Insulated panels for external roof and wall cladding

Conservation of Fuel and Power Building Regulations (2006)

England and Wales: AD-L2
Northern Ireland: Part F
Scotland: Section 6

Guidance on compliance using Insulated Panel Systems

Revised October 2007

Introduction – 2006 Energy Regulations

New regulations – non-domestic buildings

The principal aim of these new Building Regulations is to reduce the CO2 emissions to meet the UK and EU targets and to help comply with the European Energy Performance of Buildings Directive (EPBD).

The 2006 Regulations require a completely different approach to assessing the energy performance of buildings. Energy performance is expressed in terms of the mass of CO_2 emitted per year in units of $kg.m^2$ of floor area.

The traditional method of compliance based on limiting U-values for the various building elements, including an allowance for thermal bridging is withdrawn under the new regional Building Regulations.

Under the new Regulations the building is assessed using a new 'whole building methodology' that calculates the total energy performance. As it is the building services that emit CO_2 and not the building elements, the total energy building performance takes account of the CO_2 emission resulting from the provision of heating, hot water, ventilation, cooling and lighting. It is therefore based on the building's use in occupation.

The EPIC guide

This Guide has been prepared by EPIC to assist Architects and Specifiers who are using Insulated Panels in the design of Industrial, Commercial, Leisure, Transport, Education, Health and other buildings.

Sections 1-4 of the Guide cover the new requirements as they are applied to new buildings.
Sections 5 & 6 summarise the requirements applied to the refurbishment and extension of buildings.
Sections 7 & 8 summarise the requirements applied to the shell and fit out of buildings.

The EPIC Guide gives information on:

- The data that is required to be inputted for Insulated Panels including the junctions and details as well as the airtightness of the building fabric
- The SBEM Calculation Tool and the influence of the various elements that affect energy consumption
- Which systems are penalised by the methodology and discouraged from use
- Keys to achieving compliance

Availabity of New Regulations

	Title	Implementation date	Download
England and Wales	Approved Document Part L2A (New Build) and L2B (Refurbishment) – Conservation of fuel and power (2006)	6 April 2006	www.planningportal.gov.uk
Northern Ireland	DFP Technical Booklet F2 (2006) – Conservation of Fuel and Power other than dwellings	30 November 2006	www.dfpni.gov.uk
Scotland	Building (Scotland) Regulations – Technical Handbook: Section 6 Energy	1 May 2007	www.sbsa.gov.uk

Download information from the EPIC website

This Guide to Amendments to the Building Regulations 2006 together with the other EPIC Guides can be readily downloaded from the EPIC website at www.epic.uk.com

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New rules for compliance

The major change over the 2002 energy conservation regulations and standards is that under the EPBD the energy performance of the 'whole building' has to be assessed.

It is no longer satisfactory to rely on the cladding contractor to provide a compliant envelope in terms of thermal performance and air tightness. It is now the design team's responsibility to combine the fabric performance with the performance and efficiency of heating/cooling, lighting, services and controls and to illustrate compliance by calculation. Manufacturers or construction specialists can provide performance values for the calculation model, but proof of compliance is the designer's responsibility.

The new method to demonstrate compliance requires the use of the National Calculation Methodology (NCM) for determining the energy use of the whole building, including the building fabric, lighting, heating, ventilation and cooling. The NCM uses a new calculation tool to illustrate compliance called (SBEM) – Simplified Building Energy Model [(1)].

In order to comply, the design team has to show that the calculated building emissions do not exceed the target carbon dioxide emission rate (TER) determined for the building by SBEM or an approved alternative, each building being unique. The TER is defined as the minimum acceptable energy performance for new buildings. It is the mass of CO_2 emitted per year per square metre of the total useful floor area of the building (kg/m^2/year)". This target is for the provision of heating, hot water, ventilation, cooling and fixed lighting for a selection of standardised activities set out in the SBEM model.

