Project Documentation –
Detached single family house in Moraira (Alicante), Spain

1 Abstract

Source: DICAM

1.1 Data of building

Year of construction/	2015	**Space heating**	**12 kWh/(m²a)**
Area	241.9 m²		
U-value external wall	0.288 W/(m²K)	**Space cooling**	**17 kWh/(m²a)**
U-value basement wall	0.630 W/(m²K)		
U-value basement floor	1.128 W/(m²K)	**Primary Energy Renewable (PER)**	49 kWh/(m²a)
U-value roof	0.356 W/(m²K)	**Generation of renewable energy**	0 kWh/(m²a)
U-value window	1.68 W/(m²K)	**Non-renewable Primary Energy (PE)**	77 kWh/(m²a)
Heat recovery	80.7 %	**Pressure test n_{50}**	0.57 h-1
Special features	The BREEAM Certification as Excellent in Design stage has been achieved. The BREEAM Certification in Post Construction stage is in process.		

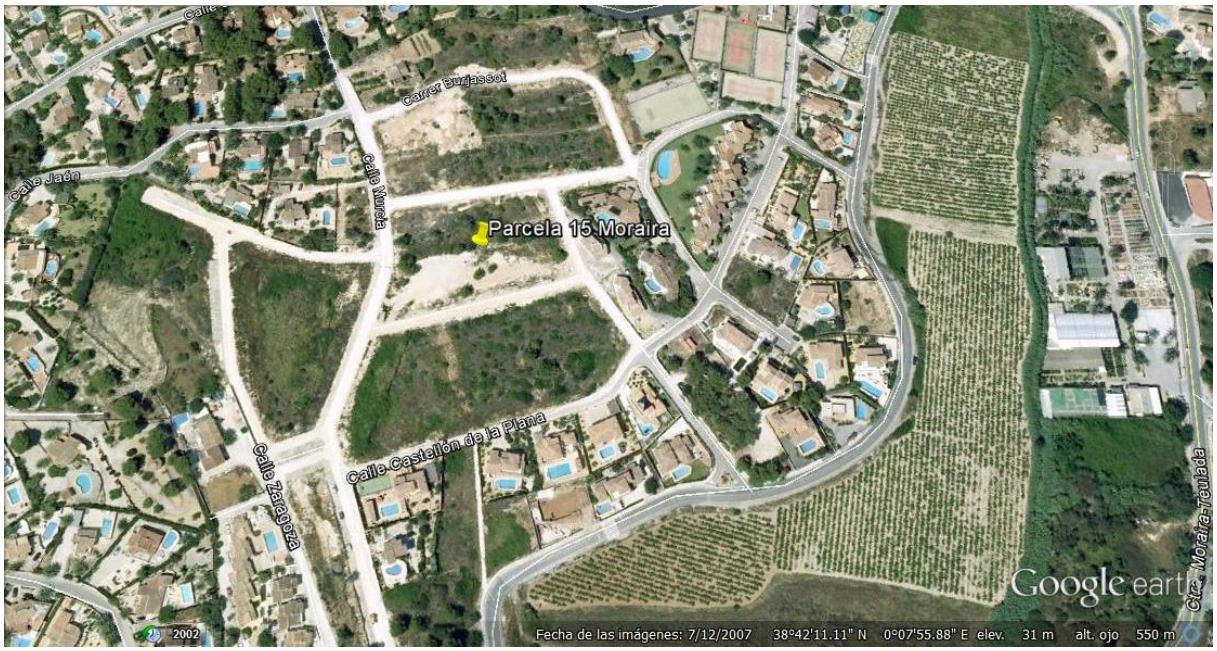
1.2 Brief Description of the Project

Detached single family house built with traditional Mediterranean construction. It has been designed to create overhangs to protect from solar radiation in summer.

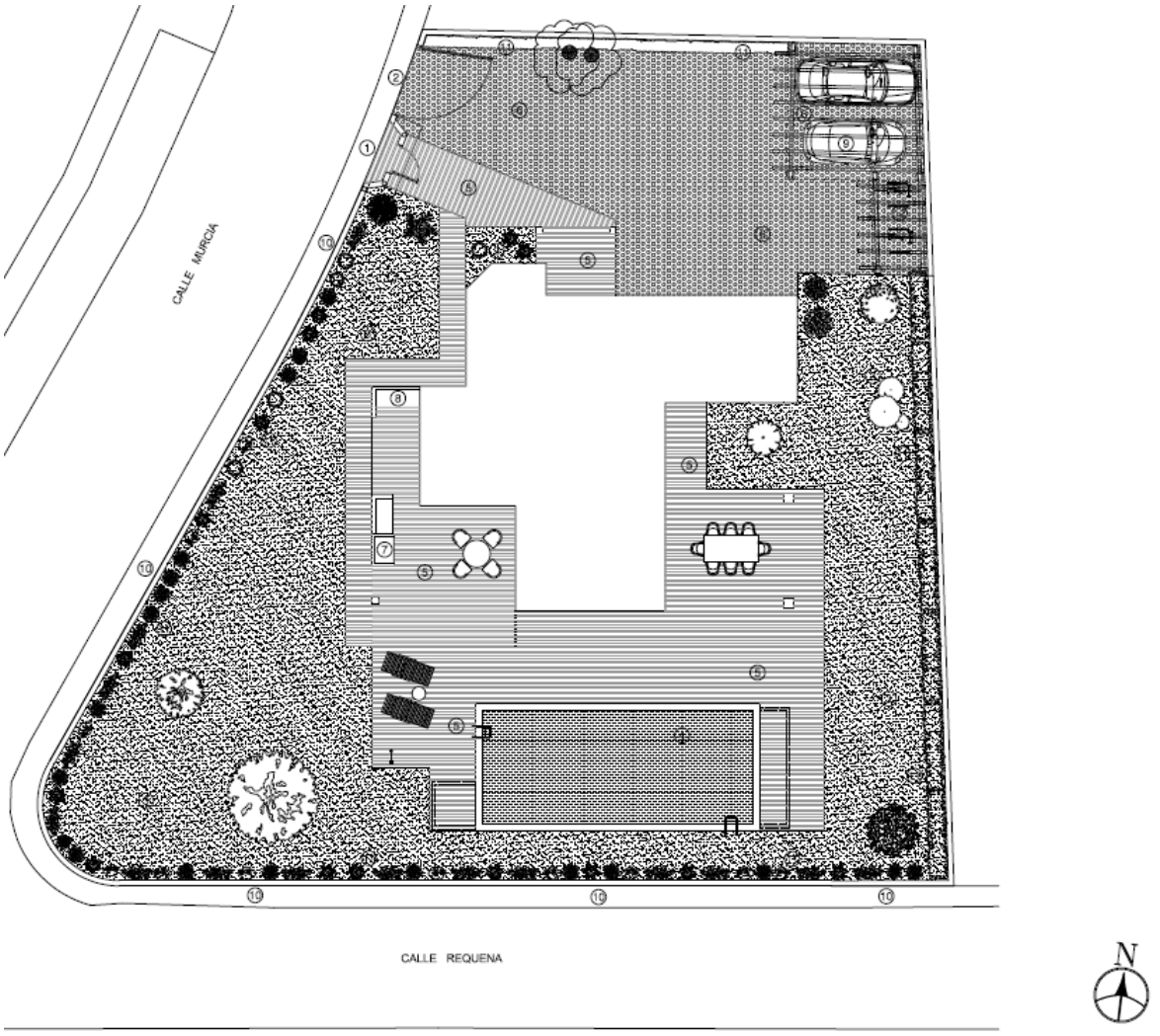
The building has a floor area of 241.9 m^2 distributed over three levels. The services room and the gym are located in the basement. The rest of living spaces are distributed between ground floor and first floor. Both floors are connected by a large double height space.

The design integrates concepts of energy efficiency and bioclimatic components like water cistern, green roof and environmentally friendly materials.

It is located in Moraira (Alicante) near the sea, with a warm and humid climate. For this reason, it will be the summer weather that generates more conditioning to solve.



