Introduction

General

This Technical Booklet has been prepared by the Department of Finance and Personnel and provides for certain methods and standards of building which, if followed, will satisfy the requirements of the Building Regulations (Northern Ireland) 2000 ("the Building Regulations").

There is no obligation to follow the methods or comply with the standards set out in this Technical Booklet.

If you prefer you may adopt another way of meeting the requirements of the Building Regulations but you will have to demonstrate that you have satisfied those requirements by other means.

Other regulations

This Technical Booklet relates only to the requirements of regulations F2, F3 and F4. The work will also have to comply with all other relevant Building Regulations.

British Standards and European Technical Specifications

In this introduction and throughout this Technical Booklet any reference to a British Standard shall be construed as a reference to –

(a) a British Standard or British Standard Code of Practice;

(b) a harmonised standard or other relevant standard of a national standards body of any Member State of the European Economic Area;

(c) an international standard recognised for use in any Member State of the European Economic Area;

(d) any appropriate, traditional procedure of manufacture of a Member State of the European Economic Area which has a technical description sufficiently detailed to permit an assessment of the goods or materials for the use specified; or

(e) a European Technical Approval issued in accordance with the Construction Products Directive,

provided that the proposed standard, code of practice, specification, technical description or European Technical Approval provides, in use, equivalent levels of safety, suitability and fitness for purpose as that provided by the British Standard.

Products conforming with a European Council Directive

Any product designed and manufactured to comply with the requirements of a European Council Directive does not have to comply with any other standard or part of a standard, whether British, International or other, which relates to the same characteristic or specific purpose as the EC Directive.

CE marked construction products

Any construction product (within the meaning of the Construction Products Directive) which bears a CE marking shall be treated as if it satisfied the requirements of any appropriate British Board of Agrément Certificate, British Standard or British Standard Code of Practice relating to such a product, where the CE marking relates to the same characteristic or specific purpose as the Certificate, Standard or Code of Practice.

Testing of materials and construction

Where for the purposes of this Technical Booklet testing is carried out it shall be carried out by an appropriate organisation offering suitable and satisfactory evidence of technical and professional competence and independence. This condition shall be satisfied where the testing organisation is accredited in a Member State of the European Economic Area in accordance with the relevant parts of the EN 45000 series of standards for the tests carried out.

Materials and workmanship

Any work to which a requirement of the Building Regulations applies must, in accordance with Part B of the Building Regulations, be carried out with suitable materials and in a workmanlike manner. You can comply with the requirements of Part B by following an appropriate British Standard or you may demonstrate that you have complied with those requirements by other suitable means, such as an acceptable British Board of Agrément Certificate, Quality Assurance Scheme, Independent Certification Scheme or Accredited Laboratory Test Certificate.

References

Any references in this Technical Booklet to a publication shall, unless otherwise stated, be construed as a reference to the edition quoted, together with any amendments, supplements or addenda thereto current at 7 August 2006.

Contents

Section 1 Common items

Definitions

1.1 In this Technical Booklet the following definitions apply –

Air permeability – the air leakage rate in cubic metres per hour per square metre of envelope area {$m^3/(h \cdot m^2)$} at a pressure difference of 50 Pascals.

BER – the Building carbon dioxide Emissions Rate measured in kilograms of carbon dioxide per square metre of floor area per year {$kg/(m^2 \cdot year)$}.

Consequential improvement – means those energy efficiency improvements required when an existing building is extended or renovated.

Conservatory – a part or extension of a building attached to and having a door giving access from the building and having not less than three quarters of its roof area and not less than one half of its external wall area made from translucent material and which is thermally separated from the building by walls, windows and doors having U-values not greater than and draught-proofing provisions not less than those of similar exposed elements elsewhere in the building.

Daylit space – means any space –

(a) within 6 m of a window wall, provided that the glazing area is not less than 20% of the internal area of the window wall; and

(b) below rooflights or similar roof glazing, provided that the glazing area is not less than 10% of the daylit floor area.

[Daylit space is defined for a glazing light transmittance of 70%. Where the light transmittance is less than 70%, the area of glazing shall be increased proportionally.]

Design air permeability – the value for air permeability selected by the designer to calculate the BER.

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

Display window – an area of glazing, including glazed doors, intended for the display of products or services on offer within the building, positioned at the external perimeter of the building, at an access level and immediately adjacent to a pedestrian thoroughfare. Where there is a workspace within one glazing height of the perimeter, it shall not be considered to be a "display window". Glazing that extends to a height of more than 3 m above an access level shall not be considered as part of a display window except –

(a) where the items on display require a greater height of glazing;

(b) in existing buildings, when replacing display windows that already extend to a greater height; or

(c) where windows of a greater height are required as a result of a planning condition.

Dwelling – means a house, flat or maisonette which is a self-contained unit designed to accommodate a single household.

Envelope area – the total internal area of all wall, floor and ceiling elements that enclose the internal volume subject to an air permeability test. This includes elements below external ground level. Overall internal dimensions shall be used to calculate this area. No subtractions shall be made for the area at junctions of internal elements (partitions, and intermediate floors) with external elements (exterior walls, floors and ceilings).

Fit-out work – means that work needed to complete the internal layout and/or building services within the building shell to meet the specific needs of incoming occupiers. The building shell is the structural and non-structural envelope of a building provided at a primary stage (usually as a speculative development) for a subsequent project to fit out.

[Fit-out work may be carried out at the same time as the construction of the building or some time after the shell has been completed.]

High usage entrance door – a door to an entrance, primarily for the use of people, that is expected to be subject to large traffic volumes, and where robustness and/or powered operation is the primary performance requirement. Such doors shall be equipped with automatic closers, and, except where operational requirements preclude, be protected by a lobby.

Principal works – means the work necessary to achieve the client's purposes in altering or extending the building and/or increasing the installed capacity of any fixed building services.

Low or zero carbon energy sources – include biofuels, micro-hydro, photovoltaics, solar hot water and wind power.

Room for residential purposes – means a room or suite of rooms, which is not a dwelling, and which is used by one or more persons to live and sleep and includes a room in a hostel, hotel, boarding house, hall of residence or a residential home, whether or not the room is separated from or arranged in a cluster group with other rooms. It excludes a room in a hospital or similar establishment used for patient accommodation.
For the purposes of this definition, a "cluster" is a group of rooms for residential purposes which is not designed to be occupied by a single household and which is separated from the rest of the building by a door that is designed to be locked.

Specialist process lighting – lighting intended to illuminate specialist tasks within a space rather than the space itself. It shall include theatre spotlights, projection equipment, lighting in TV and photographic studios, medical lighting in operating theatres and in doctors' and dentists' surgeries, illuminated signs, coloured or stroboscopic lighting and art objects with internal lighting such as sculptures, decorative fountains and chandeliers.

Specific fan power – is the sum of the design total circuit-Watts, including all losses through switchgear and controls such as inverters, of the fans in the system(s) that supply air and exhaust it back to outdoors (i.e. the sum of the supply and extract fans), divided by the design ventilation rate through that system.

TER – the Target carbon dioxide Emissions Rate measured in kilograms of carbon dioxide per square metre of floor area per year {kg/(m^2·year)}.

General rules

AREA OF ELEMENTS

1.2 The area of a building element shall be that of its internal surface measured between the finished internal faces of the enclosing fabric of the building, and in the case of a roof, shall be measured in the plane of the ceiling. The area shall include the areas where partitioning elements abut the internal surface of the wall, floor or roof.

AREA OF WINDOWS, DOORS AND ROOFLIGHTS

1.3 The area of window, door and rooflight openings in a wall or roof, shall be measured internally between reveals and from head to sill.

SERVICE OPENINGS IN WALLS AND ROOFS

1.4 An opening in a wall to accommodate building services, such as a waste pipe or ventilator, shall be regarded as part of the wall and assumed to have the same U-value as the wall.

1.5 An opening in a roof to accommodate building services, such as a flue pipe or passive stack ventilator, shall be regarded as part of the roof and assumed to have the same U-value as the roof.

Technical risks

1.6 Building work must satisfy all of the requirements of the building regulations, however the requirements of Part C (Preparation of site and resistance to moisture), Part K (Ventilation) and Part L (Combustion appliances and fuel storage systems) are particularly interrelated in the whole building approach adopted by this Part.

1.7 The incorrect application of energy efficiency measures can cause technical problems such as an increased risk of rain penetration or interstitial condensation. Measures to avoid the risks that might arise are given in the BRE Report BR 262: “Thermal insulation: avoiding risks”.

Calculation of U-values

1.8 U-values shall be calculated in accordance with the methods and conventions given in BRE Report BR 443 “Conventions for U-value calculations”.

The Council for Aluminium in Building / Centre for Window and Cladding Technology (CAB/CWCT) publication “The thermal assessment of window assemblies, curtain walling and non-traditional building envelopes” shall be used to determine the thermal performance factors for curtain walling.

Section 2 New buildings other than dwellings

GENERAL

This Section gives methodology and limiting values used by the national calculation software (SBEM, Virtual Environment or TAS) to calculate the Target carbon dioxide Emissions Rate (TER) and Building carbon dioxide Emissions Rate (BER). In practice, designers are unlikely to find it necessary to refer to all of this Section as the calculation software will automatically calculate the TER and BER when the details of a building are input to the approved software. The software will automatically flag out-of-range values and check that the BER is equal to or less than the TER as designed.

On completion of the building, details of the building as built must be entered into the software to confirm that the BER for the building as built is equal to or less than the TER to confirm compliance.

Whilst the software covers the calculation aspects of the compliance criteria it will still be necessary to demonstrate that all of the criteria in Section 2 are met.

This Section should be read in conjunction with Section 1 – Common items.

Types of work covered by this Section

2.1 This Section gives provisions for the erection of a new building other than a dwelling and certain large extensions.

2.2 This Section gives provisions for the following works –

(a) the construction of new buildings other than dwellings;

(b) fit-out works included as part of the construction of a building (where fit-out works are deferred for any reason, the fit-out works shall comply with Section 3 of this Technical Booklet); and

(c) the extension to an existing building where the total useful floor area of the extension is greater than 100 m^2 and greater than 25% of the total useful floor area of the existing building.

2.3 The provisions in this Technical Booklet also apply to buildings containing rooms for residential purposes, such as nursing homes, student accommodation and similar, which are not considered as dwellings.

2.4 Where a building contains living accommodation and also contains space to be used for professional, industrial or commercial purposes (e.g. a doctor's surgery, workshop or office), it shall be treated as a dwelling if the business part could revert to domestic use.

This would be the case where –

(a) there is direct access between the living accommodation and the business part;

(b) both are contained within the same thermal envelope; and

(c) the living accommodation occupies the greater proportion of the total floor area of the building.

It shall be designed and constructed in accordance with the provisions of Technical Booklet F1.

2.5 When constructing a building that contains dwellings, account shall be taken of the provisions of Technical Booklet F1. Technical Booklet F1 shall be used for provisions relating to work on individual dwellings, with this Technical Booklet giving provisions relating to the non-dwelling parts of the building such as heated common areas, and in the case of mixed-use developments, the commercial or retail space.

