Customer:

Eurocell Group Ltd.
Fairbrock House, Clover Nook Road
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UK

Project/Customer:

Rooflight Skypod

Content:

- U_g calculation of insulating glass in accordance to EN 673
- Ψ_{tj} simulation of profiles incl. glass edge in accordance to EN ISO 12631 and EN ISO 10077-2
- U_d calculation of roof lights on the basis of EN 1873, EN 14963 and EN ISO 10077-1

Object:

- Profile: aluminium roof light profiles (see drawing)
- Glass: 24 mm double insulating glass unit (4-16-4)
  - U_g = 1,0 W/m²K
  - U_g = 1,2 W/m²K
- Glass edge: Thermoflex Spacer by Thermoseal with 6 mm secondary sealant (hot melt butyl)
- Wall / upstand / base frame: not taken into account

Normative references:

- EN ISO 10077-1:2010-05, Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: General
- EN ISO 10077-2:2012-06, Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2: Numerical method for frames
- EN ISO 10211:2008-04, Thermal bridges in building construction – Heat flows and surface temperatures
- EN 673:2011-04, Glass in building – Determination of thermal transmittance (U value) – Calculation method
- ift guideline WA-08/3:2015, Thermally improved spacers, Part 2 – Determination of representative Ψ values for profile sections of windows
- EN ISO 6946:2008-04, Building components and building elements – Thermal resistance and thermal transmittance – Calculation method
- EN ISO 10456:2010-05, Building materials and products – hygrothermal properties – tabulated values and procedure for determining declared and designed thermal values
- Eurolux guideline 01:2011-09, Determination of thermal transmittance of roof lights in accordance to EN 1873 and EN 14963
- EN 1873:2014-08, Prefabricated accessories for roofing – Individual roof lights of plastics – Product specification and test methods
- EN 14963:2006-12, Roof coverings – Continuous roof lights of plastics with or without upstands – Classification, requirements and test methods

Assumptions/Advices:

- The following results are only valid for the shown geometries and material characteristics. The geometries are based on drawing provided by the customer.
- For the purpose of comparison the influence of the inclination to the U_g value of the insulating glass in accordance to EN 673 was not taken into account in the following simulation and the following calculation of the entire roof light. The insulating glass was assumed to be installed vertically.

Materials:

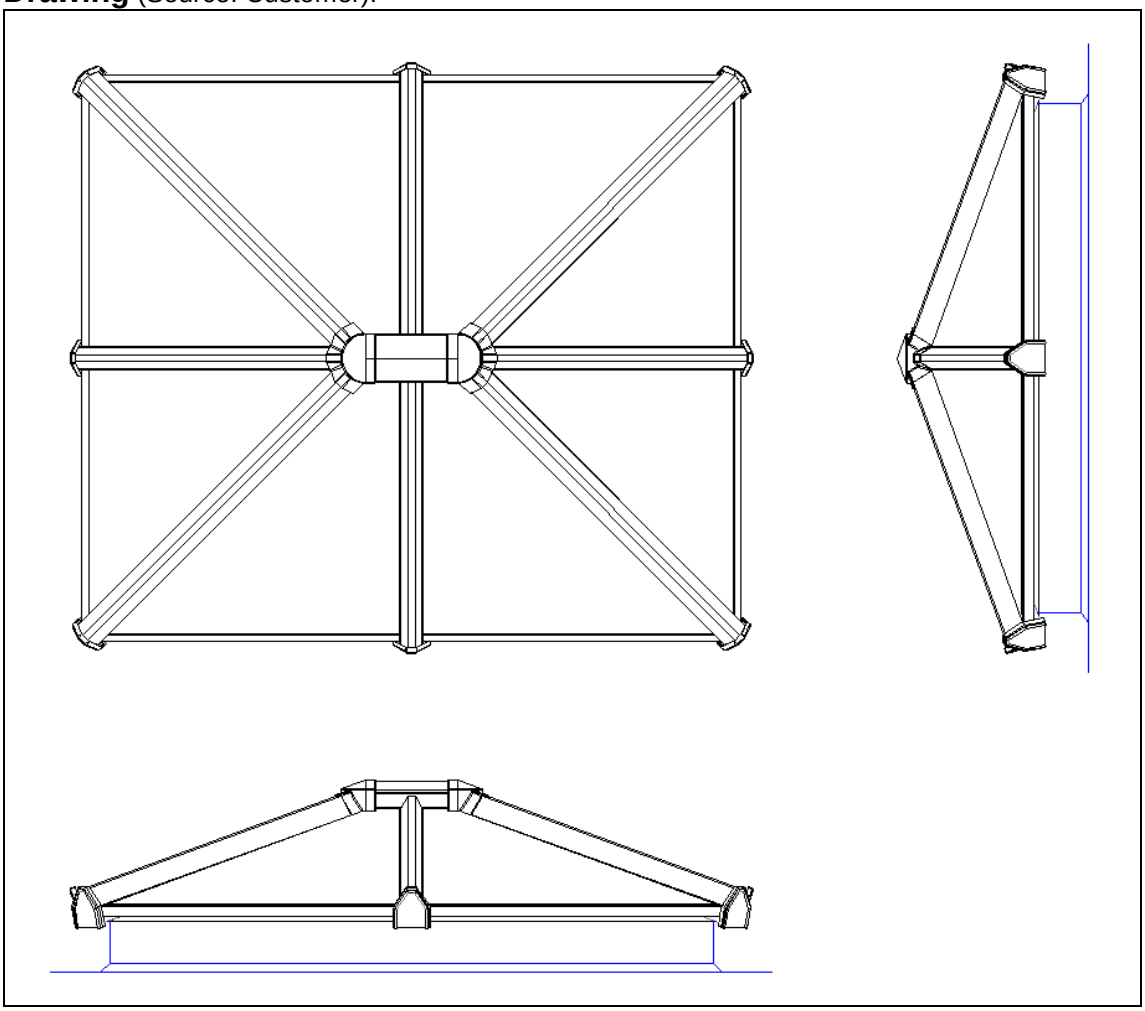
	Boundary conditions	R_s (m^2K/W)	θ (°C)	10077-2 conform
	external air	0.040	0,0	X
	internal air (standard)	0.13	20.0	X
	internal air (reduced radiation and convection)	0.20	20.0	X
	Generally	R_s (m^2K/W)	θ (°C)	10077-2 conform
	unventilated cavity	acc. to EN ISO 10077-2		X
	unventilated cavity <= 2 mm			X
	slightly ventilated cavity			X
	Materials	λ (W/mK)		10456 conform
	aluminium coated	160		X
	PVC U	0.17		X
	PVC soft	0.14		X
	foam tape	0.050		X
	float glass	1.0		X
	gas in IG cavity	acc. to EN ISO 673		X
	hot melt butyl (secondary sealant, 6 mm)	0.24		X
	Thermoflex Spacer by Thermoseal (2 box model)	0.135		X

For thermal simulations designed values of thermal conductivity must be used. The tabulated values are designed values unless there are marked as different.
Values marked with " ** " are designed values taken from customers declaration. Certificates are available from the customer.

Isothermal lines:

0°C to 20°C in 1°C steps
Red: 13°C isothermal line
Blue: 10°C isothermal line (condensation critical temperature 20°C, 50%)

Drawing (Source: Customer):



