

The Building Bye-Laws (Jersey) 2007

PROPOSED REVISIONS TO TECHNICAL GUIDANCE
DOCUMENT
11.1A

DRAFT

October 2015

MAIN CHANGES IN THE 2016 EDITION

This technical guidance document, Technical Guidance Document 11.1A: Conservation of Fuel and Power in New Dwellings, supports the energy efficiency requirements of the Building Bye-laws. This technical guidance document takes effect and applies to applications for building permission submitted on or after that date.

The main changes in this technical guidance document are that:

- The methodology for calculating energy performance for new dwellings has been changed to the UK Government's Standard Assessment Procedure for the Energy Rating of Dwellings (SAP) 2012.
- The reference dwelling used to determine the energy and fabric efficiency targets is the same size and shape as the proposed dwelling, constructed to a revised specification aimed at delivering a 30% improvement in the energy performance of new homes relative to Part 11 2011.
- A new requirement, Bye-law 17B(3), has been introduced for new dwellings to achieve or better a fabric energy efficiency target in addition to the target energy rate.
- A summary of the Part 11 reference dwelling is published at Table 3 in the technical guidance document. Further detail can be found at jsap.je. If the actual dwelling is constructed entirely to the reference dwelling specifications it will meet the energy and fabric efficiency targets and the limiting values for individual fabric elements and building services. Developers are, however, free to vary the specification provided the same overall level of energy and fabric efficiency performance is achieved or bettered.
- The guidance for insulation of circulation pipes within communal spaces is given greater prominence.

WHAT IS A TECHNICAL GUIDANCE DOCUMENT?

The Minister for Planning and 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 Planning and 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 D (documents referred to) and Appendix E (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.

NOTE: 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.

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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.

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SUMMARY

The 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: Reporting evidence of compliance.

APPENDIX D: Documents referred to.

APPENDIX E: Standards referred to.

NOTICE OF ENERGY PERFORMANCE

Bye-lawof the Building Bye-laws requires that when a new dwelling is created by building work or by a material change of use the person carrying out the work must calculate the energy performance of the dwelling and give notice of it to the department. Bye-law requires a notice of the energy rating to be given to the owner at completion of the work.

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THE REQUIREMENTS

- 1.1 This technical guidance document which takes effect on, deals with the **energy efficiency requirements** in 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

The Requirement

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 published by the Department 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 **dwelling** (the Dwelling Energy Rate, **DER**) must not be greater than the Target Energy Rate (**TER**). Additionally, the

calculated Dwelling Fabric Energy Efficiency (**DFEE**) rate must not be greater than the Target Fabric Energy Efficiency (**TFEE**) rate. The **TER/DER** and **TFEE/DFEE** rate calculations are determined using the procedures set out in paragraphs 2.7 to 2.24.

NOTE: Criterion 1 is a Bye-law and is therefore mandatory, whereas the limits for 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 2.25 to 2.30.

NOTE: 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:** the **dwelling** should have appropriate passive control measures to limit the effect of heat gains on indoor temperatures in summer, irrespective of whether the **dwelling** has mechanical cooling. The guidance given in paragraphs 2.31 to 2.34 of the Technical Guidance Document provides a way of demonstrating reasonable provision.

*NOTE: The purpose is to limit solar gains and heat gains from circulation pipes to reasonable levels during the summer period, in order to reduce the need for, or the installed capacity of, air-conditioning systems. Criterion 3 should be satisfied even if the **dwelling** is air-conditioned.*

- 1.7 **Criterion 4:** the performance of the **dwelling**, as built, should be consistent with the **DER** and **DFEE** rate. Use the guidance in Section 3 to demonstrate that this criterion has been met.
- 1.8 **Criterion 5:** the necessary provisions for enabling energy-efficient operation of the **dwelling** should be put in place. One way to achieve this is to follow the guidance in Section 4.

DESIGN STANDARDS

- 2.1 The energy efficiency requirements in Part 3 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 new building is a dwelling, its fabric energy efficiency rate, once the dwelling is constructed, shall 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 energy 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 building is constructed.
- 2) The person carrying out the work shall 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.

TARGET ENERGY RATE (TER) AND TARGET FABRIC ENERGY EFFICIENCY (TFEE) RATE

- 2.2 The Target Energy Rate (**TER**) and Target Fabric Energy Efficiency (**TFEE**) rate are the minimum energy performance standards for a newly constructed **dwelling** required to satisfy Bye-law 17B. The **TER** is expressed as the total delivered energy in kilowatt-hours per square metre of floor area per year. The **TFEE** rate is expressed as the amount of energy demand for space heating and cooling in units of kilowatt-hours per square metre of floor area per year. The results are based on the provision and standardised use of specific **fixed building services** when assessed using an approved calculation tool.
- 2.3 The approved methodology for calculating the performance of a new **dwelling** is the UK Government's Standard Assessment Procedure for the Energy Rating of **Dwellings** (SAP) 2012. The **TER** and **TFEE** rate for individual **dwellings** must be calculated using a SAP calculation tool approved by the Department.

*Note: A summary of the Part 11 2016 reference **dwelling** is published at Table 3 in this technical guidance document with the further detail in SAP 2012. If the actual **dwelling** is constructed entirely to the reference **dwelling** specifications it will meet the **TER** and **TFEE** targets and the*

limiting values for individual fabric elements and building services. Developers are, however, free to vary the specification, provided the same overall energy efficiency performance is achieved or improved.

