# TB434

Rooflight U-values

## Rooflight thermal performance - changes to Building Regulations


Regulatory changes to the conservation of fuel and power in 2021/2022 calls for a reduction in carbon emissions over the previous standards, achieved partly with an uplift in the performance of the building fabric and building services but also with the introduction of other measures such as on site power generation (e.g. photovoltaic panels and the use of heat pumps etc).

This also includes a significant change with the addition of a new metric for demonstrating regulatory compliance - **primary energy**; this is the measure of the building's operational energy consumption, which also includes the power used to create, transform and transport the energy from its raw form to where it is used.

Carbon emissions still remains as a measure to continue to drive us towards a low carbon future, although as the UK power grid moves closer towards carbon neutrality this metric will become less relevant and primary energy will become the main measure for low impact building design.

The metrics for compliance checks are now:

| **Target primary energy rate** $kWh_{PE}/m^2/year$ | **Target emission rate** $kWCO_2/m^2/year$ | **Target fabric energy efficiency rate** $kWh/m^2/year$ |
|---|---|---|
| This metric has been introduced as a way of ensuring designers continue to consider energy efficient building design and limit excessive power use | This metric still remains to continue to drive us towards a low carbon future, although as the UK power grid moves towards carbon neutrality this metric will become less relevant | This metric was also introduced to ensure there is a need to design well insulated dwellings to reduce reliance on low carbon heating systems |
| For dwellings and non-dwellings | For dwellings and non-dwellings | Dwellings only |
| Scotland - Target delivered energy rate<br>Wales - Target primary energy rate<br>Northern Ireland - n/a | Scotland - Target emission rate<br>Wales - Target emission rate<br>Northern Ireland - Target emission rate | Scotland - n/a<br>Wales - Target Fabric performance value<br>Northern Ireland - n/a |

## Rooflight U values

Prior to the 2021/2022 Building Regulation changes, all rooflights were assessed for thermal performance in the vertical plane (such as a window, with horizontal heat flow), but this has now changed to assessing rooflights in the horizontal plane (with vertical heat flow) which is typically how rooflights are used and the reason for the change. (Please note: this is relevant for England, Scotland and Wales; Northern Ireland still requires an assessment in the vertical plane).

This does change the thermal performance characteristics of all rooflights because the heat transfer through a horizontal rooflight is typically more than through the same rooflight positioned vertically. This is highlighted in BRE document BR443 - Conventions for U value calculations which states a centre pane difference from vertical to horizontal orientation of up to +0.3 $W/m^2 \cdot K$ for triple skin plastic rooflights and +0.5 $W/m^2 \cdot K$ for double glazed glass units.

So when using rooflight U-values, for comparison or for use in energy assessments, it is important to understand and be clear on the orientation of the rooflight when assessed for thermal performance.

This change within Building Regulations also coinsides with a change in the method of calculating the thermal performance of out-of-plane rooflights. The method of calculating the developed area has changed from being based on the internal surface area of the rooflight to the external surface area, as well as assessment in the horizontal plane. Guidance on this calculation method is given in the Rooflight Association (RA) Technical Document NTD2 and is based on the method in BS EN 1873:2014.

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This also includes the nomenclature where rooflight U values are now designated a $U_r$ or $U_{rc}$ value for the developed area value, and gives a helpful distinction to define the method of assessment. Previously, the thermal performance definition was either U-value or $U_d$-value for a developed area value (i.e. an out-of-plane rooflight). A summary of new and old naming conventions are below.

## Common U-value definitions

There are a number of different ways of expressing thermal performance, from differing sources:

| Value | Description |
|---|---|
| U value | Generally considered the true U value for a product, i.e. the overall heat loss through it, this is defined in BRE document BR443 and used in Approved Document L |
| $U_{roof\_opening}$ | The true U value for a product, i.e. the overall heat loss through it, this is defined in BRE document BR443 for out-of-plane rooflights (same as U value above) |
| **$U_r$ value** | The developed area U value for rooflight-only, defined in BS EN 1873:2014 and RA Tecnical Document NTD2, and suitable for checking for compliance against Building Regulation fabric limits |
| **$U_{rc}$ value** | The developed area U value for rooflight-with-upstand, defined in BS EN 1873:2014 and RA Tecnical Document NTD2, and suitable for checking for compliance against Building Regulation fabric limits |
| $U_p$ value | The developed area U value for either rooflight-only or rooflight-with-upstand, this is defined in BRE document BR443 for out-of-plane rooflights |
| $U_d$ value | The developed area U value for either rooflight-only or rooflight-with-upstand, this was the previous definition for the developed area U value (when assessed vertically and on the internal surface area); the nomenclature is still used in Approved Document L but should be the $U_r$ or $U_{rc}$ value |
| **Surface: area ratio** | This is the ratio of the developed area of the rooflight and rooflight opening, typically for out-of-plane rooflights |

## $U_r$ and $U_{rc}$ values

The thermal performance of Brett Martin Daylight Systems rooflights are defined as either a $U_r$ or $U_{rc}$ value; which confirms the rooflight has been assessed in the horizontal plane, and for out-of-plane rooflights have been calculated in accordance with guidance given in RA Technical Document NTD2.

For out-of-plane rooflight the **$U_r$** or **$U_{rc}$ value** will be accompanied by the **surface area ratio**.

For in-plane rooflights such as the Trilite GRP range the surface:area ratio will be 1 so just the **$U_r$ value** is used.

The $U_r$ and $U_{rc}$ values are suitable for use when comparing against other products where the thermal performance has been assessed in the horizontal plane and, where relevant, in accordance with guidance given in RA Technical Document NTD2. They are also the thermal performance values for checking compliance against Building Regulation fabric limits (please note: Building Regulations still refer to the rooflight developed area U value as a $U_d$ value but assessed in the horizontal plane).

They are also suitable for use in building energy assessments but must be accompanied with the appropriate surface:area ratio, to allow adjustment to the true U value to account for overall heat loss through the rooflight.

The thermal performance characteristics of Brett Martin Daylight Systems rooflights are given in the relevant rooflight datasheets.