Modular buildings

2.6 Special considerations apply to modular and/or portable buildings where –

(a) more than 70% of the external envelope of the building is to be created from sub-assemblies manufactured before 30 November 2006 and which are obtained from a centrally held stock or from the disassembly of buildings on other premises; or

(b) the intended life of the building on that specific site is less than two years.

In such situations the recommendations given in the Modular and Portable Buildings Association publication, “Energy performance standards for modular and portable buildings” shall be followed. In all other cases the provisions of this Technical Booklet shall be complied with.

TARGET CARBON DIOXIDE EMISSIONS RATE (TER)

2.7 The Target carbon dioxide Emissions Rate (TER) is the minimum acceptable energy performance for new buildings other than dwellings. It is the target established for the mass of carbon dioxide (CO_2) produced by the building and is given in units of kg per m^2 of the total useful floor area per year. This target is for the provision of heating, hot water, ventilation, cooling and fixed internal lighting for an appropriate selection of standardised activities.

2.8 The TER shall be calculated using one of the following –

(a) the Simplified Building Energy Model (SBEM) for those buildings whose design features are capable of being modelled by SBEM; or

(b) other energy modelling software approved by the Department.

As part of the submission for building regulations approval the applicant shall justify that the software used is appropriate to the application.

2.9 To demonstrate that an acceptable CO_2 emissions rate has been achieved, the building as constructed shall have a calculated Building carbon dioxide Emissions Rate (BER) equal to or less than the TER calculated in accordance with paragraphs 2.11 to 2.18.

2.10 The TER and BER shall be calculated using the same approved calculation software.

CALCULATING THE NOTIONAL CO_2 EMISSIONS AND THE TER

Calculating the notional CO_2 emissions

2.11 Calculate the CO_2 emissions rate ($C_{notional}$) for a notional building complying with the provisions given in paragraph 2.12.

[SBEM requires inputs about the notional design but has all the criteria listed in 2.12 built into it and automatically calculates $C_{notional}$ and also the TER (see paragraph 2.13).]

2.12 The notional building shall –

(a) be the same shape and size as the proposed building;

(b) comply with the energy performance values given in the detailed definition of the notional building as set out in SBEM, in respect of both the building fabric and the fixed building services;

(c) have the same area of vehicle access doors and display windows as the proposed building;

(d) exclude any service that is not by definition a fixed building service (e.g. vertical transport systems are excluded);

(e) have the same activity areas and classes of building services as the proposed building as selected from the standard activity areas and classes of building services specified in SBEM;

(f) have the same occupancy times and environmental conditions (temperatures, illuminance, ventilation rate, etc.) in each activity area as defined by the standard data associated with the reference schedules;

(g) be subject to the climate defined by the Chartered Institution of Building Services Engineers (CIBSE) Test Reference Year for the site that is most appropriate to the location of the actual building;

(h) assume the building is heated by oil unless it is heated by mains gas;

(i) assume that grid mains electricity will be used as the energy source for all other building services;

(j) use the relevant CO_2 emissions factors given in Table 2.1; and

(k) assume that the most energy intensive (worst case) fit-out specifications will be adopted throughout where a building is submitted for approval excluding fit-out works – such as in speculative "shell and core" developments and in business park units where space is to be offered with a range of service options. In addition, spaces that have the potential for fitting out without air-conditioning shall comply with Criterion 3 – Limiting the effects of solar gains, as if they were not to be air-conditioned.

Table 2.1 CO_2 emission factors

Fuel	CO_2 emission factor {kg/(kW·h)}
Natural gas	0.194
LPG	0.234
Biogas	0.025
Oil	0.265
Coal	0.291
Anthracite	0.317
Smokeless fuel (including coke)	0.392
Dual fuel (mineral and wood)	0.187
Biomass	0.025
Grid supplied electricity	0.422
Grid displaced electricity (1)	0.568
Waste heat (2)	0.018

Notes

1 Grid displaced electricity comprises all electricity generated by, for example, PV panels, wind powered generators, combined heat and power, etc. The associated CO_2 savings shall be deducted from the total CO_2 emissions for the building before determining the BER. CO_2 emissions arising from fuels used by the building's system (e.g. to power the CHP engine) shall be included in the building CO_2 emissions.

2 This includes waste heat from industrial processes and power stations rated at more than 10 MWe and with a power efficiency greater than 35%.

Calculating the Target carbon dioxide Emissions Rate (TER)

2.13 Calculate the Target carbon dioxide Emissions Rate (TER) using the following formula –

$TER = C_{notional} \times (1 - \text{improvement factor}) \times (1 - \text{LZC benchmark})$, where –

(a) "Improvement factor" is the improvement in energy efficiency given in column (a) of Table 2.2 appropriate to the classes of building services in the proposed building. Where different areas of the proposed building have different classes of building services, the level of improvement shall be calculated by applying the relevant improvement factor to each separate activity area individually; and

(b) "LZC benchmark" is the benchmark provision for low or zero carbon (LZC) energy sources given in column (b) of Table 2.2.

For example, the TER for an air-conditioned space would be –

$TER = C_{notional} \times (1 - 0.20) \times (1 - 0.10)$

$TER = C_{notional} \times 0.72$

Table 2.2 Improvements to the notional CO_2 emissions

Building services strategy	(a) Improvement factor	(b) LZC benchmark
Heated and naturally ventilated	0.15	0.10
Heated and mechanically ventilated (1)	0.20	0.10
Air-conditioned	0.20	0.10

1 Means mechanical ventilation systems intended to run continuously during the hours of occupation.

CRITERION 1 – ACHIEVING THE TER

Calculating the BER for the actual building

2.14 The BER shall be calculated using the same approved software used to calculate the TER. To demonstrate compliance two calculations of the BER will be required, one at plan submission stage and one on completion.

2.15 Calculate the BER using data from the drawings and specifications for the proposed building as designed. The BER must be equal to or less than the TER.

2.16 The report produced by the approved software will highlight those features of the design that are critical to the building achieving its TER.

A copy of this report shall be sent to the district council to facilitate checking of the building regulations application.

2.17 On completion of the building, the BER for the building as constructed shall be calculated to demonstrate that the TER has been achieved or bettered. In calculating the BER for the building as constructed the following shall be incorporated –

(a) any changes to the performance specifications that have been made during construction; and

(b) the measured air permeability, ductwork leakage and fan performances as commissioned.

[See Appendix A which provides a checklist to assist builders/developers in demonstrating compliance with Part F.]

2.18 In calculating the BER, the appropriate CO_2 emissions factors given in Table 2.1 shall be used.

Multi-fuel systems

2.19 Where systems are capable of being fired by more than one fuel, then –

(a) for biofuel-fired systems rated at 100 kW output or more, but where there is an alternative appliance to provide standby, the CO_2 emissions factor shall be based on the fuel that is normally expected to provide the lead;

(b) for systems rated at less than 100 kW output, where the same appliance is capable of burning both biofuel and fossil fuel, the CO_2 emissions factor for dual-fuel shall be used, except where the building is in a smoke control zone, where the anthracite figure shall be used; or

(c) in all other cases, the highest CO_2 emissions factor shall be used.

District or community heating or cooling systems

2.20 Where thermal energy is supplied from a district or community heating or cooling system, the emission factors shall be determined based on the particular details of the system. The assessment shall take account of the annual average performance of the whole system (i.e. the distribution circuits and all the heat generating plant, including any CHP and any waste heat recovery or heat dumping).

The BER submission shall be accompanied by a report, signed by a suitably qualified person, detailing how the emissions factors were derived.

Enhanced management and control features

2.21 Where provided, certain management and control features give improved energy efficiency. Where these are operational in a building, the BER may be reduced by an amount equal to the product of the adjustment factor given in Table 2.3 and the CO_2 emissions for the system(s) to which the feature is applied.

For example, if the CO_2 emissions due to electrical energy consumption were 70 kg/(m^2·year) without power factor correction, the provision of correction equipment to achieve a power factor of 0.95 would enable the BER to be reduced by 70 x 0.025 = 1.75 kg/(m^2·year).

Table 2.3 Adjustment factors for enhanced management and control features	
Feature	**Adjustment factor**
Automatic monitoring and targeting with alarms for out-of-range values	0.050
Power factor correction to achieve a whole-building power factor of at least 0.90 (1)	0.010
Power factor correction to achieve a whole-building power factor of at least 0.95 (1)	0.025

Note

1 The power factor adjustment can only be adopted if the whole building power factor is corrected to the level stated. The two levels of power factor correction are alternative values, not additive.

Low or zero carbon energy sources

2.22 In certain circumstances, low or zero carbon (LZC) energy sources can make a substantial and cost-effective contribution to meeting the TER. Low carbon systems include heat pumps and combined heat and power (at individual building, block or community levels), and zero carbon systems include biofuels (e.g. wood fuels and oil blends), micro-hydro, photovoltaics, solar hot water and wind power.

[The Department for Communities and Local Government (DCLG) publication "Low or zero carbon energy sources – strategic guide" describes a range of potential systems and how their contribution to the BER can be assessed.]

CRITERION 2 – MINIMUM ACCEPTABLE STANDARDS

U-values

2.23 The maximum U-values for each of the elements of the building fabric that separate a normally conditioned space from an unconditioned space or the external environment are given in Table 2.4 –

(a) column (a) gives the area-weighted average U-values for each element. The area-weighted average is calculated using the following formula –

$$U_{av} = \frac{(U_1 \times A_1) + (U_2 \times A_2) + (U_3 \times A_3) + \ldots .}{A_1 + A_2 + A_3 + \cdots \cdot}$$

(b) column (b) gives the maximum U-value for any individual element or part of an individual element such as a meter cupboard recess.

2.24 For the purposes of the previous paragraph an individual element means those areas of a given element type that have the same construction details. In the case of windows, doors and rooflights, the assessment shall be based on the unit as a whole i.e. for windows the combined performance of the glazing and frame.

Table 2.4 Limiting U-values {W/(m^2·K)}

Element	(a) Area-weighted average U-value	(b) Maximum U-value
Wall	0.35	0.70
Floor	0.25	0.70
Roof	0.25	0.35
Windows [1], rooflights, roof-windows and curtain walling	2.20	3.30
Personnel doors	2.20	3.00
Vehicle access and similar large doors	1.50	4.00
High usage entrance doors	6.00	6.00
Roof ventilators (including smoke vents)	6.00	6.00

Note

1 Excluding display windows and similar glazing. There is no limit on design flexibility for these exclusions but their impact on CO_2 emissions shall be taken into account in calculations.

2.25 When comparing against the values in Table 2.4, the U-value of a window, roof-window, rooflight or door unit shall be taken as the value for either –

(a) the standard configuration given in BRE Report BR 443 "Conventions for U-value calculations"; or

(b) the particular size and configuration of the actual unit.

In both cases, it is assumed that the U-value has been assessed with the unit in the vertical position.