2.4 The **TER** is calculated in two stages:

- a) First calculate the energy requirements for a reference **dwelling** of the same size and shape as the actual **dwelling** and which is constructed according to the reference values set out in Table 3 and SAP 2012. No values may be varied from these reference values when establishing the **TER**. The approved calculation tool will report the energy requirements (using SAP 2012) arising from:
 - i. The provision of space heating and hot water, E_H
 - ii. The use of pumps and fans, E_{PF}
 - iii. The use of internal lighting, E_L
- b) Second, calculate the **TER** using the following formula:

$$TER_{2016} = E_H + E_{PF} + E_L$$

2.5 The **TFEE** rate is calculated by determining the fabric energy efficiency from a reference **dwelling** of the same size and shape as the actual **dwelling** and which is constructed according to the reference values given in Table 3. This fabric energy efficiency is then multiplied by 1.15 to give the **TFEE** rate.

BUILDINGS CONTAINING MULTIPLE DWELLINGS

2.6 For a building that contains more than one **dwelling** (such as a terrace of houses or an apartment block), an average **TER** and/or **TFEE** rate can be calculated. The average **TER** and/or **TFEE** rate is the floor-area-weighted average of the **TERs** and/or **TFEE** rates for all the **dwelling**s in the building, calculated according to the following formula:

$$\frac{\{(TER_1 \times \text{Floor area}_1) + (TER_2 \times \text{Floor area}_2) + (TER_3 \times \text{Floor area}_3) + \dots\}}{\text{Floor area}_1 + \text{Floor area}_2 + \text{Floor area}_3 + \dots}$$

The average **TFEE** rate is calculated according to an identical formula, replacing **TER** with **TFEE** rate.

An average **TER** and/or **TFEE** rate can be calculated across multiple **dwelling**s in the same building but cannot be calculated across separate multiple buildings on the same site.

Criterion 1 – Achieving the TER and TFE Rate

2.7 Bye-law 17B states that:

Energy Performance Rates for New Buildings

17B(2) The energy performance rate of the building, once constructed, shall not exceed the rate of the energy performance for the building specified in the relevant technical guidance document.

Fabric Energy Efficiency Rates for New Dwellings.

17B(3) If the building is a dwelling, its fabric energy efficiency rate, once constructed, shall not exceed the fabric efficiency rates for the building specified in the relevant technical guidance document.

CALCULATING THE ENERGY RATE AND FABRIC ENERGY EFFICIENCY PERFORMANCE OF THE ACTUAL DWELLING

2.8 To comply with Bye-law 17B, the Dwelling Energy Rate (**DER**) and the Dwelling Fabric Energy Efficiency (**DFEE**) rate must be no worse than the **TER** and **TFEE** rate calculated as set out in paragraphs 2.2 to 2.6. The final **DER** and **DFEE** rate calculation produced in accordance with Bye-law 17H (see paragraph 2.11 below) must be based on the building as constructed, incorporating:

- a) any changes to the list of specifications that have been made during construction; and
- b) the **assessed air permeability**. The **assessed air permeability** is determined as follows:
 - i. where the **dwelling** has been pressure tested, the **assessed air permeability** is the measured **air permeability**;
 - ii. where the **dwelling** has not been pressure tested, the **assessed air permeability** is the average test result obtained from other **dwellings** of the same **dwelling type** on the development, increased by $+2.0 \text{ m}^3/(\text{h.m}^2)$ at 50 Pa;
 - iii. on small developments (see paragraph 3.22) where the builder has opted to avoid testing, the **assessed air permeability** is $15 \text{ m}^3/(\text{h.m}^2)$ at 50 Pa.

*NOTE: The safety margin in sub-paragraph (ii) is approximately one standard deviation, derived from analysing a large sample of data from post-2006 **dwellings** in the UK. For **dwellings** that will not be pressure tested, the **design air permeability** should be a maximum of 8.0*

$m^3/(h.m^2)$ at 50 Pa, so that the **assessed air permeability** (the average of other test results, plus $2.0 m^3/(h.m^2)$ at 50 Pa) is less than the limiting value of $10 m^3/(h.m^2)$ at 50 Pa.

If the design of a **dwelling** aims to achieve a low **design air permeability** but the **dwelling** is not pressure tested, the margin added under subparagraph (ii) will have a significant impact on the calculated **DER** and **DFEE** rate. In such cases, the builder should consider testing the **dwelling** so that the measured permeability can be included in the calculation.

ENERGY AND FABRIC ENERGY EFFICIENCY RATE CALCULATIONS

2.9. Bye-law 17H states that:

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 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 AND FABRIC ENERGY EFFICIENCY RATE CALCULATIONS AT DESIGN STAGE

2.10 Bye-law 17H requires that, the **DER** and the **DFEE** rate of the **dwelling** must be calculated at the design stage, to demonstrate that the **DER** and the **DFEE** rate are not greater than the **TER** and the **TFEE** rate. The designer must give this design-based calculation to the department, along with a list of specifications used in calculating the **DER** and **DFEE** rate.

NOTE: The department has published software for the purpose of producing the design-stage calculation and list of specifications.

ENERGY AND FABRIC ENERGY EFFICIENCY RATE CALCULATION WHEN WORK IS COMPLETE

2.11 In accordance with Bye-law 17H, the Department must be notified of the **TER** and **DER**, the **DFEE** rate and **TFEE** rate for the **dwelling** as constructed, no later than 5 days after the work is complete. A list of any changes to the design-stage list of specifications must be also be submitted to the Department.

