

Project documentation: CASA EL PILAR

ID 6099



1 Abstract



Single family House in Madrid, Spain.

1.1 Data of building

Year of construction	2020	Space heating	12 kWh/(m2a)
U-value external wall	0'128 W/(m2K)	Primary Energy renewable (PER)	31 kWh/(m2a)
U-value basement ceiling	0'293 W/(m2K)	Generation of renewable Energy	12 kWh/(m2a)
U-value roof	0'127 W/(m2K)	Non-renewable Primary Energy (PE)	66 kWh/(m2a)
U-value window	1'04 W/(m2K)	Pressure test n50	0'5 h-1
Heat recovery	61'8%		
Special features	Photovoltaic system		

1.2 Brief description

CASA EL PILAR

Semi-detached single family home built by conventional construction system in the city of Madrid (Spain). The house has two floors above ground and one below ground, with an SRE of 198 m². Part of the semi-basement belongs to the SRE, being conditioned. Construction ended in 2019. The main façade of the building is south facing.

1.3 Responsible project participants

Architect	Mrosa de la Iglesia Arranz y Cristina Romero Medina www.rcarquitectura.com
Implementation planning	Mrosa de la Iglesia Arranz y Cristina Romero Medina www.rcarquitectura.com
Building Systems	Mrosa de la Iglesia Arranz y Cristina Romero Medina www.rcarquitectura.com
Structural Engineering	Mrosa de la Iglesia Arranz y Cristina Romero Medina www.rcarquitectura.com
Building physics	-
Passive House project planning	Mrosa de la Iglesia Arranz www.rcarquitectura.com
Construction management	PAEE Construcción Passivhaus www.passivhaus-paee.com
Certifying body	ZE Passivhaus Services www.passiv.org
Certification ID	Project-ID 6099
Author of project documentation	Mrosa de la Iglesia Arranz y Cristina Romero Medina www.rcarquitectura.com
Date, Signature	08.03.2023



2 Views of the Passive House casa El Pilar

South-facing and east-facing sides:



North-facing side:



West-facing side:



West-facing side:

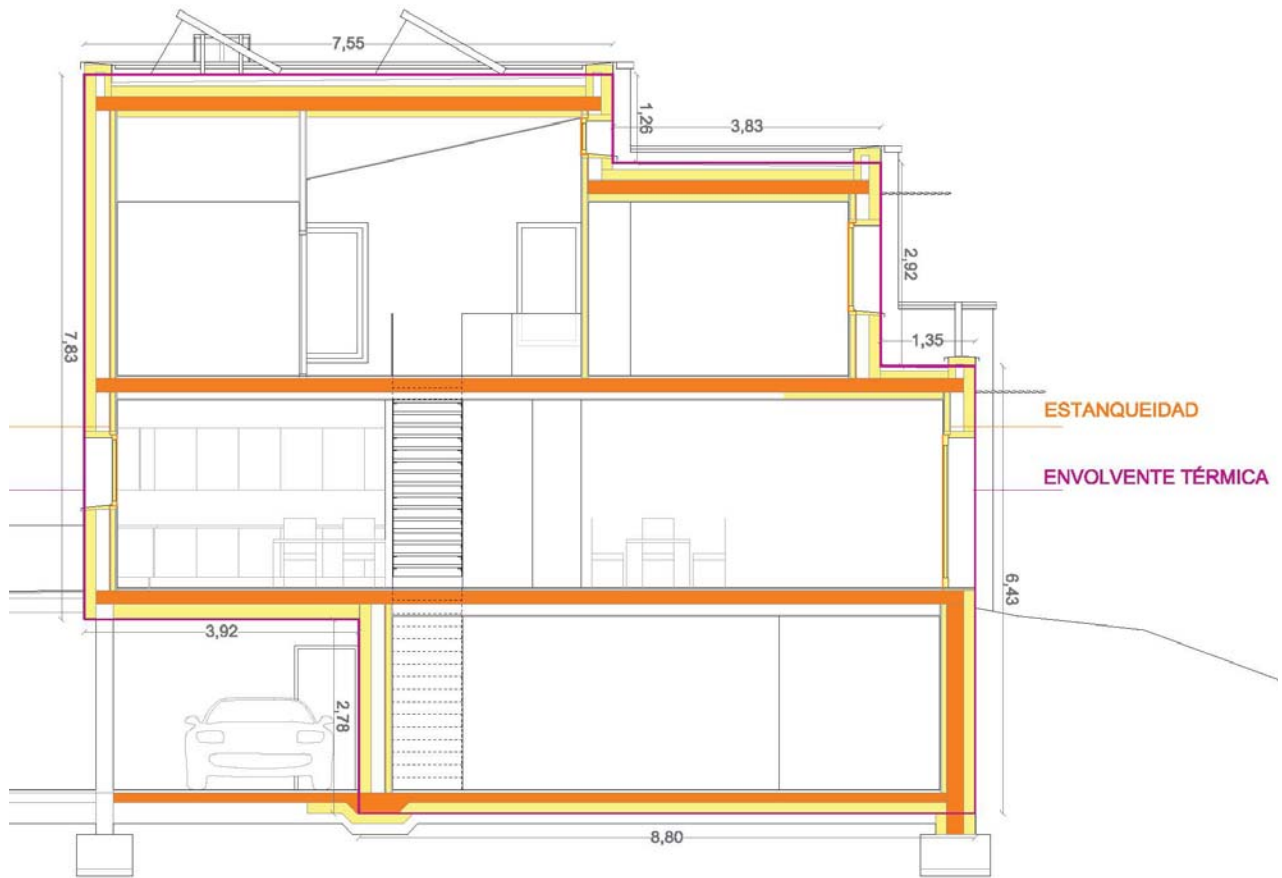


Interior view of the stairs:

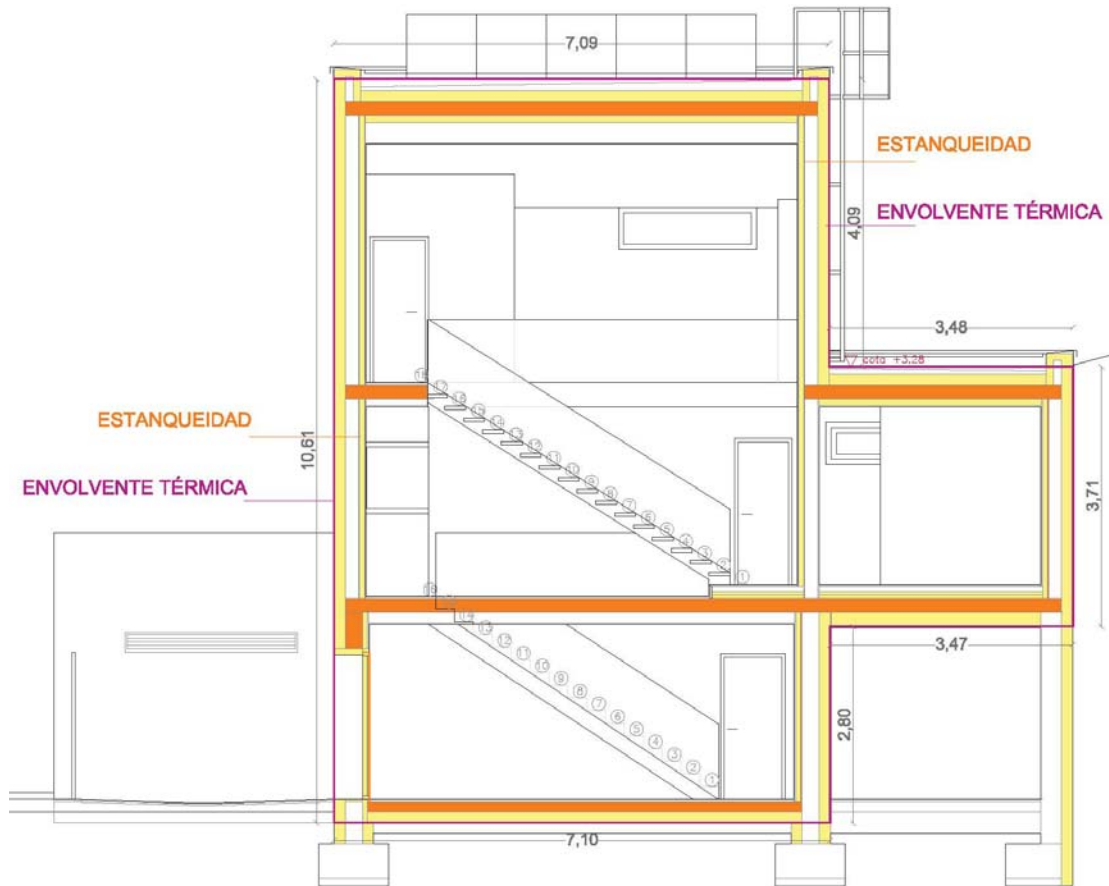


3 Sectional drawing of the Passive House casa El Pilar

North-south cross section:



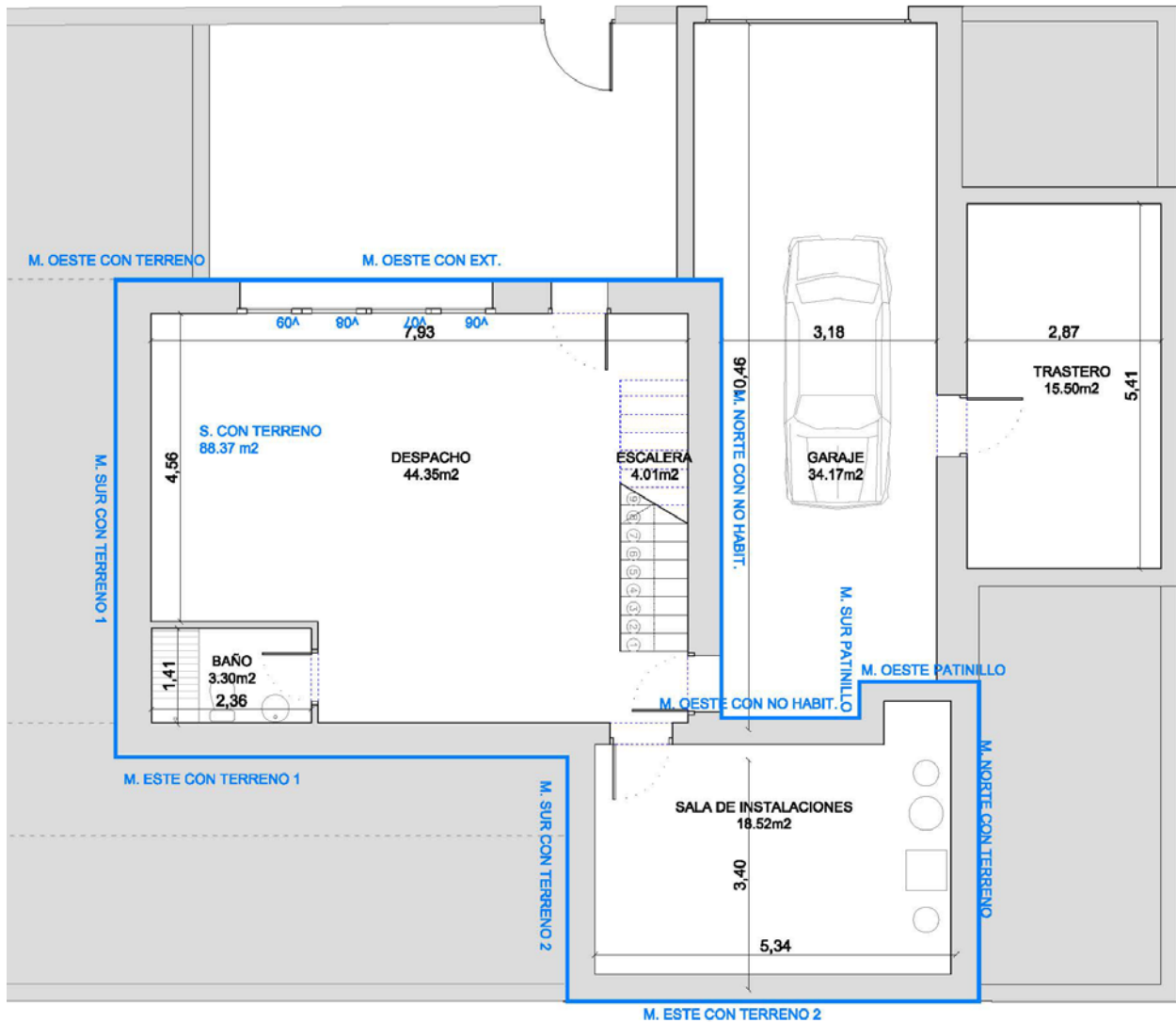
West-east cross section:



