Integrated Environmental Solutions Ltd.

VE Compliance FAQ

The Building Regulations 2010: Conservation of fuel and power

Top Tips for Achieving Compliance
Contents

1  Top Tips for Demonstrating Compliance ................................................................. 3
2  Understanding the Notional Building .................................................................... 4
3  Correct Zoning of the Model .................................................................................. 7
4  Correct Unheated Zone Assignment ...................................................................... 10
5  Setting the Correct Shading Types ....................................................................... 11
6  Construction Properties ......................................................................................... 12
7  Checking the Construction Assignment ............................................................... 17
8  Setting the Lighting Gains ...................................................................................... 18
9  Setting the Lighting Controls ................................................................................ 20
10 Setting the Correct System Parameters ............................................................... 22
11 Setting the Correct DHW Parameters ................................................................... 25
12 Check Local Settings ............................................................................................. 27
13 Understanding the Most Significant Issues ......................................................... 28
14 Defining the Building Settings .............................................................................. 30
References .................................................................................................................. 32
1 Top Tips for Demonstrating Compliance

Through our position of providing technical support, alongside our consulting model audit services, we observe similar technical issues cropping up in models which can be due to a lack of training or a misunderstanding of the building regulations.

In many cases the issue is the user is struggling to achieve compliance and in others there are simply model set up errors that can lead to discrepancies within the results. Often these lead to more challenging efforts at demonstrating compliance.

This document highlights the most regular issues we observe so that you can avoid these potential pitfalls in the future whilst at the same time providing guidance on to how to get the most out of the Virtual Environment.
2 Understanding the Notional Building

One of the key steps to achieving compliance is understanding exactly how the Target Emission Rate is calculated. Under the Part L2A the Target emission rate (TER) is established directly from the performance of the Notional Building. As there are no additional improvement factors applied to this performance so long as the design parameters of your model match or exceed those used in the Notional Building, you should be able to demonstrate compliance with the regulations.

The parameters that make up the Notional Building are provided in the “National Calculation Methodology (NCM) modelling guide (for buildings other than dwellings in England*) 2013 Edition”, which is freely available.

It is important to understand these inputs as in most cases the Notional Buildings characteristics is significantly better than the Minimum requirements set out in Approved Document Part L2A itself.

Often the minimum requirements as defined in the approved document are used to inform the design meaning that when trying to demonstrate compliance the design case is already poorer the Notional Building and it needs to make up for this elsewhere in the design. To provide an example of this the Table below illustrates the Minimum U-Values set out in the Approved Document against the properties used in the Notional Building.

<table>
<thead>
<tr>
<th>Construction Element</th>
<th>Criterion 2 Minimum U-Value*</th>
<th>Notional Building U-Value</th>
<th>Improvement against standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Walls</td>
<td>0.35 W/m².K</td>
<td>0.26 W/m².K</td>
<td>26 %</td>
</tr>
<tr>
<td>External Roof</td>
<td>0.25 W/m².K</td>
<td>0.18 W/m².K</td>
<td>28 %</td>
</tr>
<tr>
<td>Exposed Floor</td>
<td>0.25 W/m².K</td>
<td>0.22 W/m².K</td>
<td>12 %</td>
</tr>
<tr>
<td>Pedestrian Door</td>
<td>2.2 W/m².K</td>
<td>2.20 W/m².K</td>
<td>0 %</td>
</tr>
<tr>
<td>Vehicle Access Door</td>
<td>1.5 W/m².K</td>
<td>1.50 W/m².K</td>
<td>0 %</td>
</tr>
<tr>
<td>External Window</td>
<td>2.2 W/m².K</td>
<td>1.60 W/m².K</td>
<td>27 %</td>
</tr>
</tbody>
</table>

* From Table 3 Limiting fabric parameters (Approved Document Part L2A)

The construction properties are just one area where the Notional Buildings properties can be better than may be expected. As this is typically defined early in the design process it can often be too late to modify later when initial compliance assessments are performed. This means the difference in performance has to be made up elsewhere.

