STELLARIA.

TECHNICAL RESOURCE DOCUMENTATION

Thermal Reports (Soundtherm Solutions)

Description	Thermal Reports for both Hamilton and Taupo Porotherm homes
Issue Date	Hamilton 2016 | Taupo 2018
Revision	01

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New Plymouth, 10. November 2016

Hamilton House 3283 Hamilton

Compliance Report – Clause H1

1.0 INTRODUCTION

Soundtherm Solutions Ltd (SS) has been engaged by MacPherson Architecture to assist with the preliminary energy design of the proposed new dwelling; Hamilton House, Hamilton.

This document describes the recommended energy efficiency performance specification of this development, based on New Zealand Building Code Clause H1 and the energy quality desired by the client.

The report focuses on the review of the building thermal envelope partitions.

2.0 ENERGY REQUIREMENTS

The energy efficiency criteria are described in the New Zealand Standard NZS 4218:2009; Thermal Insulation – Housing and small buildings.

Energy efficient design of housing and small buildings should consider solar gain from glazing, thermal insulation and thermal mass. In the New Zealand climate, good passive solar design incorporating appropriate areas of glazing and thermal mass, combined with a well- insulated thermal envelope, can significantly reduce the energy requirements to heat and cool buildings.

2.1 LOCATION

The proposed new dwelling will be located in Hamilton. From Figure 1 can be seen that Hamilton is situated in the climate zone 2.

Figure 1 – Climate Zones (Source NZS 4218:2009)

2.2 CRITERIA AND CALCULATION METHOD

The glazing area on the East, South and West facing walls is more than 30% of the total wall area. Therefore the scheduled verification method of energy efficiency based on NZS 4218:2009 is not applicable for the proposed project.

We have used the calculation method based on BRANZ Tool and also our extended modelling method using Passive House Planning Package (PHPP) Software.

3.0 RESULTS

The energy efficiency results using BRANZ Tool are shown in Figure 1 and Figure 2. Because of improved passive house architecture and passive solar energy design we have also used a more precise and extended calculation method.

The results of this calculation are shown in Figures 3, 4 and xxxx.

Figure 2 – Calculation method using BRANZ Tool

BRANZ NZS 4218:2009 CALCULATION METHOD TOOL

PROJECT SUMMARY

Project name	Hamilton House
Address	Hamilton
Designer	Soundtherm Solutions Limited, Luboš Krajči
Address	294A Surrey Hill Road, 4374 New Plymouth
Phone	279 662 442
Date	10.11.2016
Reference number	16_006

Climate zone	2: Rest of North Island not in zones 1 or 3
Wall construction type	1: Any wall type
If mixed wall types	0 Percentage of wall area solid timber construction
	100 Percentage of wall area high thermal mass construction
	0 Percentage of wall area "Any wall type"
If solid timber wall	

Summary of calculation method heat loss

Element	Area (m²)	Proposed building heat loss (W/°C)	Reference building heat loss (W/°C)	
Roofs/ceilings	306.3	59.1	105.6	
Walls	517.8	395.3	272.5	
Floors	267.9	96.6	206.1	
Vertical glazing	204.8	204.8	833.8	
Skylights	0.0	0.0	-	
Doors	0.0	0.0	-	
Total		755.8	1418.0	W/°C

Glazing percentage: 28%
Glazing <40%: Yes
Minimum R-values OK: Yes
Issues to check: Some R-values appear to be very high. Check highlighted values.

PASS/FAIL **PASS**

Figure 3 – Calculation method using BRANZ Tool

BRANZ NZS 4218:2009 CALCULATION METHOD TOOL

BUILDING ELEMENTS

Roofs/ceilings: Skylights are not included here. Enter them in the skylights table below.

Roof/ceiling element	Description	Area (m²)	Construction R-value	Heat loss
1	Extensive roof with PUR Thermal insulation	306.27	5.18	59.1
2				
3				
4				
5				
	Total area	306.27 m²		
			Total roofs/ceilings heat loss	59.1 W/°C

Skylights: Skylights are at an angle of 60° or less to the horizontal. If the skylight R-value is not known, use a value of 0.15.

Skylight	Description	Area (m²)	Construction R-value	Heat loss
1				
2				
3				
4				
5				
	From Skylight Schedule	0		0.0
	Total area	0 m²		
			Total skylight heat loss	0.0 W/°C

Walls: Doors are not included here. Enter them in the door table.

Wall element	Description	Area (m²)	Construction R-value	Heat loss
1	Facade Porotherm R25th+	517.8	1.31	395.3
2				
3				
4				
5				
6				
	Total area	517.8 m²		
			Total wall heat loss	395.3 W/°C

Floors: Only include the ground or exterior floors. Intermediate floors not exposed to the exterior are excluded.

Floor element	Description	Area (m²)	Construction R-value	Heat loss
1	Floor Slab against Ground	245.47	3.04	80.7
2	Floor Slab against Ambient	22.4	1.41	15.9
3				
4				
5				
	Total area	267.87 m²		
			Floor heat loss	96.6 W/°C

Vertical glazing: Vertical glazing only (steeper than 60°), including glazing in doors. Skylights are on the Skylight table.
If the glazing R-value is not known, use a value of 0.15

Glazing element	Description	Area (m²)	Construction R-value	Heat loss
1				
2	Windows E	23.89	1	23.9
3	Windows S	100	1	100.0
4	Windows W	80.91	1	80.9
5				
6				
7				
8				
9				
10				
	From Glazing Schedule	0		0.0
	Total area	204.8 m²		
			Total vertical glazing heat loss	204.8 W/°C

Doors: Only the non-glazed area of doors is included. The glazed area of doors must be entered in the Glazing table.
The heat loss of doors is automatically set to 0 if the total door area is ≤ 6m² or 6% of the total wall area.
If the R-value of a door is not entered a default value of R 0.18 is automatically used.

Door element	Description	Area (m²)	Construction R-value	Heat loss
1				0.0
2				0.0
3				0.0
4				0.0
5				
	From Door Schedule	0		0.0
	Total area	0		
			Total door heat loss	0.0 W/°C

Figure 3 – Calculation method using PHPP Software

Passive House Verification

Photo or Drawing

Building:	Hamilton House
Street:	
Postcode/City:	Hamilton
Province/Country:	Hamilton
Building type:	Residential
Climate data set:	NZ0010a-Hamilton / Ruakura
Climate zone:	4: Warm-temperate — Altitude of location: 70 m
Home owner / Client:	Hamilton
Street:	
Postcode/City:	
Province/Country:	

Architecture:	MacPherson Architecture Ltd
Street:	Cnr Of Empire & Duke Street Empire St,
Postcode/City:	3434 Cambridge
Province/Country:	NZ-New Zealand
Energy consultancy:	Soundtherm Solutions NZ
Street:	294a Surrey Hill Road
Postcode/City:	4374 New Plymouth
Province/Country:	NZ-New Zealand

Mechanical system:	no
Street:	
Postcode/City:	
Province/Country:	
Certification:	no
Street:	
Postcode/City:	
Province/Country:	

Year of construction:	2016	Interior temperature winter [°C]:	20.0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2.2
No. of occupants:	3.4	Specific capacity [Wh/K per m² TFA]:	204
		Interior temp. summer [°C]:	25.0
		IHG cooling case [W/m²]:	2.2
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area — **The PHPP has not been filled completely; it is not valid as verification**

				Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area m²	452.0				
Space heating	Heating demand kWh/(m²a)	2	≤	15	-	yes
	Heating load W/m²	9	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	90	≤	10		no
	Frequency excessively high humidity (> 12g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n_{50} 1/h	0.6	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	0	≤	120		yes
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	0	≤	-		
	Generation of renewable energy kWh/(m²a)		≥	-	-	-

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Classic? no

Task: First name: Surname: Signature:

Issued on: City:

Figure 4 – PHPP, U-Values

U-value of building assemblies

Passive House with PHPP Version 9.3

Yearsley House / Climate: Hamilton / Ruakura / TFA: 452 m² / Heating: 2.1 kWh/(m²a) / Freq. overheating: 90 % / PER: 0 kWh/(m²a)

Secondary calculation: Equivalent thermal conductivity of still air spaces -> (on the right)
Wedge-shaped assembly layer -> (on the right)
Unheated / uncooled attic -> (on the right)

Assembly no.	Building assembly description	Interior insulation?
01ud	Floor against the ground	

Heat transmission resistance [m²K/W]

Orientation of building element: 3-Floor — interior R_{si}: 0.17
Adjacent to: 2-Ground — exterior R_{se}: 0.00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Floor cover						
Anhydride Maxit						50
PVC membrane						
EPS Insulation	0.035					40
Concrete	2.300					100
Xenergy XPS	0.030					50
Sand Blinding	1.600					30
compacted ground						

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%			27.0 cm

U-value supplement: W/(m²K)

U-value: 0.329 W/(m²K)

Assembly no.		Interior insulation?
02ud	Facade	

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13
Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
External Plaster	0.870	External Plaster	0.870			15
Porotherm R25th+	0.162	Porotherm R25th+	0.162			80
Porotherm R25th+	0.162	Concrete	1.600			170
Internal plaster	0.700	Internal plaster	0.700			15

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
87%	13.0%		28.0 cm

U-value supplement: W/(m²K)

U-value: 0.764 W/(m²K)

Figure 5 – PHPP, U-Values

Assembly no.		Interior insulation?
03ud	Roof	

Heat transmission resistance [m²K/W]

Orientation of building element: 1-Roof — interior R_{si}: 0.10
Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
roof covering, e.g. extensive roof or substrate						80
waterproof roof membrane						10
Thermal Insulation PUR	0.020					100
Vapour membrane						
Concrete 100 - 175	2.300					100

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: 29.0 cm

U-value supplement: W/(m²K) **U-value: 0.193** W/(m²K)

Assembly no.		Interior insulation?
04ud	Floor against unheated area	

Heat transmission resistance [m²K/W]

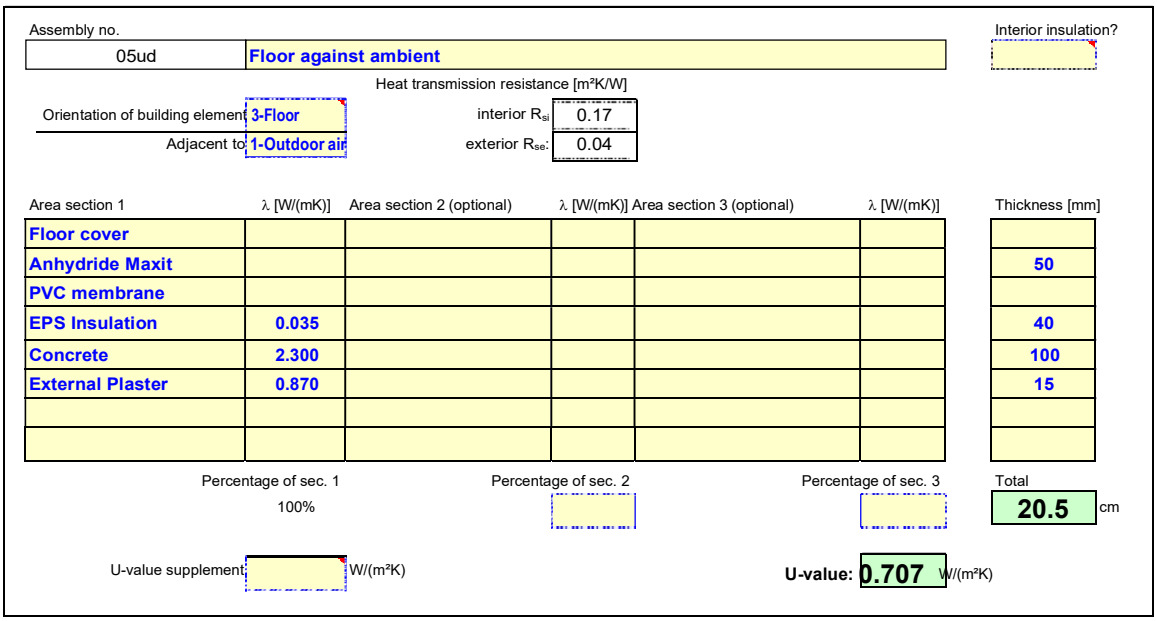
Orientation of building element: 3-Floor — interior R_{si}: 0.17
Adjacent to: 3-Ventilated — exterior R_{se}: 0.17

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Floor cover						
Anhydride Maxit						50
PVC membrane						
EPS Insulation	0.035					40
Concrete	2.300					100

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: 19.0 cm

U-value supplement: W/(m²K) **U-value: 0.655** W/(m²K)

Figure 6 – PHPP, U-Values



Assembly no.: 05ud — Floor against ambient

Interior insulation?:

Heat transmission resistance [m²K/W]

Orientation of building element: 3-Floor
Adjacent to: 1-Outdoor air

interior R_{si}: 0.17
exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Floor cover						
Anhydride Maxit						50
PVC membrane						
EPS Insulation	0.035					40
Concrete	2.300					100
External Plaster	0.870					15

Percentage of sec. 1: 100%
Percentage of sec. 2:
Percentage of sec. 3:
Total: 20.5 cm

U-value supplement: W/(m²K)

U-value: 0.707 W/(m²K)

Figure 7 – PHPP, Windows

Windows

Hamilton House / Climate: Hamilton / Ruakura / TFA: 452 m² / Heating: 2.1 kWh/(m²a) / Freq. overheating: 90 % / PER: 0 kWh/(m²a)

Window area orientation	Global radiation (main orientations)	Shading	Dirt	Non-vertical radiation incidence	Glazing fraction	g-Value	Solar irradiation reduction factor	Window area	Window U-Value	Glazing area	Average global radiation
Standard values →	kWh/(m²a)	0.75	0.95	0.85				m²	W/(m²K)	m²	kWh/(m²a)
North	91	0.75	0.95	0.85	0.81	0.64	0.49	70.88	0.68	57.56	91
East	234	0.75	0.95	0.85	0.72	0.64	0.44	23.89	0.77	17.23	234
South	431	0.75	0.95	0.85	0.83	0.64	0.50	100.83	0.67	83.41	431
West	230	0.75	0.95	0.85	0.84	0.64	0.51	80.91	0.65	68.17	230
Horizontal	356	1.00	0.95	0.85	0.00	0.00	0.00	0.00	0.00	0.00	356
Total or average value for all windows.						0.64	0.50	276.51	0.68	226.37	

