FUNDAMENTAL SERIES 4
MODULE 02
THE CONTINUING PROFESSIONAL DEVELOPMENT PROGRAMME JUNE 2006

CURRENT THINKING ON...

BUILDING REGULATIONS

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On 6th April 2006, the Office of Deputy Prime Minister (ODPM) released a collection of documents relating to Parts L, F and P of the Building Regulations 2000. A new Part VA of the Regulations was introduced to implement Articles 3 to 6 of the European Energy Performance of Buildings Directive (EPBD: 2002).

The European Energy Performance of Buildings Directive

The EPBD aims to promote the improvement of the energy performance of buildings, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness. The articles related to building regulations are:

- Article 3 - adoption of an energy appraisal methodology;
- Article 4 - setting of energy performance requirements;
- Article 5 – energy performance requirements of new buildings;
- Article 6 – energy performance of renovated existing building with total useful floor area over 1,000m^2

BUILDING REGULATIONS Approved Document F: Means of Ventilation

Changes have been made to Part F in respect of the ventilation of new dwellings, new buildings other than dwellings and existing buildings. The main changes are as follows: -

- it is suggested that new airtight domestic and non-domestic buildings, using normal construction methods, can have an air permeability down to around 3-4m3/(hm^2) @ 50Pa pressure difference;
- the recommended air supply rate for offices has been increased from 8l/s per person to 10 l/sec per person;
- replacement windows should be fitted with trickle ventilators, or an equivalent background ventilation opening should be provided in the same room.

Approved Documents Part L: Conservation of Fuel and Power

Part L has also been amended and changes have been made as follows:

- it includes gains and losses for all types of buildings. Hence, the control of solar gain in the summer to limit overheating applies to dwellings as well as to buildings other than dwellings;
- it refers to heat gains and losses through thermal elements and other parts of the building fabric, e.g. exposed floors and building elements other than walls, floors, and roofs;
- it includes heat gains and losses from pipes, ducts and vessels used for space heating, space cooling and hot water service for all types of buildings;
- it refers to providing and commissioning energy efficient fixed building services with effective controls.
- the owner should be provided with sufficient information about the building and its fixed building services including associated controls, i.e. building logbook.

The carbon dioxide emissions for dwellings and other than dwellings are computed by using the Standard Assessment Procedure (SAP) and the Simplified Building Energy Model (SBEM) of energy, respectively. Correspondingly, the CO2 emission (kg/m2/year) for the actual dwelling emission rate (DER) and for the actual building emission rate (BER), are computed using the SAP and SBEM. The building is compared with a notional building. The notional building emissions are reduced as improvement factors are applied to derive the Target Emission Rate (TER). See figure 1. The actual building emission rate (BER) should be less that or equal to the TER. The procedure to be followed during design is described in Figure 2. A notional building is constructed for the proposed building, or dwelling: • using the same size, shape and orientation as proposed building;

- complying with the Energy Performance Values for fabric and services;
- using gas for heating fuel (oil if gas not available), mains electricity for fans and pumps;
- excluding services not covered

WELCOME...

Energy in Buildings and Industry and the Energy Institute are delighted to have teamed up to bring you this Continuing Professional Development initiative.

This is the second module in the fourth series and focuses on the Building Regulations. It is accompanied by a set of multiple-choice questions. To qualify for a CPD certificate readers must submit at least eight of the ten sets of questions from this series of modules to EiBI for the Energy Institute to mark. Anyone achieving at least eight out of ten correct answers on eight separate articles qualifies for an Energy Institute CPD certificate. This can be obtained, on successful completion of the course, for a fee of £15 (for members) or £25 (for non-members).

The articles, written by a qualified member of the Energy Institute, will appeal to those new to energy management and those with more experience of the subject. The following topics will appear in the next eight issues of EiBI: space heating; variable speed drives; metering/monitoring; photovoltaics; underfloor heating; air conditioning; and heat pumps.

If you miss any of the modules in the series let me know (mark.thrower@btinternet.com) and we will send the missing modules to you by e-mail in 'pdf' format.

The previous 30 modules from the first three series are also available free of charge. Please contact me by e-mail if you would like to receive these.