Through the use of the VE Navigators, users can understand the properties of the Notional building from the very initial stages of modelling. By using the “Key Inputs Comparison” report users can compare side by side the parameters assigned to their design, the Actual building, and those assigned to the Notional Building. This report will also highlight any attributes of the Actual building that are poorer than the specification for the Notional building to highlight to the user that this may be an area they wish to address whilst the design is still adaptable.
The comparison report draws comparison between the Actual and Notional buildings:

- Construction U-Values
- Infiltration Rates
- Glazing area
- Glazing G-Values
- System Efficiencies
- Zone lighting power densities
- Zone lighting controls

Where the Actual Building can match or improve upon the Notional Building in all these areas it is in good steadying to achieve compliance.
The Virtual Environment is used at all stages of the design development and has been used in Energy models before any Compliance assessments. Different terminologies are used to describe the various models and what they represent.

The term “Real” Building is often used to describe the version of the thermal model where you have full control over everything including space usage, set-points etc. In this “Real” building the results should reflect the true operation.

When a Compliance assessment is performed an “Actual” & “Notional” variant of the building is automatically created from the “Real” building model. Unlike the “Real” building the Actual and Notional buildings are populated with NCM templates and properties that may differ from the real operation. The consequence of this is that the results from a compliance assessment can be quite different from the real building and this differentiation is important to remember throughout the design process.
3 Correct Zoning of the Model

It is important to be familiar with and model to the zoning requirements set out in the NCM Modelling Guide. While most users will zone spaces with different Activity and HVAC systems separately very often the perimeter zoning is ignored.

It is important to segregate the perimeter zones from the core zones as any Daylighting controls should only be applied to the perimeter of the building. It is worth noting that in the majority of activities the Notional Building will be equipped with daylight dimming controls. If the zones have not been correctly subdivided then the savings attributed to the dimming controls will not only be attributed to the perimeter but to the whole floor plan. This can result in a lower lighting power consumption in the Notional building and as a consequence also a lower cooling load and overall a lower TER making compliance more difficult to achieve.

The illustration below demonstrates that by not separating perimeter and core zones can lead to daylight control being applied to areas that would not in practice benefit from daylight controls.

While it is not a requirement, it is common to model substantial ceiling voids as a separate thermal zone within the model geometry. The settings users apply to this ceiling void can impact the form of the Notional Building.

In some scenarios this ceiling plenum can be relevant as the amount of glazing applied to the notional building is based on the floor-floor height. Glazing in the Notional building for a side lit activity is set as a strip of glazing the full length of the façade that is equal to 40% of the external façade but with a maximum height of 1.5m.
Consider the scenario where a meeting room has a 2.5m floor to ceiling height but with a 1.5m high ceiling void placed on top. When the ceiling void is ignored the notional building will have a glass height of 1m (40% of the 2.5m floor to ceiling height). If the ceiling void were to be included in this calculation a then the Notional building would have a window height of 1.5m.

Ceiling voids can be linked to their associated zones via the room query function. Setting this will have an impact on any zone with a floor to ceiling height less than 3.75m; any taller than this and the notional building will still be restricted to the same 1.5m maximum.
Room Query setting pairing the Ceiling void to an occupied zone

Setting pairing the ceiling void to an occupied zone via Building Regs tab on Tabular Room Data

The illustration below demonstrates how the limiting factor for glazing changes between a percentage area threshold and an absolute maximum at a height of 3.75m.

Notional glazing assignment for zones of varying height

The additional glazing in the Notional Building will result in greater Conduction losses in the heating season and greater solar gains in the cooling season and generally result in a higher TER making it easier to demonstrate compliance.
4 Correct Unheated Zone Assignment

An area that is commonly modelled incorrectly is unconditioned zones and voids within the building. While this does not necessarily result in any disadvantage against the Notional Building, it can often appear incorrectly on the BRUKL document to the effect that the Building is not meeting the minimum fabric requirements.

Zones are described as either:

- Heated or Occupied Space
- Unheated Roof
- Other Buffer Space
- Internal Void or Warm Roof

Spaces such as plant rooms or store rooms should be assigned as a “Heated or Occupied” zone with an appropriate activity selected. The space will include lighting gains, equipment gains, occupancy, etc. If the space is unconditioned then the HVAC system can be set to “None” and there will be heating or cooling associated with the zone.

