

Project Information

Reference

Date 14 September 2018

Construction Type

Element : Flat roof - 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		
Zinc	0.5	111.111	0.000		
Plywood (500 kg/m ³)	18.0	0.130	0.000		
Airspace, heat flow upwards, 50 mm thick	50.0	-	0.000		
Ampatex Aero	-	-	-		
Beltermo Ultra	120.0	0.042	2.850		L:0 0.000W/m ² K
SteicoFlex	150.0	0.036	4.150		9.000% Softwood (150.0mm) L:0 0.000W/m ² K
Ampatex DB90	-	-	-		
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	376.0mm				

U-value = 0.15W/m²K

U-value, Combined Method : 0.147W/m²K (upper/lower limit 7.000 / 6.640m²K/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	-	-
Zinc	0.5	111.111	0.000	-	100000
Plywood (500 kg/m ³)	18.0	0.130	0.000	1000.00	18.00
Airspace, heat flow upwards, 50 mm thick	50.0	-	0.000	-	0.00
Ampatex Aero	-	-	-	-	0.20
Beltermo Ultra	120.0	0.042	2.850	15.00	1.80
SteicoFlex	150.0	0.036	4.150	5.00	0.75
Ampatex DB90	-	-	-	-	100.00
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	376.0mm				

Detailed U-value Calculation Results

Construction includes 1 bridged layer

Non-bridged layers

Outside surface resistance	0.100 m ² K/W
Beltermo Ultra	2.850 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
<u>Resistance of non-bridged layers, R_{NB} =</u>	<u>3.276 m²K/W</u>

Bridged layer

SteicoFlex (L1) bridged by Softwood (B1)

Path 1 - SteicoFlex

Path 2 - Softwood

Resistance and fraction of heat flow paths

$$R_{P1} = R_{NB} + R_{L1} = 3.276 + 4.150 = 7.426 \text{ m}^2\text{K/W} \quad F_{P1} = 91.000\%$$

$$R_{P2} = R_{NB} + R_{L2} = 3.276 + 1.154 = 4.430 \text{ m}^2\text{K/W} \quad F_{P2} = 9.000\%$$

Upper resistance limit

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

$$R_{\text{upper}} = 1 / ((0.910/7.426) + (0.090/4.430)) = 7.000 \text{ m}^2\text{K/W}$$

Lower resistance limit

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

$$R_{\text{lower}} = 3.276 + 1 / ((0.910/4.150) + (0.090/1.154)) = 6.640 \text{ m}^2\text{K/W}$$

Total resistance of roof

$$R_T = (R_{\text{upper}} + R_{\text{lower}}) / 2 = (7.000 + 6.640) / 2 = 6.82 \text{ m}^2\text{K/W}$$

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) = 0.15 W/m²K

Structure element : Flat roof
 Condensation calculations performed in accordance with BS5250:2011

Condensation is occurring at the following layers interfaces:-

Interface 1 : Ampatex Aero / Beltermo Ultra

Month	Int (C°)	Int (%RH)	Ext (C°)	Ext (%RH)	Interface 1 Gc (Kg/m ²)	Ma (Kg/m ²)
Jan	21.00	56.10	5.90	85.50	0.01176	0.03512
Feb	21.00	55.20	5.70	83.50	0.01040	0.04552
Mar	21.00	55.50	6.90	82.00	0.00966	0.05517
Apr	21.00	56.20	8.80	79.50	0.00634	0.06151
May	21.00	59.30	11.50	79.00	0.00276	0.06426
Jun	21.00	64.30	14.30	79.50	-0.00102	0.06324
Jul	21.00	68.80	16.10	80.50	-0.00329	0.05994
Aug	21.00	69.30	16.00	81.50	-0.00267	0.05727
Sep	21.00	66.60	14.30	83.00	0.00042	0.00042
Oct	21.00	63.20	11.90	85.00	0.00433	0.00476
Nov	21.00	58.20	8.50	84.50	0.00815	0.01291
Dec	21.00	57.00	7.00	85.50	0.01045	0.02336

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) = 0.06426 Kg/m²

Annual moisture accumulation = 0.05727 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)
Zinc	0.0 (0.5)	7200.0	110.0	0.0
Plywood (500 kg/m ³)	0.0 (18.0)	500.0	1600.0	0.0
Airspace, heat flow upwards, 50 mm thick	0.0 (50.0)	1.2	1008.0	0.0
Ampatex Aero	0.0 (-)	300.0	850.0	0.0
Beltermo Ultra	0.0 (120.0)	180.0	2100.0	0.0
SteicoFlex	0.0 (150.0)	60.0	2100.0	0.0
Ampatex DB90	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)	950.0	850.0	10093750.0