(Source: Google Earth)



Situation plan (Source: AMALUR)

1.3 Responsible project participants

Architect/ Entwurfsverfasser	AMALUR Architects
Implementation planning/ Ausführungsplanung	DICAM control y gestión de obra SL
Building systems/ Haustechnik	Hilario Climatización
Structural engineering/ Baustatik	
Building physics/ Bauphysik	Anne Vogt and Nuria Díaz, VAND Arquitectura
Passive House project planning/ Passivhaus-Projektierung	Anne Vogt and Nuria Díaz, VAND Arquitectura
Construction management/ Bauleitung	DICAM control y gestión de obra SL
Certifying body/ Zertifizierungsstelle	Passive House Institute Darmstadt www.passiv.de
Certification ID/ Zertifizierungs ID	Project-ID (www.passivehouse-database.org) Projekt-ID (www.passivehouse-database.org) 4764
Author of project documentation / Verfasser der Gebäude-Dokumentation	Anne Vogt, VAND Arquitectura
Date, Signature/ Datum, Unterschrift	

Madrid,3rd of august 2017

2 Pictures of the project

2.1 Exterior photographs

South-East view (Source: DICAM)

South-West view (Source: DICAM)

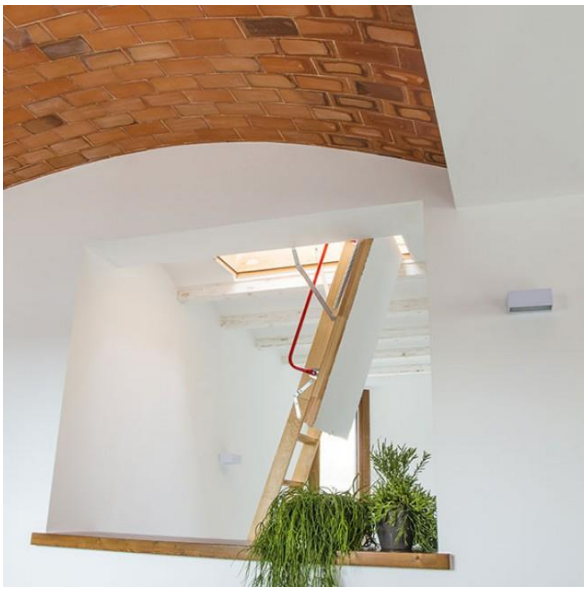
East view. (Source: DICAM)

North view (Source: DICAM)

2.2 Photographs of the inside

Basement and staircase ground floor to first level (Source: DICAM, http://dicamgroup.com)

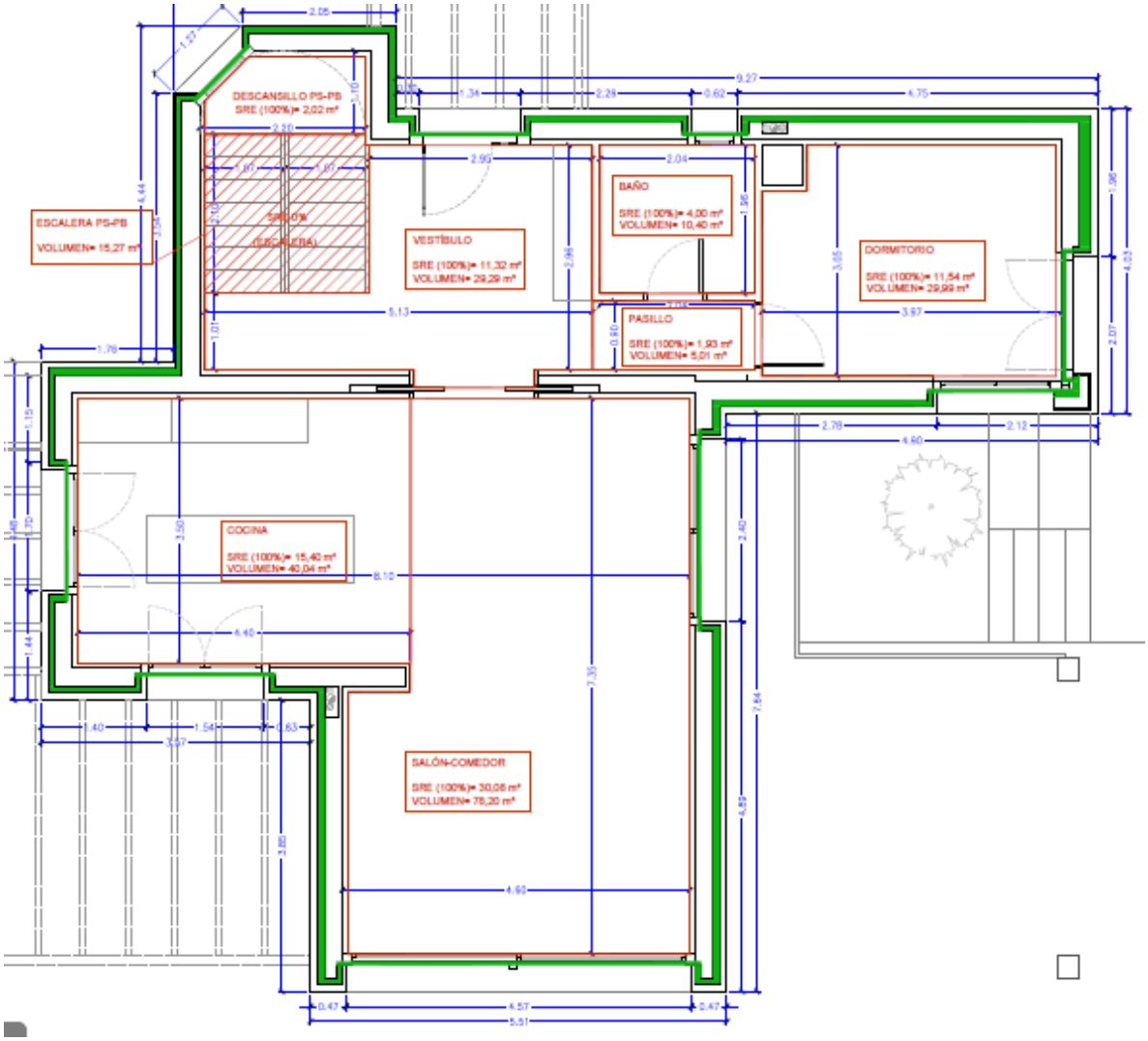
Kitchen/dining room and library (Source: DICAM, http://dicamgroup.com)

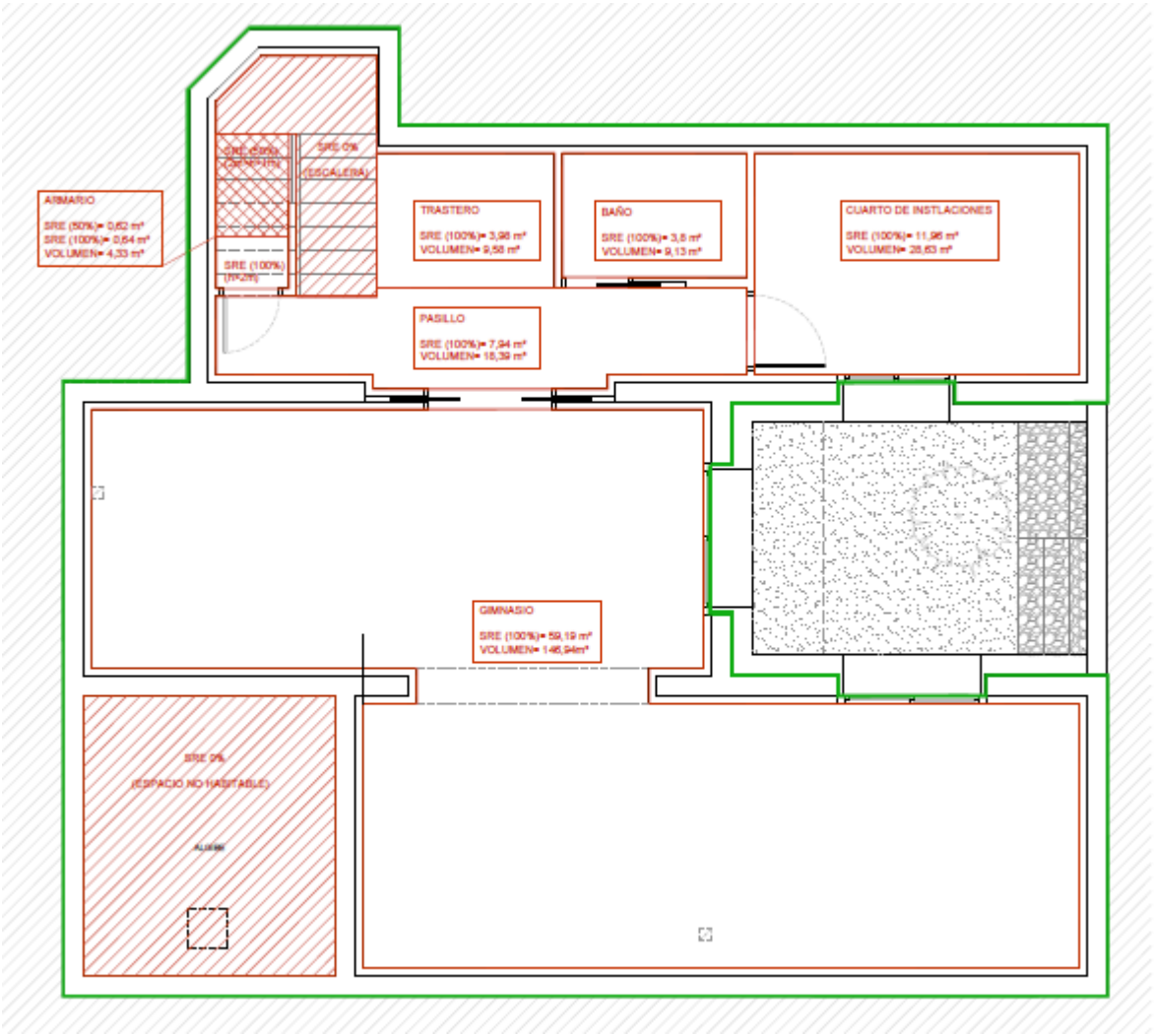
Living room and stairs to the flat roof (Source: DICAM, http://dicamgroup.com)