For unoccupied void zones such as risers, ceiling voids or attics one of the other room types should be selected. When the zone lies within the building’s insulation envelope the “Internal Void or Warm Roof” should be selected. If the zone lies outside the insulation envelope then either the “Unheated Roof” or “Other Buffer Space” should be selected.

When either the buffer space or unheated roof is selected the Criterion 2 checks are based upon the adjacent construction to the neighbouring heated zone. If this is not sufficiently insulated in the assigned construction properties it can flag as a fail for Criterion 2.
5 Setting the Correct Shading Types

Users can demonstrate the benefits associated with shading via the Suncast link. Care should be taken to ensure that shading devices are assigned to the correct category in order to ensure they are treated correctly in the compliance assessment.

Any shading devices that are part of the building design should be modelled as a “Local Shade”. Objects defined as “local shades” will be excluded in the Notional Buildings Suncast run meaning any benefit associated with them will not be passed to the Notional Building.

Any adjacent buildings or topographical shading objects such as trees or landscape components should be modelled as an “Adjacent Building” or “Topographical Shade”. These objects will be included in the Notional Buildings Suncast analysis.

If these components are incorrectly defined as a local shade then the Notional Building will exclude them from the analysis. This can result in a higher solar gain at times of low sun angle when the building is likely to be in a heating model. This increased solar gain can offset part of the heating load and result in a lower TER. During the summer months the higher solar angle means that the surrounding buildings are less likely to influence solar gain anyway so the fact they have been excluded doesn’t significantly increase the solar load in the cooling season.
6 Construction Properties

There are a number of factors in the assigned construction properties that often go unset which can ultimately impact the BER and TER.

Firstly ground contact floor U-values should be corrected in line with EN-ISO 13370. This correction is based on the ratio between the building’s footprint and perimeter. This is something that the VE will semi-automate by automatically extracting the footprint and perimeter length from the model characteristics.

In buildings with a large footprint this can make a significant difference to the resulting U-value. In cases where the un-insulated U-value is less than 0.22 W/m².K, a corrected construction will automatically be applied to the Notional Building.

<table>
<thead>
<tr>
<th>Description</th>
<th>Image</th>
<th>Un-insulated U-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Office Building</td>
<td><img src="https://www.iesve.com/image.png" alt="Image" /></td>
<td>0.367 W/m².K</td>
</tr>
<tr>
<td>425m² Footprint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>84m Perimeter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supermarket</td>
<td><img src="https://www.iesve.com/image.png" alt="Image" /></td>
<td>0.129 W/m².K</td>
</tr>
<tr>
<td>7919 m² Footprint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>404m Perimeter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As the weighted fabric loss for the building can change quite significantly for the building both heating and cooling loads for the Notional and Actual Building can be affected.

Floor Construction options for Ground Contact U-Value Adjustment
Often the Glazing Light Transmission factor is left at default values within a model. It is important for this value to be appropriately set as this input is part of the NCM diming control calculations. When a space is equipped with dimming controls the reduction applied to the lighting gain is based on the external illuminance, the area of glazing and the light transmittance of the glazing among some other factors.

If the specified Light transmittance factor is not appropriate for the glass specification it can affect the determined lighting gain and subsequently both the heating and cooling loads in the model.

The Notional Building has predefined internal construction properties for both Partitions and Ceilings. The Notional building ceiling has a build-up including 150mm of concrete and 50mm of screed making it a fairly heavyweight construction. In some cases users may opt to model a separate ceiling void above their occupied zone. In the actual building they may have assigned a lightweight ceiling tile material to the ceiling of the occupied room and a heavier structural ceiling to the void zone. In the Notional building however where the constructions are assigned automatically the structural ceiling will be assigned to both the ceiling of the occupied space and to the ceiling of the void zone. This results in there being much more thermal mass in the Notional building which can influence the Heating and cooling loads.
In order to avoid this, users can specify for internal constructions that they should be retained in the Notional Building. In this example the Ceiling tile construction assigned to the Actual building should have this setting checked.

