Technical Note No 48

U-values of windows

This Technical Note is one of four on the effect of building envelope performance on energy use in buildings. The series comprises:

> *TN 46   Introduction to building envelope energy transfer*
> *TN 47   Overall building envelope U-values*
> *TN 48   U-values of windows*
> *TN 49   U-values of curtain walls*

Introduction

This Technical Note introduces the reader to the assessment of energy transfer through windows in terms of overall U-values of windows.

Limits on window U-values to comply with the Building Regulations are described in Technical Note 47.

Windows

The basic parts of a window are the glazing, the frame, the weather strips and sealants, and the hardware.

For the purpose of heat transfer through windows, these parts can be categorised into two, ignoring the hardware:

- Frame including weather strips and sealants, and
- Glazing unit including single or multiple glass panes and spacer bar and sealant at the unit edge.

The components affecting the energy transfer through a window are: frame, glass, and the spacer bar.

Energy transfer through windows

Energy transfers through windows due to:

- Temperature difference between the warm and cold environments;
- Air leakage;
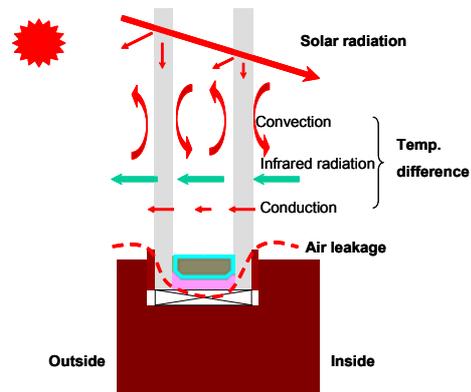- Solar radiation.

Figure 1   Energy transfer through window during heating season

The following part of this technical note deals only with the heat transfer due to temperature difference, which is measured in terms of U-value.

Heat transfer due to temperature difference

Heat transfer through a window, as shown in Figure 2, can be divided into three parts:

- One-dimensional heat transfer through glazing, Q_g, represented by centre pane U-value of glazing, U_g;
- Two-dimensional heat transfer through frame, Q_f, represented by frame U-value excluding edge effect, U_f;
- Two-dimensional heat transfer due to the interaction of the frame, the glass, and the spacer, Q_{edge}, known as the edge effect, represented by linear thermal transmittance, Ψ.