The U-values for roof-windows and rooflights given in this Technical Booklet are based on the particular U-value having been assessed with the roof-window or rooflight in the vertical position. Where a roof-window or rooflight has been assessed in a position other than the vertical, the U-value shall be modified by making a U-value adjustment in accordance with BR 443.

SAP Table 6e gives values for different window configurations that can be used in the absence of test data or calculated values.

Buildings with high internal gains

2.26 Where a building has high internal gains, a less demanding area-weighted average U-value for the glazing than that required by Table 2.4 may be an appropriate way of reducing overall CO_2 emissions and hence the BER. Where this can be demonstrated, the area-weighted average U-value for windows, doors and rooflights given in Table 2.4 may be relaxed but shall not exceed 2.7 W/(m^2·K). The limit for individual glazing elements given in column (b) of Table 2.4 shall not be exceeded.

Air permeability

2.27 The maximum acceptable design air permeability is 10 m^3/(h·m^2) @ 50 Pa (except where paragraph 2.58 (a) applies).

[Information on some ways of achieving an acceptable air permeability are given in the DCLG publication "Accredited construction details for Part L*".

* Note that "Part L" in the title refers to the part in England & Wales that is equivalent to Part F in Northern Ireland.]

2.28 Where the conditions given in paragraph 2.58 (a) apply, the air permeability may be varied from the value given in paragraph 2.27 provided that compensating provisions are made such that the TER is achieved or bettered.

Minimum acceptable standards for fixed building service systems

HEATING AND HOT WATER SYSTEMS

2.29 A heating and hot water system shall have –

(a) a boiler with an efficiency not less than that recommended for its type in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide"; and

(b) controls that meet the minimum control requirements given in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide" for that particular type of appliance and heat distribution system.

CONTROLS

2.30 The following provisions shall be made for heating, ventilation and air conditioning systems –

(a) the fixed building services system(s) shall be sub-divided into separate control zones to correspond to each area of the building that has a significantly different solar exposure, or occupancy period, or type of use;

(b) each separate control zone shall be capable of independent time and temperature control and, where appropriate, ventilation and air circulation rate;

(c) the service shall respond to the requirements of the space it serves. Where both heating and cooling are provided, they shall be controlled so as not to operate simultaneously; and

(d) the central plant shall only operate as and when the zone systems require it. The default condition shall be "off".

ENERGY METERS

2.31 Energy meters shall be provided to enable at least 90% of the estimated annual energy consumption for each fuel to be assigned to the various end-use categories (heating, lighting etc). For this purpose energy meters shall be provided –

(a) in accordance with the recommendations of CIBSE TM 39 "Building energy metering";

(b) to separately meter and monitor the performance of any low or zero carbon energy system(s); and

(c) in buildings with a total useful floor area greater than 1000 m^2, to enable automatic meter reading and data collection.

COOLING PLANT

2.32 A cooling system shall have –

(a) an efficiency not less than that recommended for its type in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide"; and

(b) controls that meet the minimum control requirements given in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide" for the particular system.

[The compliance checklists given in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide" are a useful tool in demonstrating that these provisions have been made.]

AIR HANDLING PLANT AND DUCTWORK

2.33 An air handling plant shall have –

(a) an efficiency not less than that recommended for its type in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide"; and

(b) controls that meet the minimum control requirements given in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide" for the particular system.

2.34 The air handling systems shall be capable of achieving a specific fan power at 25% of design flow rate which is no greater than that achieved at 100% design flow rate.

2.35 Fans that are rated at more than 1100 W and form part of the environmental control systems shall be equipped with variable speed drives, to aid commissioning and provide flexibility for future changes in use.

The provisions of paragraphs 2.33 to 2.35 shall not apply to smoke control fans and similar ventilation systems used solely in abnormal circumstances.

2.36 Ventilation ductwork shall be manufactured and assembled in accordance with Heating and Ventilating Contractors Association (HVCA) DW/144 "Specification for sheet metal ductwork", so as to be reasonably airtight.

INSULATION OF PIPES, DUCTS AND VESSELS

2.37 Hot and chilled water pipework and associated storage vessels, refrigerant pipework and ventilation ductwork shall be insulated in accordance with the recommendations given in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide".

[The Thermal Insulation Manufacturers and Suppliers Association (TIMSA) Guide "Guidance for achieving compliance with Part L* of the building regulations" explains the derivation of the performance standards and how they can be interpreted in practice.

* Note that "Part L" in the title refers to the part in England & Wales that is equivalent to Part F in Northern Ireland.]

FIXED INTERNAL LIGHTING

General lighting efficacy in office, industrial and storage areas in all building types

2.38 The general lighting in office, industrial and storage areas shall have an average initial efficacy of not less than 45 luminaire-lumens per circuit-Watt averaged over the total area of these types of space in the building.

2.39 The average luminaire-lumens per circuit-Watt is calculated by –

(Lamp lumens x LOR) summed for all luminaires in the relevant areas of the building, divided by the total circuit-Watts for all the luminaires where –

(a) Lamp lumens is the sum of the average initial (100 hour) lumen output of all the lamp(s) in the luminaire; and

(b) LOR is the light output ratio of the luminaire, which means the ratio of the total light output under stated practical conditions to that of the lamp or lamps contained in the luminaire under reference conditions.

[The control factor used in Section 3 is not appropriate in this Section where the calculation tool used to determine the BER accounts for the impact of controls.]

2.40 The general lighting provisions also apply to areas that involve predominately desk-based tasks, such as office areas, classrooms, seminar rooms and conference rooms, including those in educational buildings.

General lighting efficacy in all other areas

2.41 For lighting systems serving other areas it may be appropriate to provide luminaires for which photometric data is not available or luminaires that are lower powered and use less efficient lamps. In such areas, the installed lighting shall have an average initial (100 hour) lamp plus ballast efficacy of not less than 50 lamp-lumens per circuit-Watt.

Lighting controls for general lighting in all types of space

2.42 Lighting controls shall be provided so as to avoid unnecessary lighting when daylight levels are adequate or when spaces are unoccupied. The operation of automatically switched lighting shall not endanger the passage of people in or about the building.

2.43 Occupant controlled local switches shall be provided in easily accessible positions within each working area or at boundaries between working areas and general circulation routes.

[For the purposes of this paragraph, occupant controlled switches include manual switches (rocker switches, push buttons, pull cords, etc.) and remote switching devices such as wireless transmitters and telephone handset controls.]

2.44 For the purposes of lighting control, switches include dimmer switches and switching includes dimming. Dimming shall be effected by reducing rather than diverting the energy supply.

2.45 The distance on plan from any local switch to any luminaire it controls shall not be more than 6 m, or twice the height of the luminaire above the floor whichever is the greater. Where the space is a daylit space served by side windows the row of luminaires adjacent to the windows shall be separately switched.

2.46 Occupant control of local switching may be supplemented by other controls such as automatic systems which –

(a) switch the lighting off when they sense that the space is unoccupied; or

(b) either dim or switch off the lighting when there is adequate daylight.

[BRE Digest 498 “Selecting lighting controls” gives information on appropriate control strategies for lighting.]

Display lighting in all types of space

2.47 Display lighting shall have an average initial (100 hour) efficacy of not less than 15 lamp-lumens per circuit-Watt. When calculating this efficacy, the power consumed by transformers or ballasts shall be taken into account.

2.48 Spaces where display lighting is present would normally have general lighting for circulation and for the purposes of cleaning and restocking outside public access hours. Such lighting shall comply with the general lighting and controls provisions given in paragraphs 2.38 to 2.46 depending on the type of space.

Controls for display lighting in all types of space

2.49 Display lighting shall be connected to dedicated circuits that can be switched off when people will not be inspecting exhibits or merchandise or attending entertainment events. However, this provision shall not apply to displays designed to be viewed from outside the building through display windows.

For example, in a retail store it would be reasonable to provide timers that switch off the internal display lighting outside store opening hours.

CRITERION 3 – LIMITING THE EFFECTS OF SOLAR GAINS

2.50 Occupied spaces shall have provisions to limit internal temperatures due to excessive solar gains. This shall exclude spaces adjacent to display glazing that are not air-conditioned, and ventilation stacks and unoccupied atria provided to drive natural ventilation by buoyancy. This can be achieved by an appropriate combination of window size and orientation, solar protection by shading or other solar control measures, and by using thermal capacity in combination with night ventilation. BRE Report BR 364 “Solar shading of buildings” and CIBSE AM 10 “Natural ventilation in non-domestic buildings” give recommendations on strategies to limit solar gains.

2.51 In every occupied space that is not air-conditioned it shall be demonstrated that –

(a) when the building is subject to the solar irradiances for July in “CIBSE Guide A: Environmental design”, the combined solar and internal casual gains (people, lighting and equipment) per unit floor area averaged over the period 0630 to 1630 GMT is not greater than 35 W/m^2. CIBSE TM 37 “Design for improved solar shading control”, gives the information necessary to enable this check to be made and includes an adjustment factor to allow the basic limiting gain of 35 W/m^2 to be modified, dependent on the location of the building; or

(b) the operative temperature (the temperature index for thermal comfort given in “CIBSE Guide A: Environmental design”) in the occupied space does not exceed the threshold for more than a reasonable number of occupied hours per year when the building is tested against the CIBSE Design Summer Year appropriate to the building location; or

(c) in the case of school buildings, compliance with Department for Education and Skills (DfES) Building Bulletin 101 “Ventilation of school buildings” may be used to demonstrate that provisions have been made to control excessive solar gains.

[The number of hours above the threshold temperature depends on the activities within the space. Clients, designers and health and safety inspectors will agree appropriate limits in order to comply with Workplace Regulations. For example, CIBSE suggests that for office type spaces, the number of occupied hours above 28^{o}C should not exceed 1% of the annual occupied period.]

2.52 When seeking to limit solar gains, consideration should be given to the provision of adequate levels of daylighting.
[BS 8206 - 2 “Lighting for buildings. Code of practice for daylighting” gives recommendations on maintaining adequate levels of daylighting.]

CRITERION 4 – QUALITY OF DESIGN, CONSTRUCTION AND COMMISSIONING

2.53 Every building shall be designed and constructed such that the thermal and air permeability properties of the building envelope, the fixed building services and controls achieve a calculated Building carbon dioxide Emissions Rate (BER) equal to or less than the TER.

Building fabric

2.54 The building fabric shall be constructed such that there are no readily avoidable thermal bridges in the insulation layers caused by gaps within the various elements, at joints between elements, and at the edges of elements such as those around door and window openings.

2.55 The building shall be constructed –

(a) for buildings of domestic type construction, to details given in the DCLG publication "Accredited construction details for Part L*";

(b) for cladding systems, in accordance with Metal Cladding and Roofing Manufacturers Association (MCRMA) Technical paper 14 – "Guidance for the design of metal cladding and roofing"; or

(c) to details that give an equivalent level of performance when assessed in accordance with BRE IP 1/06: "Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings".

[* Note that "Part L" in the title refers to the part in England & Wales that is equivalent to Part F in Northern Ireland.]

