

Back to Earth SW Ltd

7 Tuns Lane
Silverton
Exeter
EX5 4HY

Project Information

Reference

Date 9 January 2024

Construction Type

Element : BRE443 Pitched roof - insulation at ceiling level - Loft Insulation-150

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	-	-	0.040		
Sheeted roof, or tiled roof with felt or boards or similar under the tiles	-	-	0.200		
Particleboard (600 mg/m ³)	18.0	0.000	0.000		
Beltermo Ultra	120.0	0.042	2.850		L:0 0.000W/m ² K
SteicoFlex	100.0	0.036	2.750		9.000% Softwood (100.0mm)
SteicoFlex	150.0	0.036	4.150		L:0 0.000W/m ² K 13.500% Softwood (150.0mm)
SteicoFlex					L:0 0.000W/m ² K
Ampatex Sinco	-	-	-		
Gyproc Wallboard	12.5	0.190	0.066		
Inside surface resistance	-	-	0.100		
Total thickness	400.5mm				

U-value = 0.11W/m²K

U-value, Combined Method : 0.114W/m²K (upper/lower limit 9.387 / 8.561m²K/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

Loft hatch (50mm loft hatch insulation), Delta U = 0.003W/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	-	-	0.040	-	-
Sheeted roof, or tiled roof with felt or boards or similar under the tiles	-	-	0.200	-	-
Particleboard (600 mg/m ³)	18.0	0.000	0.000	250.00	4.50
Beltermo Ultra	120.0	0.042	2.850	15.00	1.80
SteicoFlex	100.0	0.036	2.750	5.00	0.50
SteicoFlex	150.0	0.036	4.150	5.00	0.75
Ampatex Sinco	-	-	-	-	25.00
Gyproc Wallboard	12.5	0.190	0.066	50.00	0.63
Inside surface resistance	-	-	0.100	-	-
Total thickness	400.5mm				

Detailed U-value Calculation Results

Construction includes 2 bridged layers

Non-bridged layers

Outside surface resistance	0.035 m ² K/W (0.040 * cos(30.0))
Sheeted roof, or tiled roof with felt or boards or similar under the tiles	0.200 m ² K/W
Particleboard (600 mg/m ³)	0.000 m ² K/W
Beltermo Ultra	2.850 m ² K/W
Gyproc Wallboard	0.066 m ² K/W
Inside surface resistance	0.100 m ² K/W
<u>Resistance of non-bridged layers, R_{NB} =</u>	<u>3.256 m²K/W</u>

Bridged layers

SteicoFlex (L1) bridged by Softwood (B1)
SteicoFlex (L2) bridged by Softwood (B2)

Path 1 - SteicoFlex
Path 2 - Softwood /
Path 3 - SteicoFlex
Path 4 - Softwood /

Resistance and fraction of heat flow paths

$$\begin{aligned}R_{P1} &= R_{NB} + R_{L1} = 3.256 + 6.900 = 10.156 \text{ m}^2\text{K/W} & F_{P1} &= 78.715\% \\R_{P2} &= R_{NB} + R_{L2} = 3.256 + 4.919 = 8.175 \text{ m}^2\text{K/W} & F_{P2} &= 7.785\% \\R_{P3} &= R_{NB} + R_{L3} = 3.256 + 3.904 = 7.160 \text{ m}^2\text{K/W} & F_{P3} &= 12.285\% \\R_{P4} &= R_{NB} + R_{L4} = 3.256 + 1.923 = 5.179 \text{ m}^2\text{K/W} & F_{P4} &= 1.215\%\end{aligned}$$

Upper resistance limit

$$R_{\text{upper}} = 1 / \left(\frac{F_{P1}}{R_{P1}} + \frac{F_{P2}}{R_{P2}} + \frac{F_{P3}}{R_{P3}} + \frac{F_{P4}}{R_{P4}} \right) \\R_{\text{upper}} = 1 / \left(\frac{0.787}{10.156} + \frac{0.078}{8.175} + \frac{0.123}{7.160} + \frac{0.012}{5.179} \right) = 9.387 \text{ m}^2\text{K/W}$$

Lower resistance limit

$$R_{\text{lower}} = R_{NB} + 1 / \left(\frac{F_{L1}}{R_{L1}} + \frac{F_{B1}}{R_{B1}} \right) + 1 / \left(\frac{F_{L2}}{R_{L2}} + \frac{F_{B2}}{R_{B2}} \right) \\R_{\text{lower}} = 3.256 + 1 / \left(\frac{0.910}{2.750} + \frac{0.090}{0.769} \right) + 1 / \left(\frac{0.865}{4.150} + \frac{0.135}{1.154} \right) = 8.561 \text{ m}^2\text{K/W}$$

