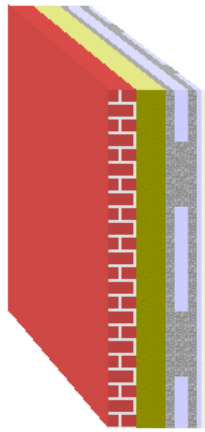
Documentation of the component 2. March 2011
Thermal transmittance (U-value) according to BS EN ISO 6946
Source: **own catalogue - Besblock**
Component: **Besblock Kappa Investigation 3**

OUTSIDE INSIDE



This illustration of inhomogeneous layers is provided only to assist in visualising the arrangement.

On the basis of the given information about the inhomogeneous layers, it is not possible to estimate how and where bearing elements intersect each other. It was assumed that the layers intersect crosswise. The size of the areas was calculated corresponding to their percentage of the whole area.

Assignment: External wall

		Manufacturer	Name	Thickness [m], number	Lambda [W/(mK)]	Q	R [m²K/W]
		Rse					0.0400
☑	1	Generic Building Materials	Brick outer leaf & Mortar outer leaf (f = 0.000 / automatic disregarding acc. BRE 4.4.3)	0.1020	0.770	D	0.1325
☑	2	Generic Building Materials	Mineral wool batt - Cavity Batts	0.1000	0.038	D	2.6316
		Fixings	Ancon RT2 50-100mm cavity No./m²:	2.5/m²	17.000	C	-
		Fixings	equivalent diameter: 3.090194E-03 m / alpha: 0.800				
		Air gaps	Level 1: dU" = 0.01 W/(m²K)				
☑	3	Generic Data via Besblock	Dense Natural Aggregate Concrete	0.0298	0.990	E	0.0301
☑	4	Inhomogeneous material layer	consisting of:	0.0425	ø 0.499		0.0852
	4a	BS EN ISO 6946	Unventilated airspace small: horizontal heat flow	61.95 %	0.197	D	-
		Airspace: mean temp.: 10°C / deltaT: <5 K / Epsilon1: 0.9 W/(m²K) / Epsilon2: 0.9 W/(m²K)					
	4b	Generic Data via Besblock	Dense Natural Aggregate Concrete	38.05 %	0.990	E	-
☑	5	Generic Data via Besblock	Dense Natural Aggregate Concrete	0.0298	0.990	E	0.0301
☑	6	Inhomogeneous material layer	consisting of:	0.0150	ø 0.156		0.0959
	6a	BS EN ISO 6946	Unventilated air layer: 15 mm, horiz. heat flow	80.00 %	0.088	D	-
	6b	Generic Building Materials	Plaster dabs -Gypsum [1200 kg/m³]	20.00 %	0.430	D	-
☑	7	Generic Building Materials	Standard wallboard plasterboard	0.0125	0.210	D	0.0595
		Rsi					0.1300
				0.3315			

Documentation of the component — 2. March 2011
Thermal transmittance (U-value) according to BS EN ISO 6946 — Page 2/4
Source: **own catalogue - Besblock**
Component: **Besblock Kappa Investigation 3**

$R_T = (R_T' + R_T'')/2 = 3.29$ m²K/W

Correction to U-value for	according to	delta U [W/(m²K)]
Mechanical fasteners	BS EN ISO 6946 Annex D	~~0.002~~
Air gaps	BS EN ISO 6946 Annex D	~~0.006~~
Air gaps and fixings corrections need not be applied, as their total effect is less than 3% (Annex D BS 6946:1996).		
		0.000

$U = 1/R_T + \Sigma\Delta U = 0.30$ W/(m²K)

