PASSIVE HOUSE OBJECT DOCUMENTATION

Calle Nunki 1, Guadalix de la Sierra, Madrid [Spain]

Single family House

Passive House Project database: ID 4264

Certificate-ID: 11439_PHI_PH_20150729_AZ

2.1 PROJECT OVERVIEW

Passivhaus Designer_ Cristina Romero, architect.

RC arquitectura |www.rcarquitectura.com | http://www.rcarquitecturablog.wordpress.com

The single-family home is in Guadalix de la Sierra [Madrid, Spain] and is constructed by an industrialized system of a light frame of wood.The work that was carried out during the project phase consisted of adapting the catalogue model, therefore pre-designed, to comply with the Passivhaus Standard, studying different options in the program PHPP. The building is monitored from April, 2015. At present the housing is totally finished, the clients reside in it and it is certified by the Passivhaus Institut.

U-value exterior wall:	0.135 W/m2K	PHPP heating demand:	15 kWh/m2a
U-value roof:	0.138 W/m2K	PHPP cooling demand:	7 kWh/m2a
U-value floor:	0.164 W/m2K	PHPP primary energy demand:	110 kWh/m2a
U-value frame:	1.12 W/m2K	Pressure test n50:	0,6 1/h
U-value glass:	0.55W/m2K 0.46W/m2K	Heat recovery:	85%

2.2 PROJECT DESCRIPTION

The project has been based on the premise of building an Eco-Friendly Passive House:

_Bioclimatic architecture design and sustainable building concepts.

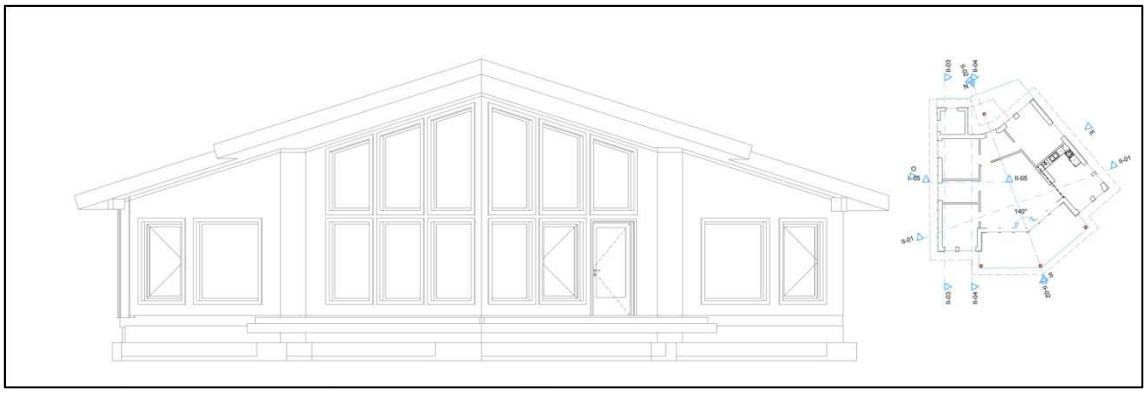
_Passive building with almost zero energy consumption according to the PassivhausStandard.

Formally, the building has a symmetrical storey in the north-south axis, but with the particularity that the east-west wings are rotated relative to that axis. The sloping woofs are born and rise from the east and west elevation. In this way, they create a ridge just above the north-south axis. Thus, the ridge gains height as you go from north to south, creating the characteristic form of a boat in the building.

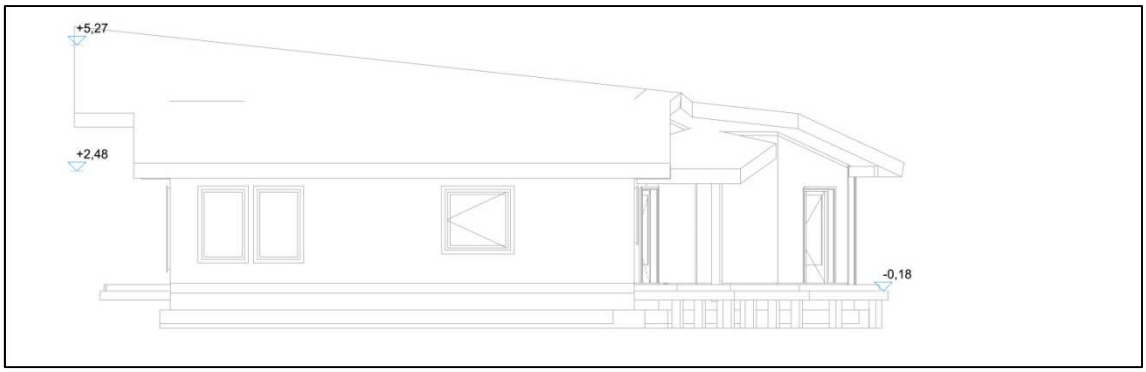
Thus, the living/dining room has a very bright interior that is of a considerable height. It opens the view towards the south and, at the same time, catches the light in the winter. The north elevation is more contained in height, secluded and protected.

For protection against the sun in the summer and for the enjoyment of the owners, a large porch has been planned on the south elevation that leverages the entire height of the deck in that area. This has been dimensioned in order to provide protection to the large windows of the elevation.

