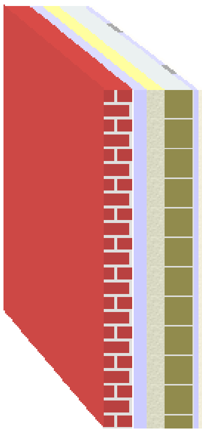
BuildDesk U 3.3

Documentation of the component — 2. February 2009
Thermal transmittance (U-value) according to BS EN ISO 6946 —
Source: **own catalogue - External walls**
Component: **Partial Fill, drylined wall - example**

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	Generic Building Materials	Brick outer leaf & Mortar outer leaf (f = 0.000 / automatic disregarding acc. BRE 4.4.3)	0.102	0.770	D	0.13
☑	2	Unventilated Airspace BR 443	Low E cavity - 50 mm, unventilated	0.050	0.113	D	0.44
☑	3	Generic Building Materials	Polyurethane - Variable thickness	0.060	0.025	D	2.40
		Fixings	Ancon RT2 101-125mm cavity No./m²:	2.5/m²	17.000	C	-
		Air gaps	Level 1: dU'' = 0.01 W/(m²K)				
☑	4	Generic Building Materials	Concrete block (dense) inner leaf (1800 kg/m³) & Mortar inner leaf (f = 0.000 / automatic disregarding acc. BRE 4.4.3)	0.100	1.130	D	0.09
☑	5	Inhomogeneous material layer	consisting of:	0.015	ø 0.156		0.10
	5a	BS EN ISO 6946	Unventilated air layer: 15 mm, horiz. heat flow	80.00 %	0.088	D	-
	5b	Generic Building Materials	Plaster dabs -Gypsum [1200 kg/m³]	20.00 %	0.430	D	-
☑	6	Generic Building Materials	Standard wallboard plasterboard	0.013	0.210	D	0.06
		Rsi					0.13
				0.340			

$R_T = (R_T' + R_T'')/2 = 3.41$ m²K/W

Correction to U-value for	according to	delta U [W/(m²K)]
Mechanical fasteners	BS EN ISO 6946 Annex D	~~0.002~~
Air gaps	BS EN ISO 6946 Annex D	~~0.005~~
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.
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E .. E: Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

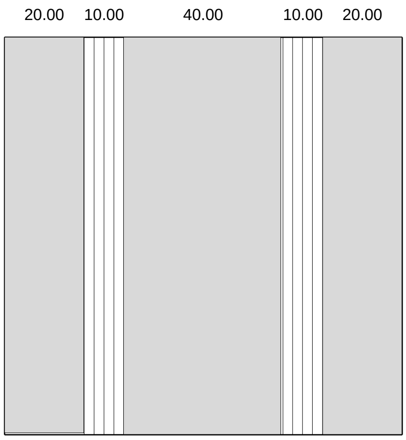
U_{max} = 0.35 W/(m²K) U = 0.29 W/(m²K) R_T = 3.41 m²K/W

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

Documentation of the component
Thermal transmittance (U-value) according to BS EN ISO 6946

Source: **own catalogue - External walls**
Component: **Partial Fill, drylined wall - example**

Draft of the component (portion in %):



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

A	20.00 + 40.00 + 20.00 consisting of material layers: 1, 2, 3, 4, 5a, 6	= 80.00%
B	10.00 + 10.00 consisting of material layers: 1, 2, 3, 4, 5b, 6	= 20.00%

Upper limit of the thermal transfer resistance R

U_A [W/(m²K)] = $\frac{1}{(\Sigma R_{i,A}) + R_{si} + R_{se}} = \frac{1}{3.29 + 0.13 + 0.04}$ = 0.29

U_B [W/(m²K)] = $\frac{1}{(\Sigma R_{i,B}) + R_{si} + R_{se}} = \frac{1}{3.16 + 0.13 + 0.04}$ = 0.30

$$R_T' = \frac{1}{A * U_A + B * U_B} = 3.44\ m^2K/W$$

Lower limit of the thermal transfer resistance R

R_{se} [m²K/W]		= 0.04
R_1'' [m²K/W] = d_1 / λ_1 =	0.102 / 0.770	= 0.13
R_2'' [m²K/W] = d_2 / λ_2 =	0.050 / 0.113	= 0.44
R_3'' [m²K/W] = d_3 / λ'_3 =	0.060 / 0.025	= 2.40
R_4'' [m²K/W] = d_4 / λ_4 =	0.100 / 1.130	= 0.09
R_5'' [m²K/W] = $d_5 / (\lambda_{5a} * A + \lambda_{5b} * B)$ =	0.015 /(0.088 * 80.00% + 0.430 * 20.00%)	= 0.10
R_6'' [m²K/W] = d_6 / λ_6 =	0.013 / 0.210	= 0.06
R_{si} [m²K/W]		= 0.13

$$R_T'' = \Sigma R_i'' + R_{si} + R_{se} = 3.39\ m^2K/W$$

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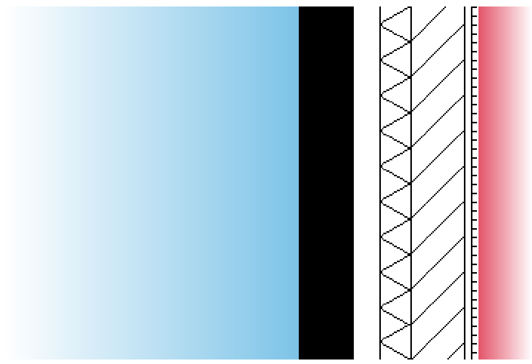
Component: **Partial Fill, drylined wall - example**