Figure 8 – PHPP, Area Determination

Passive House with PHPP Version 9.3

Areas determination

Hamilton House / Climate: Hamilton / Ruakura / TFA: 452 m² / Heating: 2.1 kWh/(m²a) / Freq. overheating: 90 % / PER: 0 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a]	Radiation-load cooling period [kWh/a]
									7 Months	12 Months
	Treated floor area	1	**452.00**	m²	*Treated floor area according to PHPP manual*					
A	**North windows**	2	**70.88**	m²	Results come from the 'Windows' worksheet. Window areas are subtracted from individual opaque areas. which is displayed in the 'Windows' worksheet.		**North windows**	**0.683**	**3414**	**11780**
A	**East windows**	3	**23.89**	m²			**East windows**	**0.771**	**2624**	**8323**
A	**South windows**	4	**100.83**	m²			**South windows**	**0.668**	**21855**	**50525**
A	**West windows**	5	**80.91**	m²			**West windows**	**0.653**	**10067**	**30925**
A	**Horizontal windows**	6	**0.00**	m²			**Horizontal windows**			
A	**Exterior door**	7	**0.00**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**			
A	**External wall - Ambient**	8	**241.29**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0.764**	**-413**	**-557**
B	**External wall - Ground**	9	**0.00**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**			
A	**Roof/Ceiling - Ambient**	10	**306.27**	m²			**Roof/Ceiling - Ambient**	**0.193**	**-335**	**-459**
B	**Floor slab / Basement ceiling**	11	**38.40**	m²			**Floor slab / Basement ceiling**	**0.655**		
A	**Floor slab / Ambient**	12	**22.40**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*		**Floor slab / Ambient**	**0.707**	**9**	**21**
P	**Floor slab / Ground**	13	**245.47**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*	Factor for X	**Floor slab / Ground**	**0.329**		
X		14	**0.00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**75%**				
							Thermal bridges - Overview	**Ψ [W/(mK)]**		
A	**Thermal bridges Ambient**	15	**29.25**	m	*Units in m*		**Thermal bridges Ambient**	**0.500**		
P	**Perimeter thermal bridges**	16	**96.00**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**	**0.150**		
B	**Thermal bridges FS/BC**	17	**0.00**	m	*Units in m*		**Thermal bridges FS/BC**			
I	**Building element towards neighbour**	18	**0.00**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**			
Total thermal envelope			**1130.34**	**m²**			**Average therm. envelope**	**0.514**		

Go to building components list

Area input

2-Sorting: BY ID

Area no.	Building assembly description	To group No.	Assigned to group	Quantity	x (	a [m]	x	b [m]	+	User determined [m²]	-	User subtraction [m²]	-	Subtraction window areas [m²]	) =	Area [m²]
	Projected building footprint	**0**	Projected building footprint	**1**	x (		x		+		-		)		=	0.0
	Treated floor area	**1**	Treated floor area	**1**	x (		x		+	**452.00**	-		)		=	452.0
	Exterior door	**7**	Exterior door		x (		x		+		-		) -		=	
1	**Facade ag. Ambient (N)**	**8**	External wall - Ambient	**1**	x (		x		+	**157.90**	-		) -	**100.8**	=	57.1
2	**Facade ag. Ambient (W)**	**8**	External wall - Ambient	**1**	x (		x		+	**101.00**	-		) -	**80.9**	=	20.1
3	**Facade ag. Ambient (S)**	**8**	External wall - Ambient	**1**	x (		x		+	**157.90**	-		) -	**70.9**	=	87.0
4	**Facade ag. Ambient E**	**8**	External wall - Ambient	**1**	x (		x		+	**101.00**	-		) -	**23.9**	=	77.1
5	**Floor ag. Ambient**	**12**	Floor slab / Ambient	**1**	x (		x		+	**22.40**	-		) -	**0.0**	=	22.4
6	**Floor ag. Ground**	**13**	Floor slab / Ground	**1**	x (		x		+	**245.47**	-		) -	**0.0**	=	245.5
7	**Floor ag. Unheated**	**11**	Floor slab / Basement ceiling	**1**	x (		x		+	**38.40**	-		) -	**0.0**	=	38.4
8	**Roof**	**10**	Roof/Ceiling - Ambient	**1**	x (		x		+	**306.27**	-		) -	**0.0**	=	306.3
9					x (		x		+		-		) -	**0.0**	=	
10					x (		x		+		-		) -	**0.0**	=	
11					x (		x		+		-		) -	**0.0**	=	
12					x (		x		+		-		) -	**0.0**	=	
13					x (		x		+		-		) -	**0.0**	=	
14					x (		x		+		-		) -	**0.0**	=	
15					x (		x		+		-		) -	**0.0**	=	
16					x (		x		+		-		) -	**0.0**	=	
17					x (		x		+		-		) -	**0.0**	=	

Area no.	Selection building assembly / Building system	U-Value [W/(m²K)]	Deviation from North	Angle of inclination from the horizontal	Orientation	Reduction factor shading	Exterior absorptivity	Exterior emissivity
(Projected building footprint)								
(Treated floor area)								
(Exterior door)	Exterior door							
1	**02ud-Facade**	**0.764**	**180**	**90**	**South**	**0.70**	**0.10**	**0.90**
2	**02ud-Facade**	**0.764**	**270**	**90**	**West**	**0.70**	**0.10**	**0.90**
3	**02ud-Facade**	**0.764**	**0**	**90**	**North**	**0.70**	**0.10**	**0.90**
4	**02ud-Facade**	**0.764**	**90**	**90**	**East**	**0.70**	**0.10**	**0.90**
5	**05ud-Floor against ambient**	**0.707**	**0**	**180**	**Hor**	**0.70**	**0.10**	**0.90**
6	**01ud-Floor against the ground**	**0.329**	**0**	**180**	**Hor**	**0.70**	**0.10**	**0.90**
7	**04ud-Floor against unheated area**	**0.655**	**0**	**180**	**Hor**	**0.70**	**0.10**	**0.90**
8	**03ud-Roof**	**0.193**	**0**	**0**	**Hor**	**0.70**	**0.10**	**0.90**
9								
10								
11								
12								
13								
14								
15								
16								
17								

Figure 9 – PHPP, Heating Demand

Specific energy for heating (annual method)

Passive House with PHPP Version 9.3

Hamilton House / Climate: Hamilton / Ruakura / TFA: 452 m² / Heating: 2.1 kWh/(m²a) / Freq. overheating: 90 % / PER: 0 kWh/(m²a)

Interior temperature: 20.0 °C
Building type: Residential
Treated floor area A_{TFA}: 452.0 m²

Building assembly	Temperature zone	Area m²	U-Value W/(m²K)	Temp. factor f_t	G_t kKh/a	kWh/a	Per m² of treated floor area
External wall - Ambient	A	241.3	0.764	1.00	38.9	7181	15.89
External wall - Ground	B			0.42			
Roof/Ceiling - Ambient	A	306.3	0.193	1.00	38.9	2301	5.09
Floor slab / Basement ceiling	B	38.4	0.655	0.42	38.9	413	0.91
Floor slab / Ambient	A	22.4	0.707	1.00	38.9	617	1.37
Floor slab / Ground	P	245.5	0.329	0.42	38.9	1323	2.93
	X			0.75			
Windows	A	276.5	0.676	1.00	38.9	7282	16.11
Exterior door	A			1.00			
Exterior TB (length/m)	A	29.3	0.500	1.00	38.9	570	1.26
Perimeter TB (length/m)	P	96.0	0.150	0.42	38.9	236	0.52
Ground TB (length/m)	B			0.42			0.00
Total of all buildingenvelope areas		1130.3					kWh/(m²a)
Transmission heat losses Q_T					Total	19923	44.1

		A_{TFA} m²	Clear room height m	m³
Ventilation system:	Effective air volume, V_V	452.0	2.50	1130.0
Effective heat recovery efficiency	η_{eff}: 0%			
Efficiency of subsoil heat exchanger				
Heat recovery efficiency of SHX	η_{SHX}: 0%			

	$n_{V,system}$ 1/h	η_{HR}	$n_{V,Res}$ 1/h	1/h
Energetically effective air changes nV	0.300 * (1 -	0.00	) + 0.006	= 0.306

	V_V m³	n_V 1/h	c_{Air} Wh/(m³K)	G_t kKh/a	kWh/a	kWh/(m²a)
Ventilation heat losses Q_V	1130.0 *	0.306 *	0.33 *	38.9 =	4438	9.8

	Q_T kWh/a	Q_V kWh/a	Reduction factor night/weekend Saving	kWh/a	kWh/(m²a)
Total heat losses Q_L	(19923 +	4438)	1.0 =	24361	**53.9**

Orientation of the area	Reduction factor See 'Windows' sheet	g-Value (perp. radiation)	Area m²	Radiation HP kWh/(m²a)	kWh/a
North	0.49 *	0.64 *	70.88 *	91 =	2031
East	0.44 *	0.64 *	23.89 *	234 =	1565
South	0.50 *	0.64 *	100.83 *	431 =	13945
West	0.51 *	0.64 *	80.91 *	230 =	6067
Horizontal	0.00 *	0.00 *	0.00 *	356 =	0
Available solar heat gains Q_S				Total	23608 kWh/(m²a) 52.2

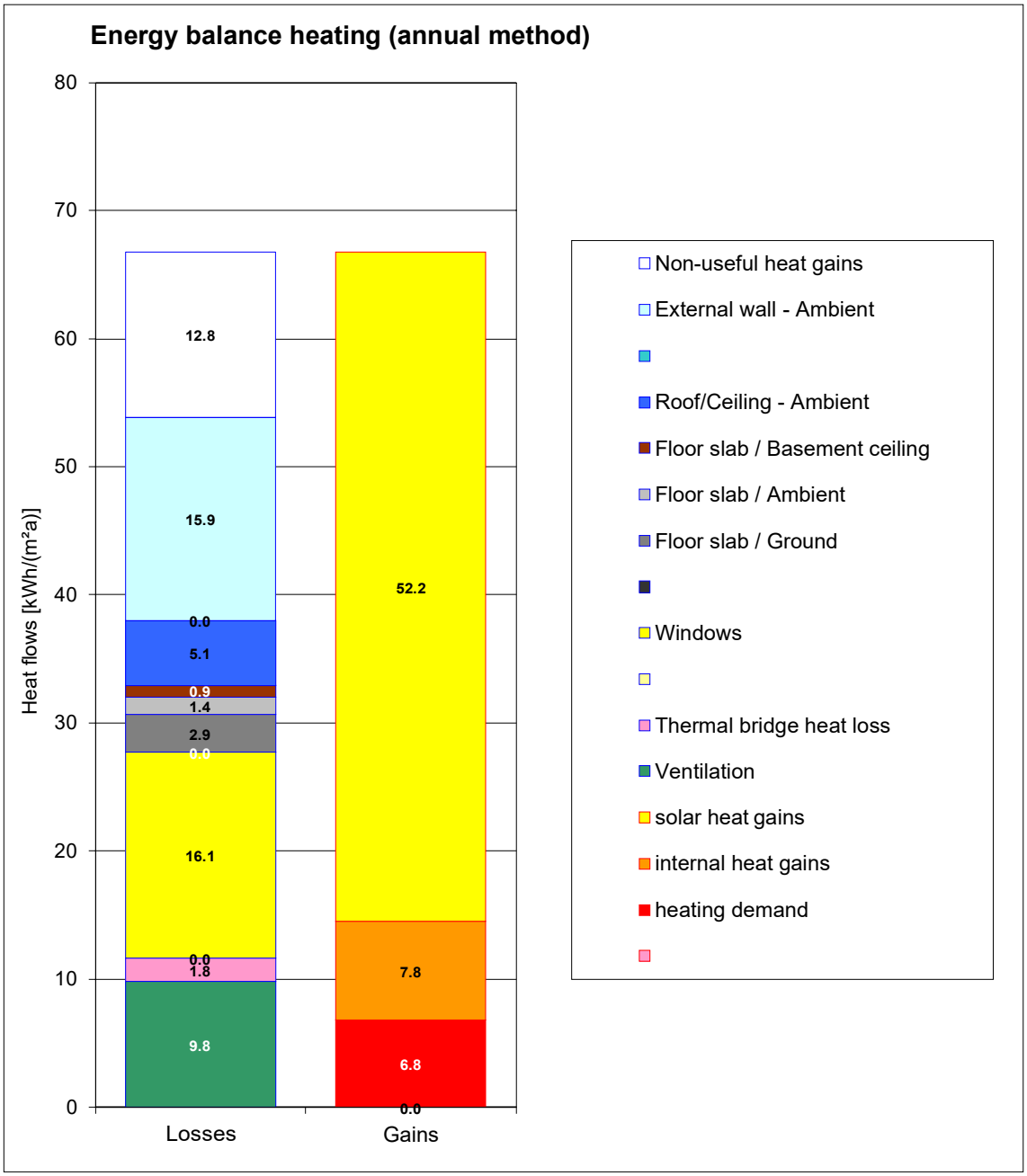
	kh/d	Length heating period d/a	Spec. power q_I W/m²	A_{TFA} m²	kWh/a	kWh/(m²a)
Internal heat gains Q_I	0.024 *	146 *	2.21 *	452.0 =	3503	7.8

		kWh/a	kWh/(m²a)
Free heat Q_F	$Q_S + Q_I$ =	27111	60.0
Ratio of free heat to losses	Q_F / Q_V =	1.11	
Utilisation factor heat gains h_G	$(1 - (Q_F / Q_L)^5) / (1 - (Q_F / Q_L)^6)$ =	79%	
Heat gains Q_G	$\eta_G * Q_F$ =	kWh/a 21305	kWh/(m²a) **47.1**

		kWh/a	kWh/(m²a)
Annual heating demand Q_H	$Q_L - Q_G$ =	3056	7

	kWh/(m²a)	(Yes/No)
Limiting value	15	**Requirement met?** Yes

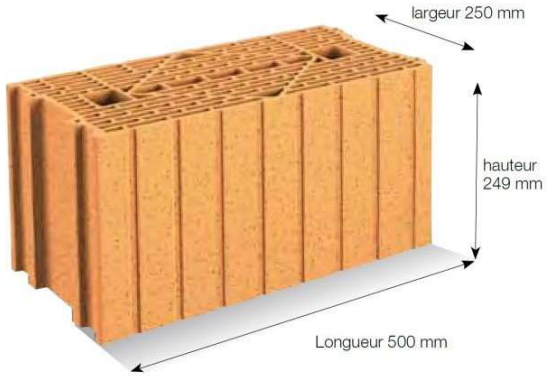
Figure 10 – PHPP, Heating Demand



4.0 BUILDING COMPONENTS OF THE THERMAL ENVELOPE

In order to achieve compliance with NZ Building Code – Clause H1 the following building components of the thermal envelope have been used in the energy efficiency calculations:

4.1 FAÇADE



Brique rectifiée pour Maçonnerie Roulée® et DRYFIX®

Porotherm R25 Th+
Mur Hybride®

Murbric

Caractéristiques techniques

48 briques/palette | 20,6 kg/brique | 8 briques/m²

De la brique	
Classe de résistance à la compression :	RC 80
Résistance à la compression normalisée :	fb = 9 N/mm² (pour les calculs suivant les Eurocodes)

Catégorie I-LD-RC 80 - Conforme à la norme NF EN 771-1 et NF EN 771-1/CN

Du mur	
Épaisseur finie du joint horizontal :	1 mm (consommation ± 2,2 kg/m², environ 0,5 sac par palette)
Joints verticaux :	emboîtements à sec ou poches à mortier remplies (± 4,5 l/m²) ou joint mince (± 2,0 kg/m², environ 0,5 sac par palette)
Type de support :	Rt 3
Revêtement extérieur :	mortier chaux-ciment ou prêt à l'emploi OC 2
Poids mur nu :	environ 165 kg/m²

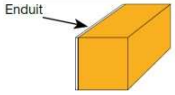
Mise en œuvre suivant norme NF DTU 20.1 et Document Technique d'Application 16/08-561 + additif 01.