3 Plans

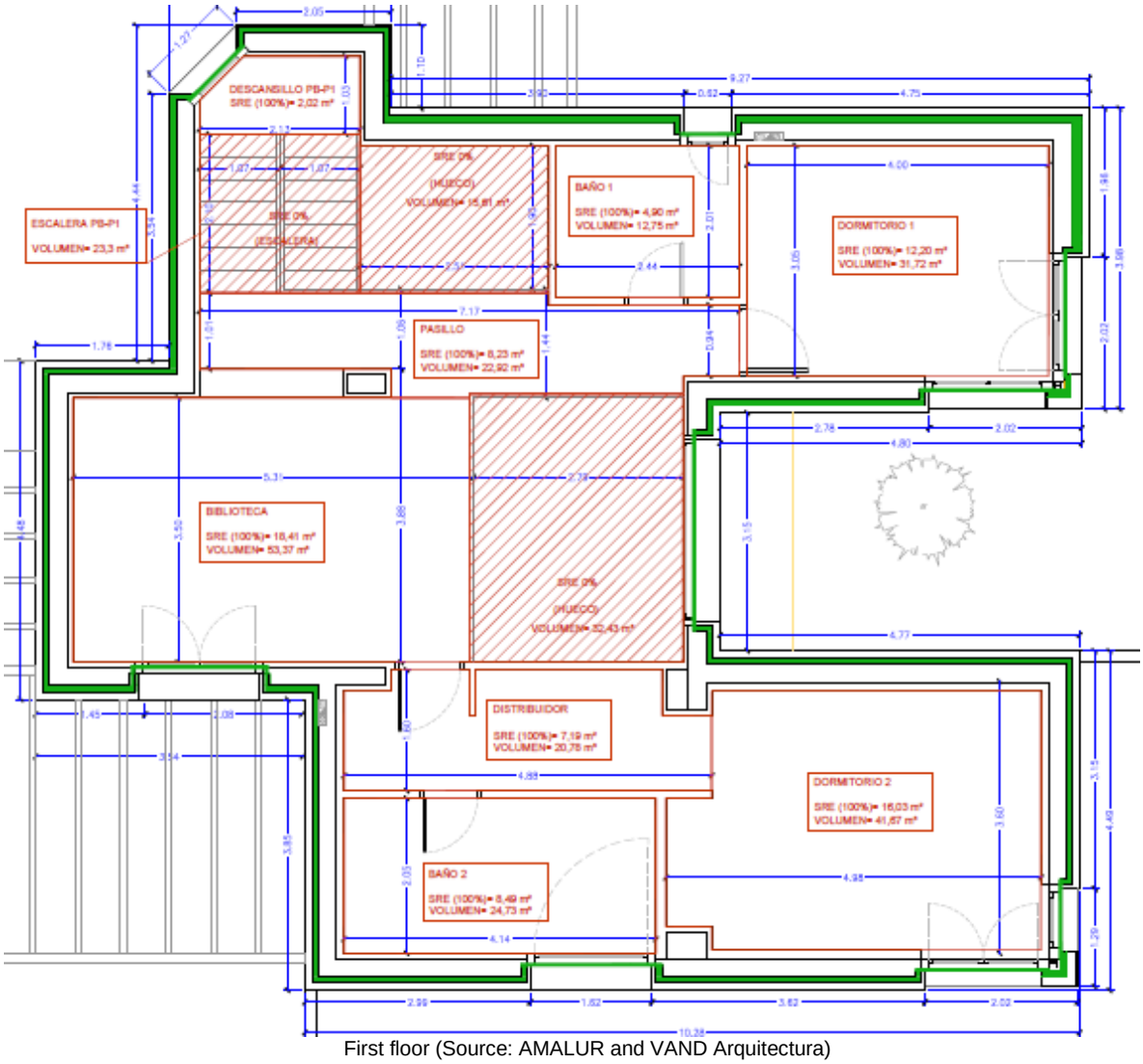
Thermal envelope (green line) and TFA are shown in the following plans:



Ground floor (Source: AMALUR and VAND Arquitectura)

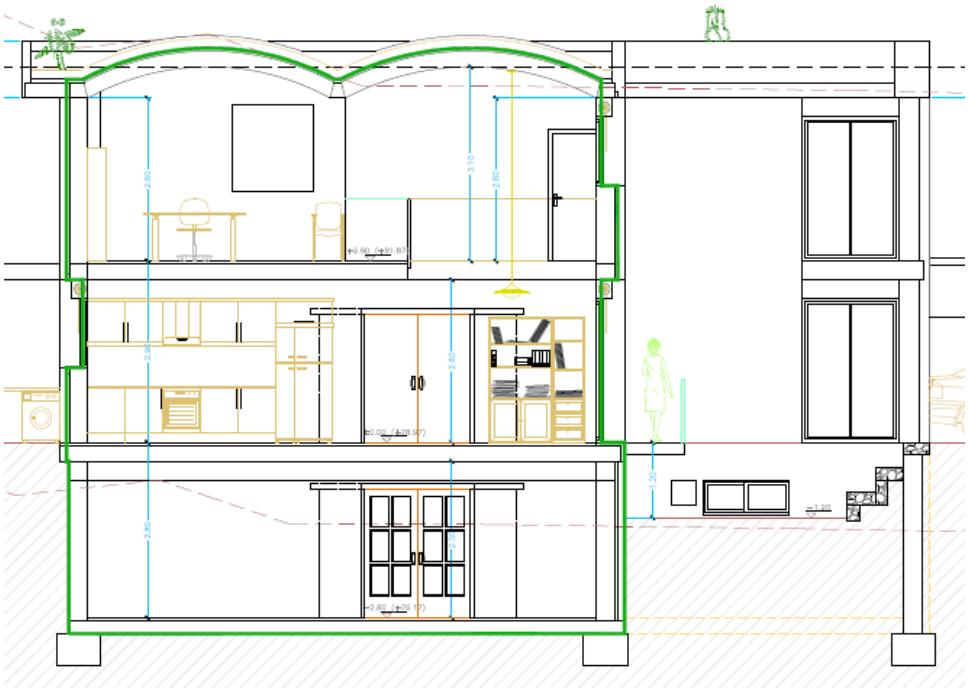


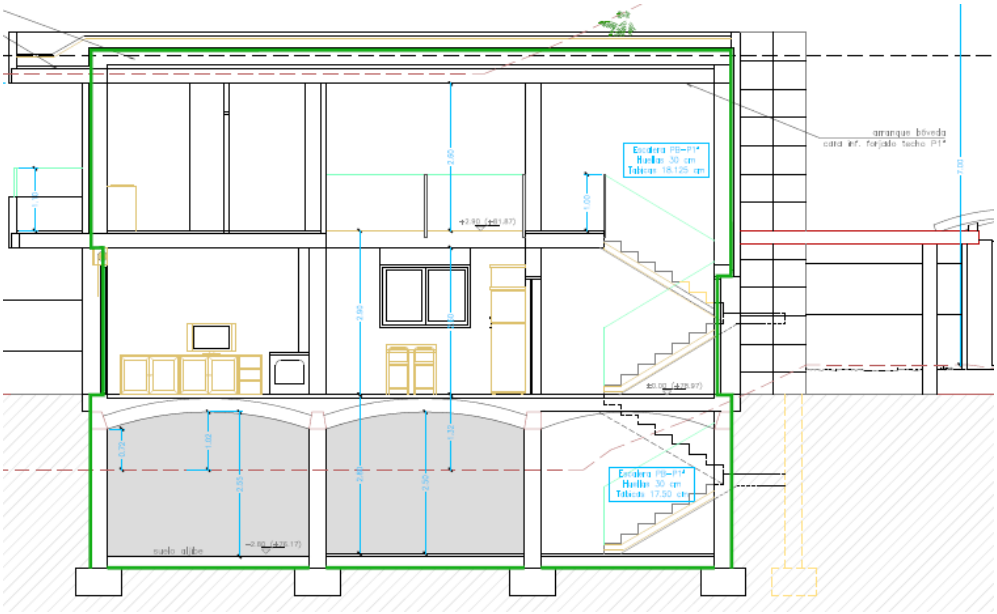
Basement floor (Source: AMALUR and VAND Arquitectura)



