BFRC Guidance Note

BFRC RATINGS CALCULATIONS

The BFRC Rating equation

The BFRC Rating equation is:
BFRC Rating = 218.6 x Window Solar Factor - 68.5 x (Window Uvalue + Air Infiltration Factor)

The units are kWh/m²/year.

The factors in the equation are:

Window Solar Factor (g-value): This measures the amount of heat gain from sunlight. The Solar Factor is expressed as a number between 0 and 1. A lower Solar Factor means less heat gain.

Note: The value used is the whole window g-value (g_{window}) and not simply the glass g-value (g_{glass}).

Window Thermal transmittance (U-value): This measures how good a product is at preventing heat from escaping. The lower the U-value the better the product is at preventing heat escaping.

Note: The value used is the whole window U-value (U_{window}) and not simply the glass U-value (U_{glass}).

Window Air Leakage (L_{50} value)

The factor L_{50} in the formula is the air leakage factor. A lower number means less uncontrolled air leakage and heat loss. Windows with high air leakage lose more heat.

In all cases the data used is that of total window and not simply the glass or frame values.

The detailed window data

Window Solar Factor

In most cases the g-value for the glass will be available from the manufacturer or from the chosen BFRC Certified Simulator. Unless otherwise confirmed by the glass supplier it should be assumed that the given is the $g_{\perp}$- value. The conversion of the $g_{\perp}$- value to the required time-averaged g_w-value is carried out according to the simplified method given in EN 832 where: $g_w = g_{\perp} \times F_w$ where $F_w = 0,9$.

This is the g-value for the glass only(g_{glass}). The actual g-value to be used in the BFRC Rating equation is g_{window} (the whole window gvalue). It is therefore necessary to know the window sightlines and the proportion of glass in the window to calculate g_{window}.

Calculate the proportion of glass in the BFRC sample window from the sightlines of the frame and gaskets to give a 'glass fraction' value and apply this to the g_{glass} value to calculate g_{window} value for use in the BFRC Rating equation.

Note: The window sightlines used must include the presence of all gaskets and the worst (i.e. largest) of the inner and outer sightlines should be used in the calculation of the glass fraction.

Window Thermal transmittance

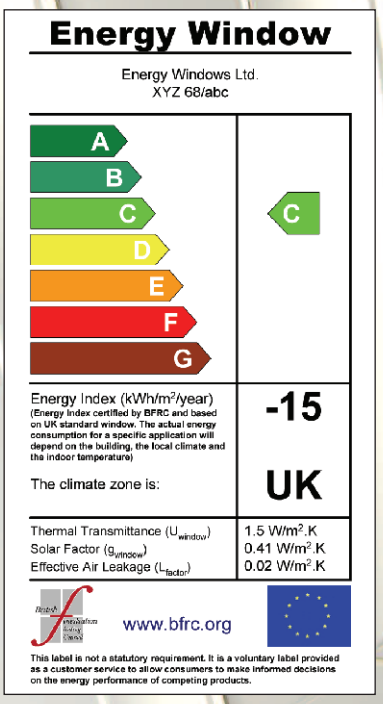
The U-value used for the BFRC Rating equation is that of the window (U_{window}) and not that of the glass (U_{glass}). This is as per the requirements of the current Building Regulations.

The centre pane U-value of the glass is not to be used under any circumstances.

The calculation of U_{window} is a detailed calculation and the use of simulation software is required. The U_{window} used in the BFRC Rating equation should always be provided from detailed simulations carried out by BFRC Certified Simulators to EN 10077-2.

Window Air Leakage

Air leakage rates for buildings and building components obtained from measurements are usually quoted for a pressure difference of 50 Pa. This is to provide a comparison between buildings or windows. The air leakage rate measured at 50 Pa (L_{50}) is not suitable for use in energy calculations and a much lower value, related to typical or average conditions, is needed. The L_{50} value must therefore be scaled back to provide the appropriate realistic value for air leakage.



BFRC RATINGS CALCULATIONS

To obtain the air leakage rate through the window for the purposes of the BFRC Ratingequation:

- Divide the air leakage at 50 Pa by 20, i.e. L = L_{50}/20 where both L and L_{50} are measured in $m^3/h/m^2$.

The air leakage rate (in $m^3/h/m^2$) must be converted to a heat loss rate (in W/m^2K) to be able to add the U and L factors in the BFRC Rating equation. This involves using the density and specific heat capacity of air and converting to the appropriate units.

Thus:

Heat loss (W/m^2K) = 0.33 L

and since L = L_{50} / 20:

Heat loss (W/m^2K) = 0.0165 L_{50}

where L_{50} is expressed in $m^3/h/m^2$ of window. This is the value to use in the BFRC Rating equation.

Note: The air leakage rate (L_{50}) to be used for this equation is that for the BFRC sample window (i.e. 1.48m x 1.23m with a central mullion and one opening light) fitted with the relevant profiles and gasket system.

Using existing results

It is unlikely that manufacturers will have current air leakage test results for the BFRC sample window at this stage. However, many manufacturers will have certified test results available from UKAS laboratories for air leakage testing to BS 6375 Part 1 (EN 42) *fitted with the relevant profiles and gasket system*. In this case the air leakage results can be given as a value of m3/h/m length of opening light. Where this is the case the following procedure should be used to convert the values:

- Calculate the total perimeter length of the opening light seal (m length of opening light) for the BFRC sample window.

Note: When using dual or multiple seal windows the perimeter length to be used is that of the innermost seal.

- Calculate the total air leakage through the window (m^3/h) by multiplying the perimeter length (m length of opening light) by the BS 6375 Part 1 (EN 42) value for air leakage at 50 Pa (in $m^3/h/m$ length of opening light).
- Calculate the effective L_{50} value ($m^3/h/m^2$) by dividing the total air leakage through the window (m^3/h) by 1.8204 (the area of the BFRC sample window in m^2, i.e. 1.48m x 1.23m).
- Calculate the Window Air Leakage heat loss by multiplying the effective L_{50} value ($m^3/h/m^2$) by 0.0165 to convert to the actual heat loss for the window.

Note: Only test results from UKAS accredited laboratories are acceptable for use in this process.

Putting the data together

The BFRC Rating number is calculated using the BFRC Rating equation:

BFRC Rating = 218.6g_{window} - 68.5

x (Uwindow + Effective L_{50}).

This gives the numerical BFRC Rating (generally a negative number) that can be converted to an A-G band using the table:

BFRC Rating Scale	BFRC Rating (kWh/m^2/year)
A	0 or greater
B	-10 to < 0
C	-20 to < -10
D	-30 to < -20
E	-50 to < -30
F	-70 to < -50
G	Less than -70