

Back to Earth SW Ltd

7 Tuns Lane
Silverton, Exeter
Devon. EX5 4HY

Project Information

Reference

Date 14 September 2018

Construction Type

Element : Pitched roof, ceiling at rafter line - 0 Spec generator copies

Internal surface emissivity : High

External surface emissivity : High

	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m ² K/W)	Pitch (°)	Bridge details Air gaps (Level, Delta U")
Outside surface resistance	-	-	0.100		
Airspace, heat flow upwards, 50 mm thick	50.0	-	0.160		
Beltermo Ultra	50.0	0.042	1.150		L:0 0.000W/m ² K
Beltermo Kombi	100.0	0.038	2.600		L:0 0.000W/m ² K
SteicoFlex	50.0	0.036	1.350		9.000% Softwood (50.0mm) L:0 0.000W/m ² K
Oriented strandboard (OSB)	11.0	0.130	0.085		
Ampatex Sinco	-	-	-		
Airspace, heat flow upwards, 25 mm thick	25.0	-	0.160		
Gyproc Wallboard	12.5	0.189	0.066		
Inside surface resistance	-	-	0.100		

Total thickness 298.5mm

U-value = 0.18W/m²K

U-value, Combined Method : 0.179W/m²K (upper/lower limit 5.668 / 5.522m²K/W, dUf 0.0000, dUg 0.0000, dUp0.0000, dUr0.0000, dUrc1 0.0000, dUrc2 0.0000)

Correction factors

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 (m ² K/W)	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)
Outside surface resistance	-	-	0.100	-	-
Airspace, heat flow upwards, 50 mm thick	50.0	-	0.160	-	0.00
Beltermo Ultra	50.0	0.042	1.150	15.00	0.75
Beltermo Kombi	100.0	0.038	2.600	15.00	1.50
SteicoFlex	50.0	0.036	1.350	5.00	0.25
Oriented strandboard (OSB)	11.0	0.130	0.085	250.00	2.75
Ampatex Sinco	-	-	-	-	25.00
Airspace, heat flow upwards, 25 mm thick	25.0	-	0.160	-	0.00
Gyproc Wallboard	12.5	0.189	0.066	50.00	0.63
Inside surface resistance	-	-	0.100	-	-
Total thickness	298.5mm				

Detailed U-value Calculation Results

Construction includes 1 bridged layer

Non-bridged layers

Outside surface resistance	0.100 m ² K/W
Airspace, heat flow upwards, 50 mm thick	0.160 m ² K/W
Beltermo Ultra	1.150 m ² K/W
Beltermo Kombi	2.600 m ² K/W
Oriented strandboard (OSB)	0.085 m ² K/W
Airspace, heat flow upwards, 25 mm thick	0.160 m ² K/W
Gyproc Wallboard	0.066 m ² K/W
Inside surface resistance	0.100 m ² K/W
Resistance of non-bridged layers, R_{NB} =	<u>4.421 m²K/W</u>

Bridged layer

SteicoFlex (L1) bridged by Softwood (B1)

Path 1 - SteicoFlex

Path 2 - Softwood

Resistance and fraction of heat flow paths

$$R_{P1} = R_{NB} + R_{L1} = 4.421 + 1.350 = 5.771 \text{ m}^2\text{K/W} \quad F_{P1} = 91.000\%$$

$$R_{P2} = R_{NB} + R_{L2} = 4.421 + 0.385 = 4.805 \text{ m}^2\text{K/W} \quad F_{P2} = 9.000\%$$

Upper resistance limit

$$R_{upper} = 1 / \left(\frac{F_{P1}}{R_{P1}} + \frac{F_{P2}}{R_{P2}} \right)$$

$$R_{upper} = 1 / \left(\frac{0.910}{5.771} + \frac{0.090}{4.805} \right) = 5.668 \text{ m}^2\text{K/W}$$

Lower resistance limit

$$R_{lower} = R_{NB} + 1 / \left(\frac{F_{L1}}{R_{L1}} + \frac{F_{B1}}{R_{B1}} \right)$$

$$R_{lower} = 4.421 + 1 / \left(\frac{0.910}{1.350} + \frac{0.090}{0.385} \right) = 5.522 \text{ m}^2\text{K/W}$$

Total resistance of roof

$$R_T = (R_{upper} + R_{lower}) / 2 = (5.668 + 5.522) / 2 = 5.59 \text{ m}^2\text{K/W}$$

Correction for air gaps, $\Delta U_g = 0.0000 \text{ W/m}^2\text{K}$

($\Delta U_f + \Delta U_g + \Delta U_p + \Delta U_r$) is less than 3% of $(1 / R_T)$ so $U = (1 / R_T) + (\Delta U_r) + (\Delta U_{rc}) = 0.18 \text{ W/m}^2\text{K}$