*NOTE: Information to support the values used in the **DER** and **DFEE** rate calculation and the list of specifications will normally 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. For example, for a boiler, details of the model reference and fuel type is sufficient evidence to allow the claimed performance to be checked against the Products Characteristics Database. Evidence that demonstrates that the **dwelling** as designed satisfies the requirements of criteria 2 and 3 may also be required.*

SECONDARY HEATING

2.12 A secondary heating appliance may meet part of the demand for space heating. When calculating the **DER**, the fraction provided by the secondary heating system must be as defined by SAP 2012 for the particular combination of main heating system and secondary heating appliance. Refer to the following when calculating the **DER**:

- a) Where a secondary heating appliance is fitted, the efficiency of the actual appliance with its appropriate fuel must be used in the calculation of the **DER**.
- b) Where a chimney or flue is provided but no appliance is installed, the presence of the following appliances must be assumed when calculating the **DER**:
 - i. if a gas point is located adjacent to the hearth, a decorative fuel-effect gas fire open to the chimney or flue with an efficiency of 20 per cent;
 - ii. if there is no gas point, an open fire in grate for burning multi-fuel with an efficiency of 37 per cent.
- c) Otherwise it must be assumed that the secondary heating system has the same efficiency as the main heating system and is served by the same fuel – i.e. the equivalent of having no secondary heating system.

INTERNAL LIGHTING

2.13 In all cases, when calculating the **DER**, allow for the proportion of low-energy lamps installed in the fixed lighting locations.

*NOTE: Low-energy lighting provision is therefore tradable. The minimum amount that would be reasonable provision in the actual **dwelling** is given in the Domestic Building Services Compliance Guide.*

BUILDINGS CONTAINING MULTIPLE DWELLINGS

- 2.14 A building that contains more than one **dwelling** (such as a terrace of houses or an apartment block) complies with Bye-law 17B if:
- a) **either** every individual **dwelling** has a **DER** that is no greater than the individual **dwelling's** corresponding **TER**;
 - b) **or** the average **DER** for the whole building is no greater than the average **TER**.

The average **DER** is the floor-area-weighted average of the individual **DERs** for all the **dwelling**s in the building, and is calculated in the same way as the average **TER** (see paragraph 2.6).

An average **DER** cannot be calculated across separate multiple buildings on a site.

*NOTE: When an average **DER** is calculated, it is still necessary to provide information for each individual **dwelling**, as required by Bye-law 17E.*

- 2.15 A building that contains more than one **dwelling** (such as a terrace of houses or an apartment block) complies with Bye-law 17B if:

- a) **either** every individual **dwelling** has a **DFEE** rate that is no greater than the individual **dwelling's** corresponding **TFEE** rate;
- b) **or** the average **DFEE** rate for the whole building is no greater than the average **TFEE** rate.

The average **DFEE** rate is the floor-area-weighted average of the individual **DFEE** rates for all the **dwelling**s in the building, and is calculated in the same way as the average **TFEE** rate (see paragraph 2.6).

An average **DFEE** rate cannot be calculated across separate multiple buildings on a site.

*NOTE: When an average **DFEE** rate is calculated, it is still necessary to provide information for each individual **dwelling**, as required by Bye-law 17E.*

ACHIEVING THE TER AND TFEE RATE

- 2.16 Provided the **dwelling** satisfies the limits on design flexibility set out in Criterion 2, the designer can achieve the **TER** by using fabric energy efficiency, system measures and integrating low and zero carbon technologies in whatever mix is appropriate.
- 2.17 Similarly, provided the **dwelling** satisfies the limits on design flexibility set out in Criterion 2, the designer can achieve the **TFEE** rate by using fabric energy efficiency measures in whatever mix is appropriate.
- 2.18 The approved compliance tools include algorithms that enable the designer to assess the role that low and zero carbon technologies can play in achieving the **TER**.
- 2.19 Where a **dwelling** is connected to a community energy system, the annual percentage heat supplied from each heat source should be the same for each newly connected **dwelling**. The submission should demonstrate that the capacity of the community scheme is sufficient to provide the percentage that is assumed. The predicted effect of all **dwelling**s proposed to be newly connected to the system in the first 12 months of operation of the system can be considered in the calculation of the percentage of heat supplied so that the increased operation of any marginal plant (e.g. boilers) is properly accounted for.
- 2.20 In order to facilitate incorporation of improvements in system efficiencies and the integration with low and zero carbon technologies, the designer should:
 - a) consider heating system designs that use low distribution temperatures; **and**

- b) where multiple systems serve the same end use, organise the control strategies such that priority is given to the least carbon-intensive option; **and**

NOTE: For example, where a solar hot water system is available, use controls that make best use of the available solar energy.

- c) consider making the **dwelling** easily adaptable by facilitating the integration of additional low and zero carbon technologies at a later date. Providing appropriate facilities at the construction stage can make subsequent enhancements much easier and cheaper, e.g. providing capped off connections that can link into a planned community heating scheme.

SPECIAL CONSIDERATIONS

- 2.21 The following paragraphs describe some 'special areas' that fall outside the normal five criteria, and give guidance on how to demonstrate reasonable provision for the conservation of fuel and power.

COMMON AREAS IN BUILDINGS WITH MULTIPLE DWELLINGS

- 2.22 The common areas of buildings containing more than one **dwelling** are not classified as **dwelling**s and therefore fall outside the scope of the five criteria outlined above. For such areas, reasonable provision is:
- a) if they are heated, to follow the guidance in Technical Guidance Document 11.2A; **or**
- b) if they are unheated, to provide individual fabric elements that meet the fabric standards set out in paragraphs 2.25 to 2.28.