Total resistance of roof

$$R_T = (R_{\text{upper}} + R_{\text{lower}}) / 2 = (9.387 + 8.561) / 2 = 8.97 \text{ m}^2\text{K/W}$$

Correction for air gaps, Delta Ug = 0.0000W/m²K

(Delta Uf + Delta Ug + Delta Up + Delta Ur) is less than 3% of (1 / Rt) so U = (1 / Rt) + (Delta Ur) + (Delta Urc) = 0.11 W/m²K

Structure element : BRE443 Pitched roof - insulation at ceiling level
Condensation calculations performed in accordance with BS5250:2021

Condensation is occurring at the following layers interfaces:-

Month	Int (C°)	Int (%RH)	Ext (C°)	Ext (%RH)
Jan	21.00	45.10	3.10	85.00
Feb	21.00	44.60	3.10	83.50
Mar	21.00	45.40	5.20	79.50
Apr	21.00	46.70	7.60	75.50
May	21.00	51.40	10.60	76.00
Jun	21.00	57.20	14.00	74.50
Jul	21.00	61.90	15.80	75.00
Aug	21.00	62.60	15.40	77.50
Sep	21.00	58.60	13.20	79.50
Oct	21.00	53.90	10.00	83.00
Nov	21.00	48.00	6.00	84.00
Dec	21.00	46.40	4.20	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)
Sheeted roof, or tiled roof with felt or boards or similar under the tiles	0.0 (-)	0.0	0.0	0.0
Particleboard (600 mg/m ³)	0.0 (18.0)	600.0	1700.0	0.0
Beltermo Ultra	0.0 (120.0)	180.0	2100.0	0.0
SteicoFlex	0.0 (100.0)	60.0	2100.0	0.0
SteicoFlex	0.0 (150.0)	60.0	2100.0	0.0
Ampatex Sinco	0.0 (-)	280.0	850.0	0.0
Gyproc Wallboard	12.5 (12.5)	0.0	0.0	0.0
Total				0.0
kappa value				0.0000
Limiting condition:	insulation			

Admittance : 0.55 W/m²K Decrement : 0.08 factor Decrement delay : -16.81 hours

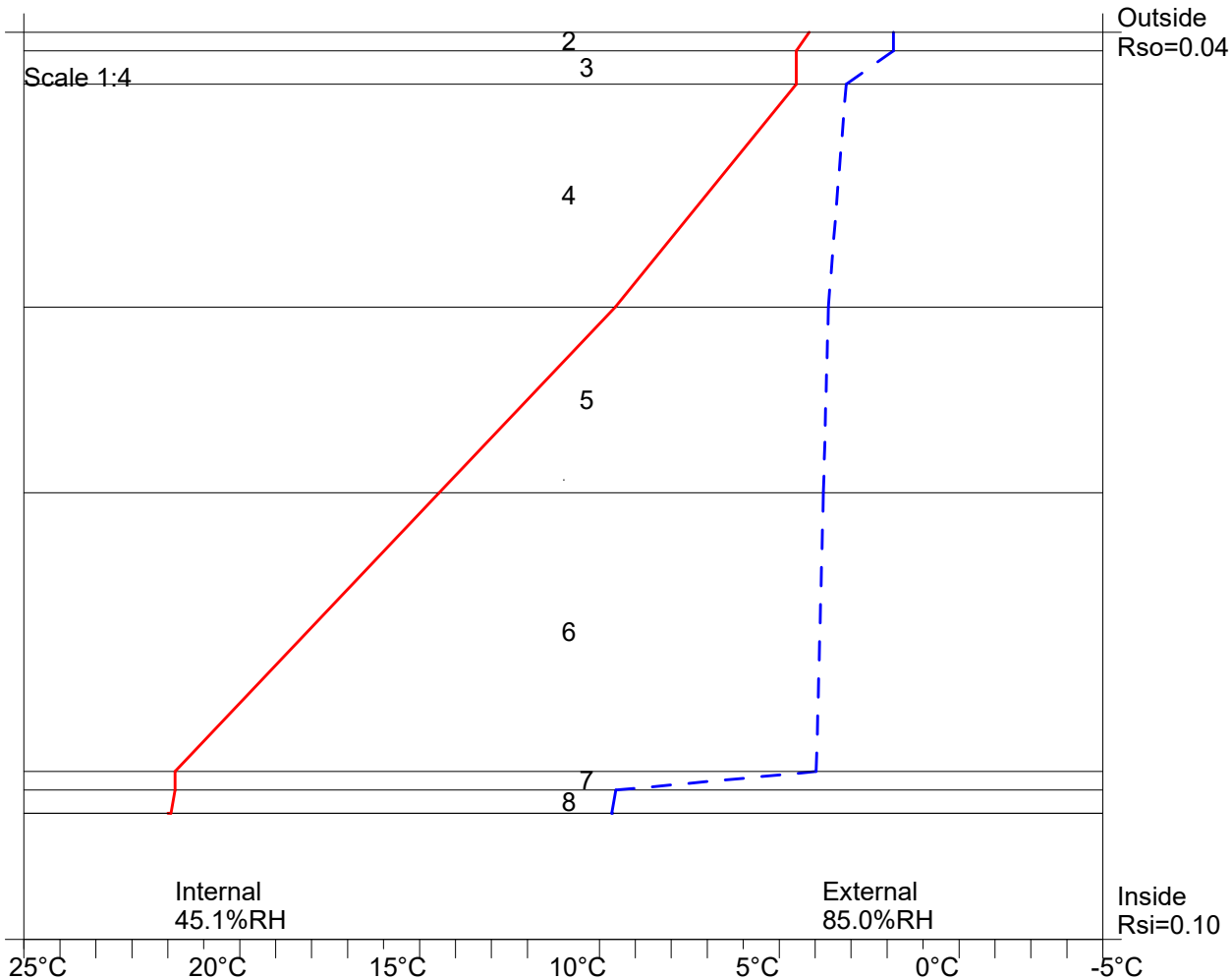
Condensation Risk Analysis (no account taken of thermal bridges)