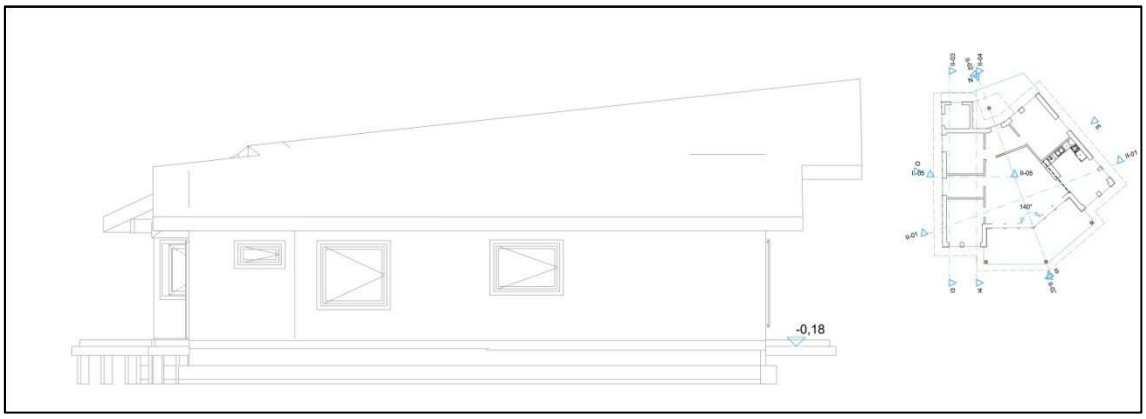
2.3 ELEVATIONS



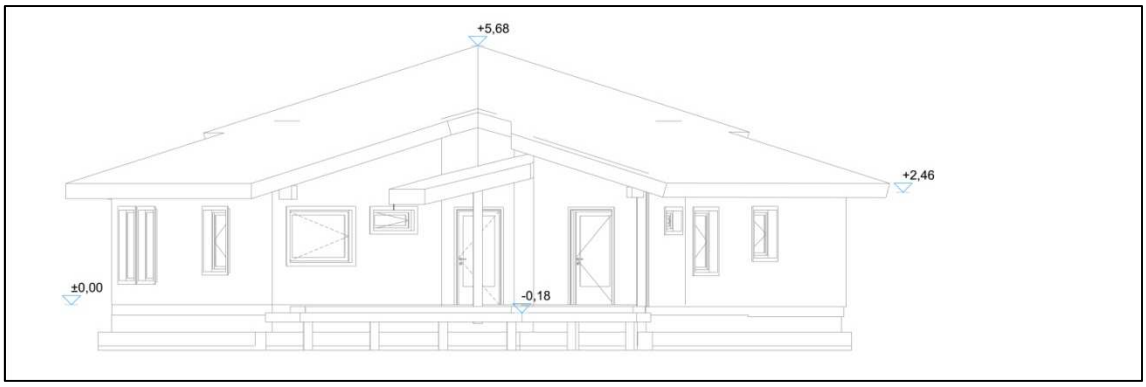
South elevation



East elevation



West elevation



North elevation

2.4 INTERIORS

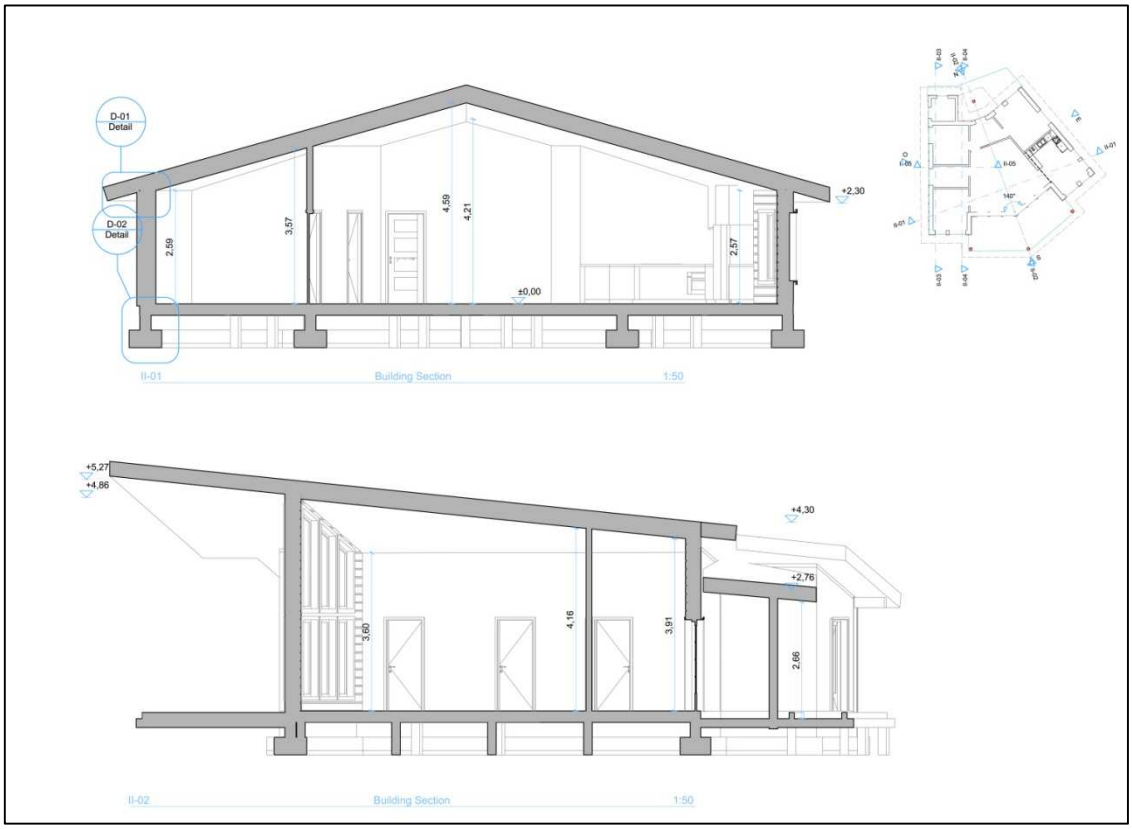
Living room

Kitchen

Living room

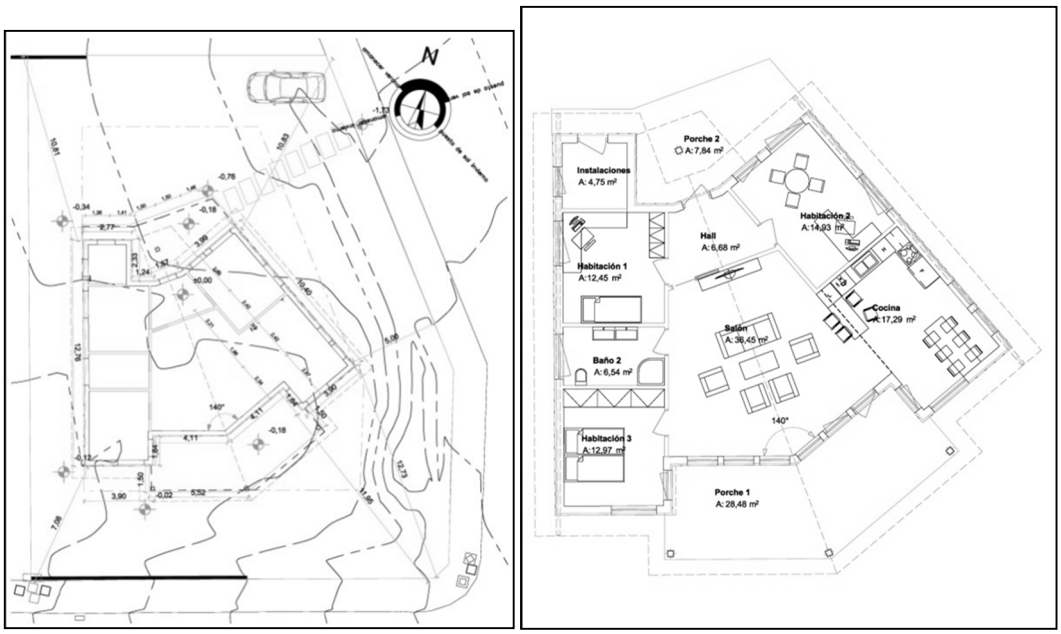
Bedroom 1

2.5 CROSS SECTION



Cross section

2.6 FLOOR PLAN



Site plan and floor plan

2.7 CONSTRUCTION DETAILS

2.7.1Roof and wall connection

Whole house structure is an industrialized system of a light frame of pine wood. Fiberwood isolation is placed between all uprights of the structure. This structure system is applied to roof, exterior walls and floor. Thus, thermal bridges are minimized.

Exterior walls are composed by: (outside to inside).

_pinewood shuttering: thickness=28mm | conductivity=0.130W/mK

_ventilated wall cavity: thickness=25mm

_wind barrier, open diff., water repellent

_OSB board: thickness=15mm | conductivity=0.130W/mK

_fiberwood isolation Isonat Plus 55 Flex: thickness=198mm | conductivity=0.038W/mK

_vapor barrier

_OSB board (AIRTIGHT LAYER): thickness=18mm | conductivity=0.130W/Mk