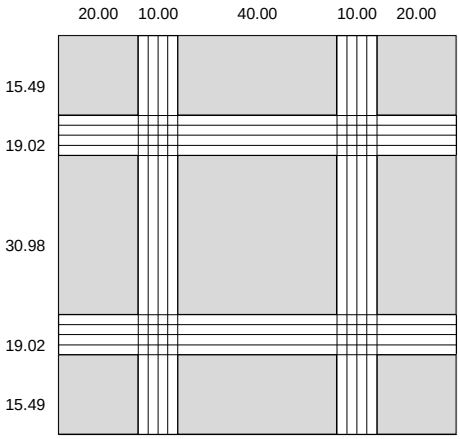
Q .. The physical values of the building materials has been graded by their level of quality. These 5 levels are the following
A .. A: Data is entered and validated by the manufacturer or supplier. Data is continuously tested by 3rd party.
B .. B: Data is entered and validated by the manufacturer or supplier. Data is certified by 3rd party
C .. C: Data is entered and validated by the manufacturer or supplier.
D .. D: Information is entered by BuildDesk without special agreement with the manufacturer, supplier or others.
E .. E: Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

U_{max} = 0.35 W/(m²K) — U = 0.30 W/(m²K) — R_T = 3.29 m²K/W

Source of Umax value: England, Wales: Approved Document L1A (2006), Table 2 - New Build Dwellings

Documentation of the component
Thermal transmittance (U-value) according to BS EN ISO 6946
Source: **own catalogue - Besblock**
Component: **Besblock Kappa Investigation 3**

Draft of the component (portion in %):



The intersection of the inhomogeneous layers results in 4 Zones (A, B, C, D). Information given in %.

A	3.10 + 6.20 + 3.10 + 6.20 + 12.39 + 6.20 + 3.10 + 6.20 + 3.10 consisting of material layers: 1, 2, 3, 4a, 5, 6a, 7	= 49.56%
B	1.55 + 3.10 + 1.55 + 1.55 + 3.10 + 1.55 consisting of material layers: 1, 2, 3, 4b, 5, 6a, 7	= 12.39%
C	3.81 + 7.61 + 3.81 + 3.81 + 7.61 + 3.81 consisting of material layers: 1, 2, 3, 4a, 5, 6b, 7	= 30.44%
D	1.90 + 1.90 + 1.90 + 1.90 consisting of material layers: 1, 2, 3, 4b, 5, 6b, 7	= 7.61%

Upper limit of the thermal transfer resistance R

U_A [W/(m²K)] = $\frac{1}{(\Sigma R_{i,A}) + R_{si} + R_{se}} = \frac{1}{3.27 + 0.13 + 0.04}$ = 0.29

U_B [W/(m²K)] = $\frac{1}{(\Sigma R_{i,B}) + R_{si} + R_{se}} = \frac{1}{3.13 + 0.13 + 0.04}$ = 0.30

U_C [W/(m²K)] = $\frac{1}{(\Sigma R_{i,C}) + R_{si} + R_{se}} = \frac{1}{3.10 + 0.13 + 0.04}$ = 0.31

U_D [W/(m²K)] = $\frac{1}{(\Sigma R_{i,D}) + R_{si} + R_{se}} = \frac{1}{2.96 + 0.13 + 0.04}$ = 0.32

$$R_T' = \frac{1}{A * U_A + B * U_B + C * U_C + D * U_D} = 3.34\ m^2K/W$$

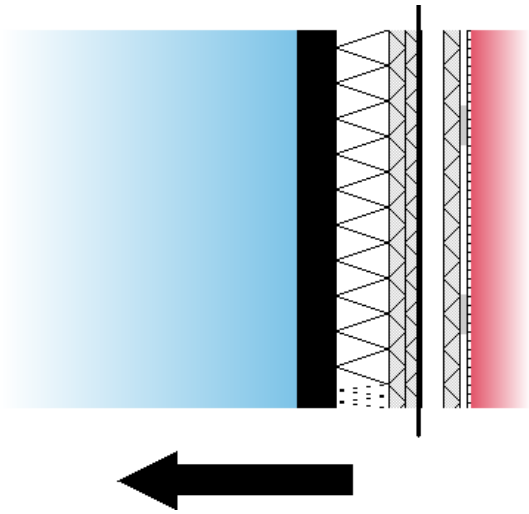
Lower limit of the thermal transfer resistance R

