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-125
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	-	-	0.040		
Sheeted roof, or tiled roof with felt or boards or similar under the tiles	-	-	0.200		
Particleboard (600 mg/m³)	18.0	0.140	0.129		
Beltermo Ultra	60.0	0.042	1.400		L:0 0.000W/m²K
SteicoFlex	100.0	0.036	2.750		9.000% Softwood (100.0mm) L:0 0.000W/m²K
SteicoFlex	125.0	0.036	3.450		13.500% Softwood (125.0mm) L:0 0.000W/m²K
Ampatex Sinco	-	-	-		
Gyproc Wallboard	12.5	0.190	0.066		
Inside surface resistance	-	-	0.100		
Total thickness	**315.5mm**				

U-value = 0.14W/m²K

U-value, Combined Method : 0.144W/m²K (upper/lower limit 7.436 / 6.724m²K/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^2K/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	0.140	0.129	250.00	4.50
Beltermo Ultra	60.0	0.042	1.400	15.00	0.90
SteicoFlex	100.0	0.036	2.750	5.00	0.50
SteicoFlex	125.0	0.036	3.450	5.00	0.63
Ampatex Sinco	-	-	-	-	25.00
Gyproc Wallboard	12.5	0.190	0.066	50.00	0.63
Inside surface resistance	-	-	0.100	-	-
Total thickness	**315.5mm**				

Detailed U-value Calculation Results

Construction includes 2 bridged layers

Non-bridged layers	
Outside surface resistance	0.035 m²K/W (0.040 * cos(30.0))
Sheeted roof, or tiled roof with felt or boards or similar under the tiles	0.200 m²K/W
Particleboard (600 mg/m³)	0.129 m²K/W
Beltermo Ultra	1.400 m²K/W
Gyproc Wallboard	0.066 m²K/W
Inside surface resistance	0.100 m²K/W
Resistance of non-bridged layers, R_{NB} =	1.935 m²K/W

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

$R_{P1} = R_{NB} + R_{L1} = 1.935 + 6.200 = 8.135$ m²K/W $F_{P1} = 78.715\%$
$R_{P2} = R_{NB} + R_{L2} = 1.935 + 4.219 = 6.154$ m²K/W $F_{P2} = 7.785\%$
$R_{P3} = R_{NB} + R_{L3} = 1.935 + 3.712 = 5.646$ m²K/W $F_{P3} = 12.285\%$
$R_{P4} = R_{NB} + R_{L4} = 1.935 + 1.731 = 3.665$ m²K/W $F_{P4} = 1.215\%$

Upper resistance limit

$R_{upper} = 1 / ((F_{P1}/R_{P1}) + (F_{P2}/R_{P2}) + (F_{P3}/R_{P3}) + (F_{P4}/R_{P4}))$
$R_{upper} = 1 / ((0.787/8.135) + (0.078/6.154) + (0.123/5.646) + (0.012/3.665)) = 7.436$m²K/W

Lower resistance limit

$R_{lower} = R_{NB} + 1 / ((F_{L1}/R_{L1}) + (F_{B1}/R_{B1})) + 1 / ((F_{L2}/R_{L2}) + (F_{B2}/R_{B2}))$
$R_{lower} = 1.935 + 1 / ((0.910/2.750) + (0.090/0.769)) + 1 / ((0.865/3.450) + (0.135/0.962)) = 6.724$m²K/W

Total resistance of roof

$R_T = (R_{upper} + R_{lower}) / 2 = (7.436 + 6.724) / 2 = 7.08$ m²K/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) = 0.14 W/m²K

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

Condensation is occuring 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/m³)	Specific heat capacity (J/kgK)	Heat capacity (kJ/m²K)
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/m³)	0.0 (18.0)	600.0	1700.0	0.0
Beltermo Ultra	0.0 (60.0)	180.0	2100.0	0.0
SteicoFlex	0.0 (100.0)	60.0	2100.0	0.0
SteicoFlex	0.0 (125.0)	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 : 0.22 factor Decrement delay : -12.91 hours

