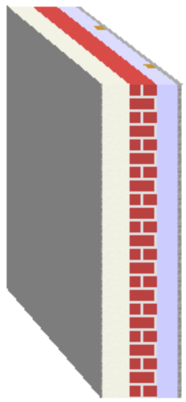
Documentation of the component
Thermal transmittance (U-value) according to BS EN ISO 6946
Source: **own catalogue - Own**
Component: **Typical Spooner Property**

OUTSIDE INSIDE



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

Assignment: External wall

		Manufacturer	Name	Thickness [m], number	Lambda [W/(mK)]	Q	R [m²K/W]
		Rse					0.04
☑	1	WBS	WBS Silicone Render	0.008	0.556	E	0.01
☑	2	WBS	WBS EPS	0.100	0.038	E	2.63
		Fixings	Plastic insulation anchors No./m²:	8/m²	0.500	D	-
		Air gaps	Level 1: dU" = 0.01 W/(m²K)				
☑	3	Own catalogue	Brick inner leaf & Mortar inner leaf (f = 0.000 / automatic disregarding acc. BRE 4.4.3)	0.102	0.560	E	0.18
☑	4	Own catalogue	Normal cavity - 50 mm, unventilated	0.050	0.278	E	0.18
☑	5	Inhomogeneous material layer	consisting of:	0.025	ø 0.138		0.18
	5a	Own catalogue	Normal cavity - 25 mm, unventilated	89.00 %	0.139	E	-
	5b	BS EN 12524	Softwood Timber [500 kg/m³]	11.00 %	0.130	D	-
☑	6	Own catalogue	Gypsum Plasterboard	0.013	0.250	E	0.05
		Rsi					0.13
				0.298			

$R_T = (R_T' + R_T'')/2 = 3.41$ m²K/W

Correction to U-value for	according to	delta U [W/(m²K)]
Mechanical fasteners	BS EN ISO 6946 Annex D	~~0.000~~
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

$U = 1/R_T + \Sigma\Delta U = 0.29$ 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 = **0.29** W/(m²K) R_T= **3.41** m²K/W

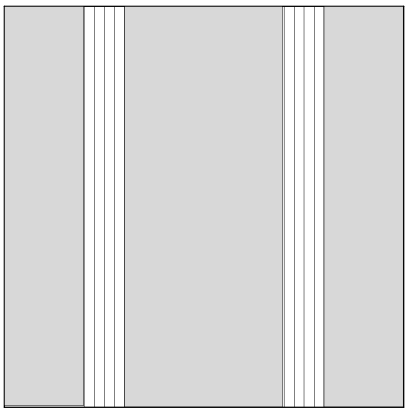
Source of Umax value: England, Wales: Approved Document L1A (2006), Table 2 - New Build Dwellings

Source: **own catalogue - Own**

Component: **Typical Spooner Property**

Draft of the component (portion in %):

22.25 5.50 44.50 5.50 22.25



The inhomogeneous layer consists of two zones (A, B).
The portion is given in %.

A	22.25 + 44.50 + 22.25 consisting of material layers: 1, 2, 3, 4, 5a, 6	= 89.00%
B	5.50 + 5.50 consisting of material layers: 1, 2, 3, 4, 5b, 6	= 11.00%

Upper limit of the thermal transfer resistance R

$$U_A\ [W/(m^2K)] = \frac{1}{(\Sigma R_{i,A}) + R_{si} + R_{se}} = \frac{1}{3.24 + 0.13 + 0.04} = 0.29$$

$$U_B\ [W/(m^2K)] = \frac{1}{(\Sigma R_{i,B}) + R_{si} + R_{se}} = \frac{1}{3.25 + 0.13 + 0.04} = 0.29$$

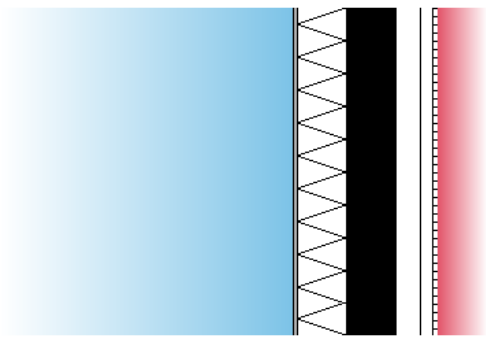
$$R_T' = \frac{1}{A * U_A + B * U_B} = 3.41\ m^2K/W$$