CONSERVATORIES AND PORCHES

- 2.23 Where conservatories and porches are installed at the same time as the construction of a new **dwelling**, and adequate thermal separation (see Tables 1 and 3) is provided between the **dwelling** and the **conservatory** or porch, and the **dwelling's** heating system is not extended into the **conservatory** or porch, follow the guidance in Technical Guidance Document 11.1B. Where conservatories and porches are installed at the same time as the construction of a new **dwelling**, and no, or inadequate, thermal separation is included between the **dwelling** and the **conservatory** or porch, or the **dwelling's** heating system is extended into the **conservatory** or porch, follow the guidance in this Technical Guidance Document including them in **TER/DER** and **TFEE/DFEE** rate calculations.

SWIMMING POOL BASINS

- 2.24 In terms of Criterion 1, the **dwelling** 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.

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Criterion 2 – Limits On Design Flexibility

- 2.25 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.
- 2.26 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.

*NOTE: In order to satisfy the **TER** and the **TFEE** rate, the building specification needs to be considerably better than the stated limiting values in many aspects of the design.*

*NOTE: Achieving the **TFEE** rate could be dependent on very good performance of one specific feature of the fabric design with poorer fabric performance elsewhere. If this key element of fabric design was to fail, or perform less well than expected, this would have a significant impact on performance. Continuing to have limiting fabric standards in Criterion 2 reduces such an impact.*

LIMITING FABRIC STANDARDS

- 2.27 Table 1 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** and the **TFEE** rate, a significantly better fabric performance than that set out in Table 1 is likely to be required.
- 2.28 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 element or unit (e.g. in the case of a window, the combined performance of the glazing and the frame).

In the case of windows, the U-value can be taken as that 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.

NOTE: 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.

2.29 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 1 Limiting Fabric Parameters	
Roof	0.20W/(m ² K)
Wall	0.30W/(m ² K)
Floor	0.25W/(m ² K)
Party wall	0.20W/(m ² K)
Swimming pool basin ¹	0.25W/(m ² K)
Windows, roof windows, glazed roof-lights ² , curtain walling and pedestrian doors	2.00W/(m ² K)
Air permeability	10.0m ³ /(h.m ²) at 50 Pa
Notes:	
<p>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.</p> <p>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)</p>	

LIMITING SYSTEM EFFICIENCIES

2.30 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 Domestic Building Services Compliance Guide. If a 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.

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

Criterion 3 – Limiting The Effects Of Heat Gains In Summer

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

LIMITING THE EFFECTS OF SOLAR GAINS IN SUMMER

2.33 Solar gains are beneficial in winter to offset demand for heating, but can contribute to overheating in the summer. The effects of solar gain in summer can be limited by an appropriate combination of window size and orientation, solar protection through shading and other solar control measures, ventilation (day and night) and high thermal capacity. If ventilation is provided using a balanced mechanical system, consider providing a summer bypass function to use during warm weather (or allow the **dwelling** to operate via natural ventilation) so that the ventilation is more effective in reducing overheating.

2.34 The JSAP tool provides information enabling designers to check whether solar gains are excessive. Reasonable provision is achieved if the SAP assessment indicates that the **dwelling** does not have a high risk of high internal temperatures. This assessment should be done regardless of whether or not the **dwelling** has mechanical cooling. If the **dwelling** has mechanical cooling, the assessment should be based on the design without the cooling system operating, but with an appropriate assumption about effective air-change rate through openable windows.

NOTE: Designers may want to exceed the requirements in the current Building Bye-laws to consider the impacts of future global warming on the risks of higher internal temperatures occurring more often. CIBSE TM 36 Climate change and the indoor environment gives guidance on this issue.

2.35 When seeking to limit solar gains, consideration should be given to the provision of adequate levels of daylight. BS 8206-2 Code of practice for daylighting gives guidance on maintaining adequate levels of daylight.

*NOTE: The Building Bye-laws do not specify minimum daylight requirements. Reducing the window area has conflicting impacts on the predicted energy use: reduced solar gain but increased use of electric lighting. As a general guide, if the area of glazing is much less than 20 per cent of the total floor area, some parts of the **dwelling** may experience poor levels of daylight, resulting in increased use of electric lighting.*

HEAT LOSSES AND GAINS FROM CIRCULATION PIPES

2.36 Reasonable provision should be made to limit heat losses from pipes as set out in the Domestic Building Services Compliance Guide. This includes insulating primary circulation pipes for domestic hot water services throughout their length.

NOTE: In the case of apartment blocks, insulating primary circulation pipes for space heating as well as for domestic hot water services within communal spaces can help to limit potentially unwanted heat gains and overheating of the space.

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QUALITY OF CONSTRUCTION & COMMISSIONING

Criterion 4 – Building Performance Consistent With DER And DFEE Rate

- 3.1 **Dwellings** should be constructed and equipped so that performance is consistent with the calculated **DER** and **DFEE** rate. As indicated in paragraph 2.11, a final calculation of the **DER** and **DFEE** rate is required to take account of any changes in performance between design and construction, and to demonstrate that the building, as constructed, meets the **TER** and **TFEE** rate as required by Bye-law 17B. The following paragraphs in this section set out what in normal circumstances is reasonable provision to ensure that the performance of the building is consistent with the **DER** and **DFEE** rate.
- 3.2 In accordance with Part 11 and Bye-law 7, the building fabric should be constructed to a reasonable standard so that:
- a) the insulation is reasonably continuous over the whole building envelope; **and**
 - b) the **air permeability** is within reasonable limits.