_fiberwood isolation Isonat Plus 55 Flex: thickness=100mm | conductivity=0.038W/mK

_gypsum plasterboard panel: thickness=15mm | conductivity=0.25W/mK

Roof is composed by: (outside to inside).

_ceramic tile: thickness=20mm | conductivity=1 W/mK

_ventilated wall cavity: thickness=73mm

_wind barrier, open diff., water repellent

_OSB board: thickness=15mm | conductivity=0.130W/mK

_fiberwood isolation Isonat Plus 55 Flex: thickness=223mm | conductivity=0.038W/mK

_vapor barrier

_OSB board (AIRTIGHT LAYER): thickness=18mm | conductivity=0.130W/mK

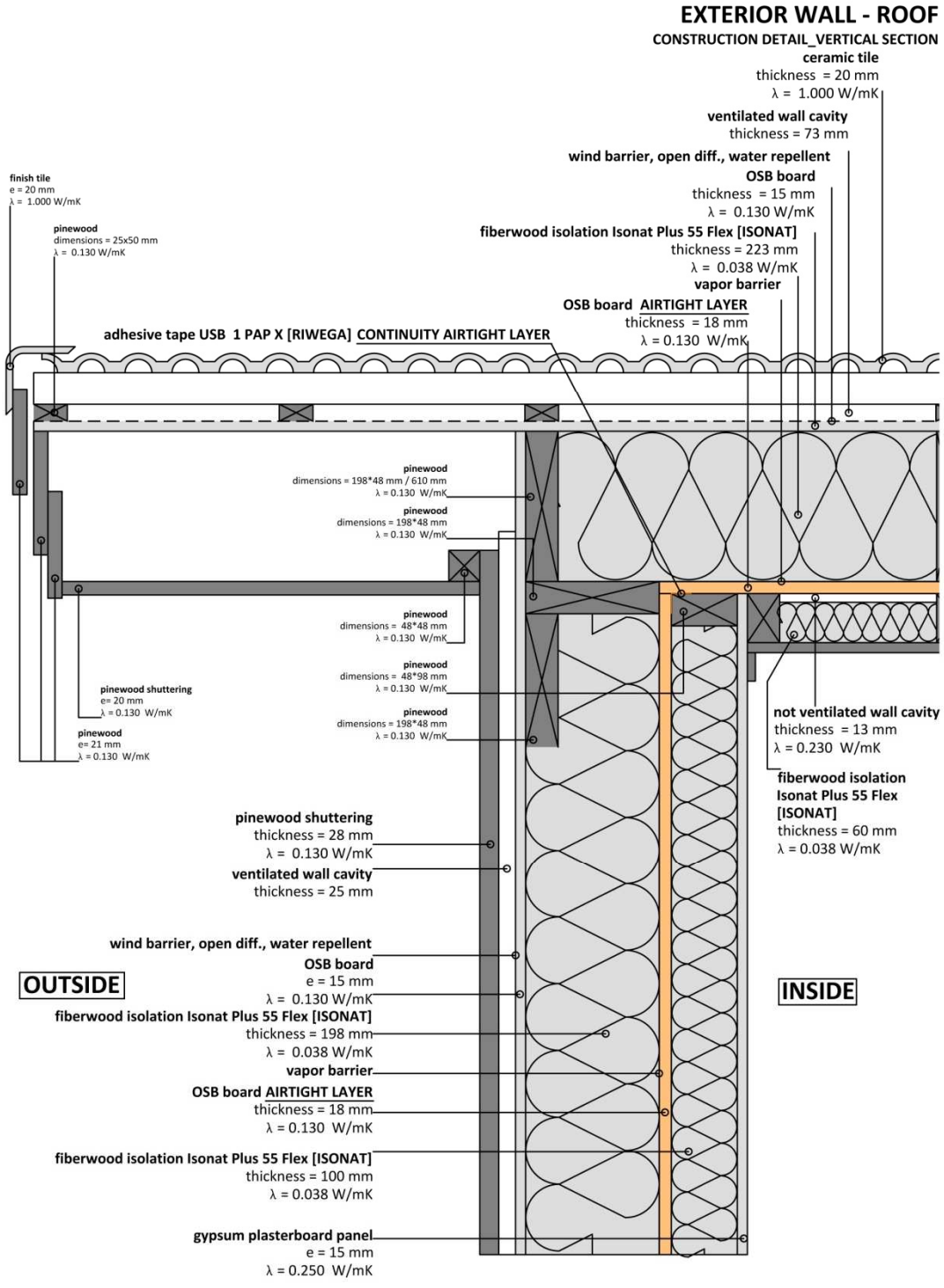
_non ventilated wall cavity: thickness=13mm

_fiberwood isolation Isonat Plus 55 Flex: thickness=60mm | conductivity=0.038W/mK

_gypsum plasterboard panel: thickness=15mm | conductivity=0.25W/mK

EXTERIOR WALL - ROOF

CONSTRUCTION DETAIL_VERTICAL SECTION



2.7.2Floor and wall connection

The joint between floor and exterior wall is very similar to the previous one (joint between roof and exterior wall). In order to avoid humidity, wood structure is raised by perforate brick small walls, properly water proofed.