Structure element : Pitched roof, ceiling at rafter line
Condensation calculations performed in accordance with BS5250:2011

Condensation is occurring at the following layers interfaces:-

Month	Int (C°)	Int (%RH)	Ext (C°)	Ext (%RH)
Jan	21.00	56.10	5.90	85.50
Feb	21.00	55.20	5.70	83.50
Mar	21.00	55.50	6.90	82.00
Apr	21.00	56.20	8.80	79.50
May	21.00	59.30	11.50	79.00
Jun	21.00	64.30	14.30	79.50
Jul	21.00	68.80	16.10	80.50
Aug	21.00	69.30	16.00	81.50
Sep	21.00	66.60	14.30	83.00
Oct	21.00	63.20	11.90	85.00
Nov	21.00	58.20	8.50	84.50
Dec	21.00	57.00	7.00	85.50

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) = 0.00000 Kg/m²

Annual moisture accumulation = 0.00000 Kg/m²

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Thermal Mass Details

	Thickness assessed (actual) (mm)	Density (kg/m ³)	Specific heat capacity (J/kgK)	Heat capacity (kJ/m ² K)
Airspace, heat flow upwards, 50 mm thick	0.0 (50.0)	1.2	1008.0	0.0
Beltermo Ultra	0.0 (50.0)	180.0	2100.0	0.0
Beltermo Kombi	0.0 (100.0)	110.0	2100.0	0.0
SteicoFlex	0.0 (50.0)	50.0	2100.0	0.0
Oriented strandboard (OSB)	11.0 (11.0)	650.0	1700.0	12155000.0
Ampatex Sinco	0.0 (-)	280.0	850.0	0.0
Airspace, heat flow upwards, 25 mm thick	25.0 (25.0)	1.2	1008.0	30996.0
Gyproc Wallboard	12.5 (12.5)	950.0	850.0	10093750.0
Total				22279746.0
kappa value				22.2797
Limiting condition:	insulation			

Admittance : 1.62 W/m²K Decrement : 0.31 factor Decrement delay : -10.72 hours

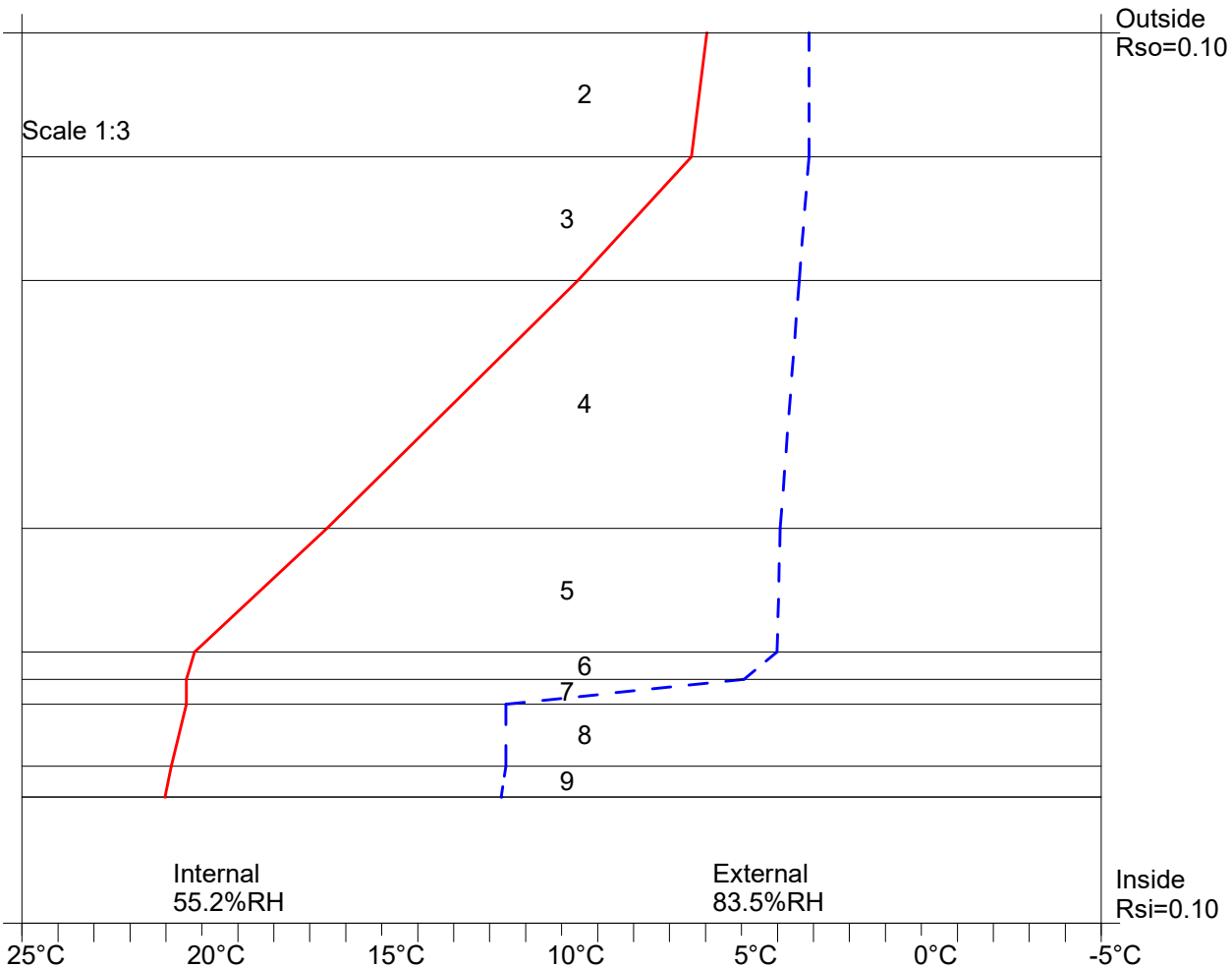
Condensation Risk Analysis (no account taken of thermal bridges)

