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-150mm
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	60.0	0.042	1.400		L:0 0.000W/m²K
SteicoFlex	150.0	0.036	4.150		9.000% Softwood (150.0mm) L:0 0.000W/m²K
Fermacell	10.0	0.320	0.031		
Ampatex Variano	-	-	-		
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	**276.5mm**				

U-value = 0.18W/m²K

U-value, Combined Method : 0.183W/m²K (upper/lower limit 5.601 / 5.303m²K/W, dUf 0.0030, 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 : 0.0030
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	1.400 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} =	1.939 m²K/W

Bridged layer

SteicoFlex (L1) bridged by Softwood (B1)

Path 1 - SteicoFlex
Path 2 - Softwood

Resistance and fraction of heat flow paths

$R_{P1} = R_{NB} + R_{L1} = 1.939 + 4.150 = 6.089$ m²K/W $F_{P1} = 91.000\%$
$R_{P2} = R_{NB} + R_{L2} = 1.939 + 1.154 = 3.093$ m²K/W $F_{P2} = 9.000\%$

Upper resistance limit

$R_{upper} = 1 / ((F_{P1}/R_{P1}) + (F_{P2}/R_{P2}))$
$R_{upper} = 1 / ((0.910/6.089) + (0.090/3.093)) = 5.601$m²K/W

Lower resistance limit

$R_{lower} = R_{NB} + 1 / ((F_{L1}/R_{L1}) + (F_{B1}/R_{B1}))$
$R_{lower} = 1.939 + 1 / ((0.910/4.150) + (0.090/1.154)) = 5.303$m²K/W

Total resistance of roof

$R_T = (R_{upper} + R_{lower}) / 2 = (5.601 + 5.303) / 2 = 5.45$ 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 : 0.0030
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) = 0.18 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 (60.0)	180.0	2100.0	0.0
SteicoFlex	0.0 (150.0)	60.0	2100.0	0.0
Fermacell	10.0 (10.0)	1150.0	1000.0	11500000.0
Ampatex Variano	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)	0.0	0.0	0.0
Total				11530996.0
kappa value				11.5310
Limiting condition:	insulation			

Admittance : 1.12 W/m²K Decrement : 0.42 factor Decrement delay : -9.57 hours