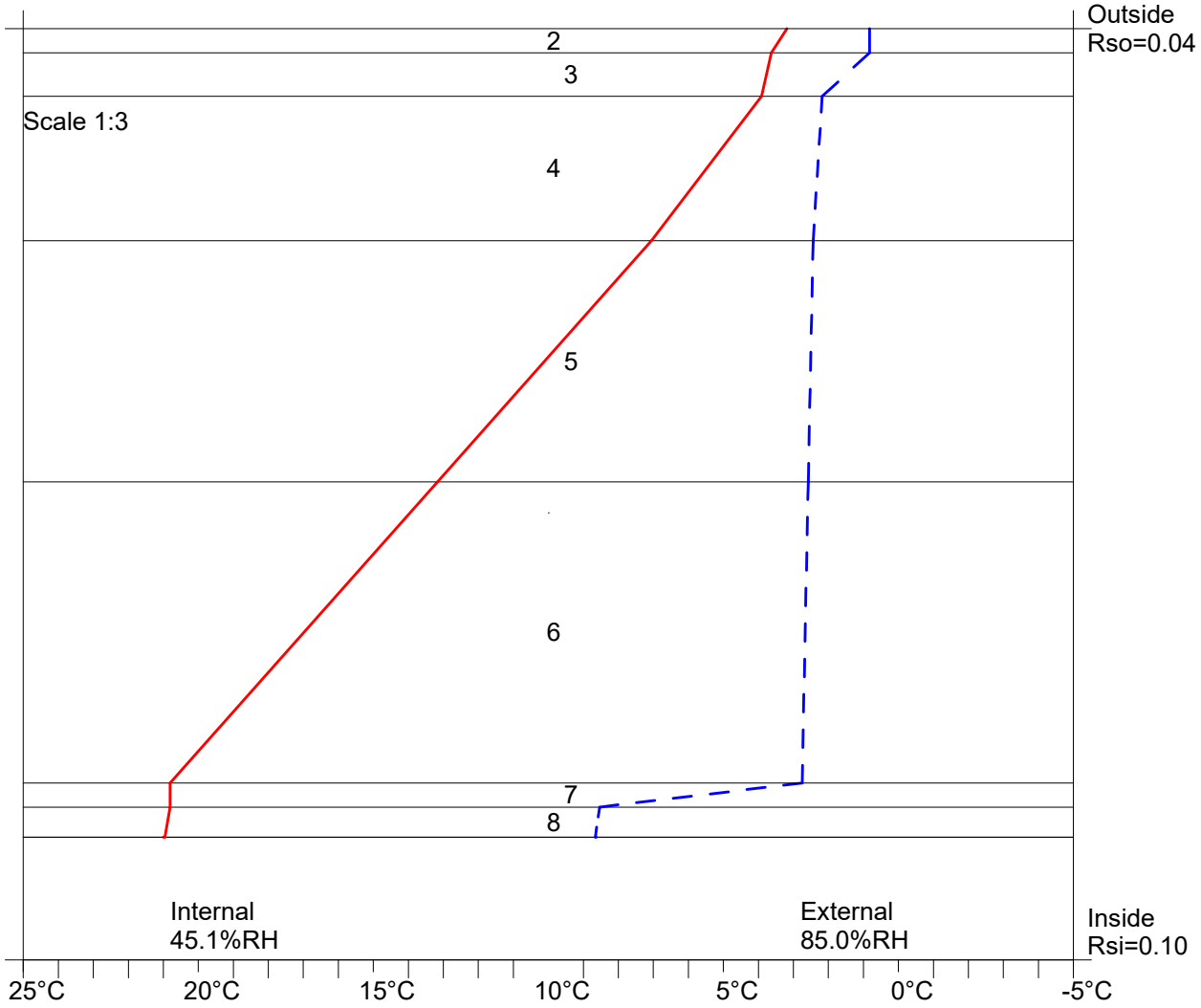
Condensation Risk Analysis (no account taken of thermal bridges)

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. 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	3.2	0.8	0.65	0.77			No
2 Sheeted roof, or tiled roof with felt or boards or similar under the tiles	3.6	0.8	0.65	0.79			No
3 Particleboard (600 mg/m³)	3.9	2.2	0.71	0.81			No
4 Beltermo Ultra	7.1	2.4	0.73	1.01			No
5 SteicoFlex	13.2	2.6	0.74	1.51			No
6 SteicoFlex	20.8	2.8	0.74	2.46			No
7 Ampatex Sinco	20.8	8.5	1.11	2.46			No
8 Gyproc Wallboard	21.0	8.7	1.12	2.48			No
9 Inside surface resistance							

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

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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. 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	15.8	11.4	1.35	1.80			No
2 Sheeted roof, or tiled roof with felt or boards or similar under the tiles	16.0	11.4	1.35	1.81			No
3 Particleboard (600 mg/m³)	16.0	11.7	1.37	1.82			No
4 Beltermo Ultra	16.9	11.8	1.38	1.93			No
5 SteicoFlex	18.7	11.8	1.38	2.16			No
6 SteicoFlex	20.9	11.8	1.38	2.48			No
7 Ampatex Sinco	20.9	13.4	1.53	2.48			No
8 Gyproc Wallboard	21.0	13.4	1.54	2.48			No
9 Inside surface resistance							

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