2.56 The builder shall demonstrate that an appropriate system of site inspection is in place to ensure that the construction standards achieve the required level of consistency. Where the accredited design details approach is adopted (see paragraph 2.55 (a) or (b)), a report showing that construction checklists such as those given in the accredited design details publication have been completed, and show satisfactory results. A copy of this report shall be forwarded to the district council.

Air permeability and air pressure testing

2.57 The BER is calculated using the design air permeability specified by the designer. Where testing is required to demonstrate that the design air permeability has been achieved (see paragraphs 2.58 to 2.61), the building shall be air pressure tested in accordance with the Air Tightness Testing and Measurement Association (ATTMA) publication "Measuring air permeability of building envelopes". The Test Report shall be produced in accordance with section 4 of that document. The tests shall be carried out by a suitably qualified person such as a tester who is registered with the British Institute of Non-destructive Testing in respect of pressure testing for air tightness of buildings.

The signed Test Report shall be submitted to the district council.

2.58 All buildings other than dwellings (including extensions that are being treated as new buildings for the purposes of complying with Part F) shall be air pressure tested, with the following variations –

(a) buildings of less than 500 m^2 in total useful floor area, where the developer may choose to avoid air pressure testing by assuming that the design air permeability is 15 $m^3/(h \cdot m^2)$ @ 50 Pa for the purposes of calculating the TER and BER, in which case compensating measures will be required;

(b) factory-made modular buildings where no site assembly work is needed, provided that the module type has been subjected to an in situ test programme, is certified by an accredited air pressure testing organisation as having satisfactory design air permeability and that this is routinely achieved on site;

(c) large extensions, whose compliance with Part F is being assessed as if they were new buildings, and where sealing off the extension from the existing building is impracticable. "Measuring air permeability of building envelopes" gives recommendations on how extensions can be tested and on situations where pressure tests are inappropriate. Where it is agreed with the district council that testing is impracticable, the extension shall be treated as a large, complex building and the provisions of the following sub-paragraph shall apply –

(i) large complex buildings (such as airport terminals and large shopping centres), where due to the building size or complexity, it may be impractical to carry out pressure testing of the whole building. "Measuring air permeability of building envelopes" indicates those situations where this might apply. Before adopting this approach, developers shall produce in advance of construction work and in accordance with the approved procedure, a detailed justification of why pressure testing is inappropriate. This justification shall be endorsed by a suitably qualified person.

Where the district council accepts that air pressure testing is impracticable, compliance shall be demonstrated where a suitably qualified person undertakes a detailed programme of design development, component testing and site supervision to give confidence that a continuous air barrier will be achieved. When following this route, it shall not be possible to claim an air permeability lower than 5 $m^3/(h \cdot m^2)$ @ 50 Pa; and

(d) compartmentalised buildings, where the building is divided into self-contained units with no internal connections. In such circumstances, it would be reasonable to carry out a pressure test on a representative section of the buildings as detailed in the ATTMA publication. In the event of a test failure, the provisions of paragraphs 2.60 and 2.61 shall apply and a further test shall be carried out on another representative section of the building to confirm that the required standard is achieved in all parts of the building.

DEMONSTRATING COMPLIANCE

2.59 Compliance with the air permeability requirements shall be demonstrated where –

(a) the measured air permeability is not greater than 10 $m^3/(h \cdot m^2)$ @ 50 Pa; and

(b) the BER calculated on completion using the measured air permeability is equal to or less than the TER.

CONSEQUENCES OF FAILING A PRESSURE TEST

2.60 Where a building fails to achieve its design air permeability, remedial measures shall be carried out on that building such that on re-test the building complies with the provisions of paragraph 2.59.

2.61 However, for buildings with a total useful floor area of less than 1000 m^2 in the period up to 31 October 2007, if the initial test result on the building is unsatisfactory, reasonable provision shall be to –

(a) carry out remedial measures such that on re-test a result is achieved that shows either –

(i) an improvement of 75% of the difference between the initial test result and the design air permeability; or

(ii) if more easily achieved, a test result within 15% of the design air permeability; or

(b) revise the TER by substituting the measured air permeability for the value given in the detailed specification for the notional building as defined in SBEM and demonstrate that the revised BER for the building as built is equal to or less than the revised TER.

Example – following an initial failure where the test result is 18.0 and the design air permeability target is 8.0, the revised pass level following remedial works would be –

Using (a)(i) – Using (a)(ii) –

$18 - \{0.75 \times (18 - 8)\} = 10.5$ $8 \times 1.15 = 9.2$

and therefore option (a)(i) is easier to achieve.

However, if the initial test result is 9.5 it would be less demanding to use the alternative option in (a)(ii). The revised pass level following remedial measures would be –

Using (a)(i) – Using (a)(ii) –

$9.5 - \{0.75 \times (9.5 - 8)\} = 8.375$ $8 \times 1.15 = 9.2$

and therefore option (a)(ii) is easier to achieve.

After 31 October 2007, paragraph 2.59 will be the only method of demonstrating compliance.

Commissioning

2.62 The building services systems shall be designed, installed and commissioned such that, for the purposes of the conservation of fuel and power, the system and its controls are handed over in efficient working order.

2.63 All fixed building services shall be commissioned in accordance with the procedure given in –

(a) CIBSE Commissioning Code M: "Commissioning management"; and

(b) the procedures for leakage testing of ductwork given in paragraphs 2.64 and 2.65.

2.64 Air leakage testing of ductwork shall be carried out in accordance with the procedures given in HVCA DW/143 "A practical guide to ductwork leakage testing", on systems served by fans with a design flow rate greater than 1 m^3/s and for those sections of ductwork where –

(a) the pressure class is such that DW/143 recommends testing; and

(b) the BER calculation assumes a leakage rate for a given section of ductwork that is lower than the standard defined in DW/144 "Specification for sheet metal ductwork" for its particular pressure class. In such circumstances, any low-pressure ductwork shall be tested using the testing provisions given in DW/143 for medium pressure ductwork.

2.65 Where a ductwork system fails to meet the required standard, remedial work shall be carried out as necessary to achieve a satisfactory performance and further ductwork sections shall be tested in accordance with DW/143.

2.66 A notice that all fixed building services have been properly commissioned shall be provided confirming that –

(a) a commissioning plan has been followed such that every system has been inspected and commissioned in an appropriate sequence and to a reasonable standard; and

(b) the results of tests confirm that the performance is reasonably in accordance with the actual building designs, including written commentaries where it is proposed to accept excursions (variations).

The notice shall be signed by a suitably qualified person and a copy shall be given to the district council and the building owner.

[For HVAC systems, a member of the Commissioning Specialists Association or the Commissioning Group of the HVCA, may be regarded as a suitably qualified person. For lighting control systems, a person accredited under the Lighting Industry Commissioning Scheme may be regarded as a suitably qualified person.]

CRITERION 5 – PROVISION OF INFORMATION

2.67 The building owner shall be given sufficient information, including details of the installed building services, plant and controls, their methods of operation and maintenance, and other details that collectively enable operation and maintenance in such a manner as to use no more fuel and power than is reasonable in the circumstances.

2.68 A building logbook shall be provided in the format given in CIBSE TM 31 “Building log book toolkit”. The information shall be presented using the TM 31 standard templates.

2.69 The data used to calculate the TER and the BER shall be recorded in the logbook.

Section 3 Existing buildings other than dwellings

GENERAL

This Section should be read in conjunction with Section 1 – Common items.

Types of work covered by this Section

3.1 This Section gives provisions for altering or extending an existing building other than a dwelling, or where a building is subject to a material change of use other than to a dwelling.

3.2 This Section gives provisions relating to the following building works –

(a) extensions (see paragraphs 3.6 to 3.21 and 3.27 to 3.63);

(b) the provision or extension of a controlled fitting (see paragraphs 3.11 to 3.14);

(c) the provision of a new thermal element (see paragraphs 3.15 to 3.17);

(d) the replacement or renovation of a thermal element (see paragraphs 3.22 to 3.26);

(e) the provision or extension of a controlled service (see paragraphs 3.36 to 3.63);

(f) a material change of use (see paragraphs 3.64 to 3.71); and

(g) consequential improvements (see paragraphs 3.72 to 3.78).

3.3 When the building works are in relation to an existing building, it may be appropriate to utilise the provisions from Section 2. The following sub-paragraphs identify the circumstances where the use of other sections might be appropriate –

(a) where the work involves the first fitting out of a new building built to comply with Section 2, the initial fit-out works shall comply with Section 2 as if it were part of the initial construction work. In all other circumstances the fit-out works shall comply with Section 3;

(b) where the work involves a large extension the work shall comply with the provisions of Section 2 (see paragraphs 3.6 and 3.7). However, where consequential improvements are required the consequential improvements shall comply with Section 3;

(c) where the work involves the construction of an extension to an existing building using sub-assemblies that have been obtained from a centrally held stock or from the disassembly or relocation of buildings, the works shall comply with Section 2. Where consequential improvements are required, the consequential improvements shall comply with Section 3; or

(d) where the work involves a building that either before or after the work is completed contains one or more dwellings the provisions of Section 3 of Technical Booklet F1 shall apply to the dwellings.

Historic buildings

3.4 Special considerations apply where the building on which the work is to be carried out has historic or architectural value and compliance with this Technical Booklet would unacceptably alter the character or appearance of the building.

3.5 When undertaking work on or in connection with a building of historic or architectural merit, the aim should be to improve energy efficiency where, and to the extent that, it is practicable. Particular issues in relation to work in historic buildings that warrant sympathetic treatment and where specialist advice from conservation experts would be beneficial include –

(a) restoring the historic character of a building that has been subject to inappropriate alteration e.g. replacement windows, doors and rooflights;

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

(c) making provisions for the fabric of historic buildings to "breathe" to control moisture and long term decay problems.

The recommendations given in the DOE (NI), Environment and Heritage Service publication "Historic buildings & energy efficiency. A guide to Part F of the Northern Ireland Building Regulations" shall be taken into account in determining appropriate energy efficiency improvements.

EXTENSIONS

3.6 Where an existing building having a total useful floor area greater than 1000 m^2 is to be extended, consequential improvements shall be made to the existing building in accordance with paragraphs 3.72 to 3.78.

Large extensions

3.7 Where a proposed extension has a total useful floor area that is –

(a) greater than 100 m^2; and

(b) greater than 25% of the total useful floor area of the existing building,

it shall be treated as a new building and shall be designed to comply with Section 2 of this Technical Booklet.

Other extensions

THERMAL ENVELOPE

3.8 For other extensions three alternative approaches are given; they are –

(a) the Standards Based Approach (paragraphs 3.9 to 3.29);

(b) the Calculated Trade-off Approach (paragraphs 3.30 to 3.32); and

(c) the Equivalent Carbon Target Approach (paragraphs 3.33 to 3.35).

