

Back to Earth SW Ltd

7 Tuns Lane
Silverton
Exeter
EX5 4HY

Project Information

Reference

Date 20 November 2023

Construction Type

Element : Flat roof - Roof-flat-single ply-200mm

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	-	-	0.040		
EPDM (ethylene propylene diene monomer)	1.0	0.250	0.004		
Plywood (500 kg/m ³)	18.0	0.130	0.138		
Beltermo Ultra	120.0	0.042	2.850		L:0 0.000W/m ² K
SteicoFlex	200.0	0.036	5.550		9.000% Softwood (200.0mm) L:0 0.000W/m ² K
Ampatex Variano	-	-	-		
Fermacell	10.0	0.320	0.031		
SteicoFlex	38.0	0.036	1.050		11.800% Softwood (38.0mm) L:0 0.000W/m ² K
Gyproc Wallboard	12.5	0.190	0.066		
Inside surface resistance	-	-	0.100		

Total thickness 399.5mm

U-value = 0.11W/m²K

U-value, Combined Method : 0.113W/m²K (upper/lower limit 9.155 / 8.529m²K/W, dUf 0.0023, 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 : 50.0000W/mK nf : 6.700 per m² Af : 12.500mm² Recess : 0.0mm

Delta Uf for Beltermo Ultra : 0.0023

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)

Detailed U-value Calculation Results

Construction includes 2 bridged layers

Non-bridged layers

Outside surface resistance	0.040 m ² K/W
EPDM (ethylene propylene diene monomer)	0.004 m ² K/W
Plywood (500 kg/m ³)	0.138 m ² K/W
Beltermo Ultra	2.850 m ² K/W
Fermacell	0.031 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} =	3.229 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

$$\begin{aligned}R_{P1} &= R_{NB} + R_{L1} = 3.229 + 6.600 = 9.829 \text{ m}^2\text{K/W} & F_{P1} &= 80.262\% \\R_{P2} &= R_{NB} + R_{L2} = 3.229 + 2.588 = 5.818 \text{ m}^2\text{K/W} & F_{P2} &= 7.938\% \\R_{P3} &= R_{NB} + R_{L3} = 3.229 + 5.842 = 9.072 \text{ m}^2\text{K/W} & F_{P3} &= 10.738\% \\R_{P4} &= R_{NB} + R_{L4} = 3.229 + 1.831 = 5.060 \text{ m}^2\text{K/W} & F_{P4} &= 1.062\%\end{aligned}$$

Upper resistance limit

$$\begin{aligned}R_{upper} &= 1 / \left(\frac{F_{P1}}{R_{P1}} + \frac{F_{P2}}{R_{P2}} + \frac{F_{P3}}{R_{P3}} + \frac{F_{P4}}{R_{P4}} \right) \\R_{upper} &= 1 / \left(\frac{0.803}{9.829} + \frac{0.079}{5.818} + \frac{0.107}{9.072} + \frac{0.011}{5.060} \right) = 9.155 \text{ m}^2\text{K/W}\end{aligned}$$

Lower resistance limit

$$\begin{aligned}R_{lower} &= R_{NB} + 1 / \left(\frac{F_{L1}}{R_{L1}} + \frac{F_{B1}}{R_{B1}} \right) + 1 / \left(\frac{F_{L2}}{R_{L2}} + \frac{F_{B2}}{R_{B2}} \right) \\R_{lower} &= 3.229 + 1 / \left(\frac{0.910}{5.550} + \frac{0.090}{1.538} \right) + 1 / \left(\frac{0.882}{1.050} + \frac{0.118}{0.292} \right) = 8.529 \text{ m}^2\text{K/W}\end{aligned}$$

Total resistance of roof

$$R_T = (R_{upper} + R_{lower}) / 2 = (9.155 + 8.529) / 2 = 8.84 \text{ m}^2\text{K/W}$$

Mechanical fasteners :-

Calculations to BS EN ISO 6946:2007

Warm pitched roof - insulation over rafters

Alpha : 0.80 per m lambda f : 50.0000W/mK nf : 6.700 per m² Af : 12.500mm² Recess : 0.0mm

Delta Uf for Beltermo Ultra : 0.0023

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) = 0.11 W/m²K

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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)
EPDM (ethylene propylene diene monomer)	0.0 (1.0)	1150.0	1000.0	0.0
Plywood (500 kg/m ³)	0.0 (18.0)	500.0	1600.0	0.0
Beltermo Ultra	0.0 (120.0)	180.0	2100.0	0.0
SteicoFlex	0.0 (200.0)	60.0	2100.0	0.0
Ampatex Variano	0.0 (-)	280.0	850.0	0.0
Fermacell	0.0 (10.0)	1150.0	1000.0	0.0
SteicoFlex	0.0 (38.0)	60.0	2100.0	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 : 0.76 W/m²K Decrement : 0.07 factor Decrement delay : -18.25 hours