Project Documentation

1 Abstract / Zusammenfassung

Casa Pasiva
certificada
Passive House Institute
| classic | plus | premium |

House for rural tourism in Ibero, Navarra, Spain

short text about the characteristics of the building	Attached house. Structure: concrete pillars and beams. Facades: ceramic bricks with mortar in the outside and clay in the inside finished to the inside with a carton-kley board. Finishes: North façade: outside wood fiber isolation with mortar. South façade: a ventilated façade finished with pine wood. Tilted roof: concrete slab, wood fiver inside and XPS outside under ceramic tiles.
Specialties	
U-values (roof, wall, window, flor slab/ basement ceiling)	Roof: 0,111 W/(m²K) Wall: North: 0,199 W/(m²K) South: 0,183 W/(m²K)

	Flor slab: 0,146 W/(m²K) Basement ceiling: 0,155 W/(m²K) Window: U_f: 0,93 W/(m²K) U_g: 0,52 W/(m²K)
Heat recovery	ComforAir550 by Zehnder
heat supply demand based on PHPP	14,65 kWh/(m²a)
primary energy demand based on PHPP	88 kWh/(m²a)
Result of the blower-door-test (n50-value, series of under- and overperssure)	0,615 m³/(hm²)

1.1 Building data

Year of construction: 2016

1.2 Brief description of the construction task

It´s a house for short stances situated in an small town 15 km far from Pamplona, in the north of Spain.

The building is situated between other residential buildings, in the center of the village.

It´s a three stores building: in the basement the entrance, a garage for two cars (a room for the heating pump) a bedroom with its bathroom and a distributor with a circular stair; in the first floor a living room, a kitchen, a bathroom and a bedroom with its bathroom; and in the second floor four bedrooms with their bathrooms.

The entrance of the house faces north and the south façade looks into a courtyard.

The structure of the building is formed by concrete pillars and beams (even for the tilted roof).

The facades are made with ceramic bricks with mortar in the outside and clay in the inside. The north façade is finished in the outside with a wood fiber isolation with mortar; the south façade is a ventilated façade finished with pine wood. Both are finished to the inside with a carton-kley board.

The building has been used for 16 months, with periodical occupancies by different groups of people, both in winter and in summer with a high comfort and satisfaction degree.

Responsible project participant, certification ID, Passive House Database ID, name

1.3 Responsible project participants

Architects:	BOA arquitectos SLP
	http://www.boa-arquitectos.com/
Structural engineers:	FS estructuras
	http://fsestructuras.com/
Technical architect:	Enrique Munguira
Implementation planning:	Progetic
	http://www.progetic.com/es/
Passivhaus designer :	Iñaki Archanco (BOA arquitectos)
Certifying body	Passive House Institute Darmstadt
	www.passiv.de
Certification ID	Project-ID (www.passivehouse-database.org) 4864
Author of project documentation:	Iñaki Archanco (BOA arquitectos)

2 Views of the Passive House in Ibero

North façade

South façade

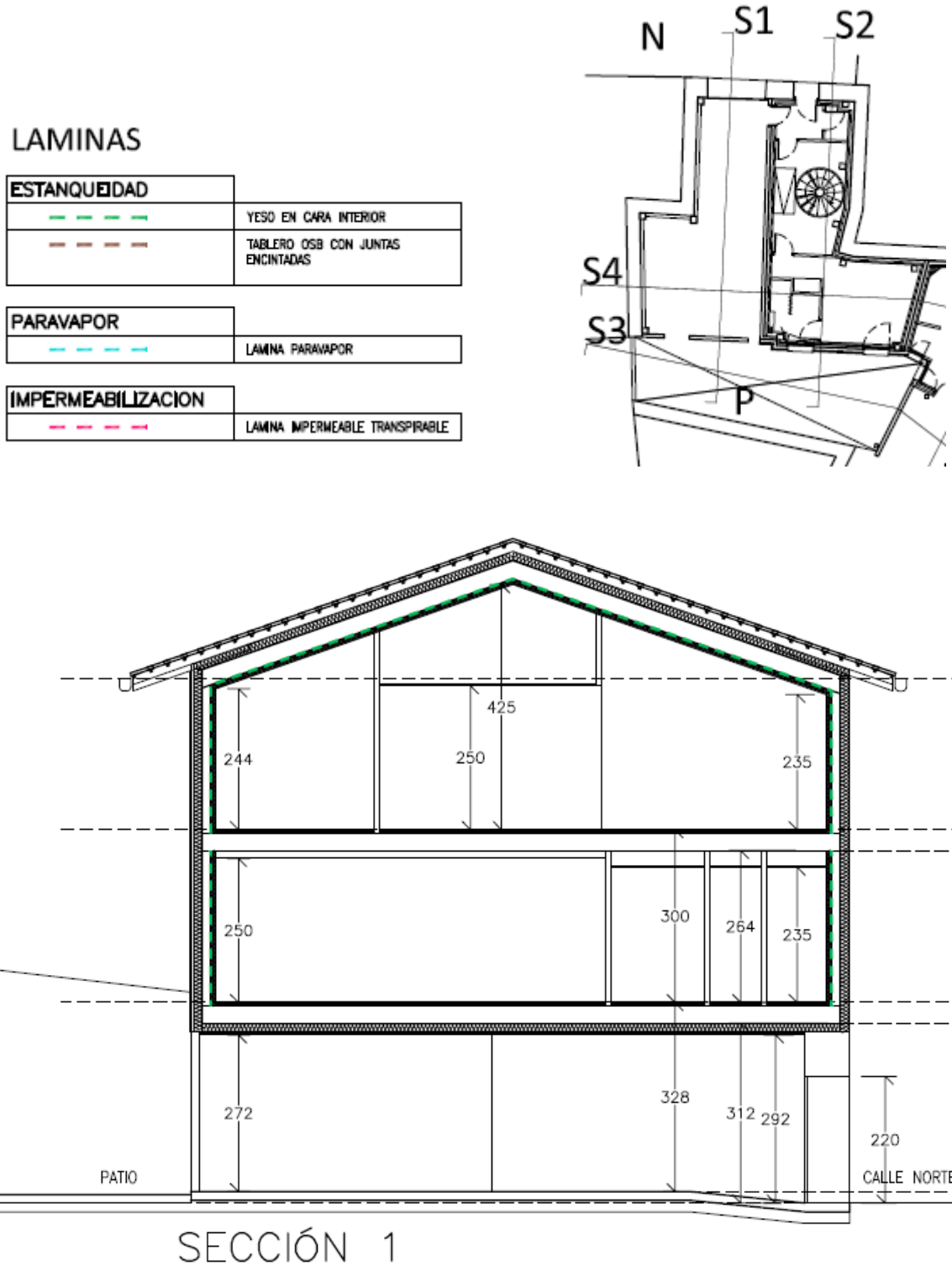
South façade, detail.

Living room

Bedroom

Distributor

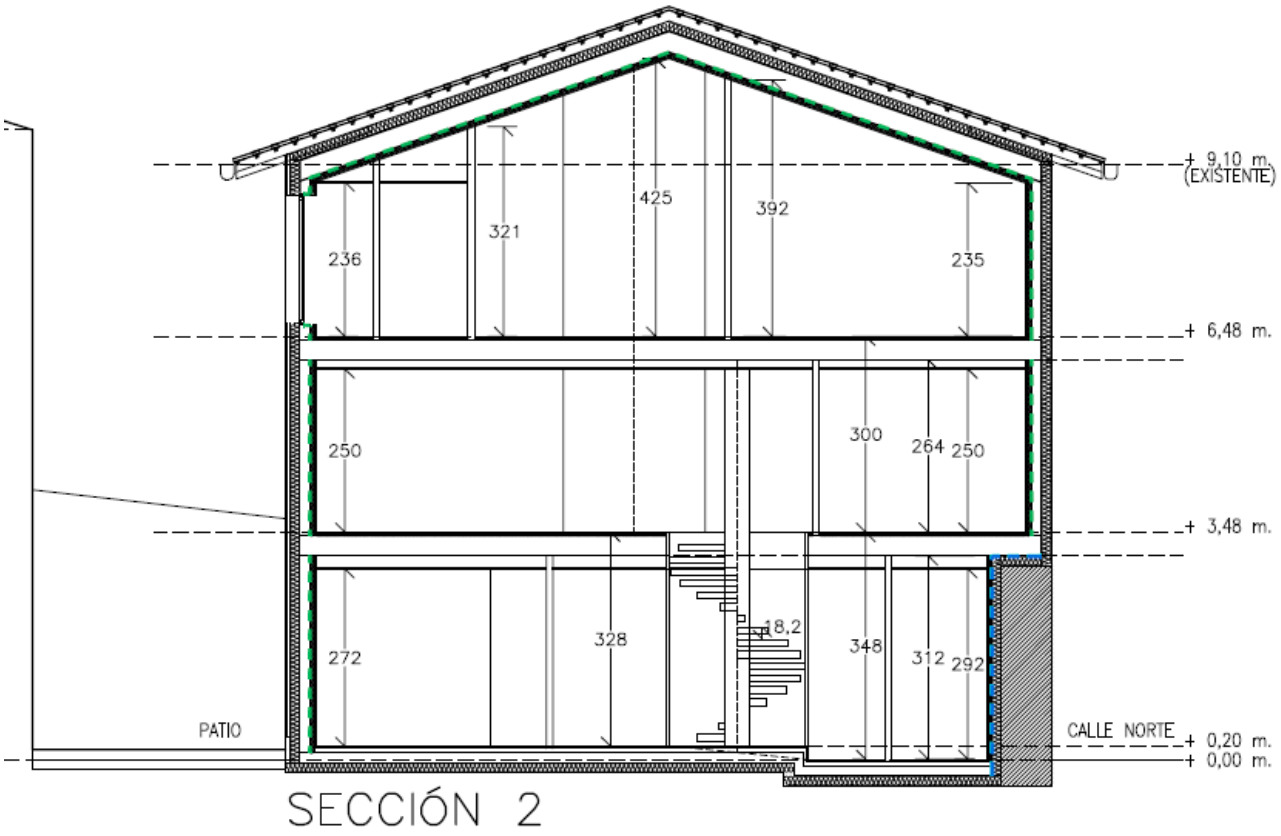
3 Sectional drawing of the house in Ibero



Section 1 through the garage shows the continuity of the thermal envelope. In the north façade we have wood-fiber insulation with a mortar finish. In the south façade the insulation is wood-fiber too, but in a wood ventilated façade system. We have XPS over the roof concrete slab. And we have mineral fiber insolation in the ceiling of the garage, under the concrete slab.

The air tightness is solved with a plaster finish over the brick walls of the facades, and the lower side of the roof concrete slab.

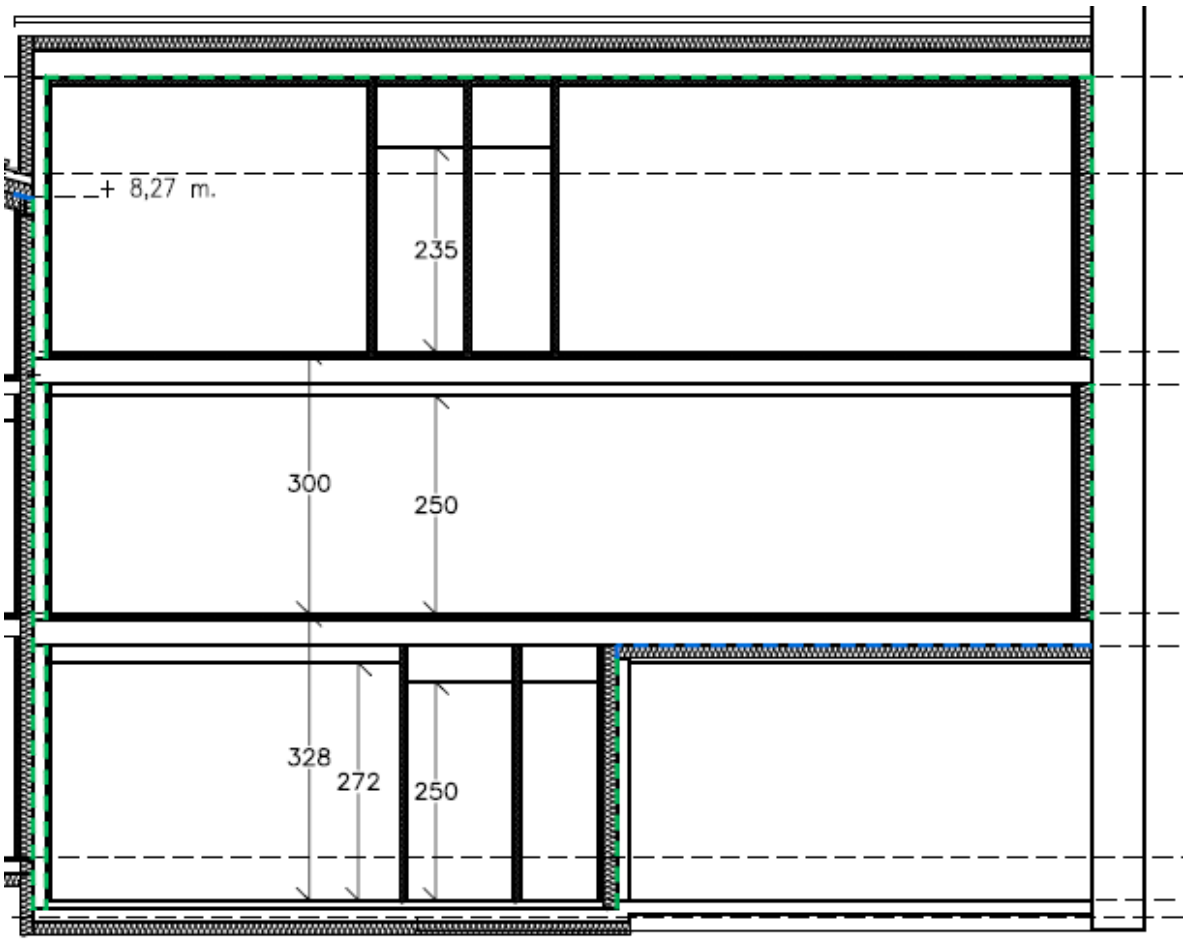
The counter flow heat exchanger is situated in an small room under the highest part of the tilted roof.



