



Documentation of the component
Thermal transmittance (U-value) according to Digest 465

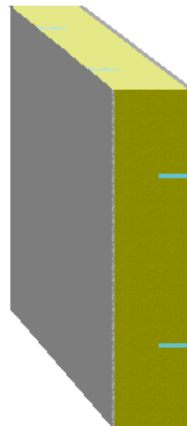
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Source: **own catalogue - Internal walls**

Component: **NCAF2797 Bowker Sadler Kingsway Int Wall 01**

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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: Internal wall

	Manufacturer	Name	Thickness [m], number	Lambda [W/(mK)]	Q	R [m²K/W]	
	Rse					0.1300	
☒	1	BS EN 12524	Gypsum plasterboard	0.0125	0.250	D	0.0500
☒	2	Light steel-frame	consisting of:	0.1000	ø 0.185		0.5408
	2a	Own catalogue	RWA45 Slabs	99.70 %	0.035	E	-
	2b	BS EN 12524	Steel	00.30 %	50.000	D	-
☒	3	Own catalogue	RWA45 Slabs	0.0500	0.035	E	1.4286
☒	4	Inhomogeneous material layer	consisting of:	0.1000	ø 0.185		0.5408
	4a	Own catalogue	RWA45 Slabs	99.70 %	0.035	E	-
	4b	BS EN 12524	Steel	00.30 %	50.000	D	-
☒	5	BS EN 12524	Gypsum plasterboard	0.0125	0.250	D	0.0500
	Rsi						0.1300
			0.2750				

The unheated space is regarded with a reduction factor b according to EN ISO 13789.

$$b = 1.00$$

$$R_T = p \cdot R_T' + (1-p) \cdot R_T'' = 4.65 \text{ m}^2\text{K/W}$$

$$U = b \cdot 1/R_T = 0.21 \text{ W/(m}^2\text{K)}$$

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.
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$$U_{\max} = \boxed{0.30 \text{ W/(m}^2\text{K)}}$$

$$U = \boxed{0.21 \text{ W/(m}^2\text{K)}} \quad R_T = \boxed{4.65 \text{ m}^2\text{K/W}}$$

Source of U_{max} value: England and Wales Approved Document L1A 2010 Tab 2 Dwellings New

Calculated with BuildDesk 3.4.5

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Steel percentage: 0.30 %

Light steel-frame, inhomogeneous layer: sections

24.92		A 	consisting of material layers: 1, 2a, 3, 4a, 5	= 99.40%
0.15		B 	consisting of material layers: 1, 2b, 3, 4a, 5	= 0.30%
49.85		C 	consisting of material layers: 1, 2a, 3, 4b, 5	= 0.30%
0.15		D 	consisting of material layers: 1, 2b, 3, 4b, 5	= 0.00%
24.92				

Upper limit of the thermal transfer resistance R

$U_A [W/(m^2K)] = \frac{1}{(\sum R_{i,A}) + R_{si} + R_{se}} =$	$\frac{1}{7.24 + 0.13 + 0.13}$	= 0.13
$U_B [W/(m^2K)] = \frac{1}{(\sum R_{i,B}) + R_{si} + R_{se}} =$	$\frac{1}{4.39 + 0.13 + 0.13}$	= 0.22
$U_C [W/(m^2K)] = \frac{1}{(\sum R_{i,C}) + R_{si} + R_{se}} =$	$\frac{1}{4.39 + 0.13 + 0.13}$	= 0.22
$U_D [W/(m^2K)] = \frac{1}{(\sum R_{i,D}) + R_{si} + R_{se}} =$	$\frac{1}{1.53 + 0.13 + 0.13}$	= 0.56

$$R_T' = \frac{1}{A * U_A + B * U_B + C * U_C + D * U_D} = 7.48 \text{ m}^2\text{K/W}$$

