Project Documentation – CARABANCHEL 34

Apartment house in Madrid (Madrid), Spain

Certified Passive House
Passive House Institute
| classic | plus | premium |

1 Abstract

Source: (Lucia Gorostegui photographer)

1.1 Data of building

Year of construction/	2019	**Space heating**	**9 kWh/(m²a)**
Area	1368,50 m²		
U-value external wall 1	0.244 W/(m²K)	**Space cooling**	**7 kWh/(m²a)**
U-value external wall 2	0.273 W/(m²K)		
U-value first floor	0.207 W/(m²K)	**Primary Energy Renewable (PER)**	107 kWh/(m²a)
U-value roof	0.189 W/(m²K)	**Generation of renewable energy**	9 kWh/(m²a)
U-value window	1.08 W/(m²K)	**Non-renewable Primary Energy (PE)**	98 kWh/(m²a)
Heat recovery	82 %	**Pressure test n_{50}**	0.2 h-1
Special features	First Public dwelling block certified Passivhaus in Madrid		

1.2 Brief Description of the Project

Madrid´s Council Housing Department has developed the construction of this dwelling block located in the popular neighbourhood of Carabanchel. The building is designed by Ruiz-Larrea & Associates Architects and has obtained the Passivhaus Classic certification in sustainable building construction.

The aim of Ruiz-Larrea & Associates has been an energy efficient design, indoor air quality and high comfort standards of every housing unit. The project is developed with constructive systems conceived to achieve PassiveHaus standards (ETICS -External Thermal Insulation Composite Systems-, air insulated façade, high performance window framing…) and also minimazes heating and cooling demand by the carefully avoiding the many thermal bridges of an existing structure.

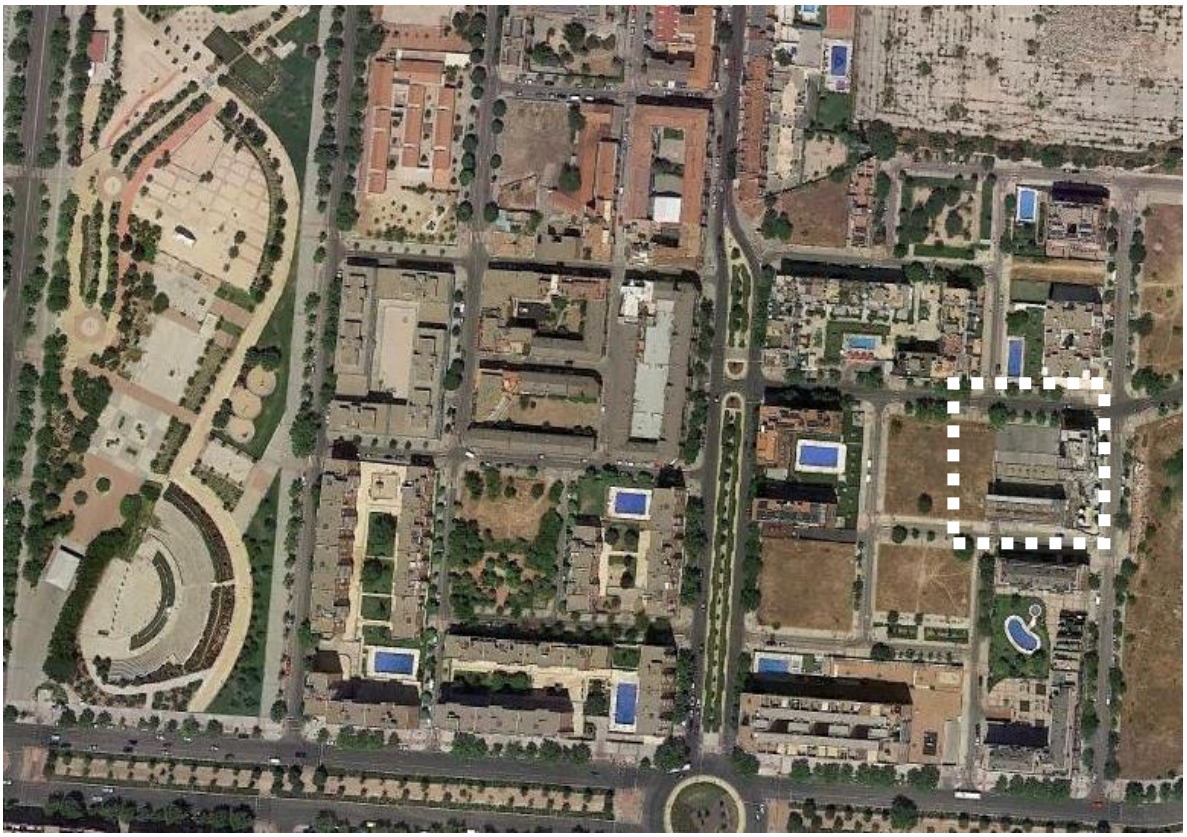
The adaptation of the structure to the standard´s requirements has led to a nearly zero-energy consuming building (NZEB) with a 60% reduction in energy demand and consumption. The main criteria to achieve the NZEB certificate are based in the so called Passivhaus construction standards.

Passivhaus is the most demanding certificate regarding comfort and energy efficiency. A Passivhaus building is basically defined as that in which the air gets heated or cooled to achieve an optimum ventilation of the indoor spaces.

The competition requirements asked for 25 dwellings of 1, 2 and 3 bedrooms and communal areas. Council´s main target with this development was to cover a lack of public housing rental.

Due to the architectural organization and layout, the air tightness tests are gained with only one thermal envelope and 5 tightness lines so one single test was carried out per storey. Thus, the reduction in number of tests to be carried out has had a positive impact on construction costs.

Besides, bioclimathic design criteria have been met as well as energy efficiency systems, eco construction standards, and indoor comfort solutions (air quality, allergen-free and VOC -free indoor spaces). These also applied to water management and consumption.



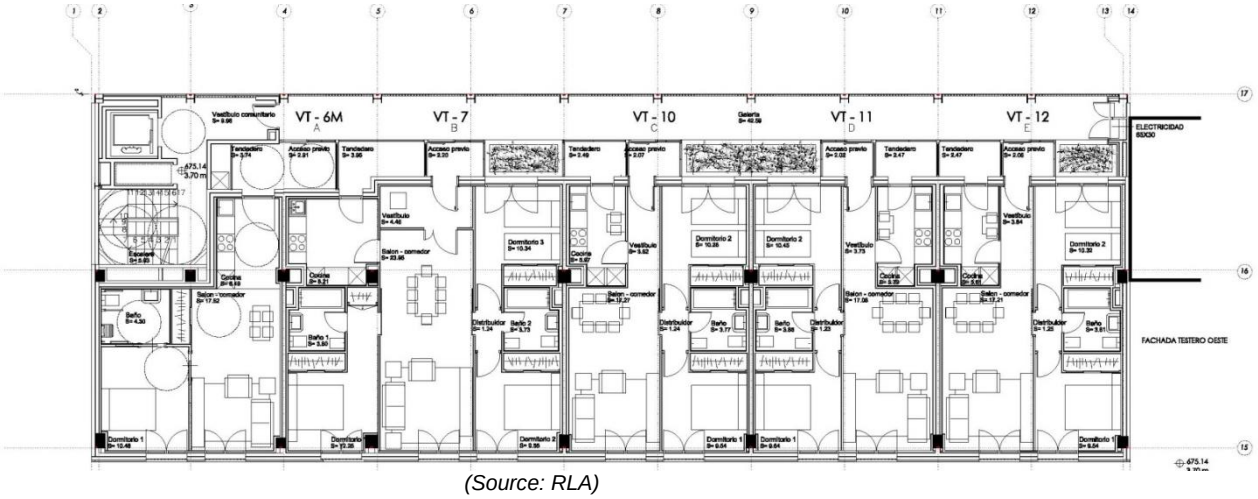
(Source: Google Earth)