PARTY WALLS AND OTHER THERMAL BYPASSES

- 3.3 Contrary to previous assumptions, party cavity walls may not be zero heat loss walls; this is because air flow in the cavity provides a heat-loss mechanism.

NOTE: Where outside air flows into the party wall cavity, a cold zone is created which causes heat loss through the wall sections on either side. The extent of air flow and heat changes depends on external conditions such as wind and temperature, and also on the effect caused by the warmed air rising in the cavity to be replaced by cooler air drawn in from outside. The air movements involved can be significant and, if no steps are taken to restrict flows, the resulting heat losses can be large.

- 3.4 Heat loss can be reduced by restricting air movement through the cavity, which can be achieved by fully filling the cavity and/or by effective sealing around the perimeter. Further guidance is available at www.buildingcontrolalliance.org.

The extent to which heat loss can be reduced depends on the detailed design and the quality of construction. In the absence of any specific independent scientific field evidence, reasonable provision is to adopt the guidance on U-values in paragraph 3.5.

NOTE: Fully filling the cavity may affect sound transmission through party walls. Developers who plan to fill a party wall cavity must satisfy the Department that the requirements of Part 9 (Sound) of Schedule 2 to the Building Bye-laws will be satisfied through specific site testing.

- 3.5 When calculating the **DER** and **DFEE** rate for a **dwelling**, a party wall U-value for the type of construction adopted, as set out in Table 2, should be applied.
- 3.6 When applying the U-values in Table 2, it is important that if edge sealing is adopted, either on its own or in conjunction with a fully filled cavity, the seal is effective in restricting air flow and is aligned with the thermal envelope. Although effective sealing may be part of a cavity barrier provided in order to comply with Part 2 (Fire) of Schedule 2 to the Building Bye-laws, a cavity barrier on its own may not be effective in restricting air flow. In order to claim a reduced U-value (0.2 or 0.0), it is necessary to demonstrate that the design adopted is likely to be robust under normal site conditions.

It is also important that the sealing system is applied in such a way as to be in line with the thermal envelope. Any solution to reducing party wall heat loss must take into account all the requirements in Schedule 2 to the Building Bye-laws, but particular attention should be given to the requirements of Part 9 (Sound).

NOTE: For example, in a room-in-roof design, the insulation layer may follow the sloping roof sections to a horizontal ceiling then continue at ceiling level. In such a case it is important that the party wall cavity seal follows the line of the insulation in the slope and horizontal ceiling sections (although for the purposes of Part 2 (Fire), it may be necessary to ensure that the fire cavity barrier follows the slope to the ridge). In the case of flats, the sealing system should follow the line of party floors and other party structures as well as the main thermal envelope.

- 3.7 In considering heat losses via party walls, it is important to remember that wherever the wall penetrates an insulation layer, such as when the blockwork of a masonry party wall penetrates insulation at ceiling level, a thermal bridge is likely to exist – even when the party wall U-value is zero. Any bridging at the party wall should be evaluated and then taken into account, along with other thermal bridges. It is important also to be satisfied that any solution to the party wall bypass does not contravene other parts of the bye-laws, in particular Part 9 (Sound).

Table 2 U-values for party walls	
Party wall construction	U-value W/(m ² k)
Solid	0.0
Unfilled cavity with no effective edge sealing	0.5
Unfilled cavity with effective edge sealing around all exposed edges and in line with insulation abutting elements	0.2
A fully filled cavity with effective sealing at all exposed edges and in line with insulation layers in abutting elements	0.0

- 3.8 The party wall is a particular case of the more general thermal bypass problem that occurs if the air barrier and the insulation layer are not contiguous and the cavity between them is subject to air movement. To avoid the consequent reduction in thermal performance, either the insulation layer should be contiguous with the air barrier at all points in the building envelope, or the space between the air barrier and insulation layer should be filled with solid material, such as in a masonry wall.

THERMAL BRIDGES

- 3.9 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.

- 3.10 Reasonable provision would be to:

- a) Adopt approved design details as set out in the UK DCLG Approved Construction Details or those that are formally recognised by the DCLG. The calculated linear thermal transmittance values can be used directly in the **DER** and **DFEE** rate calculations; **or**
- b) Use construction joint details that have been calculated by a person with suitable expertise and experience following the guidance set out in BRE Report BR 497 Conventions for calculating linear thermal transmittance and temperature factors. The linear thermal transmittance values can be used directly in the **DER** and **DFEE** rate calculations. Reasonable provision for the temperature factors is that they should achieve a performance no worse than that 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;
or

NOTE: 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.

- c) Use the linear thermal transmittance values in the 'default' column of Table K1 in SAP 2012 directly in the **DER** and **DFEE** rate calculations;
or
 - d) Use a conservative default γ -value of $0.15 \text{ W}/(\text{m}^2\text{K})$, rather than linear transmittance values for each construction joint, in the **DER** and **DFEE** rate calculation.
- 3.11 The alternative approaches for using linear transmittance values in paragraphs 3.10 (a), (b) and (c) are not mutually exclusive. For example, a builder could use approved design details for the majority of the junctions, but use a calculated bespoke detail for the window

head. Furthermore, where design details via paragraph 3.10 (a) or (b) are adopted for some junctions but not for all junctions, the linear thermal transmittance values in the 'default' column of Table K1 in SAP 2012 should be used for the other junctions.