SECCIÓN 2

Section 2 shows the part of the house with three floors: the house occupies the ground level too.

The continuity of the isolation can be seen too. Under the ground level concrete slab we have EPS.

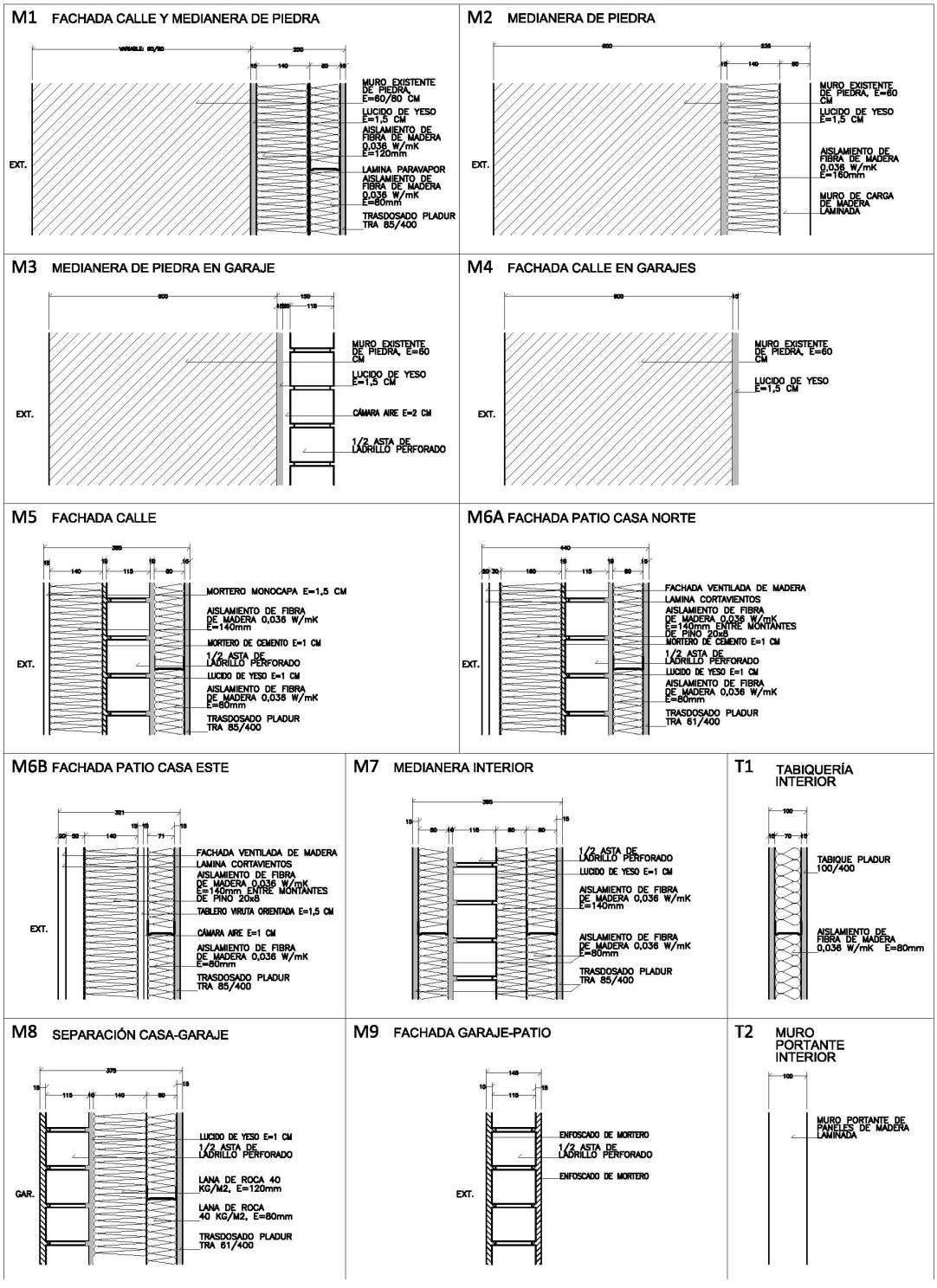


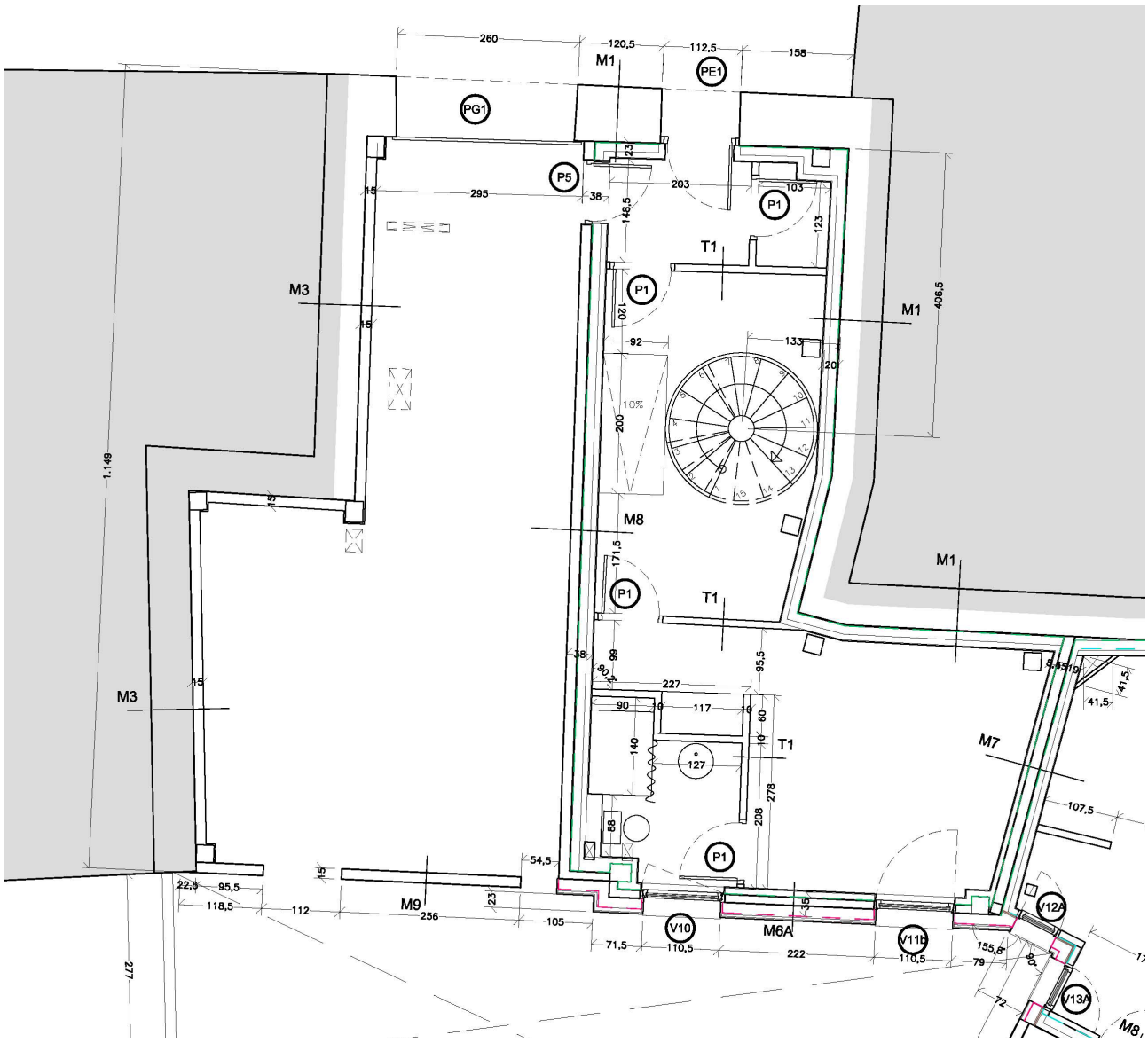
SECCIÓN 4

Section 4 is a long section. In it we can see both the part of the house with the garage and the part that occupies the three floors. The separation between house and garage was built with a brick wall with plaster in its inner side for the air tightness. Over the plaster we have wood fiber insulation. We have a thermal bridge where the wall between the house and the garage encounters the concrete slab of the ground level.

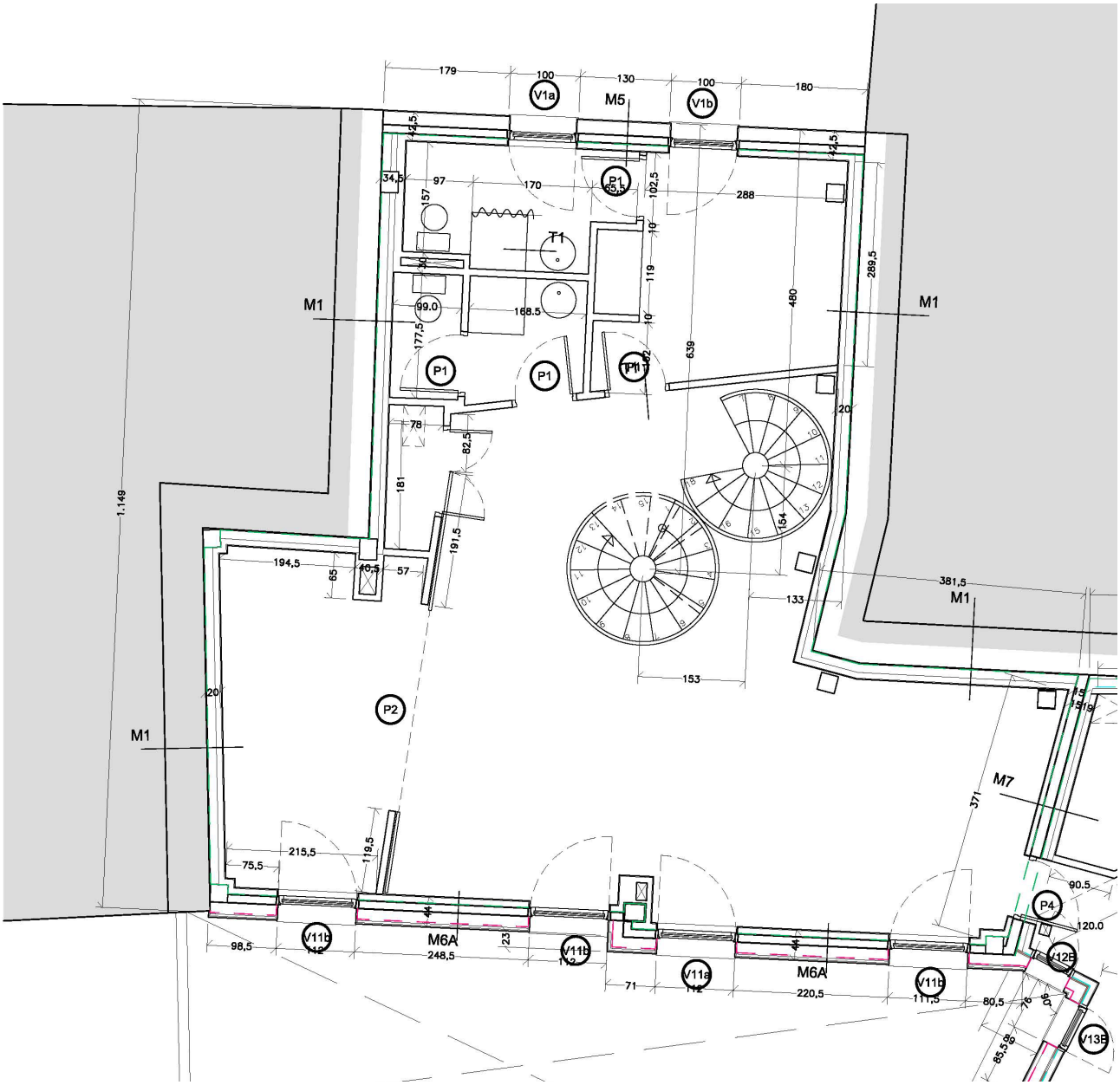
4 Floor plans of the Passive House in Ibero

