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 - 0.18 U-value wood fibre roof spec
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	-	-	0.100		
Airspace, heat flow upwards, 50 mm thick	50.0	-	0.160		
SteicoFlex	150.0	0.038	3.900		9.000% Softwood (150.0mm) L:0 0.000W/m²K
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	**237.5mm**				

U-value = 0.26W/m²K

U-value, Combined Method : 0.259W/m²K (upper/lower limit 3.928 / 3.798m²K/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	-	-	0.100	-	-
Airspace, heat flow upwards, 50 mm thick	50.0	-	0.160	-	0.00
SteicoFlex	150.0	0.038	3.900	5.00	0.75
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	**237.5mm**				

Calculations are based on manufacturers information and for default structures.

Detailed U-value Calculation Results

Construction includes 1 bridged layer

Non-bridged layers

Outside surface resistance	0.100 m²K/W
Airspace, heat flow upwards, 50 mm thick	0.160 m²K/W
Airspace, heat flow upwards, 25 mm thick	0.160 m²K/W
Gyproc Wallboard	0.066 m²K/W
Inside surface resistance	0.100 m²K/W
Resistance of non-bridged layers, R_{NB} =	0.586 m²K/W

Bridged layer

SteicoFlex (L1) bridged by Softwood (B1)

Path 1 - SteicoFlex
Path 2 - Softwood

Resistance and fraction of heat flow paths

$R_{P1} = R_{NB} + R_{L1} = 0.586 + 3.900 = 4.486$ m²K/W $F_{P1} = 91.000\%$
$R_{P2} = R_{NB} + R_{L2} = 0.586 + 1.154 = 1.740$ m²K/W $F_{P2} = 9.000\%$

Upper resistance limit

$R_{upper} = 1 / ((F_{P1}/R_{P1}) + (F_{P2}/R_{P2}))$
$R_{upper} = 1 / ((0.910/4.486) + (0.090/1.740)) = 3.928$m²K/W

Lower resistance limit

$R_{lower} = R_{NB} + 1 / ((F_{L1}/R_{L1}) + (F_{B1}/R_{B1}))$
$R_{lower} = 0.586 + 1 / ((0.910/3.900) + (0.090/1.154)) = 3.798$m²K/W

Total resistance of roof

$R_T = (R_{upper} + R_{lower}) / 2 = (3.928 + 3.798) / 2 = 3.86$ 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) = 0.26 W/m²K

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

Condensation is occuring 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/m³)	Specific heat capacity (J/kgK)	Heat capacity (kJ/m²K)
Airspace, heat flow upwards, 50 mm thick	0.0 (50.0)	1.2	1008.0	0.0
SteicoFlex	0.0 (150.0)	50.0	2100.0	0.0
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				10124746.0
kappa value				10.1247
Limiting condition:	insulation			