Top and side view

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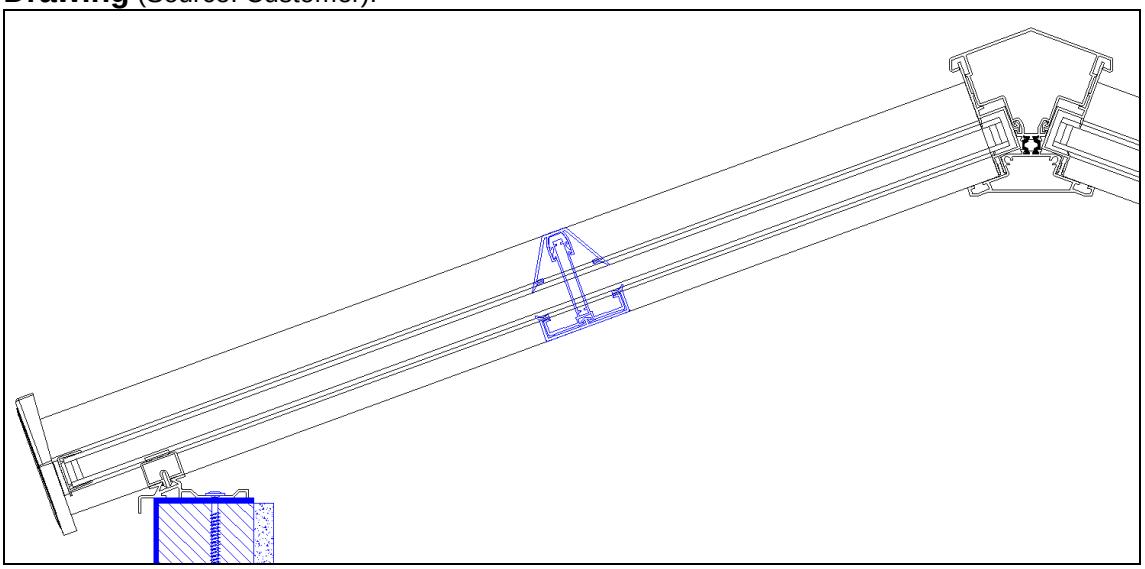
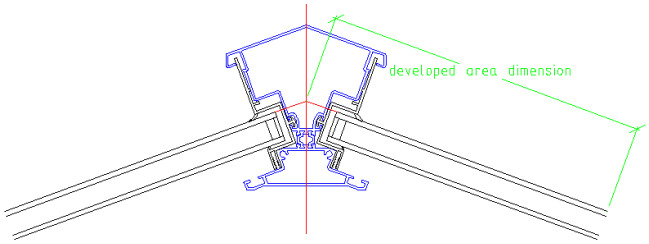
Drawing (Source: Customer):

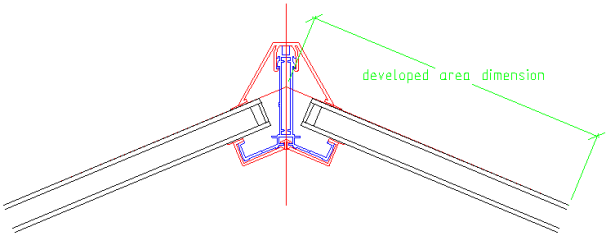


Cross section Eave, Rafter and Ridge

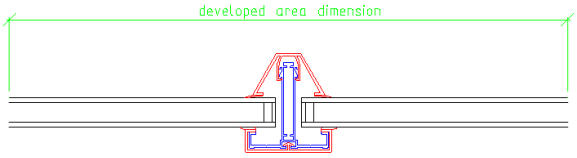
Developed area definition:



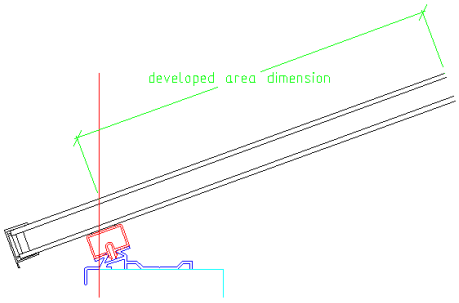
Ridge



Hip Rafter



Standard Rafter



Eave

Eave (U_g = 1.0 W/m²K)

Simulation model (detail) with insulating glass unit (isothermal lines at 0°C externally / 20°C internally)

U_g	=	***1.0***	W/m²K	(insulating glass unit centre, vertical installation)
Ψ_{tj}	=	***0.41*** (0.408)	W/mK	(profile including glass edge influence)

Minimum internal surface temperature and temperature factor with 0°C externally / 20°C internally and assumption of condensation risk:

$\Theta_{si(0°C)}$	=	4.5	°C	< 9.3°C condensation risk at 20°C/50% internally
f_{Rsi}	=	0.23		

Eave (U_g = 1.2 W/m²K)