Wall types:

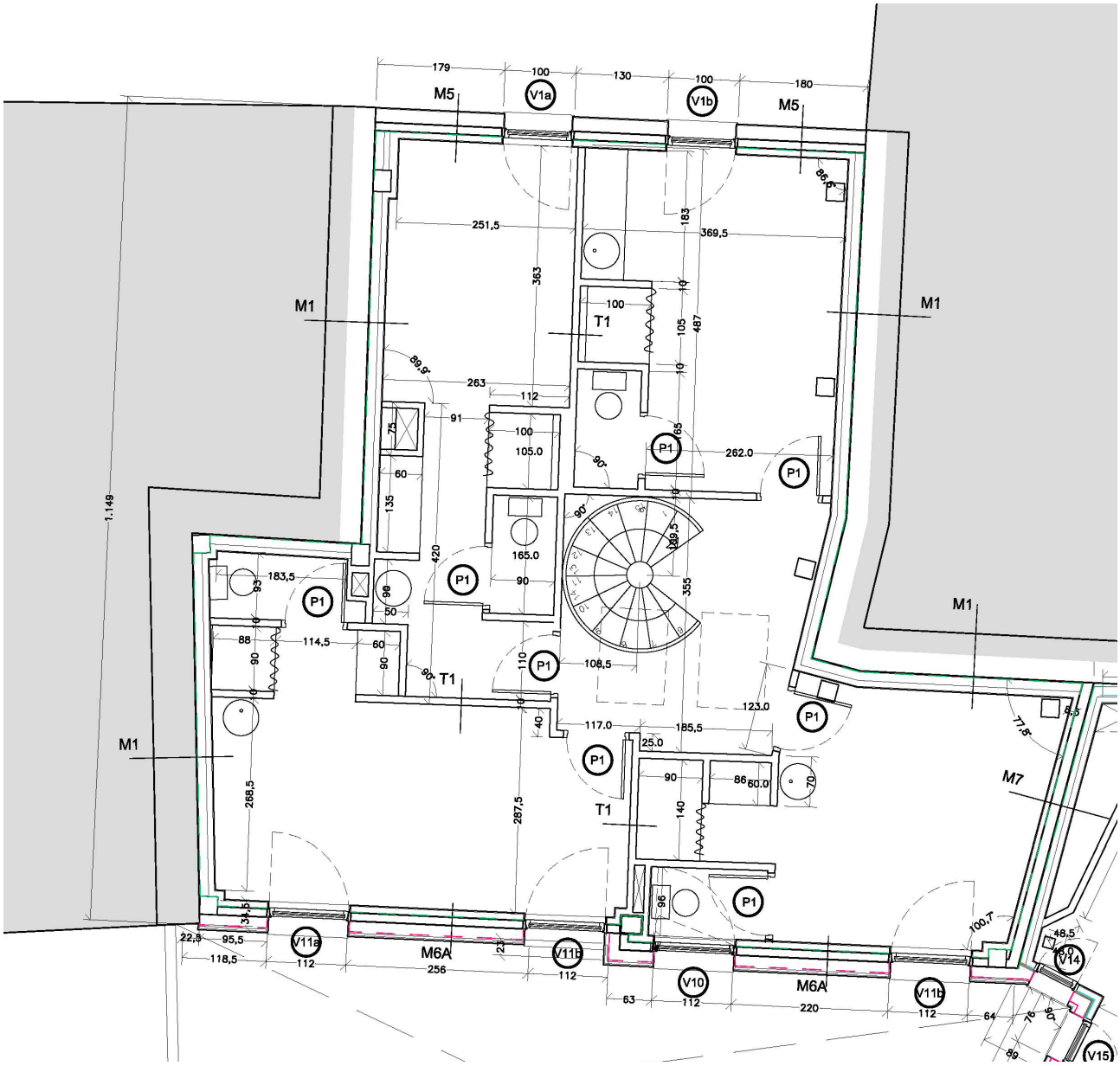




Ground floor plan. West side is occupied by the garage. In the east side we have the entrance of the house, stairs to the upper floors and a bedroom with its bathroom. Windows of the bedroom and bathroom face the south courtyard.



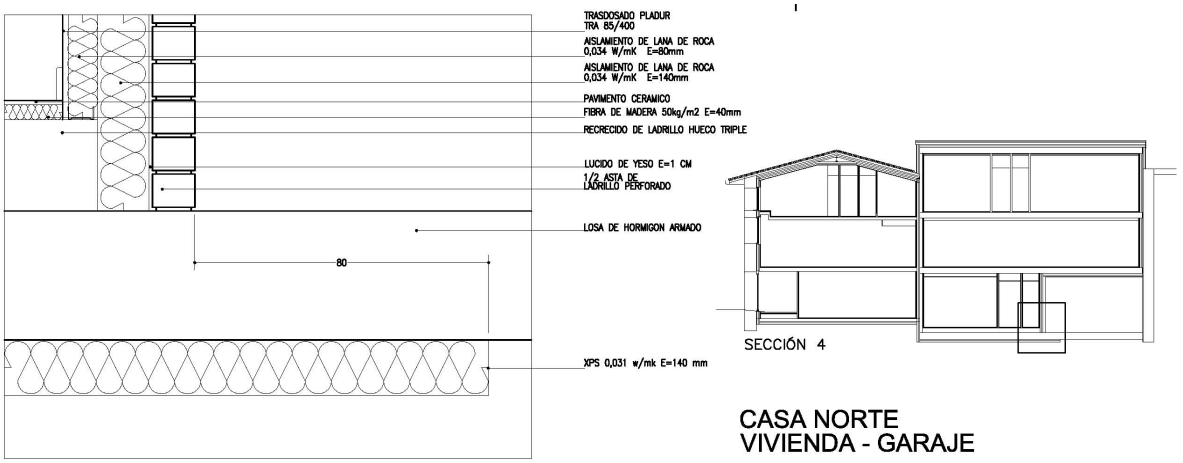
First floor. We find stairs coming from the ground floor and stairs going to the second floor in the living-room. The kitchen is on the west part. In the north part a bedroom with its bathroom. Biggest windows face south.



Second floor. Four bedrooms with their bathrooms. Over the bathroom and the entrance to the north-west bedroom there is a small loft where the counter flow heat exchanger is situated.

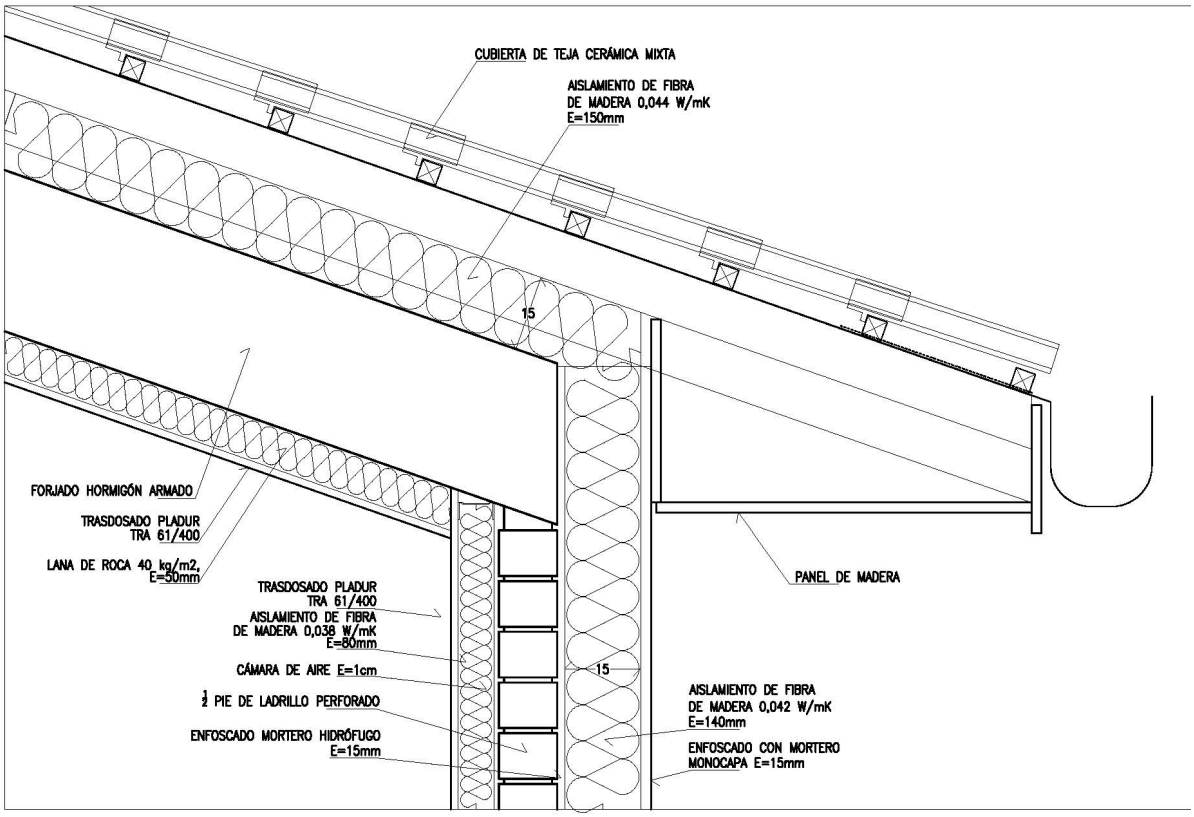
5 Construction details of the envelope and Passive House technology of the Passive House in Ibero

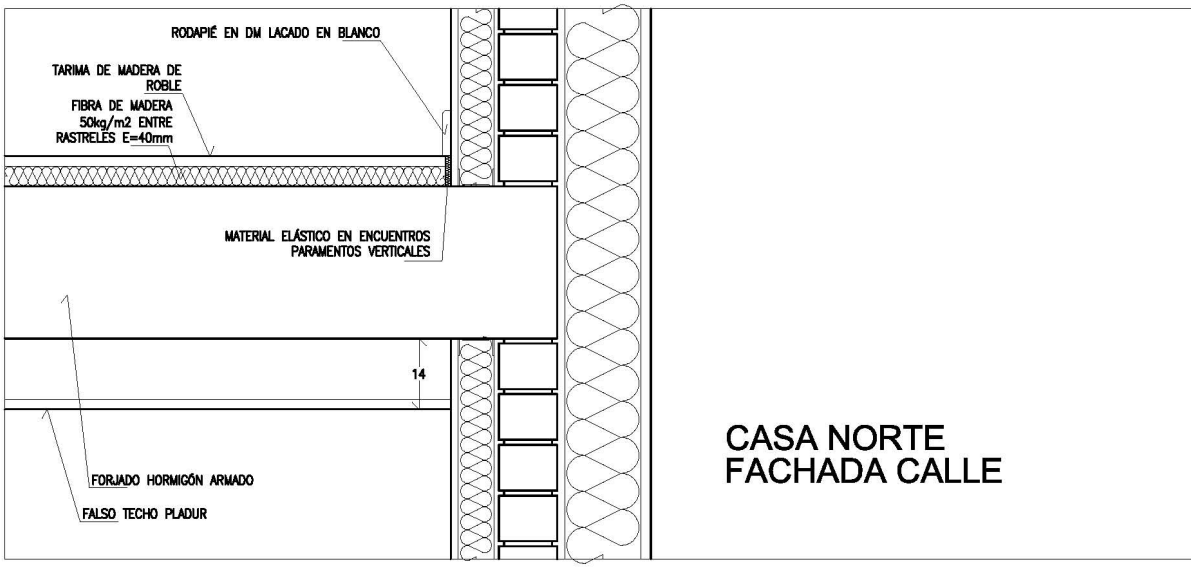
5.1 Construction including insulation of the floor slab or basement ceiling with connection points of exterior and interior walls



EPS under the concrete slab. The insulation advances under the floor of the garage to reduce the thermal bridge.