Admittance : 1.04 W/m²K Decrement : 0.83 factor Decrement delay : -3.82 hours

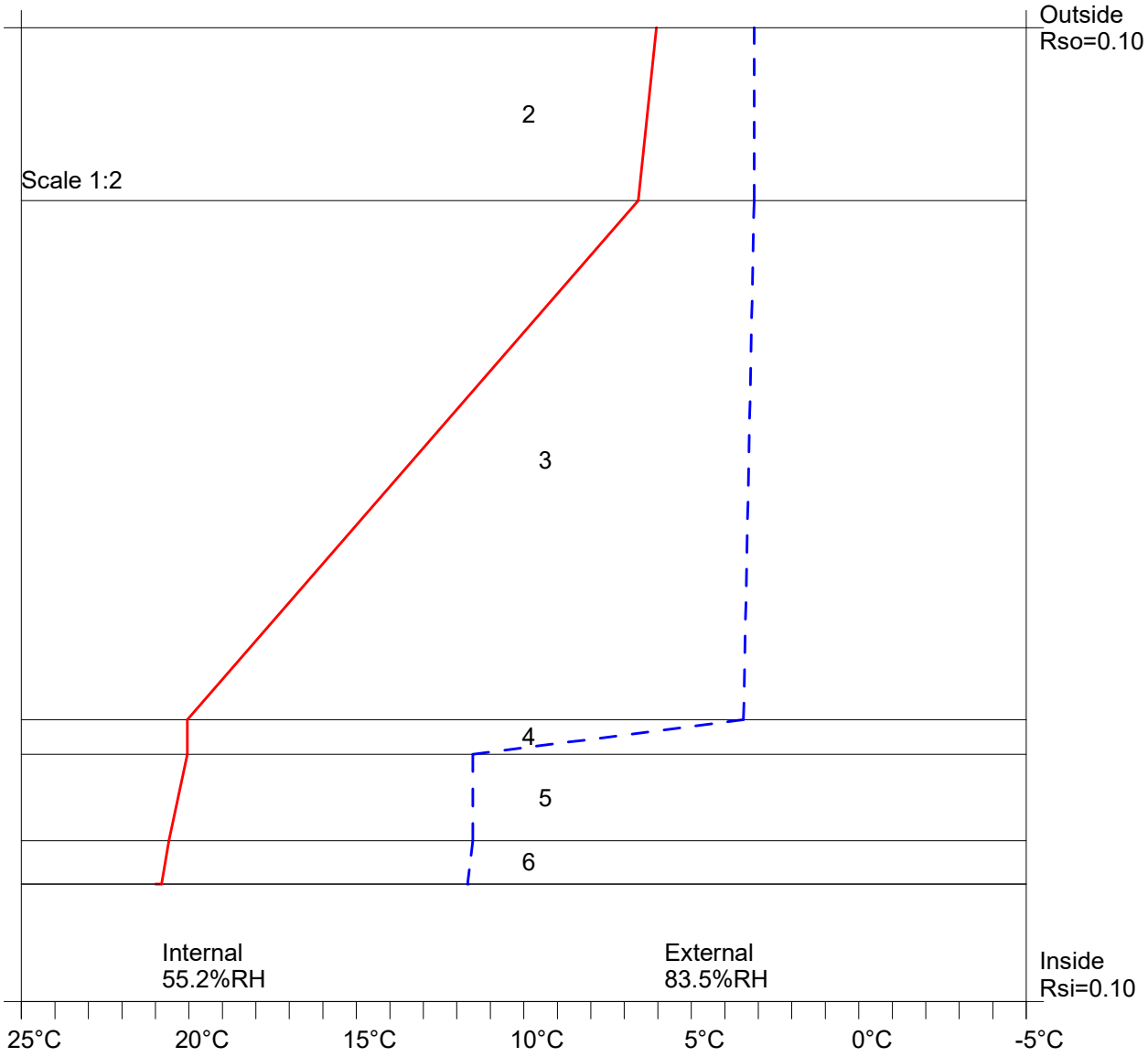
Condensation Risk Analysis (no account taken of thermal bridges)

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. 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	6.0	3.1	0.76	0.94			No
2 Airspace, heat flow upwards, 50 mm thick	6.6	3.1	0.76	0.97			No
3 SteicoFlex	20.0	3.4	0.78	2.34			No
4 Ampatex Sinco	20.0	11.5	1.36	2.34			No
5 Airspace, heat flow upwards, 25 mm thick	20.6	11.5	1.36	2.42			No
6 Gyproc Wallboard	20.8	11.7	1.37	2.46			No
7 Inside surface resistance							

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)