Exterior wall composition is the same as explained before.

Floor composition is: (inside to outside).

_laminated floor type AC4: thickness=10mm | conductivity=0.114W/mK

_no impact barrier impactodan: thickness=5mm | conductivity=0.040W/mK

_gypsum plasterboard panel: thickness=15mm | conductivity=0.25W/mK

_OSB board (AIRTIGHT LAYER): thickness=18mm | conductivity=0.130W/mK

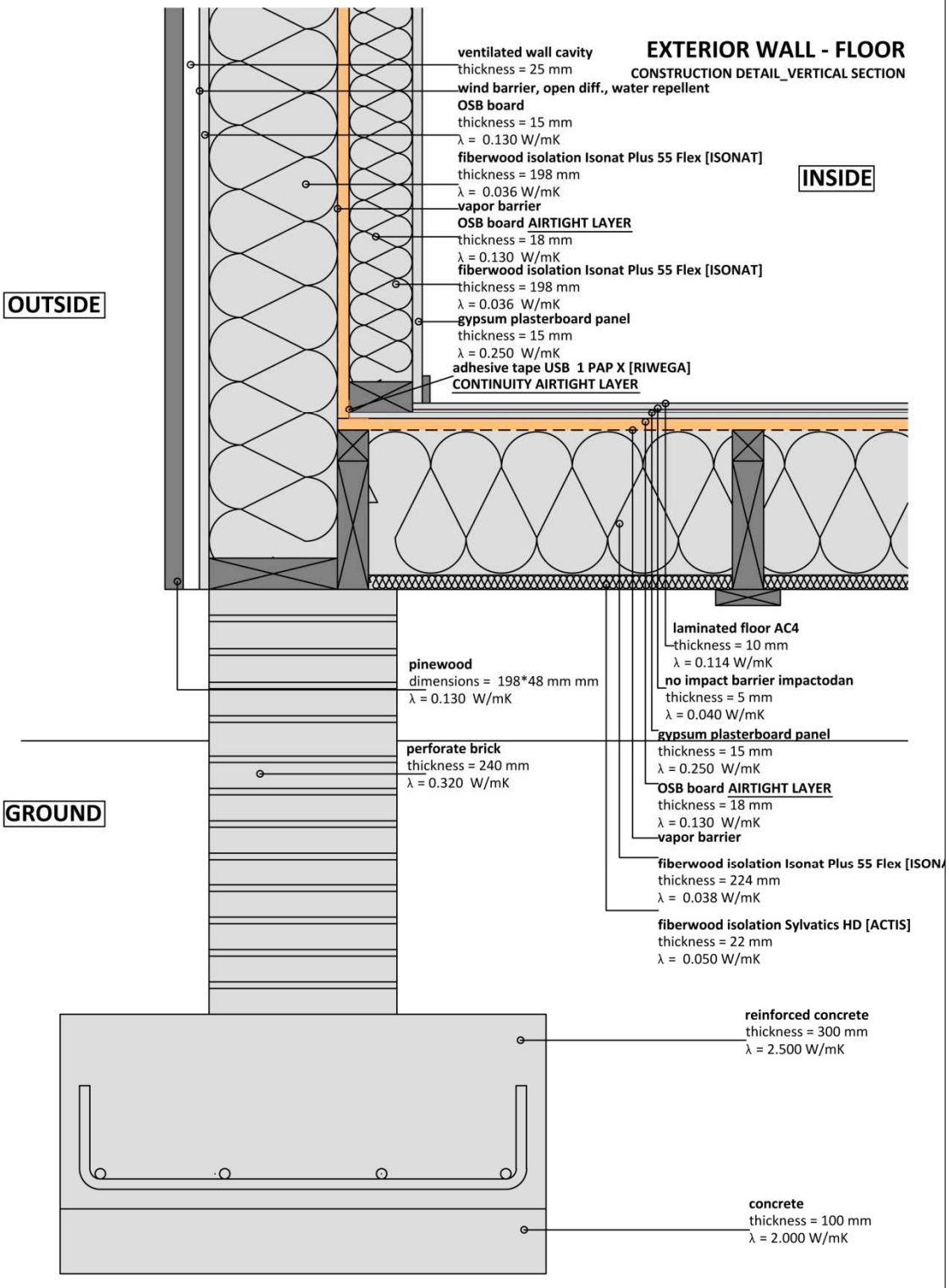
_vapor barrier

_fiberwood isolation Isonat Plus 55 Flex: thickness=224mm | conductivity=0.038W/mK