House typologies

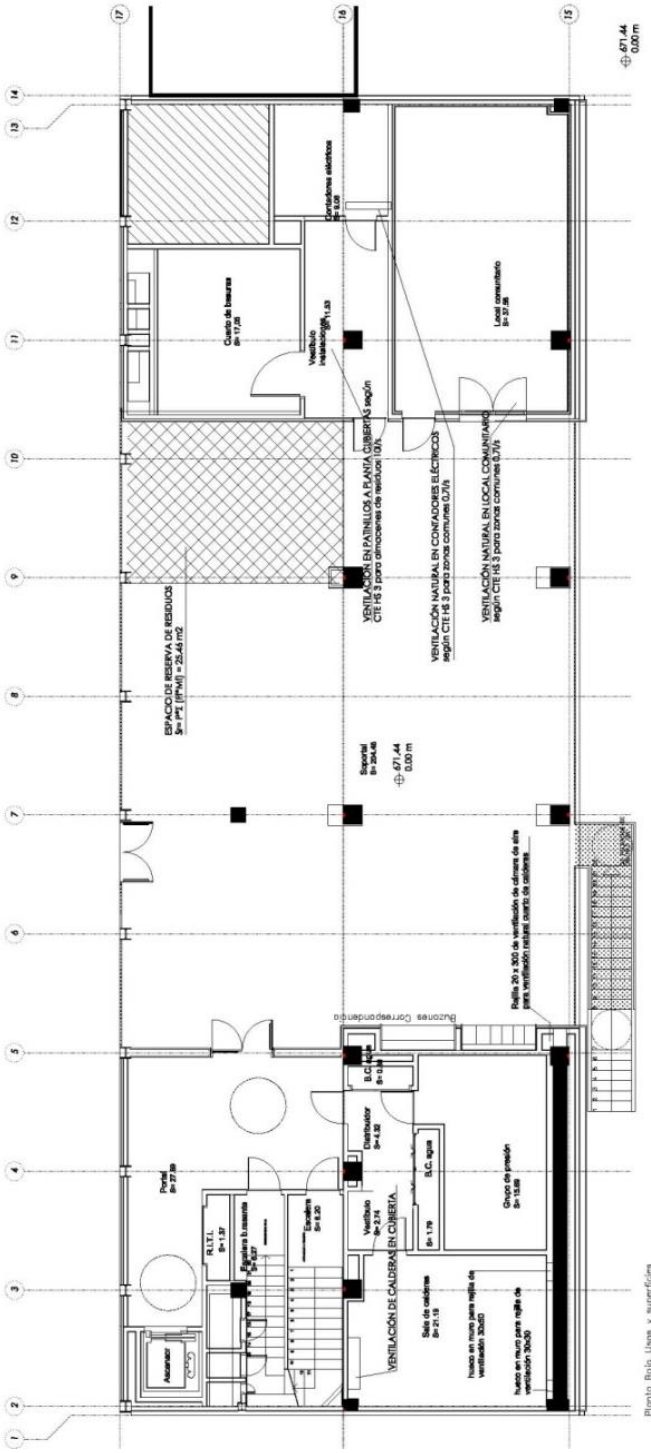
The housing block is organized around the vertical staircase and lift shaft, which link to a distribution corridor facing north. This lay out allows all units to enjoy double orientation (north-south) on their façades, therefore improving natural ventilation.

The units lay out provide a clear separation of spaces. That means, there is a day-living area where the kitchen, utility room, eating area and living rooms are located and a different
area (night-living) where bathroom and bedrooms are located staying as quiet as possible from the day-living area activities.

Facing south the window frames are vertical shaped while they turn horizontal at north façade. Parking facility was already designed in a preliminary phase and it is located in the second basement provided with a semi-automated parking system.



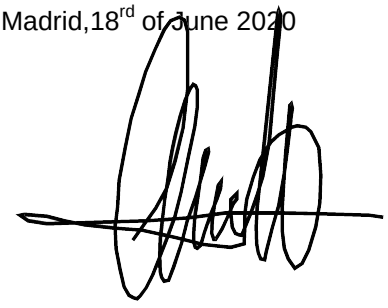
(Source: RLA)



Situation plan (Source: RLA)

1.3 Responsible project participants

Architect/ Entwurfsverfasser	RUIZ LARREA & ASOCIADOS (RLA) Architects
Implementation planning/ Ausführungsplanung	RUIZ LARREA & ASOCIADOS (RLA) Architects
Building systems/ Haustechnik	EDISON Engineering / Diego Martín Velez
Structural engineering/ Baustatik	BAC Engineering
Building physics/ Bauphysik	Antonio Gómez Gutiérrez/ Diego Martínez Vélez
Passive House project planning/ Passivhaus-Projektierung	Antonio Gómez Gutiérrez/ Diego Martínez Vélez
Construction management/ Bauleitung	MARCO INFRAESTRUCTURAS Y MEDIO AMBIENTE, S.A
Certifying body/ Zertifizierungsstelle	Nuria Díaz, VAND Arquitectura www.vandarquitectura.info
Certification ID/ Zertifizierungs ID	Project-ID (www.passivehouse-database.org) Projekt-ID (www.passivehouse-database.org) 6342
Author of project documentation / Verfasser der Gebäude-Dokumentation	Antonio Gómez Gutiérrez RLA
Date, Signature/ Datum, Unterschrift	Madrid,18rd of June 2020



2 Pictures of the project

2.1 Exterior photographs

Southt view .Proteccion Solar up *Source: (Lucia Gorostegui photographer)*

Southt view .Proteccion Solar down. *Source: (Lucia Gorostegui photographer)*

North view *Source: (Lucia Gorostegui photographer)*

Detail North-West view *Source: (Lucia Gorostegui photographer)*

2.2 Photographs of the inside

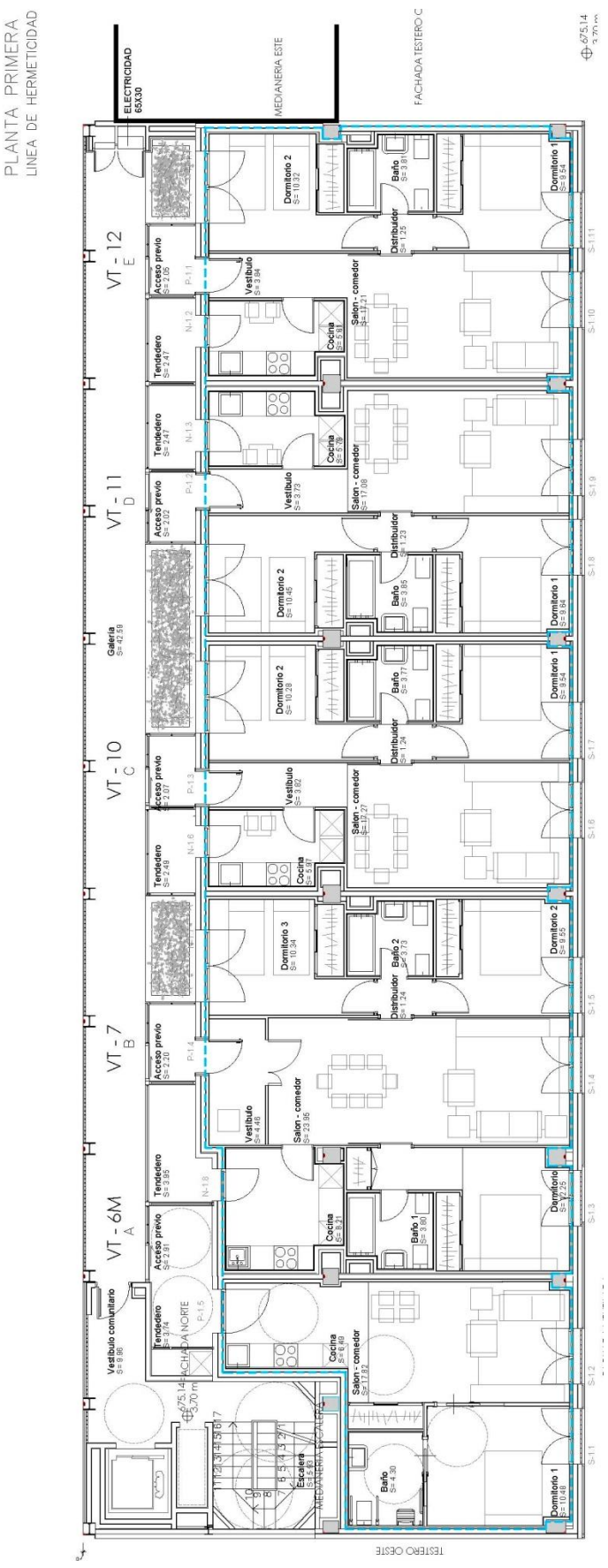
Inside view *Source: (Lucia Gorostegui photographer)*