5.2 Construction including insulation of exterior walls





Nr. elem. cons.		¿Aislamiento interior?
02ud	FACHADA NORTE SATE	

Resistencia térmica superficial [m²K/W]

Inclinación del elemento	0,13	interior R_{si}:	0,13
Adyacente a	0,04	exterior R_{se}:	0,04

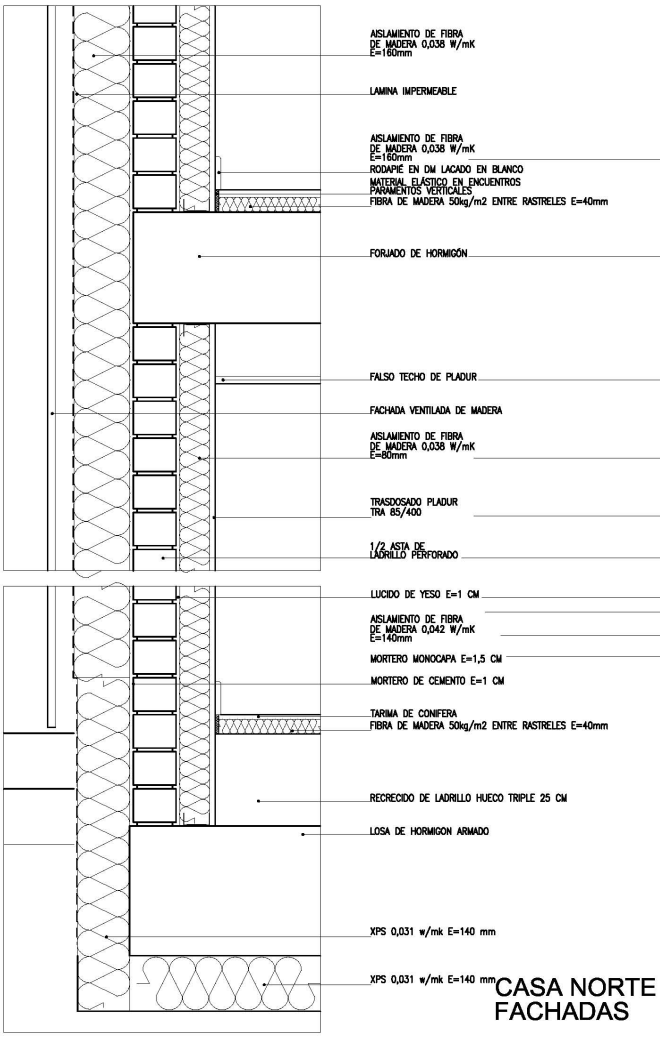
Superficie parcial 1	λ [W/(m·K)]	Superficie parcial 2 (opcional)	λ [W/(m·K)]	Superficie parcial 3 (opcional)	λ [W/(m·K)]	Espesor [mm]
RASEO DE MORTERO	1,400					20
PANEL DE FIBRA DE MADERA	0,042					140
RASEO DE MORTERO	1,300					15
LADRILLO PERFORADO	0,567					110
LUCIDO DE YESO	0,570					15
THERMOFLEX DE GUTEX	0,038	PERFIL GALVANIZASO	50,000			80
PLACA CARTÓN-YESO	0,250					15

Porcentaje superficie parcial 1	Porcentaje superficie parcial 2	Porcentaje superficie parcial 3	Total
100%	0,0%		39,5 cm

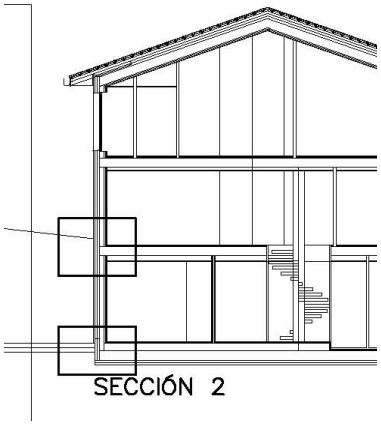
Suplemento al valor-U: 0,02 W/(m²K)

Valor-U: 0,199 W/(m²K)

North façade with wood fiber insulation on the brick wall.



CASA NORTE
FACHADAS



SECCIÓN 2

Nr. elem. cons. | ¿Aislamiento interior?

03ud	FACHADA SUR VENTILADA	

Resistencia térmica superficial [m²K/W]

Inclinación del elemento: 0,13 — interior R_{si}: 0,13

Adyacente a: 0,04 — exterior R_{se}: 0,04

Superficie parcial 1	λ [W/(m·K)]	Superficie parcial 2 (opcional)	λ [W/(m·K)]	Superficie parcial 3 (opcional)	λ [W/(m·K)]	Espesor [mm]
TABLERO DE CONIFERA	0,230					20
CAMARA	0,108			RASTREL DE PINO	0,230	20
THERMOFLEX DE GUTEX	0,038			RASTREL DE PINO	0,230	140
RASEO DE MORTERO	1,300					15
LADRILLO PERFORADO	0,567					110
LUCIDO DE YESO	0,570					15
THERMOFLEX DE GUTEX	0,038	PERFIL GALVANIZASO	50,000			80
PLACA CARTÓN-YESO	0,250					15

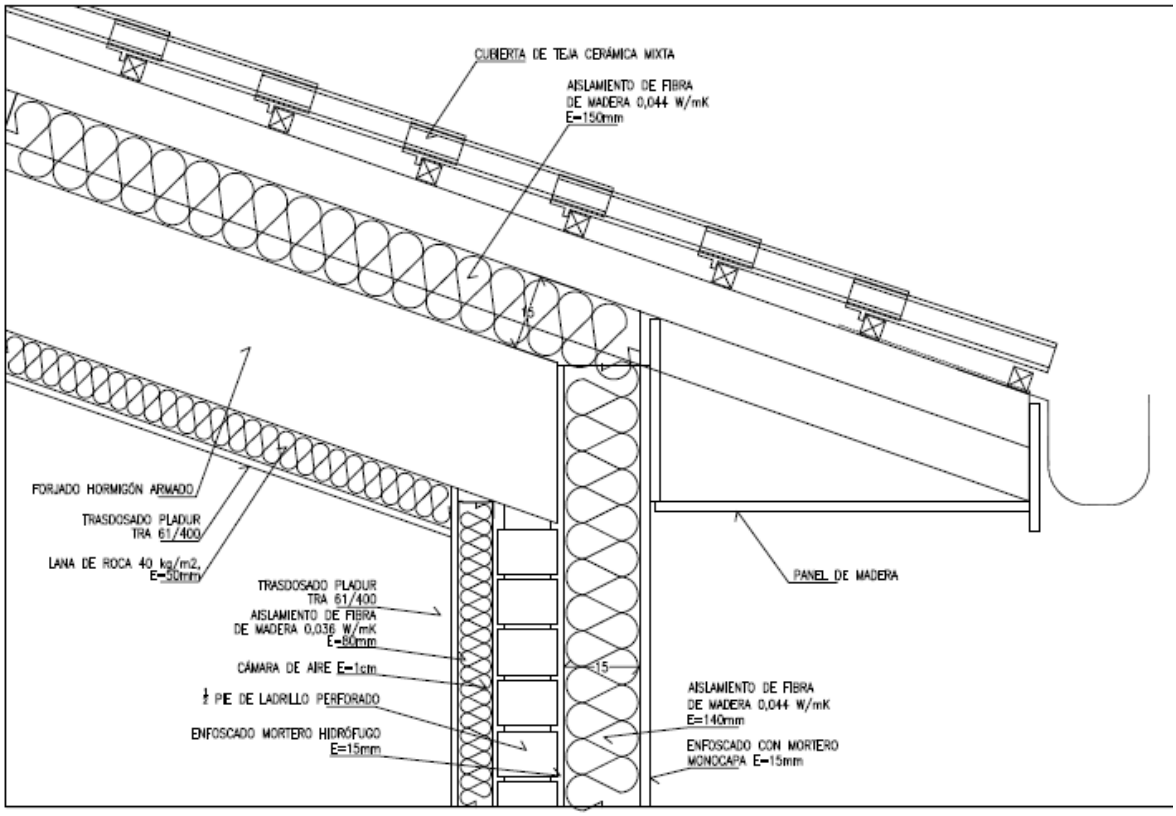
Porcentaje superficie parcial 1	Porcentaje superficie parcial 2	Porcentaje superficie parcial 3	Total
94%	0,0%	6,5%	41,5 cm

Suplemento al valor-U: W/(m²K)

Valor-U: 0,183 W/(m²K)

The south façade is solved as a ventilated façade: wood panels fixed to wooden strips. These wooden strips are nailed to other wooden strips fixed to the bricks wall. Between the main wooden strips there are wood-fiber panels, and over them a waterproof sheet.

5.3 Construction including insulation of the roof



Nr. elem. cons.		¿Aislamiento interior?
07ud	CUBIERTA	

Resistencia térmica superficial [m²K/W]

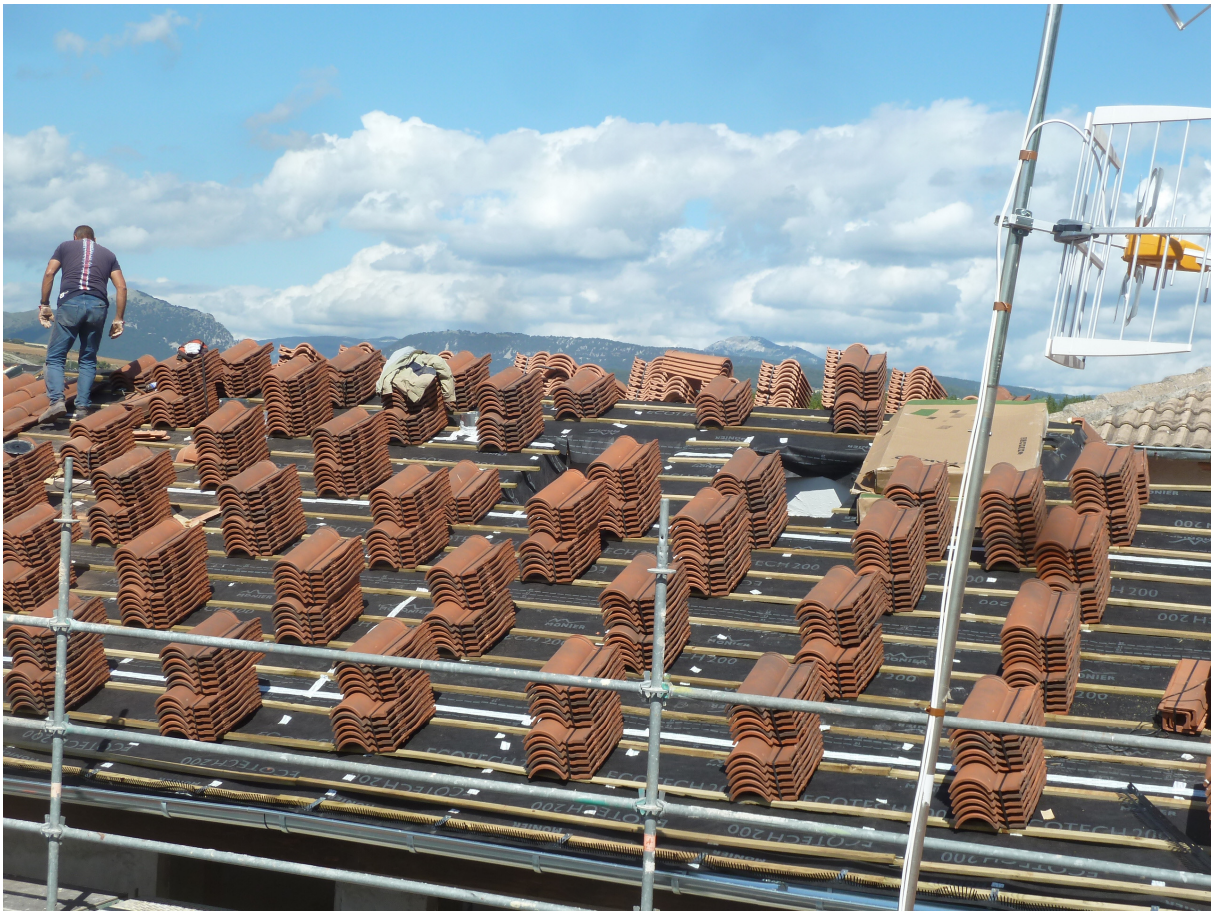
Inclinación del elemento	0,1	interior R_{si}	0,10
Adyacente a	0,04	exterior R_{se}	0,04

Superficie parcial 1	λ [W/(mK)]	Superficie parcial 2 (opcional)	λ [W/(mK)]	Superficie parcial 3 (opcional)	λ [W/(mK)]	Espesor [mm]
TEJA CERAMICA	1,000	TEJA CERAMICA	1,000	TEJA CERAMICA	1,000	20
CAMARA DE AIRE	0,245	RASTREL DE PINO	0,230	CAMARA DE AIRE	0,245	40
POLIESTIRENO ESTRUSIONADO	0,038	RASTREL DE PINO	0,230	POLIESTIRENO ESTRUSIONADO	0,038	160
FORJADO	1,211	FORJADO	1,211	VIGA DE HORMIGON	2,300	350
LUCIDO DE YESO	0,570	LUCIDO DE YESO	0,570	LUCIDO DE YESO	0,570	15
ALPHAROCK - E- 225 DE ROCKMOOL	0,034	ALPHAROCK - E- 225 DE ROCKMOOL	0,034	ALPHAROCK - E- 225 DE ROCKMOOL	0,034	160
CAMARA DE AIRE	0,240	PLACA CARTÓN-YESO	0,250	CAMARA DE AIRE	0,240	40
PLACA CARTÓN-YESO	0,250	PLACA CARTÓN-YESO	0,250	PLACA CARTÓN-YESO	0,250	15

Porcentaje superficie parcial 1	Porcentaje superficie parcial 2	Porcentaje superficie parcial 3	Total
70%	6,7%	23,7%	80,0 cm

