Development & Planning Authority

Guernsey Technical Standard

Conservation of fuel and power - Buildings other than dwellings

The Building (Guernsey) Regulations, 2012

L2

L2 Conservation of fuel and power in buildings other than dwellings

2012 edition
With May 2020 amendments

MAIN CHANGES MADE BY THE MAY 2020 AMENDMENTS

1. Changes to the routes of compliance to include electric boilers and an alternative approved methodology route using the latest English approved document L2a and L2b.

2. Text changes have been made to reflect updated 'U' value performance values for new and renovated external elements of a structure.

3. Regulation and guidance are included with respect to post completion air pressure testing, revising the air leakage rate permissible.

4. All standards referenced have been updated to latest editions/revisions.

5. Guidance in relation to the renovation of thermal elements has been added.

6. Annexes A to D have been removed as no longer relevant and remaining ones re indexed.

How this Guernsey Technical Standard L2 differs from the UK Approved Document L2

7. In addition to the different legislative references reflecting Guernsey legislation, the main differences a non resident based applicant should note is that the Thermal Efficiency standards are set at the 2002 UK levels.

8. The Carbon emission factors used in the calculations are relevant for Guernsey, see table 6.

9. The Carbon emission factor for electricity locally is more comparable to other fuels therefore an elemental method of compliance is applicable.

10. The UK Building (Approved Inspectors, etc.) Regulations 2010 are not in force in Guernsey. Therefore approved inspectors are not recognised on the Island and all references have been removed.

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Introduction

What is a Guernsey Technical Standard?

This document has been approved and issued by the Development and Planning Authority to provide practical guidance on ways of complying with requirement L2 and regulation 11 of the Building (Guernsey) Regulations, 2012 (GSI, 2012 No.11) . The Building (Guernsey) Regulations, 2012 are referred to throughout the remainder of this document as 'the Building Regulations'.

The intention of issuing Guernsey Technical Standards is to provide guidance about compliance with specific aspects of the Building Regulations in some of the more common building situations. They include examples of what, in ordinary circumstances, may be reasonable provision for compliance with the relevant requirement(s) of the Building Regulations to which they refer.

If guidance in a Guernsey Technical Standard is followed this may be relied upon as tending to show compliance with the requirement(s) covered by the guidance. Similarly a contravention of the standard may be relied upon as tending to establish a breach of the requirements. However, this is not conclusive, so simply following guidance does not guarantee compliance in an individual case or a failure to follow it meaning that there is necessarily a breach. It is also important to note that there may well be other ways of achieving compliance with the requirements. There is therefore no obligation to adopt any particular solution contained in this Guernsey Technical Standard if you would prefer to meet the relevant requirement in some other way. However, persons intending to carry out building work should always check with Building Control, that their proposals comply with Building Regulations.

The guidance contained in this Guernsey Technical Standard relates only to the particular requirements of the Building Regulations that the document addresses, (see 'Requirements' below). However, building work may be subject to more than one requirement of the Building Regulations and there may be an obligation to carry out work on a material change of use. In such cases the works will also have to comply with any other applicable requirements of the Building Regulations and work may need to be carried out which applies where a material change of use occurs.

This document is one of a series that has been approved and issued for the purpose of providing practical guidance with respect to the requirements of the Building Regulations in particular of regulations 6, 8 and 11 and Schedule 1.

At the back of this document is a list of all the documents that have been approved and issued for this purpose.

How to use this Guernsey Technical Standard

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

a. Texts shown against a yellow background are extracts from the Building Regulations, and set out the legal requirements that relate to compliance with the **conservation of fuel and power** requirements of the Building Regulations. It should be remembered however that, as noted above, building works must comply with all the other applicable provisions of the Building Regulations.

b. Key terms are defined in annex I at the rear of this document.

c. Details of technical publications referred to in the text of this document will be presented in ***italics*** and repeated in standards referred to as an annex at the rear of this document. A reference to a publication is likely to be made for one of two main reasons. The publication may contain additional or more comprehensive technical detail, which it would be impractical to include in full in this Document but which is needed to fully explain ways of meeting the requirements; or it is a source of more general information. The reason for the reference will be indicated in each case. The reference will be to a specified edition of the document. The Guernsey Technical Standard may be amended from time to time to include new references or to refer to revised editions where this aids compliance.

Where you can get further help

If you require clarification of any of the technical guidance or other information set out in this Guernsey Technical Standard and the additional detailed technical references to which it directs you, there are a number of routes through which you can seek further assistance:

- The States of Guernsey website: **www.gov.gg/planning**
- If you are the person undertaking the building work you can seek advice from Building Control Surveyors to help ensure that, when carried out, your work will meet the requirements of the Building Regulations.
- Businesses registered with a competent person self-certification scheme may be able to get technical advice from their scheme operator. A full list of competent persons schemes are included as Schedule 3 of the Building Regulations.
- If your query is of a highly technical nature you may wish to seek the advice of a specialist, or industry technical body, in the area of concern.

Responsibility for compliance

It is important to remember that if you are the person (e.g. designer, builder, installer) carrying out building work to which any requirement of Building Regulations applies you have a responsibility to ensure that the work complies with any such requirement. The building owner or occupier will also have a responsibility for ensuring compliance with Building Regulation requirements and could be served with a compliance notice in cases of non-compliance or with a challenge notice in cases of suspected non-compliance.

General Guidance

Types of work covered by this Guernsey Technical Standard

Building work

Building work, as defined in regulation 5 of the Building (Guernsey) Regulations, 2012, includes the erection or extension of a building, the provision or extension of a controlled service or fitting, and the material alteration of a building or a controlled service or fitting. In addition, the Building Regulations may apply in cases where the purposes for which, or the manner or circumstances in which, a building or part of a building is used change in a way that constitutes a material change of use.

Under regulation 6 of the Building Regulations 2012, building work must be carried out in such a way that, on completion of work,

i. the work complies with the applicable Parts of Schedule 1 of the Building Regulations,

ii. in the case of an extension or material alteration of a building, or the provision, extension or material alteration of a controlled service or fitting, it complies with the applicable Parts of Schedule 1 to the Building Regulations and also does so as satisfactorily as it did before the work was carried out.

Work described in Part L2 concerns the conservation of fuel and power in buildings other than dwellings. Work associated with conservation of fuel and power in buildings other than dwellings covered in these sections may be subject to other relevant Parts of the Building Regulations.

Material change of use

A material change of use occurs in specified circumstances in which a building or part of a building that was previously used for one purpose will be used in future for another or is converted to a building of another kind. Where there is a material change of use, the Building Regulations set requirements that must be met before the building can be used for its new purpose.

Regulation 7 of the Building (Guernsey) Regulations, 2012 specifies the following circumstances as material changes of use:

– a building is used as a dwelling where previously it was not,

– a building contains a flat where previously it did not,

– a building is used as an institution where previously it was not,

– a building is used as a public building where previously it was not,

– a building is not described in Classes I to V or VI of Schedule 2, where previously it was,

– a building contains a room for residential purposes where previously it did not,

– a building contains an office where previously it did not,

– a building is used as an hotel or guest house, where previously it was not,

– a building is an industrial building, where previously it was not,

– a building contains a shop, where previously it did not,

– a building is used for the sale of food or drink, to the public in the course of a business and for consumption in that building and where there is a maximum capacity of 15 or more persons seated or standing, where previously it was not so used,

– the building, which contains at least one room for residential purposes, contains a greater or lesser number of such rooms than it did previously,

– the building, which contains at least one dwelling, contains a greater or lesser number of dwellings than it did previously.

Part L2 will apply to the majority of the material changes of use mentioned above. This means that whenever such changes occur the building must be brought up to the standards required by Part L2.

Protected Buildings and Monuments

The types of building works covered by this Guernsey Technical Standard may include work on historic buildings. Historic buildings include:

a. a building appearing on the protected buildings listing

b. a building or other structure appearing on the protected monument listing

When exercising its functions under The Land Planning and Development Law, the States has duties under s30(1), 34, 35 and 38(1) of that Law, to secure so far as possible that monuments are protected and preserved, that the special characteristics of protected buildings are preserved and to pay special attention to the desirability of preserving and enhancing the character and appearance of a conservation area. Building Control will need to comply with these duties when considering any decisions in relation to such buildings or buildings in such areas.

Special considerations may apply if the building on which the work is to be carried out has special historic, architectural, traditional or other interest, and compliance with the **conservation of fuel and power** requirements would unacceptably alter the fabric, character or appearance of the building or parts of it.

When undertaking work on or in connection with buildings with special historic, architectural, traditional or other interest, the aim should be to improve the **conservation of fuel and power** where and to the extent that it is possible provided that the work does not prejudice the fabric, character or appearance of the host building or increase the long-term deterioration to the building's fabric or fittings.

In arriving at a balance between historic building conservation and the **conservation of fuel and power** requirements advice should be sought from the historic building adviser.

Note: Any building which is a protected monument listed under Section 29 of The Land Planning and Development (Guernsey) Law 2005 is exempt from most Building Regulations requirements including those in Part L2, (See regulation 13 and class V of Schedule 2 to the Building Regulations) unless the proposed works constitute a material change of use.

Notification of work

In almost all cases of new building work it will be necessary to notify Building Control in advance of any work starting. The exception to this: where work is carried out under a self-certification scheme listed in Schedule 3 or where works consist of emergency repairs.

Competent person self-certification schemes under Schedule 3

Under regulations 14(4), 17(4) and 19 of the Building Regulations it is not necessary to deposit plans or notify Building Control in advance of work which is covered by this Guernsey Technical Standard if that work is of a type set out in column 1 of Schedule 3 to the Regulations and is carried out by a person registered with a relevant self-certification (competent persons) scheme as set out in column 2 of that Schedule. In order to join such a scheme a person must demonstrate competence to carry out the type of work the scheme covers, and also the ability to comply with all relevant requirements in the Building Regulations. These schemes may change from time to time, or schemes may change name, or new schemes may be authorised under Schedule 3; the current list on the States website should always be consulted. Full details of the schemes can be found on the individual scheme websites.

Where work is carried out by a person registered with a competent person scheme, regulation 19 of the Building Regulations requires that the occupier of the building be given, within 30 days of the completion of the work, a certificate confirming that the work complies with all applicable Building Regulation requirements. There is also a requirement that Building Control be given a notice that this has been done, or the certificate, again within 30 days of the completion of the work. These certificates and notices are usually made available through the scheme operator.

Building Control is authorised to accept these certificates as evidence of compliance with the requirements of the Building Regulations. However, inspection and enforcement powers remain unaffected, although they are normally used only in response to a complaint that work may not comply.

Exemptions

Schedule 2 to the Building Regulations sets out a number of classes of buildings which are exempt from majority of Building Regulations requirements including Part L2

Materials and workmanship

Any building work within the meaning of the Building Regulations should, in accordance with regulation 11, be carried out with proper materials and in a workmanlike manner.

You may show that you have complied with regulation 11 in a number of ways. These include the appropriate use of a product bearing CE marking in accordance with the Construction Products Regulation (305/2011/EU-CPR) as or a product complying with an appropriate technical specification (as defined in those Regulations), a British Standard or an alternative national technical specification of any state which is a contracting party to the European Economic Area which in use is equivalent, or a product covered by a national or European certificate issued by a European Technical Approval issuing body, and the conditions of use are in accordance with the terms of the certificate.

You will find further guidance in the Guernsey Technical Standard on materials and workmanship that provides practical guidance on regulation 11 on materials and workmanship.

Supplementary guidance

Building Control occasionally issues additional material to aid interpretation of the guidance in Guernsey Technical Standards. This material may be conveyed in official letters to relevant agents and/or posted on the States website accessed through: **www.gov.gg/planning**

Technical specifications

When a Guernsey Technical Standard makes reference to specific standards or documents, the relevant version of the standard is the one listed at the end of this Guernsey Technical Standard. However, if this version of the standard has been revised or updated by the issuing standards body, the new version may be used as a source of guidance provided that it continues to address the relevant requirements of the Building Regulations.

Where it is proposed to work to an updated version of the standard instead of the version listed at the end of the publication, this should be discussed with Building Control in advance of any work starting on site.

The appropriate use of any product, which complies with a European Technical Approval as defined in the Construction Products Regulation, (305/2011/EU-CPR) as amended, repealed or replaced will meet the relevant requirements.

Independent schemes of certification and accreditation

Much of the guidance throughout this document is given in terms of performance.

Since the performance of a system, product, component or structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and accreditation of installers and maintenance firms will provide confidence in the appropriate standard of workmanship being provided.

Confidence that the required level of performance can be achieved will be demonstrated by the use of a system, material, product or structure which is provided under the arrangements of a product conformity certification scheme and an accreditation of installer scheme.

Third party accredited product conformity certification schemes not only provide a means of identifying materials and designs of systems, products and structures which have demonstrated that they reach the requisite performance, but additionally provide confidence that the systems, materials, products and structures are actually provided to the same specification or design as that tested or assessed.

Third party accreditation of installers of systems, materials, products and structures provides a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing the reliability of the anticipated performance.

Many certification bodies that approve such schemes are accredited by the **United Kingdom Accreditation Service.**

Certification of products, components, materials or structures under such schemes may be accepted as evidence of compliance with the relevant standard. Similarly the certification of installation or maintenance of products, components, materials and structures under such schemes as evidence of compliance with the relevant standard may be acceptable. Nonetheless Building Control will wish to establish in advance of the work, that any such scheme is adequate for the purpose of the Building Regulations.

Interaction with other legislation

This Guernsey Technical Standard makes reference to other legislation, including that listed below, the requirements of which may be applicable when carrying out building work. All references are to legislation as amended or repealed and replaced.

Note: All Laws, ordinances and statutory instruments can be accessed at;

www.guernseylegalresources.gg/

The Health and Safety at Work (General) (Guernsey) Ordinance, 1987 made under the Health and Safety at Work etc. (Guernsey) Law, 1979 and the Health, Safety and Welfare of Employees Law, 1950 applies to any workplace or part of a workplace. It applies to the common parts of flats and similar buildings if people such as cleaners, wardens and caretakers are employed to work in these common parts.