External Distribuidor view *Source: (Lucia Gorostegui photographer)*

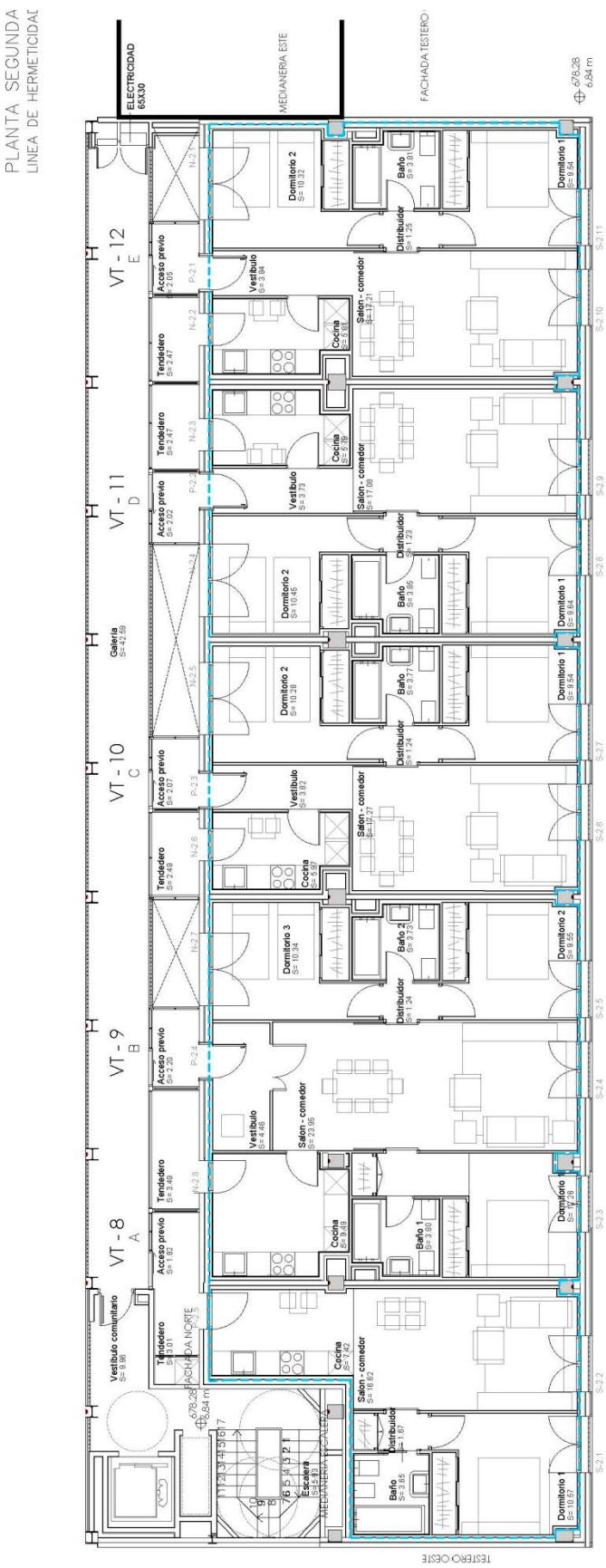
Main room inside view *Source: (Lucia Gorostegui photographer)*

3 Plans

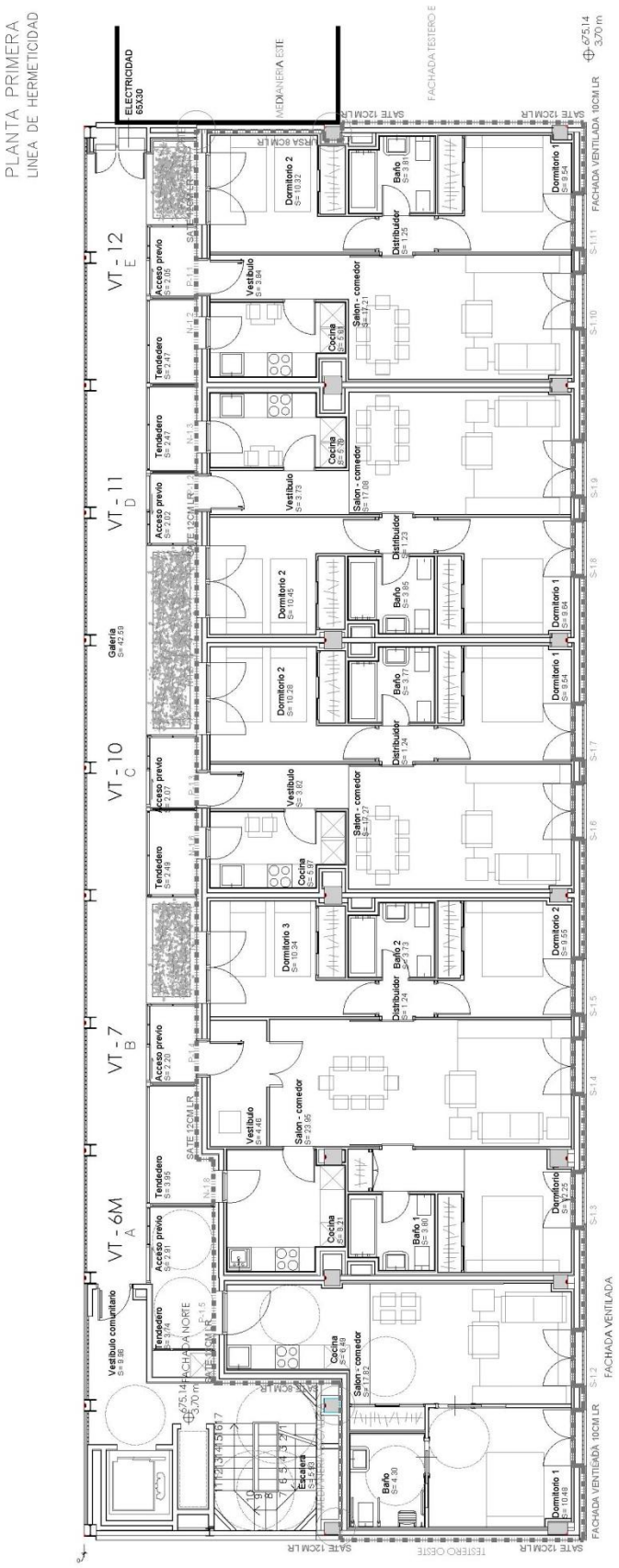
Airtightness envelope (blue line) ,thermal envelope (grey line) and TFA are shown in the following plans:



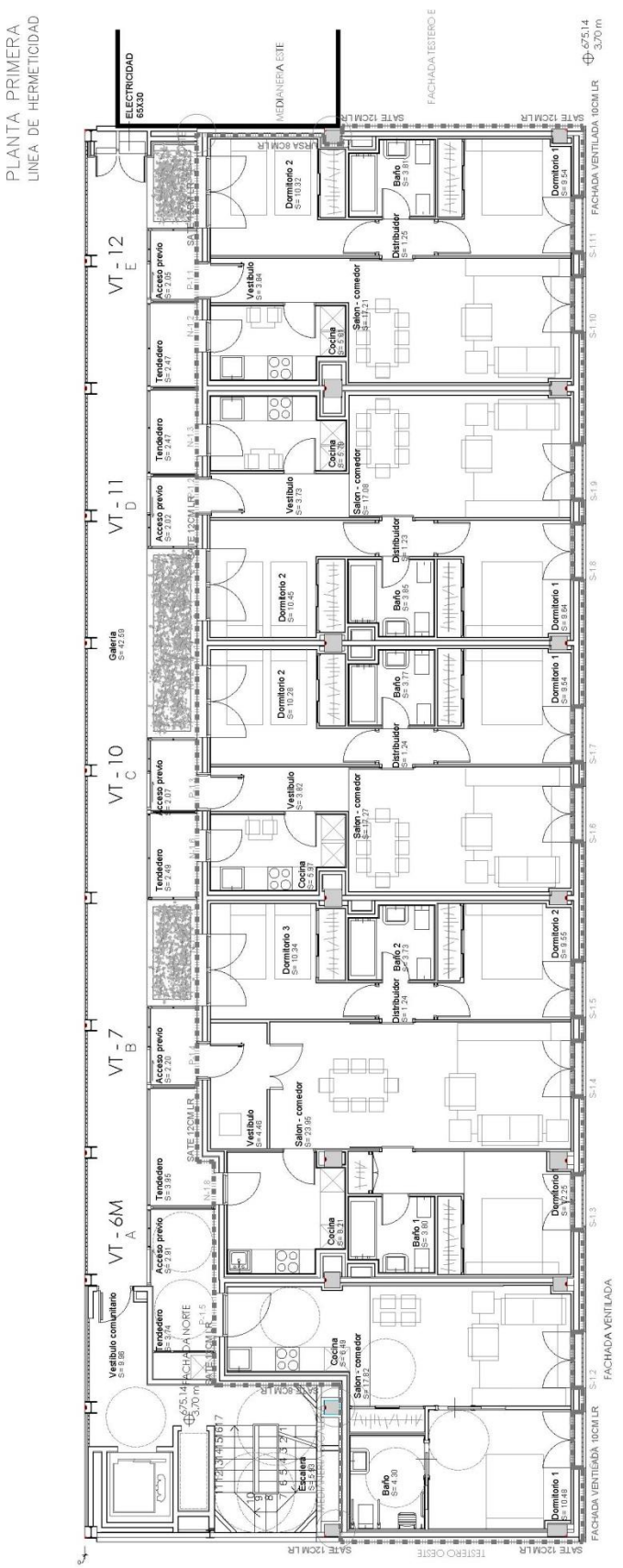
First floor (Source: RLA)



2nd,3th,4th and 5th floor (Source: RLA)

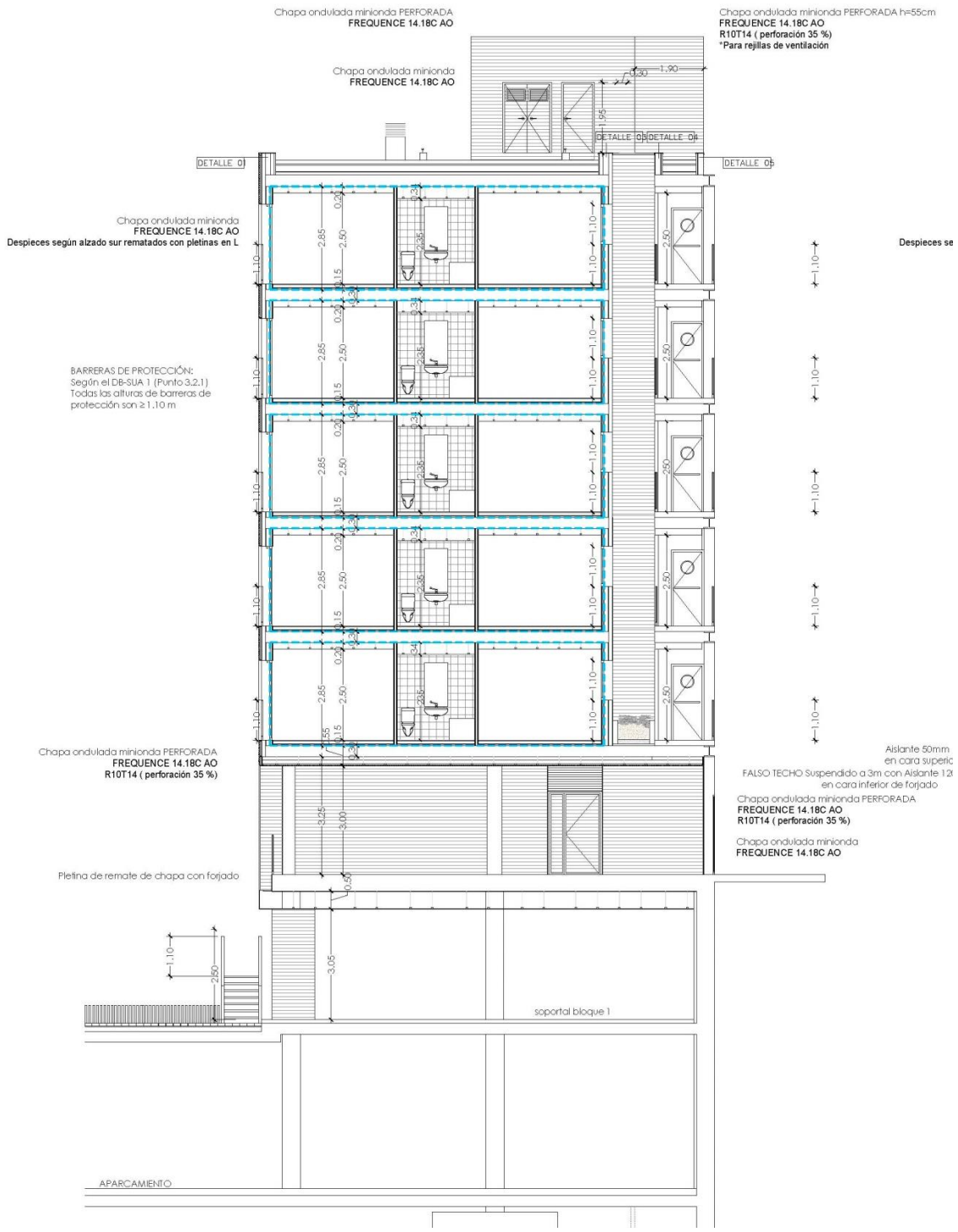


First floor (Source: RLA)



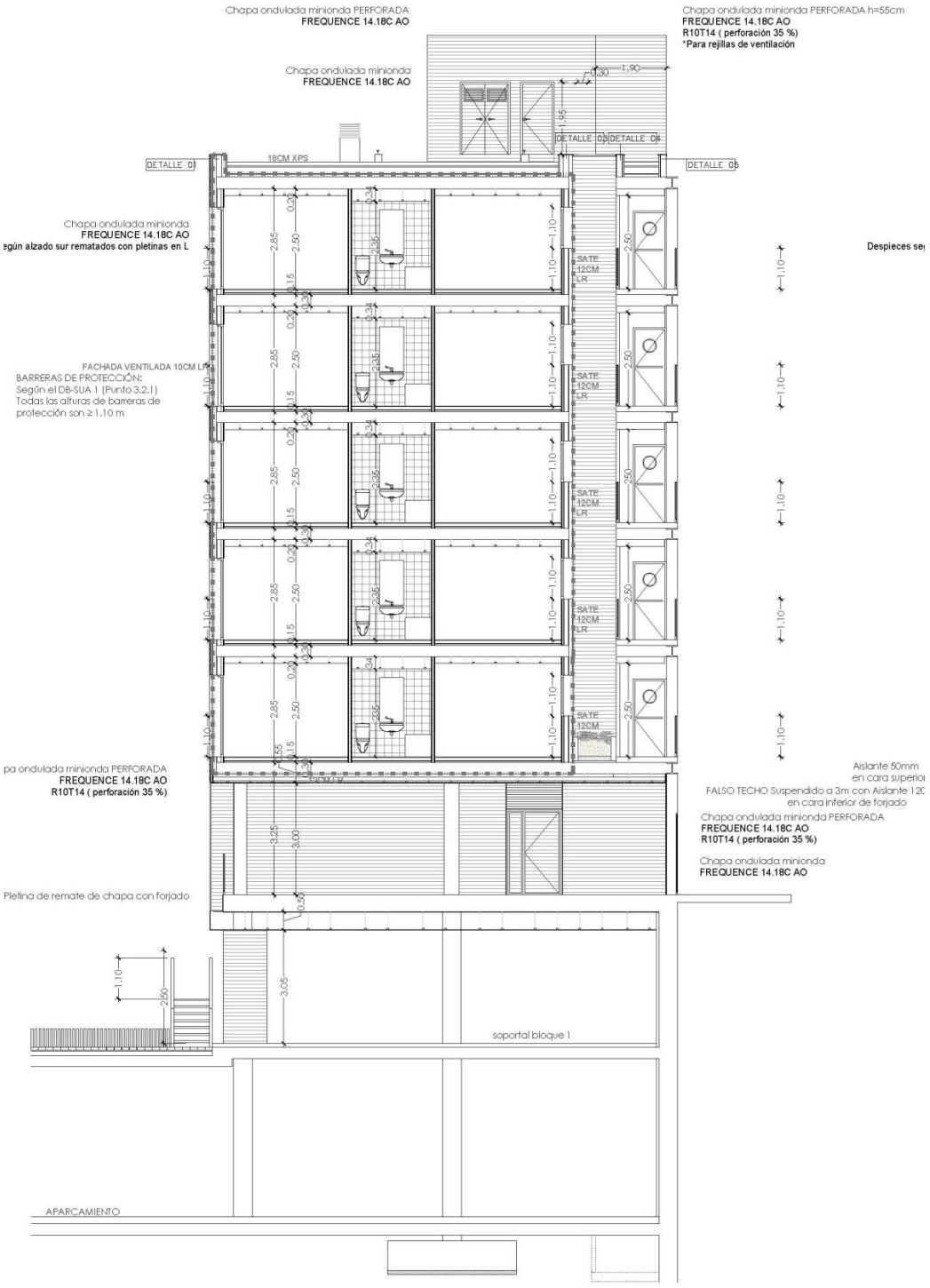
2nd,3th,4th and 5th floor (Source: RLA)