MARK THROWER, MANAGING EDITOR

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by Part L (e.g. emergency lighting, lifts etc.)
- having occupancy and design conditions as defined in the 'Reference Schedules' data;
- having the same activity areas and class of building services as proposed building

Part L1A: Conservation of Fuel and Power in New Dwellings

The following are the requirements for new dwellings: -

- using the SAP methodology, the Dwelling CO_2 emission rate (DER), designed and built, must be no worse than the Target CO_2 Emission Rate (TER);
- all U-values must be better than the design limits in Table 1;
- the heating and hot water system, the efficiency of the heating systems, the insulation of the hot water cylinder and the controls must meet the minimum value set out in the Domestic Heating Compliance Guide. [i]
- where the work involves the provision of a mechanical ventilation system or part thereof, reasonable provision would be to install a system with: Specific Fan Power (SFP) for continuous supply only and continuous extract only less than 0.8W*litres/sec; SFP for balanced systems less than 2.0 W*litres/sec; and with heat recovery efficiency of not less than 66 per cent.
- for internal lighting, lamps shall have luminous efficacy greater than 40 lumens per circuit-Watt;[ii]
- the dwelling has appropriate passive control measures to limit solar gains;
- accredited details should been adopted, otherwise evidence that details conform to standards set out in IP 1/06; [iii]
- satisfactory documentary evidence of site inspection checks has been produced;
- evidence shall be provided that demonstrates that the design air permeability has been achieved satisfactorily, i.e. less than 10 m3/h/m² at 50 Pa. For more info see table 2;
- evidence that the heating and hot water systems have been commissioned satisfactorily;
- SAP Certificate and O&M instructions available for the occupier.

In Part LA1, therefore, there is no longer a checklist available of what is or isn't allowed, i.e. an elemental method is not available. However, it is possible to derive indicative performance values, which when used will mean that the dwelling will probably comply. Figure 3 identifies building-design characteristics of a dwelling, which will generally comply with the new regulations.

Figure 1(a) – The Target CO_2 Emission Rate Calculation for new Dwellings

Main Changes in the ADBR Part:L1A

target CO_2 emission rate

TER = (C_H x fuel factor +C_L) x(1-improvement factor)

CO_2 emissions for ventilation, and space & water heating for 2002-compliant notional dwelling

CO_2 emissions for lighting

Heating fuel	Fuel factor
Mains gas	1.00
LPG	1.13
Oil	1.18
Grid electricity (for direct acting, storage and electric heat pump systems)	1.47
Solid mineral fuel	1.26
Renewable energy including bio-fuels such as wood pellets	1.00
Solid multi-fuel	1.00

Figure 1(b) – The Target CO_2 Emission Rate Calculation for new buildings other than Dwellings

Main Changes in the ADBR Part: L2A

TER = $C_{notional}$ x (1- improvement factor) x (1 - LZC benchmark)

Improvement factors and LZC benchmarks for use in the TER equation

Building services strategy for the actual building	(a) Improvement factor	(b) LZC benchmark
Heated and naturally ventilated	0.15	0.10
Heated and mechanically ventilated	0.20	0.10
Air conditioned	0.20	0.10

CO_2 emission factors for BER determination

Fuel	CO_2 emission factor kgCO_2/kWh
Natural gas	0.194
LPG	0.234
Biogas	0.025
Oil	0.265
Coal	0.291
Anthracite	0.317
Smokeless fuel (inc. coke)	0.392
Dual fuel appliances (mineral + wood)	0.187
Biomass	0.025
Grid supplied electricity	0.422
Grid displaced electricity	0.568
Waste heat	0.018

The BER can be reduced by an amount equal to the product of the Adjustment factor

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	0.010
Power factor correction to achieve a whole building power factor of at least 0.95	0.025

Figure 2 - Logic procedure that should be followed to comply with Part L.

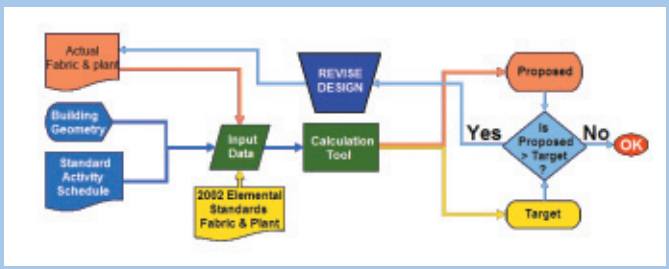

Figure 3 - New dwelling and indicative performance values

Part L1B: Conservation of Fuel and Power in existing Dwellings

Guidance is given on the following activities:

- extensions (where glazing should be less than 25 per cent of the TFA of the extension);
- when creating a new dwelling or part of a dwelling through a material change of use;
- materials alterations to existing dwellings;
- the provision of a controlled fitting;
- the provisions or extension of a controlled services the provision of renovation of a controlled element.