In a Compliance assessment, doors can be used to represent a variety of door types as well as other construction elements. In the construction properties users should select the door type appropriate for its intended use. Users can select from:

- Personnel Door
- Vehicle access or Similar Large Door
- Wall or Roof Element
- High Usage Entrance Door
- Curtain Wall.

Where the Door element is in fact representing a Door then the Notional Building will include the door in the same position and adopt the appropriate U-Value based upon the selection (i.e the Vehicle access door will have different properties to a High Usage door).
If the Door component is being used to represent either curtain wall or another wall or roof element then this will be ignored in the Notional Building. It is worth noting that if your building design has a significant amount of Curtain Wall construction, the Notional equivalent will still be a traditional wall construction with a U-Value of 0.25 W/m².K.

When modelling a Glazed entrance door, this should be done by adding the object as a Window. A construction should then be created that identifies this component as a Door. It is worth noting that in the Notional Building the door will be replaced with an Opaque door as per the requirements of the NCM Modelling Guide.

**Glazed Construction Window Type Selection**
7 Checking the Construction Assignment

Many of the attributes applied in the “Actual” model will be the same as the properties in the “Real” building model. This means that if you have been using a thermal model for design purposes moving into VE Compliance will retain the properties that are relevant for a compliance assessment.

For example if you have already created and assigned constructions then you do not have to re-assign the constructions. It is always worth checking however that the correct constructions have been applied to the correct surfaces as it can be very easy to overlook some parts of the building leaving them at the default assignment.

Introduced in VE 2013, users can visualise a large variety of the assigned properties including the construction assignments and their properties. This is a great way to inspect the model to ensure that the correct properties have been assigned throughout and that no surfaces have been overlooked.

Model inputs visualisation, assigned constructions

Model inputs visualisation, construction U-Values
8 Setting the Lighting Gains

While the Compliance model does automatically take on many of the Real Building attributes there are a number that are intentionally different in the Compliance model and therefore need to be appropriately set for Compliance. As a Compliance assessment uses the NCM Activity database rather than the user defined thermal templates, all the template data is automatically replaced. For the most part the user has no control over these parameters such as the heating and cooling set-points, ventilation rates etc.

However one aspect users can set is the lighting performance. It is important that this is done as lighting typically accounts for a significant proportion of the Buildings CO₂ emissions and will impact the buildings heating and cooling loads. Depending on the space type the Actual building will have a default Lighting Power Density (LPD) based on an inferred value of 60 lumens/circuit watt.

It used to be the case that users had to specify the lighting performance as a Lighting Power Density for compliance purposes requiring details on the lighting design to have been completed. More recent revisions of the NCM modelling guide however permit the use of the Inference methods allowing users to set an efficacy value.

The Notional Buildings lighting power is calculated using the inference method which is based on an efficacy of 60 luminaire lumens/circuit watt. The Non-Domestic Building Services compliance guide sets a minimum luminaire efficacy of 60 lumens/circuit watt for all new buildings so on this basis all new buildings should be at least as good if not better than the Notional Building with regards to lighting power.

A change in the 2013 regulations that users will need to be aware of is the fact that when the design illuminance is greater than that of the NCM Activity Database this greater value will be used in the Actual building. This change effectively penalises designs that are over illuminated which did not occur in the Part L 2010 framework. The Notional Building will always use the NCM lux level.

Because of this change, even if the actual building has more efficient luminaires you will observe that the applicable lighting power is higher than that of the Notional Building if, for example, the actual building has a design illuminance of 650 lux opposed to the NCM lux level of 600 lux. As this is
a change from the previous regulation method it is likely that this will catch out many users who are unaware of this

Also previously only allowable for production of EPCs general lighting can now be specified by and inference method for building regulations compliance. See extract below from NCM modelling guide paragraphs 82 and 83 “..... general lighting can be defined explicitly, by calculating and inputting the design/installed circuit power, or by inference, but the resulting wattage in each zone must be reported in the BRUKL (compliance output document) summary. Where general lighting is defined by calculation, a maintenance factor should be applied that is appropriate to the lighting installation as defined in the Society of Light and Lighting (SLL) Lighting Handbook.”