The TER is calculated by taking account of the combined performance values of the building fabric, services and controls and is set as a saving against a notional building of the same configuration designed to the previous 2002 levels. In the case of naturally ventilated buildings the target improvement is 23.5% and for air conditioned or mechanically ventilated buildings the target is 28%.

The final stage of the calculation procedure is to show that the predicted rate of CO_2 emissions from the building 'as-built' (BER) using the same calculation tool is not greater than the target rate (TER).

Only the building designer, or a person versed in the calculation methodology (see Section 1), who has a full knowledge of the whole building design including services and their performance criteria can properly assess Compliance under the new regulations.

Section 3 of this EPIC Guide gives a basic understanding of the workings of the SBEM methodology and describes the key issues relating to the building fabric.

Section 4 lists the key factors to compliance using the various calculation tools and highlights the critical areas of data entry.

Simplified Building Energy Model (SBEM)

The SBEM procedure is the stated method for assessing compliance in AD-L2 (2006) England and Wales, Part F2:2006 (Northern Ireland) and Section 6: 2007 (Scotland). SBEM is one of several approved software options for assessing compliance.

[(1)] The latest SBEM program and user guide can be downloaded from the following link:
www.ncm.bre.co.uk/index.jsp

Implications for the building envelope

The significance for designers of the building envelope is that although the elemental values of roofs and walls and the overall air tightness still play an important part in terms of determining the HVAC requirements, they now have to be considered alongside the energy requirements for the whole building.

Compliance, which is now based on the whole building energy performance, is firmly the responsibility of the design team for the building. Insulated Panel manufacturers and cladding companies can provide values and data to be imported into the calculation methodology but can no longer provide a fabric specification that will ensure the building complies.

Contributions towards compliance

The mechanism of compliance requires the design team to look at the energy performance and efficiency of all elements and services. The contribution from each of these areas varies considerably and therefore it is essential that designers understand the workings of the calculation method and which areas represent the most cost effective route to compliance (see section 3). The most that building envelope improvements can contribute is only one third to one half of the target saving.

For buildings designed using Insulated Panels, or any insulated cladding system, the factors giving the most cost effective and practical contribution in construction terms are as follows:

- Improving the air tightness
- Improving the thermal transmittance performance at junctions and details.
- Optimising the energy used by all services including heating, cooling and lighting
- Using automated controls for lighting and services.

The areas producing a relatively low contribution to achieving the overall target savings are:

- Improving the thermal performance values of the building fabric above the minimum allowable values
- Increasing the area of roof daylighting
- Reducing the area of windows.

Interdependence of data

Significantly changing the performance in one area or of one element may create a change in other areas that may not necessarily be beneficial – e.g. increasing the roof daylighting percentage may reduce lighting energy requirement but will adversely affect the building fabric thermal weighted average and increase the effects of solar gain.

Refurbishment

The major change is the introduction of new requirements when providing or carrying out work on thermal elements and the commissioning of heating, ventilation and lighting systems. Further requirements are introduced for buildings with a floor area greater than 1000m2 when these buildings are subject to major works. Compliance is now managed by Building Control through planning applications and building notices

Guidance is still based on an elemental approach but with improved performance standards for thermal elements, windows and services. There is new guidance on the requirement to make cost effective consequential improvements when work is carried out on larger buildings. See sections 5 and 6 for an overview of the requirements.

2 New build
Insulated Panels – cost effective compliance

Sustainable performance of cladding systems

Designing buildings in accordance with AD-L or the other National Regulations is the first stage in a long-term implementation of the European EPBD (Energy performance of Building Directive). The EPBD includes a requirement for the building energy labelling of buildings including the determination of Operational Ratings for all buildings.

The EPBD directive will lead to a new focus on the long-term energy performance of building envelope systems. Disclosure of the Operational Rating is likely to become a legal requirement and any drop in performance during the life of the cladding systems could materially affect the potential sale value and letability.

