

Building Regulations Part L—Calculating Thermal Efficiency

The new requirements for thermal insulation of buildings in England and Wales are detailed in Part L of The Building (Amendment) Regulations 2001. Part L was published in the winter 2001 in two parts, Part L1 (dwellings) and Part L2 (non-domestic). The new regulations came into effect on 1 April 2002, with all plans submitted to Building Control for approval needing to comply with the new requirements.

New methods of calculation are being introduced to calculate thermal efficiency for walls, roofs and floors to bring British Standards (BS) in line with European Standards (EN). The measure for thermal efficiency used is the U-value of a building element (ie wall, floor, roof, whole building etc). U-values are measured in W/m²K.

Changes include:

- accounting for cold bridging effect of wall ties and roof fixings;
- accounting for losses due to ventilation on the warm side of insulation; and
- control of air leakage through the building fabric, by following robust solutions measured, by calculation or by test.

Methods of Compliance—England and Wales—L1 Dwellings

There are three different methods of complying with the regulations stipulated in Part L1:

- *The Elemental Method* relates to maximum permissible U-values of individual elements used in house construction, and is regarded as the easiest approach as it minimizes the required calculations. Calculating compliance by this method is based on the SEDBUK (Seasonal Efficiency of Domestic Boilers in the UK) rating of the boiler installed in the property.
- *Target U-value Method* takes account of heating system efficiency, plus solar gain and allows some trade-off between elements.
- *The Carbon Index Method* is a complex prediction of a home's total CO₂ emissions, which must not be less than 8.0 on the index to comply.

L1 (1) Elemental U-value method

For compliance by the elemental method, each part of the structure of the dwelling (ie roofs, walls and floors) needs to meet the U-value stipulated in Table 1.

TABLE 1 U-value requirements for the elemental method of compliance to Part L1

Element	New Building Regulations Part L1 England & Wales (effective 1 April 2002)	
	Current Building Regulations	
Walls	0.45	0.35
Floors	0.45	0.25
Pitched roof— insulation between joists	0.25	0.16
Pitched roof— insulation between rafters	0.35	0.20
Pitched roof— with integral insulation	0.35	0.25
Flat roof	0.35	0.25
Windows	3.30	2.2 (metal frames) 2.0 (wood/pvc frames)

Source: E C Harris.

The use of the elemental method of compliance in England and Wales is reliant upon the minimum SEDBUK boiler efficiencies being met. If these are not met an alternative method of compliance needs to be used. Gas or oil central heating must meet the following efficiencies:

SEDBUK RATING	
Mains Natural Gas	78 per cent
LPG	80 per cent
Oil	85 per cent

L1 (2) Target U-value Method

The Target U-value method of compliance involves the calculation of the average U-value of the dwelling and the average must not exceed the calculated target value for the dwelling. The efficiency of the heating system and solar gain (ie which direction the house is facing) are taken into account when calculating the U-value, and trade-off is permitted between elements.

This method offers design flexibility, but U-values cannot be worse than listed in Table 2.

TABLE 2 Poorest U-values acceptable when trading off between construction elements

Element	U-value (W/m ² K)
Roofs	0.35
Exposed walls	0.70
Exposed/ground floors	0.70

Source: E C Harris.

L1 (3) Carbon Index method

The Carbon Index method of compliance has replaced the SAP 1998 energy rating system of compliance. The Carbon Index (CI) is based on the CO₂ emissions figure, but adjusted for floor area so that it is independent of dwelling size for a given building.

The CI needs to be greater than 8.0 to comply.

TABLE 3 List C1

<i>Carbon Factor (CF) kg/m²</i>	<i>Carbon Index (CI)</i>
7.17 or less	10.0
8.0	9.6
9.0	9.1
10.0	8.7
11.0	8.3
12.0	8.0

Source: E C Harris.

This method offers design flexibility but, as in the L1 (2) Target U-value Method, U-values cannot be worse than list in Table 4.

TABLE 4 Poorest U-values acceptable when trading off between construction elements

<i>Element</i>	<i>U-value (W/m²K)</i>
Roofs	0.35
Exposed walls	0.70
Exposed/ground floors	0.70

Source: E C Harris.

Methods of Compliance—Non Domestic—L2

As in domestic situations there are three methods of compliance for non-domestic buildings.

L2 (1) Elemental U-value Method

The new requirements for non-domestic designs using the elemental method are detailed below in Table 5.

TABLE 5 New elemental U-values required

<i>Element</i>	<i>Current Building Regulations</i>	<i>New Building Regulations Part L2 England & Wales (effective 1 April 2002)</i>
Walls	0.45	0.35
Floors	0.45	0.25
Pitched roof— insulation between joists	0.25	0.16
Pitched roof— insulation between rafters	0.30	0.20
Pitched roof— with integral insulation	0.35	0.25
Flat roof	0.35	0.25
Windows/doors/roof windows*	3.30	2.2 (metal frames) 2.0 (wood/pvc frames)
Roof lights		2.2
Vehicle access door		0.7

Source: E C Harris.

*The U-values shown in Table 5 are the average for all the elements (ie windows, doors, roof windows). The sum of these elements must not exceed the areas indicated in Table 6.

TABLE 6 **Maximum areas**

<i>Building type</i>	<i>Windows and personnel doors (% of exposed wall area)</i>	<i>Vehicle access doors, display windows and similar glazing</i>	<i>Roof lights (% of roof area)</i>
Residential buildings	30	As required	20
Offices and shops	40	As required	20
Industrial and storage buildings	15	As required	20

Source: E C Harris.

Part L permits some flexibility in construction using the elemental method for non-domestic buildings.

Calculations can be used to trade-off the heating system efficiency with building fabric U-values in either direction. If a trade-off is used the U-values for the various elements must not exceed those listed in Table 7.

TABLE 7 **Poorest U-values acceptable when trading off between construction elements**

<i>Element</i>	<i>U-value</i>
Roofs	0.35
Exposed walls	0.70
Exposed/ground floors	0.70

Source: E C Harris.

L2 (2) Whole Building Method

This method of compliance considers the whole of the building using the CI method—applicable for office buildings only and is based on the Carbon Performance Rating—to comply the carbon emissions/consumption have to be within a set range.

Using this method of construction U-values cannot be worse than those shown in Table 8.

TABLE 8 **Poorest U-values acceptable when trading off between construction elements**

<i>Element</i>	<i>U-value</i>
Roofs	0.35
Exposed walls	0.70
Exposed/ground floors	0.70

Source: E C Harris.

Schools and hospitals have their own individual standards and codes.

L2 (3) Carbon Emissions Calculation Method

The carbon emission calculation method can be used for any building and the calculation method considers the whole building performance. To comply the carbon emissions should be no greater than a building of the same size designed using the elemental method.