_fiberwood isolation Sylvatics HD: thickness=22mm | conductivity=0.050W/mK

EXTERIOR WALL - FLOOR

CONSTRUCTION DETAIL_VERTICAL SECTION



2.7.3 Windows installation detail (top)

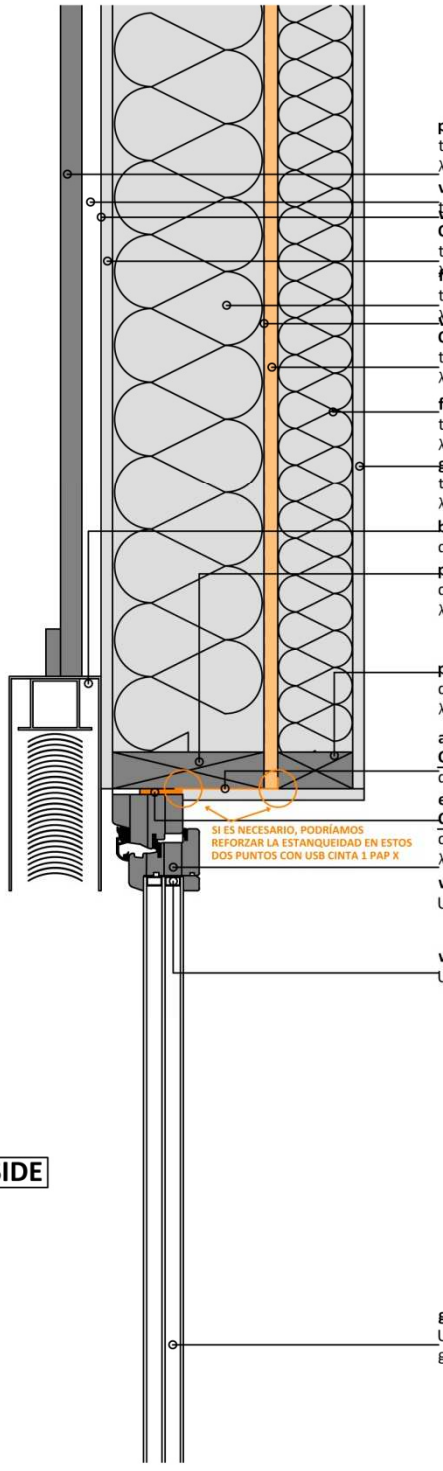
Windows are located in the same plane as the isolation (minimizing thermal bridges), and are placed aligned to the exterior for maximize solar collection, needed to achieve heating demand.

To shade windows and reduce cooling demand during summertime, jalousies are installed on the exterior side. These jalousies are fixed to the façade without drilling airtight layer.

In order to get continuity between carpentry and airtight layer (OSB board) two kinds of tapes have been used: elastic tape Gae Universal Trio (conductivity: 0.0428 W/mk) and Usb Coll 150X, Riwega brand both of them.

EXTERIOR WALL - WINDOW

CONSTRUCTION DETAIL_VERTICAL SECTION



INSIDE

pinewood shuttering
thickness = 28 mm
λ = 0.130 W/mK

ventilated wall cavity
thickness = 25 mm

wind barrier, open diff., water repellent

OSB board
thickness = 15 mm
λ = 0.130 W/mK

fiberwood isolation Isonat Plus 55 Flex [ISONAT]
thickness = 198 mm
λ = 0.038 W/mK

vapor barrier

OSB board AIRTIGHT LAYER
thickness = 18 mm
λ = 0.130 W/mK

fiberwood isolation Isonat Plus 55 Flex [ISONAT]
thickness = 98 mm
λ = 0.038 W/mK

gypsum plasterboard panel
thickness = 15 mm
λ = 0.250 W/mK

border to hide the exterior jalousie
dimensions = 120*280 mm

pinewood
dimensions = 198*48 mm
λ = 0.130 W/mK

pinewood
dimensions = 48*98 mm
λ = 0.130 W/mK

adhesive tape USB COLL 150 X [RIWEGA]
CONTINUITY AIRTIGHT LAYER
dimensions = 150*2 mm

elastic tape GAE UNIVERSAL TRIO [Riwega]
CONTINUITY AIRTIGHT LAYER
dimensions = 56*9 mm
λ = 0.0428 W/mK