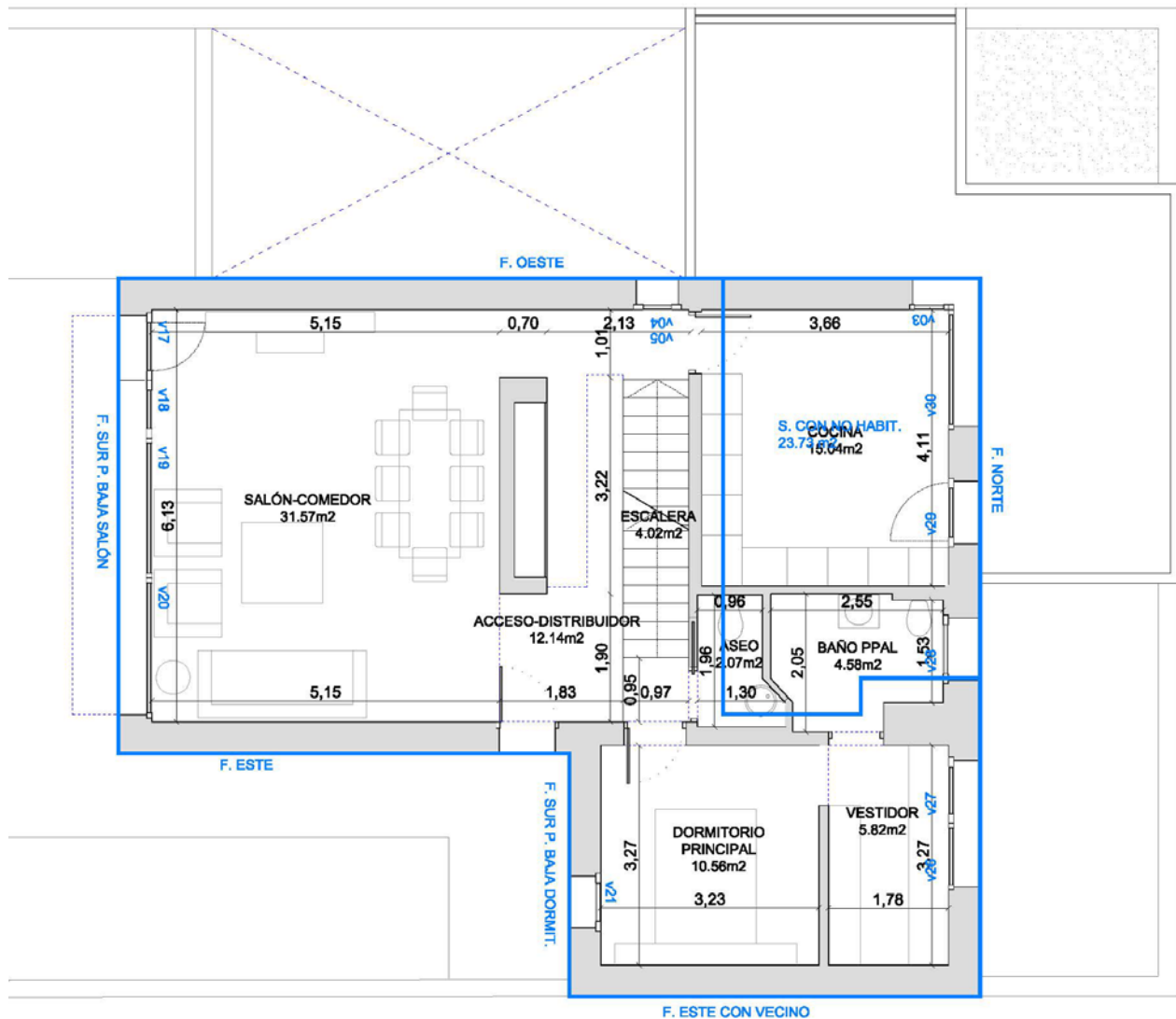
The thermal envelope, with excellent almost uninterrupted insulation, is clearly recognizable. Thermal separation of the not conditioned part of the semi-basement floor can be clearly seen. There is only one item where the continuity of the thermal insulation is interrupted, and it is at the points where the floor of the thermal envelope meets (either at the ground floor level or at the semi-basement level) with the not conditioned part of the semi-basement or with the foundation of the building.

4 Floor plans of the Passive House casa El Pilar

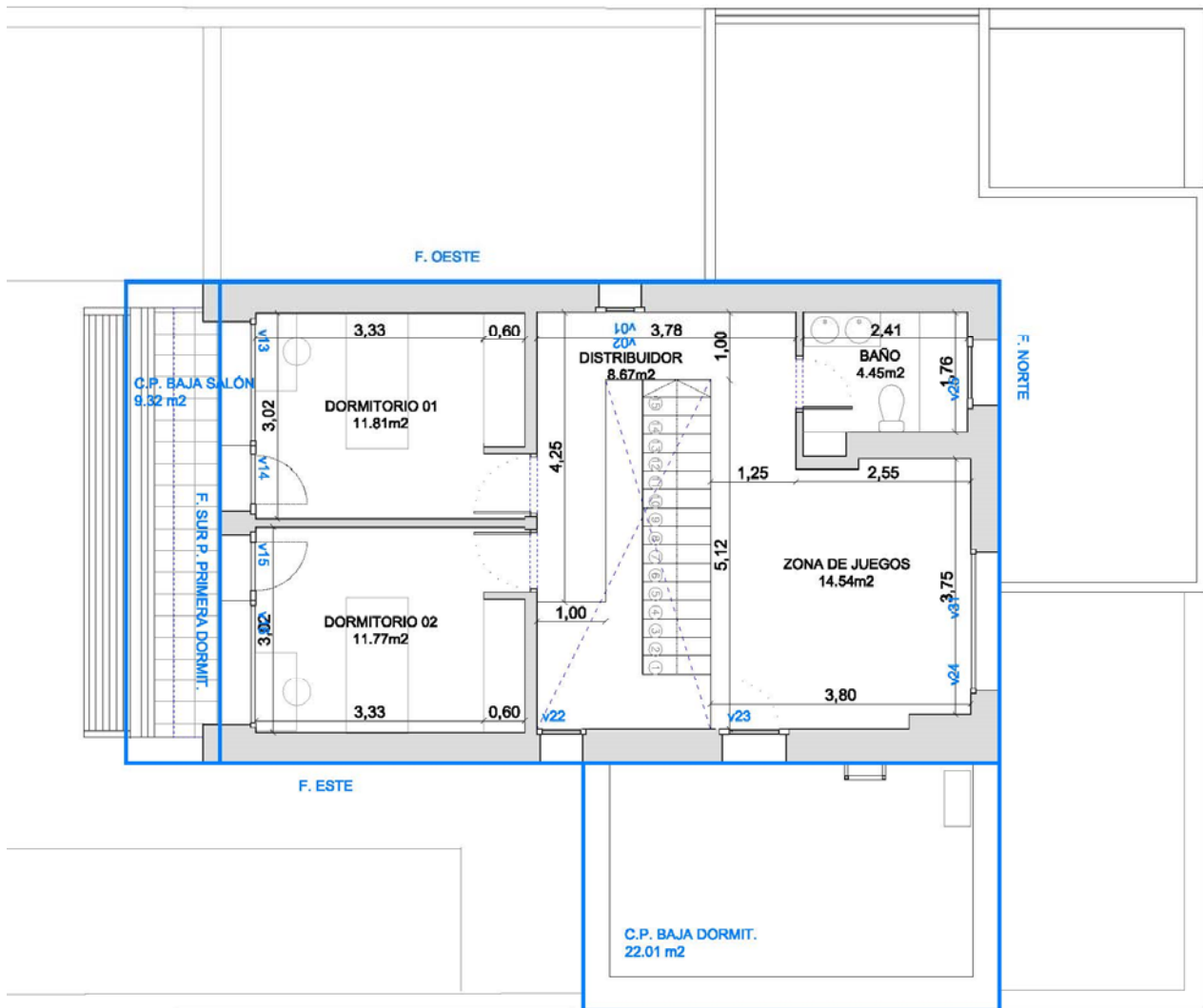
Basement plan:



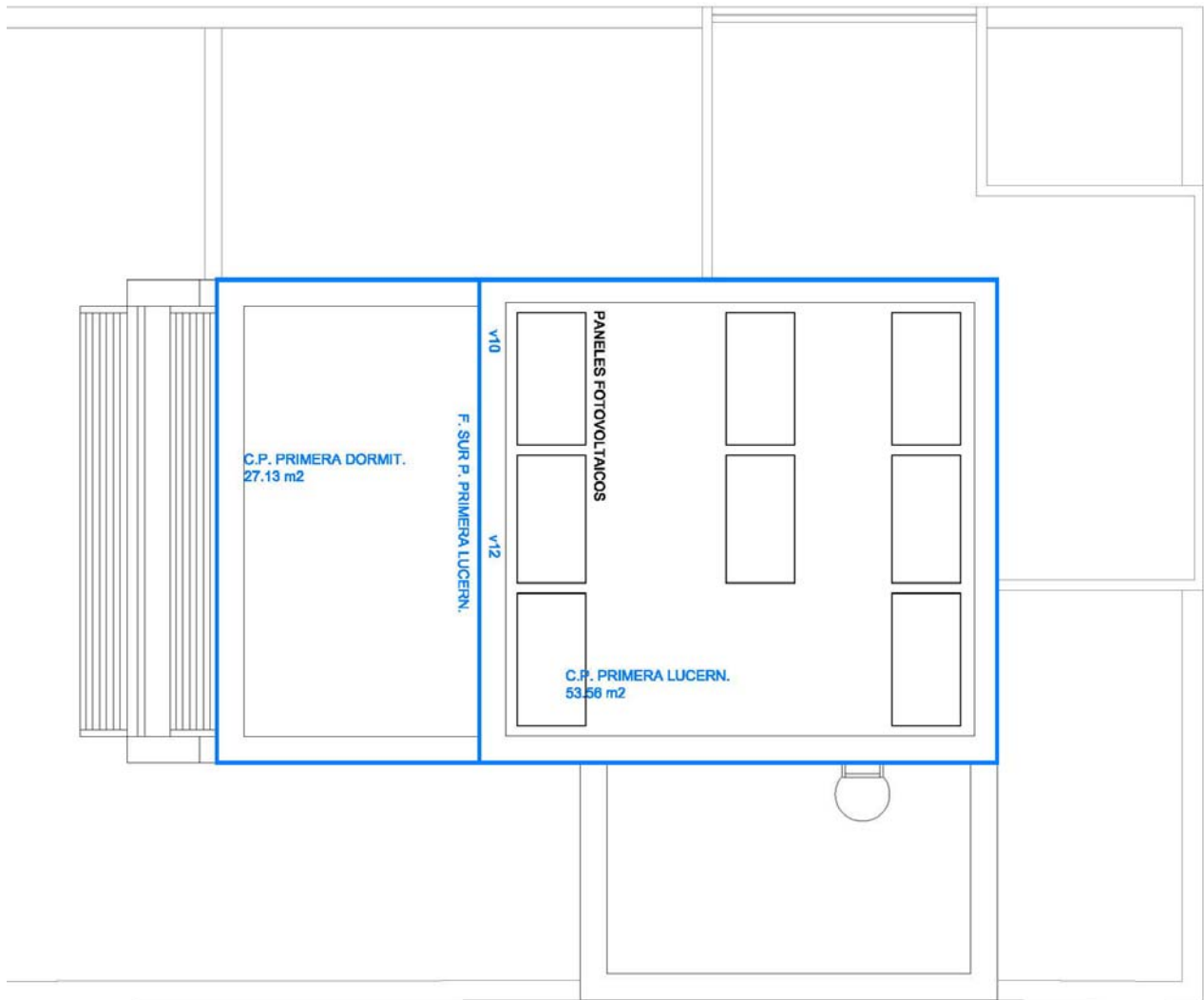
Ground floor:



First floor:



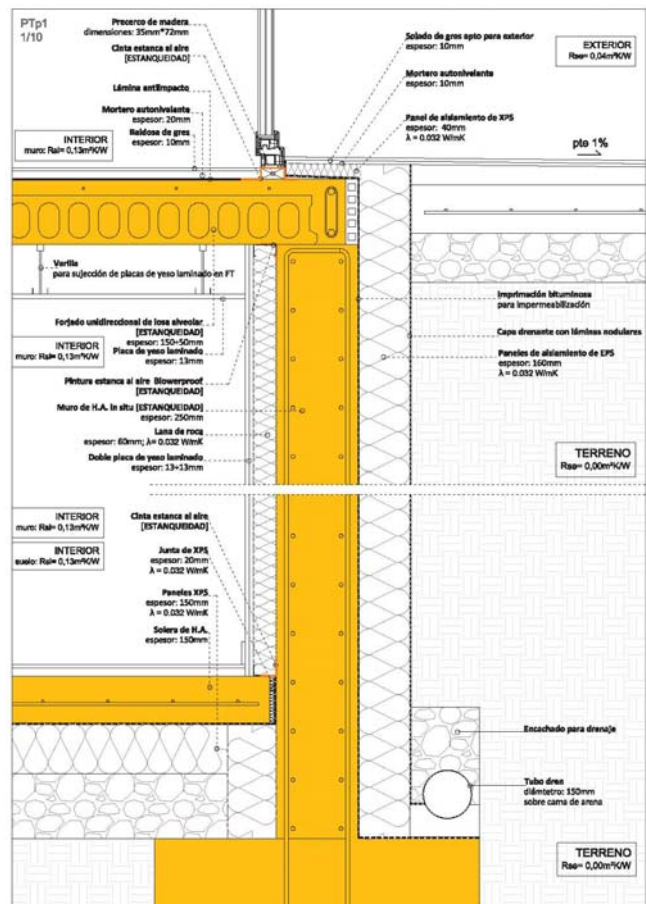
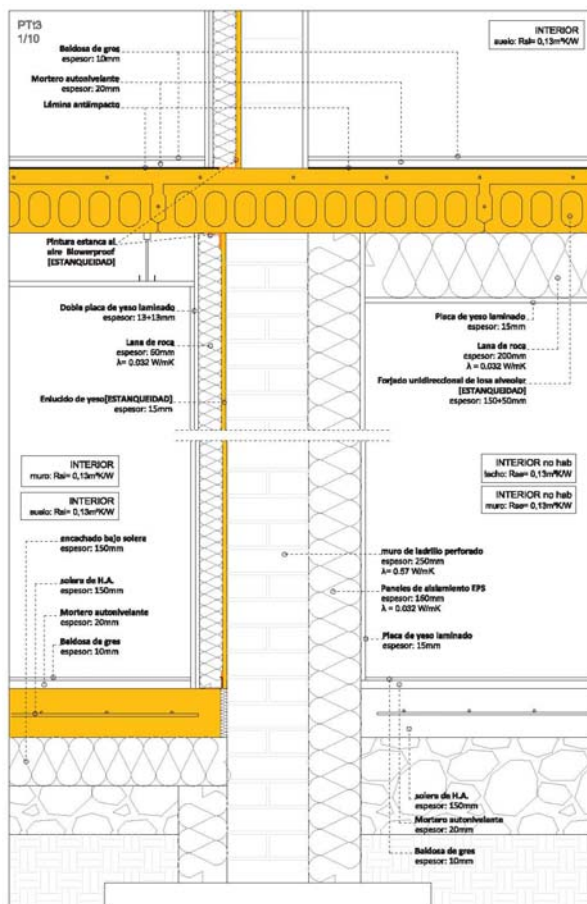
Second floor:



The ground floor contains the living-dining room and the main bedroom facing south, the kitchen facing north and west, an interior toilet, and the main bathroom and dressing room facing north. On the first floor are the children's rooms facing south, a play area with multiple orientations (north, east and south), and a bathroom facing north. In the semi-basement there is a garage outside the thermal envelope, and an office, a bathroom and an installation room inside the thermal envelope.

5 Construction details of the envelope and Passive House technology of the Passive House casa El Pilar

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





In the meeting between the thermal envelope and the foundation, an interruption in the continuity of the thermal insulation occurs. This thermal bridge is reduced by extending the thermal insulation (both of the floor slab and of the external wall or the conditioned part of the semi-basement) up to the upper face of the foundation footing.

Nr. elem. cons.	03ud		S1_suelo con terreno (solera)		¿Aislamiento interior?		0	
Inclinación del elemento	3-Suelo		Resistencia térmica superficial [m²K/W]		interior R _{se}		0.13	
Adyacente a	2-Terreno				exterior R _{se}		0.00	
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]		
XPS SL 10cm	0.035		0.000		0.000	100		
solera hormigón armado (estanqueidad)	2.500		0.000		0.000	150		
mortero autonivelante	1.300		0.000		0.000	25		
baldosa cerámica	1.000		0.000		0.000	10		
	0.000		0.000		0.000	0		
	0.000		0.000		0.000	0		
	0.000		0.000		0.000	0		
	0.000		0.000		0.000	0		
Porcentaje superficie parcial 1		Porcentaje superficie parcial 2		Porcentaje superficie parcial 3		Total		
100%						28.5 cm		
Suplemento al valor-U:		0.00 W/(m²·K)		Valor-U:		0.325 W/(m²·K)		

Nr. elem. cons.	04ud		S2_suelo con no habitable		¿Aislamiento interior?		0	
Inclinación del elemento	3-Suelo		Resistencia térmica superficial [m²K/W]		interior R _{se}		0,13	
Adyacente a	3-Ventilada				exterior R _{se}		0,13	
Superficie parcial 1	λ [W/(mK)]	Superficie parcial 2 (opcional)	λ [W/(mK)]	Superficie parcial 3 (opcional)	λ [W/(mK)]	Espesor [mm]		
pyl	0,250		0,000		0,000	15		
EPS SILVERTECH 031	0,031		0,000		0,000	160		
yeso (estanqueidad)	0,570		0,000		0,000	15		
losa cerámica	0,929		0,000		0,000	260		
mortero autonivelante	1,300		0,000		0,000	25		
baldosa cerámica	1,000		0,000		0,000	10		
	0,000		0,000		0,000	0		
	0,000		0,000		0,000	0		
Porcentaje superficie parcial 1		Porcentaje superficie parcial 2		Porcentaje superficie parcial 3		Total		
100%		0,0%		0,0%		48,5 cm		
Suplemento al valor-U		0,00 W/(m²K)		Valor-U:		0,172 W/(m²K)		

5.2 Description of the construction of the exterior walls including insulation (in necessary with connection points with other walls)

FACHADA TIPO 1
(F1_fachada en el PHPP)

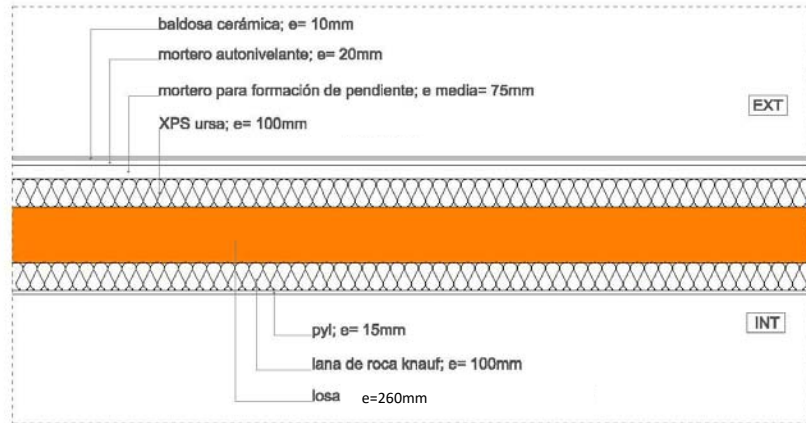


Deck and terrace parapets are completely covered with thermal insulation, in order to guarantee the continuity of the insulation layer.