3 - Dwellings with low occupancy

Jan	Feb (worst)	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
21.0C 56.1%	21.0C 55.2%	21.0C 55.5%	21.0C 56.2%	21.0C 59.3%	21.0C 64.3%	21.0C 68.8%	21.0C 69.3%	21.0C 66.6%	21.0C 63.2%	21.0C 58.2%	21.0C 57.0%
5.9C 85.5%	5.7C 83.5%	6.9C 82.0%	8.8C 79.5%	11.5C 79.0%	14.3C 79.5%	16.1C 80.5%	16.0C 81.5%	14.3C 83.0%	11.9C 85.0%	8.5C 84.5%	7.0C 85.5%

	Interface Temp. °C	Dewpoint Temp. °C	Vapour Pressure (kPa)	Saturated V.P. (kPa)	Worst Cond. (g/m ²)	Peak Buildup (g/m ²)	Condensation
1 Outside surface resistance							
2 Airspace, heat flow upwards, 50 mm thick	6.0	3.1	0.76	0.93			No
3 Beltermo Ultra	6.4	3.1	0.76	0.96			No
4 Beltermo Kombi	9.5	3.4	0.78	1.19			No
5 SteicoFlex	16.5	3.9	0.81	1.88			No
6 Oriented strandboard (OSB)	20.2	4.0	0.81	2.37			No
7 Ampatex Sinco	20.4	4.9	0.87	2.40			No
8 Airspace, heat flow upwards, 25 mm thick	20.4	11.5	1.36	2.40			No
9 Gyproc Wallboard	20.9	11.5	1.36	2.46			No
10 Inside surface resistance	21.0	11.7	1.37	2.49			No

Worst case internal / external conditions for graph : 21.0°C @ 55.2%RH / 5.7°C @ 83.5%RH



Condensation Risk Analysis (no account taken of thermal bridges)

3 - Dwellings with low occupancy

Jan	Feb (worst)	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
21.0C 56.1%	21.0C 55.2%	21.0C 55.5%	21.0C 56.2%	21.0C 59.3%	21.0C 64.3%	21.0C 68.8%	21.0C 69.3%	21.0C 66.6%	21.0C 63.2%	21.0C 58.2%	21.0C 57.0%
5.9C 85.5%	5.7C 83.5%	6.9C 82.0%	8.8C 79.5%	11.5C 79.0%	14.3C 79.5%	16.1C 80.5%	16.0C 81.5%	14.3C 83.0%	11.9C 85.0%	8.5C 84.5%	7.0C 85.5%

	Interface Temp. °C	Dewpoint Temp. °C	Vapour Pressure (kPa)	Saturated V.P. (kPa)	Worst Cond. (g/m ²)	Peak Buildup (g/m ²)	Condensation
1 Outside surface resistance							
2 Airspace, heat flow upwards, 50 mm thick	16.2	12.8	1.47	1.84			No
3 Beltermo Ultra	16.3	12.8	1.47	1.85			No
4 Beltermo Kombi	17.3	12.8	1.48	1.98			No
5 SteicoFlex	19.6	12.9	1.49	2.27			No
6 Oriented strandboard (OSB)	20.7	13.0	1.49	2.45			No
7 Ampatex Sinco	20.8	13.2	1.51	2.46			No
8 Airspace, heat flow upwards, 25 mm thick	20.8	15.0	1.71	2.46			No
9 Gyproc Wallboard	21.0	15.0	1.71	2.48			No
10 Inside surface resistance	21.0	15.1	1.71	2.49			No

Worst case internal / external conditions for graph : 21.0°C @ 68.8%RH / 16.1°C @ 80.5%RH