Sections:



(Source: RLA)

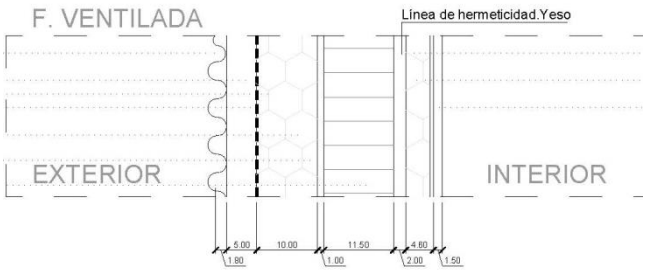
Sections:



(Source: RLA)

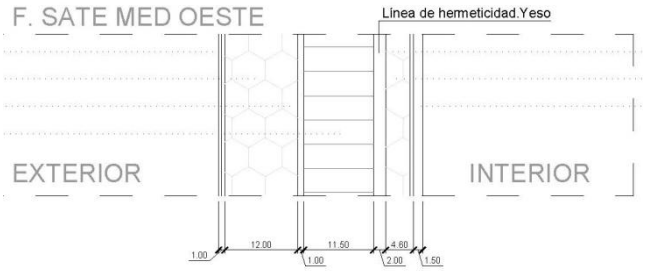
4 Technical details of the construction

4.1 Exterior walls



[EXT] = [OUTDOOR]
Wavy Sheet
Air Chamber
Substructure steel tube 50.50 galvanized
LR Insulation (λ=0.035 W/mK) 100 mm with Ejotherm H2 type thermal bridge rupture fixations with a ψ = 0.001 W /K
Waterproof Mortar 10mm
Brick stonework 120 mm
Gypsum plasterboard 20 mm
Insulation (λ=0.035 W/mK) 50 mm
Panel 50 mm
Gypsum panel 15 mm

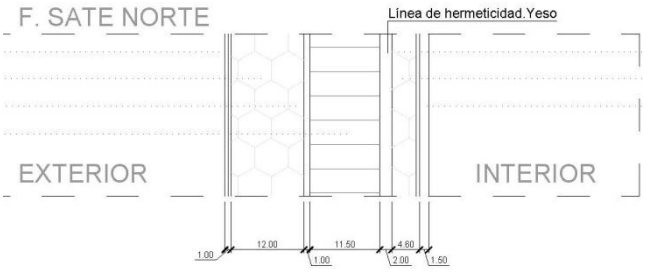
[INT] = [INTERIOR]
U-value = 0.273 W/(m²K)



[EXT] = [OUTDOOR]

Plasterboard 10 mm
LR Insulation (λ=0.035 W/mK) 120 mm with Ejotherm H2 type thermal bridge rupture fixations with a ψ = 0.001 W /K
Waterproof Mortar 10mm
Brick stonework 120 mm
Gypsum 20 mm
Insulation (λ=0.035 W/mK) 50 mm
Panel 50 mm
Gypsum plasterboard 15 mm

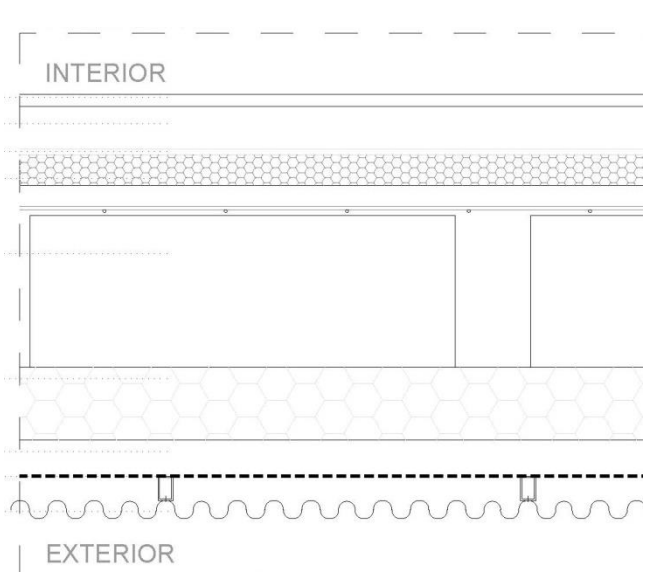
[INT] = [INTERIOR]
U-value = 0.273 W/(m²K)



[EXT] = [OUTDOOR]

Plasterboard 10 mm
Insulation (λ=0.035 W/mK) 120 mm with Ejotherm H2 type thermal bridge rupture fixations with a ψ= 0.001 W /K
Waterproof Mortar 10mm
Brick stonework 120 mm
Gypsum 20 mm
Insulation (λ=0.035 W/mK) 50 mm
Panel 50 mm
Gypsum plasterboard 15 mm
[INT] = [INTERIOR]
U-value = 0.273 W/(m²K)

4.2 Basement 1st floor



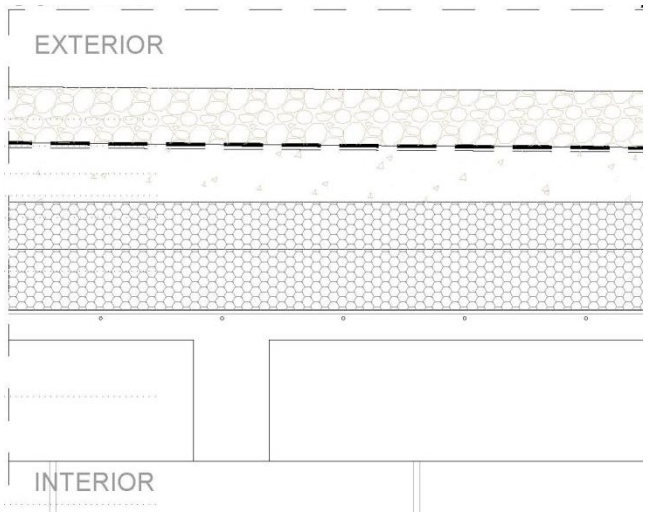
[EXT] = [OUTDOOR]

Ceramic tile
Lightweight concrete 80mm
XPS Insulation (λ=0.035 W/mK) 50 mm
Concrete 200+50 mm
LR Insulation (λ=0.035 W/mK) 120 mm
Air chamber
Wavy Sheet False ceiling
[INT] = [INTERIOR]

U-value = 0.207 /(m^2K)

XPS thermal insulation with a half-wood machined edge, with a λ = 0.036 W / mK, and consisting of 2 plywood sheets with a thickness of 100 and 80 mm.