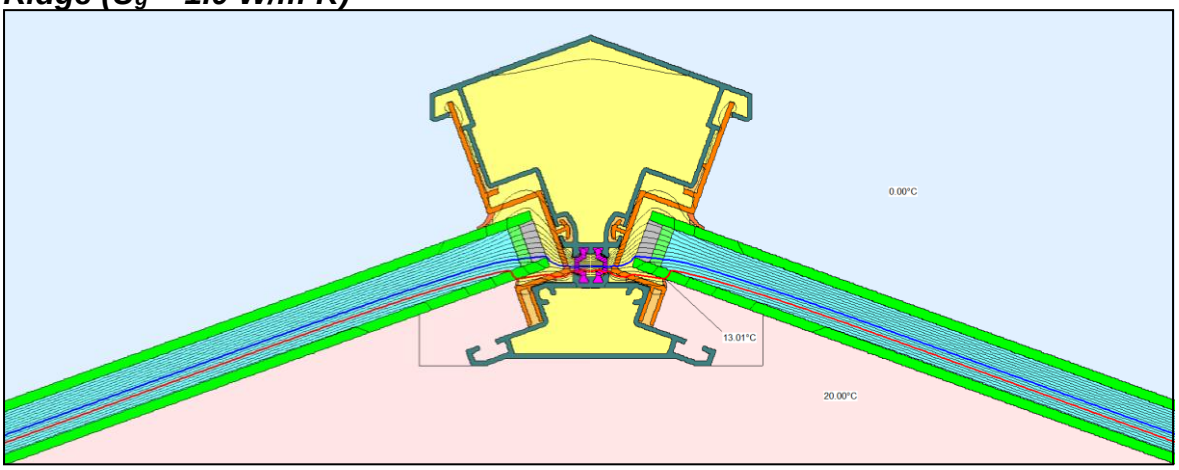
Simulation model (detail) with insulating glass unit (isothermal lines at 0°C externally / 20°C internally)

U_g	=	***1.2***	W/m²K	(insulating glass unit centre, vertical installation)
Ψ_{tj}	=	***0.40*** (0.402)	W/mK	(profile including glass edge influence)

Minimum internal surface temperature and temperature factor with 0°C externally / 20°C internally and assumption of condensation risk:

$\Theta_{si(0°C)}$	=	4.5	°C	< 9.3°C condensation risk at 20°C/50% internally
f_{Rsi}	=	0.23		

Ridge (U_g = 1.0 W/m²K)



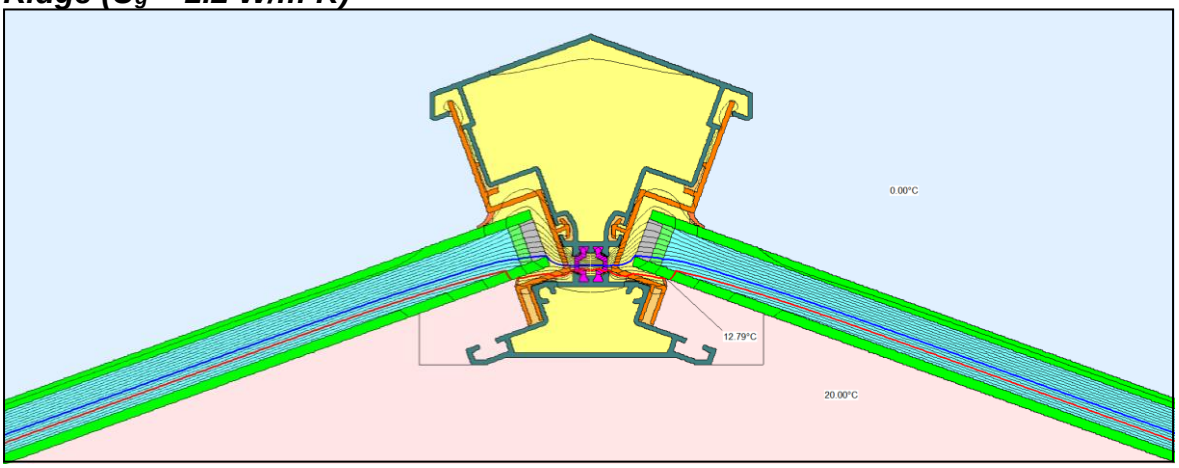
Simulation model (detail) with insulating glass unit (isothermal lines at 0°C externally / 20°C internally)