Insulated Panels offer sustainable performance during the life of the building

Designing for compliance and the future

Designing buildings in accordance with the new AD-L or the other National Regulations is the first stage in a long-term implementation of the European EPBD (Energy performance of Building Directive). Compliance in accordance with the 2006 Regulations will meet the initial requirements but the EPBD includes a requirement for the establishment of Operational Ratings for buildings.

An element of compromise is likely to be necessary when selecting the design parameters for the building that are to be entered into SBEM. This is certainly so in the case of the thermal performance values for roofs and walls where an improvement in U-value, although positive, has a rapidly decreasing effect on the benefits and contribution to the compliance calculation. The increased cost of thicker systems combined with practical construction difficulties may outweigh the energy saving benefits and therefore increasing thermal performance may not be the most cost effective way to compliance. This aspect is presented in Sections 3 & 4 under the various area headings.

Building certification and labelling

The future implementation of building certification and possible labelling of buildings introduces a new focus on building envelope systems. If they are to retain their Operational Rating there must be no drop-off in thermal performance during the life of the cladding systems and they should compare favourably with future requirements.

Draft of operational rating certificate.

Benefits and contribution to compliance of Insulated Panels

From their introduction Insulated Panels with PIR insulating cores have offered the designer a guarantee of long-term performance.

Both thermal performance and the airtightness of Insulated Panel systems can be readily controlled enabling the services engineer to design plant sizes efficiently to maximise capacity and energy efficiency. Under the original 2002 regulations this was of direct benefit to the building user. Following the 2006 regulations this benefit also translates directly into carbon savings and a positive saving to the target savings under the SBEM compliance calculations.

Reduced air permeability

The complete Insulated Panel system including approved details and accessories enables an airtight and energy efficient envelope to be installed by the established cladding installers.

Low air permeability is an important contributor to cost effective compliance and low air permeability rates can be readily achieved using insulated panel systems (see 3.6).

Thermally efficient junction details

The joints between panels are fully engineered to minimise heat transmittance and ensure that air leakage is minimised after onsite installation

The contribution from efficient details under the SBEM calculation method is significant and the use of the panel manufacturers approved details is essential to achieving the TER (see 3.4).

Efficient building services

Controlled air permeability levels and known thermal eficiencies for insulated panel systems allow efficient HVAC systems to be specified. Energy efficient, low carbon emisssion services together with the selection of automatic controls are a major contributor to successful compliance using SBEM.

Insulation efficiency

Insulated Panels produced as single piece system under factory-controlled conditions ensure that insulation thickness and performance is calculated, controlled and maintained.

The insulation performance remains virtually unchanged throughout the life of the panel due to the encapsulation of the metal facings.

PIR is one of the most efficient insulation materials available and although the insulation efficiency makes a relatively low contribution under SBEM in terms of the effect on CO_2 emissions, the beneficial effects on operational energy costs of the building are significant.

3 New build
Key issues – the SBEM calculation method

3.1 Understanding SBEM – CO_2 contributors

Compliance is demonstrated by proving that the target carbon dioxide emission rate (TER) for the whole building is achieved, as determined by the SBEM or other similar calculation method.

It is electrical, oil or gas energy used by the building services that produces CO_2. The generation of CO_2 in Kg per kW.h for each energy source is shown in Table 1.

Table 1. CO_2 emission factor by energy source

Energy source	CO_2 (kg/kW.h)
Electricity	0.422/0.568
Gas	0.194
Oil	0.265

Table 1 illustrates clearly that electrical energy used for lighting and the running of services has a considerably greater effect than gas or oil used for heating. Selecting energy efficient plant and equipment that are high users of electrical energy or restricting the use of electrical energy (e.g. lighting controls) produces the largest contribution in SBEM and the other calculation methods. EPIC's recommendations later in this section and in section 4 take this into account.

3.2 Building envelope U-values

Under the 2002 Building Regulations for England, Wales and Scotland, achieving minimum thermal performance (U-values) of the building fabric – roof, walls and floors – formed one of the principal requirements for compliance.