4.3 Flat roof



[EXT] = [OUTDOOR]

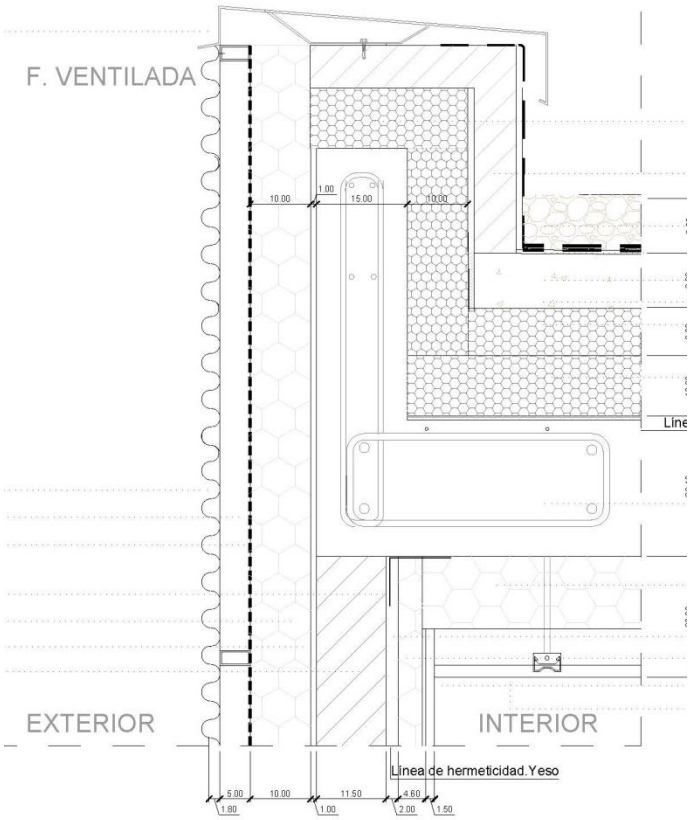
Lightweight concrete 100mm
XPS Insulation (λ=0.036 W/mK) 100+80 mm
Concrete 200+50

[INT] = [INTERIOR]

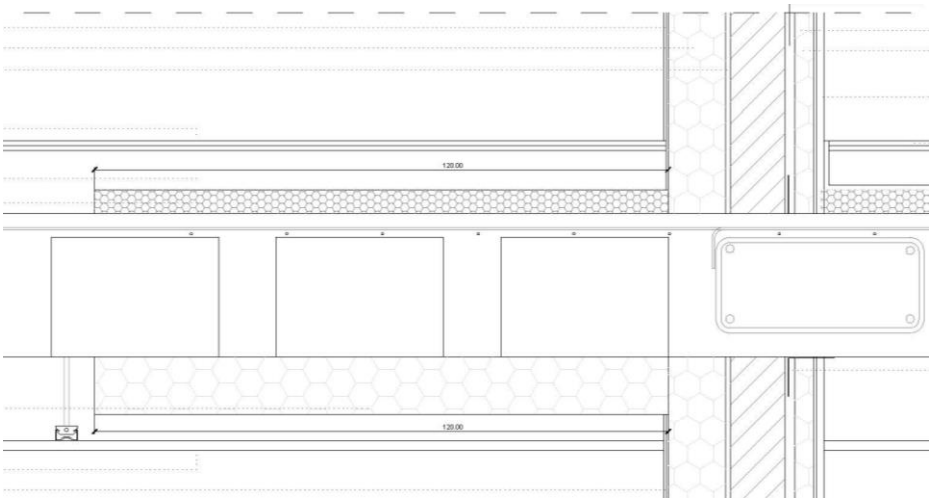
U-value = 0.189 W/(m^2K

4.4 Connection details

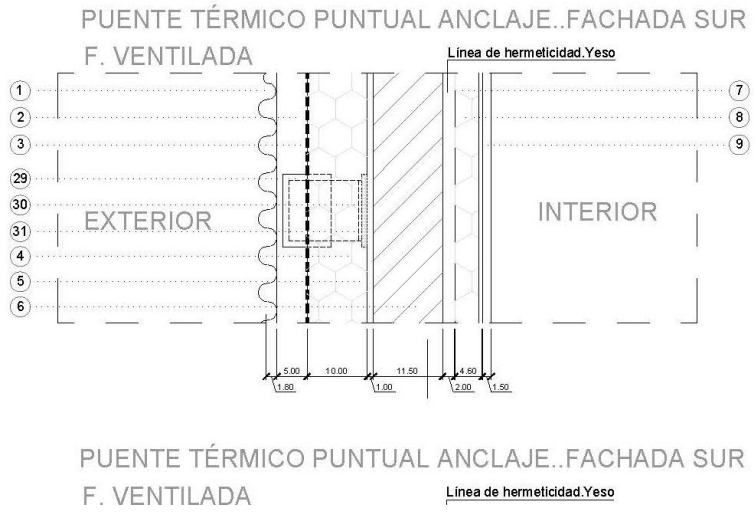
External wall-Flat roof (type 1)



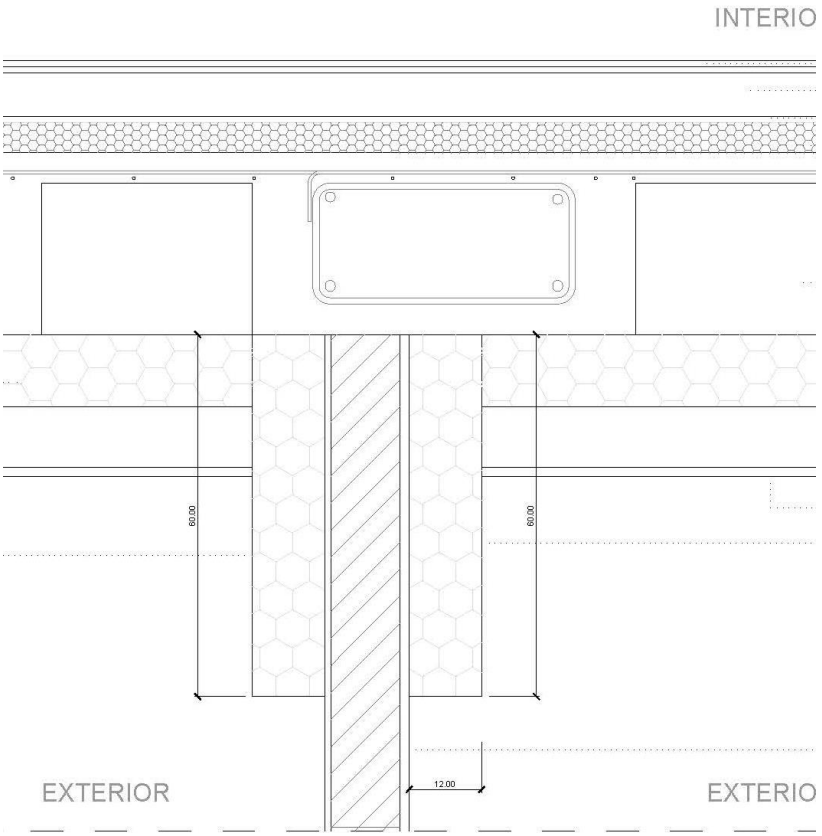
Outside floor slab- floor slab



External wall-Anchor Ventilated Facade



Connected External wall- First floor.