Documents de certifications disponibles sur demande

Performances du mur

Isolation thermique

▸ Résistance thermique du mur (sans résistances superficielles)

	Mur	Résistance thermique
	Enduit mortier 1 face + Mur en briques Porotherm R25 Th+	**R = 1,71 m².K/W**

■ Maçonnerie isolante de type a (ponts thermiques réduits)
■ Capacité thermique volumique mur nu : Cv = 660 kJ/(m³.K)

4.2 WINDOWS

KF 410
UPVC/ALUMINIUM WINDOW

TECHNICAL DATA

Design	Modern, square-edged outside and inside design
	Frame and sash outside flush, three-sided integration into facade is possible
	Can be perfectly combined with timber/aluminium windows due to same outside appearance
Thermal insulation	Thermal insulation with standard triple glazing and highly insulating edge seal (U_g = 0.5 W/m²K; g value 52 %) U_w = 0.72 W/m²K
	For best energy efficiency SOLAR+ glazing (U_g = 0.6 W/m²K; g value 64 %) U_w = 0.79 W/m²K
Sound insulation	Soundproofing up to 45 dB (with corresponding glazing)
System description	93 mm construction depth
	FIX-O-ROUND Technology
	Fully concealed hardware as standard
	Standard security
	Triple gasket system
	5 chamber system with highly thermally insulating thermal foam (HCFC, HCF and FC free)
	I-tec ventilation available upon request
I-tec	I-tec Glazing FIX-O-ROUND Technology I-tec Ventilation

Passive house certified in its standard version

Produktqualität Kunststofffenster EN 14351-1 : 2006 Nr.: 191 6025173

FLUSH DESIGN

The square-edged and straight-lined window sash ends flush towards the frame. The window can be rendered on three sides for modern glass architecture.

I-TEC GLAZING FIX-O-ROUND TECHNOLOGY

Continuous all around fixing of the glass pane ensures better stability, thermal and sound insulation, burglary protection and functioning security.

I-TEC VENTILATION

Individual control of fresh air for each room – no big loss of heat, no pollen, no outside noise, with increased security.

4.3 THERMAL INSULATION

Dow

TECHNICAL DATA Building Solutions

XENERGY™ LB

CE

Extruded polystyrene foam XPS (EN13164) - HFC free - gray color				
EN designation code	XPS-EN13164-T3-CS(10\Y)300-DS(TH)-TR400			
Property	**Standard**	**Value**	**Unit**	**EN code**
Thermal conductivity				
Declared value[1]				
- Thickness 30 - 50 mm	EN 13164	0.030	W/mK	λ_D
- Thickness > 50 - 80 mm	EN 13164	0.031	W/mK	λ_D
- Thickness > 80 - 120 mm	EN 13164	0.032	W/mK	λ_D
Mechanical properties				
- Compressive strength σ_m or compressive stress at 10% deformation σ_{10} (⊥ to the faces)	EN 826	0.3 300	N/mm² kPa	CS(10\Y)300
- Compression modulus of elasticity (⊥ to the faces)	EN 826	12	MPa	-
- Tensile Strength σ_{mt} (⊥ to the faces)	EN 1607	500	kPa	TR400
- Tensile modulus of elasticity (⊥ to the faces)	EN 1607	12	MPa	-
- Shear Strength	EN 12090	250	kPa	-
- Shear modulus of elasticity	EN 12090	8	MPa	-
Hygrometric properties				
- Long term water absorption by immersion (28 days)	EN 12087	≤ 1.5	vol %	
- Water vapour diffusion resistance factor (μ), typical	EN 12086	100	-	-
Dimensional stability:				
- Under specified temperature and humidity conditions: 48h at 23°C / 90%RH	EN 1604	≤ 2	%	DS(TH)
Dimensions and tolerances[2]				
- Thickness range	EN 823	30 - 120	mm	-
- Thickness tolerance	EN 823	-/+ 0.5	mm	T3
- Width	EN 822	600	mm	-
- Width tolerance	EN 822	- 0/+3	mm	-
- Length tolerance	EN 822	- 0/+10	mm	-
Other properties				
- Reaction to fire	EN 13501-1	E	-	Euroclass
- Linear thermal expansion coefficient	-	0,07	mm/m.K	
- Maximum service temperature	-	+75	°C	
- Capillarity	-	0	-	
- Density, typical	EN 1602	33	kg/m³	
- Surface:	-	-	-	Planed
- Edge profile:	-	BE	-	Butt Edge

5.0 CONCLUSION

Provided the recommendations given in this report are followed, energy efficiency of proposed dwelling located at Green Haven Lane are calculated to comply with the relevant New Zealand Building Code Clause H1.

This report only considers the Energy Efficiency of the proposed building. It does not address any further or additional requirements that may be required by other clauses of the New Zealand Building Code.

Yours faithfully

SOUNDTHERM SOLUTIONS NZ LIMITED

Lubos Krajci

Consultant

Document: 18_013-01_Compliance Report-Clause H1 2018-08-23.Docx

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Telephone: +64 (0)27 966 24 42

New Plymouth, 23. August 2018

COMPLIANCE REPORT CLAUSE H1 IN ACCORDANCE WITH NZS 4218-2009

TAUPO

1.0 INTRODUCTION

Soundtherm Solutions Ltd (SS) has been engaged by Stellaria to assist with the preliminary energy design of the proposed new dwelling in centralTaupo.

This document describes the recommended energy efficiency performance specification of this development, based on New Zealand Building Code Clause H1 and the energy quality desired by the client.

The report focuses on the review of the building thermal envelope partitions.

2.0 ENERGY REQUIREMENTS

The energy efficiency criteria are described in the New Zealand Standard NZS 4218:2009; Thermal Insulation – Housing and small buildings.

Energy efficient design of housing and small buildings should consider solar gain from glazing, thermal insulation and thermal mass. In the New Zealand climate, good passive solar design incorporating appropriate areas of glazing and thermal mass, combined with a well- insulated thermal envelope, can significantly reduce the energy requirements to heat and cool buildings.

2.1 LOCATION

The proposed new dwelling will be located in central Taupo. From Figure 1 can be seen that Taupo is situated in climate zone 3.

Figure 1 – Climate Zones (Source NZS 4218:2009)

2.2 CRITERIA AND CALCULATION METHOD

In order to achieve compliance with Clause H1 a building must be constructed to facilitate efficient use of energy for functional requirements (e.g. modifying temperature, providing hot water and artificial light) and to provide an adequate building envelope performance to minimise energy losses.

The requirements for energy efficiency of housing and small building envelope are described in New Zealand Standard NZS 4218:2009. This standard specifies the following three different verification methods of demonstrating compliance with Clause H1:

Schedule method	- glazing area is 30% or less of the total wall area
	- the combined area of glazing on the East, South and West facing walls is 30% or less of the combined total area of the walls
	- the skylight area is no more than 1.5m2 or 1.5% of the total roof area
	- the total area of decorative glazing louvres is 3m2 or less.
Calculation method	- a glazing area greater than 30% but less than 40% of the total wall area
	- a reduction in the construction R-Value of some building elements if this is compensated for by increasing the construction R-Value of other building elements.
Modelling method	**- may be used for any proposed building design and all buildings where the glazing area is more than 40% of the total wall area.**

Note: **Bolt** – used verification method

The glazing area on the East, South and West facing walls is more than 30% of the total wall area. Therefore the scheduled verification method of energy efficiency based on NZS 4218: 2009 is not applicable for the proposed project. We have used the modelling method using Lesosai Software Version 2018. The modelling method may be used for any proposed building design.

The proposed new dwellings will be located in the climate zone 3 and will be constructed of high thermal mass walls, floor and roof. The R-Values in Table 1 are only informative.

Table 1 – Indicative construction R-Values for buildings with high thermal mass walls NZS 4218: 2009

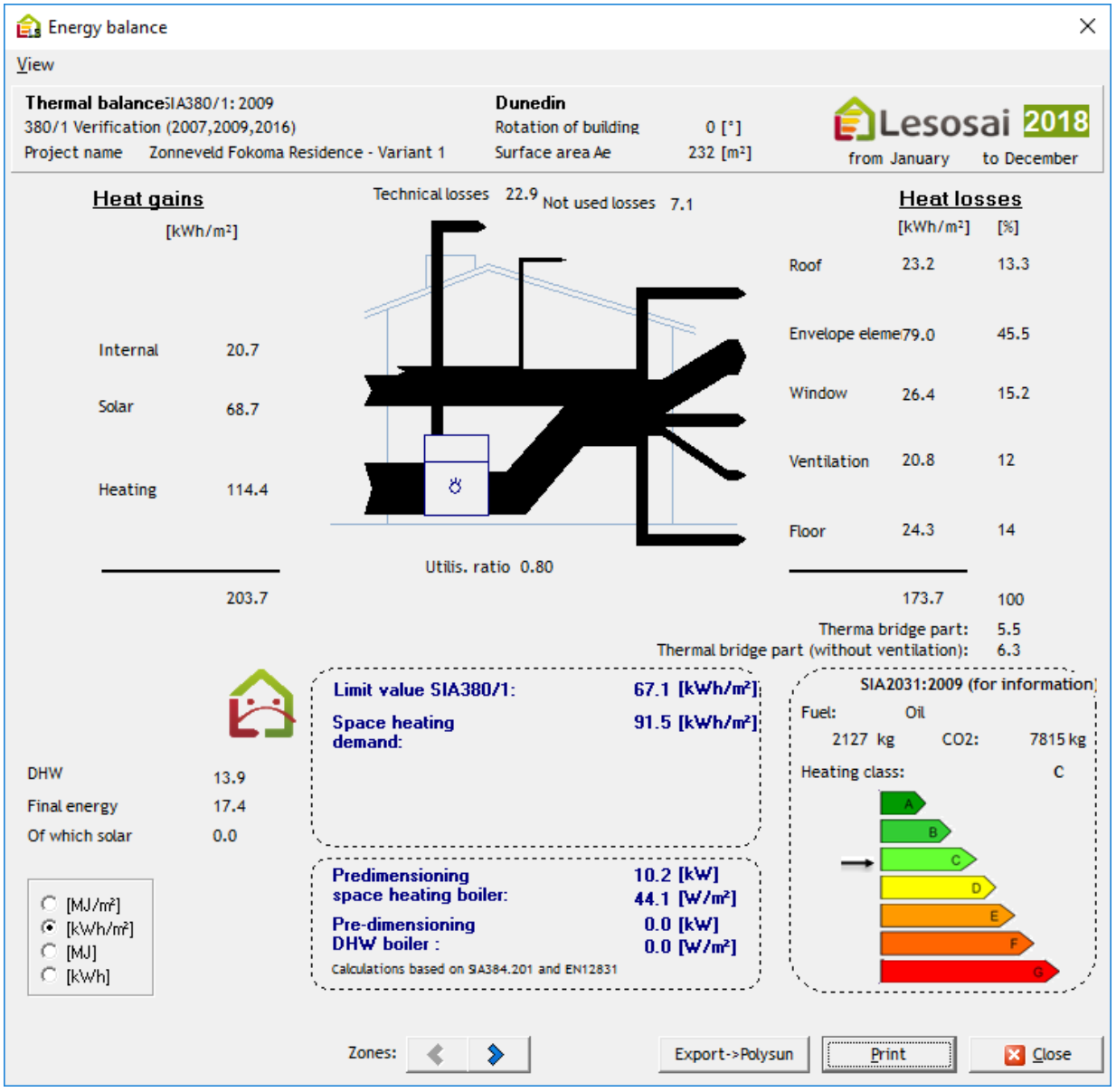
Building element	Required R-Value for Climate Zone 3 [m2K/W]
Roof	3.50
Wall	1.20
Floor	1.50
Windows and glazing	0.26
Skylights	0.31

In order to provide an evidence of compliance with New Zealand Building Code Clause H1 the modelling verification method shall be used. The sum of annual heating load of the proposed building shall not exceed the annual heating load of the reference building using R-values in Table 2.

3.0 RESULTS

The proposed building construction and the reference buildings have been modelled. The result of the proposed building calculations is shown in Figure 2. The detailed report of the calculation is attached to this report.