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]
Brick outer leaf & Mortar outer leaf (f = 0.000 / automatic disregarding acc. BRE 4.4.3)	0.102	0.770	D	45.00	D	4.59	0.13
Low E cavity - 50 mm, unventilated	0.050	0.113	D	1.00	D	0.05	0.44
Polyurethane - Variable thickness	0.060	0.025	D	50.00	D	3.00	2.40
Concrete block (dense) inner leaf (1800 kg/m³) & Mortar inner leaf (f = 0.000 / automatic disregarding acc. BRE 4.4.3)	0.100	1.130	D	120.00	D	12.00	0.09
Unventilated air layer: 15 mm, horiz. heat flow	0.015	0.088	D	1.00	D	0.02	0.17
Standard wallboard plasterboard	0.013	0.210	D	4.00	D	0.05	0.06

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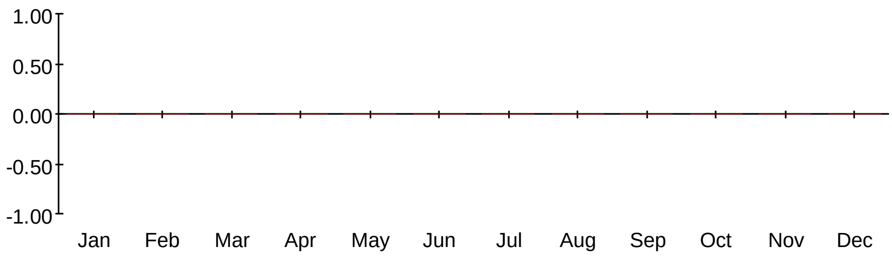
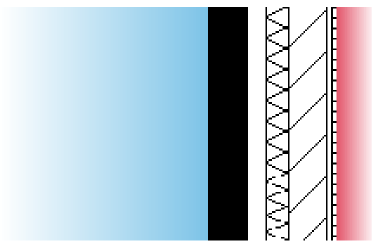
Condensation risk analysis - summary of main results
Calculation according BS EN ISO 13788

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: London (Heathrow); 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 [°C]	phi_e ---	Ti [°C]	phi_i ---	pe [Pa]	delta p [Pa]	pi [Pa]	ps(Tsi) [Pa]	Tsi,min [°C]	fRsi ---	Tsi [°C]	Tse [°C]
I	January	4.9	0.840	20.0	0.599	727	673	1400	1750	15.4	0.696	18.9	5.1
	February	4.7	0.820	20.0	0.591	700	682	1382	1727	15.2	0.687	18.9	4.9
	March	6.9	0.770	20.0	0.577	766	584	1349	1687	14.8	0.606	19.1	7.0
	April	8.8	0.710	20.0	0.557	804	499	1303	1628	14.3	0.490	19.2	8.9
	May	12.6	0.690	20.0	0.572	1006	330	1336	1670	14.7	0.281	19.5	12.7
	June	15.7	0.690	20.0	0.608	1230	192	1422	1777	15.7	-0.012	19.7	15.7
	July	17.9	0.680	20.0	0.637	1394	94	1487	1859	16.4	-0.734	19.9	17.9
	August	17.6	0.700	20.0	0.648	1408	107	1515	1894	16.6	-0.397	19.8	17.6
	September	14.9	0.750	20.0	0.641	1270	227	1497	1872	16.5	0.306	19.6	15.0
	October	11.2	0.810	20.0	0.629	1077	392	1469	1836	16.2	0.564	19.4	11.3
	November	7.6	0.840	20.0	0.611	876	552	1429	1786	15.7	0.656	19.1	7.7
	December	5.9	0.860	20.0	0.610	798	628	1426	1783	15.7	0.695	19.0	6.1

- The critical month is January with $f_{Rsi,max}$ = 0.696
  f_{Rsi} = 0.930

$f_{Rsi} > f_{Rsi,max}$, 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 $T_{se} = T_e + R_{se} * U * (T_i - T_e)$

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Interstitial condensation - main results
Calculation according BS EN ISO 13788

No condensation is predicted at any interface in any month.

Climcatic conditions
Location: London (Heathrow); 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	59.9	59.1	57.7	55.7	57.2	60.8	63.7	64.8	64.1	62.9	61.1	61.0
External temperature [°C]	Te	4.9	4.7	6.9	8.8	12.6	15.7	17.9	17.6	14.9	11.2	7.6	5.9
External rel. humidity [%]	phi_e	84.0	82.0	77.0	71.0	69.0	69.0	68.0	70.0	75.0	81.0	84.0	86.0