4.5 Windows

4.5.1 Window Frame

WERU AFINO, PVC-frame with reinforcement inside the blind-frame. Pane thickness: 48 mm rebate depth: 19 mm, spacer: TGI-Spacer P.
Certified Component warm ,temperate climatede Pvc de WERU AFINO D U w-value = 1.08 W/(m2K)

4.5.2 Glass

Type	U-Value	g-value
4/12Ar/4/12Ar/4	0.7W/m^2K	0.50
3+3/12Ar/4/12Ar/3+3	0.7W/m^2K	0.50

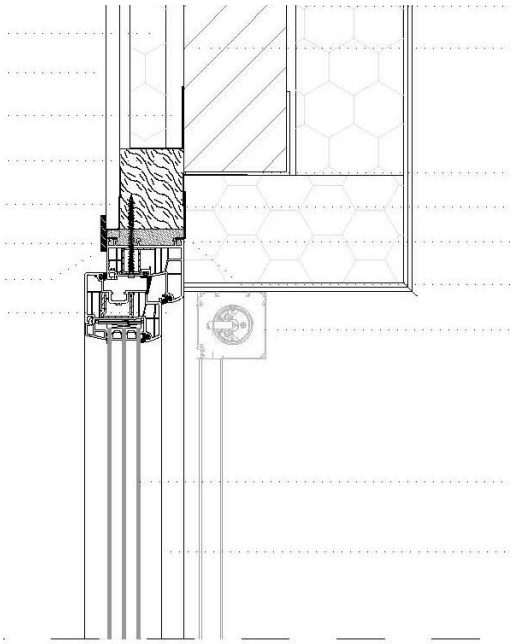
4.5.3 Shadow elements

External blinds were incorporated to provide solar protection during the summer months Motorized system of roller blinds in drawer with electric drive with lateral zipper guiding (wind resistant). In the south orientation, the fabric is of the blackout trend light white type: transmission 76% / absorption 12% G tot 0.02 / opacity 100 in RAL 9010 color; and in the north orientation it is of the trend light anthracite type: transmission 7% / absorption 93% G tot 0.05 / opacity 100 in color RAL Anthracite 7016