For general lighting, the following inference methods can be used in addition to the explicit method for Building Regulations compliance to define the general lighting:

- Inference method 1 - User sets the lamp efficacy in lumens per circuit-watt and the light output ratio of the luminaire, to determine the efficacy of the lighting system in terms of luminaire lumens per circuit-watt, which can be pro-rated against the Notional lighting curve (which is based on 60 luminaire lumens per circuit-watt) defined by Equation 7 to infer a power density for the general lighting. The user can also input the design illuminance in the zone, if known, and the power density will then be subject to be pro-rated following paragraph 81.

- Inference method 2 - User assigns a lamp type to each zone based on Table 10, where the luminaire efficacy can be pro-rated against the Notional lighting curve (which is based on 60 luminaire lumens per circuit-watt) defined by Equation 7 to infer a power density for the general lighting. The user can also input the design illuminance in the zone, if known, and the power density will then be subject to be pro-rated following paragraph 81.
9 Setting the Lighting Controls

All zones in the Notional building which receive natural daylight directly (i.e., through glazing in the zone’s own external envelopes) will be modelled with photo-electric dimming (as defined in the SBEM Technical Manual), without back-sensor control and with continuous (i.e., always on) parasitic power that is the lesser of either: 3% of the installed lighting load or 0.3 W/m². As this load is continuous it can amount to a significant CO₂ contribution.

As the Notional Building forms the TER directly users would generally need to match this performance or make up these savings elsewhere in the design. Daylight dimming can help yield reductions due to both the reduction in lighting power as well as the resulting reduction in cooling load (where applicable balanced against any increase in heating load brought about by reduction in “heating” gains into spaces from lighting).

Zones in the Notional building which do not receive natural daylight directly (i.e., through glazing in the zone’s own external envelopes), but are flagged in the NCM Activity database as appropriate to receive “local manual switching”, will be modelled with local manual switching (as defined in the SBEM Technical Manual), provided the floor area of the zone is less than 30 m². Otherwise, the general lighting is switched centrally based on the occupancy hours for the activity in the NCM Activity database.

By default zones in the Actual Building will not be equipped with any dimming control so if applicable this needs to be set by the user. Any lighting controls will incur a parasitic power that allows for the sensors and controls for the system. The default figures should be reviewed to determine if any benefit can be taken over the Notional building. The default figures for the Actual Building are 0.3 W/m² for a standalone system and 0.56 W/m² for an addressable system.

Care should be taken when assigning dimming controls to zones. If a user sets applies controls dimming controls globally to each zone in the model then internal zones and zones without any windows will still pay the penalty of parasitic power but will not benefit from any reduced lighting load.

In addition to daylight based controls, users can also set occupancy sensing controls that will apply a further reduction to the Actual Buildings lighting load.

In the 2013 Regulations all zones in the Notional building will be modelled with occupancy sensing (as defined in the SBEM Technical Manual) in the form of a “Manual-on-Auto-off” system (i.e., lights are manually switched on and automatically switched off when no movement has been detected for a set time, e.g., 5-15 minutes) with a continuous (i.e., always on) parasitic power density of 0.3 W/m². This option has the greatest reduction factor available in the methodology so it is not possible to improve upon it. As the reduction factor associated with occupancy control is much greater in the Notional Buildings additional savings will need to be made in the Actual Building to trade off this difference.

Like the Daylight dimming controls, occupancy sensing also has an additional parasitic power associated with it and the default figures should be reviewed.
Constant illuminance control is a new type of control and is available under the 2013 compliance framework. It is not applied to the Notional building so provides an option to gain some ground on the Notional Building.

When this option is selected a 10% reduction factor is applied to the general lighting power.

A Constant illuminance control system is used to modulate the lamp output to maintain the design illuminance over a long period compensating for the effects of dust build-up on luminaires that reduce their light output.

Additionally Display lighting can be further reduced by 20% by assigning ‘Time switch control’ at zone level. The display lighting in the Notional building does not benefit from automatic time switch control.

Both general lighting and display lighting (where appropriate) will use the same operating profile as defined in the NCM Activity database for each activity.
10 Setting the Correct System Parameters

The Auxiliary Energy results are calculated using the equations set out in the NCM modelling Guide. This splits auxiliary energy into 2 primary components, fan energy and pump energy.