Mixed use development

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

Summary guide to the use of this Guernsey Technical Standard

Routes to compliance for non domestic buildings			
STEP	**TEST**		**ACTION**
START	**Choose method of compliance**		
	Elemental method		Go to 1
	Whole building method		Go to 25
	Carbon Index method		Go to 30
	Alternative Approved methodology		Go to 37
Compliance by Elemental method			
1	Are all U-values ≤ the corresponding values from Table 1?	No Yes	Revise U-values and repeat 1 or Go to 3 Continue
2	Are the areas of openings ≤ the corresponding values in Table 2?	Yes No	Go to 4 Reduce opening areas and repeat 2 or continue
3	Is the average U-value ≤ to that of a notional building of the same size and shape as described in paragraphs 1.15-1.16 and taking into account the heating system efficiency as described in para 1.32?	No	FAIL - revise design and go to 1 or go to START and test compliance by another route
4	Do all occupied spaces satisfy the solar overheating criteria in para 1.20 et seq ?	No Yes	Adjust window areas or shading provisions Continue
5	Does any centralised heating plant as described in paragraph 1.25 meet the carbon intensity criteria of Table 5?	Yes No	Go to 7 Select different heating plant and repeat 5 or continue
6	Is the average U-value ≤ Uref • from paragraph 1.32?	No Yes	FAIL – revise design and go to 1 or go to START and test compliance by another route Continue
7	Do the heating system controls comply with paragraphs 1.33 and 1.34?	No Yes	FAIL – revise controls and repeat 7 or go to START and test compliance by another route Continue
8	Does the HWS system and the associated controls comply with paragraphs 1.35 to 1.37?	No Yes	FAIL – revise HWS system and controls and repeat 8 or go to START and test compliance by another route Continue

9	Does the insulation to pipes, ducts and vessels comply with paragraphs 1.38 to 1.40? by another route	No	FAIL – revise insulation specification and repeat 9 or go to START and test compliance
		Yes	Continue
10	Is there general or display lighting serving more than 100m²?	No	Go to 19
		Yes	Continue
11	Is the building an office, industrial or storage building?	No	Go to 14
		Yes	Continue
12	Is the average luminaire-lumens/circuit watt ≥ 40?	No	Revise lighting design and repeat 12 or go to START and test compliance by another route
		Yes	Continue
13	Do the lighting controls comply with paragraphs 1.56 and 1.57?	Yes	Go to 16
		No	Revise the controls and repeat 13 or go to START and test compliance by another route
14	Is the average lamp plus ballast efficacy ≥ 50 lamp-lumens per circuit watt?	No	Revise lighting design and repeat 14 or go to START and test compliance by another route
		Yes	Continue
15	Do the lighting controls meet the guidance in paragraph 1.58	No	Revise the controls and repeat 15 or go to START and test compliance by another route
		Yes	Continue
16	Is there any display lighting?	No	Go to 19
		Yes	Continue
17	Does any display lighting have an average lamp plus ballast efficacy ≥ 15 lamp-lumens per circuit watt?	No	Revise display lighting and repeat 17 or go to START and test compliance by another route
		Yes	Continue
18	Do the display lighting controls meet the standards of paragraph 1.59?	No	Revise display lighting controls and repeat 18 or go to START and test compliance by another route Yes Continue
19	Does the building have any air conditioning or mechanical ventilation systems that serve more than 200 m² floor area?	No	Go to 23
		Yes	Continue

20	Is it an office building?	No Yes	Go to 22 Continue
21	Is the Carbon Performance Rating ≤ the values in Table 11	No Yes	Revise the ACMV design and repeat 21 or go to START and test compliance by another route Go to 23
22	Is the specific fan power ≤ the values given in paragraph 1.67?	No Yes	Revise design of mechanical ventilation system and repeat 22 or go to START and test compliance by another route Continue
23	Are there any sun-spaces?	No Yes	PASS Elemental Method and go to 34 Continue
24	Do the sun-spaces meet the criteria of paragraphs 1.77 to 1.79?	No Yes	Revise sun-space design and repeat 24 or go to START and test compliance by another route PASS Elemental Method – go to 34
Compliance by Whole Building method			
25	Select building type	Office: School: Hospital: Other:	Go to 26 Go to 28 Go to 29 Method not suited - go to START and test compliance by another route
26	Is the whole office CPR ≤ the relevant value in Table 12	No Yes	FAIL – Revise design and repeat or go to START and test compliance by another route Continue
27	Are the proposed building fabric performances no worse than those given in table 3 and paragraphs 1.9-1.11 and 1.17-1.19 respectively	No Yes	Revise details and repeat 28 or go to START and test compliance by another route PASS Whole Building Method - Go to 34
28	Does the school meet the requirements of DfEE Building bulletin 87?	No Yes	FAIL - Revise design and repeat 28 or go to START and test compliance by another route PASS Whole Building Method - Go to 34

29	Does the hospital meet the requirements of NHS Estates guidance?	No	FAIL - Revise design and repeat 29 or go to START and test compliance by another route
		Yes	PASS Whole Building Method – Go to 34
Compliance by Carbon Emission Calculation Method			
30	Does the notional building meet the standards in paragraph 1.75?	No	Revise notional design and repeat 30 or go to START and test compliance by another route
		Yes	Continue
31	Does the envelope of the proposed building meet the standards of paragraph 1.75(b)	No	Revise proposed building envelope and repeat 31 or go to START and test compliance by another route
		Yes	Continue
32	Has the calculation method been agreed as appropriate to the application (paragraph 1.76)?	No	FAIL - go to START and test compliance by another route
		Yes	Continue
33	Is the carbon emitted by the proposed building ≤ that emitted by the notional building?	No	FAIL – revise design and repeat 33 or go to START and test compliance by another route
		Yes	PASS Carbon Emissions Calculation Method - go to 34
34	Is Building Control reasonably convinced that the fabric insulation in the actual building is continuous ?	No	FAIL – carry out remedial work and repeat 34
		Yes	Continue
35	Is Building Control reasonably convinced that the building is satisfactorily airtight ? (paragraph 2.2)	No	Identify leaks, seal and re-test to meet standards of paragraph 2.4.
		Yes	Continue
36	Has inspection and commissioning been completed satisfactorily? (paragraphs 2.5 and 2.6)	No	Complete commissioning and repeat 36
		Yes	PASS Construction is satisfactory – continue

Compliance by Alternative Approved methodology			
37	Has the guidance contained in the latest edition of Englands Approved Documents L1a and L1b been followed	No Yes	**FAIL** by alternative methodology **PASS** by alternative methodology
PROVIDING INFORMATION			
38	Has the log-book been prepared (paragraphs 3.1 and 3.2)?	No Yes	Prepare log-book and repeat 37 Continue
39	Has a metering strategy been prepared and sufficient meters and sub-meters installed? (paragraphs 3.3 et seq)	No Yes	Produce strategy / install meters and sub-meters and repeat 38 BUILDING COMPLIES

The Requirement L2

This Guernsey Technical Standard deals with the following requirements from Part L of Schedule 1 of the Building Regulations.

Requirement	*Limits on application*
Buildings other than dwellings	
L2. Reasonable provision must be made for the conservation of fuel and power in buildings other than dwellings by –	
(a) limiting the heat losses and gains through the fabric of the building,	
(b) limiting the heat loss - (i) from hot water pipes and hot air ducts used for space heating, and (ii) from hot water vessels and hot water service pipes;	
(c) providing space heating and hot water systems which are energy-efficient,	
(d) limiting exposure to solar overheating,	
(e) making provision where air conditioning and mechanical ventilation systems are installed, so that no more energy needs to be used than is reasonable in the circumstances, (f) limiting the heat gains by chilled water and refrigerant vessels and pipes and air ducts that serve air conditioning systems,	Requirements L2(e) and (f) apply only within buildings and parts of buildings where more than 200m^2 of floor area is to be served by air conditioning or mechanical ventilation systems.
(g) providing lighting systems which are energy efficient, and (h) providing sufficient information with the relevant services so that the building can be operated and maintained in such a manner as to use no more energy than is reasonable in the circumstances.	Requirement L2(g) applies only within buildings and parts of buildings where more than 100 m^2 of floor area is to be served by artificial lighting.

Guidance

Performance

L2.1 The requirement L2 (a) will be met by the provision of energy efficiency measures which:

a) limit the heat loss through the roof, wall, floor, windows and doors etc by suitable means of insulation, and where appropriate permit the benefits of solar heat gains and more efficient heating systems to be taken into account; and

b) limit the heat gains in summer; and

c) limit heat losses (and gains where relevant) through unnecessary air infiltration by providing building fabric which is reasonably airtight.

L2.2 The requirement L2 (b) will be met by limiting the heat loss from hot water pipes and hot air ducts used for space heating and from hot water vessels and hot water service pipes by applying suitable thicknesses of insulation where such heat does not make an efficient contribution to the space heating.

L2.3 The requirement L2 (c) will be met by the provision of space heating and hot water systems with reasonably efficient equipment such as heating appliances and hot water vessels where relevant, and timing and temperature controls, and suitable energy consumption metering, that have been appropriately commissioned such that the heating and hot water systems can be operated effectively as regards the conservation of fuel and power.

L2.4 The requirement L2 (d) will be met by the appropriate combination of passive measures, such as limiting the area of glazing which is not shaded and providing external building fabric that limits and delays heat penetration, with active measures, such as night ventilation, so that the effects of solar heat gains are kept within limits that are reasonable in the circumstances.

L2.5 When buildings are proposed to be mechanically ventilated or air conditioned, requirement L2 (e) will be met by:-

a) limiting the demands from within the building for heating and cooling and circulation of air, water and refrigerants; and

b) providing reasonably efficient plant and distribution systems, and timing, temperature and flow controls, and suitable energy consumption metering, that have been appropriately commissioned.

L2.6 The requirement L2 (f) will be met by limiting the heat gains to chilled water and refrigerant vessels and pipes and air ducts by applying suitable thicknesses of insulation including vapour barriers.

L2.7 The requirement L2 (g) will be met by the provision of lighting systems that where appropriate:

a) utilise energy-efficient lamps and luminaires, and

b) have suitable manual switching or automatic switching, or both manual and automatic switching controls, and

c) have suitable energy consumption metering, and

d) have been appropriately commissioned.

L2.8 The requirement L2 (h) will be met by providing information, in a suitably concise and understandable form, and including the results of performance tests carried out during the works, that shows how the building and its relevant building services can be operated and maintained so that they use no more energy than is reasonable in the circumstances.

Introduction to the Provisions

Technical Risk

L2.9 Guidance on avoiding technical risks (such as rain penetration, condensation etc) which might arise from the application of energy conservation measures is given in *BRE Report No 262: "Thermal Insulation: avoiding risks", 2002 Edition*. As well as giving guidance on ventilation for health, Guernsey Technical Standard F contains guidance on the provision of ventilation to reduce the risk of condensation in roof spaces. Guernsey Technical Standard J gives guidance on the safe accommodation of combustion systems including the ventilation requirements for combustion and the proper working of flues. Guernsey Technical Standard E gives guidance on achieving satisfactory resistance to the passage of sound. Guidance on some satisfactory design details is given in the publication *Limiting thermal bridging and air leakage: Robust construction details for dwellings and similar buildings; TSO, 2001*

Thermal conductivity and transmittance

L2.10 In the absence of test information, thermal conductivities and thermal transmittances (U-values) may be calculated. However, if test results for particular materials and makes of products obtained in accordance with a harmonised European standard are available they should be used in preference. Measurements of thermal conductivity should be made according to *BS EN 12664:2001 Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heatflow meter methods – Dry and moist products of low and medium thermal resistance, BS EN12667: 2000 Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance, or BS EN 12939: 2001 Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Thick products of high and medium thermal resistance.* Measurements of thermal transmittance should be made according to *BS EN ISO 8990: 1996 Thermal insulation –Determination of steady-state thermal transmission properties – Calibrated hot box* or, in the case of windows and doors, *BS EN ISO 12567-1 : 2010 Thermal performance of windows and doors – Determination of thermal transmittance by hot box method – Part 1: Complete windows and doors*. The size and configuration of windows for testing or calculation should be representative of those to be installed in the building, or conform to published guidelines on the conventions for calculating U-values, BRE.

Calculation of U-values

L2.12 U-values should calculated using the methods given in:

- for walls and roofs: *BS EN ISO 6946: 2017 Building components and building elements – Thermal resistance and thermal transmittance – Calculation methods*

- for ground floors: *BS EN ISO 13370: 2017 Thermal performance of buildings – Heat transfer via the ground – Calculation methods*

- for windows and doors: *BS EN ISO 10077-1: 2017 Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 1: Simplified methods* or *prEN ISO 10077-2:2017 Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 2: Numerical method for frames.*

- for basements: *BS EN ISO 13370:2017 Thermal performance of buildings. Heat transfer via the ground. Calculation methods*

For building elements not covered by these documents the following may be appropriate alternatives: *BRE guidance for light steel frame walls* , or finite element analysis in accordance with *BS EN ISO 10211: 2017 Thermal bridges in building construction . Heat flows and surface temperatures. Detailed calculations.*

L2.13 Thermal conductivity values for common building materials can be obtained from *BS EN 12524: 2000 Building materials and products – Hygrothermal properties – Tabulated design values* or the *CIBSE Guide A: Environmental design, Section A3: Thermal properties of building structures, CIBSE, 1999*.

L2.14 When calculating U-values the thermal bridging effects of, for instance, timber joists, structural and other framing, normal mortar bedding and window frames should generally be taken into account using the procedure given in *BS EN ISO 6946 Building components and building elements. Thermal resistance and thermal transmittance. Calculation method*. Thermal bridging can be disregarded however where the difference in thermal resistance between the bridging material and the bridged material is less than 0.1m²K/W. For example normal mortar joints need not be taken into account in calculations for brickwork. Where, for example, walls contain in-built meter cupboards, and ceilings contain loft hatches, recessed light fittings, etc, area-weighted average U-values should be calculated.

Basis for calculating areas

L2.15 The dimensions for the areas of walls, roofs and floors should be measured between finished internal faces of the external elements of the building including any projecting bays. In the case of roofs they should be measured in the plane of the insulation. Floor areas should include non-useable space such as builders' ducts and stairwells.

Conversion between carbon and carbon dioxide indices

L2.16 The performance targets in this Guernsey Technical Standard are quoted in terms of kg of carbon rather than kg of carbon dioxide, or in energy terms such as GigaJoules or MegaWatt-hours. To convert from the carbon to carbon dioxide basis multiply by the ratio of atomic weights (Carbon Dioxide 44 : Carbon 12). For example 9 tonnes per square metre per year of carbon is equivalent to {9 x (44/12)} = 33 tonnes of carbon dioxide per square metre per year.

Special cases

Low levels of heating

L2.17 Buildings or parts of buildings with low levels of heating or no heating do not require measures to limit heat transfer through the fabric. The insulation properties of the fabric containing such spaces are chosen for operational reasons and can be regarded as reasonable provision. Low levels of heating might be no more than 25W/m², an example being perhaps a warehouse where heating is intended to protect goods from condensation or frost, with higher temperatures provided only around local work stations.

A cold-store is an example of a building where insulation properties would be dictated by operational needs.

Low levels of use
L2.18 For buildings with low hours of use, lower standards for heating and lighting systems may be appropriate, but fabric insulation standards should be no worse than the guidance in this Guernsey Technical Standard. Buildings used solely for worship at set times could be one example where this paragraph would be relevant.

Buildings constructed from sub-assemblies
L2.19 Buildings constructed from subassemblies that are delivered newly made or selected from a stock are no different to any other new building and must comply with all the requirements in Schedule 1.

L2.20 In some applications however, such as buildings constructed to accommodate classrooms, medical facilities, offices and storage space to meet temporary accommodation needs, reasonable external fabric provisions for the conservation of fuel and power can vary depending on the circumstances in the particular case.
For example:-

A building created by dismantling, transporting and re-erecting on the same premises the external fabric sub-assemblies of an existing building would normally be considered to meet the requirement;

L2.21 Enclosed and heated or cooled links between such temporary accommodation, which may also be formed from subassemblies, should be insulated and made airtight to the same standards as the buildings themselves.

L2.22 Where heating and lighting are to be provided in such temporary accommodation, the requirements may be satisfied in the following ways although the extent of the provisions will depend on the circumstances in the particular case:-

a) **heating and hot water systems:** providing on/off, time and temperature controls as indicated in Section 1 of this Guernsey Technical Standard.

b) **general and display lighting:** providing general lighting systems with lamp efficacies that are not less than those indicated in paragraph 1.48 and providing display lighting with installed efficacies not less that those indicated in paragraphs 1.50-1.52.

Section 1 - Design

General

1.1 In order to achieve energy efficiency in practice, the building and its services systems should be appropriately designed (Section 1) and constructed (Section 2). Information should also be provided such that the performance of the building in use can be assessed (Section 3). This Guernsey Technical Standard provides guidance on meeting the requirements at each of these important stages of procuring a building, whether it be a new building, an extension or a refurbishment project. More detailed guidance on energy efficiency measures can be found in the *CIBSE Guide, Energy efficiency in buildings, CIBSE, 1998.*

1.2 When designing building services installations, provision should be made to facilitate appropriate inspection and commissioning (see paragraphs 2.5 – 2.6).

1.3 Specific guidance for work carried out on **existing buildings** is given in Section 4.

1.4 In large complex buildings, it may be sensible to consider the provisions for the conservation of fuel and power separately for the different parts of the building in order to establish the measures appropriate to each part.

1.5 Where alternative building services systems are provided (e.g. dual fuel boilers, and combined heat and power or heat pump systems paralleled by standby boiler capacity), then the building should meet the requirements in each possible operating mode.

Alternative methods of showing compliance

1.6 Four methods are given for demonstrating that reasonable provision has been made for the conservation of fuel and power. These different methods offer increasing design flexibility in return for greater demands in terms of the extent of calculation required. However the overall aim is to achieve the same standard in terms of carbon emissions. The methods are:

a) an **Elemental Method** (paragraphs 1.7 – 1.68). This method considers the performance of each aspect of the building individually. To comply with the provisions of Part L, a minimum level of performance should be achieved in each of the elements. Some flexibility is provided for trading off between different elements of the construction, and between insulation standards and heating system performance.

b) a **Whole-Building Method** (paragraphs 1.69 - 1.73). This method considers the performance of the whole building. For office buildings, the heating, ventilation, air conditioning and lighting systems should be capable of being operated such that they will emit no more carbon per square metre per annum than a benchmark based on the *Energy Consumption Guide 19 - Energy use in offices* data. Alternative methods are also provided for schools and hospitals.

c) a **Carbon Emissions Calculation Method** (paragraphs 1.74 – 1.76). This method also considers the performance of the whole building, but can be applied to any building type. To comply with the provisions of Part L, the annual carbon emissions from the building should be no greater than that from a notional building that meets the compliance criteria of the Elemental Method. The carbon emissions from the proposed building and the notional building need to be estimated using an appropriate calculation tool.

d) An **Alternative Approved Methodology**

Elemental Method

1.7 To show compliance following the Elemental Method, the building envelope has to provide certain minimum levels of insulation, and the various building services systems each have to meet defined minimum standards of energy efficiency as follows -

Standard U-values for construction elements

1.8 The requirement will be met if the thermal performances of the construction elements are no worse than those listed in Table 1 (as illustrated in Diagram 1).