Lower limit of the thermal transfer resistance R

R_{se} [m²K/W]		= 0.04
R_1'' [m²K/W] = d_1 / λ_1=	0.008 / 0.556	= 0.01
R_2'' [m²K/W] = d_2 / λ'_2=	0.100 / 0.038	= 2.63
R_3'' [m²K/W] = d_3 / λ_3=	0.102 / 0.560	= 0.18
R_4'' [m²K/W] = d_4 / λ_4=	0.050 / 0.278	= 0.18
R_5'' [m²K/W] = $d_5 /(\lambda_{5a} * A + \lambda_{5b} * B)$ =	0.025 /(0.139 * 89.00% + 0.130 * 11.00%)	= 0.18
R_6'' [m²K/W] = d_6 / λ_6=	0.013 / 0.250	= 0.05
R_{si} [m²K/W]		= 0.13

$$R_T'' = \Sigma R_i'' + R_{si} + R_{se} = 3.41\ m^2K/W$$

OUTSIDE INSIDE



The list of material layers shown below may differ from those in the U-value calculation print out. Only material layers which are used in the Condensation Risk Analysis are listed.

This calculation of the Condensation risk analysis according to BS EN ISO 13788:2002 has been performed on a construction containing inhomogeneous layers. This calculation is only valid through the selected section. It is advisable that you should also select the alternative position and recalculate the Condensation Risk Analysis for a more complete assessment of the construction.

Assignment: External wall

Name	Thickn. [m]	lambda [W/(mK)]	Q	μ [-]	Q	sd [m]	R [m²K/W]
WBS Silicone Render	0.008	0.556	E	6.00	E	0.05	0.01
WBS EPS	0.100	0.038	E	60.00	E	6.00	2.63
Brick inner leaf & Mortar inner leaf (f = 0.000 / automatic disregarding acc. BRE 4.4.3)	0.102	0.560	E	45.00	E	4.59	0.18
Normal cavity - 50 mm, unventilated	0.050	0.278	E	1.00	E	0.05	0.18
Normal cavity - 25 mm, unventilated	0.025	0.139	E	1.00	E	0.03	0.18
Gypsum Plasterboard	0.013	0.250	E	4.00	E	0.05	0.05

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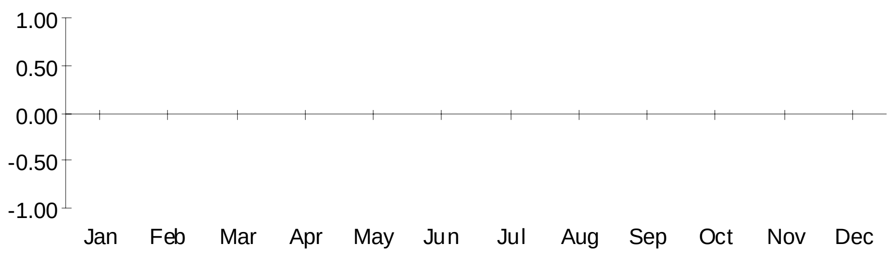
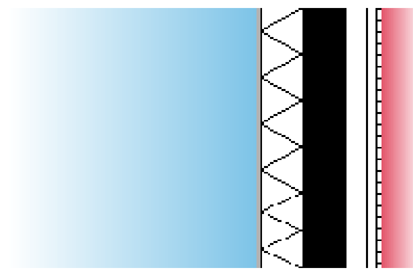
Condensation risk analysis - summary of main results
Calculation according BS EN ISO 13788

Surface temperature to avoid critical surface moisture:
No danger of mould growth is expected.

Interstitial condensation:
No condensation is predicted at any interface in any month.

Interstitial condensation and evaporation per month gc [g/m²]





Component, condensation range

CRA calculations according to BS EN ISO 13788:2002 are used as a guide in predicting interstitial condensation. This methodology uses some simplifications of the dynamic processes involved and subsequently does have some limitations. Further information can be found in Information Paper IP 2/05 'Modelling and controlling interstitial condensation in buildings'' Feb 2005.

