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 (m²K/W)	Pitch (º)	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/m³)	18.0	0.130	0.138		
Beltermo Ultra	50.0	0.042	1.150		L:0 0.000W/m²K
SteicoFlex	200.0	0.036	5.550		9.000% Softwood (200.0mm) L:0 0.000W/m²K
Ampatex Variano	-	-	-		
Fermacell	10.0	0.320	0.031		
Airspace, heat flow upwards, 25 mm thick	25.0	-	0.160		
Gyproc Wallboard	12.5	0.190	0.066		
Inside surface resistance	-	-	0.100		
Total thickness	**316.5mm**				

U-value = 0.16W/m²K

U-value, Combined Method : 0.158W/m²K (upper/lower limit 6.511 / 6.185m²K/W, dUf 0.0017, 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 : 0.0017
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 1 bridged layer

Non-bridged layers

Outside surface resistance	0.040 m²K/W
EPDM (ethylene propylene diene monomer)	0.004 m²K/W
Plywood (500 kg/m³)	0.138 m²K/W
Beltermo Ultra	1.150 m²K/W
Fermacell	0.031 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} =	1.689 m²K/W

Bridged layer

SteicoFlex (L1) bridged by Softwood (B1)

Path 1 - SteicoFlex
Path 2 - Softwood

Resistance and fraction of heat flow paths

$R_{P1} = R_{NB} + R_{L1} = 1.689 + 5.550 = 7.239$ m²K/W $F_{P1} = 91.000\%$
$R_{P2} = R_{NB} + R_{L2} = 1.689 + 1.538 = 3.228$ m²K/W $F_{P2} = 9.000\%$

Upper resistance limit

$R_{upper} = 1 / ((F_{P1}/R_{P1}) + (F_{P2}/R_{P2}))$
$R_{upper} = 1 / ((0.910/7.239) + (0.090/3.228)) = 6.511$m²K/W

Lower resistance limit

$R_{lower} = R_{NB} + 1 / ((F_{L1}/R_{L1}) + (F_{B1}/R_{B1}))$
$R_{lower} = 1.689 + 1 / ((0.910/5.550) + (0.090/1.538)) = 6.185$m²K/W

Total resistance of roof

$R_T = (R_{upper} + R_{lower}) / 2 = (6.511 + 6.185) / 2 = 6.35$ m²K/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 : 0.0017
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) = 0.16 W/m²K

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Thermal Mass Details

	Thickness assessed (actual) (mm)	Density (kg/m³)	Specific heat capacity (J/kgK)	Heat capacity (kJ/m²K)
EPDM (ethylene propylene diene monomer)	0.0 (1.0)	1150.0	1000.0	0.0
Plywood (500 kg/m³)	0.0 (18.0)	500.0	1600.0	0.0
Beltermo Ultra	0.0 (50.0)	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	10.0 (10.0)	1150.0	1000.0	11500000.0
Airspace, heat flow upwards, 25 mm thick	25.0 (25.0)	1.2	1008.0	30996.0
Gyproc Wallboard	12.5 (12.5)	0.0	0.0	0.0
Total				11530996.0
kappa value				11.5310
Limiting condition:	insulation			

Admittance : 1.12 W/m²K Decrement : 0.34 factor Decrement delay : -10.98 hours