Figure 2 – Energy balance of the proposed building



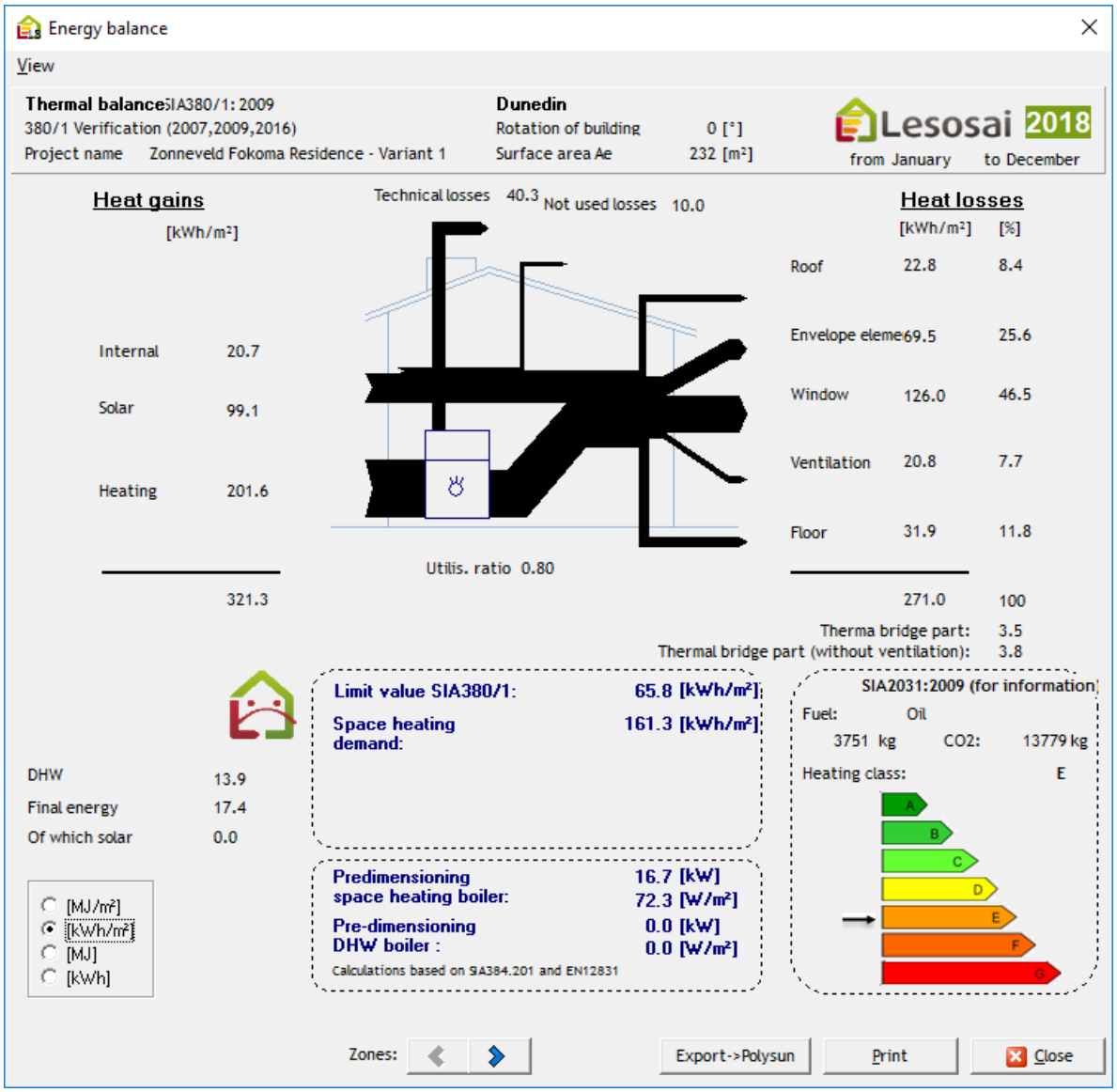
From Figure 2 can be seen that the space heating demand of the proposed building is **91.5 kWh/m²/annum**. The surface area of the proposed dwelling is 232 m².

Table 2 – Construction R-Values for reference building, NZS 4218:2009 (ref, Table 2)

Building element	Required R-Value for Climate Zone 3 [m2K/W]
Roof	3.30
Wall	2.00
Floor	1.30
Windows and glazing	0.26
Skylights	0.31

The result of the calculated annual heating load of the reference building using R-Values from Table 2 is shown in Figure 3.

Figure 3 – Energy balance of the reference building according NZS 4218: 2009



From Figure 3 can be seen that the space heating demand of the reference building is **161.3 kWh/m²/annum.** The surface area of the proposed dwelling is 232 m².

In addition a comparison between required R-Values for Climate Zone 3 with high thermal mass walls and the effective R-Values of proposed building based on scheduled verification method is shown in Table 3.

Table 3 – Designed R-Values for high thermal mass walls

Building element	Required R-Value for Climate Zone 3 with high thermal mass walls [W/m2K]	Designed U-Value [W/m2K]	Designed R-Value [m2K/W]	Compliance achieved
Roof	3.50	0.308	3.246	No
Wall	1.20	0.580	1.724	Yes
Floor	1.50	0.500	2.000	Yes
Windows and glazing	0.26	0.701	1.426	Yes
Skylights	0.31	n/a	n/a	n/a

From Table 3 can be seen that the roof construction does not achieve the required R-Values for climate zone 3. Please note that we have used the schedule verification method as an indication only. Based on this information we recommend an improvement of the thermal insulation of the roof construction from 140mm to 180mm.

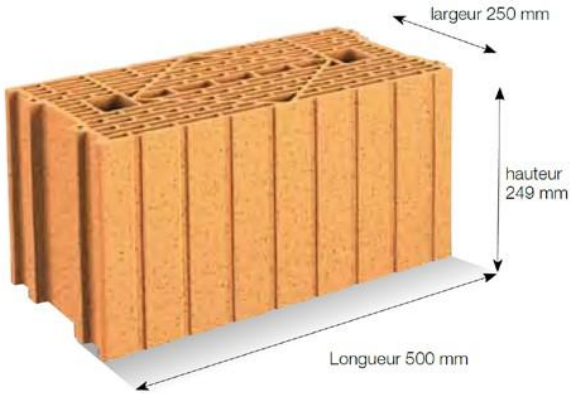
The modelling verification method is overriding the schedule verification method and confirms compliance with the NZS 4218: 2009.

The proposed building has a thermally homogenous and continuous building envelope.

4.0 BUILDING COMPONENTS OF THE THERMAL ENVELOPE

In order to achieve compliance with NZ Building Code – Clause H1 the following building components of the thermal envelope have been used in the energy efficiency calculations:

4.1 FAÇADE



Brique rectifiée pour Maçonnerie Roulée® et DRYFIX®

Murbric

Porotherm R25 Th+
Mur Hybride®

Caractéristiques techniques

48 briques/palette | 20,6 kg/brique | 8 briques/m²

De la brique	
Classe de résistance à la compression :	RC 80
Résistance à la compression normalisée :	fb = 9 N/mm² (pour les calculs suivant les Eurocodes)

Catégorie I-LD-RC 80 - Conforme à la norme NF EN 771-1 et NF EN 771-1/CN

Du mur	
Épaisseur finie du joint horizontal :	1 mm (consommation ± 2,2 kg/m², environ 0,5 sac par palette)
Joints verticaux :	emboîtements à sec ou poches à mortier remplies (± 4,5 l/m²) ou joint mince (± 2,0 kg/m², environ 0,5 sac par palette)
Type de support :	Rt 3
Revêtement extérieur :	mortier chaux-ciment ou prêt à l'emploi OC 2
Poids mur nu :	environ 165 kg/m²

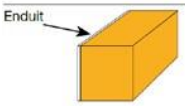
Mise en œuvre suivant norme NF DTU 20.1 et Document Technique d'Application 16/08-561 + additif 01.

Documents de certifications disponibles sur demande

Performances du mur

Isolation thermique

▸ Résistance thermique du mur (sans résistances superficielles)

	Mur	Résistance thermique
	Enduit mortier 1 face + Mur en briques Porotherm R25 Th+	**R = 1,71 m².K/W**

■ Maçonnerie isolante de type a (ponts thermiques réduits)
■ Capacité thermique volumique mur nu : Cv = 660 kJ/(m³.K)

4.2 WINDOWS

KF 410
UPVC/ALUMINIUM WINDOW

TECHNICAL DATA

Design	Modern, square-edged outside and inside design Frame and sash outside flush, three-sided integration into facade is possible Can be perfectly combined with timber/aluminium windows due to same outside appearance
Thermal insulation	Thermal insulation with standard triple glazing and highly insulating edge seal (U_g = 0.5 W/m²K; g value 52 %) U_w = 0.72 W/m²K For best energy efficiency SOLAR+ glazing (U_g = 0.6 W/m²K; g value 64 %) U_w = 0.79 W/m²K
Sound insulation	Soundproofing up to 45 dB (with corresponding glazing)
System description	93 mm construction depth FIX-O-ROUND Technology Fully concealed hardware as standard Standard security Triple gasket system 5 chamber system with highly thermally insulating thermal foam (HCFC, HCF and FC free) I-tec ventilation available upon request
I-tec	I-tec Glazing FIX-O-ROUND I-tec Ventilation

Passive house certified in its standard version

Produktqualität Kunststofffenster EN 14351-1 : 2006 Nr.: 191 6025173

FLUSH DESIGN

The square-edged and straight-lined window sash ends flush towards the frame. The window can be rendered on three sides for modern glass architecture.

I-TEC GLAZING FIX-O-ROUND TECHNOLOGY

Continuous all around fixing of the glass pane ensures better stability, thermal and sound insulation, burglary protection and functioning security.

I-TEC VENTILATION

Individual control of fresh air for each room – no big loss of heat, no pollen, no outside noise, with increased security.

4.3 THERMAL INSULATION – WALL AGAINST GROUND

Dow

TECHNICAL DATA

Building Solutions

XENERGY™ LB

CE

Extruded polystyrene foam XPS (EN13164) - HFC free - gray color				
EN designation code	XPS-EN13164-T3-CS(10\Y)300-DS(TH)-TR400			
Property	**Standard**	**Value**	**Unit**	**EN code**
Thermal conductivity				
Declared value[1]				
- Thickness 30 - 50 mm	EN 13164	0.030	W/mK	λ_D
- Thickness > 50 - 80 mm	EN 13164	0.031	W/mK	λ_D
- Thickness > 80 - 120 mm	EN 13164	0.032	W/mK	λ_D
Mechanical properties				
- Compressive strength σ_m or compressive stress at 10% deformation σ_{10} (⊥ to the faces)	EN 826	0.3 300	N/mm² kPa	CS(10\Y)300
- Compression modulus of elasticity (⊥ to the faces)	EN 826	12	MPa	-
- Tensile Strength σ_{mt} (⊥ to the faces)	EN 1607	500	kPa	TR400
- Tensile modulus of elasticity (⊥ to the faces)	EN 1607	12	MPa	-
- Shear Strength	EN 12090	250	kPa	-
- Shear modulus of elasticity	EN 12090	8	MPa	-
Hygrometric properties				
- Long term water absorption by immersion (28 days)	EN 12087	≤ 1.5	vol %	
- Water vapour diffusion resistance factor (μ), typical	EN 12086	100	-	-
Dimensional stability:				
- Under specified temperature and humidity conditions: 48h at 23°C / 90%RH	EN 1604	≤ 2	%	DS(TH)
Dimensions and tolerances[2]				
- Thickness range	EN 823	30 - 120	mm	-
- Thickness tolerance	EN 823	-/+ 0.5	mm	T3
- Width	EN 822	600	mm	-
- Width tolerance	EN 822	- 0/+3	mm	-
- Length tolerance	EN 822	- 0/+10	mm	-
Other properties				
- Reaction to fire	EN 13501-1	E	-	Euroclass
- Linear thermal expansion coefficient	-	0,07	mm/m.K	
- Maximum service temperature	-	+75	°C	
- Capillarity	-	0	-	
- Density, typical	EN 1602	33	kg/m³	
- Surface:	-	-	-	Planed
- Edge profile:	-	BE	-	Butt Edge

4.4 THERMAL INSULATION – ROOF

Ecofleece® Thermal Performance and Physical Properties

	Insulation R-Value	BRANZ Appraised	Width (mm)	Thickness (mm)	Actual m² Per Pack
Wall	1.8	✓	580	95	10
	2.2	✓	580	90	8
	2.4		580	90	8
	2.6	✓	580	140	10
Ceiling	1.8	✓	870	95	10
	2.6	✓	870	140	10
	2.9	✓	870	180	6
	3.2	✓	870	185	6
Double Layer System	2 x 1.8 3.5	✓	870	190	5
	2 x 2.2 4.3	✓	580	180	4
	2 x 2.6 5.1	✓	580	280	5

TABLE 1

*Natural Ecofleece® is a non-stock item. Special runs can be made to order but minimum quantities apply.

4.5 FLOOR SYSTEM

Introduction

Designed specifically for the environmentally conscious and those with energy efficiency in mind, the Cupolex® Thermal Slab "Pat. Pend." is a Sustainable, Safe and Competitive system for achieving concrete slab construction that meets todays demands of being both thermally and cost efficient.

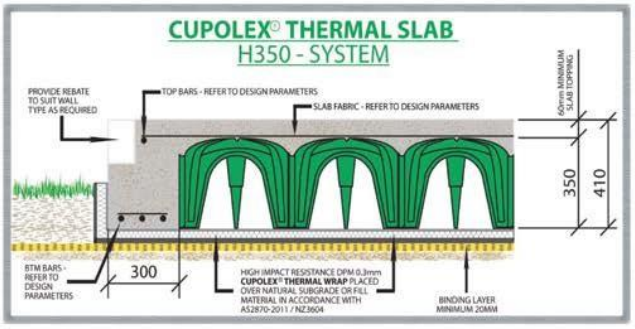
For use in both Residential and Commercial applications Cupolex® Thermal Slab is designed to ensure that your building exceeds the minimum requirements in both hot and cold climates for slab construction. This system, when included in the calculation for NatHERS assessments under the NCC will result in a minimum contribution of 2 Stars to the result.

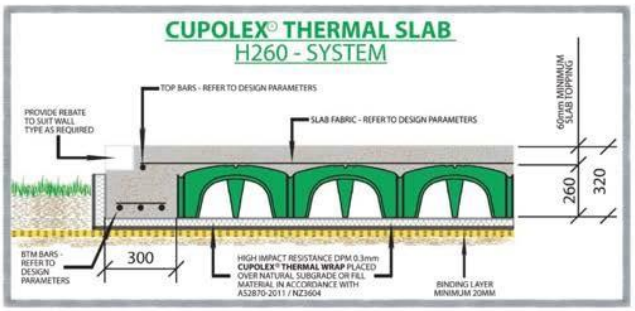
System

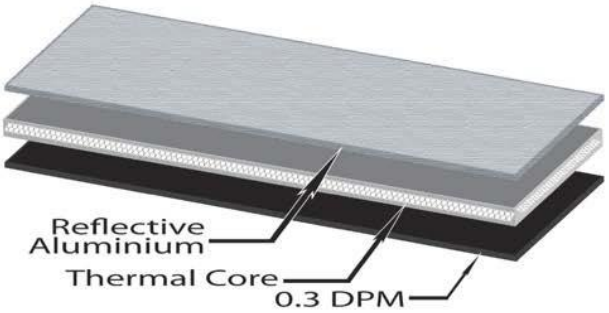
Cupolex® Thermal Slabs consist of Concrete, Aggregate and Steel reinforcement conventionally used in the construction of a foundation slab. The combination and installation of Cupolex® Structural Domes and Cupolex® Thermal Wrap are the vital components that create a unique, thermally efficient and structurally superior foundation .