First floor (Source: AMALUR and VAND Arquitectura)

Sections:

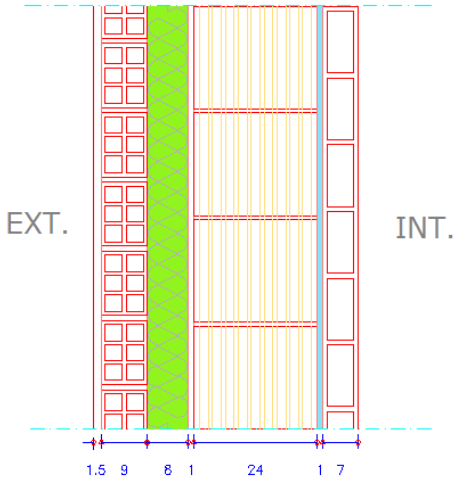




(Source: AMALUR and VAND Arquitectura)

4 Technical details of the construction

4.1 Exterior walls



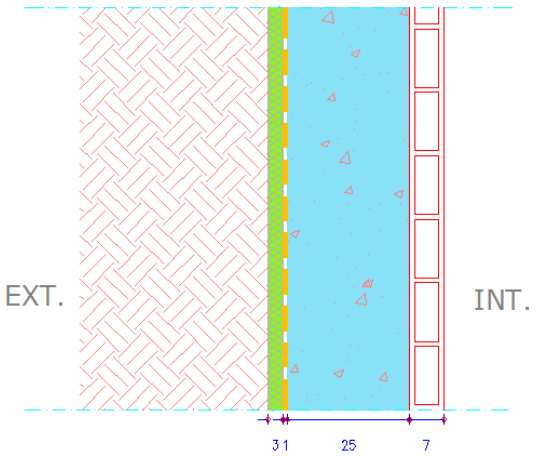
[EXT] = [OUTDOOR]

Plasterboard 15 mm
Brick stonework 90 mm
Insulation (λ=0.036 W/mK) 80 mm
Plasterboard 10 mm
Honeycomb clay block 240 mm
Gypsum plasterboard 10 mm
TC7 Panel 70 mm

[INT] = [INTERIOR]

U-value = 0.281 W/(m²K)

4.2 Basement wall



[EXT] = [OUTDOOR]

Insulation (λ=0.034 W/mK) 30 mm
Plasterboard 10 mm
Reinforced concrete 250 mm
TC7 Panel 70 mm

[INT] = [INTERIOR]

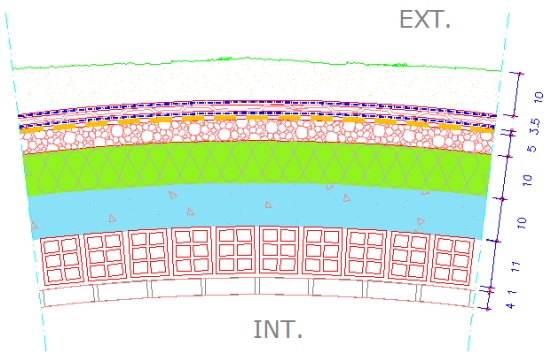
U-value = 0.694 W/(m²K)

Blue line = airtight layer

Green line = thermal envelope

4.3 Flat roof

Type 1



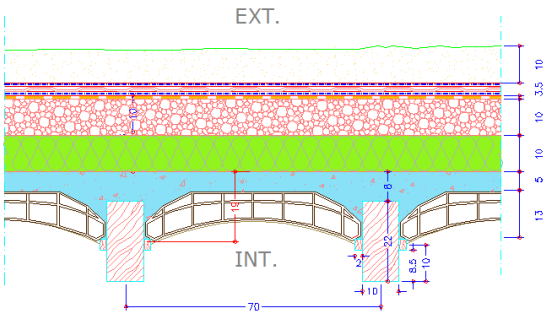
[EXT] = [OUTDOOR]

Lightweight concrete 50 mm
Insulation (λ=0.039 W/mK) 100 mm
Concrete 100 mm
Brick 115 mm
Plasterboard 10 mm
Brick 40 mm

[INT] = [INTERIOR]

U-value = 0.312 W/(m^{2}K)

Type 2



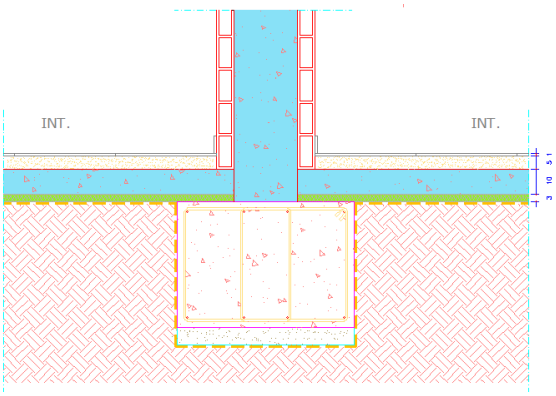
[EXT] = [OUTDOOR]

Lightweight concrete 100 mm
Insulation (λ=0.039 W/mK) 100 mm
Slab 180 mm

[INT] = [INTERIOR]

U-value = 0.333 W/(m^{2}K)

4.4 Basement floor



[EXT] = [OUTDOOR]

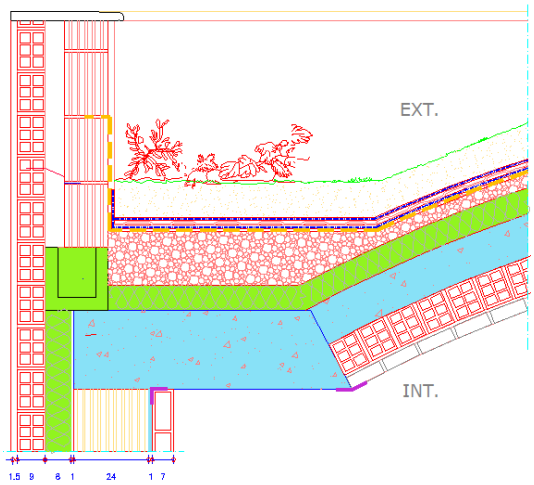
Ceramic tile 10 mm
Plasterboard 50 mm
Concrete 100 mm
Insulation (λ=0.049 W/mK) 30 mm

[INT] = [INTERIOR]

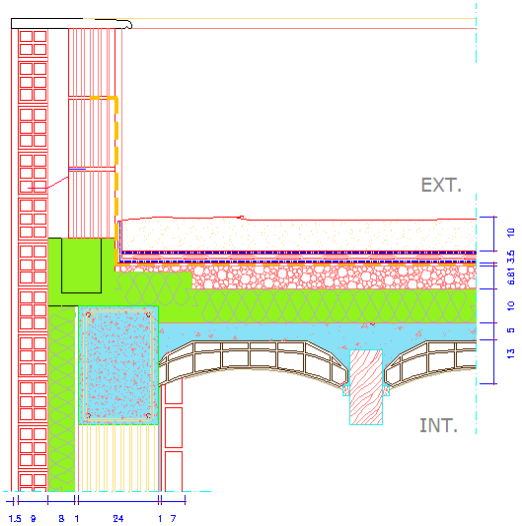
U-value = 1.128 W/(m^{2}K)

