Back to Earth SW Ltd
7 Tuns Lane
Silverton, Exeter
Devon. EX5 4HY

Project Information
Reference
Date 14 September 2018

Construction Type
Element : Wall - 0 Spec generator copies
Internal surface emissivity : High External surface emissivity : High

	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Pitch (º)	Bridge details Air gaps (Level, Delta U")
Outside surface resistance	-	-	0.130		
Render, lime-sand	15.0	0.800	0.019		
Blockwork - outer leaf, medium	100.0	0.500	0.200		6.700% Mortar (10.0mm)
Airspace, heat flow horizontal, 50 mm thick	50.0	-	0.180		L:1 0.010W/m²K
Brick inner leaf	100.0	0.560	0.179		
Render, lime-sand	25.0	0.800	0.031		
UdiTHERM	60.0	0.039	1.500		L:0 0.000W/m²K
Multigrund	5.0	0.550	0.009		
Inside surface resistance	-	-	0.130		
Total thickness	**355.0mm**				

U-value = 0.42W/m²K

U-value, Combined Method : 0.422W/m²K (upper/lower limit 2.371 / 2.367m²K/W, dUf 0.0002, dUg 0.0001, dUp0.0000, dUr0.0000, dUrc1 0.0000, dUrc2 0.0000)

Correction factors
Mechanical fasteners :-
Wall with cavity fill, mild steel double triangle ties, 900 x 450 cntrs - walls upto 15m with >=90mm leaves
Alpha : 0.80 per m lambda f : 60.0000W/mK nf : 2.500 per m² Af : 12.500mm² Recess : 0.0mm
Delta Uf for Airspace, heat flow horizontal, 50 mm thick : 0.0002
nf = fasteners per m² Af = fasteners cross-sectional area
Air gaps, Delta Ug = 0.000W/m²K

(Based on the combined method for determining U-values of structures containing repeating thermal bridges)

	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)
Outside surface resistance	-	-	0.130	-	-
Render, lime-sand	15.0	0.800	0.019	50.00	0.75
Blockwork - outer leaf, medium	100.0	0.500	0.200	50.00	5.00
Airspace, heat flow horizontal, 50 mm thick	50.0	-	0.180	-	0.00
Brick inner leaf	100.0	0.560	0.179	50.00	5.00
Render, lime-sand	25.0	0.800	0.031	50.00	1.25
UdiTHERM	60.0	0.039	1.500	25.00	1.50
Multigrund	5.0	0.550	0.009	600.00	3.00
Inside surface resistance	-	-	0.130	-	-
Total thickness	**355.0mm**				

Detailed U-value Calculation Results

Construction includes 1 bridged layer

Non-bridged layers

Outside surface resistance	0.130 m²K/W
Render, lime-sand	0.019 m²K/W
Airspace, heat flow horizontal, 50 mm thick	0.180 m²K/W
Brick inner leaf	0.179 m²K/W
Render, lime-sand	0.031 m²K/W
UdiTHERM	1.500 m²K/W
Multigrund	0.009 m²K/W
Inside surface resistance	0.130 m²K/W
Resistance of non-bridged layers, R_{NB} =	2.178 m²K/W

Bridged layer

Blockwork - outer leaf, medium (L1) bridged by Mortar (B1)

Path 1 - Blockwork
Path 2 - Mortar

Resistance and fraction of heat flow paths

$R_{P1} = R_{NB} + R_{L1} = 2.178 + 0.200 = 2.378$ m²K/W $F_{P1} = 93.300\%$

$R_{P2} = R_{NB} + R_{L2} = 2.178 + 0.106 = 2.284$ m²K/W $F_{P2} = 6.700\%$

Upper resistance limit

$R_{upper} = 1 / ((F_{P1}/R_{P1}) + (F_{P2}/R_{P2}))$

$R_{upper} = 1 / ((0.933/2.378) + (0.067/2.284)) = 2.371$m²K/W

Lower resistance limit

$R_{lower} = R_{NB} + 1 / ((F_{L1}/R_{L1}) + (F_{B1}/R_{B1}))$

$R_{lower} = 2.178 + 1 / ((0.933/0.200) + (0.067/0.106)) = 2.367$m²K/W

Total resistance of wall

$R_T = (R_{upper} + R_{lower}) / 2 = (2.371 + 2.367) / 2 = 2.37$ m²K/W

Mechanical fasteners :-

Calculations to BS EN ISO 6946:2007

Wall with cavity fill, mild steel double triangle ties, 900 x 450 cntrs - walls upto 15m with >=90mm leaves
Alpha : 0.80 per m lambda f : 60.0000W/mK nf : 2.500 per m² Af : 12.500mm² Recess : 0.0mm
Delta Uf for Airspace, heat flow horizontal, 50 mm thick : 0.0002
Correction for air gaps, Delta Ug = 0.0001W/m²K

(Delta Uf + Delta Ug + Delta Up + Delta Ur) is less than 3% of (1 / Rt) so U = (1 / Rt) + (Delta Ur) + (Delta Urc) = 0.42 W/m²K

