference building ($kgCO_2/kWh$)
Bio-fuels (i.e., whose emission factor < emission factor of natural gas)	63.00%	66.50%	The factor for the particular bio-fuel
Natural gas	86% for radiant heating*; otherwise 81.9%	86.45%	0.241
LPG			0.241
Dual fuel (Mineral + Wood)			0.226
Fuel oil			0.298
Electric heat pump	243.00%	256.50%	0.101
Non-electric heat pump	126.00%	133.00%	The factor for the particular fuel
Electricity (direct)	90.00%	95.00%	0.101
Other fuels (i.e., whose emission factor > emission factor of fuel oil)	86% for radiant heating*; otherwise 81.9%	86.45%	0.298

*Where a zone in the Actual building only receives heating (i.e., if there is mechanical ventilation, it does not provide heating and/or cooling), then the equivalent zone in the Notional Building will be modelled with direct-fired multi-burner radiant heating, where the thermal efficiency is 86%, and 65% of the thermal output is radiant (i.e., radiant component of 0.65). Zones with top-lit activities tend to be large/tall spaces where direct radiant heating allows a lower air temperature for a given level of thermal comfort, and this reduces ventilation losses. The SBEM Technical Manual[7] provides the method used by SBEM to account for the benefit of radiant heating, and DSM software should model the radiant effect of this type of heating system to at least an equivalent level of detail as SBEM. Note that direct-fired radiant heating systems do not incur auxiliary energy for pumps or fans.