AUS Group Head Office:
25 Garling Road
Kings Park NSW 2148
Phone: +61 2 9678 9833
www.cupolex.com.au

LIKE US ON facebook
AUS CUPOLEX







CUPOLEX THERMAL WRAP is a composite flexible underlay designed to meet AS2870-2011 / NZ 3604 Standards as a damp proof membrane.

5.0 CONCLUSION

This report only considers the Energy Efficiency of the proposed building. It does not address any further or additional assessments that may be required by other clauses of the New Zealand Building Code.

Based on our calculations the sum of the annual heating load of the proposed building 91.5 kWh/m2/annum does not exceed the annual heating load of the reference building 161.3 kWh/m2/annum. Therefore we can conclude the NZS 4218: 2009 modelling method requirement and the relevant New Zealand Building Code Clause H1has been achieved.

Yours faithfully

SOUNDTHERM SOLUTIONS NZ LIMITED

Luboš Krajči, MSc, PhD.

Building Science Engineer

Project:	*Taupo Residence*		Dossier number
			EGID:
Project address:	Central Taupo		
City	Taupo		NPA:

Project owner details:
Representative of owner:
Address:
Phone: **Fax:** **Email:**

Certifier details:			MacPherson Architecture Limited		
Person in charge of dossier			Chris MacPherson		
Address:	Cnr. Empire and Duke Str. Cambridge				
Phone:	07 823 51 24	**Fax:**	07 823 51 27	**Email:**	chris@macarch.co.nz
Certifier details:			Soundtherm Solutions Limited		
Person in charge of dossier			Lubos Krajci		
Address:	294A Surrey Hill Road, RD 4, 4374 NEw Plymouth				
Phone:	027 966 24 42	**Fax:**		**Email:**	l.krajci@soundtherm.co.nz

Type of construction: New building ☒ Transformation ☐ Extension ☐ Change of use ☐

1.a Energy reference surface, net volume and limit/target value

Thermal zone	Building type	A_E [m²]	A_{th}/A_E	Vol. net [m³]	$Q_{h,li}$ [MJ/m²]	Kind*
Heated Area	Habitat individuel	231.5	3.191	528.9	241.5	A1
	Total	**231.5**	**3.191**	**528.9**	**241.5**	

Temperature correction: -11.3 %

A1: New building A2: Transformation

A3: Extension A4: Change of use

1.b Height of storey and surfaceareas by zone

1.b.1 Heated Area

	Storey height [m]	A_E [m²]	Vol. Gross [m³]
Floor Level 1	2.93	156.9	459.7
Floor Level 2	2.7	74.6	201.5
	Total	231.5	661.2

2. Building envelope surface area

2.1 Heated Area

	Exterior	against unheated		Against ground		against heated	total surface area	
Surfaces in m²		without reduction factor	with reduction factor	without reduction factor	with reduction factor		without reduction factor	with reduction factor
Roof, ceiling	197.2	0.0	0.0	0.0	0.0	0.0	197.2	197.2
Wall	398.9	0.0	0.0	26.3	15.2	0.0	425.1	414.1
Floor	0.0	0.0	0.0	197.2	127.4	0.0	197.2	127.4
Total	596.1	0.0	0.0	223.4	142.6	0.0	819.5	738.7

Surface area ratio A_{th}/A_E = 3.191

3. Distribution of envelope elements and reduction factor due to permanent shading

3.1 Heated Area

3. Distribution of envelope elements and reduction factor due to permanent shading

Element surface area in m²	roof, ceiling	walls								Floor	total
		North:	NE	East	SE	South	SW	West	NW		
opaque parts	197.2	70.7	0.0	122.9	0.0	62.3	0.0	70.2	0.0	197.2	720.5
windows and doors	0.0	9.5	0.0	9.5	0.0	17.8	0.0	62.2	0.0	0.0	99.0
total	197.2	80.1	0.0	132.4	0.0	80.1	0.0	132.4	0.0	197.2	819.5
Ratio of windows and doors to envelope surface area	0.00	0.12	0.00	0.07	0.00	0.22	0.00	0.47	0.00	0.00	0.12
Facteur de réduction Fs dû à l'effet des ombres permanentes.											
F_{s1} (horizon)	0.00	0.94	0.00	0.68	0.00	0.59	0.00	0.68	0.00	----	---
F_{s2} (surplomb)	0.00	0.48	0.00	0.66	0.00	0.45	0.00	0.84	0.00	----	---
F_{s3} (lateral)	0.00	0.84	0.00	1.00	0.00	0.77	0.00	0.94	0.00	----	---
F_s (F_{s1} .F_{s2} .F_{s3})	1.00	0.38	1.00	0.45	1.00	0.22	1.00	0.54	1.00	----	---

ratio of surface area of translucid elements and doors to Ae: 42.77 %

4. Envelope elements

4.1 Flat envelope objects

n°	Designation	code	Nb Elem.	Isol. [cm]	inclin. [°]	orient. [°]	U [W/m²K]	b [-]	A [m²]	Nb.U.b.A [W/K]	Losses [MJ/m²]
1	Heated Area										0.0
2	_Boden Floor Level 1	C1	1	0	0		0.50	0.61	122.6	37.6	51.6
3	_Boden Floor Level 2	C1	1	0	0		0.50	0.70	74.6	26.1	35.8
4	_Fassade Level 2 N	B1	1	0.00	90	S	0.58	1.00	25.1	14.6	20.0
5	_Fenster W20 (20)	D1	1		90	S	0.86	1.00	1.1	1	1.3
6	_Fassade Level 2 W	B1	1	0.00	90	W	0.58	1.00	22.4	13	17.9
7	_Fenster D10 (10)	D1	1		90	W	0.68	1.00	5.6	3.8	5.3
8	_Fenster W19 (19)	D1	1		90	W	0.86	1.00	1.1	1	1.3
9	_Fenster D09 (9)	D1	1		90	W	0.68	1.00	5.6	3.8	5.3
10	_Fassade Level 2 E	B1	1	0.00	90	E	0.58	1.00	32.1	18.6	25.5
11	_Fenster W18 (18)	D1	1		90	E	0.93	1.00	0.9	.8	1.1
12	_Fenster W17 (17)	D1	1		90	E	0.86	1.00	1.1	1	1.3
13	_Fenster W16 (16)	D1	1		90	E	0.95	1.00	0.8	.7	1.0
14	_Fassade Level 2 S	B2	1	5.00	90	N	0.53	0.58	26.3	8.1	11.1
15	_Fassade Level 1 S.1	B1	1	0.00	90	N	0.58	1.00	20.8	12.1	16.6
16	_Fenster W11,W12 (1112)	D1	2		90	N	0.88	1.00	0.7	1.1	1.6
17	_Fassade Level 1 S.2	B1	1	0.00	90	N	0.58	1.00	20.0	11.6	15.9
18	_Fenster W13 (13)	D1	1		90	N	0.98	1.00	0.5	.4	0.6
19	_Fenster W14 (14)	D1	1		90	N	0.88	1.00	0.7	.6	0.8

4. Envelope elements

4.1 Flat envelope objects

n°	Designation	code	Nb Elem.	Isol. [cm]	inclin. [°]	orient. [°]	U [W/m²K]	b [-]	A [m²]	Nb.U.b.A [W/K]	Losses [MJ/m²]
20	_Fassade Level 1 S.3	B1	1	0.00	90	N	0.58	1.00	3.6	2.1	2.9
21	_Fenster W23 (23)	D1	1		90	N	0.67	1.00	7.1	4.7	6.5
22	_Fassade Level 1 N.1	B1	1	0.00	90	S	0.58	1.00	24.4	14.2	19.4
23	_Fenster W3 (3)	D1	1		90	S	0.89	1.00	1.2	1	1.4
24	_Fenster W2 (2)	D1	1		90	S	0.89	1.00	1.0	.9	1.3
25	_Fassade Level 1 N.2	B1	1	0.00	90	S	0.58	1.00	8.2	4.7	6.5
26	_Fenster W22W21 (2221)	D1	2		90	S	0.66	1.00	7.2	9.6	13.2
27	_Fassade Level 1 N.3	B1	1	0.00	90	S	0.58	1.00	4.6	2.6	3.6
28	_Decke	A1	1	14.00	0		0.31	1.00	197.2	60.7	83.4
29	_Fassade Level 1 W	B1	1	0.00	90	W	0.58	1.00	47.8	27.7	38.1
30	_Fenster D6, D7 (6,7)	D1	2		90	W	0.68	1.00	5.6	7.7	10.6
31	_Fenster W15, W1 (15,1)	D1	1		90	W	0.68	1.00	13.5	9.2	12.6
32	_Fenster D8 (8)	D1	2		90	W	0.60	1.00	10.3	12.3	16.9
33	_Fenster D1 (1)	D1	1		90	W	0.71	1.00	4.5	3.2	4.4
34	_Fassade Level 1 E	B1	1	0.00	90	E	0.58	1.00	90.9	52.7	72.4
35	_Fenster W4, W8 (4,8)	D1	2		90	E	0.89	1.00	1.3	2.2	3.1
36	_Fenster W5 (5)	D1	1		90	E	0.95	1.00	0.8	.7	1.0
37	_Fenster W6,W7,W9,W10 (6791)	D1	4		90	E	0.94	1.00	0.9	3.3	4.5
									Tot.:	375.4	515.9

b: Facteur de réduction(EN ISO 13790)
A: Surface de l'élément
g: Coefficient de transmission énergétique global pour le rayonnement diffus
Isol: épaisseur de l'isolation
cat: catalogue
SP: contre serre ou double peau

4.1B Windows and patio doors

n°	Designation	Nb Elem.	A [m²]	Atot [m²]	inclin. [°]	orient. [°]	Frame [%]	Uw [W/m²K]	Ug [W/m²K]	Uf [W/m²K]
1	_Fenster W6,W7,W9,W10 (6791)	4	0.88	3.52	90	E	29.1	0.94	0.5	1.24
2	_Fenster W16 (16)	1	0.75	0.75	90	E	30.7	0.95	0.5	1.2
3	_Fenster W5 (5)	1	0.75	0.75	90	E	30.7	0.95	0.5	1.2
4	_Fenster W4, W8 (4,8)	2	1.25	2.5	90	E	26.4	0.89	0.5	1.2
5	_Fenster W18 (18)	1	0.88	0.88	90	E	29.1	0.93	0.5	1.2
6	_Fenster W17 (17)	1	1.13	1.13	90	E	23.6	0.86	0.5	1.2
7	_Fenster W14 (14)	1	0.65	0.65	90	N	25.1	0.88	0.5	1.2
8	_Fenster W13 (13)	1	0.45	0.45	90	N	32.5	0.98	0.5	1.2
9	_Fenster W23 (23)	1	7.07	7.07	90	N	11	0.67	0.5	1.2
10	_Fenster W11,W12 (1112)	2	0.65	1.3	90	N	25.1	0.88	0.5	1.2
11	_Fenster W20 (20)	1	1.13	1.13	90	S	23.6	0.86	0.5	1.2
12	_Fenster W22W21 (2221)	2	7.23	14.46	90	S	10.8	0.66	0.5	1.2
13	_Fenster W2 (2)	1	1.04	1.04	90	S	26	0.89	0.5	1.2
14	_Fenster W3 (3)	1	1.17	1.17	90	S	25.6	0.89	0.5	1.2
15	_Fenster D10 (10)	1	5.63	5.63	90	W	12.1	0.68	0.5	1.2

4.1 B Windows and patio doors

n°	Designation	Nb Elem.	A [m²]	Atot [m²]	inclin. [°]	orient. [°]	Frame [%]	Uw [W/m²K]	Ug [W/m²K]	Uf [W/m²K]
16	_Fenster D1 (1)	1	4.5	4.5	90	W	14	0.71	0.5	1.2
17	_Fenster D6, D7 (6,7)	2	5.63	11.26	90	W	12.1	0.68	0.5	1.2
18	_Fenster W15, W1 (15,1)	1	13.5	13.5	90	W	11.9	0.68	0.5	1.2
19	_Fenster W19 (19)	1	1.13	1.13	90	W	23.6	0.86	0.5	1.2
20	_Fenster D8 (8)	2	10.28	20.56	90	W	6.5	0.6	0.5	1.2
21	_Fenster D09 (9)	1	5.63	5.63	90	W	12.1	0.68	0.5	1.2

n°	Designation	orient. [°]	$g_\perp$	Fs [-]	Fs1 [-]	Fs2 [-]	Fs3 [-]	gains [MJ/m²]	Losses [MJ/m²]
1	_Fenster W6,W7,W9,W10 (6791)	E	0.52	0.36	0.68	0.522	1	5.6	4.5
2	_Fenster W16 (16)	E	0.52	0.68	0.68	1	1	2.2	1.0
3	_Fenster W5 (5)	E	0.52	0.36	0.68	0.522	1	1.2	1.0
4	_Fenster W4, W8 (4,8)	E	0.52	0.36	0.68	0.522	1	4.2	3.1
5	_Fenster W18 (18)	E	0.52	0.68	0.68	1	1	2.7	1.1
6	_Fenster W17 (17)	E	0.52	0.68	0.68	1	1	3.7	1.3
7	_Fenster W14 (14)	N	0.52	0.58	0.94	0.612	1	2.4	0.8
8	_Fenster W13 (13)	N	0.52	0.18	0.94	0.243	0.776	0.5	0.6
9	_Fenster W23 (23)	N	0.52	0.35	0.94	0.456	0.81	18.5	6.5
10	_Fenster W11,W12 (1112)	N	0.52	0.58	0.94	0.612	1	4.8	1.6
11	_Fenster W20 (20)	S	0.52	0.59	0.59	1	1	1.5	1.3
12	_Fenster W22W21 (2221)	S	0.52	0.15	0.59	0.36	0.728	6	13.2
13	_Fenster W2 (2)	S	0.52	0.52	0.59	0.878	1	1.2	1.3
14	_Fenster W3 (3)	S	0.52	0.53	0.59	0.905	1	1.4	1.4
15	_Fenster D10 (10)	W	0.52	0.55	0.68	0.829	0.98	17.3	5.3
16	_Fenster D1 (1)	W	0.52	0.21	0.68	0.608	0.52	5.3	4.4
17	_Fenster D6, D7 (6,7)	W	0.52	0.57	0.68	0.857	0.975	35.5	10.6
18	_Fenster W15, W1 (15,1)	W	0.52	0.61	0.68	0.898	1	45.9	12.6
19	_Fenster W19 (19)	W	0.52	0.55	0.68	0.829	0.972	3	1.3
20	_Fenster D8 (8)	W	0.52	0.56	0.68	0.857	0.955	67.5	16.9
21	_Fenster D09 (9)	W	0.52	0.54	0.68	0.829	0.966	17	5.3
							Tot.:	247.3	95.1

