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

Project Information
Reference
Date 30 November 2023

Construction Type
Element : Pitched roof, ceiling at rafter line - Roof-between-50
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		
Ampatop Protecta	-	-	-		
SteicoFlex	50.0	0.036	1.350		9.000% Softwood (50.0mm) L:0 0.000W/m²K
Oriented strandboard (OSB)	9.0	0.130	0.069		
Ampatex Sinco	-	-	-		
Airspace, heat flow upwards, 25 mm thick	25.0	-	0.160		11.800% Softwood (25.0mm)
Gyproc Wallboard	12.5	0.190	0.066		
Inside surface resistance	-	-	0.100		
Total thickness	**96.5mm**				

U-value = 0.63W/m²K

U-value, Combined Method : 0.633W/m²K (upper/lower limit 1.618 / 1.540m²K/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 (m²K/W)	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)
Outside surface resistance	-	-	0.040	-	-
Ampatop Protecta	-	-	-	-	0.50
SteicoFlex	50.0	0.036	1.350	5.00	0.25
Oriented strandboard (OSB)	9.0	0.130	0.069	250.00	2.25
Ampatex Sinco	-	-	-	-	25.00
Airspace, heat flow upwards, 25 mm thick	25.0	-	0.160	-	0.00
Gyproc Wallboard	12.5	0.190	0.066	50.00	0.63
Inside surface resistance	-	-	0.100	-	-
Total thickness	**96.5mm**				

Detailed U-value Calculation Results

Construction includes 2 bridged layers

Non-bridged layers

Outside surface resistance	0.040 m²K/W
Oriented strandboard (OSB)	0.069 m²K/W
Gyproc Wallboard	0.066 m²K/W
Inside surface resistance	0.100 m²K/W
Resistance of non-bridged layers, R_{NB} =	0.275 m²K/W

Bridged layers

SteicoFlex (L1) bridged by Softwood (B1)
Airspace, heat flow upwards, 25 mm thick (L2) bridged by Softwood (B2)

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

Resistance and fraction of heat flow paths

$R_{P1} = R_{NB} + R_{L1} = 0.275 + 1.510 = 1.785$ m²K/W $F_{P1} = 80.262\%$
$R_{P2} = R_{NB} + R_{L2} = 0.275 + 0.545 = 0.820$ m²K/W $F_{P2} = 7.938\%$
$R_{P3} = R_{NB} + R_{L3} = 0.275 + 1.542 = 1.818$ m²K/W $F_{P3} = 10.738\%$
$R_{P4} = R_{NB} + R_{L4} = 0.275 + 0.577 = 0.852$ m²K/W $F_{P4} = 1.062\%$

Upper resistance limit

$R_{upper} = 1 / ((F_{P1}/R_{P1}) + (F_{P2}/R_{P2}) + (F_{P3}/R_{P3}) + (F_{P4}/R_{P4}))$
$R_{upper} = 1 / ((0.803/1.785) + (0.079/0.820) + (0.107/1.818) + (0.011/0.852)) = 1.618$m²K/W

Lower resistance limit

$R_{lower} = R_{NB} + 1 / ((F_{L1}/R_{L1}) + (F_{B1}/R_{B1})) + 1 / ((F_{L2}/R_{L2}) + (F_{B2}/R_{B2}))$
$R_{lower} = 0.275 + 1 / ((0.910/1.350) + (0.090/0.385)) + 1 / ((0.882/0.160) + (0.118/0.192)) = 1.540$m²K/W

Total resistance of roof

$R_T = (R_{upper} + R_{lower}) / 2 = (1.618 + 1.540) / 2 = 1.58$ 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) = 0.63 W/m²K

Structure element : Pitched roof, ceiling at rafter line
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	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00
Mar	0.00	0.00	0.00	0.00
Apr	0.00	0.00	0.00	0.00
May	0.00	0.00	0.00	0.00
Jun	0.00	0.00	0.00	0.00
Jul	0.00	0.00	0.00	0.00
Aug	0.00	0.00	0.00	0.00
Sep	0.00	0.00	0.00	0.00
Oct	0.00	0.00	0.00	0.00
Nov	0.00	0.00	0.00	0.00
Dec	0.00	0.00	0.00	0.00

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)
Ampatop Protecta	0.0 (-)	300.0	850.0	0.0
SteicoFlex	0.0 (50.0)	60.0	2100.0	0.0
Oriented strandboard (OSB)	9.0 (9.0)	650.0	1700.0	9945000.0
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	30240.0
Gyproc Wallboard	12.5 (12.5)	0.0	0.0	0.0
Total				9975240.0
kappa value				9.9752
Limiting condition:	insulation			