Table 1 **Standard U-values of construction elements**

Exposed Element	U-value
Pitched roof [1] with insulation between rafters	0.18
Pitched roof [1] with insulation between joists	0.16
Flat roof [2] or roof with integral insulation	0.18
Walls, including basement walls	0.28
Floors, including ground floors and basement floors	0.22
Windows, roof windows and personnel doors (area weighted average for the whole building).	1.6
frames[3]	
Vehicle access and similar large doors	0.7

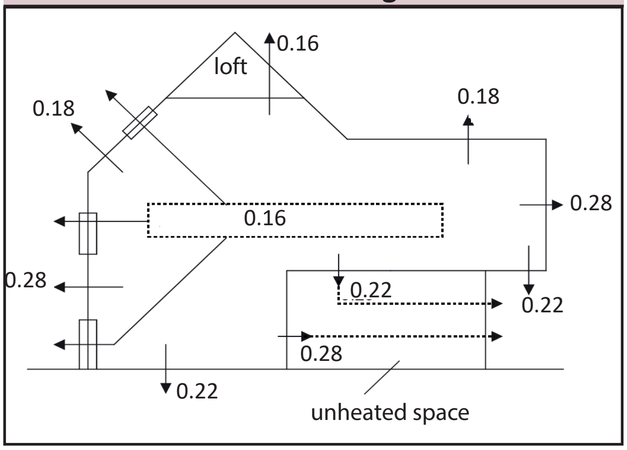
Notes to Table 1:
1 Any part of a roof having a pitch greater or equal to 70° can be considered as a wall.
2 Roof of pitch not exceeding 10°
3 Display windows, shop entrance doors and similar glazing are not required to meet the standard given in this table.

Where an element is exposed to the outside via an unheated space (e.g. an unheated atrium or an underground car park), either:

a) the unheated space may be disregarded so that the element is considered as directly exposed to the outside, or

b) the U-value of the element may be calculated as the transmission heat loss coefficient through the unheated space divided by the area of the element. The transmission heat loss coefficient should be calculated as given in *BS EN ISO 13789:2017 Thermal performance of buildings - Transmission heat loss coefficient - Calculation method*.

Diagram 1 **Standard U-values for non-domestic buildings**



Thermal bridging at junctions and around openings

1.9 The building fabric should be constructed so that there are no significant thermal bridges or gaps in the insulation layer(s) within the various elements of the fabric, at the joints between elements, and at the edges of elements such as those around window and door openings.

1.10 One way of demonstrating compliance would be to utilise details and practice that have been independently demonstrated as being satisfactory. For domestic style construction, a selection of such satisfactory details is given in the publication *Limiting thermal bridging and air leakage: Robust construction details for dwellings and similar buildings;TSO, 2001.*

1.11 An alternative way of meeting the requirements would be to demonstrate by calculation or by adopting robust design practices that the performance of the building is at least as good as it would be by following paragraph 1.10. *BRE Information paper 17/01, Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings, and the MCRMA Technical Report Note 14 Guidance for the design of metal cladding and roofing.*

Table 2 Maximum area of openings unless compensating measures are taken

Building type	Windows[1] and doors as % of the area of exposed wall[2]	Rooflights as % of area of roof
Residential buildings (where people temporarily or permanently reside)	30	20
Places of assembly, offices and shops	40	20
Industrial and storage buildings	15	20
Vehicle access doors and display windows and similar glazing	As required	

Notes:
[1] For the purposes of this calculation, dormer windows in a roof may be included in the rooflight area.
[2] See paragraph L2.15, basis for calculating areas.

Maximum areas of windows, doors and rooflights

1.12 Provision should be made to limit the rate of heat loss through glazed elements of the building. One way of complying would be to limit the total area of windows, doors and rooflights so that they do not exceed the values given in Table 2 - unless compensated for in some other way.

1.13 Care should be taken in the selection and installation of glazed systems to avoid the risk of condensation. Guidance can be obtained from *Thermal insulation: avoiding risks, BR 262, 2002 Edition BRE, 2001*.

Trade-off between construction elements

1.14 In order to provide greater design flexibility, the U-values of construction elements and the areas of windows, doors and rooflights may vary from the values given in Table 1 and Table 2 provided that suitable compensating measures are taken. If glazing areas are reduced from those given in Table 2, special care needs to be given to confirm that levels of daylight are adequate. Guidance on designing for daylight is contained in *CIBSE, LG10 Daylight and window design, 1999.*

1.15 Compliance with the provisions of Part L would be achieved if:

a) the rate of heat loss from the proposed building does not exceed that from a notional building of the same size and shape that meets the criteria set out in Table 1 and Table 2; and

b) the U-value of any part of an element is no worse than the values given in the following Table 3.

Table 3 Poorest U-values acceptable when trading off between construction elements

Element	Poorest acceptable U-value(W/m^2K)
Parts of roof [1]	0.35
Parts of exposed wall or floor [1]	0.70

Notes:
[1] Whilst parts of these elements may (within the limits given in this table) have poorer U-values than those given in Table 1, it will not normally be practical to make sufficient allowances elsewhere in the design for the whole element to be built to these standards.

1.16 As further constraints in these methods however:

a) if the U-value of the floor in the proposed building is better than the performance given in Table 1 with no added insulation, the better performance standard is to be adopted for the notional building; and

b) if the area of openings in the proposed building is less than the values shown in Table 2, the average U-value of the roof, wall or floor cannot exceed the appropriate value given in Table 1 by more than 0.02 W/m^2K.

c) no more than half of the allowable rooflight area can be converted into an increased area of window and doors.

Building air leakage standards

1.17 Buildings should be reasonably airtight to avoid unnecessary space heating and cooling demand and to enable the effective performance of ventilation systems. Further advice on air pressure testing is included in Section 2 paragraphs 2.8 - 2.14

1.18 Without prejudice to the need for compliance with all the requirements in Schedule 1 however, the need to provide for adequate ventilation for health (Part F) and adequate air for combustion appliances (Part J) should particularly be taken into account.

1.19 A way of meeting the requirement would be to incorporate sealing measures to achieve the performance standard given in paragraph 2.4. Some ways of achieving satisfactory airtightness include:

a) providing a reasonably continuous air barrier in contact with the insulation layer over the whole thermal envelope (including separating walls). Special care should be taken at junctions between elements and around door and window openings. For domestic type constructions, some satisfactory design details and installation practice are described in the robust details publication referred to in paragraph 1.10. Guidance for the design of metal cladding and roofing systems to minimise air infiltration is given in the MCRMA Technical Report No 14 referred to in paragraph 1.11.

b) sealing gaps around service penetrations.

c) draught-proofing external doors and windows.

Avoiding solar overheating

1.20 Buildings should be constructed such that:

a) those occupied spaces that rely on natural ventilation should not overheat when subject to a moderate level of internal heat gain and

b) those spaces that incorporate mechanical ventilation or cooling do not require excessive cooling plant capacity to maintain the desired space conditions.

Note: This guidance is not applicable to non-occupied spaces such as stacks and atria intended to drive natural ventilation via buoyancy.

1.21 Ways of meeting the requirement would be through:

a) the appropriate specification of glazing, and

b) the incorporation of passive measures such as shading (detailed guidance being given in *BRE Report No 364 Solar shading of buildings,* 2018. and

c) the use of exposed thermal capacity combined with night ventilation *(detailed guidance being given in energy efficiency best practice programme, Avoiding or minimising the use of air conditioning, GIR 31).*

1.22 A way of achieving compliance for spaces with glazing facing only one orientation would be to limit the area of glazed opening as a percentage of the internal area of the element under consideration to the values given in Table 4.

Table 4 **Maximum allowable area of glazing**

Orientation of glazing	Maximum allowable area of glazing (%)
N	50
NE/NW/S	40
E/SE/W/SW	32
Horizontal	12

1.23 Alternative approaches to achieving compliance include:

a) showing that the solar heat load per unit floor area averaged between the hours of 07:30 and 17:30 would not be greater than 25W/m^2 if the building were to be subject to the solar irradiances for the particular location for the month of July that were not exceeded on more than 2.5% of occasions during the period 1976 – 1995. The procedure given in Annex C can be used to do this.

b) showing by detailed calculation procedures such as those described in chapter 5 of *Environmental design*, *Guide A, CIBSE, 1999*, that in the absence of mechanical cooling or mechanical ventilation, the space will not overheat when subjected to an internal gain of 10 W/m^2.

Heating systems

1.24 Without prejudice to the need for compliance with all the requirements in Schedule 1, the need to provide for adequate ventilation for health (Part F) and adequate air for combustion appliances (Part J) should particularly be taken into account when making provisions for combustion systems such as boiler plant and direct-fired gas heaters.

Carbon intensities of heating plant

General

1.25 Heating plant should be reasonably efficient. For heating plant serving hot water and steam heating systems, electric heating and heat pumps (irrespective of the form of heat distribution), a way of complying with the requirement would be to show that:

a) the carbon intensity of the heat generating equipment at the maximum heat output of the heating system is not greater than the value shown in Table 5 column (a) and

b) the carbon intensity of the heat generating equipment when the system is producing 30% of the maximum heat output of the heating system is not greater than the value shown in Table 5 column (b).

Table 5 **Maximum allowable carbon intensities of heating systems**

Fuel	Maximum carbon intensities (kgC/kWh) at stated % of the maximum heat output of the heating system. (a) at maximum heat output	(b) at 30% of maximum heat output
Town gas	0.068	0.065
Other fuels	0.091	0.088

1.26 In some applications electric resistance heating might be appropriate. In such cases the designer will need to improve envelope insulation standards to trade-off against the higher carbon intensity of such forms of heating (see paragraph 1.32).

1.27 The carbon intensity of the heating plant is based on the carbon emitted per useful kWh of heat output. Where there are multiple pieces of heat generating equipment, the carbon intensity of the heating plant is the rating weighted average of the individual elements. This definition of carbon intensity is applicable to boilers, heat pump systems and electrical heating, and is given by:

$$\varepsilon_c = \frac{1}{\sum R} \sum \frac{R.C_f}{\eta_t} \qquad (1)$$

where:

ε_c = the carbon intensity of the heating system (kgC/kWh of useful heat).

R = the rated output of an individual element of heat raising plant (kW).

η_t = the gross thermal efficiency of that element of heat raising plant (kWh of heat per kWh of delivered fuel). For most practical cases, the efficiency may be taken as the full load efficiency for that element but, where appropriate, a part load efficiency based on manufacturer’s certified data may be used as an alternative.

C_f = the carbon emission factor of the fuel supplying that element of heat raising plant (kg of carbon emitted per kWh of delivered fuel consumed) (Table 6).

Table 6 **Carbon emission factors**

Delivered fuel	**Carbon emission factor (kgC/kWh)**
Town gas	0.053
LPG	0.068
Biogas	0
Oil [1]	0.074
Coal	0.086
Biomass	0
Electricity [2]	0.058
Waste heat [3]	0

Notes:

[1] This value can be used for all grades of fuel oil.

[2] This is the estimated average figure for grid-supplied electricity for the period 2005 – 2010. If there is on-site generation of electricity from photovoltaic panels or wind power, this could be accounted for using the carbon emissions calculation method (see paragraph 1.74 et seq). Short term energy supply arrangements such as "green tariffs" are not appropriate ways of complying with the requirements.

[3] This includes waste heat from industrial processes and from power stations rated at more than 10MW electrical output and with a power efficiency > 35%

Calculating the carbon intensity of CHP systems

1.28 Where a combined heat and power system (CHP) is proposed, the carbon intensity of the CHP (ε_{chp}) can take account of the benefit of the on-site generation in reducing emissions from power stations feeding the national grid. The adjustment can be made using equation (2). This adjusted carbon intensity can then be used in equation (1) to determine the carbon intensity of the overall heating system at 100% and 30% of heating system output.

$$\varepsilon_{chp} = \frac{C_f}{\eta_t} \qquad \frac{C_{displaced}}{HPR} \qquad (2)$$

where:

η_t = the gross thermal efficiency of the CHP engine (kWh of useful heat per kWh of fuel burned);

HPR = the heat to power ratio (kWh of useful heat produced per kWh of electricity output). This is equivalent to the ratio of the thermal and power efficiencies of the CHP unit;

$C_{displaced}$ = the carbon emission factor for gridsupplied electricity displaced by the CHP (kg/kWh). This should be taken as the factor for new generating capacity that might otherwise be built if the CHP had not been provided, i.e. the intensity of a new generation gasfired station: 0.123 kgC/kWh.

1.29 Where the CHP has no facility for heat dumping, the gross thermal efficiency is simply the CHP heat output divided by the energy content of the fuel burned. Where the CHP includes facilities for heat dumping, the gross thermal efficiency should be based on an estimate of the useful heat supplied to the building, i.e. the heat output from the CHP minus the heat dumped. Certification under the *Quality Assurance for Combined Heat and Power, CHPQA Standard, Issue 7, DETR, November 2018* scheme would be a way of showing that the gross thermal efficiency has been estimated in a satisfactory way.

Calculating the carbon intensity of community heating

1.30 When calculating the carbon intensity of the heat supplied to the building by a community heating system, account should be taken of the performance of the whole system, (i.e. the distribution circuits, and all the heat generating plant including any CHP or waste heat recovery) and the carbon emission factors of the different fuels. Certification under the CHPQA scheme (above) would be a way of showing that the thermal and power efficiencies have been estimated in a satisfactory way.

Other methods of heating

1.31 In buildings such as factories, warehouses and workshops it can be more efficient to provide local warm air or radiant heating systems. *GPG 303, 2000: The designer's guide to energy efficient buildings for industry, Energy Efficiency Best practice programme, BRECSU* provides guidance on the application of such systems.

Trade - off between construction elements and heating system efficiency

1.32 In order to allow greater design flexibility, there can be a trade-off (in either direction) between the average U-value of the envelope and the carbon intensity of the heating system provided that the rate of carbon emissions is unchanged. A way of complying would be to adjust the average U-value of the building fabric such that it is no worse than the value determined from the following equation.

$$U_{req} = U_{ref} \cdot \frac{\varepsilon_{ref}}{\varepsilon_{act}} \qquad (3)$$

where:

U_{req} = the required average U-value.

U_{ref} = the average U-value of the building constructed to the elemental standards of Table 1.

ε_{ref} = the carbon intensity of the reference heating system at an output of 30% of the installed design capacity. This should be taken from Table 5 column (b) for the fuel type used in the actual heating system.

ε_{act} = the carbon intensity of the actual heating system at an output of 30% of installed design capacity.

Space heating controls

1.33 The building should be provided with zone, timing and temperature controls such that each functional area is maintained at the required temperature only during the period when it is occupied. Additional controls may be provided to allow heating during extended unusual occupation hours and to provide for sufficient heating to prevent condensation or frost damage when the heating system would otherwise be switched off.

1.34 Ways of meeting the requirement include:

a) in buildings with a heating system maximum output not exceeding 100 kW, to follow the guidance in *GPG 132, 2001: Energy Efficiency Best Practice Programme, Heating controls in small commercial and multi-residential buildings, BESCSU*.

b) in larger or more complex buildings, to follow the guidance contained in *CIBSE Guide H, 2000: Building Control Systems*. Certification by a competent person that the provisions meet the requirements may be accepted by Building Control.

Hot water systems and their control

1.35 Hot water should be provided safely, making efficient use of energy and thereby minimising carbon emissions. Ways of achieving the requirement include -

a) avoiding over-sizing of hot water storage systems.

b) avoiding low-load operation of heat raising plant.

c) providing solar water heating.

d) minimising the length of circulation loops.

e) minimising the length and diameter of dead legs.