Pumping energy is fairly straightforward in that there is a table of W/m² values for different pump configurations for buildings with either Heating only or both heating and cooling. The notional building uses the pumping energy associated with the most efficient pump selection available meaning that it is not possible to improve upon the Notional Building here but simply match it. For systems where spaces are conditioned via a central AHU users are not permitted to select a VSD pump meaning they will be at a disadvantage to the Notional Building straight away.

The second component of Auxiliary Energy is Fan Energy which is the product of the required airflow and the specified SFP. The calculation method establishes a peak load for each zone and based on this load determines a required airflow to meet that load based on an 8°C temperature difference.

If a central plant system that uses Equation 9 in the NCM Modelling Guide is selected then this calculated airflow will be multiplied by the entered SFP. If a Fan Coil system that uses Equation 8 is selected the fan power will be based on the fresh air requirement multiplied by the Central AHU SFP + the calculated peak airflow to meet the local load multiplied by a separated Terminal Unit SFP.

The screenshots below show the different equations used to calculate fan power and an illustration of these configurations.
Typically systems that use a central AHU to condition the zones will yield a higher auxiliary Energy than those providing conditioning locally.

When using a Fan Coil Unit system it is important to set the Terminal Unit SFP under the room data. This option is only available when a suitable system is assigned to the space. The Notional Buildings Terminal Unit SFP is 0.3 W/l/s and it is important to review (and adjust for the purposed design) the default for the Actual building. This is frequently overlooked resulting in too great an Auxiliary Energy calculated in the Actual Building.

Where a system includes Mechanical Ventilation, which may include heat recovery but is otherwise unconditioned, the Ventilation SFP should be set at the room level. An example of this may be a system with radiators to provide heating and mechanical ventilation to provide minimum fresh air requirements.

If the room data does not have the “Mechanical Supply” checkbox ticked then the space will be treated as naturally ventilated and will not include for any heat recovery that may be specified.

Although the systems such as “Single Duct VAV” typically result in greater Auxiliary Energy they can also provide scope to introduce free cooling into the zone thus reducing the spaces cooling load. In order to account for this, users should set a suitable free cooling flow capacity at the zone level inputs.
Room Query Dialog, Terminal Unit SFP
11 Setting the Correct DHW Parameters

In a number of cases we have observed the DHW load in the Actual building being larger than it should be. This has the impact of increasing the BER and making it tougher to demonstrate compliance. One of the common reasons for this is users can inadvertently account for the same DHW system losses multiple times over. Although these systems may not provide any DHW loads they do still have losses attributed to them.

To compound this many users will leave storage tank losses and secondary circulation losses at default values. Again these are very conservative and can result in the system losses being over estimated.

The Non-Domestic Building Services Compliance Guide can be useful for establishing typical figures for the early stages of an assessment where specific details are still to be determined. The table below provides recommended maximum losses from DHW pipes. As can be seen from the table the default losses would be typical for pipes of a large diameter but likely to high for most scenarios.
### Table 39: Recommended maximum heat losses for direct hot water and heating pipes