Standards Based Approach

3.9 The extension shall achieve the following performance standards –

(a) areas of openings that comply with the provisions given in paragraph 3.10;

(b) controlled fittings that comply with the provisions given in paragraphs 3.11 to 3.14;

(c) newly constructed thermal elements that comply with the provisions given in paragraphs 3.15 to 3.17;

(d) renovation of thermal elements (where more than 25% of the surface area of a thermal element is being renovated) that comply with the provisions given in paragraphs 3.22 and 3.23; and

(e) existing opaque fabric that becomes part of the thermal envelope, where previously it was not, shall comply with the provisions given in paragraphs 3.24 to 3.26.

AREAS OF OPENINGS

3.10 The total area of windows, roof-windows and rooflights in an extension shall not exceed the relevant values given in Table 3.1 unless a greater percentage of glazing is present in the elevations of the adjoining part of the existing building to which the extension is attached. In such cases, the area of glazing may be increased but shall not exceed the percentage of glazing in the adjoining part of the existing building.

Table 3.1 Opening areas in the extension

Building type	Windows and personnel doors (% of exposed wall area)	Rooflights (% of roof area)
Residential buildings where people permanently or temporarily reside	30	20
Places of assembly, offices and shops	40	20
Industrial and storage buildings	15	20

Notes

1 Vehicle access doors, display windows and similar glazing are as required and are excluded from the percentages above.

2 Smoke ventilators are as required and are excluded from the percentages above.

CONTROLLED FITTINGS

3.11 Where windows, roof-windows, rooflights or doors are to be provided, they shall be draught-proofed units whose area-weighted average performance is not greater than that given in Table 3.2.

Column (a) applies to new fittings provided as part of constructing the extension. Column (b) applies to replacement fittings or new fittings installed in the existing building.

Table 3.2 Standards for controlled fittings – Maximum U-values {W/(m^2·K)} or Window Energy Rating (WER)

Fitting	(a) New fittings in an extension	(b) Replacement fittings in an existing building
Windows, roof windows and rooflights (1) (2)	1.8 for the whole unit OR 1.2 centre pane	2.2 for the whole unit OR 1.2 centre pane
Windows in buildings that are essentially domestic in character (3), a window energy rating (4) of	Band D (4)	Band E (4)
Pedestrian doors with more than 50% of their internal face glazed	2.2	2.2 for the whole unit OR 1.2 centre pane
Plastic rooflights (2)	2.2	2.2
Curtain walling	See paragraph 3.14	See paragraph 3.14
High usage entrance doors for people	6.0	6.0
Vehicle access and similar large doors	1.5	1.5
Roof ventilators (including smoke extract ventilators)	6.0	6.0

Notes

1 Excluding display windows.

2 See paragraph 1.8.

3 Essentially domestic in character means student accommodation, care homes and similar accommodation where the occupancy levels and internal gains are similar to dwellings.

4 As defined in controlled fittings in the Energy Saving Trust EST publication CE 66 “Windows for new and existing housing”.

3.12 The U-value or Window Energy Rating for a window, roof-window, rooflight or door unit may be taken as the value for –

(a) the standard configuration referred to in BRE Report BR 443 "Conventions for U-value calculations"; or

(b) the particular size and configuration of the actual unit.

In both cases, it is assumed that the U-value has been assessed with the unit in the vertical position.

Where a roof-window or rooflight has been assessed in a position other than the vertical, the U-value shall be modified by making a U-value adjustment in accordance with BR 443.

SAP Table 6e gives values for different window configurations that may be used in the absence of test data or calculated values.

3.13 In some buildings with high internal heat gains, a less demanding U-value for glazing may be an appropriate way of reducing overall CO_2 emissions. Where this can be demonstrated by calculation, the average U-value for windows, doors and rooflights may be greater than the value given in Table 3.2 but shall not exceed 2.7 W/(m^2·K).

3.14 The overall U-value of curtain walling including glazing, shall not exceed 0.9 + 1.3X, where "X" is the proportion of the curtain wall that is glazed. However, the opaque part of the curtain walling shall not exceed the limiting U-value of 0.7 W/(m^2·K).

For example, if the area of curtain walling is 60% glazed and 40% opaque, the overall U-value of the curtain walling shall not exceed 0.9 + (1.3 x 0.6) = 1.7 W/(m^2·K).

PROVISION OF THERMAL ELEMENTS

3.15 Where thermal elements are newly constructed or replaced, provision shall be made to limit heat gains and losses through those elements.

3.16 New thermal elements, such as those constructed as part of an extension, shall have a U-value not greater than that given in column (a) of Table 3.3. No individual element (see paragraph 3.32), or part of an individual element such as a meter cupboard recess, shall have a U-value greater than that given in column (b) of Table 3.4.

Table 3.3 U-values for thermal elements {W/(m^2·K)}

Element (1)	**(a) New elements (in an extension or change of use)**	**(b) Replacement elements (in an existing building)**
Wall	0.30	0.35 (2)
Pitched roof – insulation at ceiling level	0.16	0.16
Pitched roof – insulation at rafter level	0.20	0.20
Pitched roof with integral insulation or flat roof	0.20	0.25
Floor (3)	0.22 (4)	0.25 (4)

Notes

1 "Roof" includes the roof parts of dormer windows and "wall" includes the 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 may be calculated using the exposed perimeter and floor area of the enlarged building.
See BR 443 and either the Chartered Institution of Building Services Engineers "CIBSE Guide A: Environmental design" – Section A3 Themal properties of building structures, or BS EN ISO 13370: 1998 "Thermal performance of buildings – heat transfer via the ground – calculation methods".

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

3.17 Thermal elements constructed as replacements for existing elements shall have a U-value not greater than that given in column (b) of Table 3.3.
No part of an individual element, such as a meter cupboard recess, shall have a U-value greater than that given in column (b) of Table 3.4.

Table 3.4 Limiting U-values {W/(m^2·K)}		
Element	**(a) Area-weighted average U-value**	**(b) Maximum U-value**
Wall	0.35	0.70
Floor	0.25	0.70
Roof	0.25	0.35
Windows, roof-windows (1), rooflights (1), and doors	2.20	3.30

Note

1 Where a roof-window or rooflight has been assessed in a position other than the vertical, the U-value shall be modified by making a U-value adjustment in accordance with BR 443 "Conventions for U-value calculations".

CONTINUITY TO LIMIT THERMAL BRIDGING AND AIR LEAKAGE

3.18 The building fabric shall be constructed such that there are no readily avoidable thermal bridges in the insulation layers caused by gaps within the various elements, at joints between elements, and at the edges of elements such as those around door and window openings.

3.19 The building fabric shall be constructed to minimise air leakage through the new or replacement parts of the thermal envelope.

3.20 The building fabric shall be constructed –

(a) for buildings of domestic type construction, to details given in the Department for Communities and Local Government (DCLG) publication "Accredited Construction Details for Part L*";

(b) for cladding systems, in accordance with Metal Cladding and Roofing Manufacturers Association (MCRMA) Technical paper 14 – "Guidance for the design of metal cladding and roofing"; or

(c) to details that give an equivalent level of performance when assessed in accordance with BRE IP 1/06: "Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings".

[* Note that "Part L" in the title refers to the part in England & Wales that is equivalent to Part F in Northern Ireland.]

3.21 The builder shall demonstrate that an appropriate system of site inspection is in place to ensure that the construction standards achieve the required level of consistency. Where the accredited design details approach is adopted (see paragraph 3.20 (a) or (b)), a report shall be provided showing that the relevant construction checklists such as those given in the accredited design details publication have been completed and show satisfactory results and a copy shall be forwarded to the district council.

RENOVATION OF THERMAL ELEMENTS

3.22 Where more than 25% of the surface area of a thermal element is being renovated, the completed thermal element shall achieve the improved U-values given in column (b) of Table 3.5.

Table 3.5 U-values for retained thermal elements {W/(m^2·K)}

Element [1]	(a) Threshold U-value	(b) Improved U-value
Cavity wall [2]	0.70	0.55 [3]
Other wall type	0.70	0.35 [3]
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation at rafter level	0.35	0.20
Pitched roof with integral insulation or flat roof	0.35	0.25
Floor [4]	0.70	0.25 [5]

Notes

1 "Roof" includes the roof parts of dormer windows and "wall" includes the cheeks of dormer windows.

2 Where a cavity wall is unsuitable for cavity insulation it shall be treated as "Other wall type".

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 may be calculated using the exposed perimeter and floor area of the enlarged building.

See BR 443 and either the "CIBSE Guide A: Environmental design" – Section A3 Themal properties of building structures, or

BS EN ISO 13370: 1998 "Thermal performance of buildings – heat transfer via the ground – calculation methods".

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

3.23 Where upgrading to the standards required by paragraph 3.22 is not technically or functionally feasible, the element shall be upgraded to the best practicable standard that can be achieved within a simple payback period of 15 years. Appendix B gives the information necessary to assess the simple payback of the proposed works. Appendix C gives provisions that will satisfy this requirement.

RETAINED THERMAL ELEMENTS

3.24 Where an existing element becomes part of the thermal envelope where previously it was not, and where it has a U-value greater than the threshold value given in column (a) of Table 3.5, the element shall be upgraded to the standard given in column (b) of Table 3.5.

3.25 Where upgrading to the standards required by paragraph 3.24 is not technically, or functionally feasible, the element shall be upgraded to the best practicable standard that can be achieved within a simple payback period of 15 years. Appendix B gives the information necessary to assess the simple payback of the proposed works. Appendix C gives provisions that will satisfy this requirement.

3.26 Examples of where a lesser provision than that required by paragraph 3.24 might apply are where the thickness of the additional insulation would reduce the usable floor area by more than 5% or where the additional insulation would create difficulties with adjoining floor levels or where the existing structure could not support the additional insulation.

CONSERVATORIES AND HIGHLY GLAZED EXTENSIONS

3.27 Where the extension is a conservatory that is not exempt from the Building Regulations, it shall have –

(a) effective thermal separation from the existing building by having separating walls, doors and windows between the building and the conservatory that are insulated and draught-proofed to at least the same standard as the same elements in the existing building;

(b) glazed elements that comply with the standards given in column (b) of Table 3.2 and opaque elements that have U-values that are no greater than those given in column (b) of Table 3.4; and

(c) where fixed building services are installed, they shall comply with the provisions of paragraph 3.36 and shall have independent time and temperature controls separate from those of the existing building.

3.28 Where a highly glazed extension is not a conservatory (because it has less than the minimum qualifying amounts of translucent material) but otherwise complies with the requirements of paragraph 3.27, it may be treated in a similar manner to a conservatory. The area-weighted U-value of the elements in the highly glazed extension shall not be greater than that of a conservatory of the same shape and size that complies with paragraph 3.27.

3.29 Where a highly glazed extension is not thermally separated from the building, it shall be treated as a conventional extension.

Calculated Trade-off Approach

3.30 Using the Calculated Trade-off Approach the U-values given in the Standards Based Approach (paragraphs 3.9 to 3.29) may be varied in accordance with paragraphs 3.31 and 3.32.