4.2 linear thermal bridges

n°	Designation	Envelope	Nb Elem.	code	Ψ [W/mK]	b [-]	l [m]	$Nb.b.l.\Psi$ [W/K]	Losses [MJ/m²]
1	5_3_H4	_Fenster W20	1	L5	0.12	1.00	0.5	0.06	0.1
2	5_1_H4	_Fenster W20	1	L5	0.12	1.00	4.5	0.54	0.7
3	5_2_I9	_Fenster W20	1	L5	0.13	1.00	0.5	0.07	0.1
4	5_3_H4	_Fenster D10	1	L5	0.12	1.00	2.5	0.30	0.4
5	5_1_H4	_Fenster D10	1	L5	0.12	1.00	4.5	0.54	0.7
6	5_2_I9	_Fenster D10	1	L5	0.13	1.00	2.5	0.33	0.4
7	5_3_H4	_Fenster W19	1	L5	0.12	1.00	0.5	0.06	0.1
8	5_1_H4	_Fenster W19	1	L5	0.12	1.00	4.5	0.54	0.7

4.2 linear thermal bridges

n°	Designation	Envelope	Nb Elem.	code	Ψ [W/mK]	b [-]	l [m]	Nb.b.l.Ψ [W/K]	Losses [MJ/m²]
9	5_2_I9	_Fenster W19	1	L5	0.13	1.00	0.5	0.07	0.1
10	5_3_H4	_Fenster D09	1	L5	0.12	1.00	2.5	0.30	0.4
11	5_1_H4	_Fenster D09	1	L5	0.12	1.00	4.5	0.54	0.7
12	5_2_I9	_Fenster D09	1	L5	0.13	1.00	2.5	0.33	0.4
13	5_3_H4	_Fenster W18	1	L5	0.12	1.00	1.8	0.21	0.3
14	5_1_H4	_Fenster W18	1	L5	0.12	1.00	1.0	0.12	0.2
15	5_2_I9	_Fenster W18	1	L5	0.13	1.00	1.8	0.23	0.3
16	5_3_H4	_Fenster W17	1	L5	0.12	1.00	0.5	0.06	0.1
17	5_1_H4	_Fenster W17	1	L5	0.12	1.00	4.5	0.54	0.7
18	5_2_I9	_Fenster W17	1	L5	0.13	1.00	0.5	0.07	0.1
19	5_3_H4	_Fenster W16	1	L5	0.12	1.00	1.5	0.18	0.2
20	5_1_H4	_Fenster W16	1	L5	0.12	1.00	1.0	0.12	0.2
21	5_2_I9	_Fenster W16	1	L5	0.13	1.00	1.5	0.20	0.3
22	5_3_H4	_Fenster W11,W12	2	L5	0.12	1.00	1.2	0.29	0.4
23	5_1_H4	_Fenster W11,W12	2	L5	0.12	1.00	1.1	0.26	0.4
24	5_2_I9	_Fenster W11,W12	2	L5	0.13	1.00	1.2	0.31	0.4
25	5_3_H4	_Fenster W13	1	L5	0.12	1.00	1.2	0.14	0.2
26	5_1_H4	_Fenster W13	1	L5	0.12	1.00	0.8	0.09	0.1
27	5_2_I9	_Fenster W13	1	L5	0.13	1.00	1.2	0.15	0.2
28	5_3_H4	_Fenster W14	1	L5	0.12	1.00	1.2	0.14	0.2
29	5_1_H4	_Fenster W14	1	L5	0.12	1.00	1.1	0.13	0.2
30	5_2_I9	_Fenster W14	1	L5	0.13	1.00	1.2	0.15	0.2
31	5_3_H4	_Fenster W23	1	L5	0.12	1.00	2.7	0.32	0.4
32	5_1_H4	_Fenster W23	1	L5	0.12	1.00	5.3	0.63	0.9
33	5_2_I9	_Fenster W23	1	L5	0.13	1.00	2.7	0.35	0.5
34	5_3_H4	_Fenster W3	1	L5	0.12	1.00	0.4	0.05	0.1
35	5_1_H4	_Fenster W3	1	L5	0.12	1.00	5.3	0.64	0.9
36	5_2_I9	_Fenster W3	1	L5	0.13	1.00	0.4	0.06	0.1
37	5_3_H4	_Fenster W2	1	L5	0.12	1.00	0.4	0.05	0.1
38	5_1_H4	_Fenster W2	1	L5	0.12	1.00	4.7	0.57	0.8
39	5_2_I9	_Fenster W2	1	L5	0.13	1.00	0.4	0.06	0.1
40	5_3_H4	_Fenster W22W21	2	L5	0.12	1.00	2.8	0.66	0.9
41	5_1_H4	_Fenster W22W21	2	L5	0.12	1.00	5.3	1.26	1.7
42	5_2_I9	_Fenster W22W21	2	L5	0.13	1.00	2.8	0.72	1.0
43	5_3_H4	_Fenster D6, D7	2	L5	0.12	1.00	2.5	0.60	0.8
44	5_1_H4	_Fenster D6, D7	2	L5	0.12	1.00	4.5	1.08	1.5
45	5_2_I9	_Fenster D6, D7	2	L5	0.13	1.00	2.5	0.65	0.9
46	5_3_H4	_Fenster W15, W1	1	L5	0.12	1.00	4.5	0.54	0.7
47	5_1_H4	_Fenster W15, W1	1	L5	0.12	1.00	6.0	0.72	1.0
48	5_2_I9	_Fenster W15, W1	1	L5	0.13	1.00	4.5	0.59	0.8
49	5_3_H4	_Fenster D8	2	L5	0.12	1.00	4.6	1.10	1.5
50	5_1_H4	_Fenster D8	2	L5	0.12	1.00	4.5	1.08	1.5
51	5_2_I9	_Fenster D8	2	L5	0.13	1.00	4.6	1.19	1.6
52	5_3_H4	_Fenster D1	1	L5	0.12	1.00	2.0	0.24	0.3
53	5_1_H4	_Fenster D1	1	L5	0.12	1.00	4.5	0.54	0.7
54	5_2_I9	_Fenster D1	1	L5	0.13	1.00	2.0	0.26	0.4

4.2 linear thermal bridges

n°	Designation	Envelope	Nb Elem.	code	Ψ [W/mK]	b [-]	l [m]	Nb.b.l.Ψ [W/K]	Losses [MJ/m²]
55	5_3_H4	_Fenster W4, W8	2	L5	0.12	1.00	2.5	0.60	0.8
56	5_1_H4	_Fenster W4, W8	2	L5	0.12	1.00	1.0	0.24	0.3
57	5_2_I9	_Fenster W4, W8	2	L5	0.13	1.00	2.5	0.65	0.9
58	5_3_H4	_Fenster W5	1	L5	0.12	1.00	1.5	0.18	0.2
59	5_1_H4	_Fenster W5	1	L5	0.12	1.00	1.0	0.12	0.2
60	5_2_I9	_Fenster W5	1	L5	0.13	1.00	1.5	0.20	0.3
61	5_3_H4	_Fenster W6,W7,W9,W10	4	L5	0.12	1.00	1.8	0.84	1.2
62	5_1_H4	_Fenster W6,W7,W9,W10	4	L5	0.12	1.00	1.0	0.48	0.7
63	5_2_I9	_Fenster W6,W7,W9,W10	4	L5	0.13	1.00	1.8	0.91	1.2
							Tot.:	25.22	34.6

Tot. L1: 0 W/K - 0 m Tot. L2: 0 W/K - 0 m Tot. L3: 0 W/K - 0 m

Tot. L5: 25.22 W/K - 205.338 m

4.3 point thermal bridges

n°	Designation	Enveloppe	code	χ [W/K]	b [-]	z	b.z.χ [W/K]	Losses [MJ/m²]
1				0.00	0.00	0.00	0.00	0.0
						Tot.:	0.00	0.0

5. Special input data (SIA380/1)

Thermal zone	Ratio of thermal capacity to energy related floor surf. area C/Ae [MJ/m²K]	Spezifischer Wärmeverlust [W/K]	Regulation [K]	if integrated heating system, max. starting temperature ϑ [°C]	If heating unit in front of translucide envelope element, max. starting temperature ϑ [°C]	Fresh air flow rate [m³/(h.m²)]
Heated Area	0.5	455	0.0		0.0	0.70

6. Thermal balance

Thermal zone	Q_T [MJ/m²]	Q_V [MJ/m²]	Q_i [MJ/m²]	Q_s [MJ/m²]	η_g	Qh [MJ/m²]	$Q_{h,II}$ [MJ/m²]	Lim. [%]	Q_{ww} [MJ/m²]
Heated Area	550.5	74.8	74.4	247.3	0.92	329.3	241.5	100	50
Total	551	75	74	247	---	329	242		50

$Q_h = (Q_T + Q_v) - \eta_g (Q_i + Q_s)$

($Q_{h,II}$: SIA 380/1)

7. Monthly thermal balance

7. Monthly thermal balance

7.1 Heated Area

Monthly balance

Month	Q_T [MJ/m²]	Q_V [MJ/m²]	Heat gains Q_I [MJ/m²]	Heat gains Q_S [MJ/m²]	Heat gains Total [MJ/m²]	η_g	Qh [MJ/m²]
January	27.2	3.7	6.3	28.2	34.5	0.8	3.3
February	23.4	3.2	5.7	24.9	30.6	0.8	2.5
March	32.1	4.4	6.3	21.4	27.8	0.9	10.4
April	43.8	6	6.1	15.8	21.9	1	27.9
May	53	7.2	6.3	11.9	18.3	1	42
June	62.4	8.5	6.1	8.9	15	1	55.9
July	70.4	9.6	6.3	10.8	17.1	1	62.9
August	64.7	8.8	6.3	14.6	20.9	1	52.7
September	53.1	7.2	6.1	21	27.1	1	33.4
October	46.8	6.4	6.3	25.9	32.2	1	21.6
November	40.5	5.5	6.1	30.5	36.6	0.9	12
December	33.2	4.5	6.3	33.3	39.6	0.8	4.8
Total	550.5	74.8	74.4	247.3	321.7	-	329.4

Elements

n°	Designation	Against	code	Nb Elem.	b	U [W/m²K]	A [m²]	Model number	
1	_Decke	Exterior	A1	1	1	0.31	197.2		M3
2	_Fassade Level 1 S.2	Exterior	B1	1	1	0.58	20.0		M1
3	_Fassade Level 2 E	Exterior	B1	1	1	0.58	32.1		M1
4	_Fassade Level 1 N.3	Exterior	B1	1	1	0.58	4.6		M1
5	_Fassade Level 1 N.1	Exterior	B1	1	1	0.58	24.4		M1
6	_Fassade Level 1 W	Exterior	B1	1	1	0.58	47.8		M1
7	_Fassade Level 1 S.3	Exterior	B1	1	1	0.58	3.6		M1
8	_Fassade Level 2 W	Exterior	B1	1	1	0.58	22.4		M1
9	_Fassade Level 1 S.1	Exterior	B1	1	1	0.58	20.8		M1
10	_Fassade Level 2 N	Exterior	B1	1	1	0.58	25.1		M1
11	_Fassade Level 1 N.2	Exterior	B1	1	1	0.58	8.2		M1
12	_Fassade Level 1 E	Exterior	B1	1	1	0.58	90.9		M1
13	_Fassade Level 2 S	Ground	B2	1	0.58	0.53	26.3		M2
14	_Boden Floor Level 1	Ground -0m,55m	C1	1	0.61	0.50	122.6		
15	_Boden Floor Level 2	Ground -0m,55m	C1	1	0.7	0.50	74.6		
16	_Fenster W22W21	Exterior	D1	2	1	0.66	7.2	2221	F14
17	_Fenster D6, D7	Exterior	D1	2	1	0.68	5.6	6,7	F15
18	_Fenster D8	Exterior	D1	2	1	0.60	10.3	8	F17
19	_Fenster D1	Exterior	D1	1	1	0.71	4.5	1	F18
20	_Fenster W4, W8	Exterior	D1	2	1	0.89	1.3	4,8	F19
21	_Fenster W15, W1	Exterior	D1	1	1	0.68	13.5	15,1	F16
22	_Fenster W2	Exterior	D1	1	1	0.89	1.0	2	F13
23	_Fenster W14	Exterior	D1	1	1	0.88	0.7	14	F10
24	_Fenster W23	Exterior	D1	1	1	0.67	7.1	23	F11
25	_Fenster W19	Exterior	D1	1	1	0.86	1.1	19	F3
26	_Fenster D10	Exterior	D1	1	1	0.68	5.6	10	F2
27	_Fenster W20	Exterior	D1	1	1	0.86	1.1	20	F1
28	_Fenster D09	Exterior	D1	1	1	0.68	5.6	9	F4
29	_Fenster W3	Exterior	D1	1	1	0.89	1.2	3	F12
30	_Fenster W18	Exterior	D1	1	1	0.93	0.9	18	F5
31	_Fenster W16	Exterior	D1	1	1	0.95	0.8	16	F7
32	_Fenster W5	Exterior	D1	1	1	0.95	0.8	5	F20
33	_Fenster W13	Exterior	D1	1	1	0.98	0.5	13	F9
34	_Fenster W11,W12	Exterior	D1	2	1	0.88	0.7	1112	F8
35	_Fenster W17	Exterior	D1	1	1	0.86	1.1	17	F6
36	_Fenster W6,W7,W9,W10	Exterior	D1	4	1	0.94	0.9	6791	F21

Linear thermal bridges

n°	Designation	Envelope	code	Ψ [W/mK]	b	l [m]	b.l.Ψ [W/K]
1	5_3_H4	_Fenster W20	L5	0.12	1.00	0.5	0.06
2	5_1_H4	_Fenster W20	L5	0.12	1.00	4.5	0.54
3	5_2_I9	_Fenster W20	L5	0.13	1.00	0.5	0.07