4.4.1 Connection details

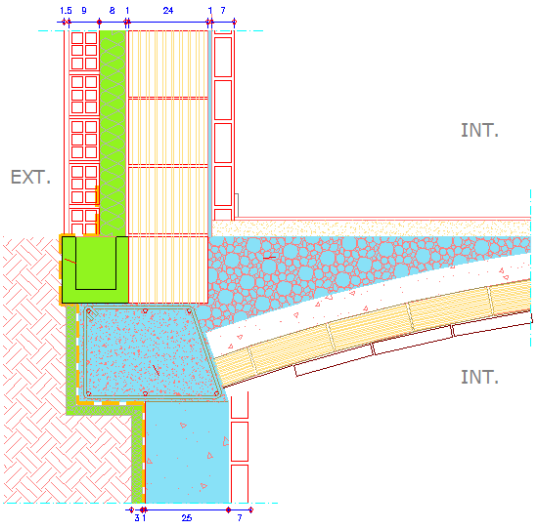
External wall-Flat roof (type 1) **External wall-Flat roof (type 2)**

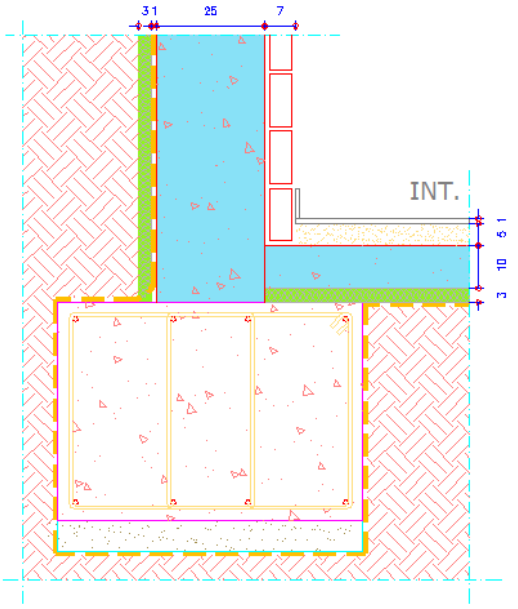


External wall-Basament wall



Basement Wall- floor slab





Blue line = airtight layer

Purple line = airtight tape

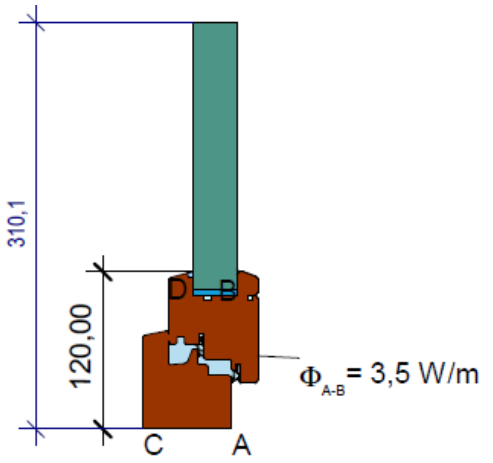
Green line = thermal envelope

4.5 Windows

4.5.1 Window Frame

A wooden frame made by a local carpenter has been installed.

Uf-value calculation by flixo software:



$$U_{eq\ A-B} = \frac{3{,}465}{20{,}000 \cdot 0{,}120} = 1{,}44\ W/(m^2 \cdot K)$$

4.5.2 Glass

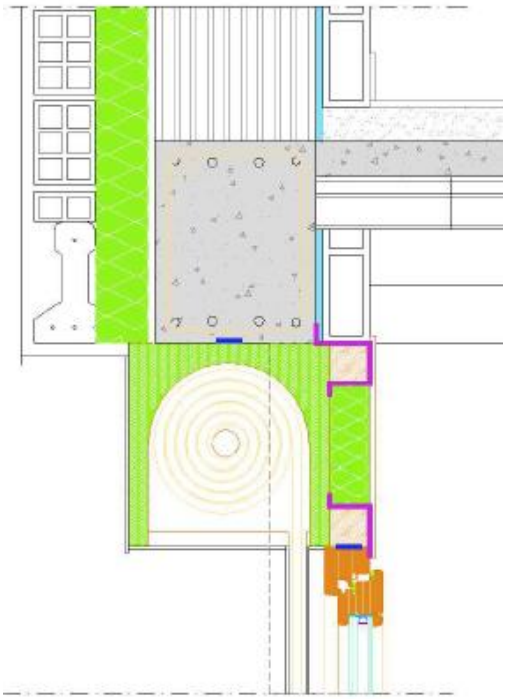
Type	U-Value	g-value
6+6/16 Arg/3+3	1.04 W/m^{2}K	0.39

4.5.3 Shadow elements

External blinds were incorporated to provide solar protection during the summer months. They are controlled by a home automation system.

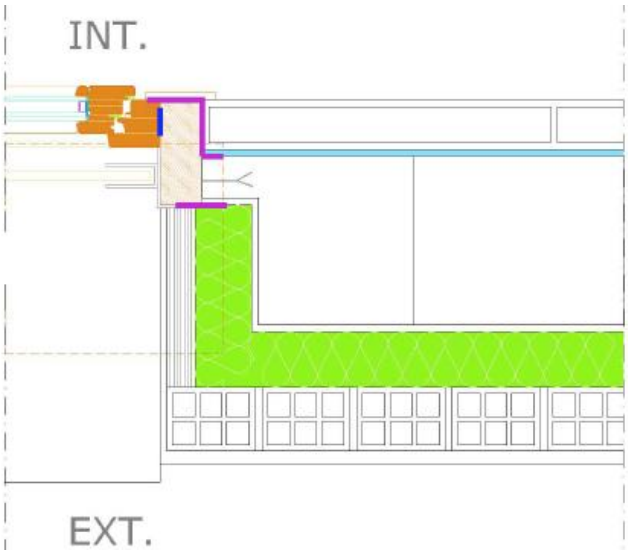
4.5.4 Window installation detail

Top installation



Bottom installation

Lateral installation



Blue line = airtight layer

Purple line = airtight tape

Green line = thermal envelope

4.6 Construction phase

Basement floor insulation (Source: DICAM)

Basement wall insulation (Source: DICAM)

ETICS installation (Source: DICAM)

Green roof (Source: DICAM)

Window installation (Source: DICAM

5 Airtightness

5.1 BlowerDoor test results

Despresurización Test Analysis				
Correlation, r :	99,96			
	Mean	95% confidence limits		Uncertainty
		Lower	Upper	
Slope, n:	0,69318	0,67333	0,71303	
Air leakage coefficient, C_{env} [m³/h/Paⁿ]:	27,224	25,49	29,08	
Air leakage coefficient, C_L [m³/h/Paⁿ]:	27,224	25,49	29,08	
Air flow at 50 Pa, V_{50} [m³/h]	409,87	403,7	416,1	+/-1,5%
Air changes at 50 Pa, n_{50} [/h]	0,5788	0,5498	0,6077	+/-5,2%
Permeability at 50 Pa, q_{50} [m³/h/m²]	0,4758	0,451	0,501	+/-5,2%
Specific leakage at 50 Pa, w_{50} [m³/h/m²]	1,5841	1,5014	1,6669	+/-5,2%

Presurización Test Analysis				
Correlation, r :	99,83			
	Mean	95% confidence limits		Uncertainty
		Lower	Upper	
Slope, n:	0,60488	0,57005	0,63971	
Air leakage coefficient, C_{env} [m³/h/Paⁿ]:	37,567	33,50	42,12	
Air leakage coefficient, C_L [m³/h/Paⁿ]:	37,316	33,28	41,84	
Air flow at 50 Pa, V_{50} [m³/h]	397,71	386,8	408,9	+/-2,8%
Air changes at 50 Pa, n_{50} [/h]	0,5616	0,5335	0,589	+/-5,7%
Permeability at 50 Pa, q_{50} [m³/h/m²]	0,4617	0,435	0,488	+/-5,7%
Specific leakage at 50 Pa, w_{50} [m³/h/m²]	1,5174	1,4415	1,5932	+/-5,7%