3.31 Fabric standards referred to in paragraph 3.9 and the opening areas referred to in paragraph 3.10 may be varied provided that –

(a) the area-weighted U-value of all the elements in the extension is no greater than that of an extension of the same shape and size that complies with the U-value standards referred to in paragraph 3.9 and the opening areas referred to in paragraph 3.10;

(b) the area-weighted U-value for each element type is not greater than the relevant value given in column (a) of Table 3.4; and

(c) the maximum U-value of any individual element or part of an individual element, such as a meter cupboard recess, is not greater than the relevant value given in column (b) of Table 3.4.

The area-weighted U-value is calculated using the following formula –

$$U_{av} = \frac{(U_1 \times A_1) + (U_2 \times A_2) + (U_3 \times A_3) + \ldots .}{A_1 + A_2 + A_3 + \cdot \cdot \cdot \cdot}$$

3.32 For the purposes of the above paragraph an individual element means those areas of a given element type that have the same construction details. In the case of windows, doors and rooflights, the assessment shall be based on the unit as a whole i.e. for windows the combined performance of the glazing and frame.

Equivalent Carbon Target Approach

3.33 An approved calculation methodology shall be used to demonstrate that the carbon dioxide emissions from the existing building and proposed extension are no greater than for the existing building and a notional extension of the same shape and size that complies with the standards referred to in paragraphs 3.9 and 3.10. In doing these calculations the area-weighted average U-value of each element type in the extension shall be not greater than the relevant value given in column (a) of Table 3.4 and the U-value of any individual element (see paragraph 3.32) shall be not greater than the relevant value given in column (b) of that table. For the purposes of these calculations, both the proposed and notional buildings shall incorporate the measures necessary to comply with the provisions for consequential improvement. See paragraphs 3.72 to 3.78.

3.34 Work to controlled services shall comply with paragraphs 3.36 to 3.63.

3.35 Where additional upgrades are proposed to the existing building to compensate for lower performance in the extension, the upgrades shall comply with the provisions given in this Technical Booklet. The U-values for upgrading retained thermal elements are given in column (b) of Table 3.5.

Controlled services

3.36 Where the work involves the provision or extension of a controlled service, the new fixed building services shall be installed so that –

(a) they achieve the efficiency appropriate to that service as given in paragraphs 3.37 to 3.58; and

(b) for central plant (i.e. boilers, chillers and main air handling plant), they have an efficiency not less than that of the controlled service being replaced. Where the new service uses a different fuel, the efficiency of the new appliance shall be multiplied by the ratio of the CO_2 emissions factor of the fuel used by the appliance being replaced to that of the fuel used by the new appliance when making this check. The emissions factor shall be taken from Table 2.1 in Section 2 of this Technical Booklet.

[When fuel switching, where an existing chiller having a CoP of 2.5 is replaced with an absorption chiller with a CoP of 0.8 and which is fired by waste heat, the equivalent efficiency of the absorption chiller would be 0.8 x (0.422/0.018) = 18.8, which is greater than the efficiency (CoP) of the existing system (2.5) and therefore criterion (b) would be satisfied. (0.422 and 0.018 kg/kWh are the CO_2 emissions factors for electricity and waste heat respectively.)]

Heating and hot water systems

3.37 Where the work involves the provision or extension of a heating or hot water system or part thereof, it shall have –

(a) an efficiency of not less than that recommended for its type in the DCLG publication “Non-domestic heating, cooling and ventilation compliance guide”; and

(b) controls that meet the minimum control requirements given in the DCLG publication “Non-domestic heating, cooling and ventilation compliance guide” for the installed appliance and its heat distribution system.

[The compliance checklists given in the DCLG publication “Non-domestic heating, cooling and ventilation compliance guide” are a useful tool in demonstrating that these provisions have been met.]

Controls

3.38 Where new HVAC systems are to be provided, the following general requirements shall apply to the system –

(a) the fixed building service system(s) shall be sub-divided into separate control zones to correspond to each area of the building that has a significantly different solar exposure, occupancy period, or type of use;

(b) each separate control zone shall be capable of independent time and temperature control and, where appropriate, ventilation and air circulation rate;

(c) the service shall respond to the requirements of the space it serves. Where both heating and cooling are provided they shall be controlled so as not to operate simultaneously; and

(d) the central plant shall only operate as and when the zone requires it. The default condition shall be "off".

Energy meters

3.39 Energy meters shall be provided in those building service systems installed as part of the works to enable at least 90% of the estimated annual energy consumption for each fuel to be assigned to the various end-use categories (heating, lighting etc). For this purpose energy meters shall be provided –

(a) in accordance with the recommendations of CIBSE TM 39 "Building energy metering";

(b) to separately meter and monitor the performance of any low or zero carbon energy system(s); and

(c) in buildings with a total useful floor area greater than 1000 m^2, to enable automatic meter reading and data collection.

Cooling plant

3.40 Where it is practical and cost effective to do so, measures to reduce cooling loads (e.g. through solar control or more efficient lighting) shall be incorporated as part of any work to replace a chiller. BRE Report BR 364 "Solar shading of buildings" gives recommendations on appropriate solar control strategies.

3.41 A cooling system shall have –

(a) an efficiency not less than that recommended for its type in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide"; and

(b) controls that meet the minimum control requirements given in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide" for the particular system.

[The compliance checklists given in the DCLG publication "Non-domestic heating, cooling and ventilation compliance guide" are a useful tool in demonstrating that these provisions have been met.]

Air handling plant and ductwork

3.42 An air handling plant shall have –

(a) an efficiency not less than that recommended for its type in the DCLG publication “Non-domestic heating, cooling and ventilation compliance guide”; and

(b) controls that meet the minimum control requirements given in the DCLG publication “Non-domestic heating, cooling and ventilation compliance guide” for particular system.

3.43 The air handling systems shall be capable of achieving a specific fan power at 25% of design flow rate which is no greater than that achieved at 100% design flow rate.

3.44 Fans that are rated at more than 1100 W and form part of the environmental control systems, shall be equipped with variable speed drives, to aid commissioning and provide flexibility for future changes in use.

The provisions of paragraphs 3.42 to 3.44 shall not apply to smoke control or similar ventilation systems used solely in abnormal circumstances.

3.45 Ventilation ductwork shall be constructed and manufactured in accordance with the Heating and Ventilating Contractors Association (HVCA) publication DW/144 “Specification for sheet metal ductwork”, so as to be reasonably airtight.

Insulation of pipes, ducts and vessels

3.46 Hot and chilled water pipework and associated storage vessels, refrigerant pipework and ventilation ductwork shall be insulated in accordance with the recommendations given in the DCLG publication “Non-domestic heating, cooling and ventilation compliance guide”.

[The Thermal Insulation Manufacturers and Suppliers Association (TIMSA) guide “Guidance for achieving compliance with Part L* of the building regulations” explains the derivation of the performance standards and how they can be interpreted in practice.

* Note that “Part L” in the title refers to the part in England & Wales that is equivalent to Part F in Northern Ireland.]

Fixed internal lighting

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

3.47 The general lighting in office, industrial and storage areas shall have an average initial efficacy of not less than 45 luminaire-lumens per circuit-Watt averaged over the total area of these types of space in the building.

3.48 The average luminaire-lumen per circuit-Watt is calculated by –

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

(a) Lamp-lumens is the sum of the initial (100 hour) lumen output of all the lamp(s) in the luminaire;

(b) LOR is the light output ratio of the luminaire, which means the ratio of the total light output of the luminaire under stated practical conditions to that of the lamp or lamps in the luminaire under reference conditions; and

(c) Control factor is the factor applicable when automatic controls substantially reduce the power consumption when electric light is not required (see Table 3.6 for the appropriate control factors).

Table 3.6 Luminaire control factors

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

3.49 The general lighting provisions also apply to areas that involve predominately desk-based tasks, including classrooms, seminar rooms and conference rooms including those in educational buildings.

GENERAL LIGHTING EFFICACY IN ALL OTHER AREAS

3.50 For lighting systems serving other areas it may be appropriate to provide luminaires for which photometric data is not available or luminaires that are lower powered and use less efficient lamps. In such areas, the installed lighting shall have an average initial (100 hour) lamp plus ballast efficacy of not less than 50 lamp-lumens per circuit-Watt.

LIGHTING CONTROLS FOR GENERAL LIGHTING IN ALL TYPES OF SPACE

3.51 Lighting controls shall be provided so as to avoid unnecessary lighting when daylight levels are adequate or when spaces are unoccupied. The operation of automatically switched lighting shall not endanger the passage of people moving in or about the building.

3.52 Occupant controlled local switches shall be provided in easily accessible positions within each working area or at boundaries between working areas and general circulation routes.

[For the purposes of this paragraph, occupant controlled switches include manual switches (rocker switches, push buttons, pull cords, etc.) and remote switches such as wireless transmitters and telephone handset controls.]

3.53 For the purposes of lighting control, switches include dimmer switches and switching includes dimming. Dimming shall be effected by reducing rather than diverting the energy supply.

3.54 The distance on plan from any local switch to any luminaire it controls shall not be more than 6 m, or twice the height of the luminaire above the floor whichever is the greater. Where the space is a daylit space served by side windows the row of luminaires adjacent to the windows shall be separately switched.

3.55 Occupant control of local switching may be supplemented by other controls such as automatic systems which –

(a) switch the lighting off when they sense that the space is unoccupied; or

(b) either dim or switch off the lighting when there is adequate daylight.

Table 3.6 gives the control factors for such enhanced controls which may be used as part of achieving the luminaire efficiency given in paragraph 3.48.

[BRE Digest 498 “Selecting lighting controls” gives information on appropriate control strategies for lighting.]

DISPLAY LIGHTING IN ALL TYPES OF SPACE

3.56 Display lighting shall have an average initial (100 hour) efficacy of not less than 15 lamp-lumens per circuit-Watt. When calculating this efficacy, the power consumed by transformers or ballasts shall be taken into account.

3.57 Spaces where display lighting is present would normally have general lighting for circulation and for the purposes of cleaning and restocking outside public access hours. Such lighting shall comply with the general lighting and controls provisions given in paragraphs 3.47 to 3.55 depending on the type of space.

CONTROLS FOR DISPLAY LIGHTING IN ALL TYPES OF SPACE

3.58 Display lighting shall be connected to dedicated circuits that can be switched off when people will not be inspecting exhibits or merchandise or attending entertainment events. However, this provision shall not apply to displays designed to be viewed from outside the building through display windows. For example in a retail store it would be reasonable to provide timers that switch off the internal display lighting outside store opening hours.

Commissioning

3.59 The building services systems shall be designed, installed and commissioned such that, for the purposes of the conservation of fuel and power, the system and its controls are handed over in efficient working order.

3.60 All fixed building services shall be commissioned in accordance with the procedures given in –

(a) the CIBSE Commissioning Code M: "Commissioning management"; and

(b) the procedures for leakage testing of ductwork given in paragraphs 3.61 and 3.62.

3.61 Air leakage testing of ductwork shall be carried out in accordance with the procedures given in HVCA DW/143 "A practical guide to ductwork leakage testing", on systems served by fans with a design flow rate greater than 1 m^3/s and for those sections of ductwork where the pressure class is such that DW/143 recommends testing.