For heating, ventilation and lighting similar requirements to Part L1A exist; however, an air permeability test is not required. Reasonable provision for those thermal elements constructed, as repayments for existing elements would be to meet the standards set out in table 3. Measures that achieve a simple payback not exceeding 15 years should be considered. For more information refer to table A1 of Appendix A of the Approved Document. For extensions, where even greater design flexibility is required a reasonable method would be to use SAP2005 to show that the calculated CO2 emission rate from the dwelling with its proposed extension is no greater that for the dwelling plus a notional extension built to the latest standards.

Part L2A: Conservation of Fuel and Power in new buildings other than dwellings

The following are the requirements of new dwellings:

- using the SBEM (BRE software iSBEM or other accredited commercial software that use the National Calculation Method (NCM), the emissions from building (BER) must be less than or equal to the target (TER);
- the "as built" details must be the same as used in BER calculations.
- schedule of U-values produced as standard output from approved software, must have U-values better than the limits on design flexibility. See table 1.
- a reasonable limit for the design air permeability is 10m3/(hm2) @ 50 Pa. Guidance on some ways of achieving this is given in the TSO publication on robust construction details. Better standards of air permeability are technically desirable in building with mechanical ventilation and air conditioning; [iv]
- for internal lighting, lamps shall have luminous efficacy greater than 45 lumens per circuit-Watt as averaged over the whole area of these types of space in the building.
- boiler efficiency greater than 86 per cent;
- systems should be provided with appropriate controls to enable the achievement if reasonable standards of energy efficiency in use. The systems should be sub-divided into separate control zones to correspond to each area of the building that has a significantly different solar exposure, or pattern, or type of use;
- each separate control zone should be capable of independent timing, and temperature control, and where appropriate ventilation and air recirculation rate;
- the provision of the service should respond to the requirements of the space it serves. If both heating and cooling are provided, they should be controlled so as not to operate simultaneously;
- with respect to summer overheating, the combined solar and internal gains (people, lighting and equipment) per unit floor area averaged should not be greater than 35W/m2, or the number of occupied hours with dry resultant temperatures over 28°C should not exceed 1 per cent of the annual occupied period;
- central plant should only operate as and when the zone systems require it. The default condition should be off;
- reasonable provision for the performance of air handling plant would be to follow the guidance in the 'Non-domestic heating, cooling and ventilation compliance guide' [v] in providing: suitable efficient air handling plant; effective control systems. In addition the systems should be capable of achieving a SFP at 25 per cent of design flow rate no greater than that achieved at 100%. Reasonable provision for ventilation system fans rated at more than 1,100 watts would be to equip them with variable speed drives;
- energy meters should be installed in accordance with GIL 65; [vi]
- a commissioning report should be submitted in accordance with CIBSE Code M;
- a report should be available confirming that the results of the ductwork leakage tests are in line with the leakage specification;
- a suitable building log-book should been prepared according to CIBSE TM31 template (or equivalent).

Table 1 - Limiting U-value standards (W/m2*K)

Element	Area Weighted Average U-value*	Limiting U-value
Wall	0.35	0.70
Floor	0.25	0.70
Roof	0.25	0.35
Windows, roof windows, rooflights and doors	2.2	3.3
For building other than dwelling only		
Pedestrian doors	2.2	3.0
Vehicle Access and similar large doors	1.5	4.0
High usage entrance doors	6.0	6.0
Roof ventilators (inc. smoke vents)	6.0	6.0
* The area-weighted U-value is given by the following expression: [(U1*A1) + (U2*A2) + (U3*A3) +...] / [A1 + A2 + A3 + ...]		

Table 2 – Air Permeability tests for dwellings

Dwellings that have adopted approved construction details:	
On each development, an air pressure test should be carried out on a unit of each dwelling type selected by the BCB.	
Dwellings that have NOT adopted accredited construction details	
Number of Instances of the dwelling type	Number of tests to be carried out on the dwelling type
4 or less	One test of each dwelling type.
Greater than 4, but equal or less than 40	Two tests of each dwelling type.
more than 40	At least 5% of the dwelling type, unless the first 5 units of the type that are tested achieve the design permeability, when the sampling frequency can be subsequently reduced to 2%.
As an alternative approach, when no more than two dwelling are to be erected, reasonable provision would be to use a value of 15m3/(h*m2) @ 50 Pa when calculating DER in SAP.	

