Fabric Losses

- Heat loss mechanisms
- Conduction - Quantified using U-values

u-value calculation

- Heat transfer through the Fabric, via conduction
- Does not measure heat loss via Convection or Radiation
- Assumes that the quality of the fabric is uninterrupted by air infiltration, which can result in increased losses through convection

U-Values

- Measured in Watts (W) per square (m^2) meter of fabric per degree of temperature (ºC) difference between inside and outside. (W/ m^2 ºC)
- Sometimes seen as W/ m^2 K

R-value

- In order to calculate a U-value the sum of the thermal resistances of individual materials within a particular element of structure must first be calculated. These are termed R-values and are a measure of how well a particular *thickness* of material resists the passage of heat by conduction (Baden Powell, 1999).
- Units are m^2K/W

k-value (or lambda value)

- Published figures of the thermal conductivity of materials.
- Units are W/mK.

Worked example

Matrix A Formula					thickness (m) / k-value (W/Mk)		R-value
Construction Type:							
External Wall							
Material Breakdown…	Thickness		conversion		k-value		R-value
	(mm)		1000		W/mK		
Block med weight	112	/		/		=	
Cavity	0	/		/			
Kingspan TW50 insulation	25	/		/		=	
Block med weight	100	/		/		=	
plasterboard	12	/		/		=	
Plaster	3	/		/		=	
Surface resistance inside	(Rsi) =		n/a		n/a	=	0.012
Surface resistance outside	(Rso) =		n/a		n/a	=	0.06
Resistance of air space	(Ra) =		n/a		n/a	=	0.18
				Sum of R-values		=	
Matrix B	U-value Formula		1				
			Sum of R-values + Rsi + Rso + Ra				
			Total U-Value (W/mK)			=	

Total Fabric loss formula

- **Q = 'U' . A . Δt**

Where:

Q = Heat transfer (W)

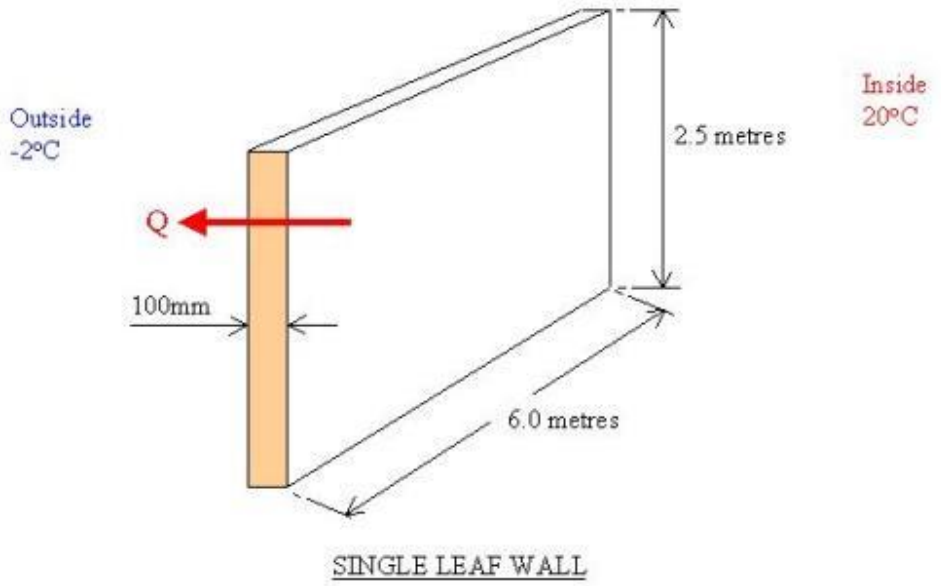
'U' = 'U' value (W/m^2degC)

A = Cross sectional area of wall (m^2)

δt = Temperature difference between inside & outside (degC)

Example

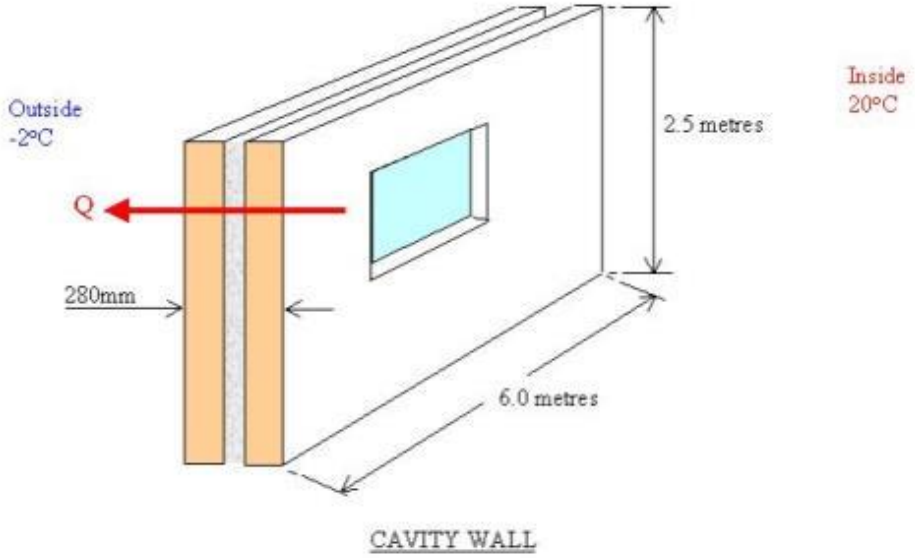
Calculate the heat flow through the wall shown below.



The 'U' value for the wall is 3.0 W/m^2 °C

Example 2

Calculate the heat flow through the wall shown below.



The 'U' value for the blockwork in the wall is 0.317 W/m^2 °C

The 'U' value for the double-glazed window is 2.8 W/m^2 °C.

The window size is 2.0 m long x 1.0 m high.

Answer

Q = 'U' . A . δt

First calculate the heat loss through the window.

Q = 2.8 x 2.0 x 1.0 x (20 - - 2)
Q = 2.8 x 2.0 x 22
Q = 123.20 Watts

Next calculate the heat loss through the blockwork.

Q = 0.317 x (15.0 - 2.0) x (20 - - 2)
Q = 0.317 x 13 x 22
Q = 90.66 Watts

Finally calculate the total heat loss

Q total = heat loss through window + heat loss through blockwork

Q total = 123.20 + 90.66

Q total = 213.86 Watts.