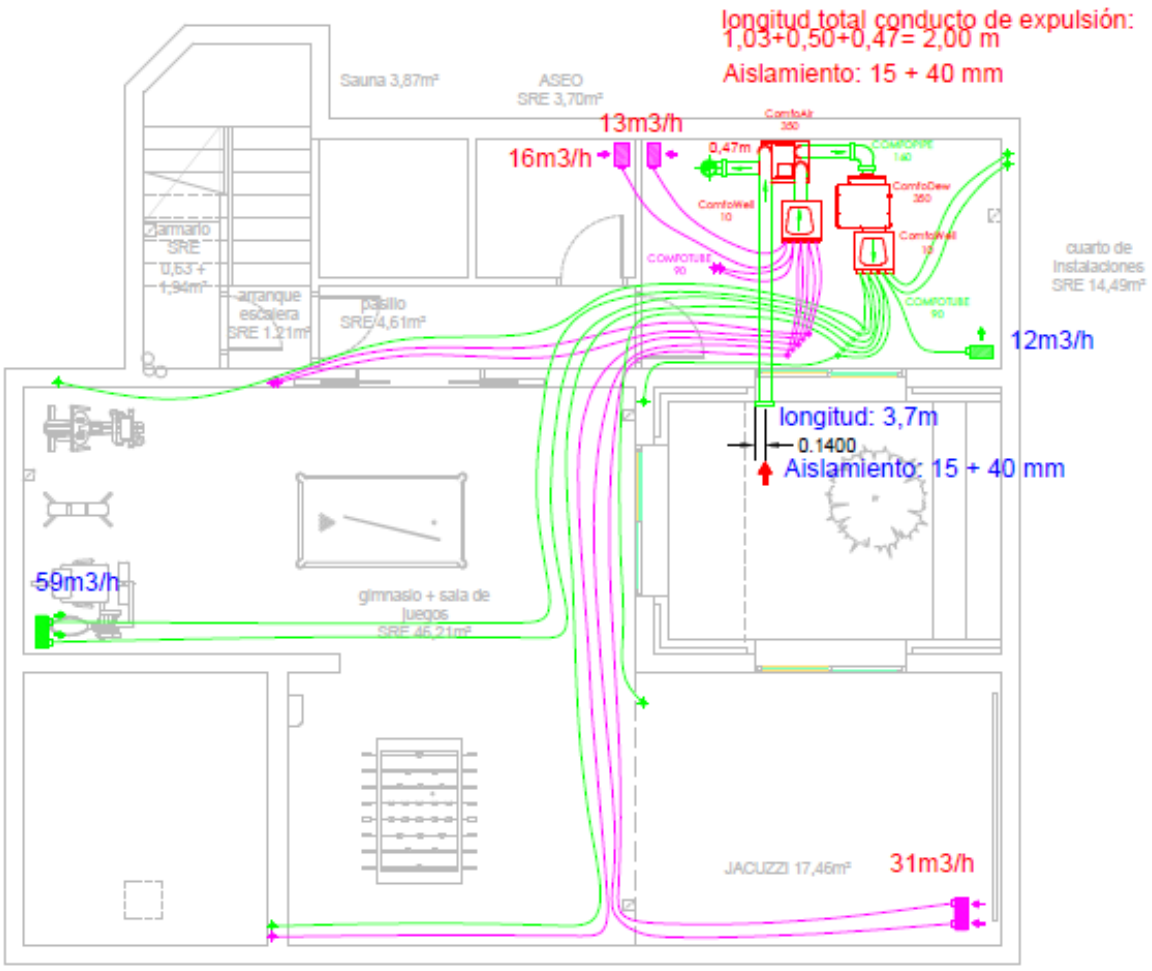
	Resultados	Intervalo de confianza de 95%		Incertidumbre
Air flow at 50 Pa, V_{50} [m³/h]	404,0	395,5	412,5	+/-2,1%
Air changes at 50 Pa, n_{50} [/h]	~~0,5702~~	0,541	0,598	+/-5,5%
Permeability at 50 Pa, q_{50} [m³/h/m²]	~~0,469~~	0,443	0,494	+/-5,5%
Specific leakage at 50 Pa, w_{50} [m³/h/m²]	1,541	1,463	1,618	+/-5,5%