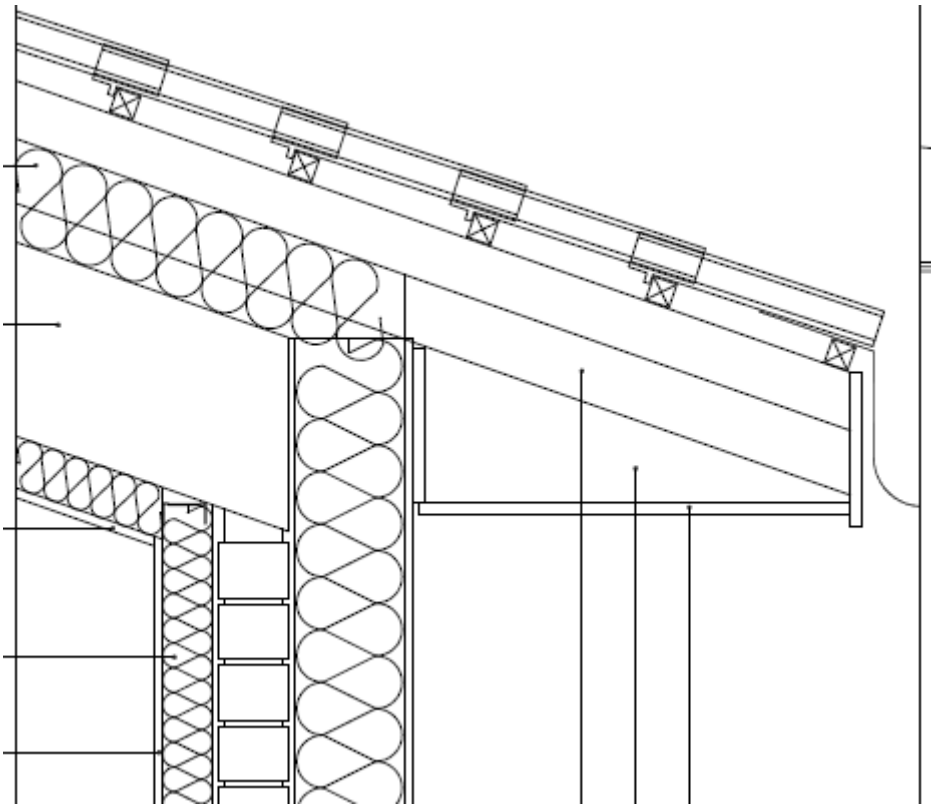
Suplemento al valor-U: W/(m²K)

Valor-U: 0,111 W/(m²K)



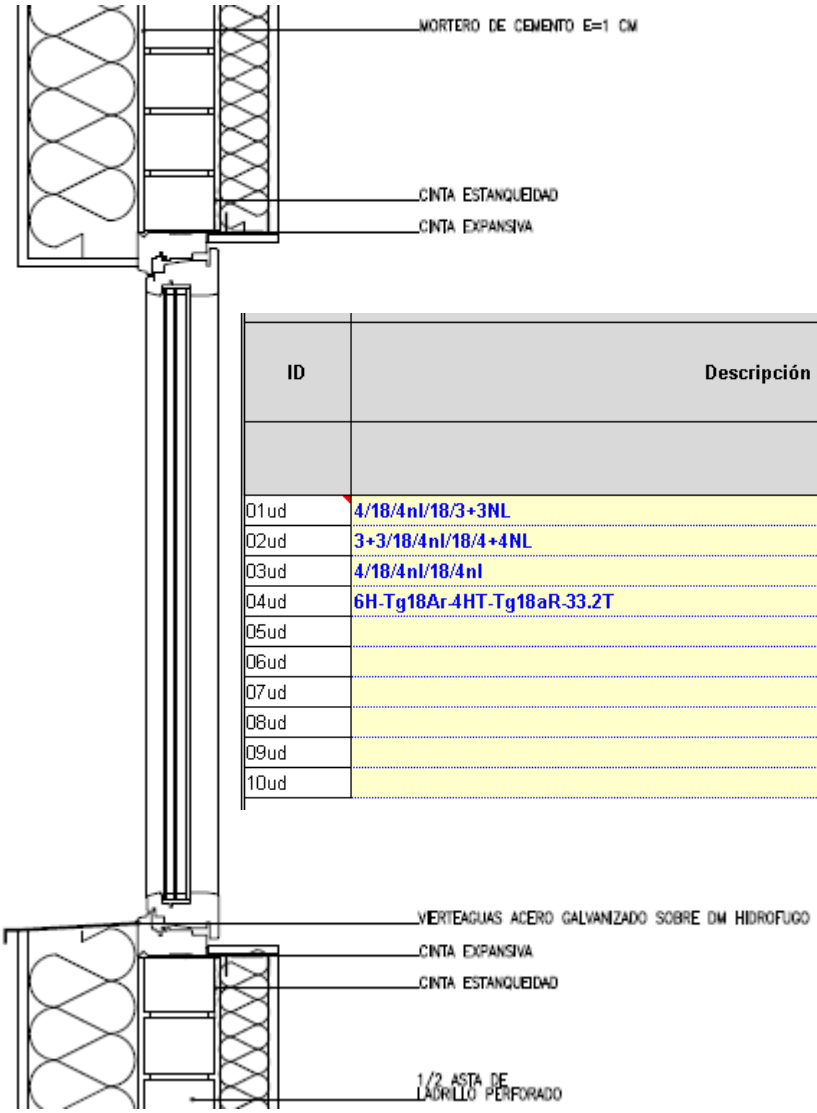
The roof is a tilted concrete slab and over it two XPS panels were fixed (with wooden strips between the slabs of the second level), and a waterproof screen. Over the last one there are wooden strips and ceramic tiles.

In the connection between the roof and the north façade the wood fiver insulation goes up to the wooden panels of the roof´s eaver.



In the south façade the wood fiber panels of the façade go up to cover the front of the XPS panels of the roof.

5.4 Window sections including installation drawing

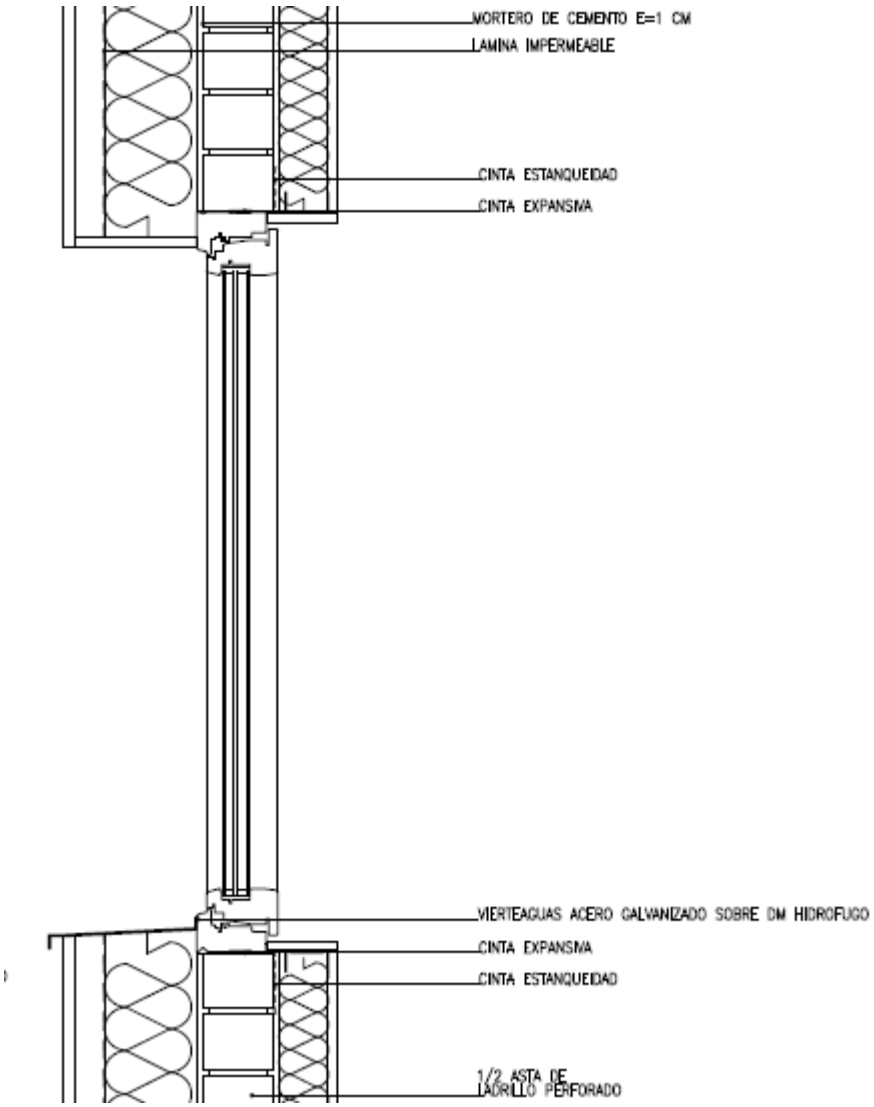


ID	Descripción	Valor g	Valor-Ug
			W/(m²K)
01ud	4/18/4nl/18/3+3NL	0,50	0,52
02ud	3+3/18/4nl/18/4+4NL	0,50	0,52
03ud	4/18/4nl/18/4nl	0,53	0,53
04ud	6H-Tg18Ar-4HT-Tg18aR-33.2T	0,44	0,54
05ud			
06ud			
07ud			
08ud			
09ud			
10ud			

Marcos de ventana

ID	Descripción	Valor U_f				Ancho del marco				Puente térmico en borde de vidrio			
		Izquierda	Derecha	Abajo	Arriba	Izquierda	Derecha	Abajo	Arriba	$\Psi_{Borde\ vidrio}$ izquierda	$\Psi_{Borde\ vidrio}$ derecha	$\Psi_{Borde\ vidrio}$ abajo	$\Psi_{Borde\ vid}$ arriba
		W/(m²K)	W/(m²K)	W/(m²K)	W/(m²K)	m	m	m	m	W/(mK)	W/(mK)	W/(mK)	W/(mK)
01ud	Practicable izquierda en ventana de 2 hojas	0,93	0,93	0,93	0,93	0,108	0,072	0,108	0,108	0,040	0,040	0,040	0,040
02ud	Practicable derecha en ventana de 2 hojas	0,93	0,93	0,93	0,93	0,072	0,108	0,072	0,072	0,040	0,040	0,040	0,040
03ud	Fijo	0,93	0,93	0,93	0,93	0,072	0,072	0,072	0,072	0,040	0,040	0,040	0,040
04ud	1 hoja practicable-ventilado	0,93	0,93	0,93	0,93	0,104	0,104	0,104	0,104	0,052	0,052	0,052	0,052
05ud	1 hoja practicable-sate	0,93	0,93	0,93	0,93	0,104	0,104	0,104	0,104	0,052	0,052	0,052	0,052
06ud	VENTANA FAKRO FTT U6	0,81	0,81	0,81	0,81	0,100	0,100	0,100	0,100	0,040	0,040	0,040	0,040
07ud													
08ud													
09ud													
10ud													

North façade windows are fixed to the brick wall. The exterior insulation overlaps the windows ´frame. In the inside the airtight is achieved with tapes fixed to the wooden frame and to the plaster of the wall.

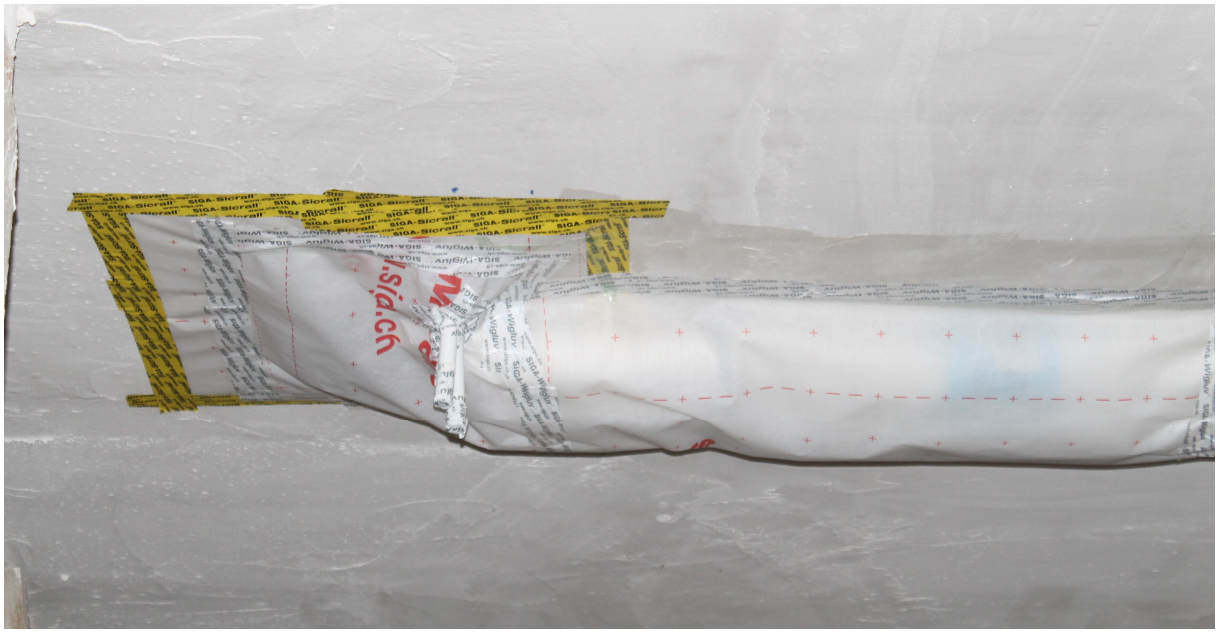


In the south façade the airtightness is solved in the same way, and outside the wooden strips of the ventilated façade overlap the windows frame and the waterproof sheet is fixed to the window frame.