Table 3 - U-Value recommendation for existing buildings

Standards for thermal elements W/m2K			Upgrading retained thermal elements		
Element W/m2K	New thermal elements in an extension	Replacement thermal elements in an existing building	Element	Threshold value	Improved value W/m2K
Wall	0.30	0.35	Other Wall type	0.70	0.55
Windows	1.8	2.0		0.70	0.35
Floor	0.16	0.16		0.70	0.25
Pitched roof insulation (ceiling)	0.20	0.20		0.35	0.16
Pitched roof insulation (rafters)	0.20	0.25		0.35	0.20
Pitched roof insulation (integral)	0.22	0.25		0.35	0.25

Part L2B: Conservation of Fuel and Power in existing buildings

This AD applies to existing buildings with a total useful floor area (TUFA) over 1,000m2, where the proposed building work consists of or includes an extension, or the initial provision of any fixed building services, or an increase to the installed capacity of any fixed building services. Where the proposed extension has a total useful floor area that is both greater than 100m2 and 25 per cent of the TUFA of the existing building, then the work should be regarded as a new building and the guidance in Part L1A followed. For heating, ventilation and lighting similar requirements to Part L2A exist; however, air permeability testing is not required.
Reasonable provision for those thermal elements constructed, as repayments for existing elements would be to meet the standards set out in table 3. Measures, such as improvements of building elements, heating, ventilation, heating and cooling, that achieve a simple payback not exceeding 15 years should be considered for both buildings with less or more than 1,000m² TUFA. For more information refer to table A1 and paragraphs 16 and 17 of Section 1, p.18 of the Approved Document.
For extensions, where even greater design flexibility is required reasonable provision would be to use SBEM to show that the calculated CO_2 emission rate from the building with its proposed extension is no greater that for the building plus a notional extension built to the latest standards. Finally, a new or updated logbook should be provided which will list any new thermal elements and buildings services, including meters, and any other details that collectively enable the energy consumption of the building and building services comprising the works to be monitored and controlled.

Approved Document P: Electrical Safety - Dwellings

BUILDING REGULATIONS

SERIES 4 / MODULE 2

QUESTIONS

Please mark your answers on the sheet below by placing a cross in the box next to the correct answer. Only mark one box for each question. You may find it helpful to mark the answers in pencil first before filling in the final answers in ink. Once you have completed the answer sheet in ink, return it to the address below. Photocopies are acceptable.

1. What is the minimum supply flow rate for offices in litres/sec per person?
- ☐ 8
- ☐ 10
- ☐ 12
- ☐ 15

2. Which of the following in not included in the new Part L?
- ☐ Energy consumption of fans
- ☐ Energy consumption of external lighting
- ☐ Energy consumption for emergency lighting, CCTV and lifts
- ☐ Summer overheating of dwellings and other than dwellings

3. Which of the following emission improvement factors is not correct?
- ☐ For heated and naturally ventilated buildings the factor is 0.235
- ☐ For heated and mechanically ventilated buildings the factor is 0.28
- ☐ For air conditioned building the factor is 0.28
- ☐ For dwellings the factor is 0.25

4. Which of the following statements is not correct?
- ☐ The BER for dwelling is calculated using the SAP
- ☐ The DER for dwelling is calculated using the SAP
- ☐ The BER for buildings other than dwelling is calculated using the SBEM
- ☐ The BER for buildings other than dwelling is calculated using the iSBEM

5. Which of the following is not included for energy appraisal of the notional building?
- ☐ Standard occupancy pattern according to 'Reference Schedules'
- ☐ Building services and fabric that are designed according to the 'Energy Performance Values'
- ☐ Renewable energy sources for 10% of its energy consumption
- ☐ Activity areas and class of building services same as the proposed building

6. For dwelling, the Specific Fan Power balanced systems should be less
- ☐ 0.66 W*litres/sec
- ☐ 0.8 W*litres/sec
- ☐ 1.0 W*litres/sec
- ☐ 2.0 W*litres/sec