2 - Offices, shops and dwellings with low occupancy

Jan (worst)	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
21.0C 45.1%	21.0C 44.6%	21.0C 45.4%	21.0C 46.7%	21.0C 51.4%	21.0C 57.2%	21.0C 61.9%	21.0C 62.6%	21.0C 58.6%	21.0C 53.9%	21.0C 48.0%	21.0C 46.4%
3.1C 85.0%	3.1C 83.5%	5.2C 79.5%	7.6C 75.5%	10.6C 76.0%	14.0C 74.5%	15.8C 75.0%	15.4C 77.5%	13.2C 79.5%	10.0C 83.0%	6.0C 84.0%	4.2C 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 Sheeted roof, or tiled roof with felt or boards or similar under the tiles	3.2	0.8	0.65	0.77			No
3 Particleboard (600 mg/m ³)	3.5	0.8	0.65	0.79			No
4 Beltermo Ultra	3.5	2.1	0.71	0.79			No
5 SteicoFlex	8.6	2.6	0.74	1.11			No
6 SteicoFlex	13.5	2.8	0.75	1.54			No
7 Ampatex Sinco	20.8	3.0	0.76	2.46			No
8 Gyproc Wallboard	20.8	8.5	1.11	2.46			No
9 Inside surface resistance	20.9	8.7	1.12	2.47			No

Worst case internal / external conditions for graph : 21.0°C @ 45.1%RH / 3.1°C @ 85.0%RH



Condensation Risk Analysis (no account taken of thermal bridges)

2 - Offices, shops and dwellings with low occupancy

Jan (worst)	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
21.0C 45.1%	21.0C 44.6%	21.0C 45.4%	21.0C 46.7%	21.0C 51.4%	21.0C 57.2%	21.0C 61.9%	21.0C 62.6%	21.0C 58.6%	21.0C 53.9%	21.0C 48.0%	21.0C 46.4%
3.1C 85.0%	3.1C 83.5%	5.2C 79.5%	7.6C 75.5%	10.6C 76.0%	14.0C 74.5%	15.8C 75.0%	15.4C 77.5%	13.2C 79.5%	10.0C 83.0%	6.0C 84.0%	4.2C 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 Sheeted roof, or tiled roof with felt or boards or similar under the tiles	15.8	11.4	1.35	1.80			No
3 Particleboard (600 mg/m ³)	15.9	11.4	1.35	1.81			No
4 Beltermo Ultra	15.9	11.7	1.37	1.81			No
5 SteicoFlex	17.4	11.8	1.38	1.98			No
6 SteicoFlex	18.8	11.8	1.39	2.17			No
7 Ampatex Sinco	20.9	11.9	1.39	2.48			No
8 Gyproc Wallboard	20.9	13.4	1.53	2.48			No
9 Inside surface resistance	21.0	13.4	1.54	2.48			No

Worst case internal / external conditions for graph : 21.0°C @ 61.9%RH / 15.8°C @ 75.0%RH