The new 2006 Regulations for new building designs no longer specify U-value levels but have retained the 2002 minimum values as the minimum acceptable values within the SBEM calculation methodology. SBEM will use these default values unless the designer enters improved values. Use of cladding materials or systems below this standard will be penalised in the calculation tool unless the area-weighted value for the element is met.

For Northern Ireland, U-values are introduced for the first time in the new requirements.

Methods for the calculation of U-values for cladding systems are listed in the relevant Building Regulations. If requested by Building Control, Insulated Panel manufacturers will provide proof that the values have been calculated in accordance with approved methods.

Table 2 shows the typical thickness for PIR cored panels required to achieve the minimum acceptable (default) levels.

EPIC recommends

EPIC do not advise lowering U-values for roof and wall elements below 0.2 W/m²K, recommending the use of alternative ways to achieving lower energy ratings (Section 4)

Table 2 Thermal performance of Insulated Panels

Type of panel	Thickness	U-value (W/m²K)	Limiting area weighted average value
General roof panel	80-90 mm	0.25	0.25
Flat wall panel	60-70 mm	0.35	0.35
Wall panel (Scotland)	80-90 mm	0.30	0.30

Cost effective solution

The thickness and values in Table 2 represent EPIC's recommendation for the most cost effective solution for compliance under SBEM given the limited contribution achievable by increasing the U-values compared to the contributions that can be more cost effectively achieved through savings in other areas (see Section 2).

EPIC's recommendations on cost effectiveness balance the relatively limited effect and contribution of increasing the panel thickness against the increased cost of the panel system and the effect in terms of speed and handling during installation on site, including the increased depth of detailing especially at reveals, heads and jambs etc.

3.3 Building envelope – Cm values

In addition to U-values, the thermal mass of the cladding element (Cm in kJ/m²K) is now included as part of the SBEM calculation to determine the effects of intermittent heating etc.

The Cm value includes an average thermal mass for a steel portal frame and sheeting rails on the heated side of the Insulated Panel.

EPIC recommends

Check that the Cm value in the SBEM calculation is set at 7.0 kJ/m²K for the metal panel cladding system. (Some early versions of SBEM had different default values and should be corrected)

Table 3 Cm values for typical insulated panel systems

	Cm value (kJ/m²K)
Roof – metal faced insulated panel	7.0
Wall – metal faced insulated panel	7.0

3.4 Thermal bridging ψ–values

The 2006 National Regulations require that 'the building fabric should be constructed so that there is no reasonably avoidable thermal bridges at joints between elements and at the edges of elements such as those round window and door openings'.

The SBEM calculation methodology incorporates data on ψ–values to assess the additional heat loss through repeating thermal bridges at the major junction details. This data entry replaces the 'ψ' and 'α' combined calculation method in the 2002 Building Regulations.

NOTE. Some alternative approved calculation methods take an alternative approach to thermal bridging and do not require the input of ψ–values.

As a result of the high level of thermal performance currently achieved by the roof and wall elements, the effect of thermal bridging is proportionately greater and can under the SBEM methodology contribute as much as 6% towards the target saving.

The importance of low ψ-values is particularly building-size sensitive with small buildings requiring a higher standard of detailing and hence lower ψ-values than larger constructions in order to achieve compliance.

To capitalise on the available saving and ensure a good future Operational Rating, designers should ensure that the design drawings use either the approved details provided by:

- The Insulated Panel manufacturer (see back cover for contact details) or
- The generic details illustrated in MCRMA/EPIC Technical Paper TP17.*

The ψ–values supplied either by the panel manufacturer or from TP17 as applicable should be used for the seven principal details listed in the SBEM dropdown lists, as appropriate to the building design. Compliance assumes that the generic junction complies with the relevant figure and is built to a reasonable standard of workmanship including continuity of insulation and air seals.

Approved details from the Insulated Panel Manufacturers are generally deigned to give lower and more efficient ψ-values for most of the common junctions. Use of these details can result in significant improvements in TER as much as 6%.