Lower limit of the thermal transfer resistance R

$R_{se} [m^2K/W] = d_1 / \lambda_{1.1} =$	$0.0125 / 0.250$	= 0.13
$R_1'' [m^2K/W] = d_1 / \lambda_{1.1} =$	$0.0125 / 0.250$	= 0.05
$R_2'' [m^2K/W] = d_2 / (\lambda_{2a} * (A + C) + \lambda_{2b} * (B + D)) =$	$0.1000 / (0.035 * 99.70\% + 50.000 * 0.30\%)$	= 0.54
$R_3'' [m^2K/W] = d_3 / \lambda_{3.3} =$	$0.0500 / 0.035$	= 1.43
$R_4'' [m^2K/W] = d_4 / (\lambda_{4a} * (A + B) + \lambda_{4b} * (C + D)) =$	$0.1000 / (0.035 * 99.70\% + 50.000 * 0.30\%)$	= 0.54
$R_5'' [m^2K/W] = d_5 / \lambda_{5.5} =$	$0.0125 / 0.250$	= 0.05
$R_{si} [m^2K/W]$		= 0.13

$$R_T'' = \sum R_i'' + R_{si} + R_{se} = 2.87 \text{ m}^2\text{K/W}$$



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Kind of frame:	Hybrid frame
Flange width:	known not to exceed 50 mm
Stud spacing s [m]:	0.600
Stud depth d [m]:	0.100
Web thickness t [m]:	0.00180
Steel percentage [%]:	0.30

Weight factor p

Formula: $p = 0,8 * (R_{T''}/R_T') + 0,32 - 0,2 * (0,6/s) - 0,04 * (d/0,1) = 0.387$

$$R_T = p * R_{T'} + (1-p) * R_{T''} = 4.65 \text{ m}^2\text{K/W}$$

Documentation of the component
Heat capacity

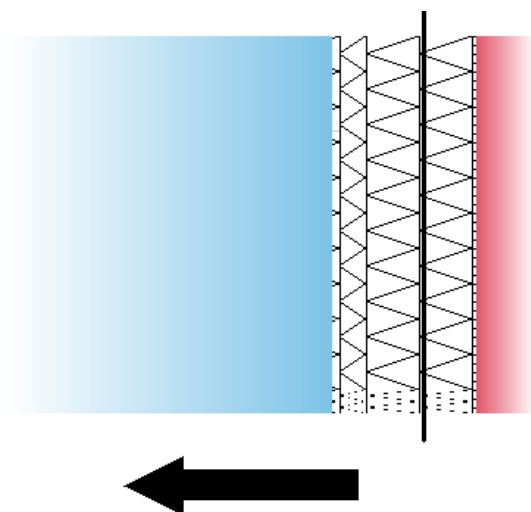
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The list of materials shown below may differ from those in the U-value calculation printout. Only material layers which are used in the heat capacity calculation are listed.

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 $\lambda \leq 0.08 \text{ W/(mK)}$).

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 Gypsum plasterboard	0.0125	0.250	D	1.00	D	900.0	D	11.3	A, -, C
2 Light steel-frame consisting of:	0.1000							1.1	A, -, C
2a RWA45 Slabs	99.70%	0.035	E	1.03	E	45.0	E	4.6	A, -, C
2b Steel	00.30%	50.000	D	0.45	D	7800.0	D	1.1	A, -, C
3 RWA45 Slabs	0.0500	0.035	E	1.03	E	45.0	E	0.0	A, -, C
4 Inhomogeneous material layer consisting of:	0.0125							0.1	A, -, C
4a RWA45 Slabs	99.70%	0.035	E	1.03	E	45.0	E	0.6	A, -, C
4b Steel	00.30%	50.000	D	0.45	D	7800.0	D	0.1	A, -, C
4 Inhomogeneous material layer consisting of:	0.0875							0.9	-, -, -
4a RWA45 Slabs	99.70%	0.035	E	1.03	E	45.0	E	4.0	-, -, C
4b Steel	00.30%	50.000	D	0.45	D	7800.0	D	0.9	-, -, -
5 Gypsum plasterboard	0.0125	0.250	D	1.00	D	900.0	D	11.3	-, -, -
Start of calculation - Warm									
0.2750								12.2	

Heat capacity = 12.2 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 $\lambda \leq 0.08 \text{ W/(mK)}$).

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