Structure element : Wall
Condensation calculations performed in accordance with BS5250:2011

Condensation is occuring at the following layers interfaces:-
Interface 1 : Render, lime-sand / UdiTHERM

Month	Int (C°)	Int (%RH)	Ext (C°)	Ext (%RH)	Interface 1 Gc (Kg/m²)	Ma (Kg/m²)
Jan	21.00	54.70	3.50	86.00	0.02469	0.02867
Feb	21.00	53.80	3.80	82.50	-0.00435	0.02432
Mar	21.00	53.90	5.70	80.00	-0.07459	0.00000
Apr	21.00	54.40	8.00	77.00	0.00000	0.00000
May	21.00	57.90	11.30	77.00	0.00000	0.00000
Jun	21.00	62.20	14.40	76.00	0.00000	0.00000
Jul	21.00	66.80	16.50	76.50	0.00000	0.00000
Aug	21.00	67.40	16.10	78.50	0.00000	0.00000
Sep	21.00	64.60	13.80	81.50	0.00000	0.00000
Oct	21.00	60.80	10.70	84.00	0.00000	0.00000
Nov	21.00	56.50	6.40	85.50	0.00000	0.00000
Dec	21.00	55.50	4.50	86.50	0.00398	0.00398

Gc = Monthly moisture accumulation per area at an interface
Ma = Accumulated moisture content per area at an interface

Peak accumulated moisture content per area at interface (Ma) = 0.02867 Kg/m²

Annual moisture accumulation = 0.00000 Kg/m²

Project Information
Reference
Date 14 September 2018

Thermal Mass Details

	Thickness assessed (actual) (mm)	Density (kg/m³)	Specific heat capacity (J/kgK)	Heat capacity (kJ/m²K)
Render, lime-sand	0.0 (15.0)	1600.0	1000.0	0.0
Blockwork - outer leaf, medium	0.0 (100.0)	1400.0	840.0	0.0
Airspace, heat flow horizontal, 50 mm thick	0.0 (50.0)	1.2	1008.0	0.0
Brick inner leaf	0.0 (100.0)	1700.0	840.0	0.0
Render, lime-sand	0.0 (25.0)	1600.0	1000.0	0.0
UdiTHERM	0.0 (60.0)	140.0	2100.0	0.0
Multigrund	5.0 (5.0)	1300.0	1000.0	6500000.0
Total				6500000.0
kappa value				6.5000

Limiting condition: insulation

Admittance : 1.06 W/m²K Decrement : 0.09 factor Decrement delay : -12.92 hours

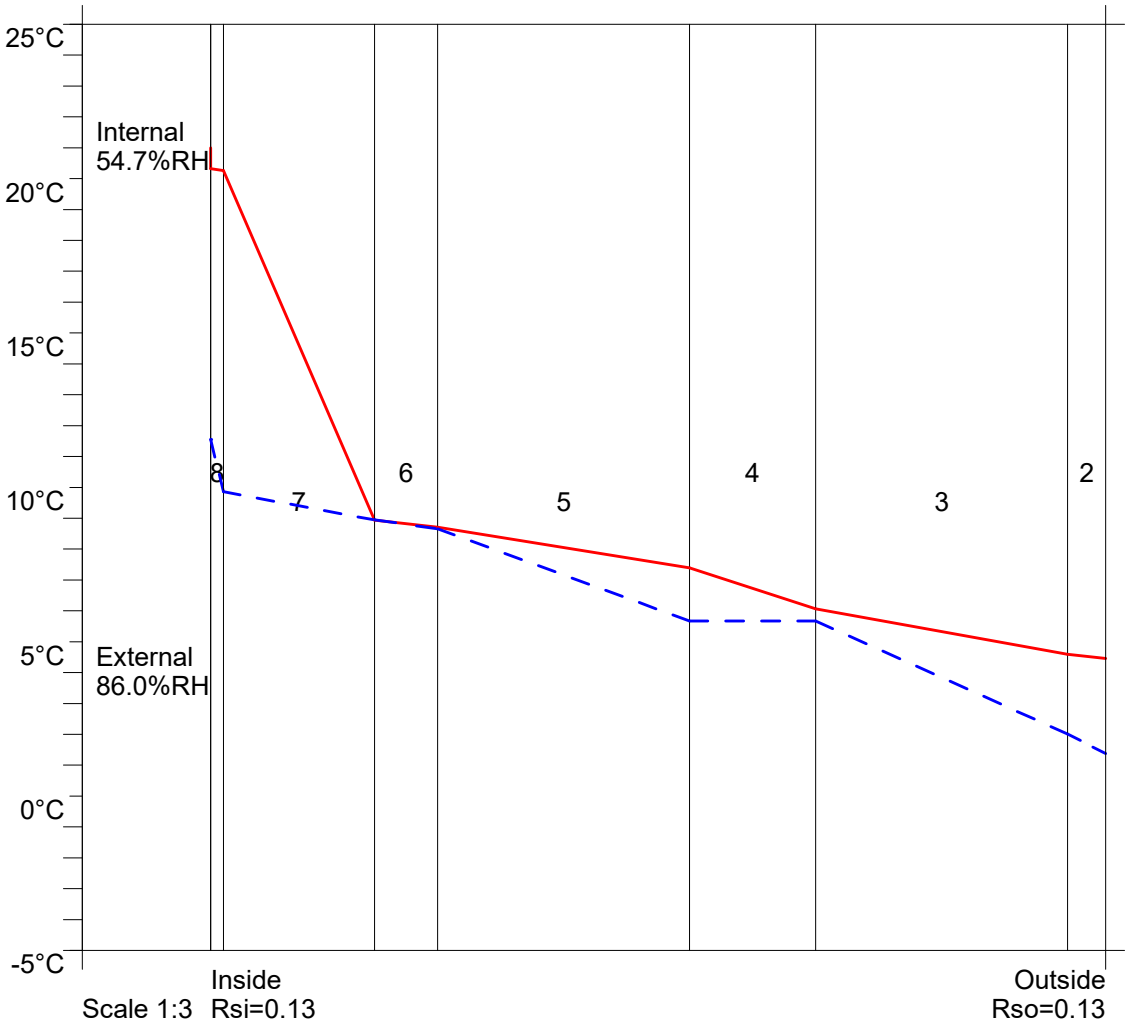
Condensation Risk Analysis (no account taken of thermal bridges)

