

Project Information

Reference

Date 14 September 2018

Construction Type

Element : Pitched roof, ceiling at rafter line - 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 | | |
| Pitched roof, tiles, with underlay or boards | - | - | 0.000 | | |
| Airspace, heat flow upwards, 50 mm thick | 50.0 | - | 0.000 | | |
| Ampatex Aero | - | - | - | | |
| SteicoFlex | 100.0 | 0.036 | 2.750 | | 9.000% Softwood (100.0mm) L:0 0.000W/m ² K |
| Beltermo Kombi | 100.0 | 0.038 | 2.600 | | L:0 0.000W/m ² K |
| Beltermo Ultra | 60.0 | 0.042 | 1.400 | | L:0 0.000W/m ² K |
| 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 | 347.5mm | | | | |

U-value = 0.15W/m²K

U-value, Combined Method : 0.147W/m²K (upper/lower limit 6.938 / 6.659m²K/W, dUf 0.0004, dUg 0.0000, dUp0.0000, dUr0.0000, dUrc1 0.0000, dUrc2 0.0000)

Correction factors

Mechanical fasteners :-

Warm pitched roof - insulation over rafters

Alpha : 0.80 per m lambda f : 17.0000W/mK nf : 6.700 per m² Af : 7.450mm² Recess : 0.0mm

Delta Uf for Beltermo Ultra : 0.0004

nf = fasteners per m² Af = fasteners cross-sectional area

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 | - | - |
| Pitched roof, tiles, with underlay or boards | - | - | 0.000 | - | 0.00 |
| Airspace, heat flow upwards, 50 mm thick | 50.0 | - | 0.000 | - | 0.00 |
| Ampatex Aero | - | - | - | - | 0.20 |
| SteicoFlex | 100.0 | 0.036 | 2.750 | 5.00 | 0.50 |
| Beltermo Kombi | 100.0 | 0.038 | 2.600 | 15.00 | 1.50 |
| Beltermo Ultra | 60.0 | 0.042 | 1.400 | 15.00 | 0.90 |
| 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 | 347.5mm | | | | |

Detailed U-value Calculation Results

Construction includes 1 bridged layer

Non-bridged layers

| | |
|---|--------------------------|
| Outside surface resistance | 0.100 m ² K/W |
| Beltermo Kombi | 2.600 m ² K/W |
| Beltermo Ultra | 1.400 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 |
| Resistance of non-bridged layers, R _{NB} = | 4.426 m ² K/W |

Bridged layer

SteicoFlex (L1) bridged by Softwood (B1)

Path 1 - SteicoFlex

Path 2 - Softwood

Resistance and fraction of heat flow paths

$$R_{P1} = R_{NB} + R_{L1} = 4.426 + 2.750 = 7.176 \text{ m}^2\text{K/W} \quad F_{P1} = 91.000\%$$

$$R_{P2} = R_{NB} + R_{L2} = 4.426 + 0.769 = 5.195 \text{ m}^2\text{K/W} \quad F_{P2} = 9.000\%$$

Upper resistance limit

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

$$R_{\text{upper}} = 1 / \left((0.910/7.176) + (0.090/5.195) \right) = 6.938 \text{ m}^2\text{K/W}$$

Lower resistance limit

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

$$R_{\text{lower}} = 4.426 + 1 / \left((0.910/2.750) + (0.090/0.769) \right) = 6.659 \text{ m}^2\text{K/W}$$

Total resistance of roof

$$R_T = (R_{\text{upper}} + R_{\text{lower}}) / 2 = (6.938 + 6.659) / 2 = 6.80 \text{ m}^2\text{K/W}$$

Mechanical fasteners :-

Calculations to BS EN ISO 6946:2007

Warm pitched roof - insulation over rafters

Alpha : 0.80 per m lambda f : 17.0000W/mK nf : 6.700 per m² Af : 7.450mm² Recess : 0.0mm

Delta Uf for Beltermo Ultra : 0.0004

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

Condensation is occurring 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/m ³) | Specific heat capacity (J/kgK) | Heat capacity (kJ/m ² K) |
|--|--|---------------------------------|--------------------------------------|---|
| Pitched roof, tiles, with underlay or boards | 0.0 (-) | 1.2 | 1008.0 | 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 |
| SteicoFlex | 0.0 (100.0) | 60.0 | 2100.0 | 0.0 |
| Beltermo Kombi | 0.0 (100.0) | 110.0 | 2100.0 | 0.0 |
| Beltermo Ultra | 0.0 (60.0) | 180.0 | 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
kappa value 10124746.0
10.1247