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Jan	Feb (worst)	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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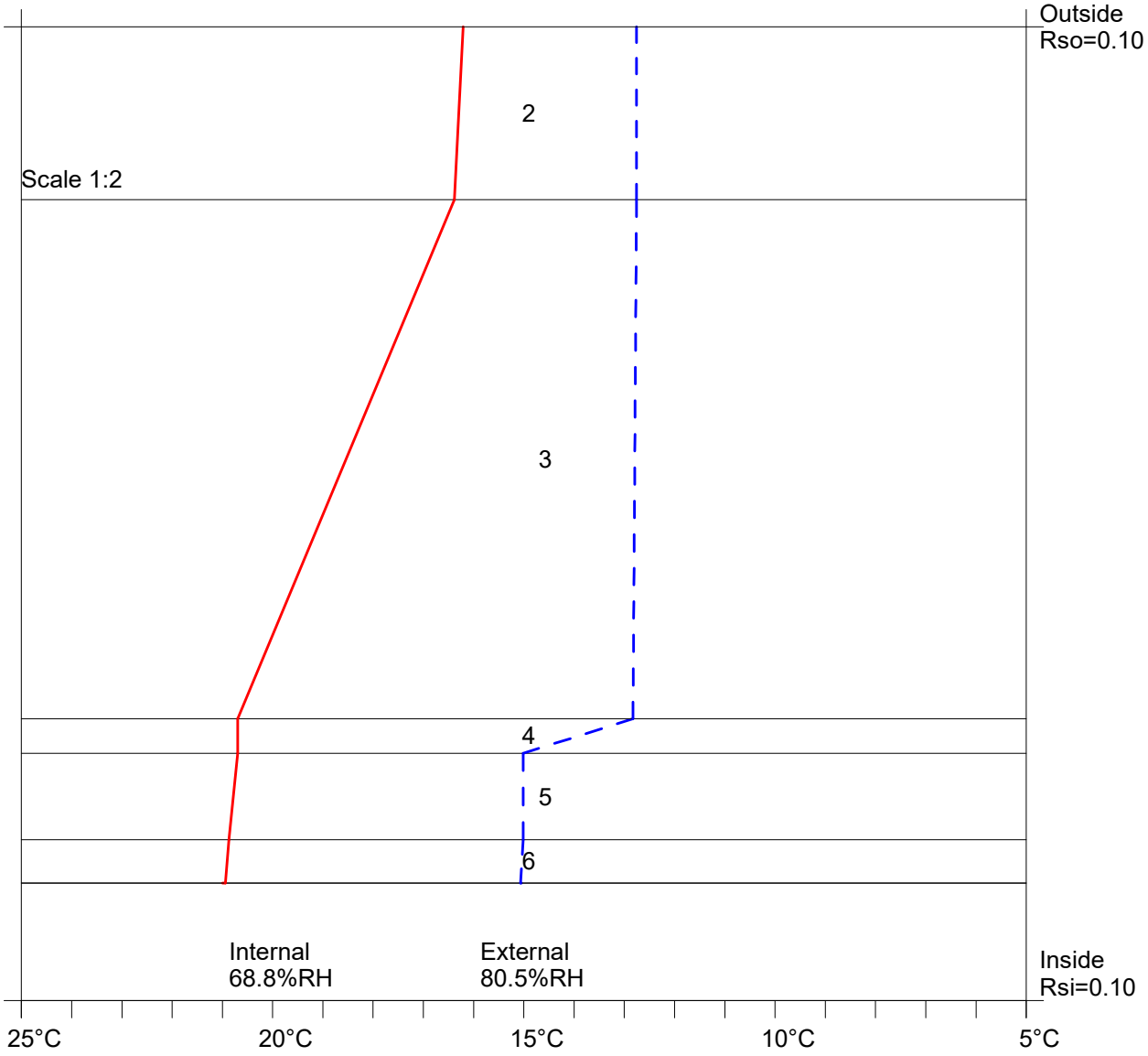
5.9C 85.5%	5.7C 83.5%	6.9C 82.0%	8.8C 79.5%	11.5C 79.0%	14.3C 79.5%	16.1C 80.5%	16.0C 81.5%	14.3C 83.0%	11.9C 85.0%	8.5C 84.5%	7.0C 85.5%

	Interface Temp. 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	16.2	12.8	1.47	1.84			No
2 Airspace, heat flow upwards, 50 mm thick	16.4	12.8	1.47	1.86			No
3 SteicoFlex	20.7	12.8	1.48	2.44			No
4 Ampatex Sinco	20.7	15.0	1.70	2.44			No
5 Airspace, heat flow upwards, 25 mm thick	20.9	15.0	1.70	2.47			No
6 Gyproc Wallboard	20.9	15.1	1.71	2.48			No
7 Inside surface resistance							