<table>
<thead>
<tr>
<th>Outside pipe diameter (mm)</th>
<th>Heat loss (W/m)</th>
<th>Low temperature heating(^\text{[1]})</th>
<th>Medium temperature heating(^\text{[2]})</th>
<th>High temperature heating(^\text{[3]})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hot water(^{[1]})</td>
<td>(\leq 95^\circ\text{C})</td>
<td>(95^\circ\text{C}) to (120^\circ\text{C})</td>
<td>(120^\circ\text{C}) to (150^\circ\text{C})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(\leq 95^\circ\text{C})</td>
<td>(95^\circ\text{C}) to (120^\circ\text{C})</td>
<td>(120^\circ\text{C}) to (150^\circ\text{C})</td>
</tr>
<tr>
<td>17.2</td>
<td>6.60</td>
<td>8.90</td>
<td>11.34</td>
<td>17.92</td>
</tr>
<tr>
<td>21.3</td>
<td>7.13</td>
<td>9.28</td>
<td>11.56</td>
<td>18.32</td>
</tr>
<tr>
<td>26.9</td>
<td>7.83</td>
<td>10.06</td>
<td>13.56</td>
<td>18.70</td>
</tr>
<tr>
<td>33.7</td>
<td>8.43</td>
<td>11.07</td>
<td>13.83</td>
<td>19.00</td>
</tr>
<tr>
<td>42.4</td>
<td>9.72</td>
<td>12.30</td>
<td>14.39</td>
<td>19.25</td>
</tr>
<tr>
<td>48.3</td>
<td>10.21</td>
<td>12.94</td>
<td>15.66</td>
<td>20.17</td>
</tr>
<tr>
<td>60.3</td>
<td>11.57</td>
<td>14.45</td>
<td>16.67</td>
<td>21.96</td>
</tr>
<tr>
<td>76.1</td>
<td>13.09</td>
<td>16.35</td>
<td>18.25</td>
<td>23.96</td>
</tr>
<tr>
<td>88.9</td>
<td>14.58</td>
<td>17.91</td>
<td>20.42</td>
<td>24.71</td>
</tr>
<tr>
<td>114.3</td>
<td>17.20</td>
<td>20.27</td>
<td>22.09</td>
<td>25.99</td>
</tr>
<tr>
<td>139.7</td>
<td>19.65</td>
<td>23.71</td>
<td>25.31</td>
<td>29.32</td>
</tr>
<tr>
<td>168.3</td>
<td>22.31</td>
<td>26.89</td>
<td>28.23</td>
<td>32.47</td>
</tr>
<tr>
<td>210.1</td>
<td>27.52</td>
<td>32.54</td>
<td>31.61</td>
<td>36.04</td>
</tr>
<tr>
<td>(\leq 37.3) mm</td>
<td>32.40</td>
<td>38.83</td>
<td>37.66</td>
<td>42.16</td>
</tr>
</tbody>
</table>

**Note:**

To ensure compliance with the maximum heat loss criteria, insulation thicknesses should be calculated according to BS EN ISO 12241 using standardised assumptions:

1. Horizontal pipe at 60°C in still air at 15°C
2. Horizontal pipe at 75°C in still air at 15°C
3. Horizontal pipe at 100°C in still air at 15°C
4. Horizontal pipe at 125°C in still air at 15°C
12 Check Local Settings

There are many settings applied at the local level that are often overlooked. These are important in order to ensure that the analysis is accurate but there is also scope to demonstrate an improvement over the Notional Building.

One of the local level settings is to select Demand Controlled Ventilation. Including Demand Controlled Ventilation in the design will reduce heating loads and Auxiliary Energy.

For the 2013 Notional building for zones with mechanical ventilation, the Notional building benefits from demand control of ventilation through variable fan speed control based on CO₂ sensors. This was not previously the case and reduces the opportunity to improve upon the Notional building and also effects the minimum ventilation rate thus reducing ventilation losses and heating loads.

![Room Query Dialog, Demand Controlled Ventilation](image)

One of the easiest and fastest ways to check and modify local settings is through the use of Tabular Edit. This interface enables users to make group or individual changes and the filters make it easier to spot incorrect assignments. There are many default tabs but users can also customise these and/or create new tabs.

![Adjusting Room System information via Tabular Edit](image)
13 Understanding the Most Significant Issues

After an analysis has been completed, users can interrogate the results in order to better understand the most significant factors and loads within their analysis. If users find that their initial assessment results in a fail, users should compare the results between the Actual and Notional buildings performance to identify which areas the Actual Building performed poorer in. This will give users a better idea as to where to concentrate their design efforts and target the changes that are most likely to make an impact.

For example, if a comparison shows that CO₂ emissions associated with lighting are the most significant and that the buildings cooling load is more significant than the heating, then trying to improve the performance by increasing insulation levels is likely not the most effective solution. Instead looking at adding lighting controls or reducing lighting power is likely to yield a more significant reduction.

The VE Compliance Navigator includes an automated report that breaks down the energy end use for both the Actual and Notional Buildings enabling users to quickly and easily identify the dominant loads. Based on these dominant loads a set of suggestions are made as to how the user might most effectively reduce the buildings energy consumption.