The test has been carried out by: TermaGraf

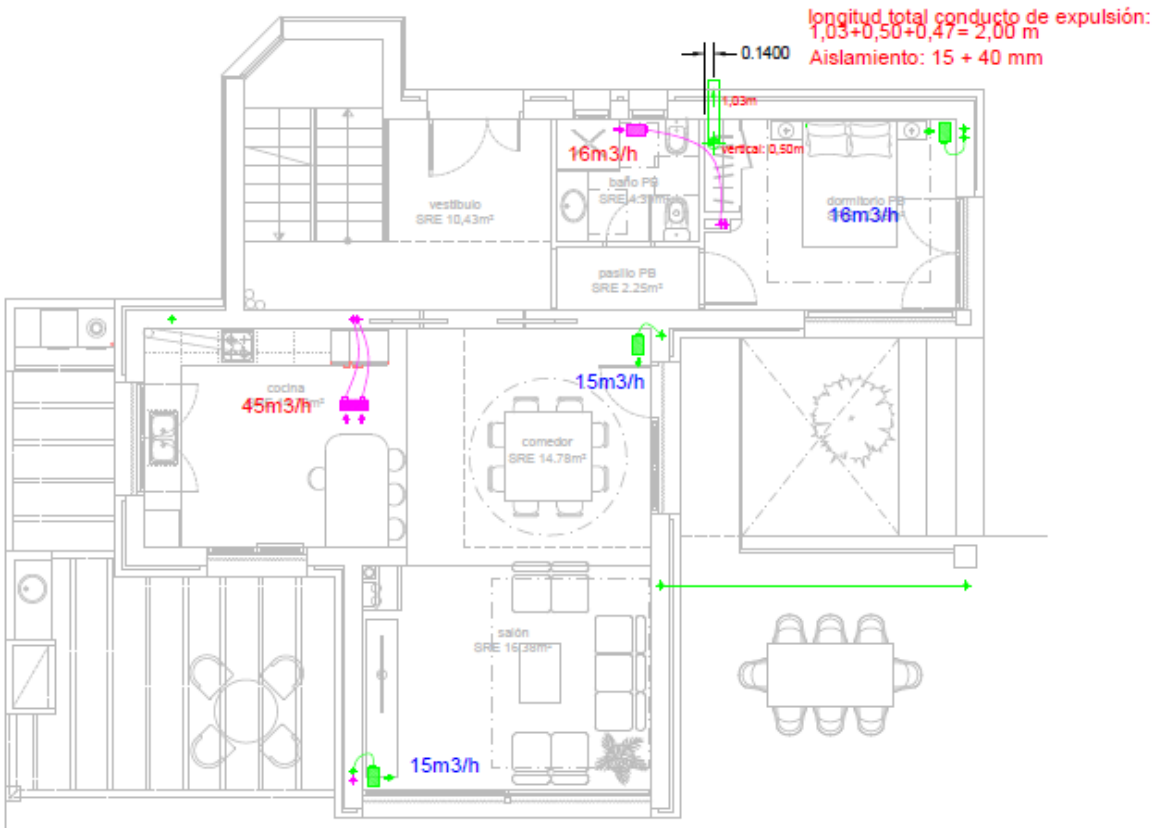
6 Ventilation

6.1 Ventilation planning

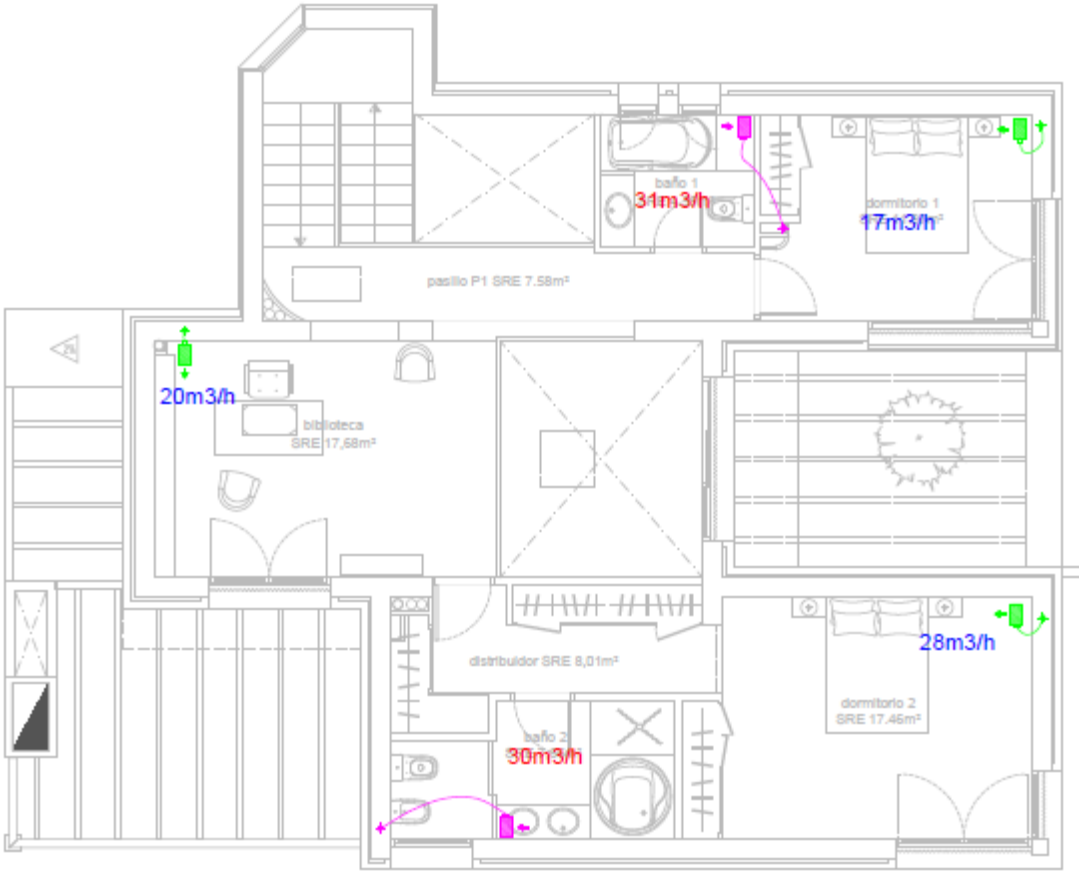
Due to the warm and humid climate, it is necessary to have dehumidification in supply air. This is done by a cool water battery that is connected to an air-to-water heat pump.



Basement floor (Source: HILARIO climatización and VAND Arquitectura)



Ground floor (Source: AMALUR and VAND Arquitectura)



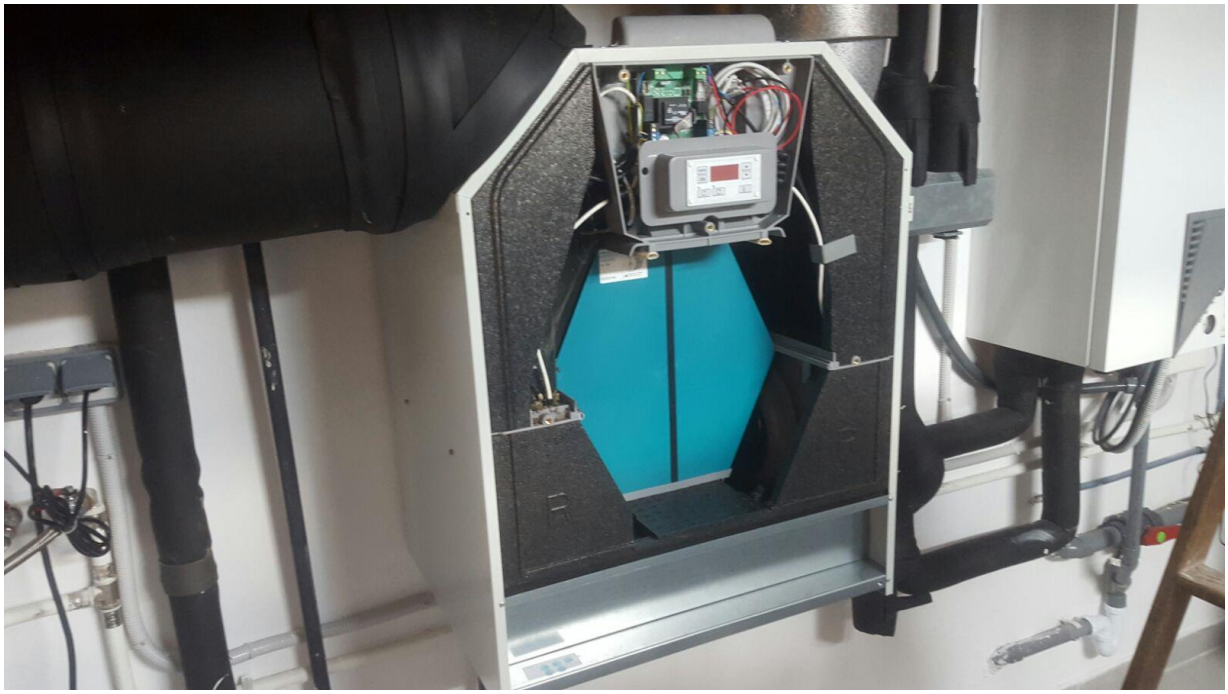
First floor (Source: AMALUR and VAND Arquitectura)

6.2 Construction phase

(Source: DICAM)

6.3 Ventilation unit

Average air flow rate m^3/h	Average air change rate 1/h	Heat recovery efficiency	Effective heat recovery efficiency unit	Specific power input Wh/m^3
181 m^3/h	0.30 /h	84 %	80.7 %	0.29 Wh/m^3



Ventilation unit (Source: DICAM

7 Building Services

7.1 Heating/cooling

To provide both heating and cooling load, a fancoil has been installed in each floor. Besides, the air entering the mechanic ventilation unit is pre-cooled in summer by a cool water battery.

They are connected to air-to-water heat pump that generates warm and cold water.

7.2 Domestic hot water

Domestic hot water demand is covered by water-to-water heat pump that recovers heat from the building wastewater.

Water-to-Water Heat Pump (Source:DICAM)

Service room (Source: DICAM)

8 PHPP Results

Casa Pasiva Comprobación

Edificio:	Villa Moraira		
Calle:	C/Murcia. Parcela 15.		
CP / Ciudad:	Urbanizació	Teulada (Alicante)	
Provincia/País:	España	ES-España	
Tipo de edificio:	Vivienda unifamiliar		
Datos climáticos:	ES0009b-Alicante		
Zona climática:	5: Cálida	Altitud de la localización:	80 m
Propietario / cliente:	DICAM control y gestión de obra SL		
Calle:	Plaza Ramón Contreras Mongrell nº10 Duplicado Puerta		
CP / Ciudad:	46019	Valencia	
Provincia/País:	Valencia	ES-España	

Arquitectura:	AMALUR		
Calle:	C/Benlmaclet nº 2		
CP / Ciudad:	46120	Alboraya	
Provincia/País:	Valencia	ES-España	
Consult. energética:	VAND Arquitectura		
Calle:	C/ Villablanca 85		
CP / Ciudad:	28032	Madrid	
Provincia/País:	Madrid	ES-España	

Ingeniería:	Hilario Climatización		
Calle:	Av. Juan Gil Albert nº17		
CP / Ciudad:	3804	Alcoi	
Provincia/País:	Alicante		
Certificación:			
Calle:			
CP / Ciudad:			
Provincia/País:			