1.36 A way of satisfying the requirements for conventional hot water storage systems would be to provide controls that shut off heating when the required water temperature is achieved. The supply of heat should also be shut off during those periods when hot water is not required.

1.37 Ways of meeting the requirement include:-

a) in small buildings, following the guidance in *GPG 132, 2001: Energy Efficiency Best Practice Programme, Heating controls in small commercial and multi-residential buildings, BESCSU.*

b) in larger, more complex buildings or for alternative systems (e.g. solar hot water heating), following the guidance contained in *CIBSE Guide H, 2009: Building Control Systems*. Certification by a competent person that the provisions meet the requirements may be accepted by Building Control.

Insulation of pipes, ducts and vessels
Limit of application:
1.38 This section only applies to pipework, ductwork and vessels for the provision of space heating, space cooling (including chilled water and refrigerant pipework) and hot water supply for normal occupation. Pipework, ductwork and vessels for process use are outside the scope of the Building Regulations.

Meeting the requirement
1.39 A way of meeting the requirement would be to apply insulation to the standards required in *BS 5422: 2009 Methods for specifying thermal insulation materials on pipes, ductwork and equipment in the temperature range -40°C to +700°C,* to all pipework, ductwork and storage vessels. The requirement for storage vessels should be taken as that given in BS 5422 for flat surfaces.

1.40 Insulation would not be necessary for compliance with Part L if the heat flow through the walls of the pipe, duct or vessel is always useful in conditioning the surrounding space when fluid is flowing through the pipe or duct, or is being stored in the vessel in question. However, it may be prudent to provide it to facilitate control stability.

Lighting efficiency standards
1.41 Lighting systems should be reasonably efficient and make effective use of daylight where appropriate.

1.42 For the purposes of Guernsey Technical Standard L circuit-watts means the power consumed in lighting circuits by lamps and their associated control gear and power factor correction equipment.

General lighting efficacy in office, industrial and storage buildings
1.43 Electric lighting systems serving these buildings should be provided with reasonably efficient lamp/luminaire combinations. A way of meeting the requirements would be to provide lighting with an initial efficacy averaged over the whole building of not less than 40 luminaire-lumens/circuit-watt. This allows considerable design flexibility to vary the light output ratio of the luminaire, the luminous efficacy of the lamp or the efficiency of the control gear.

1.44 The average luminaire-lumens/circuit-watt is calculated by

$$\eta_{lum} = \frac{1}{P} \cdot \sum \frac{LOR.\phi_{lamp}}{C_L} \quad (4)$$

where

η_{lum} = the luminaire efficacy (luminaire-lumens/circuit-watt);

LOR = the light output ratio of the luminaire, which means the ratio of the total light output of a luminaire under stated practical conditions to that of the lamp or lamps contained in the luminaire under reference conditions;

ϕ_{lamp} = the sum of the average initial (100 hour) lumen output of all the lamp(s) in the luminaire;

P = the total circuit watts for all the luminaires;

C_L = the factor applicable when controls reduce the output of the luminaire when electric light is not required. The values of C_L are given in Table 7.

Table 7 **Luminaire control factors**

Control function	C_L
a) The luminaire is in a day lit space (see paragraph 1.45), and its light output is controlled by • A photoelectric switching or dimming control, with or without manual override, or • Local manual switching (see paragraph 1.57a)	0.80
b) The luminaire is in a space that is likely to be unoccupied for a significant proportion of working hours and where a sensor switches off the luminaire in the absence of occupants but switching on is done manually	0.80
c) Circumstances a) and b) above combined.	0.75
d) None of the above.	1.00

1.45 For the purposes of this Guernsey Technical Standard, a day lit space is defined as any space within 6m of a window wall, provided that the glazing area is at least 20% of the internal area of the window wall. Alternatively it can be roof-lit, with a glazing area at least 10% of the floor area. The normal light transmittance of the glazing should be at least 70%, or, if the light transmittance is reduced below 70%, the glazing area could be increased proportionately, but subject to the considerations given in paragraphs 1.12 and 1.20 – 1.23.

1.46 This guidance need not be applied in respect of a maximum of 500 W of installed lighting in the building, thereby allowing flexibility for the use of feature lighting etc.

1.47 Annex A gives examples that show how the luminaire efficacy requirement can be met either by selection of appropriate lamps and luminaires or by calculation.

General lighting efficacy in all other building types

1.48 For electric lighting systems serving other building types, it may be appropriate to provide luminaires for which photometric data is not available and/or are lower powered and use less efficient lamps. For such spaces, the requirements would be met if the installed lighting capacity has an initial (100 hour) lamp plus ballast efficacy of not less than 50 lamp-lumens per circuit-watt. A way of achieving this would be to provide at least 95% of the installed lighting capacity using lamps with circuit efficacies no worse than those in Table 8.

1.49 For the purposes of Guernsey Technical Standard L, high efficiency control gear means low loss or high frequency control gear that has a power consumption (including the starter component) not exceeding that shown in Table 9.

Display lighting in all buildings

1.50 For the purposes of Guernsey Technical Standard L, display lighting means lighting intended to highlight displays of exhibits or merchandise,or lighting used in spaces for public entertainment such as dance halls, auditoria, conference halls and cinemas.

Table 8 **Light sources meeting the criteria for general lighting**

Light source	Types and ratings
High pressure Sodium	All types and ratings
Metal halide	All types and ratings
Induction lighting	All types and ratings
Tubular fluorescent	26mm diameter (T8) lamps, and 16mm diameter (T5) lamps rated above 11W, provided with high efficiency control gear. 38mm diameter (T12) linear fluorescent lamps 2400mm in length
Compact fluorescent	All ratings above 11W
Other	Any type and rating with an efficacy greater than 50 lumens per circuit Watt.

Table 9 **Maximum power consumption of high efficiency control gear**

Nominal lamp rating (Watts)	Control gear power consumption (Watts)
Less than or equal to 15	6
Greater than 15, Not more than 50	8
Greater than 50, Not more than 70	9
Greater than 70, Not more than 100	12
Greater than 100	15

1.51 Because of the special requirements of display lighting, it may be necessary to accept lower energy performance standards for display lighting. Reasonable provision should nevertheless be made and a way of complying would be to demonstrate that the installed capacity of display lighting averaged over the building has an initial (100 hour) efficacy of not less than 15 lamp-lumens per circuit-watt. In calculating this efficacy, the power consumed by any transformers or ballasts should be taken into account.

1.52 As an alternative, it would be acceptable if at least 95% of the installed display lighting capacity in circuit-Watts comprises lighting fittings incorporating lamps that have circuit efficacies no worse than those in Table 10.

Table 10 **Light sources meeting the criteria for display lighting**

Light source	Types and ratings
High pressure Sodium	All types and ratings
Metal halide	All types and ratings
Tungsten halogen	All types and ratings
Compact and tubular fluorescent	All types and ratings
Other	Any type and rating with an efficacy greater than 15 lumens per circuit Watt.

Emergency escape lighting and specialist process lighting

1.53 For the purposes of Guernsey Technical Standard L, the following definitions apply:

a) 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.

b) 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.

1.54 Emergency escape lighting and specialist process lighting are not subject to the requirements of Part L.

Lighting controls

1.55 Where it is practical, the aim of lighting controls should be to encourage the maximum use of daylight and to avoid unnecessary lighting during the times when spaces are unoccupied. However, the operation of automatically switched lighting systems should not endanger the passage of building occupants. Guidance on the appropriate use of lighting controls is given in *Photoelectric control of lighting: design, set-up and installation issues, BRE Information Paper IP 2/99.*

Controls in offices and storage buildings

1.56 A way of meeting the requirement would be the provision of local switches in easily accessible positions within each working area or at boundaries between working areas and general circulation routes. For the purposes of Guernsey Technical Standard L2, reference to switch includes dimmer switches and switching includes dimming. As a general rule, dimming should be effected by reducing rather than diverting the energy supply.

1.57 The distance on plan from any local switch to the luminaire it controls should generally be not more than eight metres, or three times the height of the light fitting above the floor if this is greater. Local switching can be supplemented by other controls such as time switching and photo-electric switches where appropriate. Local switches could include:

a) switches that are operated by the deliberate action of the occupants either manually or by remote control. Manual switches include rocker switches, push buttons and pull cords. Remote control switches include infra red transmitter, sonic, ultrasonic and telephone handset controls.

b) automatic switching systems which switch the lighting off when they sense the absence of occupants.

Controls in buildings other than offices and storage buildings

1.58 A way of meeting the requirement would be to provide one or more of the following types of control system arranged to maximise the beneficial use of daylight as appropriate:

a) local switching as described in paragraph 1.57;

b) time switching, for example in major operational areas which have clear timetables of occupation;

c) photo-electric switching.

Controls for display lighting (all building types)

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

Air-conditioning and mechanical ventilation (ACMV)

1.60 For the purposes of Guernsey Technical Standard L, the following definitions apply:

a) mechanical ventilation is used to describe systems that use fans to supply outdoor air and/or extract indoor air to meet ventilation requirements. Systems may be extensive and can include air filtration, air handling units and heat reclamation, but they do not provide any active cooling from refrigeration equipment. The definition would not apply to a naturally ventilated building, which makes use of individual wall or window mounted extract fans to improve the ventilation of a small number of rooms.

b) air conditioning is used to describe any system where refrigeration is included to provide cooling for the comfort of building occupants. Air conditioning can be provided from stand-alone refrigeration equipment in the cooled space, from centralised or partly centralised equipment, and from systems that combine the cooling function with mechanical ventilation.

c) treated areas; these are the floor areas of spaces that are served by the mechanical ventilation or air conditioning system in the context and should be established by measuring between the internal faces of the surrounding walls. Spaces that are not served by these systems such as plant rooms, service ducts, lift-wells etc. should be excluded.

d) process requirements; in office buildings process requirements can be taken to include any significant area in which an activity takes place which is not typical of the office sector, and where the resulting need for heating, ventilation or air conditioning is significantly different to that of ordinary commercial offices. When assessing the performance of air conditioning or mechanical ventilation systems, areas which are treated because of process requirements should be excluded from the treated area, together with the plant capacity, or proportion of the plant capacity, that is provided to service those areas. Activities and areas in office buildings considered to represent process requirements would thus include:

- Staff restaurants and kitchens;
- Large, dedicated, conference rooms;
- Sports facilities;
- Dedicated computer or communications rooms.

e) In the following text, air conditioning and/or mechanical ventilation systems as defined above are collectively described as ACMV.

1.61 Buildings with ACMV should be designed and constructed such that:

a) the form and fabric of the building do not result in a requirement for excessive installed capacity of ACMV equipment. In particular, the suitable specification of glazing ratios and solar shading are an important way to limit cooling requirements (see paragraphs 1.20 – 1.23).

b) components such as fans, pumps and refrigeration equipment are reasonably efficient and appropriately sized to have no more capacity for demand and standby than is necessary for the task.

c) suitable facilities are provided to manage, control and monitor the operation of the equipment and the systems.

CPR method for office buildings with ACMV

1.62 In the case of an office development, one way of achieving compliance (if there are no innovative building or building services provisions) is to show that the Carbon Performance Rating (CPR) is satisfactory. Where there are innovative features in the design the carbon emissions calculation method, or another acceptable alternative would be more appropriate.

1.63 The CPR is a rating based on standardised occupancy patterns that relates the performance of the proposed building to a benchmark based on the measured consumption data contained in *ECON19* (full reference in paragraph 1.6b). The rating of the proposed building is calculated from the rated input power of the installed equipment as this combines the effect of load reduction by good envelope design and energy efficient system design into a single parameter. The detail of the CPR calculation is contained in Annex B. If there are any areas in the building with significant process loads (e.g. a major computer suite), such areas and their associated plant capacity should be excluded from the calculation of the CPR. However, in order to facilitate comparison with operational performance, such discounted loads should be separately metered (see paragraph 3.6d)). For an illustration of this calculation method, see Annex B.

1.64 For new ACMV systems, compliance would be achieved if the CPR is no greater than the values shown in Table 11.

Table 11 **Maximum allowable Carbon Performance Ratings**

	Maximum CPR ($kgC/m^2/year$) for a new system installed in:	
System type	**a) a new building**	**b) an existing building**
Air conditioning	10.3	11.35
Mechanical ventilation	6.5	7.35

If both new air conditioning and mechanical ventilation systems are to be installed in a building, the system types and their treated areas should be dealt with separately and the appropriate CPR achieved for each.

1.65 For a building that already contains an ACMV system and substantial alteration is being made to that existing ACMV system, compliance would be achieved if the CPR is improved (i.e. reduced) by 10% as a result of the work, or does not exceed the values in Table 11 column b), whichever is the least demanding.

1.66 When the work solely comprises replacement of existing equipment, the product of the installed capacity per unit treated area (P) and the control management factor (F) should:-

a) be reduced by at least 10%, OR

b) meet a level of performance equivalent to the component benchmarks given in *CIBSE, Energy Assessment and Reporting Methodology: Office Assessment Method, TM22, CIBSE, 2006* (i.e. the product of service provision, efficiency and control factor), whichever is the least demanding.

Methods for other buildings with ACMV

1.67 For other buildings, it is only possible at present to define an overall performance requirement for the mechanical ventilation systems (whether or not the air being supplied and/or extracted is heated or cooled). In such cases, the requirement can be met if the specific fan power (SFP) is less than the values given in the following sub-paragraphs. The specific fan power is the sum of the design total circuit-watts, including all losses through switchgear and controls such as inverters, of all fans that supply air and exhaust it back to outdoors (i.e., the sum of supply and extract fans), divided by the design ventilation rate through the building.

a) for ACMV systems in new buildings, the SFP should be no greater than 2.0 W/litre/second.

b) for new ACMV systems in refurbished buildings, or where an existing ACMV system in an existing building is being substantially altered, the SFP should be no greater than 3.0 W/litre/second.

These SFP values are appropriate to typical spaces ventilated for human occupancy. Where specialist processes or higher than normal external pollution levels require increased levels of filtration or air cleaning, higher SFPs may be appropriate.

1.68 Mechanical ventilation systems should be reasonably efficient at part load. One way to achieve this would be to provide efficient variable flow control systems incorporating for instance variable speed drives or variable pitch axial fans. More detailed guidance on these measures is given in *Variable flow control, General Information Report 41, Energy Efficiency Best Practice programme, 1996.*

Whole-building Method

1.69 To show compliance following the Wholebuilding Method, the carbon emissions or primary energy consumption at the level of the complete building have to be reasonable for the purpose of the conservation of fuel and power. This approach allows much more design flexibility than the Elemental method.

Office buildings

1.70 The Whole-Office Carbon Performance Rating method is a development of the CPR described in paragraphs 1.62 and 1.63. In this compliance route, the rating is expanded to cover lighting and space heating as explained in detail in *BRE Digest No 457: "The Carbon Performance Rating for offices".*

1.71 The requirement would be met if:

a) the whole-office CPR is no greater than the values shown in Table 12 AND

b) the envelope meets the requirements of paragraphs 1.9-1.11, 1.17-1.19 and Table 3.

Table 12 **Maximum whole-office CPR**

	Maximum allowable CPR ($kgC/m^2/year$)	
Building type	**New office**	**Refurbished office**
Naturally ventilated	7.1	7.8
Mechanically ventilated	10.0	11.0
Air-conditioned	18.5	20.4

Schools

1.72 For schools, a way of complying with the requirements would be to show that the proposed building conforms with the *DfEE, Guidelines for environmental design in schools, Building Bulletin 87, TSO, 1997*

Hospitals

1.73 For hospitals, a way of complying with the requirements would be to show that the proposed building conforms with the *NHS Estates: Achieving energy efficiency in new hospitals, TSO, 1994.*

Carbon Emissions Calculation Method

1.74 To show compliance using the Carbon Emissions Calculation Method, the calculated annual carbon emissions of the proposed building should be no greater than those from a notional building of the same size and shape designed to comply with the Elemental Method. This approach allows more flexible design of the building, taking advantage of any valid energy conservation measure and taking account of useful solar and internal heat gains.

1.75 The following constraints should however be applied:-

a) when establishing the parameters of the notional building, the constraint on floor U-value in paragraph 1.16a) should be applied, and

b) the proposed building fabric and air leakage performances should be no worse than those given in Table 3 and paragraphs 1.9-1.11 and 1.17-1.19 respectively.