Linear thermal bridges

n°	Designation	Envelope	code	Ψ [W/mK]	b	l [m]	b.l Ψ [W/K]
4	5_3_H4	_Fenster D10	L5	0.12	1.00	2.5	0.30
5	5_1_H4	_Fenster D10	L5	0.12	1.00	4.5	0.54
6	5_2_I9	_Fenster D10	L5	0.13	1.00	2.5	0.33
7	5_3_H4	_Fenster W19	L5	0.12	1.00	0.5	0.06
8	5_1_H4	_Fenster W19	L5	0.12	1.00	4.5	0.54
9	5_2_I9	_Fenster W19	L5	0.13	1.00	0.5	0.07
10	5_3_H4	_Fenster D09	L5	0.12	1.00	2.5	0.30
11	5_1_H4	_Fenster D09	L5	0.12	1.00	4.5	0.54
12	5_2_I9	_Fenster D09	L5	0.13	1.00	2.5	0.33
13	5_3_H4	_Fenster W18	L5	0.12	1.00	1.8	0.21
14	5_1_H4	_Fenster W18	L5	0.12	1.00	1.0	0.12
15	5_2_I9	_Fenster W18	L5	0.13	1.00	1.8	0.23
16	5_3_H4	_Fenster W17	L5	0.12	1.00	0.5	0.06
17	5_1_H4	_Fenster W17	L5	0.12	1.00	4.5	0.54
18	5_2_I9	_Fenster W17	L5	0.13	1.00	0.5	0.07
19	5_3_H4	_Fenster W16	L5	0.12	1.00	1.5	0.18
20	5_1_H4	_Fenster W16	L5	0.12	1.00	1.0	0.12
21	5_2_I9	_Fenster W16	L5	0.13	1.00	1.5	0.20
22	5_3_H4	_Fenster W11,W12	L5	0.12	1.00	1.2	0.29
23	5_1_H4	_Fenster W11,W12	L5	0.12	1.00	1.1	0.26
24	5_2_I9	_Fenster W11,W12	L5	0.13	1.00	1.2	0.31
25	5_3_H4	_Fenster W13	L5	0.12	1.00	1.2	0.14
26	5_1_H4	_Fenster W13	L5	0.12	1.00	0.8	0.09
27	5_2_I9	_Fenster W13	L5	0.13	1.00	1.2	0.15
28	5_3_H4	_Fenster W14	L5	0.12	1.00	1.2	0.14
29	5_1_H4	_Fenster W14	L5	0.12	1.00	1.1	0.13
30	5_2_I9	_Fenster W14	L5	0.13	1.00	1.2	0.15
31	5_3_H4	_Fenster W23	L5	0.12	1.00	2.7	0.32
32	5_1_H4	_Fenster W23	L5	0.12	1.00	5.3	0.63
33	5_2_I9	_Fenster W23	L5	0.13	1.00	2.7	0.35
34	5_3_H4	_Fenster W3	L5	0.12	1.00	0.4	0.05
35	5_1_H4	_Fenster W3	L5	0.12	1.00	5.3	0.64
36	5_2_I9	_Fenster W3	L5	0.13	1.00	0.4	0.06
37	5_3_H4	_Fenster W2	L5	0.12	1.00	0.4	0.05
38	5_1_H4	_Fenster W2	L5	0.12	1.00	4.7	0.57
39	5_2_I9	_Fenster W2	L5	0.13	1.00	0.4	0.06
40	5_3_H4	_Fenster W22W21	L5	0.12	1.00	2.8	0.66
41	5_1_H4	_Fenster W22W21	L5	0.12	1.00	5.3	1.26
42	5_2_I9	_Fenster W22W21	L5	0.13	1.00	2.8	0.72
43	5_3_H4	_Fenster D6, D7	L5	0.12	1.00	2.5	0.60
44	5_1_H4	_Fenster D6, D7	L5	0.12	1.00	4.5	1.08
45	5_2_I9	_Fenster D6, D7	L5	0.13	1.00	2.5	0.65
46	5_3_H4	_Fenster W15, W1	L5	0.12	1.00	4.5	0.54

Linear thermal bridges

n°	Designation	Envelope	code	Ψ [W/mK]	b	l [m]	b.l Ψ [W/K]
47	5_1_H4	_Fenster W15, W1	L5	0.12	1.00	6.0	0.72
48	5_2_I9	_Fenster W15, W1	L5	0.13	1.00	4.5	0.59
49	5_3_H4	_Fenster D8	L5	0.12	1.00	4.6	1.10
50	5_1_H4	_Fenster D8	L5	0.12	1.00	4.5	1.08
51	5_2_I9	_Fenster D8	L5	0.13	1.00	4.6	1.19
52	5_3_H4	_Fenster D1	L5	0.12	1.00	2.0	0.24
53	5_1_H4	_Fenster D1	L5	0.12	1.00	4.5	0.54
54	5_2_I9	_Fenster D1	L5	0.13	1.00	2.0	0.26
55	5_3_H4	_Fenster W4, W8	L5	0.12	1.00	2.5	0.60
56	5_1_H4	_Fenster W4, W8	L5	0.12	1.00	1.0	0.24
57	5_2_I9	_Fenster W4, W8	L5	0.13	1.00	2.5	0.65
58	5_3_H4	_Fenster W5	L5	0.12	1.00	1.5	0.18
59	5_1_H4	_Fenster W5	L5	0.12	1.00	1.0	0.12
60	5_2_I9	_Fenster W5	L5	0.13	1.00	1.5	0.20
61	5_3_H4	_Fenster W6,W7,W9,W10	L5	0.12	1.00	1.8	0.84
62	5_1_H4	_Fenster W6,W7,W9,W10	L5	0.12	1.00	1.0	0.48
63	5_2_I9	_Fenster W6,W7,W9,W10	L5	0.13	1.00	1.8	0.91

Point thermal bridges

n°	Designation	Envelope	code	χ [W/K]	b	z	b.z χ W/K
1				0.00	0.00	0.00	0.00

Window and door-window

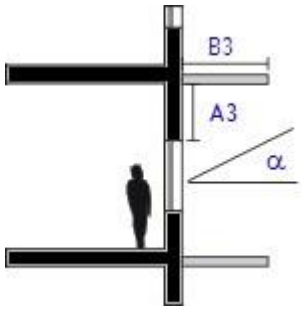
n°	Designation	Nb Elem.	A [m²]	Uw [W/m²K]	inclin. [°]	orient. [°]	Cavity spac. Length	% of frame:	Model number	
1	_Fenster W6,W7,W9,W10	4	0.9	0.94	90	E	4.7	29	6791	F21
2	_Fenster W16	1	0.8	0.95	90	E	4.2	31	16	F7
3	_Fenster W5	1	0.8	0.95	90	E	4.2	31	5	F20
4	_Fenster W4, W8	2	1.3	0.893	90	E	6.2	26	4,8	F19
5	_Fenster W18	1	0.9	0.928	90	E	4.7	29	18	F5
6	_Fenster W17	1	1.1	0.855	90	E	5.1	24	17	F6
7	_Fenster W14	1	0.7	0.875	90	N	3.08	25	14	F10
8	_Fenster W13	1	0.5	0.983	90	N	2.74	33	13	F9
9	_Fenster W23	1	7.1	0.667	90	N	15.1	11	23	F11
10	_Fenster W11,W12	2	0.7	0.875	90	N	3.08	25	1112	F8
11	_Fenster W20	1	1.1	0.855	90	S	5.1	24	20	F1
12	_Fenster W22W21	2	7.2	0.664	90	S	15.22	11	2221	F14
13	_Fenster W2	1	1.0	0.893	90	S	5.22	26	2	F13
14	_Fenster W3	1	1.2	0.887	90	S	5.8	26	3	F12
15	_Fenster D10	1	5.6	0.683	90	W	13.2	12	10	F2
16	_Fenster D1	1	4.5	0.712	90	W	12.2	14	1	F18
17	_Fenster D6, D7	2	5.6	0.683	90	W	13.2	12	6,7	F15
18	_Fenster W15, W1	1	13.5	0.681	90	W	31.4	12	15,1	F16
19	_Fenster W19	1	1.1	0.855	90	W	5.1	24	19	F3
20	_Fenster D8	2	10.3	0.6	90	W	13.24	7	8	F17
21	_Fenster D09	1	5.6	0.683	90	W	13.2	12	9	F4

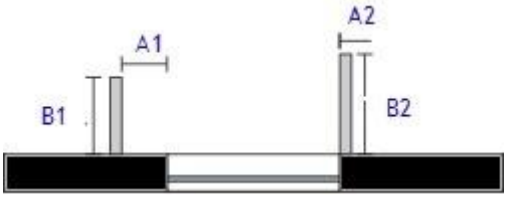
Window and door-window

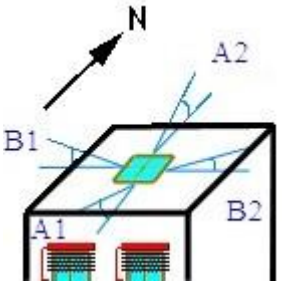
n°	Designation	Fs [-]	A1 [m]	B1 [m]	A2 [m]	B2 [m]	A3 [m]	B3 [m]	α	Fs1 [-]	Fs2 [-]	Fs3 [-]	Voil. [-]
1	_Fenster W6,W7,W9,W10	0.36	0	0	0	0	0.2	0.9	30	0.68	0.52	1	0
2	_Fenster W16	0.68	0	0	0	0	0	0	30	0.68	1	1	0
3	_Fenster W5	0.36	0	0	0	0	0.2	0.9	30	0.68	0.52	1	0
4	_Fenster W4, W8	0.36	0	0	0	0	0.2	0.9	30	0.68	0.52	1	0
5	_Fenster W18	0.68	0	0	0	0	0	0	30	0.68	1	1	0
6	_Fenster W17	0.68	0	0	0	0	0	0	30	0.68	1	1	0
7	_Fenster W14	0.58	0	0	0	0	0.2	0.9	30	0.94	0.61	1	0
8	_Fenster W13	0.18	0	2	0	0	0.2	2	30	0.94	0.24	0.78	0
9	_Fenster W23	0.35	0	4	0	0	0.2	4	30	0.94	0.46	0.81	0
10	_Fenster W11,W12	0.58	0	0	0	0	0.2	0.9	30	0.94	0.61	1	0
11	_Fenster W20	0.59	0	0	0	0	0	0	30	0.59	1	1	0
12	_Fenster W22W21	0.15	0	0	0	4	0.2	4	30	0.59	0.36	0.73	0
13	_Fenster W2	0.52	0	0	0	0	0.2	0.9	30	0.59	0.88	1	0
14	_Fenster W3	0.53	0	0	0	0	0.2	0.9	30	0.59	0.9	1	0
15	_Fenster D10	0.55	12	3.5	0	0	0.2	1	30	0.68	0.83	0.98	0
16	_Fenster D1	0.21	0	1.3	0	6	0.2	2.2	30	0.68	0.61	0.52	0
17	_Fenster D6, D7	0.57	9	3.5	0	0	0.2	0.9	30	0.68	0.86	0.98	0
18	_Fenster W15, W1	0.61	0	0	0	0	0.2	0.9	30	0.68	0.9	1	0

Window and door-window

n°	Designation	Fs [-]	A1 [m]	B1 [m]	A2 [m]	B2 [m]	A3 [m]	B3 [m]	α	Fs1 [-]	Fs2 [-]	Fs3 [-]	Voil. [-]
19	_Fenster W19	0.55	8.8	3.5	0	0	0.2	1	30	0.68	0.83	0.97	0
20	_Fenster D8	0.56	0	0	5.3	4.7	0.2	0.9	30	0.68	0.86	0.95	0
21	_Fenster D09	0.54	6	3.5	0	0	0.2	1	30	0.68	0.83	0.97	0





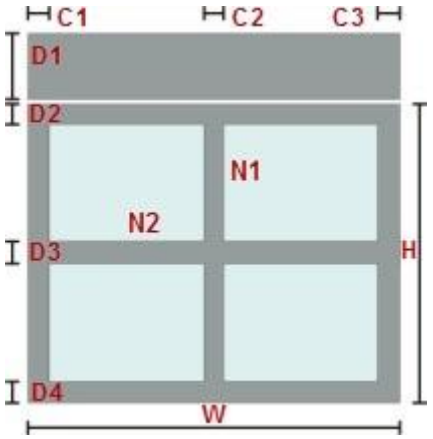


Window and door-window

n°	Designation	Glz [%]	H [cm]	W [cm]	C1 [cm]	C2 [cm]	C3 [cm]	D1 [cm]	D2 [cm]	D3 [cm]	D4 [cm]	N1 [-]	N2 [-]
1	_Fenster W20	76.4	225.0	50	5	0	5	0	5	0	5	0	0
2	_Fenster D10	87.9	225.0	250	5	10	5	0	5	0	5	1	0
3	_Fenster W19	76.4	225.0	50	5	0	5	0	5	0	5	0	0
4	_Fenster D09	87.9	225.0	250	5	10	5	0	5	0	5	1	0
5	_Fenster W18	70.9	50.0	175	5	10	5	0	5	0	5	1	0
6	_Fenster W17	76.4	225.0	50	5	10	5	0	5	0	5	0	0
7	_Fenster W16	69.3	50.0	150	5	10	5	0	5	0	5	1	0
8	_Fenster W11,W12	74.9	55.0	119	5	10	5	0	5	0	5	0	0
9	_Fenster W13	67.5	38.0	119	5	10	5	0	5	0	5	0	0
10	_Fenster W14	74.9	55.0	119	5	10	5	0	5	0	5	0	0
11	_Fenster W23	89	263.0	269	5	10	5	0	5	0	5	1	0
12	_Fenster W3	74.4	265.8	44	5	10	5	0	5	0	5	0	0
13	_Fenster W2	74	237.1	44	5	10	5	0	5	0	5	0	0
14	_Fenster W22W21	89.2	263.0	275	5	10	5	0	5	0	5	1	0
15	_Fenster D6, D7	87.9	225.0	250	5	10	5	0	5	0	5	1	0
16	_Fenster W15, W1	88.1	300.0	450	5	10	5	0	5	0	5	3	0
17	_Fenster D8	93.5	225.0	457	5	10	5	0	5	0	5	0	0
18	_Fenster D1	86	225.0	200	5	10	5	0	5	0	5	1	0
19	_Fenster W4, W8	73.6	50.0	250	5	10	5	0	5	0	5	1	0
20	_Fenster W5	69.3	50.0	150	5	10	5	0	5	0	5	1	0
21	_Fenster W6,W7,W9,W10	70.9	50.0	175	5	10	5	0	5	0	5	1	0