Limiting condition: insulation

Admittance : 1.36 W/m²K Decrement : 0.20 factor Decrement delay : -12.39 hours

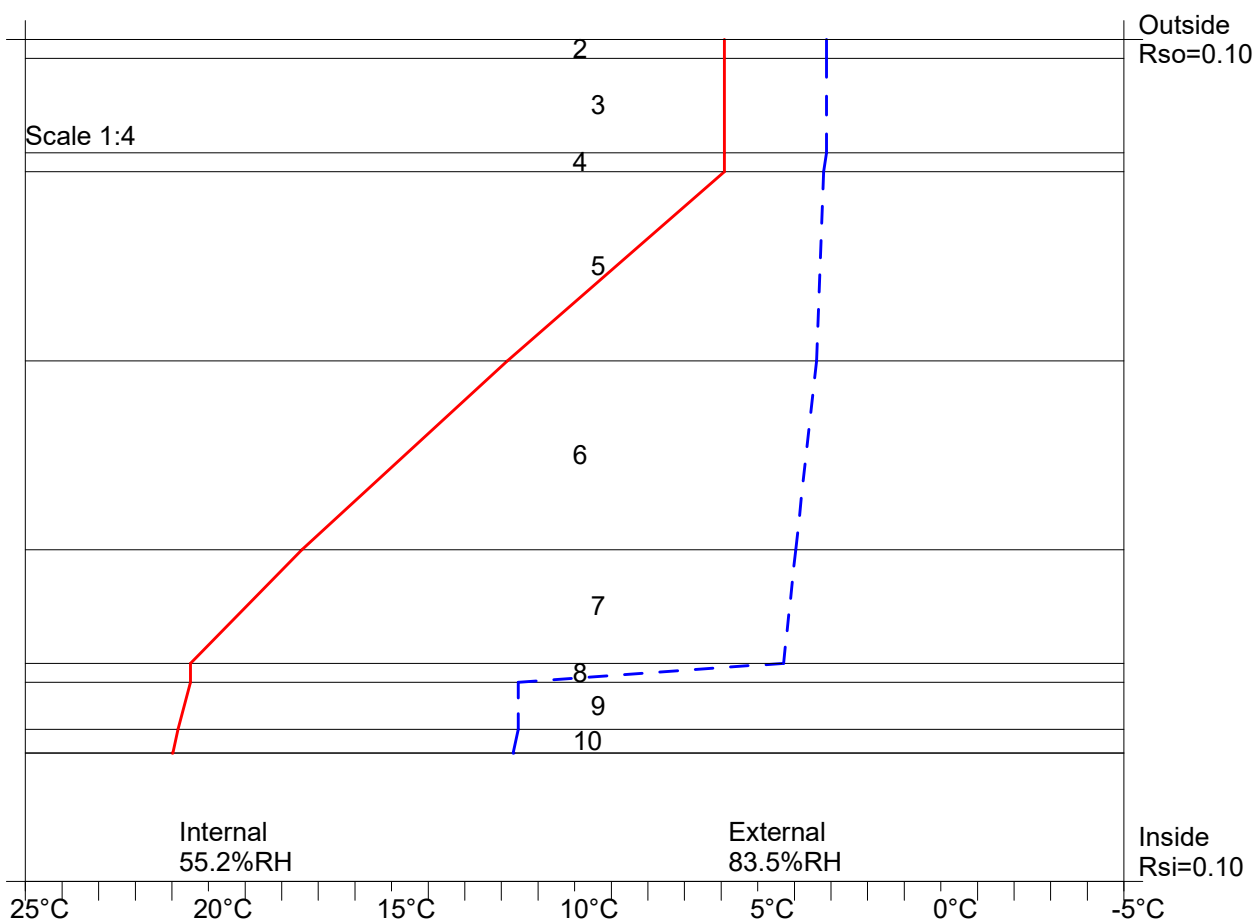
Condensation Risk Analysis (no account taken of thermal bridges)

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 Pitched roof, tiles, with underlay or boards | 5.9 | 3.1 | 0.76 | 0.93 | | | No |
| 3 Airspace, heat flow upwards, 50 mm thick | 5.9 | 3.1 | 0.76 | 0.93 | | | No |
| 4 Ampatex Aero | 5.9 | 3.1 | 0.76 | 0.93 | | | No |
| 5 SteicoFlex | 5.9 | 3.2 | 0.77 | 0.93 | | | No |
| 6 Beltermo Kombi | 11.8 | 3.4 | 0.78 | 1.39 | | | No |
| 7 Beltermo Ultra | 17.4 | 4.0 | 0.81 | 1.99 | | | No |
| 8 Ampatex Sinco | 20.5 | 4.3 | 0.83 | 2.41 | | | No |
| 9 Airspace, heat flow upwards, 25 mm thick | 20.5 | 11.5 | 1.36 | 2.41 | | | No |
| 10 Gyproc Wallboard | 20.8 | 11.5 | 1.36 | 2.46 | | | No |
| 11 Inside surface resistance | 21.0 | 11.7 | 1.37 | 2.48 | | | 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 Pitched roof, tiles, with underlay or boards | 16.2 | 12.8 | 1.47 | 1.84 | | | No |
| 3 Airspace, heat flow upwards, 50 mm thick | 16.2 | 12.8 | 1.47 | 1.84 | | | No |
| 4 Ampatex Aero | 16.2 | 12.8 | 1.47 | 1.84 | | | No |
| 5 SteicoFlex | 16.2 | 12.8 | 1.47 | 1.84 | | | No |
| 6 Beltermo Kombi | 18.1 | 12.8 | 1.48 | 2.07 | | | No |
| 7 Beltermo Ultra | 19.9 | 12.9 | 1.49 | 2.32 | | | No |
| 8 Ampatex Sinco | 20.8 | 13.0 | 1.50 | 2.46 | | | No |
| 9 Airspace, heat flow upwards, 25 mm thick | 20.8 | 15.0 | 1.70 | 2.46 | | | No |
| 10 Gyproc Wallboard | 20.9 | 15.0 | 1.70 | 2.48 | | | No |
| 11 Inside surface resistance | 21.0 | 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