Table 4 summarises the junction details listed in SBEM together with ψ–values values quoted by IP 01/06 and used as the SBEM default values. The approved details recommended by the Insulated Panel manufacturers generally give improved ψ–values.

Note. SBEM version v2.0c (May' 07) flags up a message for buildings designed with a flat roof i.e. below 20° stating 'This roof may need additional thermal bridges due to valley gutters'. However SBEM does not allow for a valley gutter in the calculation for the Notional Building and entry of a ψ-value for valley gutters will produce a negative contribution in the compliance calculation compared to the Notional Building.

It is important to select a valley gutter system with a good ψ-value. EPIC members can provide guidance on suitable valley gutter systems.

* *MCRMA EPIC Technical Paper TP17 can be viewed or downloaded from www.epic.uk.com*

Table 4 Summary of ψ–values found in SBEM compared to manufacturers details

Junction detail	ψ–values from Insulated Panel manufacturers	ψ–values from IP 01/06 and MCRMA/EPIC TP17	MCRMA/EPIC TP17 Figure No for generic detail
Roof – wall combined eaves and verge*	ψ–values provided by manufacturers for approved details are equal to or better than IP 01/06	0.6	11 & 12
Wall – ground floor		1.15	13
Wall-wall corner		0.25	14
Wall -floor not ground		0.07	15
Lintel above window or door		1.27	16
Sill below window		1.27	17
Jamb at window or door		1.27	18

* SBEM uses a combined detail to represent both eaves and verge arrangement. The calculation method for this can be found in MCRMA/EPIC TP17.

EPIC recommends

Due to the limitations of the SBEM calculation tool, EPIC recommends that designers do not enter ψ-values for any additional details that may be in the building design but are not listed in SBEM. (See above note on valley gutters.)

3.5 Building envelope – rooflights

The regional Building Regulations indicate a minimum U-value requirement of 2.2 W/m^2K. However, SBEM uses a default U-value of 1.82 W/m^2K area weighted average for profiled in plane rooflights, which is a non-standard value for most triple-skin rooflights.

EPIC recommends that designers use the rooflight manufacturers' values and not the default value in SBEM. Although this may result in a small negative effect within the compliance calculation it has the benefit of being in agreement with the as-built computation.

The contribution of rooflights has changed with the varying drafts of the SBEM calculation tool. The amount of roof daylighting directly influences the internal lighting requirements and the potential solar gain.

For normal industrial portal frame, insulated panel clad buildings the optimum contribution according to current model calculations occurs with about 10% of rooflights.

Key issues – the SBEM calculation method

3.6 Air permeability

The various Regional Building Regulations require that buildings are designed to achieve an air permeability of not more than 10 $m^3/(h{\cdot}m^2)$ at 50 Pa pressure. They also state that better standards of air permeability are technically desirable in buildings with mechanical ventilation and air conditioning.

Air permeability levels are set at 10 $m^3/(h{\cdot}m^2)$. Better standards of air permeability are technically desirable in buildings with mechanical ventilation and air conditioning.

In England, Wales, Northern Ireland and Scotland the completed building envelope must be tested to confirm the rate of air permeability.

Note. Technical Standard Section 6 (Scotland). 6.2.6 states that buildings designed using Accredited Details (Scotland) can assume a level of 10 $m^3/(h{\cdot}m^2)$ without testing. This statement however relates to domestic type constructions. SBSA have confirmed that industrial and commercial buildings shall always be tested for air tightness.

Where a better i.e. lower design value is used for the SBEM compliance calculations, the completed building envelope will have to achieve the stated lower rate when tested.

The exception to mandatory air permeability testing for England, Wales and Northern Ireland is for buildings below 500m^2 footprint area. For these smaller buildings where the developer chooses to avoid the need for a pressure test the calculation model will use an air permeability rating of 15 $m^3/(h{\cdot}m^2)$. Compensating improvements in other areas of the building fabric and building services will be required to achieve the necessary compliance.