*NOTE: The effect of using linear transmittance values that are poorer than those in the reference **dwelling** specification should be compensated for by improved standards elsewhere in the **dwelling** design. When default linear transmittance values from Table K1 in SAP 2012 are used for the majority of the construction joints in a **dwelling**, or when the conservative default g -value of $0.15\text{W}/(\text{m}^2\text{K})$ is used, the builder would need to significantly improve upon the reference **dwelling** values elsewhere in the design to meet the **TER** and **TFEE** rate.*

3.12 When adopting the approaches in paragraphs 3.10 (a) and (b), the builder should demonstrate to the Department that an appropriate system of site inspection is in place to give confidence that the construction procedures achieve the required standard of consistency.

AIR PERMEABILITY AND PRESSURE TESTING

3.13 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.

- 3.14 The approved procedure for pressure testing is given in the Air Tightness Testing and Measurement Association (ATTMA) publication Measuring **air permeability** of building envelopes (**dwelling**s) 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.
- 3.15 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.
- 3.16 The approved circumstances under which the Department requires pressure testing to be carried out are set out in paragraphs 3.17 to 3.22.
- 3.17 On each development, an air pressure test should be carried out on three units of each **dwelling type** or 50 per cent of all instances of that **dwelling type**, whichever is the less. For the purposes of this technical guidance document, a block of flats should be treated as a separate development, irrespective of the number of blocks on the site.

*NOTE: Larger developments may include many **dwelling types**. Multiple units of each type should be tested to confirm the robustness of the designs and the construction procedures.*

- 3.18 The specific **dwelling**s making up the test sample should be selected by the Department in consultation with the pressure tester. **Dwellings** should be selected so that about half of the scheduled tests for each **dwelling type** are carried out during construction of the first 25 per cent of each **dwelling type**. The results of all tests on **dwelling**s in the sample should be reported to the Department, including any test failures (see paragraphs 3.19 to 3.21).

*NOTE: The aim is to enable lessons to be learned and adjustments to the design and/or site procedures to be made before the majority of the **dwelling**s are built.*

SHOWING COMPLIANCE WITH BYE-LAW 17F, AND THE CONSEQUENCES OF FAILING A PRESSURE TEST

- 3.19 The **dwelling** is shown to comply with the requirements if:
- 1) the measured **air permeability** is not worse than the limit value of $10 \text{ m}^3/(\text{h}\cdot\text{m}^2)$ at 50 Pa; **and**
 - 2) the **DER** and the **DFEE** rate calculated using the measured **air permeability** are not worse than the **TER** and the **TFEE** rate.

*NOTE: If a low (i.e. better) **design air permeability** is used in order to achieve a performance that is better than the **TER** and the **TTEE** rate, the design will not fail to comply with the **energy efficiency requirements** if the pressure test achieves the limit value and the **TER** and the **TTEE** rate are achieved.*

- 3.20 If satisfactory performance is not achieved, then remedial measures should be carried out on the **dwelling** and new tests carried out until the **dwelling** achieves the criteria set out in paragraph 3.19. In addition, a further **dwelling** of the same **dwelling type** should be tested, thereby increasing the overall sample size.
- 3.21 When a **dwelling** fails the initial pressure test, other **dwellings** of the same **dwelling type** that have not been tested should be examined and, where appropriate, remedial measures applied.

ALTERNATIVE TO PRESSURE TESTING ON SMALL DEVELOPMENTS

- 3.22 On development sites where no more than two **dwellings** are to be erected, reasonable provision is to:
- demonstrate that during the preceding 12-month period, a **dwelling** of the same **dwelling type** constructed by the same builder was **pressure** tested according to the procedures given in paragraphs 3.13 to 3.18 and achieved the **design air permeability**; or
 - use a value of $15 \text{ m}^3/(\text{h}\cdot\text{m}^2)$ at 50 Pa for the **air permeability** when calculating the **DER** and the **DFEE** rate, which then avoids the need for pressure testing.

*NOTE: The effect of using this cautious value in option b should be compensated for by improved standards elsewhere in the **dwelling** design.*

COMMISSIONING OF HEATING AND HOT WATER SYSTEMS

- 3.23 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.

3.24 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/DER** and **TFFEE/ DFFEE** rate calculations so that the Department can check that the **commissioning** is being done as the work proceeds.

*NOTE: 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.*

3.25 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**.

3.26 Where **commissioning** is carried out, it should be done in accordance with procedures approved by the Minister:

- a) For heating and hot water systems, the approved procedures are set out in the Domestic Building Services Compliance Guide.
 - b) For ventilation systems, the approved procedure is set out in the Domestic Ventilation Compliance Guide.
- 3.27 **Commissioning** is often carried out by the person who installs the system. In other cases, it may be carried out by a subcontractor or by a specialist firm. It is important that whoever carries it out follows the relevant approved procedure in doing so.
- 3.28 Notice of completion of **commissioning** should normally be given to the Department within five days of the completion of the **commissioning** work. In cases where work is carried out by a person registered with a competent person scheme, it must be given within 30 days.
- 3.29 Until the Department receives the **commissioning** notice, it may not consider it appropriate to give a completion certificate.

PROVIDING INFORMATION**Criterion 5 – Provisions For Energy-Efficient Operation Of The Dwelling.**

- 4.1 In accordance with Bye-law 17E the owner of the **dwelling** 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.