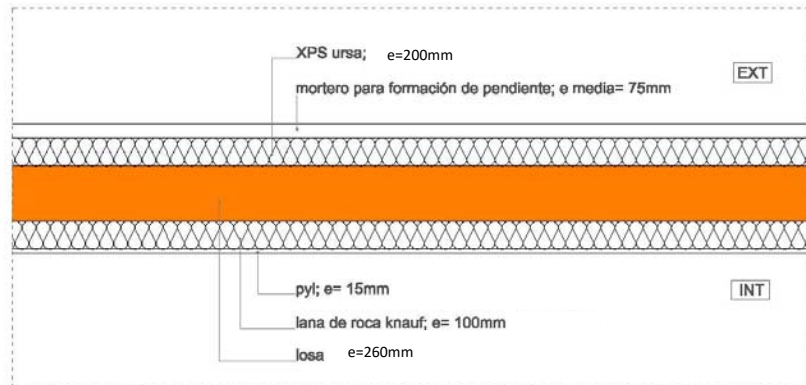
calle postas 59 1º 10 28300 aranjuez

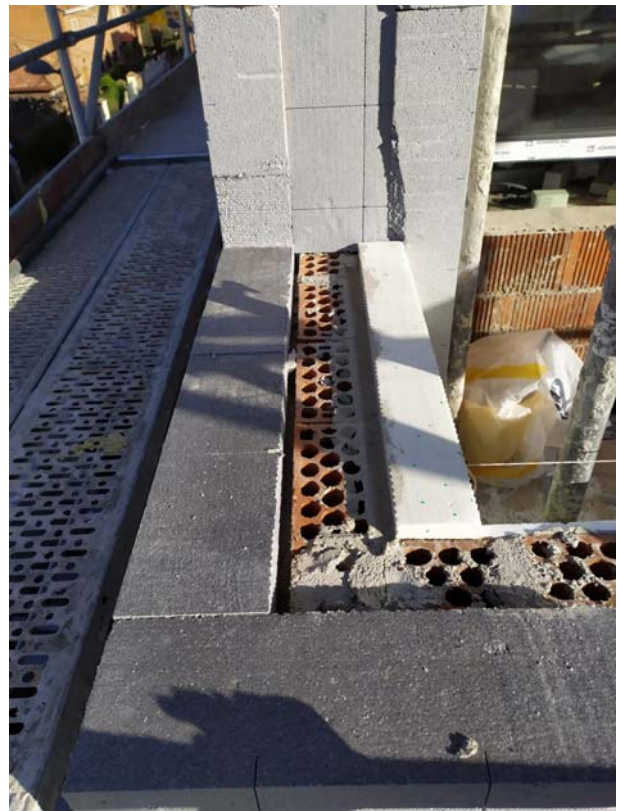
5.3 Description of the construction of the roof/top floor ceiling including insulation with connection points with exterior and interior walls

CUBIERTA TIPO 1
(C1_cubierta transitable en el PHPP)



CUBIERTA TIPO 2
(C2_cubierta no transitable)





A layer of gypsum plaster is applied on the inside of a ceramic roof tile. The gypsum plaster is protected by a layer of mineral fibre insulation in a camera formed by gypsum plasterboards.

On the outside, an insulation of extruded polystyrene and mortar forming slopes are applied under the waterproofing layer.

Denominación de elemento constructivo	
01kf	C1 cubierta transitable sobre el salón
Resistencia térmica superficial $[m^2K/W]$	
Inclinación del elemento: 1.Techo	interior R_{si} : 0,13
Adyacente a: 1.Aire exterior	exterior R_{se} : 0,04

A elementos constructivos paralelos

Superficie parcial 1	λ $[W/(mK)]$	Superficie parcial 2 (op)	λ $[W/(mK)]$	Superficie parcial 3 (op)	λ $[W/(mK)]$	Espesor e_i [mm]
baldosa cerámica	1,000					10
mortero autonivelante	1,300					20
mortero para formación de pendiente	1,300					50
XPS SL 10cm	0,035					100
losa cerámica	0,929					260
yaso (estanqueidad)	0,570					15
Ultracoustic	0,035					100
pyl	0,250					15
Porcentaje superficie parcial 1: 100% Porcentaje superficie parcial 2: Porcentaje superficie parcial 3: Total: 57,0 cm						

U_0 :	0,158	$W/(m^2K)$
R_0 :	6,314	$(m^2K)/W$

B elemento constructivo en forma de cuña

Superficie parcial 1	λ $[W/(mK)]$	Superficie parcial 2 (op)	λ $[W/(mK)]$	Superficie parcial 3 (op)	λ $[W/(mK)]$	Espesor e_i [mm]
mortero para formación de pendiente	1,300					50

Porcentaje superficie parcial 2	Porcentaje superficie parcial 3	Espesor e_i [cm]
		5,0 cm

U_1 :	26,000	$W/(m^2K)$
R_1 :	0,038	$(m^2K)/W$

Valor-U de superficie rectangular: **0,158** $W/(m^2K)$

Denominación de elemento constructivo						
02kf	C2_cubierta no transitable superior					
Resistencia térmica superficial [m²K/W]						
Inclinación del elemento:	1-Techo	interior R _s :	0,13			
Adyacente a:	1-Aire exte	exterior R _s :	0,04			
A elementos constructivos paralelos						
Superficie parcial 1	λ [W/(mK)]	Superficie parcial 2 (opcio	λ [W/(mK)]	Superficie parcial 3 (opcio	λ [W/(mK)]	Espesor Total Espesor e _s [mm]
impermeabilización autoprotegida...	0,250					0
mortero para formación de pendiente	1,300					50
XPS SL 10cm	0,035					200
losa cerámica	0,929					260
yeso (estanqueidad)	0,570					15
Ultracoustic	0,035					100
pyl	0,250					15
Porcentaje superficie parcial 1		Porcentaje superficie parcial 2		Porcentaje superficie parcial 3		Total
100%						64,0 cm