U_g	=	***1.0***	W/m²K	(insulating glass unit centre, vertical installation)
Ψ_{tj}	=	***0.24*** (0.242)	W/mK	(profile including glass edge influence)

Minimum internal surface temperature and temperature factor with 0°C externally / 20°C internally and assumption of condensation risk:

$\Theta_{si(0°C)}$	=	13.0	°C	> 9.3°C no condensation risk at 20°C/50% internally
f_{Rsi}	=	0.65		

Ridge (U_g = 1.2 W/m²K)



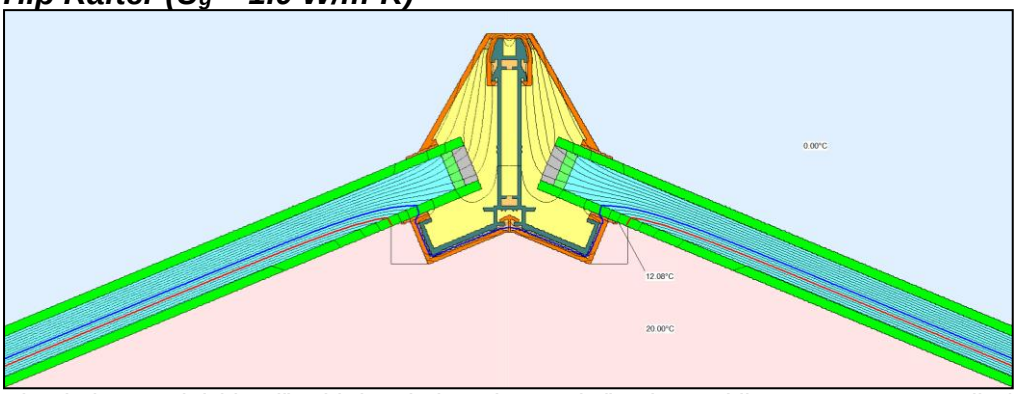
Simulation model (detail) with insulating glass unit (isothermal lines at 0°C externally / 20°C internally)

U_g	=	***1.2***	W/m²K	(insulating glass unit centre, vertical installation)
Ψ_{tj}	=	***0.22*** (0.220)	W/mK	(profile including glass edge influence)

Minimum internal surface temperature and temperature factor with 0°C externally / 20°C internally and assumption of condensation risk:

$\Theta_{si(0°C)}$	=	12.8	°C	> 9.3°C no condensation risk at 20°C/50% internally
f_{Rsi}	=	0.64		

Hip Rafter (U_g = 1.0 W/m²K)



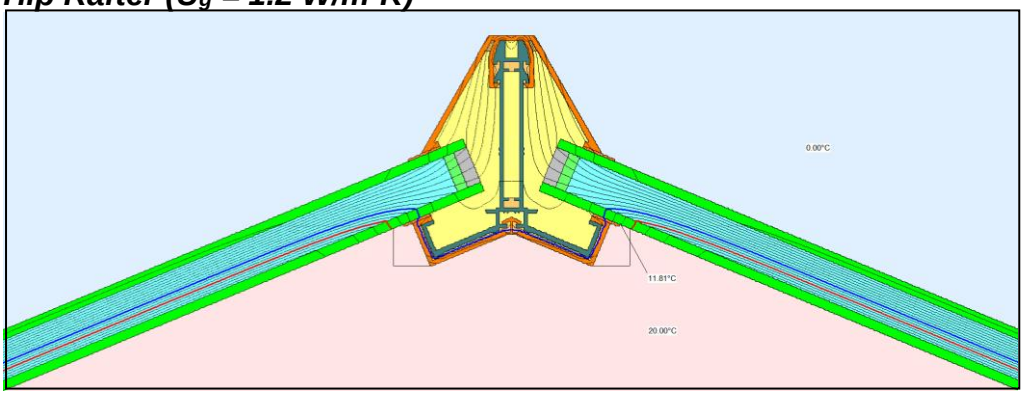
Simulation model (detail) with insulating glass unit (isothermal lines at 0°C externally / 20°C internally)