Insulated panels – major contributor to better airtightness

Insulated panels have built-in, tight, engineered joints to minimise air permeability. Panel manufacturers provide robust junction details for their insulated panel systems with the result that lower air permeability values than the Building Regulations limit are readily achieved.

Air permeability tests conducted on insulated panel clad buildings since the introduction of testing in 2002 have shown that air permeability levels well below 10 are readily achieved in practice. Levels as low as 2 $m^3/(h{\cdot}m^2)$ are not uncommon.

Designing for low air permeability is a very important element of cost effective compliance. The maximum allowable value under SBEM is 10 $m^3/(h{\cdot}m^2)$. Table 5 illustrates the readily attainable levels in terms of size of building footprint that should be achievable with Insulated Panels built to a reasonable standard of workmanship. An improvement from 10 to 5 $m^3/(h{\cdot}m^2)$ would make a positive contribution towards achieving the TER.

Table 5. Attainable air permeability performance by building size

Building footprint (m^2)	Achievable air permeability
Up to 2500	10 $m^3/(h{\cdot}m^2)$
2500-5000	7.5 $m^3/(h{\cdot}m^2)$
5000 plus	5 $m^3/(h{\cdot}m^2)$

3.7 Building services and controls

One of the most difficult areas to understand is the way SBEM and similar models have treated lighting, heating, cooling and controls and the inter-relationship between services and controls. One of the principal aims of the model is to encourage the use of automatic controls such as photoelectric dimming and efficient means of providing heating and cooling.

As a result the less efficient forms of lighting and the least efficient types of plant are penalised in the energy saving calculation. Designers should contact the lighting or services provider to confirm the latest energy efficient technology and its effect on compliance within the SBEM and other calculation tools.

In section 4 EPIC provides guidance on the positive and negative effects of a variety of the most common lighting, heating and HVAC systems. This is critical in some cases because compliance cannot be achieved with some of the older traditional systems and for others there is a significant penalty.

EPIC's experience with the calculation methods shows that they are very sensitive to changes in services or systems and it is almost impossible to predetermine the affect of any change.

WARNING: Designers are advised not to accept specification or system changes to building services or controls without carrying out a trial check using the calculation tool

This Insulated Panel Building achieved an air permeability level below 3 $m^3/(h \cdot m^2)$

4 New build
Key factors to compliance using SBEM

4.1 Introduction

This section of the guide, compiled with the assistance of EPIC's Consultants and technical experts, has been designed:

- To give designers a better understanding of the key variables that control the CO_2 emissions
- To facilitate their path through the SBEM screens
- To optimise the inputs into the calculation tool for Insulated Panel buildings

The information in this EPIC supporting document focuses on metal portal frame buildings constructed with insulated panels as the building envelope. It complements the guidance given in the SBEM tutorial programmes that are downloadable from BRE. However the guidance in the tutorials is general in nature and attempts to cover a wide variety of buildings. As a result certain options are not valid for Insulated Panel buildings or if entered may set up a string of irrelevant criteria.

The methodology and data input for insulated panels set out in Section 4.3 is also valid for alternative metal cladding systems on all building types. Similarly, the principles apply to other approved compliance calculation tools on the market, which are based on SBEM.

Great care should be taken with the preparation and input of data. Problems are not readily identifiable if unexpected results/non-compliance are produced by the SBEM calculation tool.

This section is set out in the same order as the data input into SBEM. However the experts recommend that time should be spent defining a method of working and pre-planning the zoning and data input before embarking on the task of data input (see 4.2).

4.2 Methodology

SBEM is a methodology and it is beneficial to establish a method of working to facilitate the input of data.

Zoning

One of the most important preliminary tasks is to mark out and identify the various distinct zones within a building. SBEM defines zones as spaces that are distinct from adjacent areas in terms of activity, heating/cooling requirement, lighting provided or required, or other services required.