3 - Dwellings with low occupancy

Jan (worst)	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
21.0C 54.7%	21.0C 53.8%	21.0C 53.9%	21.0C 54.4%	21.0C 57.9%	21.0C 62.2%	21.0C 66.8%	21.0C 67.4%	21.0C 64.6%	21.0C 60.8%	21.0C 56.5%	21.0C 55.5%
3.5C 86.0%	3.8C 82.5%	5.7C 80.0%	8.0C 77.0%	11.3C 77.0%	14.4C 76.0%	16.5C 76.5%	16.1C 78.5%	13.8C 81.5%	10.7C 84.0%	6.4C 85.5%	4.5C 86.5%

	Interface Temp. ºC	Dewpoint Temp. ºC	Vapour Pressure (kPa)	Saturated V.P. (kPa)	Worst Cond. (g/m²)	Peak Buildup (g/m²)	Conden-sation
1 Outside surface resistance	4.5	1.4	0.67	0.84			No
2 Render, lime-sand	4.6	2.0	0.71	0.85			No
3 Blockwork - outer leaf, medium	6.1	5.7	0.91	0.94		0 in Jan	No
4 Airspace, heat flow horizontal, 50 mm thick (Delta U" = 0.010W/m²K)	7.4	5.7	0.91	1.03			No
5 Brick inner leaf	8.7	8.7	1.12	1.13		0 in Feb	No
6 Render, lime-sand	8.9	8.9	1.14	1.14	25 in Jan	29 in Jan	Yes
7 UdiTHERM	20.3	9.9	1.21	2.37			No
8 Multigrund	20.3	11.5	1.36	2.38			No
9 Inside surface resistance							

Worst case internal / external conditions for graph : 21.0°C @ 54.7%RH / 3.5°C @ 86.0%RH



Condensation Risk Analysis (no account taken of thermal bridges)

3 - Dwellings with low occupancy

Jan (worst)	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
21.0C 54.7%	21.0C 53.8%	21.0C 53.9%	21.0C 54.4%	21.0C 57.9%	21.0C 62.2%	21.0C 66.8%	21.0C 67.4%	21.0C 64.6%	21.0C 60.8%	21.0C 56.5%	21.0C 55.5%
3.5C 86.0%	3.8C 82.5%	5.7C 80.0%	8.0C 77.0%	11.3C 77.0%	14.4C 76.0%	16.5C 76.5%	16.1C 78.5%	13.8C 81.5%	10.7C 84.0%	6.4C 85.5%	4.5C 86.5%

	Interface Temp. ºC	Dewpoint Temp. ºC	Vapour Pressure (kPa)	Saturated V.P. (kPa)	Worst Cond. (g/m²)	Peak Buildup (g/m²)	Conden-sation
1 Outside surface resistance	16.7	12.4	1.44	1.91			No
2 Render, lime-sand	16.8	12.5	1.45	1.91			No
3 Blockwork - outer leaf, medium	17.2	13.2	1.51	1.96		0 in Jan	No
4 Airspace, heat flow horizontal, 50 mm thick (Delta U" = 0.010W/m²K)	17.5	13.2	1.51	2.00			No
5 Brick inner leaf	17.8	13.9	1.58	2.04		0 in Feb	No
6 Render, lime-sand	17.9	14.0	1.60	2.05	25 in Jan	29 in Jan	Yes
7 UdiTHERM	20.8	14.2	1.62	2.46			No
8 Multigrund	20.8	14.6	1.66	2.46			No
9 Inside surface resistance							

Worst case internal / external conditions for graph : 21.0°C @ 66.8%RH / 16.5°C @ 76.5%RH