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



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Construction Type
Element : Pitched roof, ceiling at rafter line - 0.18 U-value wood fibre roof spec
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	-	-	0.100		
Airspace, heat flow upwards, 50 mm thick	50.0	-	0.160		
SteicoFlex	150.0	0.038	3.900		13.500% Softwood (150.0mm) L:0 0.000W/m²K
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	**237.5mm**				

U-value = 0.28W/m²K

U-value, Combined Method : 0.276W/m²K (upper/lower limit 3.698 / 3.538m²K/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	-	-	0.100	-	-
Airspace, heat flow upwards, 50 mm thick	50.0	-	0.160	-	0.00
SteicoFlex	150.0	0.038	3.900	5.00	0.75
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	**237.5mm**				

Calculations are based on manufacturers information and for default structures.

Detailed U-value Calculation Results

Construction includes 1 bridged layer

Non-bridged layers

Outside surface resistance	0.100 m²K/W
Airspace, heat flow upwards, 50 mm thick	0.160 m²K/W
Airspace, heat flow upwards, 25 mm thick	0.160 m²K/W
Gyproc Wallboard	0.066 m²K/W
Inside surface resistance	0.100 m²K/W
Resistance of non-bridged layers, R_{NB} =	0.586 m²K/W

Bridged layer

SteicoFlex (L1) bridged by Softwood (B1)

Path 1 - SteicoFlex
Path 2 - Softwood

Resistance and fraction of heat flow paths

$R_{P1} = R_{NB} + R_{L1} = 0.586 + 3.900 = 4.486$ m²K/W $F_{P1} = 86.500\%$

$R_{P2} = R_{NB} + R_{L2} = 0.586 + 1.154 = 1.740$ m²K/W $F_{P2} = 13.500\%$

Upper resistance limit

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

$R_{upper} = 1 / ((0.865/4.486) + (0.135/1.740)) = 3.698$m²K/W

Lower resistance limit

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

$R_{lower} = 0.586 + 1 / ((0.865/3.900) + (0.135/1.154)) = 3.538$m²K/W

Total resistance of roof

$R_T = (R_{upper} + R_{lower}) / 2 = (3.698 + 3.538) / 2 = 3.62$ 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) = 0.28 W/m²K

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

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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)
Airspace, heat flow upwards, 50 mm thick	0.0 (50.0)	1.2	1008.0	0.0
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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				10124746.0
kappa value				10.1247
Limiting condition:	insulation			

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Condensation Risk Analysis (no account taken of thermal bridges)

3 - Dwellings with low occupancy

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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. 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	6.0	3.1	0.76	0.94			No
2 Airspace, heat flow upwards, 50 mm thick	6.6	3.1	0.76	0.97			No
3 SteicoFlex	20.0	3.4	0.78	2.34			No
4 Ampatex Sinco	20.0	11.5	1.36	2.34			No
5 Airspace, heat flow upwards, 25 mm thick	20.6	11.5	1.36	2.42			No
6 Gyproc Wallboard	20.8	11.7	1.37	2.46			No
7 Inside surface resistance							