U_g	=	***1.0***	W/m²K	(insulating glass unit centre, vertical installation)
Ψ_{tj}	=	***0.31*** (0.314)	W/mK	(profile including glass edge influence)

Minimum internal surface temperature and temperature factor with 0°C externally / 20°C internally and assumption of condensation risk:

$\Theta_{si(0°C)}$	=	12.1	°C	> 9.3°C no condensation risk at 20°C/50% internally
f_{Rsi}	=	0.60		

Hip Rafter (U_g = 1.2 W/m²K)



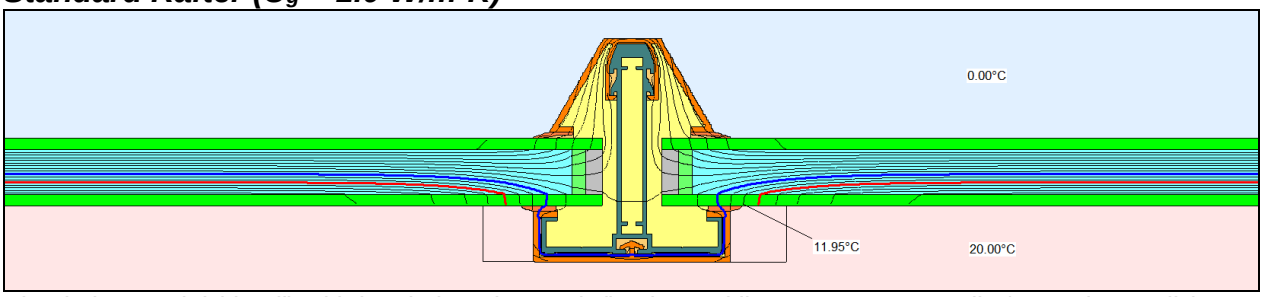
Simulation model (detail) with insulating glass unit (isothermal lines at 0°C externally / 20°C internally)

U_g	=	***1.2***	W/m²K	(insulating glass unit centre, vertical installation)
Ψ_{tj}	=	***0.29*** (0.288)	W/mK	(profile including glass edge influence)

Minimum internal surface temperature and temperature factor with 0°C externally / 20°C internally and assumption of condensation risk:

$\Theta_{si(0°C)}$	=	11.8	°C	> 9.3°C no condensation risk at 20°C/50% internally
f_{Rsi}	=	0.59		

Standard Rafter (U_g = 1.0 W/m²K)



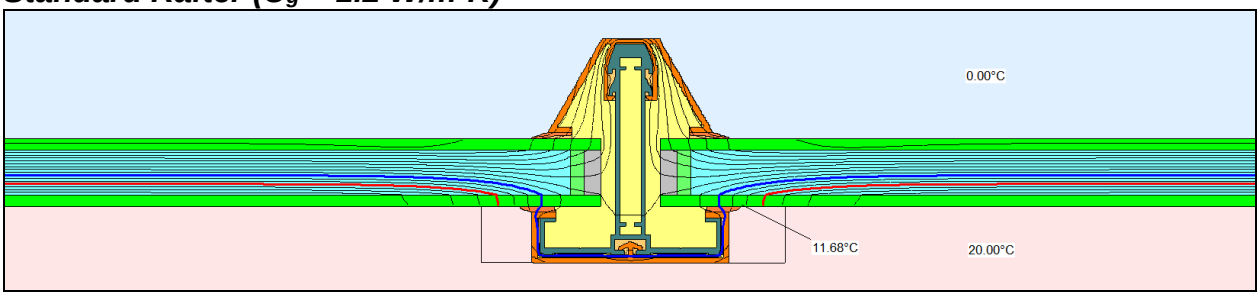
Simulation model (detail) with insulating glass unit (isothermal lines at 0°C externally / 20°C internally)