windows frame ESPERIA92 [CARINBISA]
U = 1.168 W/m2K

warm edge spacer CROMATECH ULTRA [CARINBISA]
U = 0.040 W/m2K

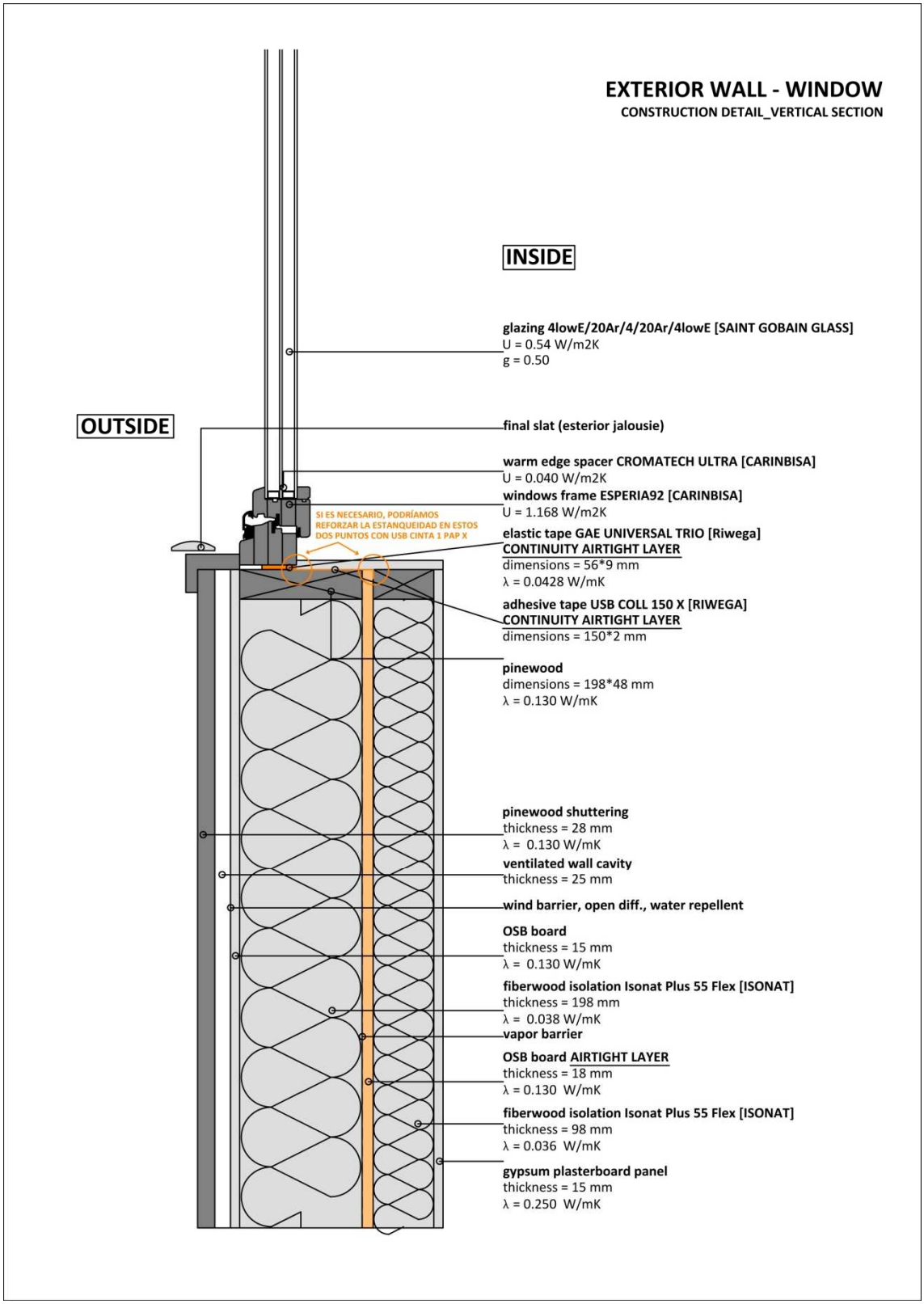
OUTSIDE

glazing 4lowE/20Ar/4/20Ar/4lowE [SAINT GOBAIN GLASS]
U = 0.54 W/m2K
g = 0.50

2.7.3 Windows installation detail (down)

Windows installation detail (down) is the same as the top one, explained before.

The only difference is a little flashing placed on the exterior wall and the inferior piece of the jalousies.



Windows and installation of the window

Window Frame Information

Carpentry is formed by a wooden frame ESPERIA V92 made by Carinbisa, with an U Value of 1.168 W/m2k in the bottom zone, and an U value of 1.120 W/m2k in the rest of zones.

Window frame

		U_f-Value				Frame width				Glazing edge thermal bridge				Installation thermal bridge			
ID	Description	left	right	bottom	above	left	right	bottom	above	$\Psi_{Glazing\ edge}$ left	$\Psi_{Glazing\ edge}$ right	$\Psi_{Glazing\ edge}$ bottom	$\Psi_{Glazing\ edge}$ top	$\Psi_{Installation}$ left	$\Psi_{Installation}$ right	$\Psi_{Installation}$ bottom	$\Psi_{Installation}$ top
		W/(m²K)	W/(m²K)	W/(m²K)	W/(m²K)	m	m	m	m	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)
01ud	WOOD FRAME	1.12	1.12	1.17	1.12	0.111	0.111	0.126	0.111	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
02ud	FIXED WOOD FRAME	1.12	1.12	1.17	1.12	0.081	0.081	0.081	0.081	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040

Window Glass Information

Window glasses are argon filled triple glazing and warm edge spacers (with thermal bridge spacer ψ = 0.040 W/mK).

Two kinds of glazing have been used:

- 4lowE/20Ar/4/20Ar/4lowE, with 0,55 W/m2K Ug value and 0,55 g value, for small windows
- 4-4lowE/16Ar/4/16Ar/4-4lowE, with 0,65 W/m2K Ug value, and 0,46 g value, for larger windows.

Glazing

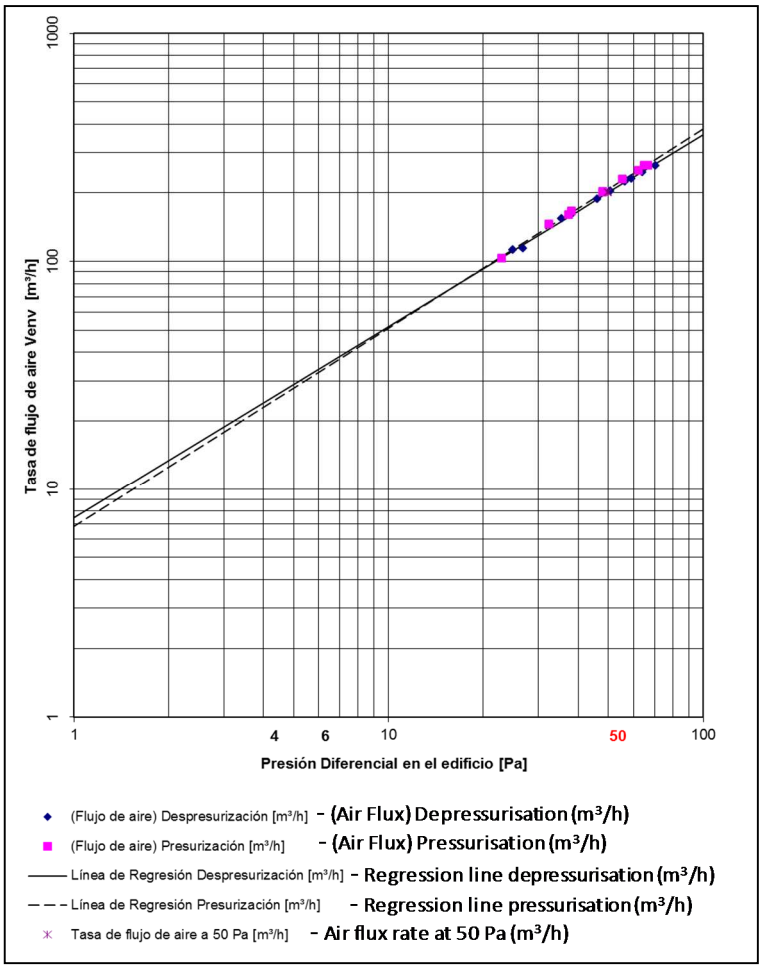
ID	Description	g-Value	U_g-Value
			W/(m²K)
01ud	GLAZING 4lowE/20Ar/4/20Ar/4lowE	0.55	0.55
02ud	LAMINATED GLAZING 4-4lowE/16Ar/4/16Ar/4-4lowE	0.46	0.65

2.7.5 Description of the airtight envelope; documentation of the pressure test

To comply with the airtight layer in the housing we have used OSB board with 18mm of thickness, placed inside the envelope with adhesive and elastic tapes that ensure continuity airtight layer.