6 Description of the airtight envelope; documentation of the pressure test result

The airtightness is solved casting plaster over the brick walls and the concrete slabs of the roof and the basement ceiling. In the points were the continuity of the plaster is broken for the passing of the insolation special sheets are employed:


SIGA-Majasan
www.siga.ch

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SIGA

Cuadro resumen con los principales parámetros obtenidos como resultados del ensayo Blower Door a **Despresurización** realizado:

		Resultados		Intervalo de confianza (95%)		Incertidumbre
V_{50}	Caudal medio (50 Pa)	328,5	[m^3/h]	[323,6	333,3]	+/-1,5%
n_{50}	**Renovaciones por hora (50 Pa)**	**0,609**	**[h^{-1}]**	[0,588	0,629]	+/-3,3%
q_{50}	Permeabilidad al aire (50 Pa)	0,576	[$m^3/(m^2*h]$	[0,577	0,596]	+/-3,3%
W_{50}	Tasa especifica de filtrado (50Pa)	1,618	[$m^3/(m^2*h]$	[1,564	1,672]	+/-3,3%

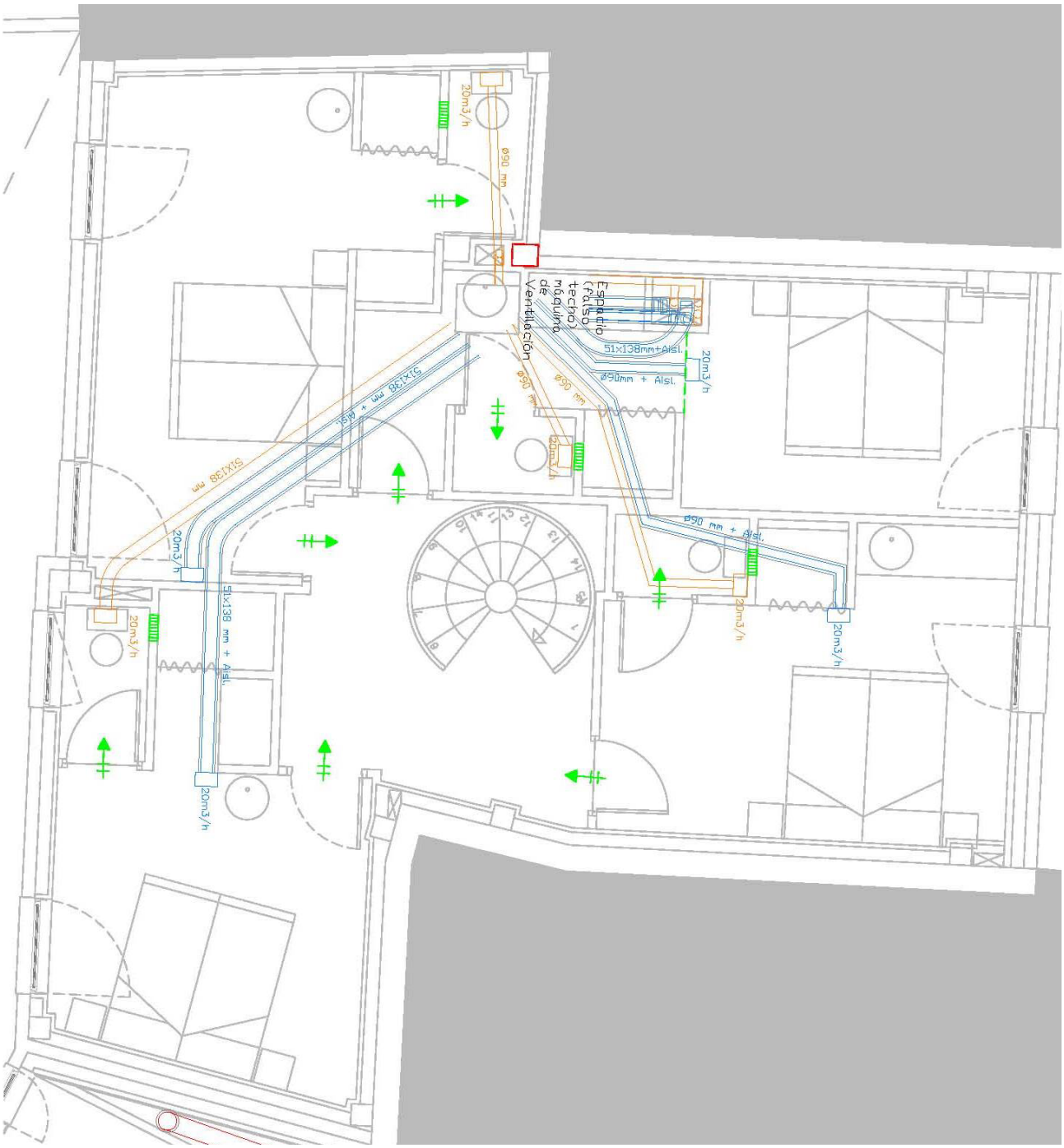
Cuadro resumen con los principales parámetros obtenidos como resultados del ensayo Blower Door a **Presurización** realizado:

		Resultados		Intervalo de confianza (95%)		Incertidumbre
V_{50}	Caudal medio (50 Pa)	334,6	[m^3/h]	[317,1	353,0]	+/-5,4%
n_{50}	**Renovaciones por hora (50 Pa)**	**0,620**	**[h^{-1}]**	[0,582	0,658]	+/-6,1%
q_{50}	Permeabilidad al aire (50 Pa)	0,587	[$m^3/(m^2*h]$	[0,551	0,623]	+/-6,1%
W_{50}	Tasa especifica de filtrado (50Pa)	1,648	[$m^3/(m^2*h]$	[1,547	1,745]	+/-6,1%

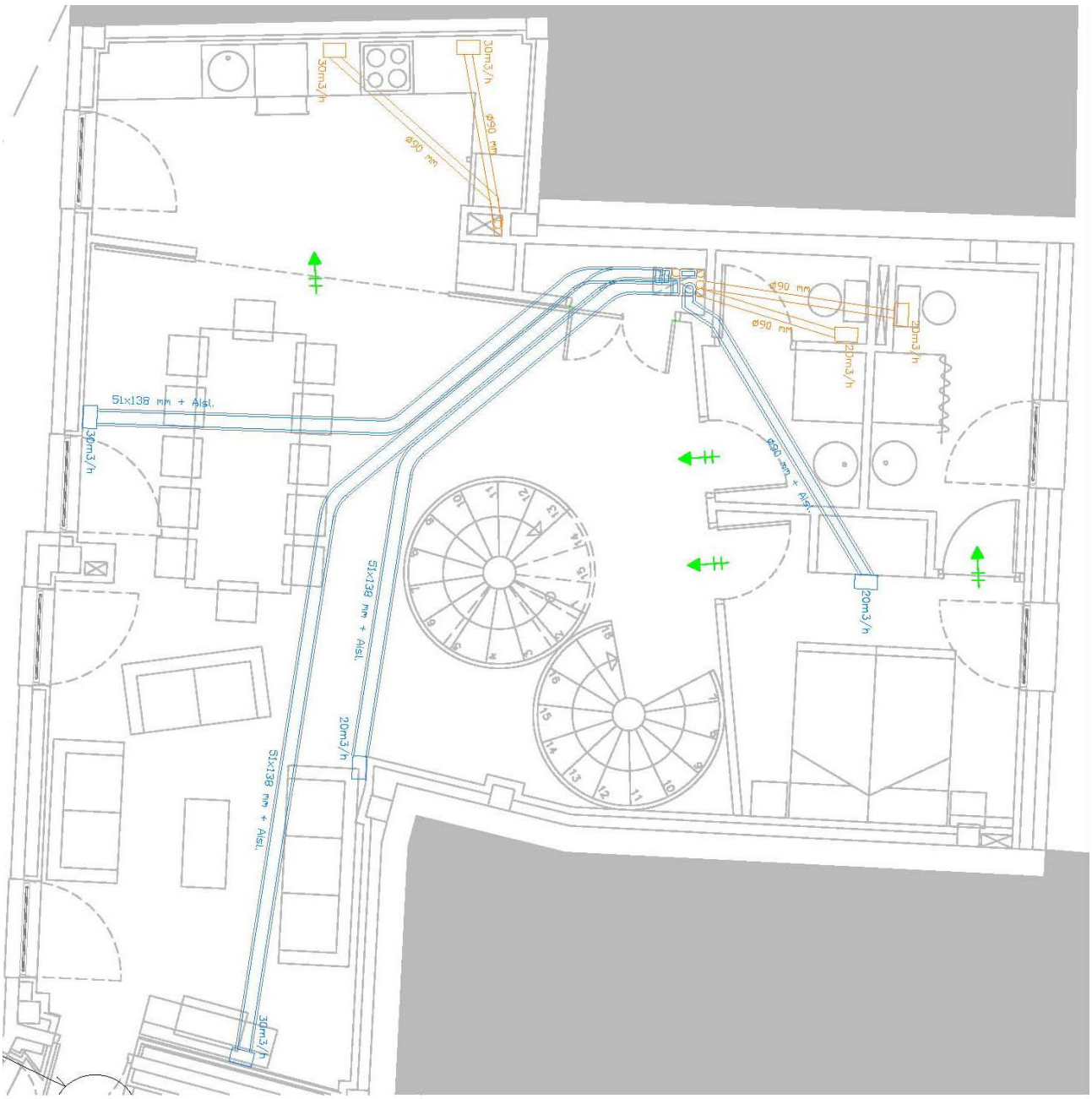
Cuadro resumen con los principales parámetros obtenidos como resultados del ensayo Blower Door **Combinado *(Presurización + Despresurización)*** realizado:

		Resultados		Intervalo de confianza (95%)		Incertidumbre
V_{50}	Caudal medio (50Pa)	331,5	[m^3/h]	[320,5	343,0]	+/-3,4%
n_{50}	**Renovaciones por hora (50 Pa)**	**0,610**	**[h^{-1}]**	[0,585	0,643]	+/-4,7%
q_{50}	Permeabilidad al aire (50 Pa)	0,582	[$m^3/(m^2*h]$	[0,554	0,609]	+/-4,7%
W_{50}	Tasa especifica de filtrado (50Pa)	1,633	[$m^3/(m^2*h]$	[1,556	1,711]	+/-4,7%

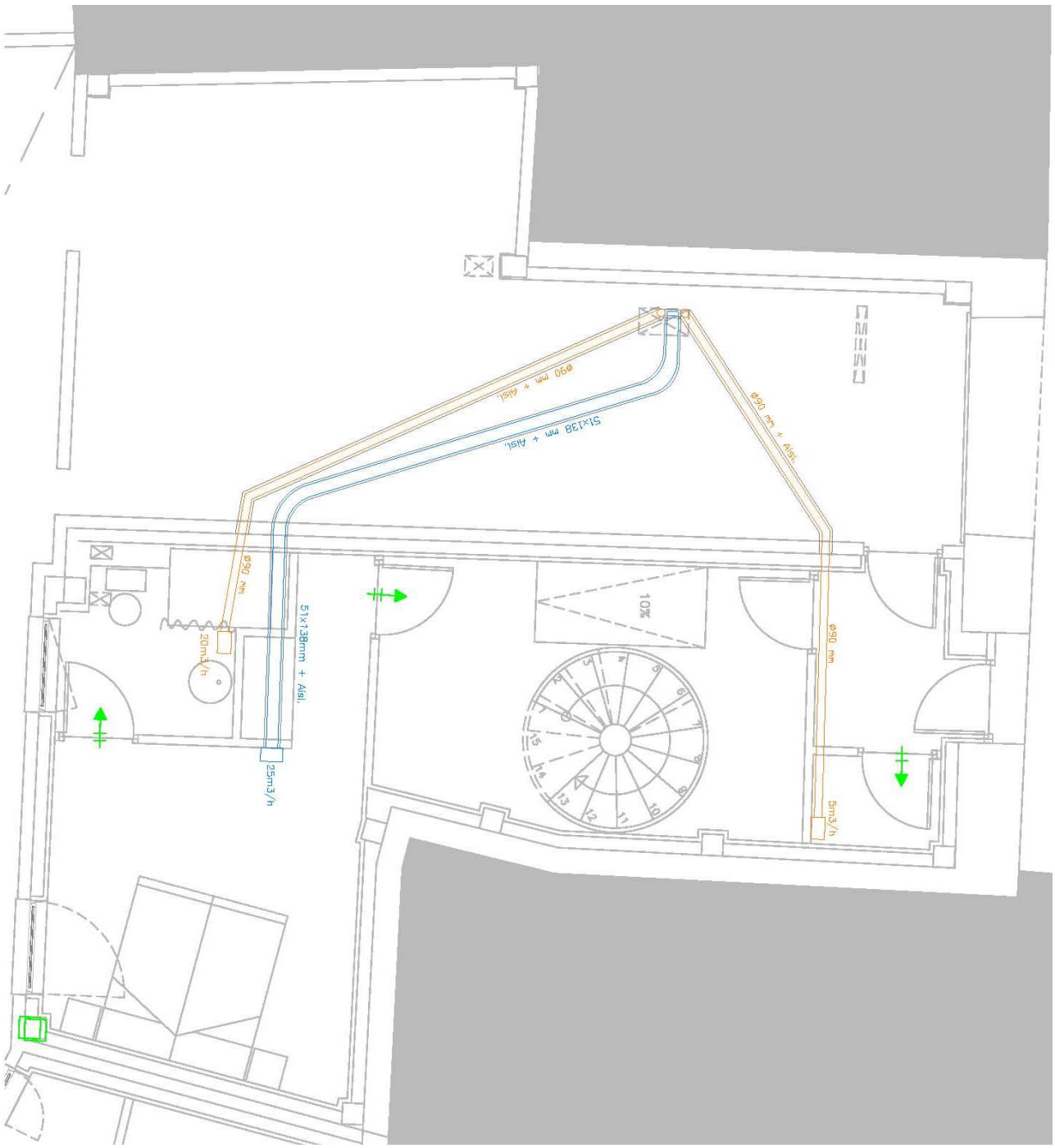
7 Planning of ventilation ductwork (example)