1.76 The calculations should be carried out using an acceptable method. The method may be acceptable to Building Control if:-

a) it has been approved by a relevant authority responsible for issuing professional guidance, or

b) it has been accepted by the organisation responsible for the work as having satisfied their in-house quality assurance procedures. This could be demonstrated by submitting with the calculations a completed copy of Annex B (Checklist for choosing BEEM software) of *CIBSE AM11, 1998: Building Energy and Environmental Modelling.*, showing that the software used is appropriate for the purpose to which it has been applied.

Conservatories, atria and similar sun-spaces

1.77 For the purposes of section 1 of Guernsey Technical Standard L2, sun-space (which includes conservatories and atria) means a building or part of a building having not less than threequarters of the area of its roof and not less than half the area of its external walls (if any) made of translucent material.

1.78 When a sun-space is attached to and built as part of a new building:

a) where there is no separation between the sun-space and the building, the sun-space should be treated as an integral part of the building;

b) where there is separation between the sun-space and the building, energy savings can be achieved if the sun-space is not heated or mechanically cooled. If fixed heating or mechanical cooling installations are proposed, however, they should have their own separate temperature and on/off controls.

1.79 When a sun-space is attached to an existing building and an opening is enlarged or newly created as a material alteration, reasonable provision should be made to enable the heat loss from, or the summer solar heat gain to, the building to be limited. Ways of meeting the requirement would be:

a) to retain the existing separation where the opening is not to be enlarged; or

b) to provide separation as, or equivalent to, windows and doors having the average U-value given in Table 1.

1.80 For the purposes of this Guernsey Technical Standard, separation between a building and a sun-space means:

a) separating walls and floors that are insulated to at least the same degree as the exposed walls and floors;

b) separating windows and doors with the same U-value and draught-proofing provisions as the exposed windows and doors elsewhere in the building.

1.81 Attention is drawn to the safety requirements of Part N of the Building Regulations regarding glazing materials and protection.

An Alternative Approved methodology

1.30 For the purposes of complying with the requirements of L1 of Schedule 1 it is acceptable to follow the compliance metodology as set out in UK Government issued *Approved Document L1A Conservation of fuel and power in new dwellings 2013 edition with 2016 and all previous amendments,* and *Approved Document L1B Conservation of fuel and power in existing dwellings 2010 with 2018 and all previous amendments.* These are published for use in England

1.31 Any further revisions of the above documents or subsequant editions thereof may similarly be accepted with prior agreement from the Development and Planning Authority

Section 2 - Construction

Building Fabric

Continuity of insulation

2.1 To avoid excessive thermal bridging, appropriate design details and fixings should be used (see paragraph 1.9). Responsibility for achieving compliance with the requirements of Part L rests with the person carrying out the work. In the case of new buildings, that "person" will usually be, e.g., a developer or main contractor who has carried out the work subject to Part L, directly or by engaging a subcontractor. The person responsible for achieving compliance should (if suitably qualified) provide a certificate or declaration that the provisions meet the requirements of Part L2(a); or they should obtain a certificate or declaration to that effect from a suitably qualified person. Such certificates or declarations would state:

a) that appropriate design details and building techniques have been used and that the work has been carried out in ways that can be expected to achieve reasonable conformity with the specifications that have been approved for the purposes of compliance with Part L2; or

b) that infra-red thermography inspections have shown that the insulation is reasonably continuous over the whole visible envelope. *A practical guide to infra-red thermography for building surveys, BRE report 176, BRE, 1991* gives guidance on the use of thermography for building surveys.

Airtightness

2.2 Air barriers should be installed to minimise air infiltration through the building fabric (see paragraph 1.19). In this case too, certificates or declarations should be provided or obtained by the person carrying out the work, stating:

a) for buildings of any size, that the results of air leakage tests carried out accordance with Regulation 26 'Pressure testing' (paragraphs 2.8 - 2.14) are satisfactory; or

b) alternatively for buildings of less than 1000m^2 gross floor area, that appropriate design details and building techniques have been used, and that the work has been carried out in ways that can be expected to achieve reasonable conformity with the specifications that have been approved for the purposes of compliance with Part L2.

Inspection and Commissioning of the Building Services Systems

2.5 In Part L2, in the context of building services systems, 'providing' and 'making provision' should be taken as including, where relevant, inspection and commissioning with meanings as described below:

a) Inspection of building services systems means establishing at completion of installation that the specified and approved provisions for efficient operation have been put in place.

b) Commissioning means the advancement of these systems from the state of static completion to working order to the specifications relevant to achieving compliance with Part L, without prejudice to the need to comply with health and safety requirements. For each system it includes setting-to-work, regulation (that is testing and adjusting repetitively) to achieve the specified performance, the 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.

2.6 As noted in paragraph 2.1, responsibilty for achieving compliance with the requirements of Part L rests with the person carrying out the work. In the case of building services systems, that "person" may be, e.g., a developer or main contractor who has carried out the work directly, or by engaging a subcontractor to carry it out; or it may be a specialist firm directly engaged by a client. The person responsible for achieving compliance should provide a report, or obtain one from a suitably qualified person, that indicates the inspection and commissioning activities necessary to establish that the work complies with Part L have been completed to a reasonable standard. Such reports should include:

a) a commissioning plan that shows that every system has been inspected and commissioned in an appropriate sequence. A way of demonstrating compliance would be to follow the guidance in the *CIBSE Commissioning Codes and BSRIA Commissioning Guides*.

b) the results of the tests confirming the performance is reasonably in accordance with the approved designs including written commentaries where excursions are proposed to be accepted.

2.7 Such reports may be accepted by Building Control as evidence of compliance. Building Control will, however, wish to establish, in advance of the work, that any person who will be providing such a report is suitably qualified.

Air permeability and pressure testing

2.8 In order to demonstrate that an acceptable air permeability has been achieved, Regulation 26 states:

Regulation

Pressure testing

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

(2) Where this regulation applies, the person carrying out the work must, for the purposes of ensuring compliance with paragraph (1) -

(a) ensure that-
- (i) pressure testing is carried out in such circumstances as are approved by the Department, and
- (ii) the testing is carried out in accordance with a procedure approved by the Department, and

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

(3) The notice referred to in paragraph (2)(b) must -

(a) record the results and the data upon which they are based in a manner approved by the Department, and

(b) be given to the Department not later than seven days after the day on which the final test is carried out.

(4) The Department is authorised to accept, as evidence that the requirements of pargraph (2)(a)(ii) have been satisfied, a certificate to that effect by a person who is registered by the British Institute of Non-Destructive Testing in respect of pressure testing for the air tightness of buildings.

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

Note: For the avoidance of doubt, air pressure testing in L2 is only required for new buildings and does not apply to an extension or material alteration of a building.

2.9 The approved procedure for pressure testing is given in the Air Tightness Testing and Measurement Association (ATTMA) publication Measuring air permeability of building envelopes (dwellings) and, specifically, the method that tests the envelope area. The perferred test method is that trickle ventilators should be temporarily sealed rather than just closed. Building Control 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.

2.10 Building Control are authorised to accept, as evidence of compliance, a certificate offered under regulation 26(4). It should be confirmed to Building Control that the person who completed the testing has received appropriate training and is registered to test the specific class of building concerned. See http://www.bindt.org/att_list/

2.11 The approved circumstances under which the Development and Planning Authority requires pressure testing to be carried out in paragraphs 1.71 to 1.76.

2.12 All buildings that are not dwellings must be subject to pressure testing, with the following exceptions:

a. Buildings less than 500m^2 total useful floor area; in this case where part L compliance has been demonstratred under the Alternative Approved Methodology route - the UK's Approved Document L2A, 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 15m^3/(h.m^2) at 50 Pa.

b. A factory-made modular building of less than 500m^2 floor area, with a planned service life of more than 2 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 Regulation 26 can be demonstrated by giving notice to Building Control 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. These results must achieve the 5.0m^3/(h.m^2) at 50 Pa limit.

c. 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 qualiofied 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 possible to claim air permeability better than 5.0 m^3/(h.m^2) at 50 Pa has been achieved.

NOTE: *One example of a suitably qualified person would be an ATTMA member. The 5.0 m^3/(h.m^2) 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.*

d. Compartmentalised building. 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 2.13 and 2.14 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.

2.13 Compliance with the requirement in paragraph L1(a)(i) of Schedule 1 of the Building (Guernsey) Regulations would be demonstrated if:

a. the measured air permeability is not worse than the limiting value of $10m^3/(h.m^2)$ at 50 Pa; and if using the Alternative Approved Metodology - UK's Approved Document L2a route to compliance,

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

NOTE: *If it proves impractical to meet the design air permeability, any shortfall must be compensated through improvements to subsequant 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

2.14 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 2.13

NOTE: *If using the Alternative Approved Methodology - UK's Approved Document L2a route to compliance, and the measured air permeability on reset is greater than the design air permeability but less than the limiting value of $10m^3/(h.m^2)$ 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 $10m^3/(h.m^2)$ unless they are confident of achieving the improved value.*

Section 3 - Providing Information

Building log-book

3.1 The owner and/or occupier of the building should be provided with a log-book giving details of the installed building services plant and controls, their method of operation and maintenance, and other details that collectively enable energy consumption to be monitored and controlled. The information should be provided in summary form, suitable for day-to-day use. This summary 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.

3.2 The details to be provided could include:

a) a description of the whole building, its intended use and design philosophy and the intended purpose of the individual building services systems;

b) a schedule of the floor areas of each of the building zones categorised by environmental servicing type (e.g. airconditioned, naturally ventilated);

c) the location of the relevant plant and equipment, including simplified schematic diagrams;

d) the installed capacities (input power and output rating) of the services plant;

e) simple descriptions of the operational and control strategies of the energy consuming services in the building;

f) a copy of the report confirming that the building services equipment has been satisfactorily commissioned (see paragraph 2.6(b);

g) operating and maintenance instructions that include provisions enabling the specified performance to be sustained during occupation;

h) a schedule of the building's energy supply meters and sub-meters, indicating for each meter, the fuel type, its location, identification and description, and instructions on their use. The instructions should indicate how the energy performance of the building (or each separate tenancy in the building where appropriate) can be calculated from the individual metered energy readings to facilitate comparison with published benchmarks (see paragraphs B6 to B9 in Annex B). Guidance on appropriate metering strategies is given, starting at paragraph 3.3 below;

i) for systems serving an office floor area greater than 200 m^2, a design assessment of the building services systems' carbon emissions and the comparable performance benchmark (see paragraph B4 in Annex B);

j) the measured air permeability of the building (see paragraph 2.4).

Installation of energy meters

3.3 To enable owners or occupiers to measure their actual energy consumption, the building engineering services should be provided with sufficient energy meters and sub-meters. The owners or occupiers should also be provided with sufficient instructions including an overall metering strategy that show how to attribute energy consumptions to end uses and how the meter readings can be used to compare operating performance with published benchmarks (see paragraph 3.2.h). *GIL 65, 2001: Sub metering new build non-domestic buildings, BRECSU* provides guidance on developing metering strategies.

3.4 Reasonable provision would be to enable at least 90% of the estimated annual energy consumption of each fuel to be accounted for. Allocation of energy consumption to the various end uses can be achieved using the following techniques:-

a) direct metering;

b) measuring the run-hours of a piece of equipment that operates at a constant known load;

c) estimating the energy consumption, e.g. from metered water consumption for HWS, the known water supply and delivery temperatures and the known efficiency of the water heater;

d) estimating consumption by difference, e.g. measuring the total consumption of gas, and estimating the gas used for catering by deducting the measured gas consumption for heating and hot water;

e) estimating non-constant small power loads using the procedure outlined in Chapter 11 of the *CIBSE Energy Efficiency Guide, 1998: Chapter 11, General electric power*.

3.5 Reasonable provision of meters would be to install incoming meters in every building greater than 500m^2 gross floor area (including separate buildings on multi-building sites). This would include:

a) individual meters to directly measure the total electricity, gas, oil and LPG consumed within the building;

b) a heat meter capable of directly measuring the total heating and/or cooling energy supplied to the building by a district heating or cooling scheme.

3.6 Reasonable provision of sub-metering would be to provide additional meters such that the following consumptions can be directly measured or reliably estimated (see paragraph 3.4).

a) electricity, natural gas, oil and LPG provided to each separately tenanted area that is greater than 500m^2.

b) energy consumed by plant items with input powers greater or equal to that shown in Table 13.

c) any heating or cooling supplied to separately tenanted spaces. For larger tenancies, such as those greater than 2500m^2, direct metering of the heating and cooling may be appropriate, but for smaller tenanted areas, the heating and cooling end uses can be apportioned on an area basis.

d) any process load (see paragraph 1.60d)) that is to be discounted from the building's energy consumption when comparing measured consumption against published benchmarks.

Table 13 **Size of plant for which separate metering would be reasonable.**

Plant item	Rated input power (kW)
Boiler installations comprising one or more boilers or CHP plant feeding a common distribution circuit.	50
Chiller installations comprising one or more chiller units feeding a common distribution circuit	20
Electric humidifiers	10
Motor control centres providing power to fans and pumps	10
Final electrical distribution boards	50

Section 4 - Work on existing buildings

Replacement of a controlled service or fitting

4.1 “Controlled Service or fitting” is defined in Regulation 2 of the Building Regulations as “a service or fitting in relation to which Paragraph C1, F1, G1 to G5, G7, Part H or J or paragraph L1, L2, M3, M4 or P2 of Schedule 1 imposes a requirement;”.

4.2 The definition of building work in Regulation 5 includes the provision or extension of a controlled service or fitting in or in connection with a building.

4.3 Reasonable provision where undertaking replacement work on controlled services or fittings (whether replacing with new but identical equipment or with different equipment and whether the work is solely in connection with controlled services or includes work on them) depends on the circumstances in the particular case and would also need to take account of historic value (see paragraph 4.7 et seq). Possible ways of satisfying the requirements include the following:-

a) **Windows, doors and rooflights.** Where these elements are to be replaced, providing new draught-proofed ones with an average U-value not exceeding the appropriate entry in Table 1, (the requirement does not apply to repair work on parts of these elements, such as replacing broken glass or sealed double-glazing units or replacing rotten framing members). The replacement work should comply with the requirements of Parts L and N. In addition the building should not have a worse level of compliance, after the work, with other applicable Parts of Schedule 1. These may include Parts B, F and J.

b) **Heating systems**. Where heating systems are to be substantially replaced, providing a new heating system and controls as if they are new installations. In lesser work, make reasonable provision for insulation, zoning, timing, temperature and interlock controls. Without prejudice to the need for compliance with all the requirements in Schedule 1, the need to comply with the requirements of Parts F and J should particularly be taken into account.

c) **Hot water systems.** When substantially replacing hot water systems, pipes and vessels – providing controls and insulation as if they are new installations. In lesser work, make reasonable provision for insulation, timing and thermostatic controls.

d) When replacing a complete lighting system serving more than 100m^2 of floor area, provide a new lighting system as if for a new building. Where only the complete luminaires are being replaced, provide new luminaires that meet the the standards given in paragraphs 1.43 or 1.48 (but the requirement does not apply where only components such as lamps or louvres are being replaced). Where only the control system is to be replaced, provide new controls that meet the standards in paragraphs 1.56 to 1.58 (but the requirement does not apply where only components such as switches and relays are being replaced).

e) **Air conditioning or mechanical ventilation systems**. When replacing air conditioning or mechanical ventilation systems that serve more than 200m^2 of floor area in office buildings, improving the Carbon Performance Rating in line with the guidance in paragraphs 1.62 to 1.66 of this Guernsey Technical Standard. In buildings other than offices, provide mechanical ventilation systems that meet the SFP standards in paragraph 1.67.

4.4 When carrying out work as described in paragraph 4.3 sub-clauses (b) to (e):

a) the work should be inspected and commissioned following the guidance in paragraph 2.6.

b) the building log-book should be prepared or updated as necessary to provide the appropriate details of the replacement controlled service or fitting (paragraphs 3.1 and 3.2).

c) the relevant part of the metering strategy should be prepared or revised as necessary, and additional metering provided where needed so as to enable the energy consumption of the replacement controlled service or fitting to be effectively monitored (paragraphs 3.3 to 3.6).