View of the construction

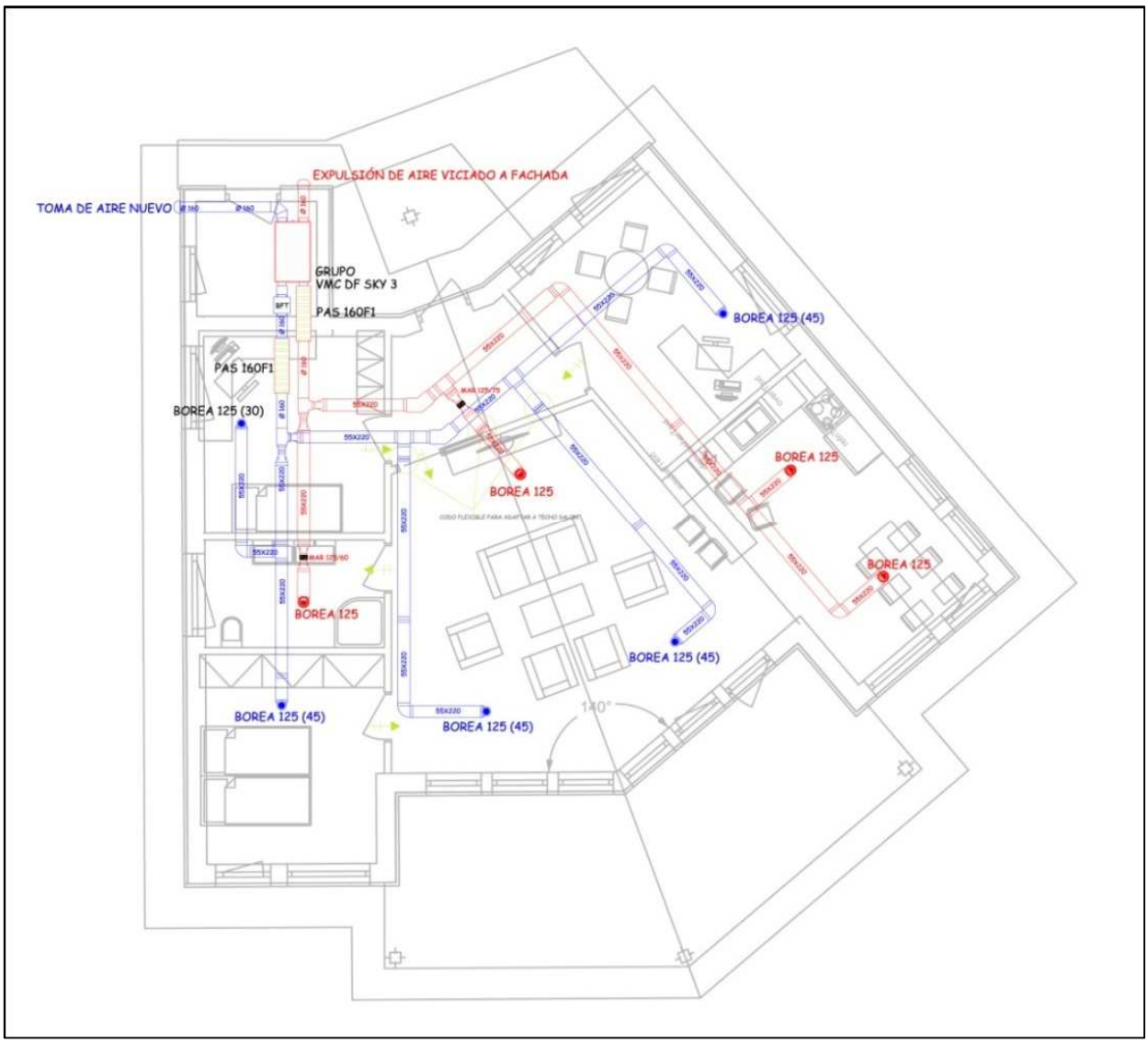
The Blower Door Test result was 0,55 1/h, assuring the adequate airtightness.



Graphic showing the infiltration and exfiltration curve of the Blower Door Test results.

2.7.6 Ventilation

The housing have a mechanical ventilation system with aheat recovery unit. This unit is the model Renovent Sky 300, manufacturer by Brink climate Systemas B.V., certified by PHI with an efficient of 85% and electric power consumption 0.31 Wh/m^3. It is placed outside the envelope. The pipes located out the envelope are EPE, with circular section (160mm) and a conductivity 0,041W/m.k. The pipes located inside the envelope are thermoplastic with rectangular section (55x110mm), auto extinguish according to UNE EN 13501-1:2002.



VMC DF – Central VMC high performance double flux (up to 95%) SIBER DF SKY 3
BOREA 125 (35) – adjustable grille (flow)
BE – Extraction auto-adjustable grille
Exchanger pipe land-air
Blowing pipe (Siber® StancoFix 55 x 220mm)
Blowing isolated pipe Siber® Air Isolante ⌀ int. 160 mm / ⌀ int. 192 mm
Extracting pipe (Siber® StancoFix 55 x 220mm)
Extracting isolated pipe Siber® Air Isolante ⌀ int. 160 mm / ⌀ int. 192 mm

Ventilation plan

*View of the*heat recovery unit and water coil. |View of the two insufflations entrance located in living room.

2.7.7 Heat supply

The building has an aerothermy system for heating and cooling.The radiation equipments used in the house are a heating and cooling underfloor and water coil connected to ventilation system. The house has got a biomass stovetoo:

_ Heating and cooling underfloor is situated in the kitchen. This system lets heat or coolthe kitchen and room enclosed to it.

_Water coil is located in the air ventilation system. The system works by introducing the hot or cold heat transfer fluid from the system aerothermy. It let to heat or cools the air that come in to the house; increasing or decreasing the temperature of different rooms.

_The biomass stove is in the living room. This system is canalized. It takes air for combustion from outside, making the system does not impair the operation of air renewal system of Siber.


*View of the*heating and cooling underfloor during the construction | View the living room where is situated the biomass stove.