- 4.2 A way of complying with the requirement is to provide a suitable set of operating and maintenance instructions aimed at assisting the occupiers of the **dwelling** achieve the expected level of energy efficiency. The documentation should be specific to the **dwelling**, and be in a durable format that can be kept and referred to over the service life of the various systems and components. The documentation should include relevant information in an easily understood format.

- 4.3 Without prejudice to the need to comply with health and safety requirements, this should:
- a) Explain the essential design principles (insulation, materials etc.) and the key features, with floor plans showing the location of the main heating and ventilation components in the **dwelling**.
 - b) Explain how to operate, control and maintain the following systems:
 - i. space heating system;
 - ii. hot water heating system;
 - iii. ventilation system;
 - iv. any other technology which has been included in the dwelling, e.g. solar panels or other low and zero carbon technology, or a technology for which SAP Appendix Q has been utilised.

- c) Signpost other important documentation which should include:
- i. appliance manuals;
 - ii. a copy of the **TER/DER** and **TFEE/DFEE** rate calculations;
 - iii. a copy of the 'as-built' **energy performance certificate**, which will inform the occupier as to predicted the energy performance of the **dwelling**.

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MODEL DESIGNS

- 5.1 The **TER** and **TFEE** rate are based on a **dwelling** of the same size and shape as the actual **dwelling**, constructed to a reference building specification. If the actual **dwelling** is constructed entirely to this specification it will meet the **TER** and better the **TFEE** rate and therefore pass Criterion 1. Table 3 provides a summary of the reference building specification.
- 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** and **TFEE** rate in each case, provided that this specification meets all other provisions within this technical guidance document, in particular the limiting fabric parameters in Table 1.
- 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 2.8 to 2.15.

Table 3 Reference Dwelling Values	
Element or system	Value
Climate data	Jersey
Size and shape	Same as actual dwelling
Opening areas (windows, roof windows and doors)	Same as actual dwelling up to a maximum for total area of openings of 25% of total floor area. If the total area of openings in the actual dwelling exceeds 25% of the total floor area, reduce to 25% as follows: 1) Include all opaque and semi-glazed doors with the same areas as the actual dwelling (excluding any doors not in exposed elements, e.g. entrance door to a flat from a heated corridor). 2) Reduce area of all windows and roof windows by a factor equal to [25% of total floor area less area of doors included in 1)] divided by [total area of windows and roof windows in actual dwelling].
External walls including semi-exposed walls	$U = 0.18 \text{ W/m}^2\text{K}$
Party walls	$U = 0$
Floors	$U = 0.13 \text{ W/m}^2\text{K}$
Roofs	$U = 0.13 \text{ W/m}^2\text{K}$

Table 3 Reference Dwelling Values	
Element or system	Value
Opaque door (<30% glazed area)	$U = 1.0 \text{ W/m}^2\text{K}$
Semi-glazed door (30%-60% glazed area)	$U = 1.2 \text{ W/m}^2\text{K}$
Windows and glazed doors with >60% glazed area	$U = 1.4 \text{ W/m}^2\text{K}$ Frame factor = 0.7 Solar energy transmittance = 0.63 Light transmittance = 0.80 Orientation same as actual dwelling Overshading same as actual dwelling
Roof windows	$U = 1.4 \text{ W/m}^2\text{K}$ (Adjustment factor of +0.3 $\text{W/m}^2\text{K}$ applied to roof window as described below Table 6e of SAP 2012; resultant U value = 1.7 $\text{W/m}^2\text{K}$) Other parameters as for windows
Curtain wall	Curtain walling to be treated as standard glazing and opaque wall with the same areas as the actual dwelling. When the total opening area exceeds 25% of floor area the glazed area to be reduced to 25% as for opening areas above. U -value of opaque wall = 0.18 $\text{W/m}^2\text{K}$ U -value of glazing = 1.5 $\text{W/m}^2\text{K}$ (which includes an allowance of 0.1 for thermal bridging within the curtain wall)
Thermal mass	Medium (250 $\text{kJ/m}^2\text{K}$)
Living area	Same as actual dwelling
Number of sheltered sides	Same as actual dwelling
Allowance for thermal bridging	<ol style="list-style-type: none"> If the thermal bridging in the actual dwelling has been specified by using the default γ-value of 0.15 $\text{W/m}^2\text{K}$, the thermal bridging is defined by $\gamma = 0.05 \text{ W/m}^2\text{K}$. Otherwise the thermal bridging allowance is calculated using the lengths of junctions in the actual dwelling and the ψ values in Table R2 of SAP 2012. <p>Note. Where the area of openings is > 25% of the total floor area the lengths of junctions in the notional dwellings remain the same as the lengths in the actual dwelling, even though window area is reduced as described for 'Opening areas' above.</p>
Ventilation system	Natural ventilation with intermittent extract fans
Air permeability	5 $\text{m}^3/\text{h}\cdot\text{m}^2$ at 50 Pa
Chimneys	None
Open flues	None
Extract fans / passive vents	2 extract fans for total floor area up to 70 m^2 , 3 for total floor area > 70 m^2 and up to 100 m^2 , 4 for total floor area > 100 m^2
Main heating fuel (space and water)	Standard electricity (SAP code 30)

Table 3 Reference Dwelling Values

Element or system	Value
Heating system	Direct electric room heaters, panel convector or radiant heaters (SAP code 691) 100% efficient
Heating system controls	Programmer and appliance thermostats (SAP code 2603)
Hot water system	Electric immersion (SAP code 903) Single immersion No separate time control for space and water heating
Hot water cylinder	If cylinder specified in actual dwelling: volume of cylinder in actual dwelling Otherwise: 150 litres Declared loss factor = $0.85 \times (0.2 + 0.051 V^{2/3})$ kWh/day, where V is the volume of the cylinder in litres
Primary water heating losses	None
Water use limited to 125 litres per person per day	Yes
Secondary space heating	None
Low energy light fittings	100% of fixed outlets
Air conditioning	None

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/m²). 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 **DER** and the **DFEE** rate, and is based on a specific measurement of the **dwelling** concerned or on measurements of other **dwelling**s of the same **dwelling type**.