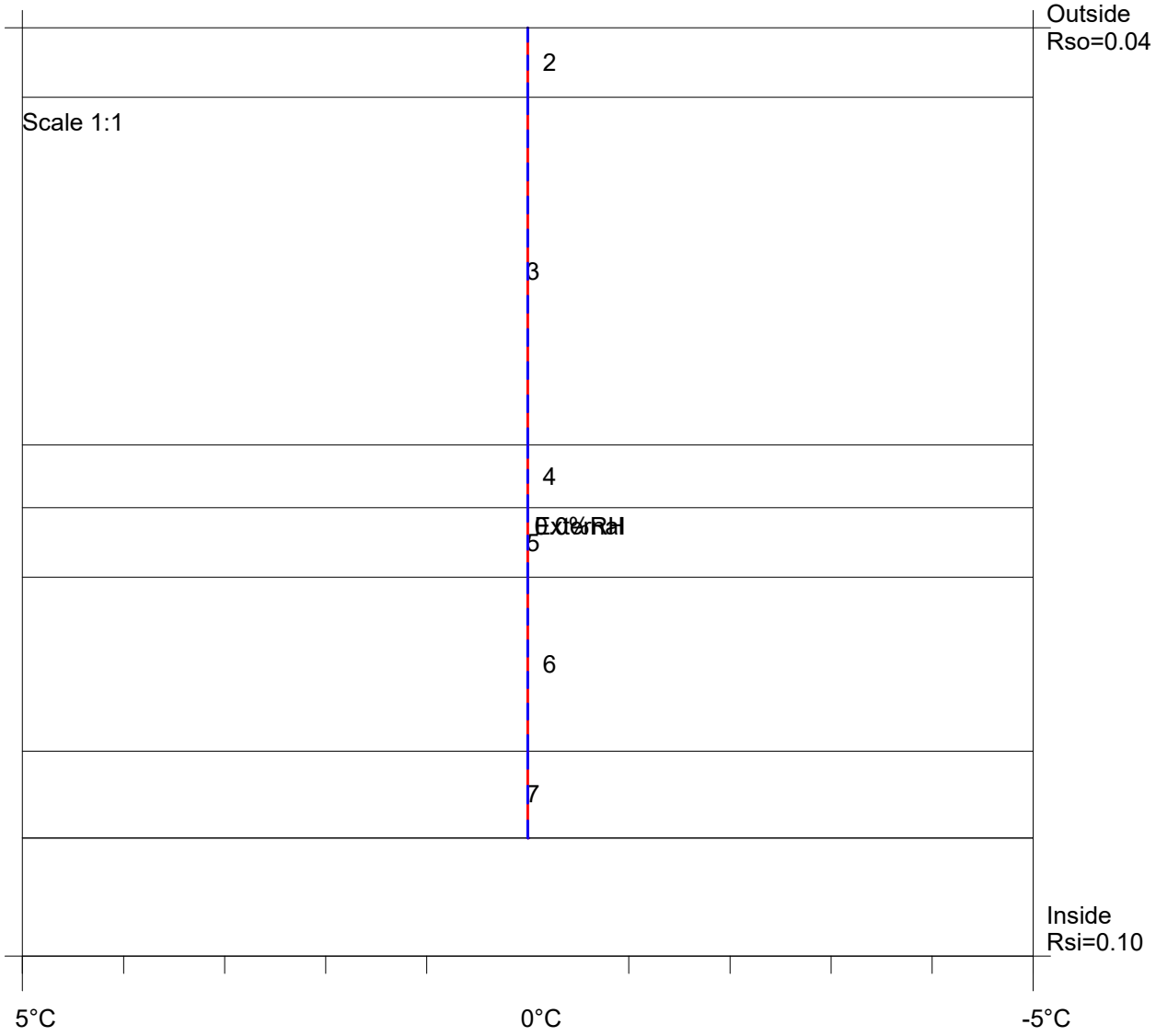
Admittance : 0.90 W/m²K Decrement : 0.99 factor Decrement delay : -1.25 hours

Condensation Risk Analysis (no account taken of thermal bridges)

Jan (worst)	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%
0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%

	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	0.0	0.0	0.00	0.61			No
2 Ampatop Protecta	0.0	0.0	0.00	0.61			No
3 SteicoFlex	0.0	0.0	0.00	0.61			No
4 Oriented strandboard (OSB)	0.0	0.0	0.00	0.61			No
5 Ampatex Sinco	0.0	0.0	0.00	0.61			No
6 Airspace, heat flow upwards, 25 mm thick	0.0	0.0	0.00	0.61			No
7 Gyproc Wallboard	0.0	0.0	0.00	0.61			No
8 Inside surface resistance							

Worst case internal / external conditions for graph : 0.0°C @ 0.0%RH / 0.0°C @ 0.0%RH



Condensation Risk Analysis (no account taken of thermal bridges)

Jan (worst)	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%
0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%	0.0C 0.0%

	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	0.0	0.0	0.00	0.61			No
2 Ampatop Protecta	0.0	0.0	0.00	0.61			No
3 SteicoFlex	0.0	0.0	0.00	0.61			No
4 Oriented strandboard (OSB)	0.0	0.0	0.00	0.61			No
5 Ampatex Sinco	0.0	0.0	0.00	0.61			No
6 Airspace, heat flow upwards, 25 mm thick	0.0	0.0	0.00	0.61			No
7 Gyproc Wallboard	0.0	0.0	0.00	0.61			No
8 Inside surface resistance							

Worst case internal / external conditions for graph : 0.0°C @ 0.0%RH / 0.0°C @ 0.0%RH