U₀: **0,109** W/(m²K)
R₀: **9,146** (m²K)/W

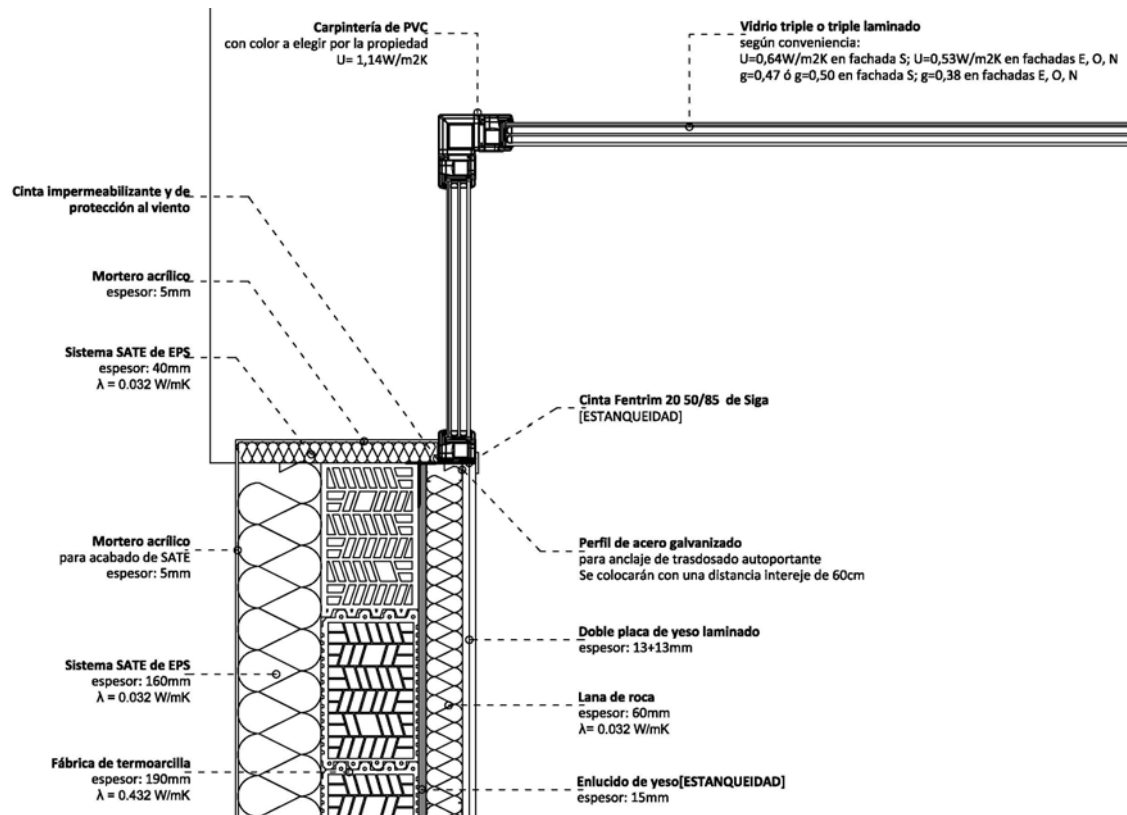
B elemento constructivo en forma de cuña

	λ [W/(mK)]	Superficie parcial 2 (opcio	λ [W/(mK)]	Superficie parcial 3 (opcio	λ [W/(mK)]	Espesor e _s [mm]
mortero para formación de pendiente	1,300					50
Porcentaje superficie parcial 1		Porcentaje superficie parcial 2		Porcentaje superficie parcial 3		Espesor e _s [mm]
100%						5,0 cm

U₁: **26,000** W/(m²K)
R₁: **0,038** (m²K)/W

Valor-U de superficie rectangular: **0,109** W/(m²K)

5.4 Description of the window sections including installation drawing





Three types of glazing with three panes were used and two chambers filled with argon gas. The glazing used on the north, west and east façades (triple Low-E glazing) has the following characteristics:

_The U_g value is $0,53 \text{ W/m}^2\text{K}$.

_The g value is $0,38$.

Glazing used on the south façade (triple Low-E glazing and sun control) has the following characteristics:

_The U_g value is $0,64 \text{ W/m}^2\text{K}$.

_The g value is $0,47$ or $0,50$, depending on whether the glazing is laminated or simple.

The window frame is made of PVC profiles (Kömmerling 76), and it has the next characteristics:

_The U_f value is $1,1 \text{ W/m}^2\text{K}$.

The intercalary in the edge of the glazing is a warm edge type, being the Ψ value $0,038 \text{ W/mK}$.

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



Basement floor: The in-situ concrete slab in itself is airtight. Any penetrations and joints are treated using airtight liquid membrane.

Basement ceiling: The in-situ concrete compression layer in itself is airtight. Any penetrations and joints are treated using airtight liquid membrane.

Basement walls in contact with the ground: The in-situ concrete walls in themselves are airtight. Any penetrations and joints are treated using airtight liquid membrane.

Exterior walls: for airtightness of exterior walls and partition walls of the Passive House building, gypsum interior plaster was applied all over the surface. Any penetrations and joints are treated using airtight liquid membrane.

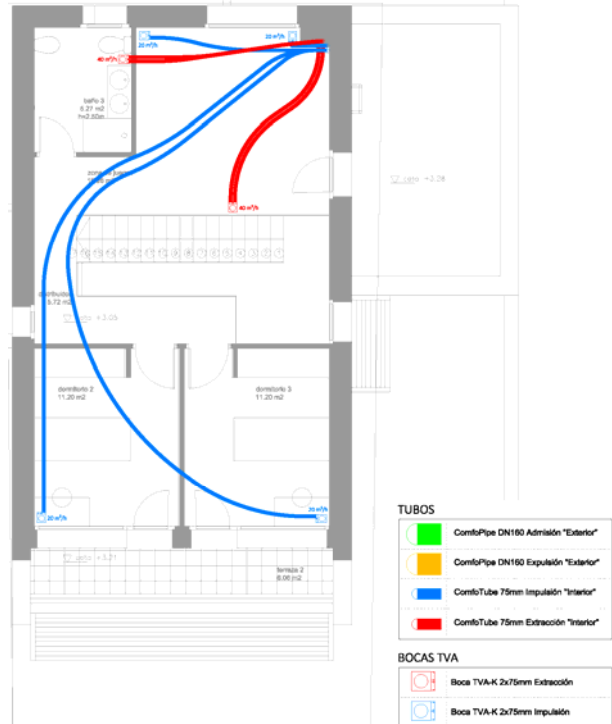
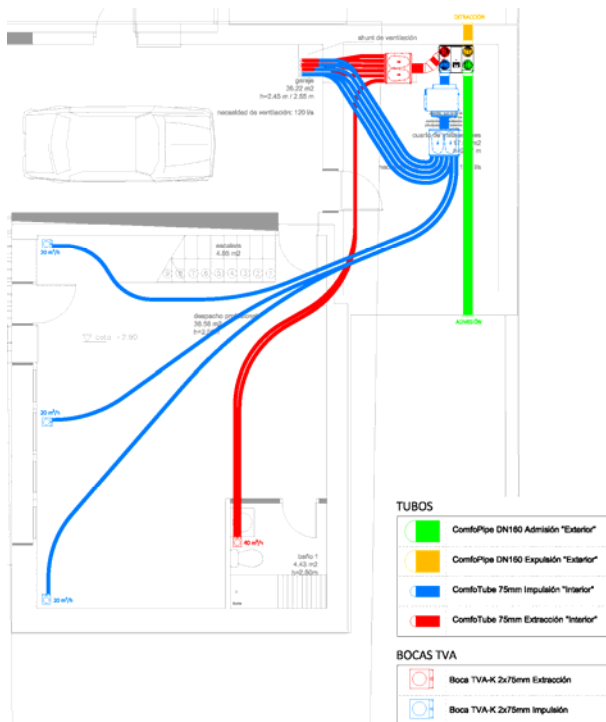
Roof: gypsum interior plaster was applied all over the surface. Any penetrations and joints are treated using airtight liquid membrane.

Windows: the windows frames of PVC are airtight. The glazing is sealed into this with silicone sealant all around. The plaster ends at the gap of the window. The space between the window frame and the plaster is covered by a piece of airtight sheet which is stick on both sides by airtight tape.