Second floor plan. Blue ducts suply air in the bedrooms. Brown ducts estract the dirt air from bathrooms.

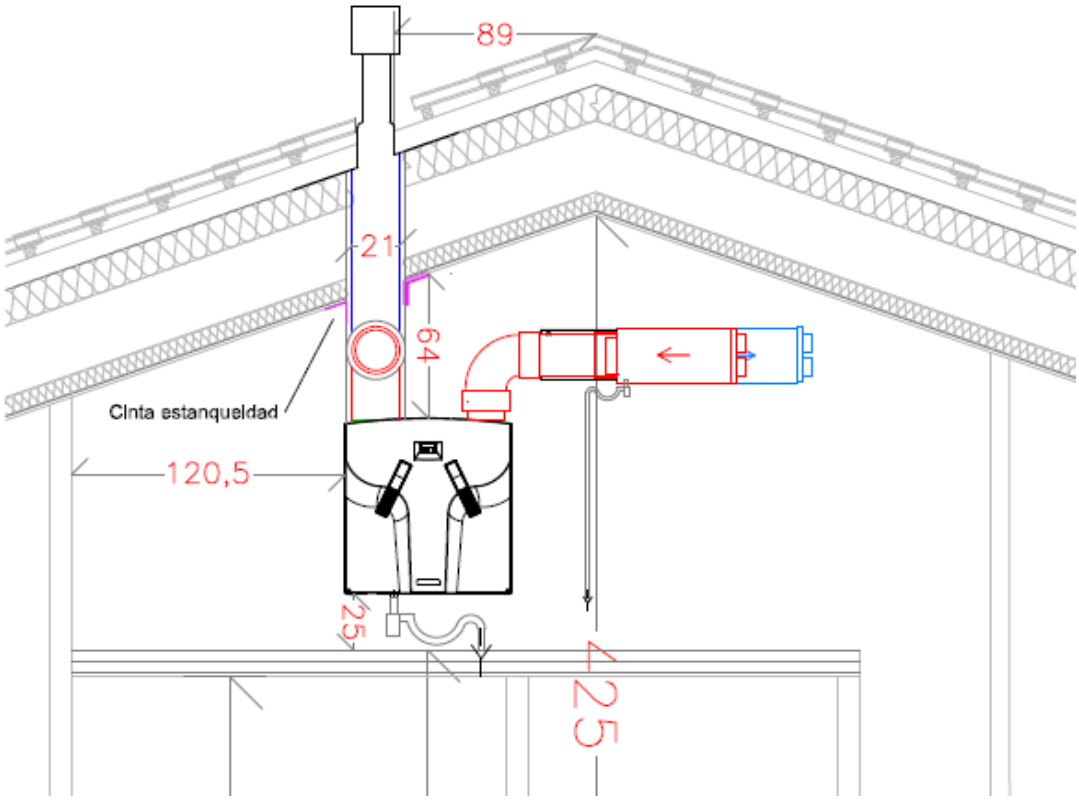


First floor plan. Suply ducts go through the ceiling of the floor to the living-room and bed-room. Xtract ducts take air from bath-rooms and the kitchen.



Basement floor plan. The ducts, in the basement floor, go out of the airtight envelope in the garage, and enter again to supply air to the bed-room and extract it from the bath-room and the small store in the entrance.

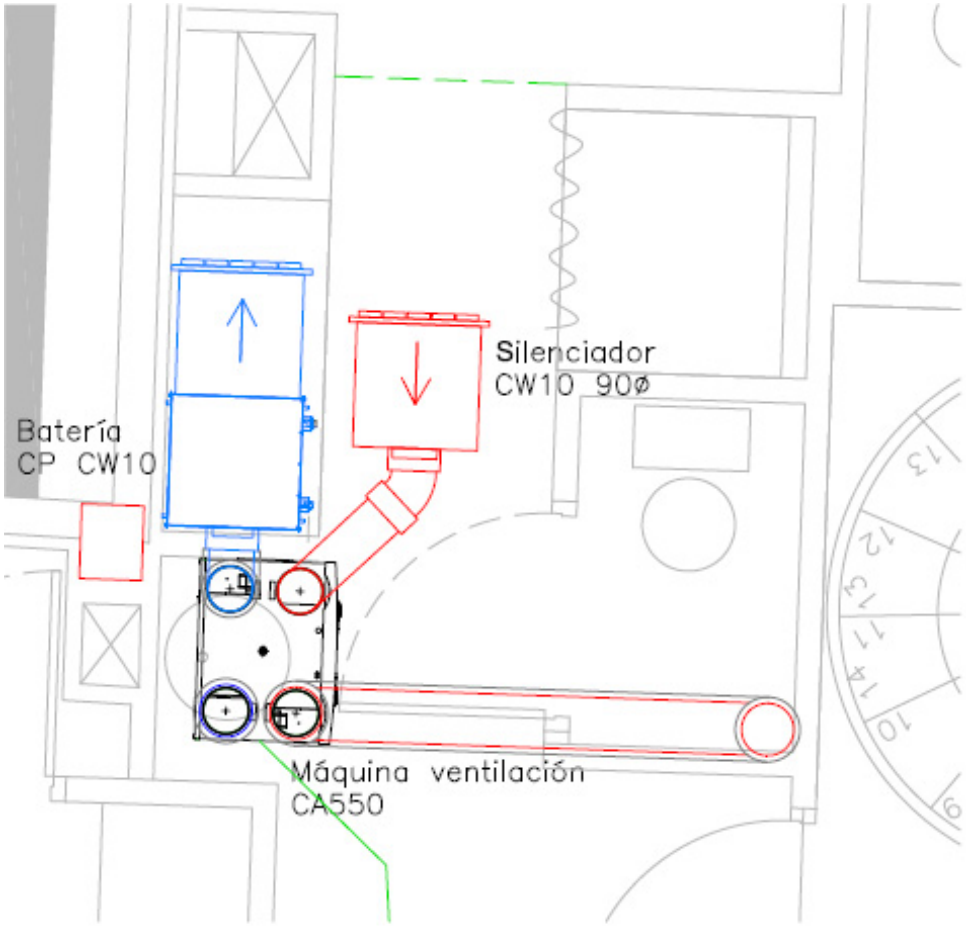
8. Ventilation plan for the central unit / type / specific values



The counterflow air-to-air heat exchanger used for heat recovery is located in a technical floor unther tre roof of the house. It´s a Zehnder certificated machine.

Zehnder ComfoAir 550

Zehnder ComfoAir 550



FALSO TECHO DE PLANTA BAJOCUBIERTA (E:1/25)

From the machine unther the roof the ducts go down to the diferent floors.

Ventilation unit — **Zehnder ComfoAir 550**

Descriptions

Technical specifications

Heat exchanger:	Plastic
Fans:	EC direct current radial fans
Filters:	Extract air: G4 Outside air: G4 (optional F7 pollen filter)
Condensate connection:	DN 32
Air duct connections:	4 x DN 180 at top
	DN 125 / 150 / 160
Electrical connection:	230 V, 50 Hz
Temperature range:	Min. 10 °C/max. 40 °C
Acoustic performance (min./max.):	Extract air 28 dB(A)/63 dB(A)
	Supply air: 35 db(A) / 79 dB(A)
Heat recovery:	Up to 95%
Volumetric flow:	Maximum 550 m3/h at 240 Pa external
	Minimum 50 m3/h at 5 Pa external
Power consumption:	
At 225 m3/h and 100 Pa:	0.30 Wh/m3
Dimensions:	Height: 800 mm
	Width: 725 mm
	Depth: 569 mm
Weight:	47 kg

9. Heat supply

For the hot water production a heat-pump is used.

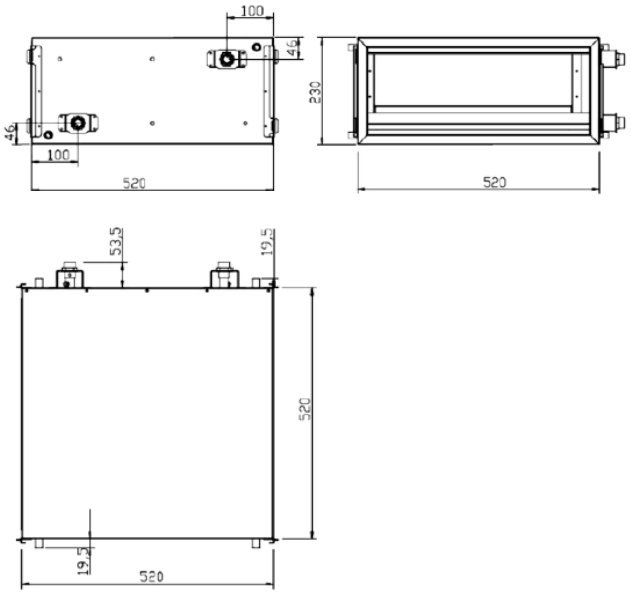
Bomba de calor de 1 compresor hasta aprox. 55 ºC tem

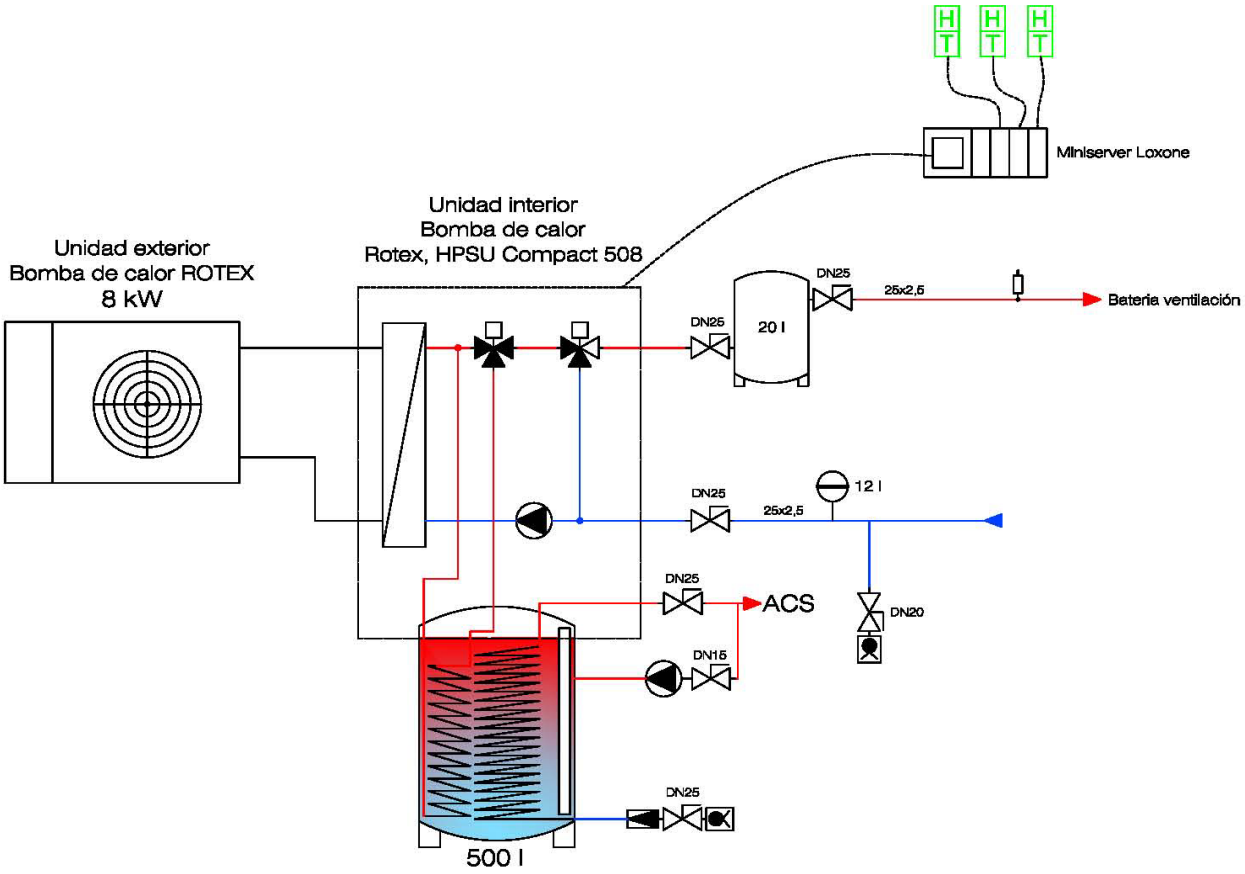
Datos técnicos HPSU Unidad exterior		~1/230 V		
Tipo de unidad exterior		**6 kW**	**7 kW**	**8 kW**
				