Material changes of use

4.6 In addition to the guidance given under this heading on page 9 of this document, reasonable provision where undertaking a material change of use depends on the circumstances in each particular case and would need to take account of historic value (see paragraph 4.8). Without prejudice to the need for compliance with all the requirements in Schedule 1, the need to comply with the requirements of Parts F and J should particularly be taken into account.

4.7 Reasonable provision where undertaking a material change of use depends on the circumstances in the particular case and would need to take account of historic value (see paragraph 4.8 et seq). Without prejudice to the need for compliance with all the requirements in Schedule 1, the need to comply with the requirements of Parts F and J should particularly be taken into account. Possible ways of satisfying the requirements include:

a) **Accessible lofts**. When upgrading insulation in accessible lofts, providing additional insulation to achieve a U-value not exceeding 0.25 W/m^2K where the existing insulation provides a U-value worse than 0.35 W/m^2K.

b) **Roof insulation**. When substantially replacing any of the major elements of a roof structure - providing insulation to achieve the U-value considered reasonable for new buildings.

c) **Floor insulation**. Where the structure of a ground floor is to be substantially replaced – providing insulation in heated rooms to the standard considered reasonable for new buildings.

d) **Wall insulation.** When substantially replacing complete exposed walls or their external renderings or cladding or internal surface finishes, or the internal surfaces of separating walls to unheated spaces, providing a reasonable thickness of insulation.

e) **Sealing measures**. When carrying out any of the above work, including reasonable sealing measures to improve airtightness.

f) **Controlled services and fittings**. When replacing controlled services and fittings, following the guidance in paragraphs 4.3 and 4.4.

Protected Buildings

4.8 Further to the general advice given under this heading on page 10 The need to conserve the s pecial characteristics of such historic buildings needs to be recognised. In such work, the aim should be to improve energy efficiency where and to the extent that it is practically possible, always provided that the work does not prejudice the character of the historic building, or increase the risk of long-term deterioration to the building fabric or fittings. In arriving at an appropriate balance between historic building conservation and energy conservation, it would be appropriate to take into account the advice of the historic buildings advisor.

4.9 Particular issues relating to work in historic buildings that warrant sympathetic treatment and where advice from others could therefore be beneficial include –

a) restoring the historic character of a building that had been subject to previous inappropriate alteration, eg replacement windows, doors and rooflights;

b) rebuilding a former historic building (e.g. following a fire or filling in a gap site in a terrace;

c) making provisions enabling the fabric of historic buildings to "breathe" to control moisture and potential long term decay problems. See *The need for old buildings to breathe, SPAB Information sheet 4, 1986.*

4.10 New thermal elements must comply with Part L1 of Schedule 1 to the Building Regulations. Work on existing thermal elements must comply with regulation 22 of the Building Regulations which states:

Requirements relating to thermal elements.

22. **(1)** Where a person intends to renovate a thermal element, such work must be carried out as is necessary to ensure that the whole thermal element complies with the requirements of paragraph L1(a)(i) of Schedule 1.

(2) Where a thermal element is replaced, the new thermal element must comply with the requirements of paragraph L1(a)(i) of Schedule 1.

(3) For the purposes of these Regulations, a "thermal element" means a wall, floor or roof which separates a thermally conditioned part of the building ("the conditioned space") from -

(a) the external environment including the ground, or

(b) in the case of a wall or floor, another part of the building which is -

(i) not thermally conditioned,

(ii) an extension of a building falling within Class VI of Schedule 2, or

(iii) where the building falls within paragraph (4), conditioned to a different temperature,

and, for the avoidance of doubt, includes all parts of such a wall, floor or roof between the surface bounding the conditioned space and the external environment or other part of the building, as the case may be.

(4) A building falls within this paragraph if -

(a) the building is not a dwelling, and

(b) the other part of the building is used for a purpose which is not identical or similar to that for which the conditioned space is used.

The Provision of Thermal Elements

U-values

4.11 U-values shall be calculated using the methods and conventions set out in BR 443.

4.12 Reasonable provision for newly constructed thermal elements such as those constructed as part of an extension would be to meet the standards set out in Table 5.

4.13 Reasonable provision for those thermal elements constructed as replacements for existing elements would be to meet the standards set out in Table 14.

Table 14 **Standards for new thermal elements**

Element[1]	**Standard (W/m².K)**
Wall	0.28[2]
Pitched roof – insulation at ceiling level	0.16
Pitched roof – insulation at rafter level	0.18
Flat roof or roof with integral insulation	0.18
Floors[3]	0.22[4]

Notes:

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

Continuity of insulation and airtightness

4.14 The building fabric should be constructed so that there are no reasonably avoidable thermal bridges in the insulation layers caused by gaps within the various elements, at the joints between elements, and at the edges of elements such as those around window and door openings. Reasonable provision should also be made to reduce unwanted air leakage through the new envelope parts. The work should comply with all the requirements of Schedule 1, but particular attention should be paid to Parts F and J.

Renovation of Thermal Elements

4.15 For the purposes of this Guernsey Technical Standard, **renovation** of a **thermal element** through:

a. the provision of a new layer means either of the following activities:

   i. Cladding or rendering the external surface of the **thermal element**; or

   ii. Dry-lining the internal surface of a **thermal element**.

b. the replacement of an existing layer means stripping down the element to expose the basic structural components (brick/blockwork, timber/metal frame, joists, rafters, etc.) and then rebuilding to achieve all the necessary performance requirements. As discussed in paragraphs 4.8 - 4.9, particular considerations apply to renovating elements of traditional construction.

4.16 Where a thermal element is subject to a renovation through undertaking an activity listed in paragraph 4.15a or 4.15b, the performance of the whole element should be improved to achieve or better the relevant U-value set out in column (b) of Table 15, provided the area to be renovated is greater than 50 per cent of the surface of the individual element or 25 per cent of the total building envelope.

4.17 In relation to the renovation of individual thermal elements, when assessing the proportion of the surface area that is to be renovated, the area of the thermal element should be assessed as the area of each individual thermal element, not the area of all the elements of that type in the building. The area of each thermal element should also be interpreted in the context of whether the element is being renovated from inside or outside, e.g. if removing all the plaster finish from the inside of a solid brick wall, the area of the element is the area of external wall in the room. If removing external render, it is the area of the elevation in which that wall sits.

This means that if all the roofing on the flat roof of an extension is being stripped down, the area of the element is the roof area of the extension, not the total roof area of the building. Similarly, if the rear wall of a single-storey extension was being re-rendered externally, then the rear wall of ther extension should be upgraded to the standards of Table 15 column (b), even if it was less than 50 per cent of the total area of the building elevation when viewed from the rear. If plaster is being removed from a bedroom wall, the relevant area is the area of the external wall in the room, not the area of the external elevation which contains that wall section. This is because the marginal cost of dry-lining with insulated plasterboard rather than plain plasterboard is small.

4.17 If achievement of the relevant U-value set out in column (b) of Table 15 is not technically or functionally feasible or would not achieve a **simple payback** of 15 years or less, the element should be upgraded to the best standard that is technically and functionally feasible and which can be achieved within a **simple payback** of no greater than 15 years. Guidance on this approach is given in Annex B to Guernsey Technical Standard L1.

4.18 When renovating **thermal elements**, the work should comply with all the requirements in Schedule 1 of the Building Regulations, but particular attention should be paid to Parts F and J.

Retained Thermal Elements

4.19 Part L of Schedule 1 to the Building Regulations applies to retained thermal elements in the following circumstances:

a. where an existing thermal element is part of a building subject to a material change of use;

b. where an existing element is to become part of the thermal envelope where previously it was not.

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

Generally, this lesser standard should not be worse than 0.7 W/m^2.K.

Examples of where lesser provision than column (b) might apply are where the thickness of the additional insulation might reduce usable floor area of any room by more than 5 per cent or create difficulties with adjoining floor levels, or where the weight of the additional insulation might not be supported by the existing structural frame.

4.21 When upgrading retained **thermal elements**, the work should comply with all the requirements in Schedule 1, but particular attention should be paid to Parts F and J.

Table 15 **Upgrading retained thermal elements**

Element[1]	**(a) Threshold U-value W/m²·K**	**(b) Improved U-value W/m²·K**
Wall – cavity insulation[2]	0.70	0.55
Wall – external or internal insulation[3]	0.70	0.30
Floor[4,5]	0.70	0.25
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation between rafters[6]	0.35	0.18
Flat roof or roof with integral insulation[7]	0.35	0.18

1 'Roof' includes the roof parts of dormer windows and 'wall' includes the wall parts (cheeks) of dormer windows.

2 This applies only in the case of a wall suitable for the installation of cavity insulation. Where this is not the case, it should be treated as 'wall – external or internal insulation'.

3 A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.

4 The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.

5 A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.

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

7 A lesser provision may be appropriate if there are particular problems associated with the load-bearing capacity of the frame or the upstand height.

Annex A - Meeting the lighting standards

General lighting in office, industrial and storage buildings

By selection of lamp and luminaire types
A1 The performance standard for the electric lighting system in these building types depends on the efficiencies of both the lamp/ballast combination and the luminaire. The recommendation in paragraph 1.43 is met if:

a) the installed lighting capacity in circuit Watts comprises lighting fittings incorporating lamps of the type shown in Table 16, and

b) all the luminaires have a light output ratio of at least 0.6.

A2 A maximum of 500W of installed lighting in the building is exempt from the above requirement (paragraph 1.46).

Table 16 **Types of high efficacy lamps for non-daylit areas of offices, industrial and storage buildings**

Light source	Types
High pressure sodium	All ratings above 70W
Metal halide	All ratings above 70W
Tubular fluorescent	All 26mm diameter (T8) lamps and 16mm diameter (T5) lamps rated above 11W, provided with low-loss or high frequency control gear.
Compact fluorescent	All ratings above 26W

A3 Otherwise, if the use of other types of lighting or less efficient luminaires is planned, a calculation of the average initial luminaire efficacy is required (paragraph 1.44).

Example calculation of average luminaire efficacy
A4 A small industrial unit is being constructed incorporating production, storage and office areas. Lighting in the production area (which is non-daylit) is to be controlled by staged time switching to coincide with shift patterns. The storage area is anticipated to be occasionally visited, and is to be controlled by local absence detection, where a sensor switches the lighting off if no one is present, but switching on is done manually. The office areas are day lit; the furthest luminaire is less than 6m from the window wall, which is 30% glazed with clear low emissivity double glazing. Lighting control in this area is by localised infra red switch. Lighting control in the non-day lit corridor, toilet and foyer areas is by full occupancy sensing with automatic on and off.

A5 The lighting controls therefore meet the requirements of paragraph 1.56 (for the office and storage areas) and paragraph 1.58 (for the production and circulation areas).

A6 Table 17 below shows a schedule of the light sources proposed, together with a calculation of the overall average luminaire efficacy. It incorporates the luminaire control factor, which allows for the reduced energy use due to lighting in day lit and rarely occupied spaces. The storage areas are occasionally visited and incorporate absence detection, so have a luminaire control factor of 0.8.

A7 The day lit office areas with local manual switching also have a luminaire control factor of 0.8. Note that if the office areas had tinted glazing, of transmittance 0.33, the equivalent area of glazing of transmittance 0.7 would need to be calculated. This is 30% x 0.33/0.7 = 14% of the window wall area. As this area is less than 20% of the window wall, the office areas would not count as day lit if this type of glazing were used.

A8 From Table 17, the total corrected lumen output of all the lamps in the installation is 333,730 lumens.

A9 The total circuit Watts of the installation is 7292 Watts. Therefore the average luminaire efficacy is 333,730/7292 = 45.8 lumens/Watt. As this is greater than 40 lumens/Watt, the proposed lighting scheme therefore meets the requirements of this Guernsey Technical Standard.

Note that up to 500W of any form of lighting, including lamps in luminaires for which light output ratios are unavailable, could also be installed in the building according to paragraph 1.46.

Table 17 **Size of plant for which separate metering would be reasonable.**

Position	Number N	Description	Circuit Watts (W) per fitting	Lamp lumen output Ø (lm) per fitting	Luminaire light output ratio LOR	Luminaire control factor CL	Total corrected luminaire output =Nx Ø x LOR/CL(lm)	Total circuit Watts (W)
Production	16	250W high bay metal halide	271	17000	0.8	1	217600	4336
Offices	12	4 x 18W fluorescent with aluminium Cat 2 louvre and high frequency control gear	73	4600	0.57	0.8	39330	876
Storage	16	58W fluorescent with aluminium louvres and mains frequency control gear	70	4600	0.6	0.8	55200	1120
Circulation, toilets and foyer		30 24W compact fluorescent mains frequency downlights	32	1800	0.4	1	21600	960
						Totals	**333730**	**7292**

Table 18 **Schedule of light sources and overall average circuit efficacy calculation.**

Position	Number	Description	Circuit Watts (W) per lamp	Lumen output (lm) per lamp	Total circuit Watts (W)	Total Lamp lumen output (lm)
Over tables	20	60W tungsten	60	710	1200	14,200
Concealed perimeter and bar lighting	24	32W T8 fluorescent high frequency ballast	36	3300	864	79,200
Toilets and circulation	6	18W compact fluorescent mains frequency ballast	23	1200	138	7,200
Kitchens	6	50W, T8 fluorescent high frequency ballast	56	5200	336	31,200
				Totals	**2538**	**131,800**

General lighting in other building types

Lighting calculation procedure to show average circuit efficacy is not less than 50 lumens/watt

A10 A lighting scheme is proposed for a new public house comprising a mixture of concealed perimeter lighting using high frequency fluorescent fittings and supplementary tungsten lamps in the dining area. Lights in the dining and lounge areas are to be switched locally from behind the bar. Lighting to kitchens and toilets is to be switched locally.

A11 Table 18 shows a schedule of the light sources proposed together with the calculation of the overall average circuit efficacy.

A12 From Table 18, the total lumen output of the lamps in the installation is 131,800 lumens.
A13 The total circuit Watts of the installation is 2538 Watts.

A14 Therefore, the average circuit efficacy is:

$$\frac{131800}{2538} = 51.9 \text{ lumens/Watt}$$

A15 The proposed lighting scheme therefore meets the requirements of this Guernsey Technical Standard.

A16 If 100W tungsten lamps were used in the dining area instead of the 60W lamps actually proposed, the average circuit efficacy would drop to 43.4 lumens/W, which is unsatisfactory. If, however, 11W compact fluorescent lamps, which have similar light output to 60W tungsten lamps, were used in the dining area the average circuit efficacy would be 83.2 lumens/W.

Lighting calculation procedure to show that 95% of installed circuit power is comprised of lamps listed in table 8 (paragraph 1.48)
A17 A new hall and changing rooms are to be added to an existing community centre. The proposed lighting scheme incorporates lamps that are listed in Table 8 except for some low voltage tungsten halogen downlighters which are to be installed in the entrance area with local controls. A check therefore has to be made to show that the low voltage tungsten halogen lamps comprise less than 5% of the overall installed capacity of the lighting installation.

Main hall
A18 Twenty wall mounted uplighters with 250W high pressure Sodium lamps are to provide general lighting needs. The uplighters are to be mounted 7m above the floor. On plan, the furthest light is 20.5m from its switch, which is less than three times the height of the light above the floor.

A19 It is also proposed to provide twenty 18W compact fluorescent lights as an additional system enabling instant background lighting whenever needed.

Changing rooms, corridors and entrance
A20 Ten 58W, high frequency fluorescent light fittings are to be provided in the changing rooms and controlled by occupancy detectors. Six more 58W fluorescent light fittings are to be located in the corridors and the entrance areas and switched locally. Additionally, in the entrance area there are to be the six 50W tungsten halogen downlighters noted above.

Calculation
A21 A schedule of light fittings is prepared as follows:

Position	Number	Description of light source	Circuit Watts per lamp	Total circuit Watts(W)
Main hall	20	250W SON	286W	5720
Main hall	20	18W compact fluorescent	23W	460
Entrance, changing rooms and corridors	16	58W HF fluorescent	64W	1024
Entrance	6	50W low voltage tungsten halogen	55W	330
			Total =	**7534W**

A22 The percentage of circuit Watts consumed by lamps not listed in Table 8 is

$$\frac{330 \times 100}{7534} = 4.4\ \%$$

A23 Therefore, more than 95% of the installed lighting capacity, in circuit Watts, is from light sources listed in Table 8. The switching arrangements comply with paragraph 1.58. The proposed lighting scheme therefore meets the requirements of the Regulations.