Any low-pressure ductwork shall be tested using the testing provisions given in DW/143 for medium pressure ductwork.

3.62 Where a ductwork system fails to meet the required leakage standard, remedial work shall be carried out as necessary to achieve a satisfactory performance and further ductwork sections shall be tested in accordance with DW/143.

3.63 A notice that all fixed building services have been properly commissioned shall be provided by the builder confirming that –

(a) a commissioning plan has been followed such that every system has been inspected and commissioned in an appropriate sequence and to a reasonable standard; and

(b) the results of tests confirm that the performance is reasonably in accordance with the actual building designs, including written commentaries where it is proposed to accept excursions (variations).

The notice shall be signed by a suitably qualified person and a copy shall be given to the district council and the building owner.

[For HVAC systems, a member of the Commissioning Specialists Association or the Commissioning Group of the HVCA, may be regarded as a suitably qualified person. For lighting control systems, a person accredited under the Lighting Industry Commissioning Scheme may be regarded as a suitably qualified person.]

MATERIAL CHANGE OF USE

3.64 Where a building is subject to a material change of use, two alternative approaches are given; they are –

(a) the Standards Based Approach; and

(b) the Equivalent Carbon Target Approach.

Standards Based Approach

3.65 Where controlled fittings or services are being provided or extended, they shall comply with the provisions of paragraphs 3.11, 3.12 and 3.36 to 3.63.

3.66 Where the work involves the provision of a new or replacement thermal element, it shall comply with the provisions of paragraphs 3.15 to 3.21.

3.67 Where more than 25% of the surface area of a thermal element is being renovated, the element shall be upgraded to achieve the improved U-values given in column (b) of Table 3.5.

3.68 Where upgrading to the standards required by paragraph 3.67 is not technically or functionally feasible, the element shall be upgraded to the best practicable standard that can be achieved within a simple payback period of 15 years. Appendix B gives the information necessary to assess the simple payback of the proposed works. Appendix C gives provisions that will satisfy this requirement.

3.69 Where a thermal element is to be retained it shall be upgraded in accordance with the provisions of paragraphs 3.24 to 3.26.

3.70 Any existing window (excluding display windows but including roof-windows or rooflights) or door (excluding high usage entrance doors) that separates a conditioned space from an unconditioned space (or the external air), and which has a U-value greater than 3.3 W/(m^2·K), shall be replaced in accordance with the provisions of paragraphs 3.11 to 3.14.

Equivalent Carbon Target Approach

3.71 An approved calculation methodology shall be used to demonstrate that the calculated carbon dioxide emissions rate from the building is no greater than for a notional building of the same shape and size complying with the standards in the Standards Based Approach above.

The U-values of any individual element (see paragraph 3.32) shall be not greater than the maximum U-values in column (b) of Table 3.4.

CONSEQUENTIAL IMPROVEMENTS

General

3.72 Consequential improvements shall be made to an existing building having a total useful floor area greater than 1000 m^2, if –

(a) it is extended;

(b) any fixed building service is installed for the first time; or

(c) an existing fixed building service is increased in capacity.

On extending a building

3.73 Where an existing building having a total useful floor area greater than 1000 m^2 is to be extended, consequential improvements shall be made to the existing building in accordance with paragraph 3.74 and Table 3.7.

3.74 Measures from Table 3.7 shall be adopted to the extent that the total cost of the consequential improvements is not less than 10% of the value of the principal works.

The value of the principal works and the value of the consequential improvements shall be established using prices current at the date of deposit of plans with the district council, and shall be confirmed in a report signed by a suitably qualified person.

These consequential improvements shall be carried out where they are technically, functionally and economically feasible.

Economically feasible means within a simple payback of 15 years.

Table 3.7	Improvements that in normal circumstances are practicable and economically feasible
1	Upgrading heating systems more than 15 years old by the provision of new plant or improved controls.
2	Upgrading cooling systems more than 15 years old by the provision of new plant or improved controls.
3	Upgrading air handling systems more than 15 years old by the provision of new plant or improved controls.
4	Upgrading general lighting systems that have an average lamp efficacy of less than 40 lamp-lumens per circuit-Watt and that serve areas greater than 100 m^2 by the provision of new luminaires or improved controls.
5	Installing energy metering in accordance with the provisions of CIBSE TM 39 “Building Energy Metering".
6	Upgrading thermal elements which have a U-value greater than those given in column (a) Table 3.4 to not less than those given in column (b).
7	Replacing existing windows (excluding display windows), roof-windows and rooflights or doors (excluding high usage entrance doors) that have a U-value greater than 3.3 W/(m^2·K) with fittings that have a U-value not greater than that given in column (b) of Table 3.2. See also paragraph 3.12.
8	Increasing the on-site low or zero carbon (LZC) energy generating systems (1) where the on-site LZC systems provide less than 10% of the energy demand, provided that the increase would achieve a simple payback of 7 years or less.

Note

1 The DCLG publication “The low or zero carbon energy sources: Strategic guide” describes a range of potential systems and how their contribution to the BER can be assessed.

On installing or increasing the capacity of building services

3.75 Where it is proposed to install a fixed building service for the first time or to increase the installed capacity per unit area of an existing service, in an existing building with a total useful floor area greater than 1000 m^2, consequential improvements shall be made to –

(a) improve the building fabric in those parts of the building served by the building service in accordance with paragraphs 3.77 and 3.78; and

(b) make additional improvements to the building in accordance with paragraph 3.74 and Table 3.7.

The cost of any improvements made to comply with paragraph 3.75(a) is not limited to 10% of the cost of the principal works, and shall not be taken as contributing to the consequential improvements required by paragraph 3.74.

These improvements shall be carried out where they are technically, functionally and economically feasible.

Economically feasible means within a simple payback period of 15 years. Appendix B gives the information necessary to assess the simple payback of the proposed works. Appendix C gives provisions that will satisfy this requirement.

3.76 The installed capacity of a fixed building service is the design output of the distribution system output devices (the terminal units) serving the space in question, divided by the total useful floor area of that space.

3.77 Where the installed capacity per unit area of a heating system is increased –

(a) the thermal elements (within the heated area served) that have U-values greater than those given in column (a) of Table 3.5 shall be improved to not less than those given in column (b) of that table. This need only be carried out where it is technically and functionally feasible and to the best practicable standard that can be achieved within a simple payback period of 15 years.

Appendix B gives the information necessary to assess the simple payback of the proposed works. Appendix C gives provisions that will satisfy this requirement; and

(b) existing windows (excluding display windows), roof-windows or rooflights or doors (excluding high usage entrance doors) within the area served, and which have U-values greater than 3.3 W/(m^2·K), shall be replaced by fittings complying with column (b) of Table 3.2. See also paragraph 3.12.

3.78 Where the installed capacity per unit area of a cooling system is increased –

(a) the thermal elements (within the cooled areas served) that have U-values greater than those given in column (a) of Table 3.5 shall be improved to not less than those given in column (b) of that table.

This need only be carried out where it is technically and functionally feasible and to the best practicable standard that can be achieved within a simple payback period of 15 years.

Appendix B gives the information necessary to assess the simple payback of the proposed works. Appendix C gives provisions that will satisfy this requirement; and

(b) where the area of windows (excluding display windows) and roof-windows within the area served by the cooling system exceeds 40% of the exposed wall area or the area of rooflights exceeds 20% of the area of the roof and the design solar load exceeds 25 W/m^2, the solar control provisions shall be upgraded such that at least one of the following criteria is met –

(i) the average solar load is not greater than 25 W/m^2;

(ii) the average solar load is reduced by not less than 20%;

(iii) the effective g-value (see CIBSE TM 37 “Design for improved solar shading control”) is not greater than 0.3; and

(c) any lighting system within the area served by the cooling system which has an average lamp efficacy of less than 40 lamp-lumens per circuit-Watt, shall be upgraded in accordance with paragraphs 3.47 to 3.55.

PROVISION OF INFORMATION

3.79 The building owner shall be given sufficient information, including details of the installed building services plant and controls, their methods of operation and maintenance, and other details that collectively enable operation and maintenance in such a manner as to use no more fuel and power than is reasonable in the circumstances.

3.80 A building logbook shall be provided in the format given in CIBSE TM 31 “Building log book toolkit”. The information shall be presented using the TM 31 standard templates.

3.81 The new or updated logbook shall provide details of –

(a) any newly provided, renovated or upgraded thermal elements or controlled fittings;

(b) any newly provided or extended fixed building services, their method of operation and maintenance requirements;

(c) any newly installed energy meters; and

(d) any other details that collectively enable the energy consumption of the building and building services comprising the works to be monitored and controlled.

Appendix A Compliance checklist

THIS APPENDIX IS NOT PART OF THE DEEMED-TO-SATISFY PROVISION

The following table provides a checklist to assist builders/developers in demonstrating compliance with Part F. The checklist shows the evidence that needs to be provided to allow the check to be made, and who should produce the evidence. For most criteria, the evidence can be provided by a suitably qualified person acting on behalf of the builder/developer.

Nº	Check	Evidence	Produced by	Design compliant?	As built compliant?
Criterion 1 Achieving the TER					
1	Calculated CO_2 emissions rate from the notional building {kg/(m^2·year)}	Standard output from SBEM calculation	SBEM assessment	N/A	N/A
2	Improvement factor	From Table 2.2	Developer's submission		
3	LZC benchmark	From Table 2.2	Developer's submission		
4	TER {kg/(m^2·year)}	Standard output from SBEM calculation	SBEM assessment		
5	BER for building as designed {kg/(m^2·year)}	Standard output from SBEM calculation	SBEM assessment	N/A	N/A
6	Are the emissions from the building as designed equal to or less than the target?	Compare TER and BER as designed	SBEM assessment		N/A
7	BER for building as constructed {kg/(m^2·year)}	Standard output from SBEM software	SBEM assessment	N/A	N/A
8	Are the emissions from the building as constructed equal to or less than the target?	Compare TER and BER as constructed	SBEM assessment	N/A	
Criterion 2 Minimum acceptable standards					
	Fabric U-values				
9	Are all U-values within the design limits?	Schedule of U-values produced by SBEM software	SBEM assessment		
10	Is air permeability no greater than the worst acceptable standard?	Standard output from SBEM software	SBEM assessment		
	Heating and hot water systems				
11	Are all fixed building services standards acceptable?	Schedule of appliance efficiencies produced by SBEM software	SBEM assessment		
12	Does the fixed internal lighting comply with paragraphs 2.38 to 2.49?	Schedule of fixed internal lighting	Builder or electrical contractor		
13	Are energy meters installed in accordance with CIBSE TM 39?	Metering strategy publication	Developer		