Results of pressure test on 29/10/2020:

	<u>Despresurización</u>	<u>Presurización</u>	<u>Media</u>
Resultados del test a 50 Pa:			
V50: m ³ /h50 (Caudal de Aire)	307 (+/- 0.9 %)	313 (+/- 0.8 %)	310
n50: 1/h (Tasa de Renovación de Aire)	0.51	0.52	0.52
w50: m ³ /(h·m ² Área del Suelo)	1.53	1.56	1.55
q50:			
Áreas de Infiltraciones:			
EqLA @ 10 Pa (cm ²)	109.0 (+/- 2.6 %)	113.5 (+/- 2.2 %)	111.2
LBL ELA @ 4 Pa (cm ²)	54.9 (+/- 4.3 %)	57.8 (+/- 3.6 %)	56.4
Curva de Infiltraciones del Edificio:			
Coefficiente de Caudal de Aire (Cenv) m ³ /(h·Pa ⁿ)	19.4 (+/- 6.8 %)	20.9 (+/- 5.9 %)	
Coefficiente de Infiltraciones (CL) m ³ /(h·Pa ⁿ)	19.0 (+/- 6.8 %)	20.4 (+/- 5.9 %)	
Exponente (n)	0.711 (+/- 0.019)	0.698 (+/- 0.016)	
Coefficiente de Correlación	0.99957	0.99967	
Norma del Test:	EN 13829		
Modo del Test:	Despresurización y Presurización		
Método del Test:	A		
Norma a cumplir:	EN 13829 n50 ≤ 0.6 1/h		

7.1 Description of the planning of the ventilation ductwork



Fresh air is intaken near the entrance to the plot. Fresh air is supplied in rooms "despacho profesional" (basement floor); "dormitorio 1" and "salon-comedor" (ground floor); and "zona de juegos", "dormitorio 2" and "dormitorio 3" (first floor). Air is transferred in the next areas: "escalera", "acceso distribuidor", "vestidor" and "distribuidor". Air is extracted from "baño 1" (basement floor); "cocina", "aseo" and "baño 2" (ground floor); and baño 3" and "zona de juegos" (first floor). There is a geothermal heat exchange present: a conduit about 40 meters long, buried in the south and east of the plot.

7.2 Description of the planning for the central unit (of the ventilation system) / the ventilation device



The heat recovery used in the ventilation system is ComfoAir Q350 ERV, Comfort Vent Q50 ERV (Zehnder).

Its characteristics are:

_Airflow range: 70-270 m³/h

Heat recovery rate: $\eta{HR} = 86\%$

Specific electric power: $P{el,spec} = 0,22 \text{ Wh/m}^3$

_Humidity recovery: $\eta_x = 73\%$

8 Description of the heat supply system



The hot water generation and space heating and cooling takes place through an aerothermal heat pump. The indoor unit is located in the facilities room. The outdoor unit is located on the deck of the master bedroom.

Spaces are heated and cooled by radiant ceiling panels, located in every room, except in the basement rooms, in the bathroom and toilet and in the dressing room.

The building has a photovoltaic installation located on the roof, made up of 8 photovoltaic panels with a power of 400 W each.

9 Brief documentation of important PHPP results (at least the information contained in the "verification" worksheet)

Casa Pasiva Comprobación									
				Edificio: vivienda unifamiliar pareada Calle: Encarnación Andrés CP / Ciudad: 28035 Madrid Provincia/País: Madrid ES-España Tipo de edificio: vivienda unifamiliar Datos climáticos: ES0001b-Madrid Zona climática: 4: Cálido-templado Altitud de la localización: 661 m					
				Propietario / cliente: Calle: CP / Ciudad: Madrid Provincia/País: Madrid ES-España					
				Instalaciones: RC arquitectura Calle: Postas CP / Ciudad: 28300 Aranjuez Provincia/País: Madrid ES-España					
				Certificación: ZE Passivhaus Services Ltd Calle: 386 BUXTON ROAD CP / Ciudad: SK2 7BY STOCKPORT Provincia/País: GREATER MANCHESTER					
Arquitectura: RC arquitectura Calle: Postas CP / Ciudad: 28300 Aranjuez Provincia/País: Madrid ES-España Consultoría: RC arquitectura Calle: Postas CP / Ciudad: 28300 Aranjuez Provincia/País: Madrid ES-España				Año construcción: 2020 Nr. de viviendas: 1 Nr. de personas: 3,1					
				Temp. interior invierno [°C]: 20,0 Ganancias internas de calor (GIC): caso calefacción [W/m²]: 2,4 Capacidad específica [Wh/K por m² de SRE]: 84					
				Temp. interior verano [°C]: 25,0 GIC caso refrigeración [W/m²]: 2,4 Refrigeración mecánica: x					
Valores específicos referenciados a la superficie de referencia energética									
Superficie de referencia energética		m²	197,6		Criterio		Criterios alternativos		¿Cumplido? ²
Calefacción	Demanda de calefacción	kWh/(m²a)	13	≤	15	-			Sí
	Carga de calefacción	W/m²	10	≤	-	10			
Refrigeración	Demanda refrigera. & deshum.	kWh/(m²a)	10	≤	15	15			Sí
	Carga de refrigeración	W/m²	8	≤	-	10			
	Frecuencia de sobrecalentamiento (> 25 °C)	%	-	≤	-				
	Frecuencia excesivamente alta humedad (> 12 g/kg)	%	0	≤	10				Sí
Hermeticidad	Resultado ensayo presión n ₅₀	1/h	0,5	≤	0,6				Sí
Energía Primaria no renovable (EP)	Demanda EP	kWh/(m²a)	66	≤	-				-
Energía Primaria Renovable (PER)	Demanda PER	kWh/(m²a)	32	≤	60	60			Sí
	Generación de Energía Renovable	kWh/(m²a)	12	≥	-	-			
² Celda vacía: Falta dato; -: No requerimiento									
Confirmando que los valores aquí presentados han sido determinados siguiendo la metodología de PHPP y están basados en los valores característicos del edificio. Los cálculos de PHPP están adjuntos a esta comprobación.									
Función: 1-Disenador Nombre: mrosa_ia Apellido: de la iglesia Fecha emisión: 287913265_131115_PEPES_es09 Ciudad: Madrid				¿Casa Pasiva Classic? Sí Firma:					
Project data imported from designPH 1.1.5 Código desplegado PHPP9: 287913265_131115_PEPES_es09									

10.1 Overall construction costs

950 €/m2 living/useful area.

10.2 Building costs

950 €/m2 living/useful area.

11 If available: experiences (user assessment, actual consumption values)

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12 If available: reference to any existing studies / publications relating to this project

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