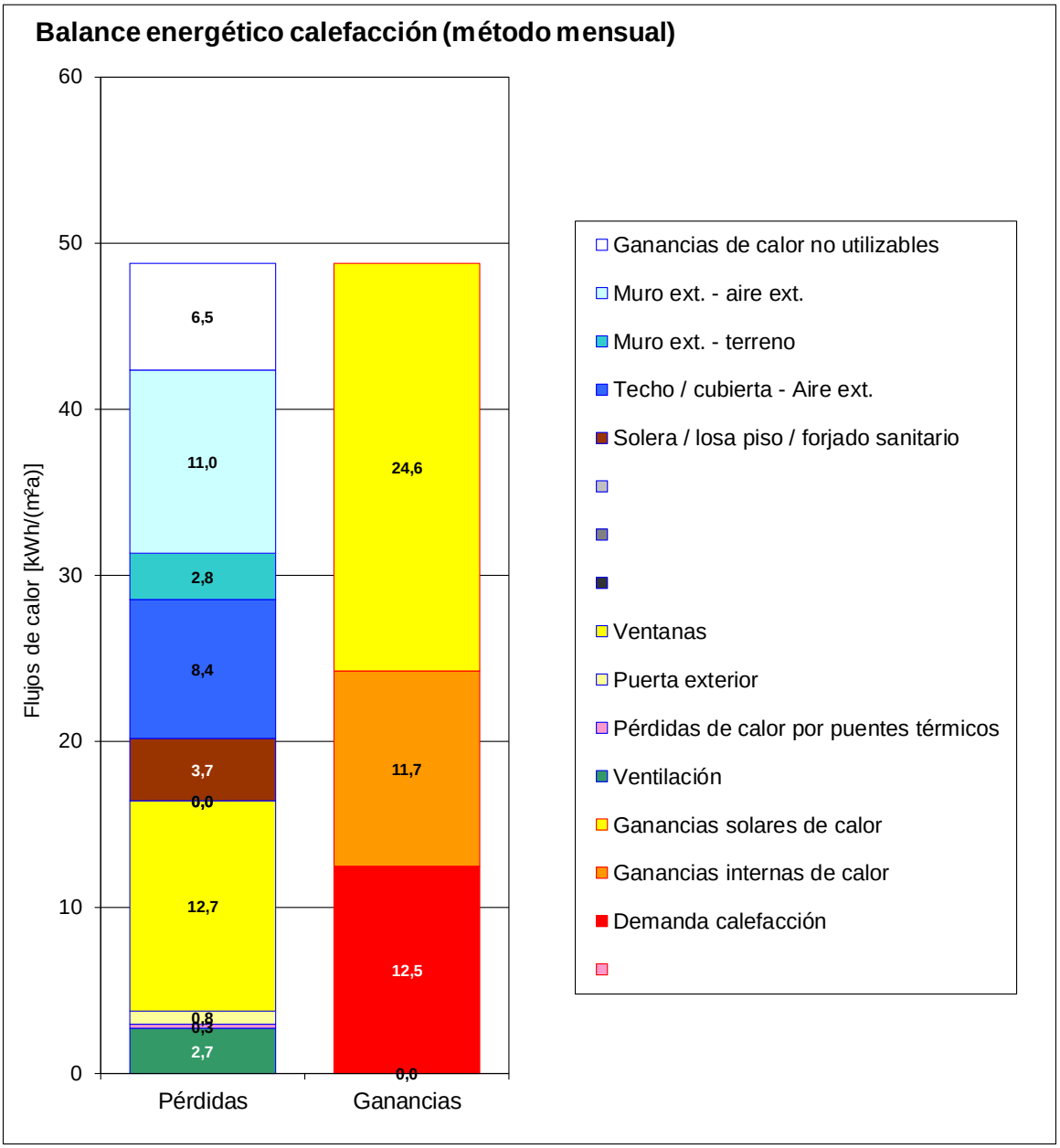
Año construcción:	2015	Temp. interior invierno [°C]:	20,0	Temp. interior verano [°C]:	25,0
Nr. de viviendas	1	Ganancias internas de calor (GIC); caso calefacción [W/m²]:	2,3	GIC caso refrig. [W/m²]:	4,5
Nr. de personas:	3,1	Capacidad específica [Wh/K por m² de SRE]:	204	Refrigeración mecánica:	x

Valores específicos del edificio con referencia a la superficie de referencia energética

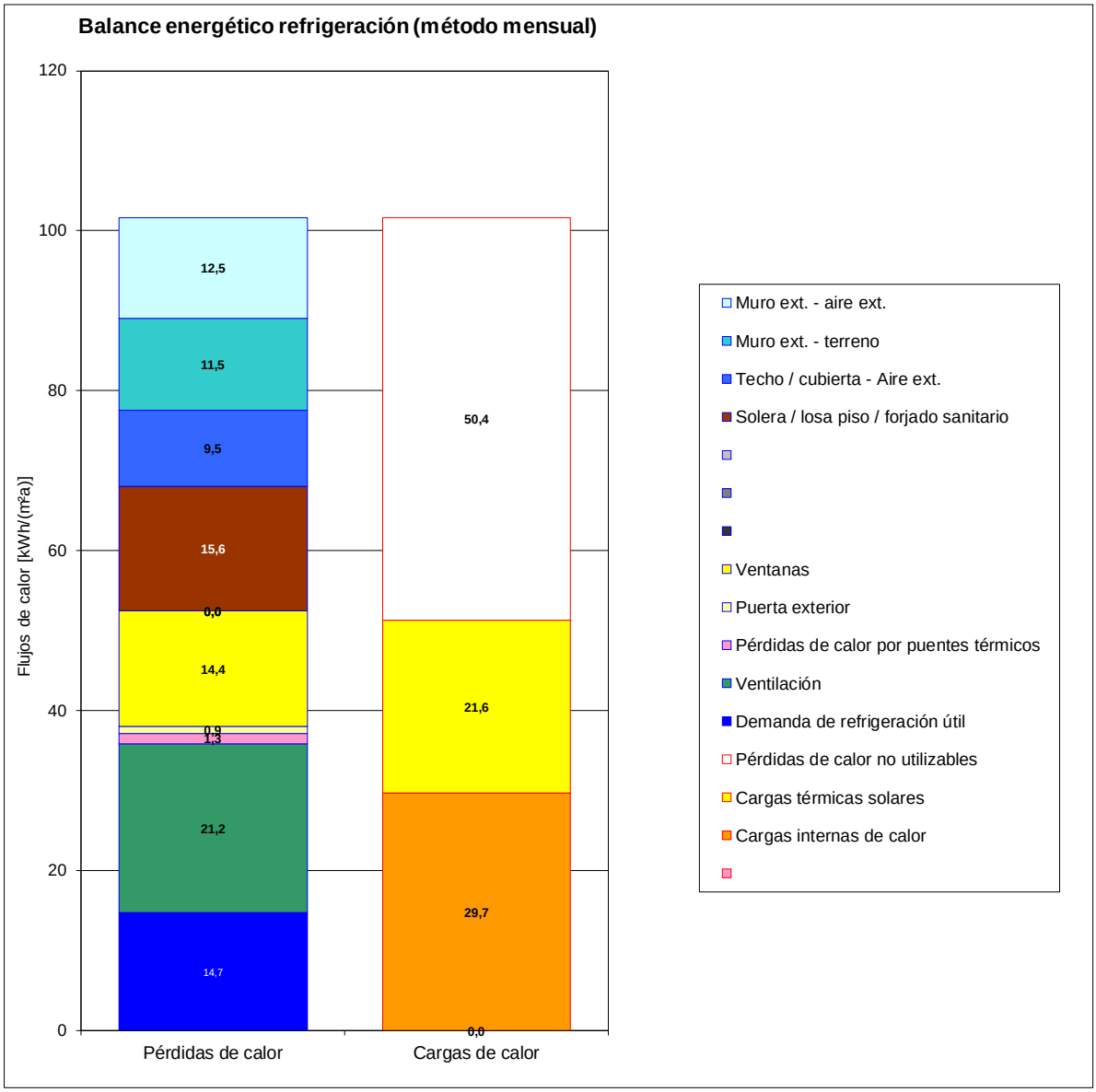
					Criterio	Criterios alternativos	¿Cumplido?[2]
	Superficie de referencia energética	m²	241,9				
Calefacción	Demanda de calefacción	kWh/(m²a)	12	≤	15	-	Sí
	Carga de calefacción	W/m²	11,7	≤	-	10	
Refrigeración	Demanda refrigeración & deshum.	kWh/(m²a)	17,3	≤	17	17	Sí
	Carga de refrigeración	W/m²	10,6	≤	-	10	
	Frecuencia de sobrecalentamiento (> 25 °C)	%	-	≤	-		-
	Frecuencia excesivamente alta humedad (> 12 g/kg)	%	0	≤	10		Sí
Hermeticidad	Resultado ensayo presión n_{50}	1/h	0,6	≤	0,6		Sí
Energía Primaria no renovable (EP)	Demanda EP	kWh/(m²a)	77	≤	100		Sí
Energía Primaria Renovable (PER)	Demanda PER	kWh/(m²a)	49	≤	-	-	-
	Generación de Energía Renovable (en relación con área de la huella del edificio proyectado)	kWh/(m²a)	0	≥	-	-	

[2] Celda vacía: Falta dato; '-': Sin requerimiento

Energy balance heating



Energy balance cooling


Balance energético refrigeración (método mensual)
Flujos de calor [kWh/(m²a)]
120
100
80
60
40
20
0
12,5
11,5
9,5
15,6
0,0
14,4
0,9
1,3
21,2
14,7
50,4
21,6
29,7
0,0
Pérdidas de calor
Cargas de calor
Muro ext. - aire ext.
Muro ext. - terreno
Techo / cubierta - Aire ext.
Solera / losa piso / forjado sanitario
Ventanas
Puerta exterior
Pérdidas de calor por puentes térmicos
Ventilación
Demanda de refrigeración útil
Pérdidas de calor no utilizables
Cargas térmicas solares
Cargas internas de calor