These zones have to be separately identified and may be bounded by physical walls – or 'imaginary' walls, to create virtual zones with different heating/cooling or lighting requirements. It is assumed that imaginary walls have a zero transmission where there are similar conditions in the adjacent spaces.

AD-L2A defines daylit space as 'any space within 6 m of a window wall, provided that the glazing area is at least 20% of the internal area of the window wall.' This can be used as a yardstick for zoning as can specific areas under localised runs of rooflights.

4.3 Data entry into SBEM

4.3.1 Building Type

Building type – options	Notes and recommendations on data entry
SBEM requires that the main use of the building is entered. This automatically sets some of the energy parameters such as: • the notional hours of building use and therefore the main energy contribution • types of heating and cooling • domestic hot water requirements • daylighting SBEM identifies a number of different building types for selection. Reasonable care should be taken in identifying the building activity and as a consequence the types of lighting, domestic hot water, controls etc associated with the occupancy and use.	Compliance is achieved by comparing the actual building with a notional building of the same basic design. If the correct predominant use is not entered this could severely affect the ability to comply and services etc will not be compared on a like-for-like basis. **Example – DIY/retail** The corect lighting controls must be selected for the different building zones. Display lighting has a greater impact on services and CO_2 levels than other lighting systems.
Speculative buildings Developers have the option of selecting 'speculative industrial space' or shell and fit out buildings where the activity is not known at the time of construction	*Note – speculative buildings. A full SBEM calculation has to be repeated and compliance proven when the building is brought into use.*

4.3.2 Location

Location options	Notes on data entry
Initial selection is to choose the relevant Building Regulations – England and Wales, Northern Ireland or Scotland. The second selection parameter is 'weather [location]' – a drop-down list of locations.	*It is important to select the correct location because the location automatically sets defaults for weather, heating and lighting and wind exposure.*
Scotland. Selection of Scottish Building Regulations and weather (Scotland) will automatically set defaults for any U-value and other parameters that are different from England and Wales and Northern Ireland.	*Note – where Scotland/Scottish Building Regulations are selected an additional 'tick-box' appears, to confirm that in the case of naturally ventilated buildings, studies have confirmed that they will not overheat.*

Key factors to compliance using SBEM

4.3.3 Building fabric

U-value and ψ-value – options	Notes and recommendations on data entry
U-values – roofs and walls Selection options are either to select the generic product type offered or enter the U-value as stated by the Insulated Panel manufacturer.	*EPIC recommends that the U-value stated by the manufacturer for the specified Insulated Panel system be entered. These values are calculated by accredited methods and include allowances for the thermal performance at the joints and fixings used for securement. (see section 3.2)*
Cm – roofs and walls The SBEM default value should be checked to ensure that the correct value is used for insulated panel roof and wall systems: • Roof: Cm = 7.0 • Wall: Cm = 7.0	The Cm default value in the calculation models must be checked. (See section 3.3).
U-values and Cm – internal walls and ceilings U-values and Cm values stated by the system manufacturer should be used in the SBEM calculations. In the case of 'imaginary walls a U-value of '0' should be used.	
U-values – floors The U-value of floors varies with perimeter and any insulation applied to the edges. The U-value used by SBEM for the notional building is adjusted for size but is not adjusted in the calculation for the actual building.	Recommendation. Initially use the default value of 0.25 W/m^2K. If the TER result for the building is non-compliant recalculate using the correction factors for perimeter. The method of correction is set out in BR443. The BRE and other software packages for U-value calculations can be used to determine the effective U-value.
ψ–values – roofs and walls Designers should either: • specify details in accordance with IP 01/06 and tick the box or • Specify the Insulation Panel manufacturer's approved details and enter the manufacturer's calculated ψ-values for each of the applicable details For any other details not involving metal cladding tick 'robust' if applicable	*EPIC strongly recommends that the Insulation Panel Manufacturer's approved details are always used and the manufacturer's quoted values entered in the calculation. This will have a significant contribution towards compliance.* *NOTE. Only enter ψ-values for the relevant details listed in the SBEM tool. Entering additional details with attendant ψ-values will make a negative contribution to compliance (See section 3.4)*