2.8 PHPP RESULTS

Comprobación Passivhaus

Edificio:	VIVIENDA UNIFAMILIAR AISLADA EN GUADALIX DE LA SIERRA
Calle:	NUNKI 1
CP / Ciudad:	28794 GUADALIX DE LA SIERRA (MADRID)
País:	SPAIN
Tipo de edificio:	VIVIENDA UNIFAMILIAR AISLADA
Clima:	[ES] - Madrid — Altitud del sitio del edificio (en [m] sobre el nivel del mar): 841
Propietario / cliente:	HABITAR NATURAL 100 POR 100 MADERA S.L.
Calle:	NUNKI 1
CP / Ciudad:	28794 GUADALIX DE LA SIERRA (MADRID)
Arquitectura:	GORKA ELORZA ECHEBARRÍA
Calle:	EDIFICIO ÓPERA 26-1
CP / Ciudad:	01005 VITORIA-GASTEIZ
Instalaciones:	GORKA ELORZA ECHEBARRÍA
Calle:	EDIFICIO ÓPERA 26-1
CP / Ciudad:	01005 VITORIA-GASTEIZ

Año construcción:	2014	Temperatura interior invierno:	20.0	°C	Volumen exterior V_e m³:	450.5
Nr. de viviendas	1	Temperatura interior verano:	25.0	°C	Refrigeración mecánica:	X
Nr. de personas:	3.0	Cargas internas de calor invierno:	2.1	W/m²		
Cap. específica:	60 Wh/K por m² SRE	ídem verano:	4.3	W/m²		

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

				Requerimientos	¿Cumplido?*
	Superficie de referencia energética	103.3	m²		
Calefacción	Demanda de calefacción	**15**	**kWh/(m²a)**	15 kWh/(m²a)	**sí**
	Carga de calefacción	**14**	**W/m²**	10 W/m²	**-**
Refrigeración	Demanda total refrigeración	**7**	**kWh/(m²a)**	15 kWh/(m²a)	**sí**
	Carga de refrigeración	**10**	**W/m²**	-	**-**
	Frecuencia de sobrecalentamiento (> 25 °C)		%	-	**-**
Energía primaria	Calef., ref., deshum., ACS, elect. auxiliar, ilum., aparatos eléct.	**110**	**kWh/(m²a)**	120 kWh/(m²a)	**sí**
	ACS, calefacción y electricidad auxiliar	68	kWh/(m²a)	-	**-**
	Ahorro de EP a través de electricidad solar		kWh/(m²a)	-	**-**
Hermeticidad	Resultado ensayo de presión n_{50}	**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 metodoloía PHPP y están basados en los valores característicos del edificio. Los cálculos con PHPP están adjuntos a esta aplicación.

Nombre:	ANNA MARIA	**PHPP Versión 8.4** **Número de registro PHPP:**	PHIDE_140314_2632xxxx_de8
Apellidos:	ZIEBA	**Expedido en:**	DARMSTADT
Compañía:	PASSIVHAUS INSTITUT	**Firma:**	

2.9 CONSTRUCTION COSTS

The construction cost has been 1.150€/m2

2.10. BUILDING COST

The building cost has been 170.200 €.

2.11 YEAR OF CONSTRUCTION

2014

2.12. ARCHITECTURAL DESIGN OVERVIEW

Three key featuresconverge in its conception and development:

1_An industrialized system where dry construction prevails.

2_The use of natural materials.

3_Seeking maximum comfort and energy savings through compliance with the Passivhaus Standard.

Part of the work that was carried out during the project phase consisted of adapting the catalogue model, therefore pre-designed, to comply with the PassivhausStandard. The industrialized system that was used consists of a light frame of wood from the north of Finland. This structure is perfectly cut and numbered from the factory. At the construction site, the only work to be carried out is the assembly. Apart from the foundation, which is traditional, the rest of the materials that are used are that of dry assembly. As in all industrialized systems, the construction times and waste that is generated are reduced significantly. For the most part, the materials that are used in the building are natural. The frame is made out of red pine wood, the insulation blankets are made out of wood fibres and the enclosure of the structure is made out of wood shaving boards. The cladding plasterboard is fixed to the structure via uprights, which are also made out of wood, thus avoiding the use of any metallic element. The paints that are used in the interior of the house are ecological and the primer for the treatment of the wood is completely natural.

2.13 TECHNICAL DESIGN OVERVIEW

The owners of the building are thinking about introduce a Photovoltaic system and obtain a Passivhaus Plus or Premium certification.

2.14 PHPP CERTIFICATION

The certification was conducted by Anna Zieba from the Passivhaus Institut based in Darmstadt, Germany.

2.15 STRUCTURAL ENGINEERING

The structural engineering was defined by Gorka Elorza, assisted by Kuusamo Long Houses, supplier of the structural system.

Building:	VIVIENDA UNIFAMILIAR AISLADA EN GUADALIX DE LA SIERRA			
Street:	NUNKI 1			
Postcode/City:	28794	GUADALIX DE LA SIERRA (MADRID)		
Province/Country:	MADRID	SPAIN		
Building type:	VIVIENDA UNIFAMILIAR AISLADA			
Climate data set:	ES0001b-Madrid			
Climate zone:	4: Warm-temperate	Altitude of location:	841	

Architecture:	GORKA ELORZA ECHEBARRÍA	
Street:	EDIFICIO ÓPERA 26-1	
Postcode/City:	01005	VITORIA-GASTEIZ
Province/Country:		SPAIN

Mechanical system:	GORKA ELORZA ECHEBARRÍA	
Street:	EDIFICIO ÓPERA 26-1	
Postcode/City:	01005	VITORIA-GASTEIZ
Province/Country:		SPAIN

2.16 EXPERIENCES

These are the opinions of the users of the housing:

Raquel: *One thing that has surprised me is that we do not suffer from dry respiratory tracts. We have an average of 41% humidity. Our house never has any bad smells - it always smells fresh, with a wood scent. I never notice stuffy rooms in the morning when I get up from bed or after a friend's gathering...ultimately, it always smells good. In the mornings, I wake up more rested and without headaches.*

Ander: *The light in our house is the best! We do not switch on the lights until the sun has gone down completely. As 65% of the house is made out of glass and it is a bioclimatic house, it gives us total joy to see so much light throughout the day. You feel uplifted from the minute that you get up.*

Raquel: *The silence is one of the things that shocked me the most when I went to live there. Occasionally, I would see a car or a truck go past in front of the house and I literally could not hear it. Additionally, the sound between the rooms is almost zero, you can hardly hear anything.*

2.17 MONITORING

The building is monitored from April, 2015. The sensors measure indoor air temperature, relative humidity and CO_2 concentrations. In the exterior has been installed measure temperature and wind speed. The exterior blinds are motorized and it´s programming.