Annex B - Methods for office buildings

Assessing the contribution to carbon emissions due to building services design and operation

B1 The efficiencies of buildings, and of the services systems that produce the indoor conditions required by occupants, can be assessed and compared provided a consistent system is used to describe the buildings and their energy use.

B2 Applying such a consistent approach in the office building sector has allowed energy consumption benchmarks to be developed with which the performance of existing buildings, or the likely performance of new designs, can be compared. The benchmarks result from a number of surveys of operational buildings, and are included in Energy Consumption Guide 19 “Energy use in offices” (ECON 19). Performance benchmarks.

B3 The information contained in ECON 19 provides benchmarks for the energy consumed by ACMV, heating and lighting services, together with benchmark information describing the hours of use of the equipment. Benchmarks also describe the energy consumed by the additional equipment necessary to support use of the building for typical office activities. The benchmarks refer to office buildings described as representing ‘typical’ and ‘good practice’ for the sector.

Design Assessment

B4 The annual energy likely to be consumed by a particular service can be estimated as the product of the total installed input power rating of the plant installed to provide the service and the annual hours of use of that plant at the equivalent of full load. The annual hours of use can be considered to be the result of combining a benchmark value for the ‘typical’ hours of use of the service with a management factor that acts to reduce or increase this value. The management factor is a number related to the provisions that have been included that have the potential to help the occupier control and manage the use of the plant.

B5 The Carbon Performance Rating (CPR) referred to in paragraphs B10 to B19 of this Annex is a technique for assessing the likely performance of building services systems using this design information. It uses benchmarks consistent with ECON19 and is intended to estimate the potential for efficient operation of building services systems using information available at the design or construction stage.

Performance assessment

B6 The inclusion of meters (Section 3 of this Guernsey Technical Standard) improves the confidence with which occupiers may assess their buildings’ performance by estimating the energy consumed by servicing plant and the additional equipment required for the full operation of the building.

B7 A technique of estimating operational energy consumption, and comparing the achieved performance of buildings with the ECON19 benchmarks, has been developed to assess the achieved performance of office buildings. This method is described in CIBSE Technical Memorandum TM 22 “Energy Assessment and Reporting Methodology: Office Assessment Method”.

B8 A means of comparing the design of services with benchmarks of installed load and energy use is described the CIBSE Guide volume “Energy Efficiency in Buildings”.

B9 The results of ongoing performance assessment could be used to provide valuable information from which to maintain and improve performance benchmarks, and hence the CPR method, and to inform the design process.

The Carbon Performance Rating (CPR)

The CPR for mechanical ventilation - CPR(MV)

B10 The assessment is based on the calculation of a Carbon Performance Rating using the following relationship:

$$CPR_{(MV)} = PD \times HD \times CD \times FD$$

B11 The design is considered to represent acceptable practice where the result of the calculation $CPR_{(MV)}$ = 6.5 or less.

B12 For the system installed to provide mechanical ventilation, the factors PD, HD, CD and FD are as defined below:

PD is the total installed capacity (sum of the input kW ratings) of the fans installed to provide mechanical ventilation divided by the relevant treated area (square metres)

HD is the typical annual equivalent hours of full load operation, and is taken as 3700 hours per year

CD is the conversion factor relating the emissions of carbon to the fuel used, here electricity, in kgC/kWh. (See Table 6 for carbon emission factors)

FD is a factor which depends on the provisions that are made to control and manage the installed plant and which could act to improve the annual efficiency of the plant above that of the typical installation, or to reduce the effective annual hours of use. (See Table 19)

The CPR for air conditioning – $CPR_{(MR)}$

G13 The assessment is based on the calculation of a Carbon Performance Rating using the following relationship:

$$CPR_{(ACMV)} = (PD \times HD \times CD \times FD) + (PR \times HR \times CR \times FR)$$

G14 The design is considered to represent acceptable practice where the result of the calculation $CPR_{(ACMV)}$ = 10.3 or less.

G15 For the distribution system transferring cooled medium to the conditioned spaces, the factors PD, HD, CD and FD are as defined below:

PD is the total installed capacity (sum of the input kW ratings) of the fans and pumps installed to distribute air and/or cooled media around the building divided by the relevant treated area (square metres)

HD is the typical annual equivalent hours of full load operation, and is taken as 3700 hours per year

CD is the conversion factor relating the emissions of carbon to the fuel used, here electricity, in kgC/kWh. (See Table 6 for carbon emission factors)

FD is a factor which depends on the provisions that are made to control and manage the installed plant and which could act to improve the annual efficiency of the plant above that of the typical installation, or to reduce the effective annual hours of use. (See Table 20)

For the refrigeration system, the factors PR, HR, CR and FR are as defined below:

PR is the total installed capacity (sum of the input kW ratings) of the plant installed to provide the cooling or refrigeration function divided by the relevant treated area (square metres)

HR is the typical annual equivalent hours of full load operation of the refrigeration plant, and is taken as 1000 hours per year

CR is the conversion factor relating the emissions of Carbon to the fuel used, here most frequently electricity, sometimes gas, in kgC/kWh. (See Table 6 for carbon emission factors)

FR is a factor which depends on the provisions that are made to control and manage the installed plant and which could act to improve the annual efficiency of the plant above that of the typical installation, or to reduce the effective annual hours of use. (See Table 21)

Plant control and management factors

B16 Tables 19, 20 and 21 below itemise a number of control and management features which could act to improve the annual efficiency of the relevant plant above that of the typical installation, or to reduce the effective annual hours of use. Values to be associated with each feature are obtained from column A, B or C as appropriate and the resultant factor is obtained by multiplying together all of the individual values obtained. Values are selected from columns A, B and C of the table depending on the extent to which facilities for monitoring and reporting are provided, as follows:

Column C No monitoring provided

Column B Provision of energy metering of plant and/or metering of plant hours run, and/or monitoring of internal temperatures in zones

Column A Provision as B above, plus the ability to draw attention to 'out of range' values.

B17 The plant management features for Table 19 are:

Table 19 **To obtain factor (FD) for the air distribution system**

Plant management features	Values A	B	C
a) Operation in mixed mode with natural ventilation	0.85	0.9	0.95
b) Controls which restrict the hours of operation of distribution system	0.9	0.93	0.95
c) Efficient means of controlling air flow rate	0.75	0.85	0.95
Column product (FD):			

a) Mixed mode operation available as a result of including sufficient openable windows to provide the required internal environment from natural ventilation when outdoor conditions permit. This may only apply where the perimeter zone exceeds 80% of the treated floor area.

b) Control capable of limiting plant operation to occupancy hours with the exceptions noted below in which operation outside the hours of occupancy forms a necessary part of the efficient use of the system:

for control of condensation,

for optimum start/stop control, or

as part of a 'night cooling' strategy.

c) Air flow rate controlled by a variable motor speed control which efficiently reduces input power at reduced output; variable pitch fan blades. (Damper, throttle or inlet guide vane controls do not attract this factor).

Table 20 **To obtain factor (FD) for the cooling distribution system**

Plant management features	Values A	B	C
a) Operation in mixed mode with natural ventilation	0.85	0.9	0.95
b) Controls which restrict the hours of operation of distribution system	0.9	0.93	0.95
c) Efficient means of controlling air flow rate	0.75	0.85	0.95
Column product (FD):			

B18 The plant management features for Table 20 are:

a) Mixed mode operation available as a result of including sufficient openable windows to provide the required internal environment from natural ventilation when outdoor conditions permit. This may only apply where the perimeter zone exceeds 80% of the treated floor area. This factor is credited only where interlocks are provided to inhibit the air conditioning supply in zones with opened windows.

b) and c) are as described in Table 19 above for mechanical ventilation.

Table 21 **To obtain factor (FD) for the refridgeration plant**

Plant management features	Values A	B	C
a) Free cooling from cooling tower	0.9	0.93	0.95
b) Variation of fresh air using economy cycle or mixed mode operation	0.85	0.9	0.95
c) Controls to restrict hours of operation	0.85	0.9	0.95
d) Controls to prevent simultaneous heating and cooling in the same zone	0.9	0.93	0.95
e) Efficient control of plant capacity, including modular plant	0.9	0.93	0.95
f) Partial ice thermal storage	1.8	1.86	1.9
g) Full ice thermal storage	0.9	0.93	0.95
Column product (FD):			

B19 The plant management features for Table 21 are:

a) Systems that permit cooling to be obtained without the operation of the refrigeration equipment when conditions allow (eg 'strainer cycle'; 'thermosyphon').

b) Systems that incorporate an economy cycle in which the fresh air and recirculated air mix is controlled by dampers, or where mixed mode operation is available as defined below Table 20.

c) Controls that are capable of limiting plant operation to the hours of occupancy of the building, with the exceptions noted below in which operation outside the hours of occupancy forms a necessary part of the efficient use of the system:

for control of condensation,

for optimum start/stop control, or

as part of a strategy to pre-cool the building overnight using outside air.

d) Controls that include an interlock or dead band capable of precluding simultaneous heating and cooling in the same zone.

e) Refrigeration plant capacity controlled online by means that reduce input power in proportion to cooling demand and maintain good part load efficiencies (eg. modular plant with sequence controls; variable speed compressor). (Hot gas bypass control does not attract this factor).

f) Partial ice storage in which the chiller is intended to operate continuously, charging the store overnight and supplementing its output during occupancy.

g) Full ice storage in which the chiller operates only to recharge the thermal store overnight and outside occupancy hours.

Example CPR calculations

Example calculation for a office proposal including air conditioning

B20 In this example it is intended to include an air conditioning system in a new office building. The relevant details from the proposal are that:

The total area to be treated by the system is 3000m^2.

Cooling will be provided by two speedcontrolled electrically powered compressors, with a total rated input power of 150kW.

The refrigeration compressor energy consumption will be metered.

The fans used to distribute cooled air to treated spaces have a total rated input power of 35kW.

The fan energy consumption will be metered.

A time clock control is to be provided so that the operation of the cooling system (refrigeration and air distribution) may be restricted to occupancy hours.

Windows in treated areas will be openable so that natural ventilation may be used, and the cooling system turned off, when required.

The CPR calculation for air conditioning is:

$CPR_{(ACMV)}$ = (PD x HD x CD x FD) + (PR x HR x CR x FR)

In this proposal, for the cooling distribution system:

PD is the total installed capacity (sum of the input kW ratings) of the fans divided by the relevant treated area (square metres)

= 0.0117 (35/3000)

HD = 3700 hours per year

CD is the carbon conversion factor for electricity, in kgC/kWh. (See Table 6 for carbon emission factors)

= 0.113

FD = 0.84, determined from Table 41 as follows:

As the major plant will be metered, factors from Column B of the Table are used. Then:

Factor for including the opportunity for natural ventilation (mixed mode operation) = 0.9

Factor for including provision to restrict the hours of use of the system (time control) = 0.93

Column product (FD) = 0.84 (0.9 x 0.93)

And, for the refrigeration system:

PR = the total installed capacity (sum of the input kW ratings) of the refrigeration plant divided by the treated area (square metres)

= 0.05 (150/3000)

HR = 1000 hours per year

CR = the carbon conversion factor for electricity, in kgC/kWh. (See Table 6 for carbon emission factors)

= 0.113

FR = 0.75, determined from Table 42 as follows:

As the major plant will be metered, factors from Column B of the Table are used. Then: Factor for including the opportunity for natural ventilation (mixed mode operation) = 0.9

Factor for including provision to restrict the hours of use of the system (time control) = 0.9

Factor for providing efficient means of controlling plant capacity = 0.93

Column product (FR) = 0.75 (0.9 x 0.9 x 0.93)
The CPR calculation is then:

$CPR_{(ACMV)}$ = (0.0117 x 3700 x 0.113 x 0.84) + (0.05 x 1000 x 0.113 x 0.75)

= 8.35

The proposal therefore achieves a calculated rating of 8.35, which is lower than the required CPR of 10.3 and would therefore be acceptable on this basis.

Note: The rating of 8.35 indicates that, under similar patterns of occupancy and use, the proposed building would be likely to cause about 20% less carbon emission than would be caused by one like the typical air conditioned office building defined in ECON 19 (full reference in paragraph 1.6b).

Example calculation for a proposal to increase the area treated by an office mechanical ventilation system

B21 In this example it is intended to increase the area treated by an existing office mechanical ventilation system. The relevant details from the proposal are that:

The total area to be treated by the system is to be increased from 3200m^2 to 3800m^2.

The total input power rating of the fans is to be unchanged at 72kW.

The fan input power will be metered, where previously it was not.

An existing time clock control provision for the system is to be kept.

The CPR calculation for mechanical ventilation is:

$$CPR_{(MV)} = (PD \times HD \times CD \times FD)$$

In this proposal, for the existing air distribution system:

PD is the total installed capacity (sum of the input kW ratings) of the fans divided by the relevant treated area (square metres)

= 0.0225 (72/3200)

HD = 3700 hours per year

CD is the carbon conversion factor for electricity, in kgC/kWh. (See Table 6 for carbon emission factors)

= 0.113

FD = 0.95, determined from Table 19 as follows:

As the plant is not metered, factors from Column C of the Table are used. Then: Factor for including provision to restrict the hours of use of the system (time control) = 0.95

Column product (FD) = 0.95

The CPR calculation is then:

$CPR_{(MV)}$ = (0.0225 x 3700 x 0.113 x 0.95) = 8.94

Since this calculated rating of 8.94 for the existing system is higher than the target 6.5 for new construction, the altered system would be required to reduce the rating by 10%, or to 7.15 (6.5+10%), whichever is the less demanding. In this case the 10% reduction is the less demanding and results in a target rating of 8.04.

In this proposal, for the extended air distribution system:

PD is the total installed capacity (sum of the input kW ratings) of the fans divided by the relevant treated area (square metres)

= 0.01895 (72/3800)

HD = 3700 hours per year

CD is the carbon conversion factor for electricity, in kgC/kWh. (See Table 6 for carbon emission factors)

= 0.113

FD = 0.93, determined from Table 19 as follows:

As plant will now be metered, factors from Column B of the Table are used, then:

Factor for including provision to restrict the hours of use of the system (time control) = 0.93

Column product (FD) = 0.93

The CPR calculation is then:

$CPR_{(MV)}$ = (0.01895 x 3700 x 0.113 x 0.93)
= 7.37

This alteration achieves a rating lower than its particular target of 8.04 and would therefore be acceptable on this basis.

Note: The rating of 7.37 indicates that, under similar patterns of occupancy and use, the proposed building would be likely to cause about 13% greater carbon emission than one like the typical air conditioned office building defined in ECON 19 (full reference in paragraph 1.6b).

Example calculation for a office proposal including air conditioning and a dedicated, air conditioned, computer suite.

B22 In this example it is intended to include an air conditioning system in a new office building that also houses a dedicated computer suite that will be served as a separate controlled zone from the centralised air conditioning system. The relevant details from the proposal are that:

The total area to be treated by the system is 3500m^2.

Cooling will be provided by two speedcontrolled electrically powered compressors, with a total rated input power of 225kW.

The refrigeration compressor energy consumption will be metered.

The fans used to distribute cooled air to treated spaces have a total rated input power of 45kW.

The fan energy consumption will be metered. Windows in treated office areas will be openable, with interlocks to disable the local air conditioning terminals, so that natural ventilation may be used when required.

Efficient fan speed control will be installed to accommodate the variations in demand for air supply.

The treated area of the computer room is $500m^2$. The designer has estimated that the refrigeration input power required to service the computer room is 45kW and the fan input power required to provide air supply to the computer room is 10kW.