4.3.4 Rooflights

Rooflight – options	Important notes on data entry
U-values for rooflights	
Building Regulations indicate a minimum U-value requirement of 2.2 W/m²K. However, SBEM uses a default U-value of 1.82 W/m²K area weighted average for profiled in plane rooflights, which is a non-standard value for most triple-skin rooflights.	*EPIC recommends that designers use the rooflight manufacturers' values and not the default value in SBEM.*
Percentage of rooflights	
The amount of roof daylighting directly influences the internal lighting. However this has to be balanced against the increased solar gain.	*For normal industrial portal frame, insulated panel clad buildings the optimum contribution according to SBEM and the other accredited model calculations occurs with about 10% of rooflights.*

4.3.5 Air leakage rate

Air leakage – options	Important notes on data entry
The default leakage rate is 10 $m^3/(h \cdot m^2)$.	*Designing to an air permeability of 5 $m^3/(h \cdot m^2)$ should be achievable for larger buildings with Insulated panels built to a reasonable standard of workmanship and using manufacturer's approved details.*
Actual achievable rates – insulated panels Air permeability tests conducted on insulated panel clad buildings since the introduction of testing in 2002 have shown that air permeability levels well below 10 $m^3/(h \cdot m^2)$ are readily achieved in practice. (See 3.6)	*NOTE The larger the building footprint, the easier it is to achieve low air leakage figures on final test (see Table 5 page 12).*

4.3.6 Windows and doors

Selection options	Important notes on data entry
It is important within the SBEM and other model calculation methods to select well insulated window glazing and well insulated door units.	Select well insulated window glazing. Select well insulated doors.

4.3.7 Building Services – Lighting and controls

Lighting and control – options	Important notes on data entry
Designs that reduce energy consumption play a key role in achieving compliance. The choice of energy efficient lighting and the optimisation of lighting controls in conjunction with rooflight and glazing areas are critical to achieving the maximum effect. The use of photoelectric dimming and occupancy light switching can achieve significant savings	Lighting systems and controls have more influence on the energy consumption and therefore compliance than improving the values for the building fabric. *NOTE Care is needed in defining the type of lighting associated with each zone.*

4.3.8 Building Services – HVAC and controls

HVAC and control – options	Notes and recommendations on data entry
Heating systems should be selected that are effective for the type of building and not chosen purely to achieve compliance. An effective heating system will achieve lower CO_2 emissions than an unsuitable system that may have to be run at maximum for long periods.	Efficient heating systems have more influence on the energy consumption and therefore compliance than improving the values for the building fabric.
The selection menu includes the follow systems that are the most frequently used for the larger industrial/warehouse type buildings. • Unflued radiant heater • Flued radiant heater • Multiburner radiant heaters • Flued forced-convection air heaters • Unflued forced-convection air heaters • Single-duct VAV (heating and cooling) • Dual-duct VAV (heating and cooling) The services systems manufacturer should be contacted to obtain the required information for entry into the SBEM calculation.	*EPIC recommends FLUED heater types as the preferred options to avoid potential condensation problems.* Heater systems should be chosen according to the application. Flued forced-convection heaters are more suited for better warm air distribution in high-bay racking applications than radiant heaters and probably in the larger sheds. When cooling is included with heating in a ducted system the default values in SBEM allow easy compliance of BER with TER. The total CO_2 emissions, if the cooling system was installed, are higher than a heated building with the same installed capacity but still achieve the required compliance standard.

EPIC
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EPIC was set up in 1991 to promote quality roofing and cladding systems through the use of factory-engineered panels. Insulated panels maximise thermal efficiency whilst reducing the risk and effects of condensation and significant energy loss through air leakage.

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EPIC have also published a series of other Guides including:
– Fire safety, Specification and Installation of Insulated Panels
– Insulated Panels, The Fire Safety Order (2005)
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