Window and door-window

n°	Designation	Glz [%]	H [cm]	W [cm]	C1 [cm]	C2 [cm]	C3 [cm]	D1 [cm]	D2 [cm]	D3 [cm]	D4 [cm]	N1 [-]	N2 [-]



List of models: walls, roof, floors, ceilings, unglazed doors

M1 - Facade

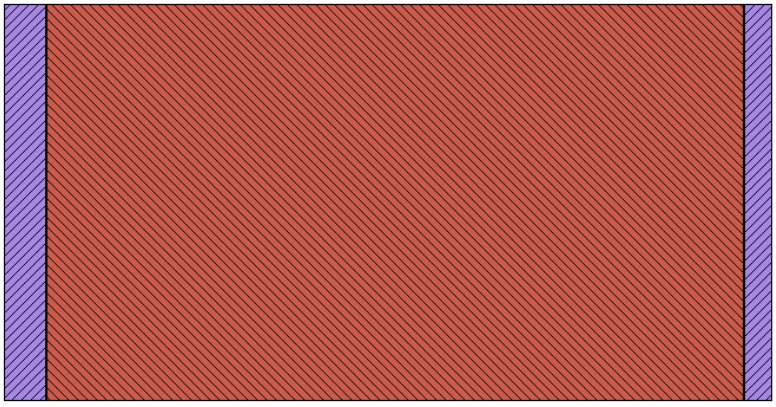
Use: Wall
Against exterior

Thermal capacity
[kJ/m²K]

Cm 10cm (24h): 114
Cm 3cm (2h): 44.6

Geometry
Thickness [mm]: 275

Interior SIA 180 (2014) Exterior



3

U value

Static

0.58 [W/m²K]

Rsi: 0.13 [m²K/W]

Rse: 0.04 [m²K/W]

Meteo: Dunedin (NEW ZEALAND), Altitude of building site : 500 m (+432 m)

Section 1

Material name:	Thick. [cm]	Sd [m]	λ [W/mK]	μ [-]	ρ [kg/m³]	c [wh/kgK]	R [m²K/W]
Rsi							0.130
1 SIA 381/1 : External mortar rendering	1.5	0.375	0.87	25	1800	0.306	0.017
2 Custom : Porotherm R25th	25	1.25	0.164	5	1100	0.25	1.523
3 SIA 381/1 : Internal mortar rendering 1400 kg/m³	1	0.08	0.7	8	1400	0.25	0.014
Rse							0.040
dUg= 0 [W/m²K], dUf= 0 [W/m²K]						dR	0
						RT	**1.724**

frsi = 0.864 [-], frsi,min,cond = 0.828 [-], frsi,min,moist = 0.750 [-]

Hygrothermal caracteristics

First Month: January	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Security factor
Interior													
Temperature [°C]	20	20	20	20	20	20	20	20	20	20	20	20	-
Relative humidity [%]	69.4	69.5	66.7	62.4	60.2	57.2	55.5	57.1	60.2	63	64.7	67.6	
Exterior													
Temperature [°C]	14.1	14.4	13.1	10.2	8.56	6.09	4.82	6.04	8.16	9.92	11	12.8	-
Relative humidity [%]	79.8	77.1	72	70	70.4	70.8	69	70.8	76	80.2	81.4	81.3	

List of models: walls, roof, floors, ceilings, unglazed doors

Ma: accumulated moisture contents
Gc: rate of condensation

Graphs in real thickness: January

No condensation in the section

List of models: walls, roof, floors, ceilings, unglazed doors

M2 - Facade

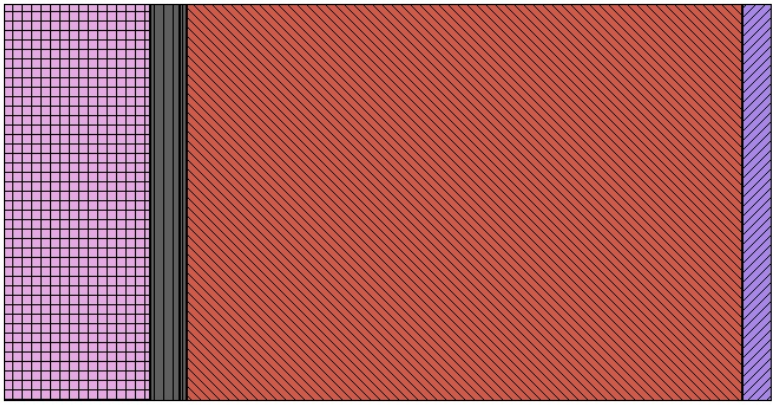
Use: Wall
Against ground (3.5m)

Thermal capacity
[kJ/m²K]

Cm 10cm (24h): 98.9
Cm 3cm (2h): 2.83

Geometry
Thickness [mm]: 261

Interior SIA 180 (2014) Exterior



3

U value

Static
0.5299 [W/m²K]

Rsi: 0.13 [m²K/W]

Rse: 0.00 [m²K/W]

Meteo: Dunedin (NEW ZEALAND), Altitude of building site : 500 m (+432 m)

Section 1

	Material name:	Thick. [cm]	Sd [m]	λ [W/mK]	μ [-]	ρ [kg/m³]	c [wh/kgK]	R [m²K/W]
	Rsi							0.130
1	SIA 381/1 : Extruded polystirene, insulation gaz, controlled	5	7.5	0.033	150	65	0.403	1.515
2	SIA 381/1 : F3 J2 V60 + 3 bitumen layers	1	210	0.2	21000.0004 693866	1200	0.444	0.05
3	SIA 381/1 : Bitumen layer	0.1	60	0.2	60000.0013 411045	1200	0.444	0.005
4	Minergie ECO : Cement block	19	2.38	1.1	12.5	1700	0.306	0.173
5	SIA 381/1 : Internal mortar rendering 1400 kg/m³	1	0.08	0.7	8	1400	0.25	0.014
	Rse							0.000
	dUg= 0 [W/m²K], dUf= 0 [W/m²K]						dR	0
							RT	**1.887**

frsi = 0.875 [-], frsi,min,cond = 0.776 [-], frsi,min,moist = 1.021 [-]
Mould risk.

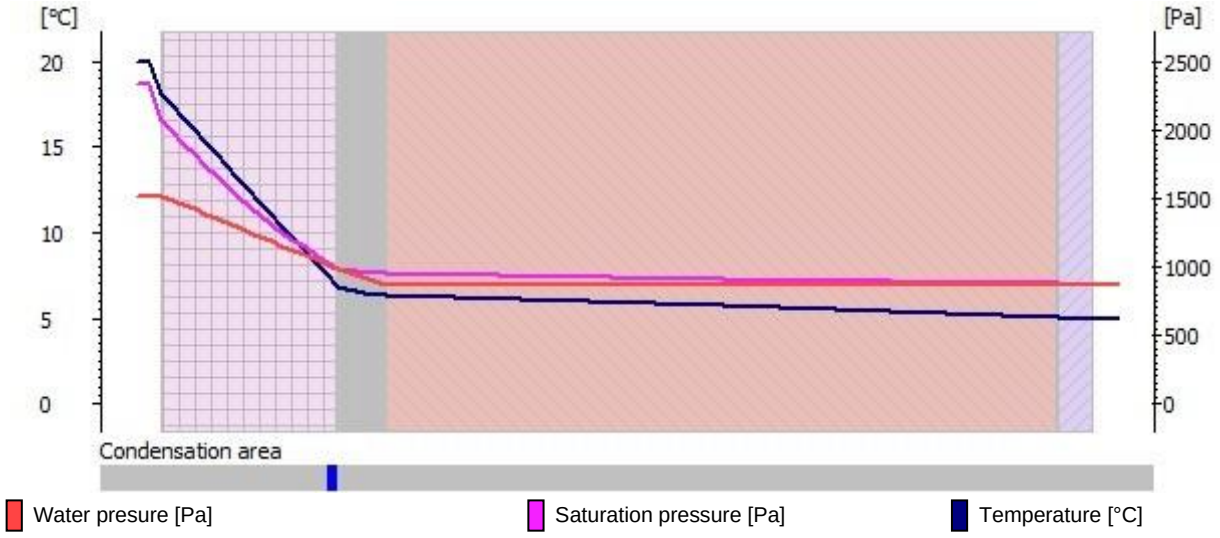
Hygrothermal caracteristics

First Month: October	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Security factor
Interior													
Temperature [°C]	20	20	20	20	20	20	20	20	20	20	20	20	-
Relative humidity [%]	72.2	72.7	70.3	65.6	63	59.5	57.8	59.4	62.5	65.1	66.8	69.9	
Exterior													
Temperature [°C]	4.96	4.96	4.96	4.96	4.96	4.96	4.96	4.96	4.96	4.96	4.96	4.96	-
Relative humidity [%]	100	100	100	100	100	100	100	100	100	100	100	100	
Interface 1 - 2													
gc [g/m²]	50	46	47	38	35	28	26	29	33	38	40	46	-
Ma [g/m²]	174	219	266	304	338	366	392	421	453	38	78	124	

List of models: walls, roof, floors, ceilings, unglazed doors

Ma: accumulated moisture contents
Gc: rate of condensation

Graphs in real thickness: October



The section has probably condensation that doesn't dry during the summer, contact materials industry if you have a doubt.

List of models: walls, roof, floors, ceilings, unglazed doors

M3 - Roof

Use: Roof
Against exterior

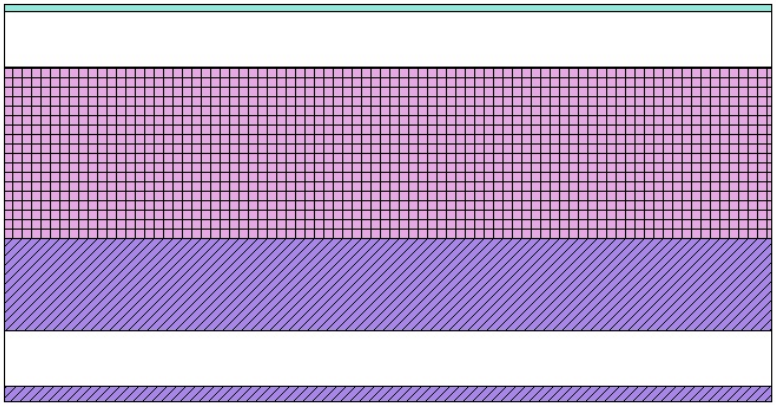
Thermal capacity
[kJ/m²K]

Cm 10cm (24h): 120
Cm 3cm (2h): 8.85

Geometry
Thickness [mm]: 319

Exterior SIA 180 (2014)

1



U value

Static
0.3081 [W/m²K]

Rsi: 0.13 [m²K/W]

Rse: 0.04 [m²K/W]

Interior

Meteo: Dunedin (NEW ZEALAND), Altitude of building site : 500 m (+432 m)

Section 1

	Material name:	Thick. [cm]	Sd [m]	λ [W/mK]	μ [-]	ρ [kg/m³]	c [wh/kgK]	R [m²K/W]
	Rsi							0.130
1	Minergie ECO : Gypsum plasterboard	1.3	0.0975	0.21	7.5	850	0.222	0.062
2	CEN : Air layer	4.5	0.01	0.275	1	1.23	0.278	0.164
3	SIA 381/1 : Concrete slab	7.5	5.25	1.48	70	2400	0.306	0.051
4	Custom : Ecofleece Insulation	14	1.05	0.0576	7.5	30	0.444	2.431
5	CEN : Air layer	4.5	0.01	0.122	1	1.23	0.278	0.369
6	Minergie ECO : Steel sheet, coated with zinc	0.06	600	50	999999.952 502551	7850	0.125	0
	Rse							0.040
	dUg= 0 [W/m²K], dUf= 0 [W/m²K]						dR	0
							RT	**3.246**

frsi = 0.926 [-], frsi,min,cond = 0.828 [-], frsi,min,moist = 0.750 [-]

Hygrothermal caracteristics

First Month: March	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Security factor
Interior													
Temperature [°C]	20	20	20	20	20	20	20	20	20	20	20	20	-
Relative humidity [%]	69.4	69.5	66.7	62.4	60.2	57.2	55.5	57.1	60.2	63	64.7	67.6	
Exterior													
Temperature [°C]	14.1	14.4	13.1	10.2	8.56	6.09	4.82	6.04	8.16	9.92	11	12.8	-
Relative humidity [%]	79.8	77.1	72	70	70.4	70.8	69	70.8	76	80.2	81.4	81.3	
Interface 5 - 6													
gc [g/m²]		-2	4	16	23	31	35	32	25	20	15	7	0.01
Ma [g/m²]	208	206	4	19	43	74	109	141	166	186	201	208	

List of models: walls, roof, floors, ceilings, unglazed doors

Ma: accumulated moisture contents
Gc: rate of condensation

Graphs in real thickness: March

The section has probably condensation that doesn't dry during the summer, contact materials industry if you have a doubt.

List of window models

20 - (F1)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

10 - (F2)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

19 - (F3)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

9 - (F4)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

18 - (F5)

List of window models

Glazing type:

Glazing name	*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

17 - (F6)

Glazing type:

Glazing name	*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

16 - (F7)

Glazing type:

Glazing name	*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

1112 - (F8)

Glazing type:

Glazing name	*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

13 - (F9)

List of window models

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

14 - (F10)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

23 - (F11)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

3 - (F12)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

2 - (F13)

List of window models

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

2221 - (F14)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

6,7 - (F15)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

15,1 - (F16)

Glazing type:

Glazing name			*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

8 - (F17)

List of window models

Glazing type:

Glazing name	*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

1 - (F18)

Glazing type:

Glazing name	*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

4,8 - (F19)

Glazing type:

Glazing name	*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

5 - (F20)

Glazing type:

Glazing name	*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.2	*Linear coeff.* W/mK	0.042

6791 - (F21)

List of window models

Glazing type:

Glazing name	*Manufacturer*	*Standard*

Gp [-]	0.52	*Glazing U W/m²K*	0.5

Frame kind: ***Cavity spacerbar***

Material	PVC	*U-value frame W/m²K*	1.24	*Linear coeff.* W/mK	0.042