R_{se} [m²K/W]		= 0.04
R_1'' [m²K/W] = d_1/λ_1 =	0.1020 / 0.770	= 0.13
R_2'' [m²K/W] = d_2/λ'_2 =	0.1000 / 0.038	= 2.63
R_3'' [m²K/W] = d_3/λ_3 =	0.0298 / 0.990	= 0.03
R_4'' [m²K/W] = $d_4/(\lambda_{4a} * (A + B) + \lambda_{4b} * (C + D))$ =	0.0425 /(0.197 * 61.95% + 0.990 * 38.05%)	= 0.09
R_5'' [m²K/W] = d_5/λ_5 =	0.0298 / 0.990	= 0.03
R_6'' [m²K/W] = $d_6/(\lambda_{6a} * (A + C) + \lambda_{6b} * (B + D))$ =	0.0150 /(0.088 * 80.00% + 0.430 * 20.00%)	= 0.10
R_7'' [m²K/W] = d_7/λ_7 =	0.0125 / 0.210	= 0.06
R_{si} [m²K/W]		= 0.13

$$R_T'' = \Sigma R_i'' + R_{si} + R_{se} = 3.23\ m^2K/W$$

Documentation of the component
Heat capacity
Source: **own catalogue - Besblock**
Component: **Besblock Kappa Investigation 3**

OUTSIDE INSIDE



The list of materials shown below may differ from those in the U-value calculation printout. Only material layers which are used in the heat capacity calculation are listed.

Single material layers shown in the U-value calculation printout may be separated to meet the exclusion criteria:

A .. The total thickness of the layers exceed 0.1 m.
B .. The mid point in the construction is reached.

For insulation layers the following criteria applies:

C .. An insulating layer is reached (defined as lambda <= 0.08 W/(mK)).

	Name	Thickness [m]	lambda [W/(mK)]	Q	Thermal capacity [kJ/(kgK)]	Q	Density [kg/m³]	Q	Thermal mass kJ/(m²K)	Criteria Exclusion
	End of calculation - Cold									
1	Brick outer leaf & Mortar outer leaf (f = 0.000 / automatic disregarding acc. BRE 4.4.3)	0.1020	0.770	D	0.80	D	1700.0	D	~~138.7~~	A, -, C
2	Mineral wool batt - Cavity Batts	0.1000	0.038	D	1.03	D	25.0	D	~~0.0~~	A, -, C
3	Dense Natural Aggregate Concrete	0.0295	0.990	E	1.00	E	1800.0	E	~~53.1~~	A, -, -
3	Dense Natural Aggregate Concrete	0.0003	0.990	E	1.00	E	1800.0	E	0.5	-, -, -
4	Inhomogeneous material layer consisting of:	0.0425							29.1	-, -, -
4a	Unventilated airspace small: horizontal heat flow	61.95%	0.197	D	1.01	D	1.2	D	0.0	-, -, -
4b	Dense Natural Aggregate Concrete	38.05%	0.990	E	1.00	E	1800.0	E	29.1	-, -, -
5	Dense Natural Aggregate Concrete	0.0298	0.990	E	1.00	E	1800.0	E	53.6	-, -, -
6	Inhomogeneous material layer consisting of:	0.0150							3.6	-, -, -
6a	Unventilated air layer: 15 mm, horiz. heat flow	80.00%	0.088	D	1.01	D	1.2	D	0.0	-, -, -
6b	Plaster dabs -Gypsum [1200 kg/m³]	20.00%	0.430	D	1.00	D	1200.0	D	3.6	-, -, -
7	Standard wallboard plasterboard	0.0125	0.210	D	1.00	D	700.0	D	8.8	-, -, -
	Start of calculation - Warm									
		0.3315							**95.5**	

Heat capacity = 95.5 kJ/(m²K)

The following exclusion criteria apply:
A .. The total thickness of the layers exceed 0.1 m.
C .. An insulating layer is reached (defined as lambda <= 0.08 W/(mK)).

Q .. The physical values of the building materials has been graded by their level of quality. These 5 levels are the following
A .. A: Data is entered and validated by the manufacturer or supplier. Data is continuously tested by 3rd party.
B .. B: Data is entered and validated by the manufacturer or supplier. Data is certified by 3rd party
C .. C: Data is entered and validated by the manufacturer or supplier.
D .. D: Information is entered by BuildDesk without special agreement with the manufacturer, supplier or others.
E .. E: Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.