Nº	Check	Evidence	Produced by	Design compliant?	As built compliant?
Criterion 3	**Limiting the effects of solar gain in summer**				
14	Method of showing compliance: para 2.51(a), gains not more than 35 W/m^2, or para 2.51(b), operative temperature more than 28ºC for not more than X hours per year, or para 2.51(c), Building Bulletin 101	Schedule for each zone	Developer		
Criterion 4	**Quality of design, construction and commissioning**				
15	Have the key features of the design been included (or bettered) in practice?	List of key features produced as standard output from SBEM	District council assessment	N/A	
	Building fabric				
16	Is the level of thermal bridging acceptable?	Schedule of details used and their reference codes; or Evidence that the details used deliver equivalent performance	Developer's submission		
17	Has satisfactory evidence of site inspection checks been provided?	Completed and signed checklist pro-formas	Developer's submission	N/A	
	Air permeability and air pressure testing				
18	Design air permeability {m^3/(h·m^2) @ 50 Pa}	Standard output from SBEM calculation	SBEM assessment		N/A
19	Has the design air permeability been achieved?	Test report, or Report on the agreed programme of design development and component testing, or Modular building test report	Developer's submission	N/A	
	Commissioning of the fixed building services				
20	Has commissioning been completed satisfactorily?	Commissioning report submitted in accordance with CIBSE Code M	Commissioning engineer	N/A	
21	Has evidence been provided that the ductwork is satisfactorily airtight?	Report confirming that the results of leakage test are in accordance with the specification	Heating Engineer		
Criterion 5	**Provision of information**				
22	Has a suitable building logbook been provided?	Completed CIBSE TM 31 template	Developer's submission	N/A	

Appendix B Simple payback

THIS APPENDIX IS PART OF THE DEEMED-TO-SATISFY PROVISION

B1 Simple payback means the number of years it will take to recover the initial investment through energy savings, and is calculated by dividing the marginal additional cost of implementing an energy efficiency measure (excluding VAT) by the value of the annual energy savings (excluding VAT) achieved by that measure, where –

(a) the marginal additional cost is the additional cost (materials and labour) of incorporating, for example, additional insulation, not the whole cost of the work;

(b) the cost of implementing the measure shall be based on prices current at the date on which the proposal is submitted to the district council and shall be confirmed in a report signed by a suitably qualified person;

(c) the annual energy savings shall be estimated using approved energy calculation software; and

(d) for the purposes of this Technical Booklet the following energy prices shall be used when evaluating the value of the annual energy savings –

Mains gas	1.45	p/kWh
Electricity	5.0	p/kWh
Heating oil	1.9	p/kWh
LPG	3.39	p/kWh

Energy efficiency measures are considered to be cost effective if they achieve a simple payback within 15 years.

For example, if the cost of implementing a measure was £4,300 and the value of the annual energy savings was £384/year, the simple payback would be 4300/384 = 11.2 years and the measure is therefore regarded as cost effective.

[Energy prices are increasing significantly, so designers may wish to use higher values such as those current at the time of the Building Regulation application.]

Appendix C Cost effective target U-values

THIS APPENDIX IS PART OF THE DEEMED-TO-SATISFY PROVISION

C1 Where the work involves the renovation of a thermal element such as the replacement of surface finishes or coverings, an opportunity arises for insulation improvements to be undertaken at marginal additional cost. This appendix gives recommendations on the cost effectiveness of insulation measures when undertaking various types of work on a thermal element.

C2 Table C1 gives the circumstances and provisions that in most cases can be considered reasonable provisions when upgrading thermal elements. However, as renovation work is context dependent, some flexibility in applying the provisions is necessary with the aim being as far as possible to make a reasonable improvement to the thermal performance of the element being renovated.

As part of this flexible approach it will be necessary to take account of technical risks, practicability and the impact of such works on adjoining buildings.

C3 In general terms the proposed works should take account of –

(a) other requirements of the building regulations;

(b) technical risks relating to insulation improvements as described in the BRE Report BR 262: “Thermal insulation: avoiding risks”; and

(c) where the building has historic value recommendations given in the DOE (NI), Environment and Heritage Service’s publication “Historic buildings & energy efficiency. A guide to Part F of the Northern Ireland Building Regulations”.

C4 Where it is not practicable in the context of a specific scheme to achieve the performance standard given in Table C1 the level of performance achieved shall be as close as possible thereto.

Table C1 Cost effective target U-values when undertaking works to thermal elements			
Improvement opportunity	**Target U-value W/(m²·K)**	**Typical construction**	**Main matters to be considered**
Pitched roof constructions			
Renewal of roof covering – No living accommodation in the roof void – existing insulation (if any) horizontal at ceiling level. No existing insulation, existing insulation less than 50 mm, in poor condition and/or likely to be significantly disturbed or removed as part of the planned work.	0.16	Provide 250 mm loft insulation such as mineral or cellulose fibre laid between and over the ceiling joists.	Impact on boarded walkways or boarded roofspaces. Condensation risks. Impact of new insulation on access to and the insulation of services.
Renewal of roof covering – Existing insulation in good condition and will not be significantly disturbed by proposed works. Existing insulation 50 mm to 100 mm in thickness.	0.20	Top up insulation to at least 200 mm with insulation such as mineral or cellulose fibre laid between and over the ceiling joists.	Impact on boarded walkways or boarded roofspaces. Condensation risks. Impact of new insulation on access to and the insulation of services.
Renewal of the ceiling immediately below a cold loft space. Existing insulation removed as part of the works.	0.16	Provide 250 mm loft insulation – such as mineral or cellulose fibre laid between and over the ceiling joists.	The impact on boarded walkways or boarded roofspaces. Condensation risks. Impact of new insulation on access to and the insulation of services.
Renewal of roof covering – Living accommodation in roof space (room-in-the-roof).	0.20	Cold structure – Insulation between and below rafters. Warm structure – Insulation between and above rafters.	Condensation risks. Practical considerations in relation to the thickness of insulation involved.
Dormer construction			
Renewal of cladding to dormer cheeks.	0.35	Insulate between and over studs or externally.	Condensation risks.
Renewal of roof covering.	-	Refer to guidance on flat or pitched roofs as appropriate.	Condensation risks.
Flat roof constructions			
Renewal of roof covering – Existing insulation, if any, less than 100 mm, or in poor condition and likely to be significantly disturbed or removed as part of the planned works.	0.25	Insulation between and/or over joists to achieve the target U-value.	Condensation risks. Impact of BS 6229.
Renewal of the ceiling to flat roof area. Existing insulation removed as part of the works.	0.25	Insulation between and/or below joists to achieve the target U-value.	Condensation risks. Impact of BS 6229. Impact on ceiling height.

Improvement opportunity	Target U-value W/(m^2·K)	Typical construction	Main matters to be considered
Solid wall constructions			
Renewal of internal finish to external wall or dry lining for the first time.	0.35	Dry lining of plasterboard to inner face of the external wall with insulation between battens. Insulated wall board fixed to internal surface.	Impact on reduced floor area. Condensation risks. Dampness risks.
Renewal of external finish or cladding or applying a new finish or cladding for the first time.	0.35	External insulation system with render. Cladding with insulation behind.	Condensation risks. Dampness risks. Impact of increased wall thickness on adjoining buildings.
Cavity wall constructions			
Replace wall ties to at least one elevation.	0.55	Blown cavity fill.	Suitability for cavity fill.
Ground floor constructions			
Renovation of a solid or suspended floor involving the replacement of screed or a timber deck.	0.25	Solid floor – replace screed with an insulated floor deck. Suspended timber floor – insulate between and/or over floor joists.	Impact on floor levels. Inherent U-value. Usually cost effective if existing U-value is greater than 0.7 W/(m^2·K).

Appendix D Model designs

THIS APPENDIX IS NOT PART OF THE DEEMED-TO-SATISFY PROVISION

D1 Some builders may prefer to adopt model design solutions rather than develop their own. These model packages of fabric U-values, boiler seasonal efficiencies, window opening allowances etc will have been shown to achieve overall compliance within certain parameters.

[The construction industry may develop model designs for this purpose and provision has been made to register the designs on the internet at www.modeldesigns.info.]

D2 Where a model design is used, it will still be necessary to demonstrate compliance to the satisfaction of the district council.

Appendix E Publications referred to

THIS APPENDIX IS NOT PART OF THE DEEMED-TO-SATISFY PROVISION

Air Tightness Testing and Measurement Association (ATTMA)

Measuring air permeability of building envelopes, 2006

BRE

BR 262: Thermal insulation: avoiding risks, 2002

BR 364: Solar shading of buildings, 1999

BR 443: Conventions for U-value calculations, 2006

BRE Digest 498: Selecting lighting controls, 2006

Information Paper IP1/06 Assessing the effect of thermal bridging at junctions and around openings in the external elements of buildings, 2006

Simplified Building Energy Model (iSBEM): A User Guide to iSBEM, 2006

British Standards Institution (BSI)

BS 8206 - 2: 1992 Lighting for buildings. Code of practice for daylighting

BS EN ISO 13370:1998 Thermal performance of buildings – Heat transfer via the ground – Calculation methods

Chartered Institution of Building Services Engineers (CIBSE)

AM 10: Natural ventilation in non-domestic buildings, 2005

Comissioning management: CIBSE Commissioning code M, 2003

CIBSE Guide A: Environmental design, 2006

TM 31: Building log book toolkit, 2006

TM 37: Design for improved solar shading control, 2006

TM 39: Building energy metering, 2006

Council for Aluminium in Building / Centre for Window and Cladding Technology (CAB/CWCT)

Thermal assessment of window assemblies, curtain walling and non-traditional building envelopes, 2006

Department for Education and Skills (DfES)

Building bulletin 101: Ventilation of school buildings, 2005

Department of the Environment, Food and Rural Affairs (DEFRA)

SAP 2005: The Government's Standard Assessment Procedure for the energy rating of dwellings, 2005

Department for Communities and Local Government (DCLG) formerly ODPM

Accredited construction details for Part L*
(* Note that "Part L" in the title refers to the part in England & Wales that is equivalent to Part F in Northern Ireland. This document will not be printed but is published on the DCLG website.)

Low or zero carbon energy sources: Strategic guide, 2006

Non-domestic heating, cooling and ventilation compliance guide, 2006

DOE (NI), Environment and Heritage Service

Historic buildings & energy efficiency. A guide to Part F of the Northern Ireland Building Regulations, 2006
(This document will not be printed but is published on their website www.ehsni.gov.uk)

Energy Saving Trust (EST)

CE 66 Windows for new and existing housing, 2006

Heating and Ventilating Contractors Association (HVCA)

DW/143 A practical guide to ductwork leakage testing, 2000

DW/144 Specification for sheet metal ductwork, 1998

Metal Cladding and Roofing Manufacturers Association (MCRMA)

Technical Paper 14: Guidance for the design of metal cladding and roofing to comply with Approved Document L2, 2001
(Note that “Approved Document L2” in the title refers to the part in England & Wales that is equivalent to Part F in Northern Ireland)

Modular and Portable Buildings Association (MPBA)

Energy performance standards for modular and portable buildings, 2006

Thermal Insulation Manufacturers and Suppliers Association (TIMSA)

TIMSA Guidance for achieving compliance with Part L* of the Building Regulations; 2006
(* Note that “Part L” in the title refers to the part in England & Wales that is equivalent to Part F in Northern Ireland)