Prestaciones				
Potencia Nominal Calefacción A-7/I35 *	kW	4,2	5,1	5,7
Potencia Nominal Calefacción A2/I35 *	kW	5,5	6,6	7,2
Potencia Nominal Calefacción A10/I35 *	kW	8,6	10,1	11,0
COP Nominal A-7/I35 **		2,53	2,70	2,67
COP Nominal A2/I35 **		3,47	3,49	3,34
COP Nominal A10/I35 **		4,94	4,78	4,54
Potencia Nominal Refrigeración A35/I18 *	kW	7,2	8,2	8,4
Potencia Nominal Refrigeración A35/I7 *	kW	5,1	5,9	6,1

It supplies hot water to the post-heating battery of the air exchange system:

Zehnder ComfoPost CW10
Batteria di post trattamento per sistemi di ventilazione comfort

ComfoPost CW10





ELEMENTOS ESQUEMA DE PRINCIPIO		Ref.:	Fcante.:	ELEMENTOS ESQUEMA DE PRINCIPIO		Ref.:	Fcant.:
	Válvula Reguladora Caudal	--	--		Válvula Reductora de Presión	--	--
	Válvula de mariposa	--	--		Válvula 2 vías	--	--
	Válvula de Bola	--	--		Caudalímetro	--	--
	Válvula Antiretorno	--	--		Filtro en Y	--	--
	Válvula de Seguridad	--	--		Desagüe	--	--
	Válvula de 3 vías proporcional	--	--		Bomba	--	--
	Válvula de 3 vías todo-nada	--	--		Vaso de Expansión	--	--

ELEMENTOS ESQUEMA DE PRINCIPIO		Ref.:	Fcant.:	ELEMENTOS ESQUEMA DE PRINCIPIO		Ref.:	Fcant.:
	Intercambiador Placas	--	--		Agua de red	--	--
T	Termómetro	--	--	ACS	Recuperador calor para ACS	--	--
M	Manómetro	--	--		Bomba de calor	--	--
	Manguito Antivibratorio	--	--		Bomba de calor con recuperación para ACS	--	--
	Purgador Automático	--	--		Disipador calor dinámico	--	--
	Sonda temperatura	--	--		Válvula de presión diferencial	--	--
P	Sonda presión	--	--				

Cliente :
BOA ARQUITECTOS

Aceptado Cliente :

Proyecto :
EJECUTIVO Viviendas unifamiliares entre medianeras

Dirección :
Berriobide, 40, oficina 124. Ansoain.

Plano :
INSTALACIONES - Esquema hidráulico.

Carrer de Ramón Turró, 100. 3-3.
08005 Barcelona
T. 93 878 22 43
progetic@progetic.com
www.progetic.com

PROGETIC
ENGINYERIA PER AL DESENVOLUPAMENT SOSTENIBLE

Fecha de creación :	Tamaño Plano :	Número :
30/01/2015	Din-A3	7
Dibujado :	Referencia :	Escala :
	–	--

10. PHPP. Verification sheet.

Comprobación Passivhaus

Edificio:	CASA RURAL LARREBERRI 16-A				
Calle:	C/ LARREBERRI 16-A				
CP / Ciudad:	31173 / IBERO				
País:	ESPAÑA				
Tipo de edificio:	VIVIENDA UNIFAMILIAR ENTRE MEDIANERAS PARA USO COMO CASA RURAL				
Clima:	[ES] - Pamplona, Navarra D1	Altitud del sitio del edificio (en [m] sobre el nivel del mar):	395		
Propietario / cliente:	SUGEA HOME SL				
Calle:	C/ OIANONDOA 8, BAJO				
CP / Ciudad:	31013 / BERRIOZAR				
Arquitectura:	BOA ARQUITECTOS SLP				
Calle:	C/ BERRIOBIDE 40, OFICINA 124				
CP / Ciudad:	31013 / ANSOAIN				
Instalaciones:	SOLANO E IRIARTE				
Calle:	C/San Esteban, 11				
CP / Ciudad:	31699 / Zabaldica				
Año construcción:	2014	Temperatura interior invierno:	20,0 °C	Volumen exterior V_e m³:	1067,9
Nr. de viviendas	1	Temperatura interior verano:	25,0 °C	Refrigeración mecánica:	
Nr. de personas:	5,0	GIC invierno:	2,1 W/m²		
Capacidad específica	132 Wh/K por m² de SRE	GIC verano:	5,0 W/m²		

Valores característicos del edificio con relación a la superficie de referencia energética y año

				Requerimientos	¿Cumplido?*
	Superficie de referencia energética	203,3	m²		
Calefacción	Demanda de calefacción	14,65	kWh/(m²a)	15 kWh/(m²a)	sí
	Carga de calefacción	8,6	W/m²	10 W/m²	sí
Refrigeración	Demanda total refrigeración		kWh/(m²a)	-	-
	Carga de refrigeración		W/m²	-	-
	Frecuencia de sobrecalentamiento (> 25 °C)	8,5	%	-	-
Energía primaria	Calef., ref., deshum., ACS, elect. auxiliar, ilum., aparatos eléct.	88	kWh/(m²a)	120 kWh/(m²a)	sí
	ACS, calefacción y electricidad auxiliar	65	kWh/(m²a)	-	-
	Ahorro de EP a través de electricidad solar		kWh/(m²a)	-	-
Hermeticidad	Resultado ensayo de presión n50	0,6	1/h	0,6 1/h	sí

* Campo vacío: faltan datos; '-': sin requerimiento

Passivhaus?	sí

Confirmamos que los valores aqui presentados han sido determinados siguiendo la metodoloia PHPP y están basados en los valores característicos del edificio.
Los cálculos con PHPP están adjuntos a esta aplicación.

		PHPP Versión 8.5	
Nombre:	IÑAKI	Número de registro PHPP:	PEPES_200913_25388555_es
Apellidos:	ARCHANCO MANCHO	Expedido en:	
Compañía:	BOA ARQUITECTOS SLP	Firma:	

11. Construction costs

The house (we call it “the north house”) was built together with a second house (we call it “the east house” and it was certified Enerphit), so the budget was for two houses.

Usable area for both houses:

passivhaus

SUP. ÚTILES CASA NORTE	
GARAJE	43,5
ENTRADA	2,3
CUARTO 1	1,5
DISTRIBUIDOR PB	10,2
DISTRIBUIDOR PBC	7,7
ESCALERA PB-P1	3,0
ESCALERA P1-PBC	3,0
ESTAR-COMEDOR	47,6
COCINA	10,0
DORMITORIO 1	15,3
DORMITORIO 2	10,6
DORMITORIO 3	15,1
DORMITORIO 4	14,8
DORMITORIO 5	15,4
DORMITORIO 6	14,1
BAÑO 1	4,2
BAÑO 2	4,8
BAÑO 3	4,2
INODORO-DUCHA 3	2,7
INODORO-DUCHA 4	2,7
INODORO-DUCHA 5	2,2
INODORO-DUCHA 6	3,0
TOTAL ÚTIL	**237,9**

enerphit

SUP. ÚTILES CASA ESTE	
GARAJE	64,10
ENTRADA	4,90
CUARTO 1	3,20
DISTRIBUIDOR PB	21,10
SALA PB	22,80
DISTRIBUIDOR P1	8,10
DISTRIBUIDOR PBC	16,40
ESCALERA PB-P1	3,60
ESCALERA P1-PBC	4,20
CUARTO 2	2,50
ESTAR	28,70
COMEDOR	20,30
COCINA	8,90
DORMITORIO 1	14,30
DORMITORIO 2	12,40
DORMITORIO 3	14,50
DORMITORIO 4	17,50
DORMITORIO 5	14,90
DORMITORIO 6	12,90
DORMITORIO 7	15,20
BAÑO 1	4,30
BAÑO 2	4,10
INODORO-DUCHA 1	2,00
INODORO-DUCHA 3	2,70
INODORO-DUCHA 4	2,20
INODORO-DUCHA 5	2,30
INODORO-DUCHA 6	2,00
INODORO-DUCHA 7	3,90
TOTAL ÚTIL	**334,00**

The final cost of the two buildings was:

2 CASA RURALES EN IBERO

CAPITULO	RESUMEN	EUROS	%
C01	ACTUACIONES PREVIAS	47.649,45	8,67
C02	ESTRUCTURA	89.368,41	16,26
C03	CUBIERTA	33.745,31	6,14
C04	FACHADA	74.208,28	13,50
C05	PARTICIONES	80.150,35	14,59
C06	REVESTIMIENTOS	64.585,00	11,75
C07	INSTALACIONES	129.618,27	23,59
C08	PINTURAS	19.900,71	3,62
C09	SEGURIDAD Y SALUD	4.170,91	0,76
C10	CONTROL DE CALIDAD	1.432,39	0,26
C11	GESTIÓN DE RESIDUOS	4.693,99	0,85
	TOTAL EJECUCIÓN MATERIAL	**549.523,07**	
	21,00% IVA	115.399,84	
	TOTAL CERTIFICACIÓN Nº	**664.922,91**	

So the construction cost per usable square meter was: 549.523,07 € / (237,9+334,0) m² = **960,87 €/m²**

12. Other information

The house was built along the 2015 and 2016 years, and it was finished in April 2016.

The architects of the building were BOA arquitectos (Raúl Belloso Luqui, Pablo Díaz Torquemada and Iñaki archanco Mancho).

The structure of the building is formed with concrete pillar and beams supporting concrete slabs. The foundation of the building is a concrete slab. The isolation goes under the foundation slab.

12.1 Experiences

The houses were designed and built for the use of tourist groups to spend short periods of time so they could experience a passivhaus.

The houses have been open from June 2016.

The occupation level of the houses has not been very high, but the satisfaction degree of the occupants was high, and the inside temperatures, both in summer and winter were good, except during the summer of 2016. In that period the temperatures inside were high because the night free-cooling with the opening of the windows was not done (during that period there were not users).

For the summer of 2017 exterior wood blinds were placed in the south windows of the north house:

This was enough to keep a low temperature inside the houses even though they were not occupied so windows were not opened during night time to do the free-cooling.

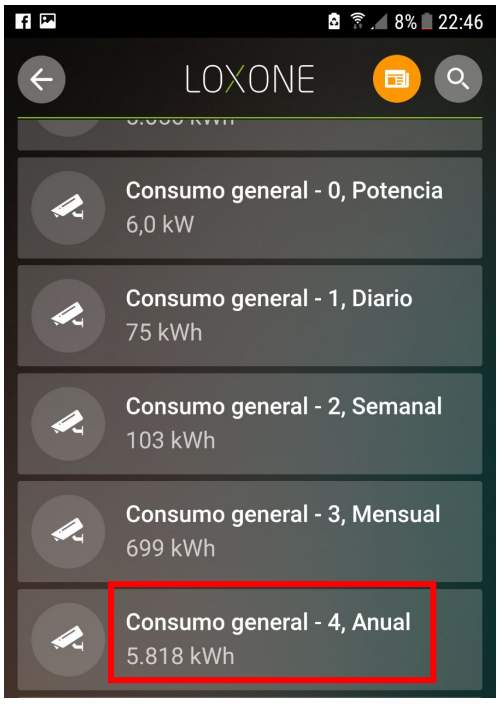
The houses have a home automation system to control the air exchanging device and the air to water pump for the hot water production. This system keeps information on temperatures, electricity consumption,…

The electricity consumption of the air bomb (for hot water production) during one year was:

The reference surface of the house is 203,3 m². So the annual consumption for square meter was:

3.229 kWh / 203,3 m² = 15,88 kWh/ m² per year

The total electricity consumption during one year was



The reference surface of the house is 203,3 m². So the annual consumption for square meter was:

5.818 kWh / 203,3 m² = 28,61 kWh/ m² per year