The relevant plant input power ratings and the relevant treated area are the result of subtracting the computer room area and the plant required to service it from the totals, hence:

Relevant treated area = $3000m^2$ (3500 – 500)

Relevant refrigeration installed capacity = 180kW (225 – 45)

Relevant fan installed capacity = 35kW (45 – 10)

The CPR calculation for air conditioning is:

$CPR_{(ACMV)}$ = (PD x HD x CD x FD) + (PR x HR x CR x FR)

In this proposal, for the cooling distribution system:

PD is the total installed capacity (sum of the input kW ratings) of the fans divided by the relevant treated area (square metres)

= 0.0117 (35/3000)

HD = 3700 hours per year

CD is the carbon conversion factor for electricity, in kgC/kWh. (See Table 6 for carbon emission factors)

= 0.113

FD = 0.765, determined from Table 20 as follows:

As the major plant will be metered, factors from Column B of the Table are used. Then:

Factor for including the opportunity for natural ventilation (mixed mode operation) = 0.9

Factor for including efficient control of air flow rate = 0.85

Column product (FD) = 0.765 (0.9 x 0.85)
And, for the refrigeration system:

PR = the total installed capacity (sum of the input kW ratings) of the refrigeration plant divided by the treated area (square metres)

= 0.06 (180/3000)

HR = 1000 hours per year

CR = the carbon conversion factor for electricity, in kgC/kWh. (See Table 6 for carbon emission factors)

= 0.113

FR = 0.837, determined from Table 21 as follows:

As the major plant will be metered, factors from Column B of the Table are used. Then:

Factor for including the opportunity for natural ventilation (mixed mode operation) = 0.9

Factor for providing efficient means of controlling plant capacity = 0.93

Column product (FR) = 0.837 (0.9 x 0.93)

The CPR calculation is then:

$CPR_{(ACMV)}$ = (0.0117 x 3700 x 0.113 x 0.765) + (0.06 x 1000 x 0.113 x 0.837) = 9.42

The proposal therefore achieves a calculated rating of 9.42, which is lower than the required CPR of 10.3 and would therefore be acceptable on this basis.

Note: The rating of 9.42 indicates that, under similar patterns of occupancy and use, the proposed building would be likely to cause about 10% less carbon emission than one like the typical air conditioned office building defined in ECON 19 (full reference in paragraph 1.6b).

Annex C - Methods for solar overheating

C1 This annex provides the detail for the procedure described in paragraph 1.23a).

C2 When estimating the solar load, the space being considered should be split into perimeter and interior zones. Perimeter zones are those defined by a boundary drawn a maximum of 6m away from the window wall(s). Interior zones are defined by the space between this perimeter boundary and the non-window walls or the perimeter boundary of another perimeter zone. When calculating the average solar cooling load, the contribution from all windows within that zone should be included, plus the area of any rooflight (or part rooflight) that is within the zone boundary. For interior zones, the contribution from all rooflights (or part rooflight) that is within its zone boundary should be included. For each zone within the space, the total solar cooling load (Qslw+ Qslr) should be no greater than 25W/m^2. The average solar cooling load per unit floor area averaged between the hours of 07:30 and 17:30 can be calculated by use of the following equations.

a) The contribution from vertical glazing should be calculated from

$$Q_{slw} = \frac{1}{A_p} \sum A_g\, q_s\, f_c\, (1-f_{rw}) \qquad \text{(C1)}$$

where:-

Q_{slw} is the solar load per unit floor area (W/m^2).
A_p is the floor area of the perimeter zone (m^2).
A_g is the area of the glazed opening (m^2).
q_s is the solar load for the particular orientation of opening (W/m^2 of glazing) - Table 22.
f_c is a correction factor for glazing/blind combination (Table 23).
f_{rw} is the framing ratio for the window (default value for vertical windows = 0.1).

b) The contribution from any horizontal rooflights in the space should be calculated from

$$Q_{slr} = q_{sr}\, g_{rr}\, f_c\, (1-f_{rr}) \qquad \text{(C2)}$$

where:-

Q_{slr} is the solar load per unit floor area (W/m^2 of floor area).
q_{sr} is the solar load for horizontal openings (W/m^2 of opening area) (Table 43).
g_{rr} is the ratio of the total area of rooflight to the floor area.
f_{rr} is the framing ratio for the rooflight (default value for horizontal rooflights =0.3).
f_s is a correction factor for glazing/blind combination (Table 23).
f_c is a correction factor for glazing/blind combination (Table 23).

Table 22 **Average solar load between 07.30 and 17.30 for different orientations**

Orientation	Average solar load (W/m²)
N	125
NE/NW	160
E/W	205
SE/SW	198
S	156
Horizontal	327

Table 23 **Correction factors for intermittent shading using various glass/blind combinations**

Glazing/blind combination (described from inside to outside)	Correction factor f_c
Blind/clear/clear	0.95
Blind/clear/reflecting	0.62
Blind/clear/absorbing	0.66
Blind/low-e/clear	0.92
Blind/low-e/reflecting	0.60
Blind/low-e/absorbing	0.62
Clear/blind/clear	0.69
Clear/blind/reflecting	0.47
Clear/blind/absorbing	0.50
Clear/clear/blind/clear	0.56
Clear/clear/blind/reflecting	0.37
Clear/clear/blind/absorbing	0.39
Clear/clear/blind	0.57
Clear/clear/clear/blind	0.47

C3 As a preferred alternative to the generic numbers in these tables, shading coefficient data for a particular device can be used:

a) For fixed shading (including units with absorbing or reflecting glass), the correction factor fc is given by

$$f_c = \frac{S_c}{0.7} \qquad (C3)$$

b) For moveable shading, the correction factor is given by

$$f_c = \frac{1 + \frac{S_c}{0.7}}{2} \qquad (C4)$$

where S_c is the shading coefficient for the glazing/shading device combination, i.e. the ratio of the instantaneous heat gain at normal incidence by the glazing/shading combination relative to that transmitted by a sheet of 4mm clear glass.

c) Where there is a combination of fixed and moveable shading, the correction factor is given by

$$f_c = \frac{S_{cf} + S_{ctot}}{1.4} \qquad (C5)$$

where S_{cf} is the shading coefficient of the fixed shading (with glazing) and S_{ctot} is the shading coefficient of the combination of glazing and fixed and moveable shading.

Example 1

C4 Consider a classroom in a school. The room is 9m long by 6m deep, with a floor to ceiling height of 2.9m. There is glazing on one wall, with rooflights along the internal wall opposite the window wall. The windows are 1200mm wide by 1000mm high, and there are six such windows in the external wall, which faces SE. The windows are clear double glazed, with mid-pane blinds, of wooden frames with a framing percentage of 25%. There are three 0.9m^2 horizontal rooflights, with an internal blind and low-e glass on the inner pane of the double pane unit.

For the windows Q_{slw}=(6 x 1.2 x 1.0 x 198 x 0.69 x (1-0.25))/(9*6) = 13.7 W/m^2

For the rooflight Q_{slr} = (327 x (3 x 0.9/54) x 0.92 x 0.7) = 10.5 W/m^2

The total solar load is 13.7 + 10.5 = 24.2, which is less than the limiting value of 25 W/m^2.

Example 2

C5 This example shows how the method in this annex could be used to determine, for each space, a shading coefficient that would enable the solar loads to meet the requirements of Part L.

C6 Consider an office building, with a floor to ceiling height of 2.8m and curtain walling construction with a glazing ratio of 0.65. The default framing factor of 0.1 is appropriate in this case. The long side of the office faces south and the short side faces west. The main office area is open plan, but there is a 5m by 3m corner office. For the open plan areas, the perimeter zone is defined by the 6m depth rule, but for the corner office, it is defined by the partitions. In order to avoid solar overheating, it is proposed to provide fixed external shading. Equations (C1) and (C3) can be used to determine the required shading coefficient for the glass/shading combination*. Combining equations (H1) and (H3) and re-arranging gives:-

$$S_c = \frac{0.7 \times Q_{slw} \times A_p}{\Sigma A_g \times q_s \times (1 - f_{rw})} \qquad (C6)$$

For the south facing open plan area, consider a typical module 10m wide. In this case

S_c = (0.7 x 25 x 10 x 6)/(10 x 2.8 x 0.65 x 156 x 0.9) = 0.41.

For a similar west facing open plan area S_c =(0.7 x 25 x 10 x 6)/(10 x 2.8 x 0.65 x 205 x 0.9) = 0.31.

For the corner office, there are two window orientations, and so the summation term of equation (C5) is calculated as shown in the table.

Orientation of window	Area of window (m^2)	Solar load per unit glass area (Table 40)	Total solar load (W) allowing for 10% framing
South	5 x 2.8 x 0.65 = 9.10	156	= 9.10 x 156 x (1-0.1) = 1278
West	3 x 2.8 x 0.65 = 5.46	205	= 5.46 x 205 x (1-0.1) = 1007
Total solar load	**= 1278 +1007 = 2285**		

In this case S_c = (0.7 x 25 x 5 x 3)/2285 = 0.11. Such a shading coefficient is quite demanding to achieve in practice. One alternative might be to reduce the glazing area by using opaque insulating panels. If the building is to be air conditioned, another option would be to demonstrate that the Carbon Performance Rating of the building's ACMV systems is no greater than the values shown in Table 11.
If the corner office was not partitioned from a general open floor area, it's solar load could be considered as part of the load of one of the facades it shares.

Annex D - Key terms

Air permeability is the physical property used to measure airtightness of building fabric. It measures the resistance of the building envelope to inward or outward air permeation. It is defined as the average volume of air (in cubic metres per hour) that passes through unit area of the structure of the building envelope (in square metres) when subject to an internal to external pressure difference of 50 Pa. It is expressed in units of cubic metres per hour, per square metre of envelope area, at a pressure difference of 50 Pa. The envelope area of the building is defined as the total area of the floor, walls and roof separating the interior volume from the outside environment, i.e. the conditioned space.

A roof window is a window in the plane of a pitched roof and may be considered as a rooflight for the purposes of this Guernsey Technical Standard.

Exposed element means an element exposed to the outside air (including a suspended floor over a ventilated or unventilated void, and elements so exposed indirectly via an unheated space), or an element in the floor or basement in contact with the ground. In the case of an element exposed to the outside air via an unheated space (previously known as a “semi-exposed element”). Partywalls, separating two dwellings or otherpremises that can reasonably be assumed to be heated to the same temperature, are assumed not to need thermal insulation.

Thermal conductivity (i.e. the lambda value) of a material is a measure of the rate at which that material will pass heat and is expressed in units of Watts per metre per degree of temperature difference (W/mK).

Thermal transmittance (i.e. the U-value) is a measure of how much heat will pass through one square metre of a structure when the air temperatures on either side differ by one degree. U-values are expressed in units of Watts per square metre per degree of temperature difference (W/m^{2}K).

Annex E - Standards referred to and other documents

BS 5422:2001 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range –40°C to +700°C

BS EN ISO 6946:2007 Building components and building elements. Thermal resistance and thermal transmittance. Calculation method

BS 7913:1998 The principles of the conservation of historic buildings

BS EN ISO 8990:1996 Thermal insulation – Determination of steady-state thermal transmission properties – Calibrated and guarded hot box

BS EN ISO 10077-1:2000 Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 1: Simplified methods

EN ISO 10077-2 Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 2: Numerical method for frames

BS EN ISO 10211-1:1996 Thermal bridges in building construction – Calculation of heat flows and surface temperatures – Part 1: General methods

BS EN ISO 10211-2:2001 Thermal bridges in building construction – Calculation of heat flows and surface temperatures – Part 2: Linear thermal bridges

BS EN 12524:2000 Building materials and products – Hygrothermal properties – Tabulated design values

BS EN ISO 12567-1:2000 Thermal performance of windows and doors – Determination of thermal transmittance by hot box method – Part 1: Complete windows and doors

BS EN 12664:2001 Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Dry and moist products of low and medium thermal resistance

BS EN 12667:2000 Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance

BS EN 12939:2001 Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Thick products of high and medium thermal resistance

BS EN ISO 13370:2007 Thermal performance of buildings. Heat transfer via the ground. Calculation methods

BS EN ISO 13789:1999 Thermal performance of buildings - Transmission heat loss coefficient - Calculation method

The Stationery Office

Limiting thermal bridging and air leakage: Robust construction details for dwellings and similar buildings, TSO 2001

Guidelines for environmental design in schools, Building Bulletin 87, TSO, 1997.

NHS Estates: Achieving energy efficiency in new hospitals, TSO, 1994.
British Cement Association (BCA) and National House Building Council (NHBC)

Building Research Energy Conservation Support Unit (BRECSU)

GIR 31, 1995 Avoiding or minimising the use of air-conditioning

GPG 303, 2000 The designer's guide to energy-efficient buildings for industry.

GPG 132, 2001 Heating controls in small commercial and multi-residential buildings

GIR 41, 1996 Variable flow control

GIL 65, 2001 Sub-metering New Build Nondomestic Buildings: A guide to help building designers meet Part L of the Building Regulations.

Building Research Establishment (BRE) (published by CRC Ltd)

Conventions for the calculation of U-values: expected publication date early 2002

IP 5/98 Metal cladding: assessing thermal performance

U-value calculation procedure for light steel frame walls: expected publication date early 2002

IP 17/01 Assessing the effects of thermal bridging at junctions and around openings

BR 262, 2002 Edition Thermal insulation: avoiding risks,

BR 364, 1999 Solar shading of buildings

IP 2/99 Photoelectric control of lighting: design, set-up and installation issues

Digest 457, 2001, The Carbon Performance Rating for offices,

BR 176, 1991 A practical guide to infra-red thermography for building surveys,.

Centre for Window and Cladding Technology (CWCT)

Guide to good practice for assessing glazing frame U-values (1998, new edition in preparation)

Guide to good practice for assessing heat transfer and condensation risk for a curtain wall (1998, new edition in preparation)

Chartered Institution of Building Services Engineers (CIBSE)

Guide A: Environmental design, Section A3: Thermal properties of building structures, 1999

Energy efficiency in buildings, 1998

LG10: Daylight and window design, 1999

Guide A: Environmental Design, Section A5: Thermal response and plant sizing, 1999.

Guide H: Building Control Systems, 2000

TM22: Energy Assessment and Reporting Methodology: Office Assessment Method, 1999

AM11; Building Energy and Environmental Modelling, 1998

TM23: Testing buildings for air leakage, 2000

Energy Efficiency in Buildings, Chapter 11: General electric power, 1998

Commissioning Specialists Association

Technical Memorandum 1: Standard specification for the commissioning of mechanical engineering services installations for buildings, 1999

Council for Aluminium in Building (CAB)

Guide for assessment of the thermal performance of aluminium curtain wall framing, 1996

UK's Department of the Environment, Transport and the Regions (DETR)

Energy Consumption Guide 19: Energy use in offices-, 1998

CHPQA Standard: Quality Assurance for Combined Heat and Power, Issue 1, November 2000.

Metal Cladding and Roofing Manufacturers Association (MCRMA)

Technical Note 14: Guidance for the design of metal cladding and roofing to comply with Approved Document L 2002 Edition:

Society for the Protection of Ancient Buildings (SPAB)

Information sheet 4: The need for old buildings to breathe, 1986.

GUERNSEY TECHNICAL STANDARDS

The following documents have been approved and issued Development and Planning Authority for the purpose of providing practical guidance with respect to the requirements of the Building Regulations

Guernsey Technical Standard A: Structure, 2017 edition.

Guernsey Technical Standard B: Fire Safety - Volume 1 - Dwellinghouses, 2012 edition with May 2016 amendments.

Guernsey Technical Standard B: Fire Safety - Volume 2 - Buildings other than dwellinghouses, 2012 edition with May 2016 amendments.

Guernsey Technical Standard C: Site preparation and resistance to contaminants and moisture 2012 edition with May 2016 amendments.

Guernsey Technical Standard D: Toxic substances 2012 edition with May 2016 amendments.

Guernsey Technical Standard E: Resistance to the passage of sound, 2012 edition with May 2016 amendments.

Guernsey Technical Standard F: Ventilation, 2012 edition with May 2016 amendments.

Guernsey Technical Standard G: Health, hygiene and water efficiency, 2012 edition with May 2016 amendments.

Guernsey Technical Standard H: Drainage and waste disposal, 2012 edition with May 2016 amendments.

Guernsey Technical Standard J: Heat producing appliances and fuel storage systems, 2012 edition with May 2016 amendments.

Guernsey Technical Standard K: Safe means of access and egress, 2012 edition with May 2016 amendments.

Guernsey Technical Standard L1: Conservation of fuel and power – Dwellings, 2012 edition with April 2020 amendments.

Guernsey Technical Standard L2: Conservation of fuel and power – Buildings other than dwellings, 2012 edition with April 2020 amendments.

Guernsey Technical Standard M: Access to and use of buildings, 2012 edition with May 2016 amendments.

Guernsey Technical Standard N: Glazing - Materials and protection, 2012 edition with May 2016 amendments.

Guernsey Technical Standard P: Roads - Layout design and construction, 2012 edition with May 2016 amendments.

Guernsey Technical Standard Regulation 11: Materials and Workmanship, 2012 edition with May 2016 amendments.

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