When performing a compliance assessment it should be remembered that the operation of Real building can be quite different to the operation assumed for compliance. As such the dominant loads can be quite different. This is something that designers should bear in mind when considering the design as a solution that is good for a Compliance assessment may not be the best solution for the Real building and it is important that this is not forgotten.
**Sample screenshot showing Dominant Loads report breakdown for Auxiliary Energy**

- **Options:**
  - Consider improvements - tackle the largest AEY first; remember reducing fabric and solar loads also reduces auxiliary energy values.
  - Consider whether the selected system type is the most appropriate for the space loads.
  - Decoupling ventilation from heat (cost delivery) leads to lower aux energy HVAC systems; this more likely in designs with lower design loads.
  - Hydronic Systems such as Chilled Beams typically have significantly lower auxiliary energy values.
  - Is Demand Controlled Ventilation via fan speed control suitable for application?
14 Defining the Building Settings

There are 2 key new building settings that should be considered under the 2013 version via the Set Building and System Data tab.

Firstly, the following extract comes from the NCM Modelling Guide (Paragraph 40) with respect to Air Permeability:

“Zones in the Notional building will use the air permeability values from Table 3, provided that zones whose activity types are flagged as involving metal cladding in the NCM Activity database (see paragraph 32) will use the values in the ‘Top-lit’ column of Table 3. The calculation method used to predict the infiltration rate must use the air permeability as the parameter defining the envelope leakage. For compliance and certification, the same method must be used in the Actual, Notional, and Reference buildings. Acceptable methods include:

a. The method specified in the SBEM Technical Manual, which is taken from EN 152429.
b. Other methods that use a relationship between infiltration rate and air permeability and are set out in national or international standards or recognised UK professional guidance documents which relate average infiltration rate to envelope permeability. An example of the latter would be tables 4.13 to 4.20 of CIBSE Guide A (2006). Methods that use flow networks are not acceptable for compliance or certification purposes as there is no simple way to check that the permeability of the Notional building delivers the required permeability standard.”

The following shows the new values in the Notional building and where these are shown in the VE.

### Table 3 Air permeability for the Notional building (m³/h per m² of envelope area at 50 Pa)

<table>
<thead>
<tr>
<th>Gross Internal area of the building</th>
<th>Side-lit or unlit (where HVAC specification is heating only)</th>
<th>Side-lit or unlit (where HVAC specification includes cooling)</th>
<th>Top-lit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than or equal 250 m²</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Greater than 250 m² and less than 3,500 m²</td>
<td>3</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Greater than or equal to 3,500 m² and less than 10,000 m²</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Greater than or equal 10,000 m²</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

---

Extract from NCM Modelling Guide

Extract from Building and System data tab (within VE Compliance)
With respect to the statement regarding “The calculation method used to predict the infiltration rate must use the air permeability as the parameter defining the envelope leakage” the software now allows for Infiltration to be set via “CIBSE TM 23” or “CIBSE Guide A” methods. Both “CIBSE TM23” and “CIBSE A” documents are available online for reference.

From the images below you can see that the subsequent Infiltration Rate (ach) used in the Actual / Notional and Reference buildings vary and consideration should be given to which method should be used. Dependant on the dominant loads in the building (i.e. heating or cooling) there may be benefit in choosing one method over the other.

The second new item set via the does not affect the simulation results but will show up on the BRUKL document.

---

Extract from the Building and System data tab (within VE Compliance)

---

Extract from Building and System data tab (within VE Compliance)
References


   See [http://www.ncm.bre.co.uk/download.jsp](http://www.ncm.bre.co.uk/download.jsp) for latest version

2. iSBEM User Guide_v5.2.d

   See [http://www.ncm.bre.co.uk/download.jsp](http://www.ncm.bre.co.uk/download.jsp) for latest version

3. SBEM Technical Manual iSBEM_v5.2.d

   See [http://www.ncm.bre.co.uk/download.jsp](http://www.ncm.bre.co.uk/download.jsp) for latest version


   See [http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partI/compliance](http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partI/compliance) for latest version