U_g	=	***1.0***	W/m²K	(insulating glass unit centre, vertical installation)
Ψ_{tj}	=	***0.31*** (0.309)	W/mK	(profile including glass edge influence)

Minimum internal surface temperature and temperature factor with 0°C externally / 20°C internally and assumption of condensation risk:

$\Theta_{si(0°C)}$	=	12.0	°C	> 9.3°C no condensation risk at 20°C/50% internally
f_{Rsi}	=	0.60		

Standard Rafter (U_g = 1.2 W/m²K)



Simulation model (detail) with insulating glass unit (isothermal lines at 0°C externally / 20°C internally)

U_g	=	***1.2***	W/m²K	(insulating glass unit centre, vertical installation)
Ψ_{tj}	=	***0.29*** (0.290)	W/mK	(profile including glass edge influence)

Minimum internal surface temperature and temperature factor with 0°C externally / 20°C internally and assumption of condensation risk:

$\Theta_{si(0°C)}$	=	11.7	°C	> 9.3°C no condensation risk at 20°C/50% internally
f_{Rsi}	=	0.58		

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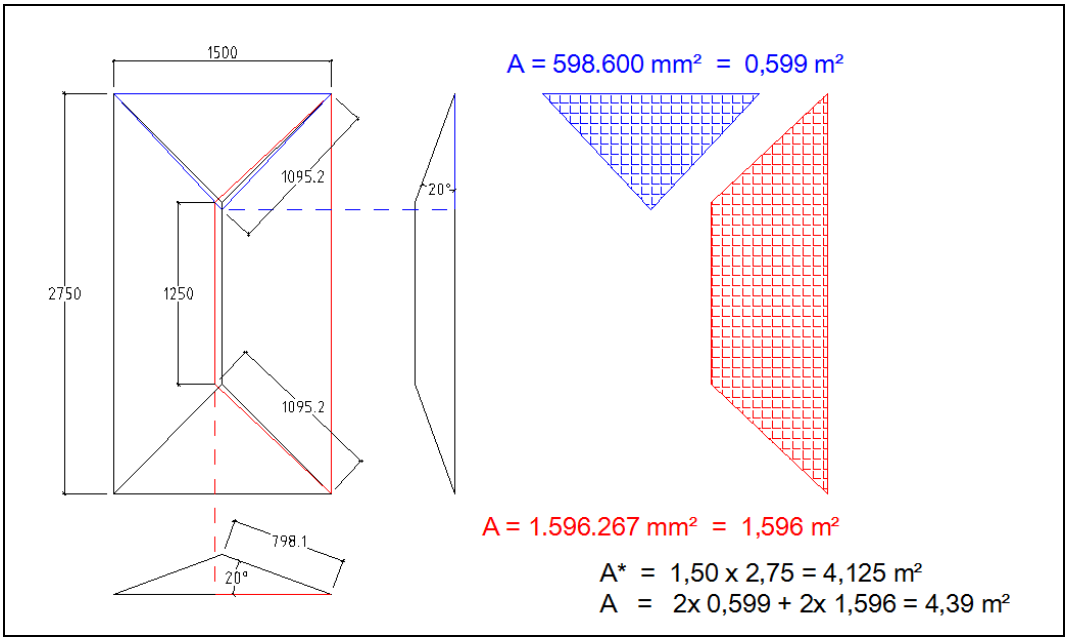
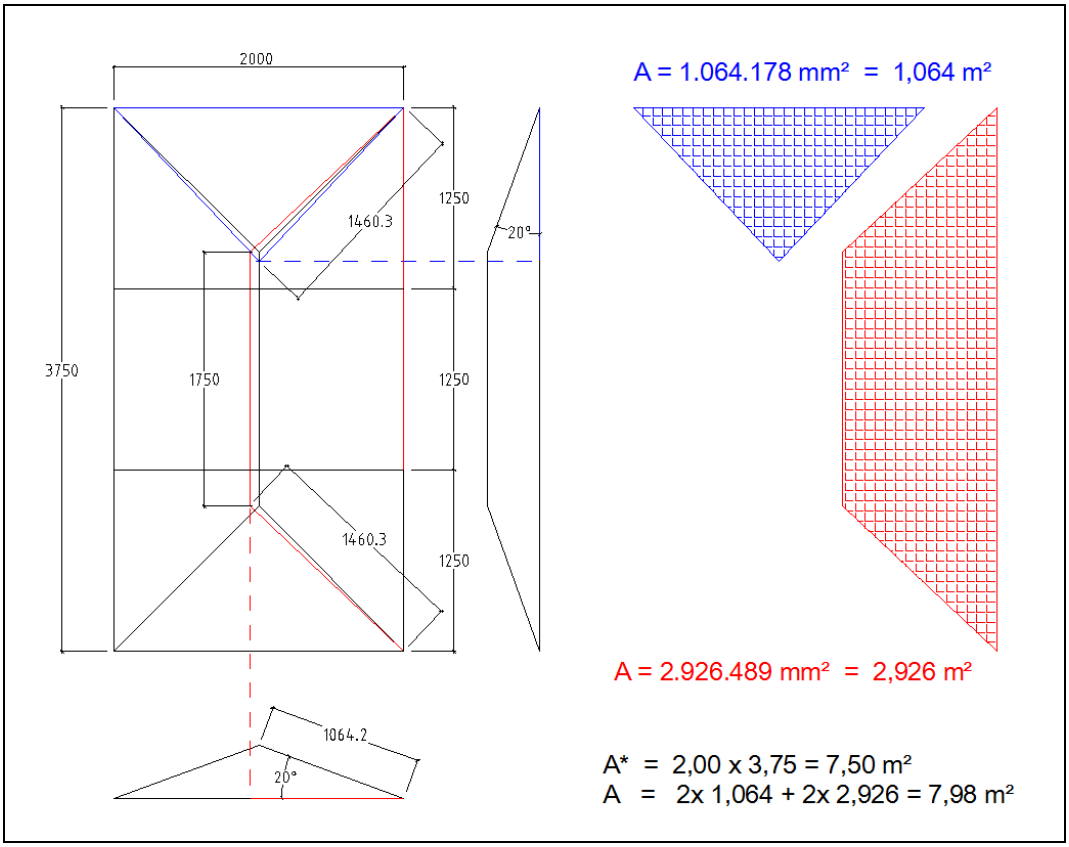
Dimension:

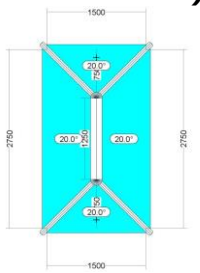
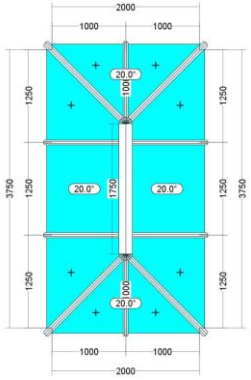


Small Skypod



Medium Skypod

Summary and U_d calculation:

	U_g = 1.0* W/m²K	U_g = 1.2* W/m²K	length in m small / medium Skypod
Ψ_{tj} in W/mK			
Eave	**0.41** (0.408)	**0.40** (0.402)	8.50 / 11.50
Ridge	**0.24** (0.242)	**0.22** (0.220)	1.25 / 1.75
Hip Rafter	**0.31** (0.314)	**0.29** (0.288)	4.38 / 5.84
Standard Rafter	**0.31** (0.309)	**0.29** (0.290)	0.00 / 4.26
U_d in W/m²K			*Developed roof light area A_d in m²*
Small Skypod (1.50 x 2.75 m) 	**2.2*** (2.172)	**2.3*** (2.328)	4.39
Medium Skypod (2.00 x 3.75 m) 	**2.0** *(2.036)	**2.2*** (2.193)	7.98

Advice: For the purpose of comparison the influence of the inclination to the U_g value of the insulating glass in accordance to EN 673 was not taken into account in this calculation. The insulating glass was assumed to be installed vertically.

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Rosenheim, 26th May 2017

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