Total
kappa value 10123990.0
10.1240

Limiting condition: insulation

Admittance : 1.08 W/m²K Decrement : 0.16 factor Decrement delay : -13.72 hours

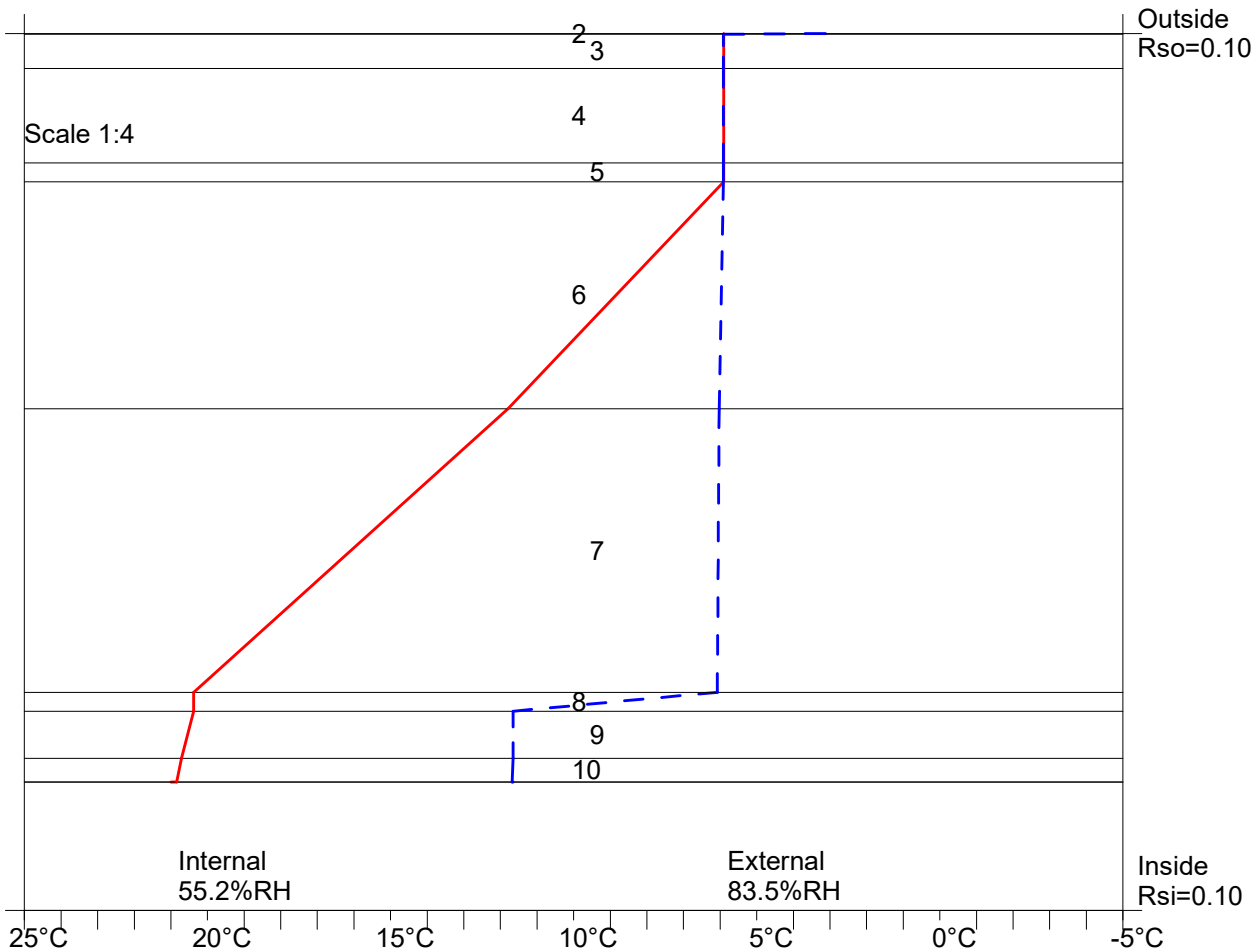
Condensation Risk Analysis (no account taken of thermal bridges)

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 Zinc	5.9	3.1	0.76	0.93			No
3 Plywood (500 kg/m ³)	5.9	5.9	0.93	0.93		0 in May	No
4 Airspace, heat flow upwards, 50 mm thick	5.9	5.9	0.93	0.93			No
5 Ampatex Aero	5.9	5.9	0.93	0.93			No
6 Beltermo Ultra	5.9	5.9	0.93	0.93	12 in Jan	64 in May	Yes
7 SteicoFlex	11.8	6.0	0.94	1.38			No
8 Ampatex DB90	20.4	6.1	0.94	2.39			No
9 Airspace, heat flow upwards, 25 mm thick	20.4	11.7	1.37	2.39			No
10 Gyproc Wallboard	20.7	11.7	1.37	2.44			No
11 Inside surface resistance	20.8	11.7	1.37	2.46			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 Zinc	16.2	12.8	1.47	1.84			No
3 Plywood (500 kg/m ³)	16.2	15.1	1.71	1.84		0 in May	No
4 Airspace, heat flow upwards, 50 mm thick	16.2	15.1	1.71	1.84			No
5 Ampatex Aero	16.2	15.1	1.71	1.84			No
6 Beltermo Ultra	16.2	15.1	1.71	1.84	12 in Jan	64 in May	Yes
7 SteicoFlex	18.1	15.1	1.71	2.07			No
8 Ampatex DB90	20.8	15.1	1.71	2.46			No
9 Airspace, heat flow upwards, 25 mm thick	20.8	15.1	1.71	2.46			No
10 Gyproc Wallboard	20.9	15.1	1.71	2.47			No
11 Inside surface resistance	20.9	15.1	1.71	2.48			No

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