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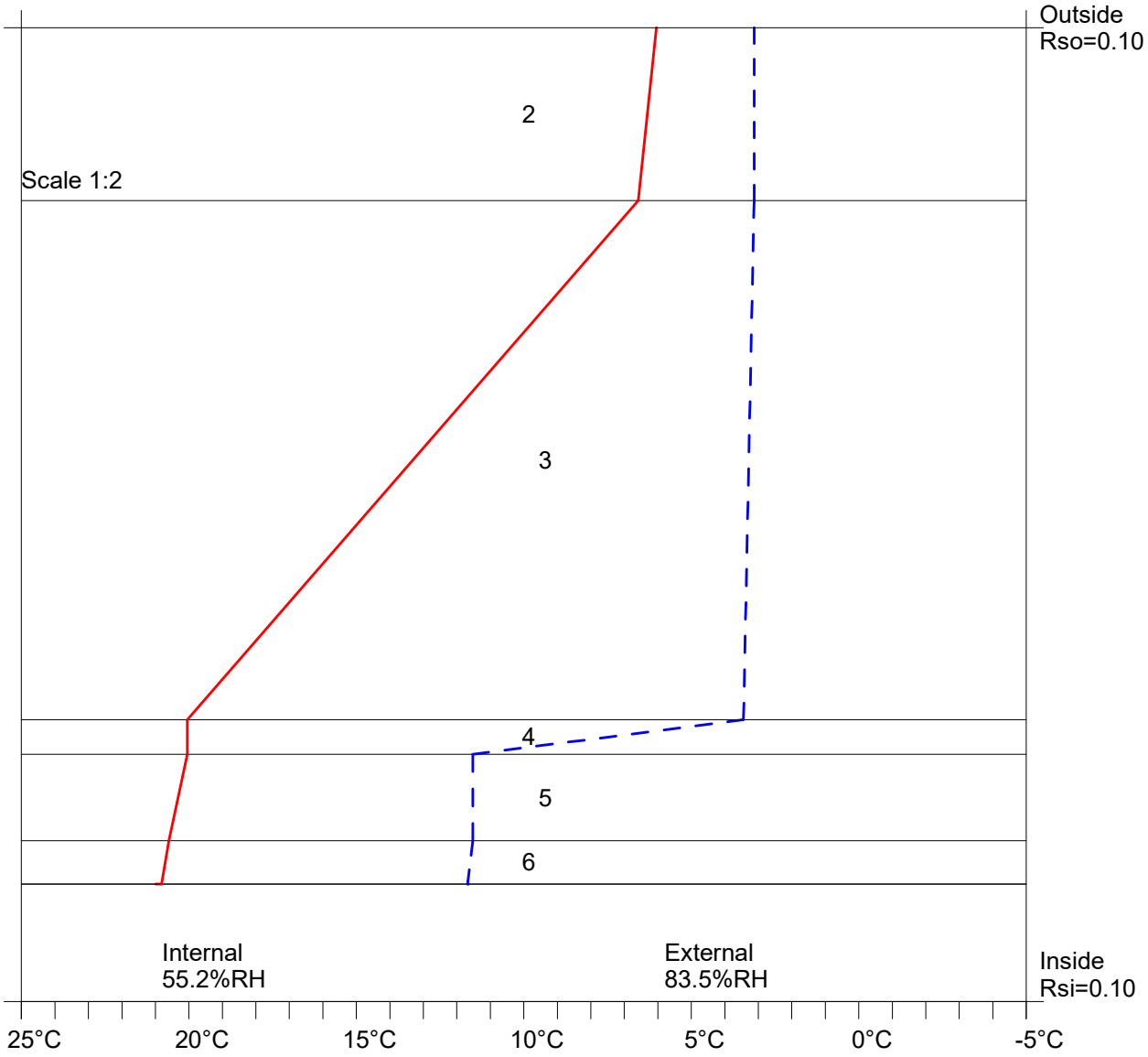

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5.9C 85.5%	5.7C 83.5%	6.9C 82.0%	8.8C 79.5%	11.5C 79.0%	14.3C 79.5%	16.1C 80.5%	16.0C 81.5%	14.3C 83.0%	11.9C 85.0%	8.5C 84.5%	7.0C 85.5%

	Interface Temp. 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	16.2	12.8	1.47	1.84			No
2 Airspace, heat flow upwards, 50 mm thick	16.4	12.8	1.47	1.86			No
3 SteicoFlex	20.7	12.8	1.48	2.44			No
4 Ampatex Sinco	20.7	15.0	1.70	2.44			No
5 Airspace, heat flow upwards, 25 mm thick	20.9	15.0	1.70	2.47			No
6 Gyproc Wallboard	20.9	15.1	1.71	2.48			No
7 Inside surface resistance							

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