Surface temperature to avoid critical surface humidity
Calculation according BS EN ISO 13788

Location: Leeds; Humidity class according BS EN ISO 13788 annex A: Dwellings with low occupancy

		1	2	3	4	5	6	7	8	9	10	11	12
	Month	Te	phi_e	Ti	phi_i	pe	delta p	pi	ps(Tsi)	Tsi,min	fRsi	Tsi	Tse
		[°C]	---	[°C]	---	[Pa]	[Pa]	[Pa]	[Pa]	[°C]	---	[°C]	[°C]
●	January	5.2	0.790	20.0	0.581	698	659	1358	1697	14.9	0.658	19.0	5.4
	February	5.0	0.760	20.0	0.569	663	668	1331	1664	14.6	0.642	18.9	5.2
	March	6.9	0.710	20.0	0.552	706	584	1290	1612	14.1	0.553	19.1	7.0
	April	8.1	0.700	20.0	0.550	756	530	1286	1607	14.1	0.504	19.2	8.2
	May	12.4	0.660	20.0	0.551	950	339	1288	1611	14.1	0.227	19.5	12.5
	June	14.6	0.670	20.0	0.579	1113	241	1353	1692	14.9	0.053	19.6	14.7
	July	16.7	0.680	20.0	0.616	1292	147	1439	1799	15.8	-0.260	19.8	16.7
	August	16.2	0.700	20.0	0.624	1288	169	1458	1822	16.0	-0.042	19.7	16.2
	September	13.5	0.710	20.0	0.594	1098	290	1388	1735	15.3	0.273	19.5	13.6
	October	11.0	0.790	20.0	0.615	1036	401	1437	1797	15.8	0.536	19.4	11.1
	November	7.0	0.810	20.0	0.595	811	579	1390	1738	15.3	0.639	19.1	7.1
	December	6.3	0.810	20.0	0.592	773	610	1383	1729	15.2	0.651	19.0	6.5

- The critical month is January with $f_{Rsi,max}$ = 0.658
  f_{Rsi} = 0.929

$f_{Rsi} > f_{Rsi,max}$, the component complies.

Nr Explanation

1 External temperature
2 External rel. humidity
3 Internal temperature
4 Internal relative humidity
5 External partial pressure $p_e = \phi_e * p_{sat}(T_e)$; $p_{sat}(T_e)$ according formula E.7 and E.8 of BS EN ISO 13788
6 Partial pressure difference. The security factor of 1.10 according to BS EN ISO 13788, ch.4.2.4 is already included.
7 Internal partial pressure $p_i = \phi_i * p_{sat}(T_i)$; $p_{sat}(T_i)$ according formula E.7 and E.8 of BS EN ISO 13788
8 Minimum saturation pressure on the surface obtained by $p_{sat}(T_{si}) = p_i / \phi_{si}$,
where ϕ_{si} = 0.8 (critical surface humidity)
9 Minimum surface temperature as function of $p_{sat}(T_{si})$, formula E.9 and E.10 of BS EN ISO 13788
10 Design temperature factor according 3.1.2 of BS EN ISO 13788
11 Internal surface temperature, obtained from $T_{si} = T_i - R_{si} * U * (T_i - T_e)$
12 External surface temperature, obtained from $T_{se} = T_e + R_{se} * U * (T_i - T_e)$

Interstitial condensation - main results
Calculation according BS EN ISO 13788

No condensation is predicted at any interface in any month.

Climcatic conditions
Location: Leeds; Humidity class according BS EN ISO 13788 annex A: Dwellings with low occupancy

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Internal temperature [°C]	Ti	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Internal rel. humidity [%]	phi_i	58.1	56.9	55.2	55.0	55.1	57.9	61.6	62.4	59.4	61.5	59.5	59.2
External temperature [°C]	Te	5.2	5.0	6.9	8.1	12.4	14.6	16.7	16.2	13.5	11.0	7.0	6.3
External rel. humidity [%]	phi_e	79.0	76.0	71.0	70.0	66.0	67.0	68.0	70.0	71.0	79.0	81.0	81.0