7. The building regulations require the building as built to have air permeability @ 50Pa pressure difference less than:
- ☐ 3 m3/(h/m^2)
- ☐ 4 m3/(h/m^2)
- ☐ 10 m3/(h/m^2
- ☐ 14 m3/(h/m^2)

8. For internal lighting of commercial buildings, lamps shall have luminous efficacy, in luminaire lumens per circuit-Watt, greater than:
- ☐ 35
- ☐ 40
- ☐ 45
- ☐ 55

9. The number of occupied hours with dry resultant temperatures over 28oC should not exceed the annual occupied period more than
- ☐ 1 per cent
- ☐ 2 per cent
- ☐ 3 per cent
- ☐ 5 per cent

10. When Power Factor Correction (PFC) technology is used to achieve a whole building power factor of at least 0.95, the adjustment (BER improvement) factor is equal to:
- ☐ 0.010
- ☐ 0.025
- ☐ 0.035
- ☐ 0.050

Name ..... (Mr. Mrs, Ms) .....

Business Address .....

Town .....

.....

Post Code .....

email address .....

Tel No. .....

Completed answers should be mailed to:
The Education Department, Energy in Buildings & Industry,
P. O. Box 825, GUILDFORD, GU4 8WQ

FUNDAMENTAL SERIES 4 MODULE 02

Approved Document P has been amended to make it clearer when appropriate inspection and testing should be carried out as part of demonstrating compliance, and by whom, as references to inspection and testing are no longer part of requirements. The AD applies to installations attached to a dwelling, as well as in it. Finally, the list of electrical installation work that need not be notified to a building control body in Schedule 2B has been amended.

The Building and Approved Inspectors Regulations 2006

The new regulations allow approved inspectors to take steps (including the making of tests and taking samples) to ensure that the following new requirements have been met - thermal elements, removal of exemptions, CO_2 targets, consequential improvements to energy performance. For more information refer to the CIBSE Low Carbon Consultants Register.

The major changes in the Building Regulations are with respect to Part L. Architects and engineers have the challenge to develop buildings that meet their client's needs, with the level of carbon emissions less than the TER for the proposed buildings. Even if the elements of building are independently assessed and improved - i.e. thermal bridges around windows and concrete slabs, and air permeability of building fabric -, the building should be considered as a whole. In order to reach optimisation of the new building, the design approach should be holistic and continuously improving within the budget and time constrains of the project, rather than a linear approach of one discipline following another.

Useful Documentation

The following documents referred to in the Part L: 2006 Approved Documents are published by NBS:

- 'Low or Zero Carbon Energy Sources: Strategic Guide'
- 'Domestic Heating Compliance Guide''
- 'Non Domestic Heating, Cooling and Ventilation Compliance Guide'
- 'The National Calculation Methodology for determining the energy performance of buildings Part 1: A guide to the application of the SBEM and other approved calculation tools for Building Regulations purposes'

Useful contacts

- The SBEM Helpline on 0870 460 8141
- ODPM Helpline 0845 365 4357 for all enquiries regarding: Part F: Ventilation; Part L: Energy Efficiency; and Part P: Electrical safety.
- http://www.ncm.bre.co.uk
- http://projects.bre.co.uk/sap2005
- http://www.cibse.org
- (Visit: CIBSE Guidance Note; CIBSE Part L Web-cast; Low Carbon Consultants Register)
- http://www.energyinst.org.uk
- (Visit: Special Interest Groups: Energy Efficiency in Buildings)
- http://www.odpm.gov.uk/index.asp?id=1164177

References

- i NBS (2006), Domestics Heating Compliance Guide
- ii Circuit-Watt means the power consumed in lighting circuits by lamps and their associated control gear and power factor correction equipment.
- iii BRE (2006), Information Paper IP01/06: Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings
- iv TSO(2001), Limiting Thermal Bridging and Air Leakage: Robust construction details for dwellings and similar buildings, Amendment 1 (www.est.org.uk)
- v NBS (2006), Non-domestic heating, cooling and ventilation compliance guide
- vi The Government's Energy Efficiency Best Practice programme (2002), GIL 65: Metering energy use in new non-domestic buildings - A guide to help designers meet Part L2 of the Building Regulations

If you miss any of the modules in the series let me know (mark.thrower@btinternet.com) and we will send the missing modules to you by e-mail in 'pdf' format. The previous 30 modules from the first three series are also available free of charge. Please contact me by e-mail if you would like to receive these.