NOTE: The envelope area of a terraced house includes the party wall(s). The envelope area of a flat in a multiple-storey building includes the floors, walls and ceilings which are shared with adjacent flats.

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.

A **Conservatory** is an extension that 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, that is adequately thermally separated from the building.

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.

DER is the **Dwelling** Energy Rate expressed as kWh/m²/year.

DFEE rate is the **Dwelling** Fabric Energy Efficiency rate expressed as kWh/m²/year.

Dwelling means a self-contained unit designed to accommodate a single household.

*NOTE: Buildings exclusively containing **rooms for residential purposes**, such as nursing homes, student accommodation and similar, are not **dwelling**s, and in such cases, Technical Guidance Document 11.2A applies.*

Dwelling type is the particular group allocated to each **dwelling** on a development to provide the basis for assessing the pressure testing regime.

The allocation of each **dwelling** to a **dwelling type** should be the responsibility of the person carrying out the pressure testing. To be classed as of the same type, **dwelling**s should:

- i. be of the same generic form (i.e. detached, semi-detached, end terrace, mid-terrace, ground-floor flat (including ground-floor maisonette), mid-floor flat, top-floor flat (including top-floor maisonette));
- ii. include the same number of storeys;
- iii. have the same **design air permeability**;
- iv. have similar adjacency to unheated spaces such as stairwells, integral garages etc.
- v. have the same principal construction details;
- vi. have a similar (i.e. ± 1) number of significant penetrations, i.e. for windows, doors, flues / chimneys, supply/exhaust terminals, waste water pipes;
- vii. have envelope areas that do not differ by more than 10 per cent (see **air permeability** for a definition of envelope 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.

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.

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.

TER is the Target Energy Rate expressed as kWh/m²/year.

TFEE is the Target Fabric Energy Efficiency rate expressed as kWh/m²/year.

ABBREVIATIONS

UKAS:	The United Kingdom Accreditation Service
SEDBUK:	Seasonal Efficiency of Domestic Boilers in the UK
TFA:	Total floor area
TMP:	Thermal mass parameter

TYPES OF WORK COVERED BY THIS DOCUMENT

- 1) This technical guidance document gives guidance on what, in ordinary circumstances, may be considered reasonable provision to comply with the energy efficiency requirements of the Building Bye-laws for those erecting new **dwelling**s.

LIVE-WORK UNITS

- 2) If a unit contains both living accommodation and space to be used for commercial purposes (e.g. as a workshop or office), the whole unit 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 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 unit.

*Note: 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**, it does not mean that the building should not be treated as a **dwelling**.*

MIXED-USE DEVELOPMENTS

- 3) When constructing a **dwelling** as part of a larger building that contains other types of accommodation, sometimes called a mixed-use development, use this Technical Guidance Document 11.1A for guidance in relation to each individual **dwelling**. Technical Guidance Document 11.2A gives guidance relating to the non-**dwelling** parts of such buildings, such as heated common areas, and in the case of mixed-use developments, the commercial or retail space.

MATERIAL CHANGES OF USE

- 4) The act of erecting a new **dwelling** is not a material change of use. Technical Guidance Document 11.1B applies where a **dwelling** is being created in an existing building as the result of a material change of use of all or part of the building.

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) Since the data in SAP 2012 and the results it calculates can provide a substantial proportion of the evidence in support of the compliance demonstration, the compliance software tool (JSAP) should be used to produce output reports.
- 3) Two versions of output reports need to be produced: the first at the building application stage to include the **TER/DER** and **TFEE/DFEE** calculation plus supporting list of specifications, and the second after completion to include the as-built **TER/DER** and **TFEE/DFEE** calculation plus any changes to the list of specifications. The first design-stage report and accompanying list of specifications are used by the department to assist checking that what has been designed is actually built.
- 4) 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 (e.g. what is the wall construction that delivers the claimed U-value?).

DOCUMENTS REFERRED TO**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

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

TM 36 Climate change and the indoor environment: impacts and adaptation [2005]. ISBN 978 1 90328 750 7

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

Technical Standard L1 Measuring air permeability of building envelopes (dwellings) [2010].

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

National Planning Policy Framework [2012].

Domestic Building Services Compliance Guide [2013].

Domestic Ventilation Compliance Guide [2010].

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

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

BSRIA**www.bsria.co.uk**

BSRIA BG 8/2009 Model Commissioning Plan.

Department for Energy and Climate Change (DECC)**www.decc.gov.uk**The Government's Standard Assessment Procedure for energy rating of dwellings, SAP 2012. (Available at www.bre.co.uk/sap2012)

STANDARDS REFERRED TO

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

BS 8206-2 Lighting for buildings. Code of practice for daylighting [2008].

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)].

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