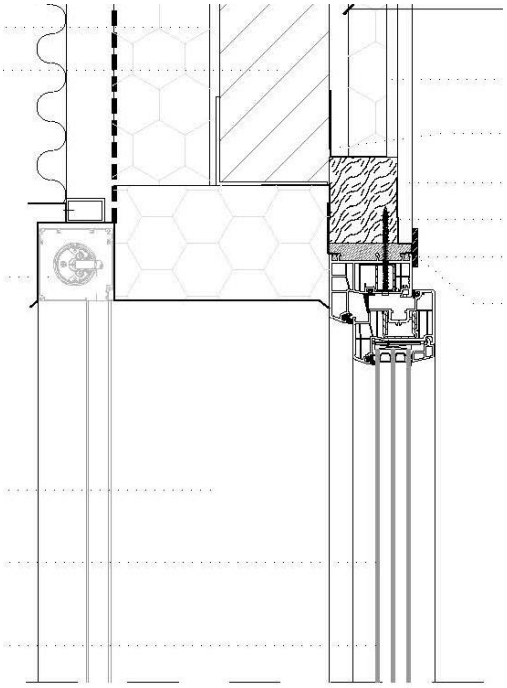
4.5.4 Window installation detail

Top installation

SATE Facade

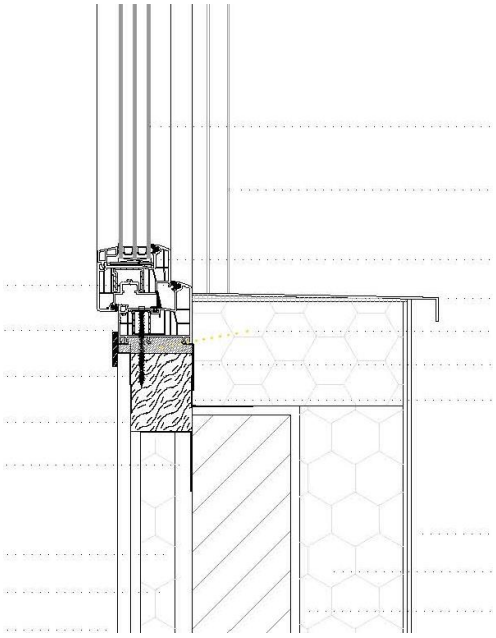


Ventilated Facade

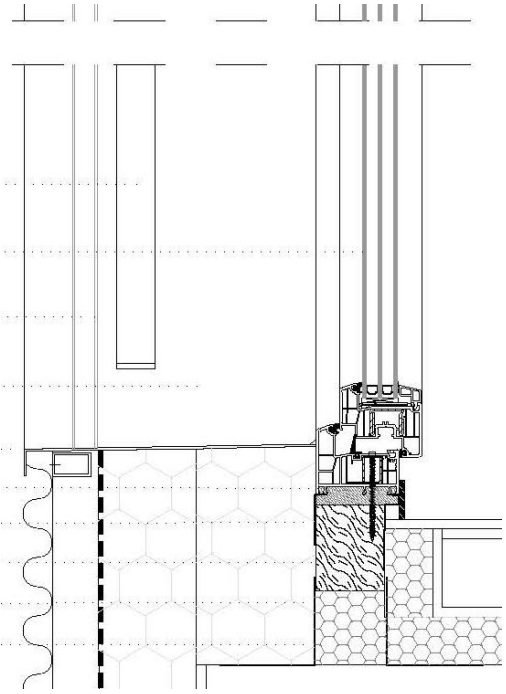


Bottom installation

SATE Facade

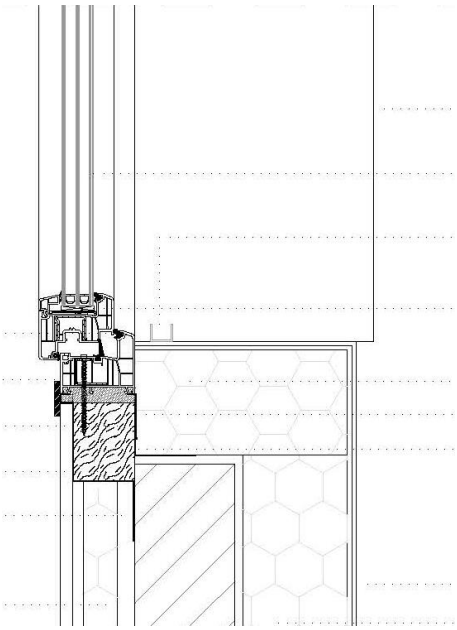


Ventilated Facade

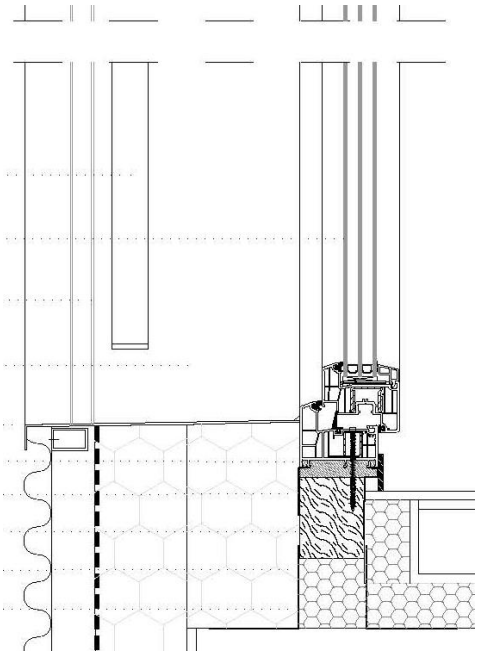


Lateral installation

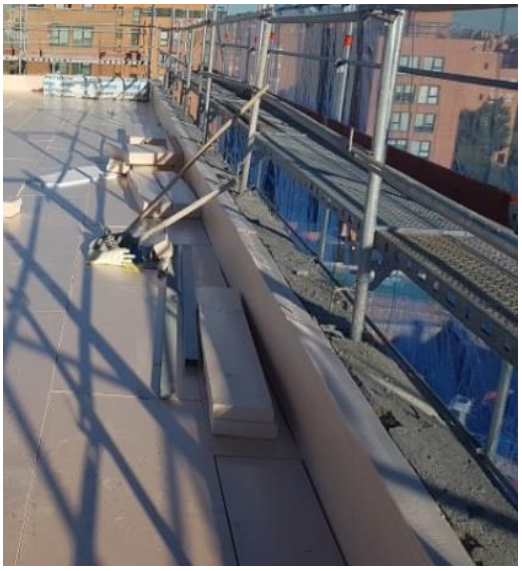
SATE Facade



Ventilated Facade



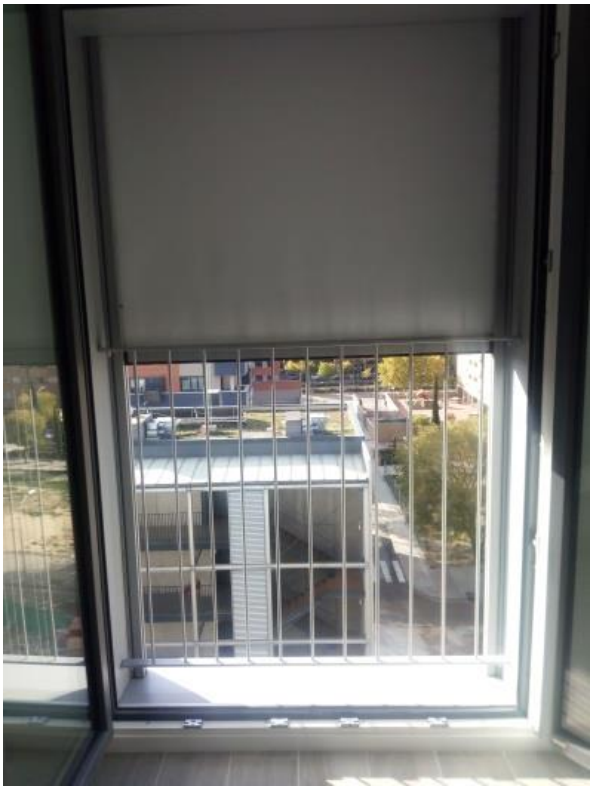
4.6 Construction phase

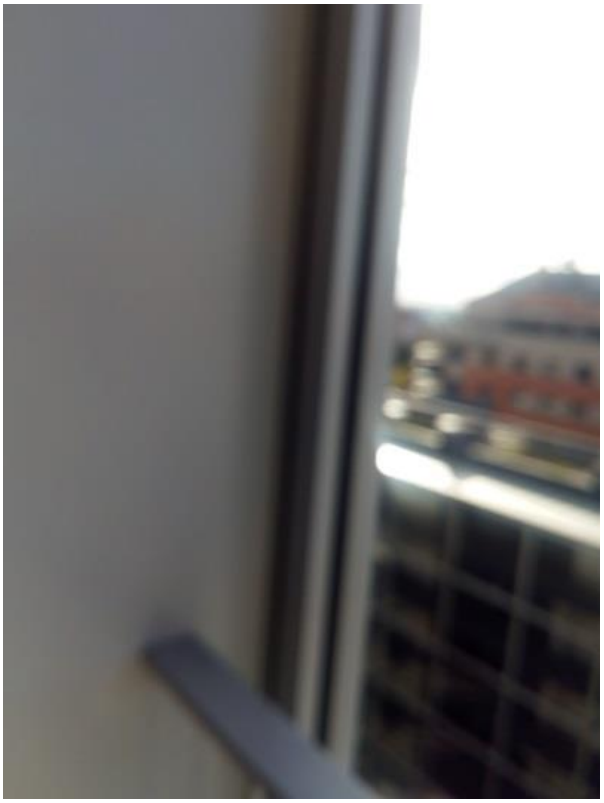


Roof insulation (Source: RLA)

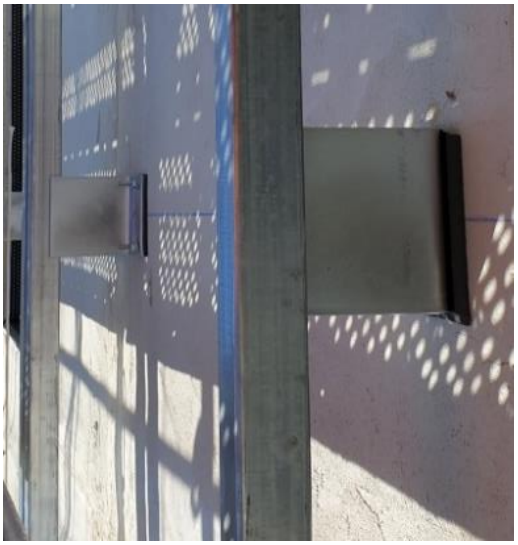
First Floor under and top insulation installation (Source: RLA)

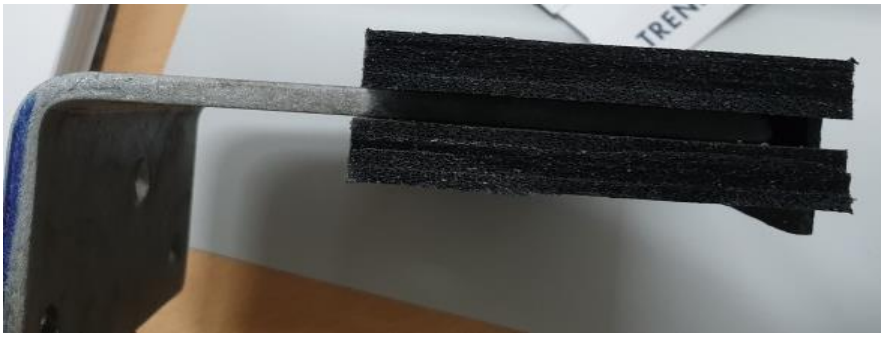
Window installation (Source: RLA)






Shadow elements installation (Source: RLA)

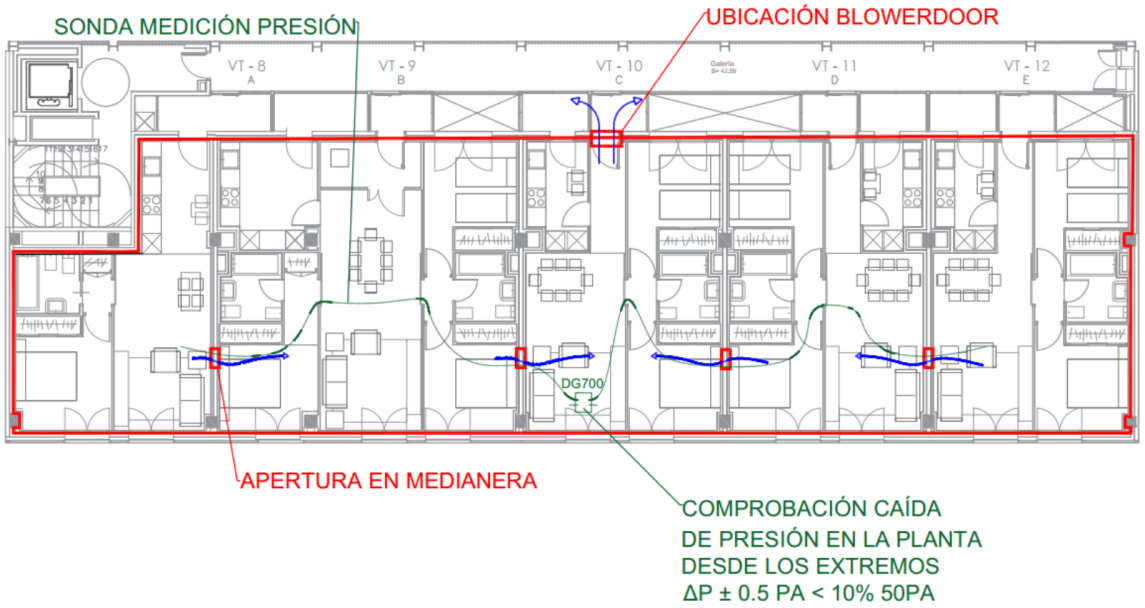




Ventilated Facade installation (Source: RLA)

5 Airtightness

5 airtight lines with a single Test per floor communicating with each of the homes present per floor. This reduces the number of Test .All this with the aim to achieve optimal costs of construction



Hermeticidad – planificación y ejecución

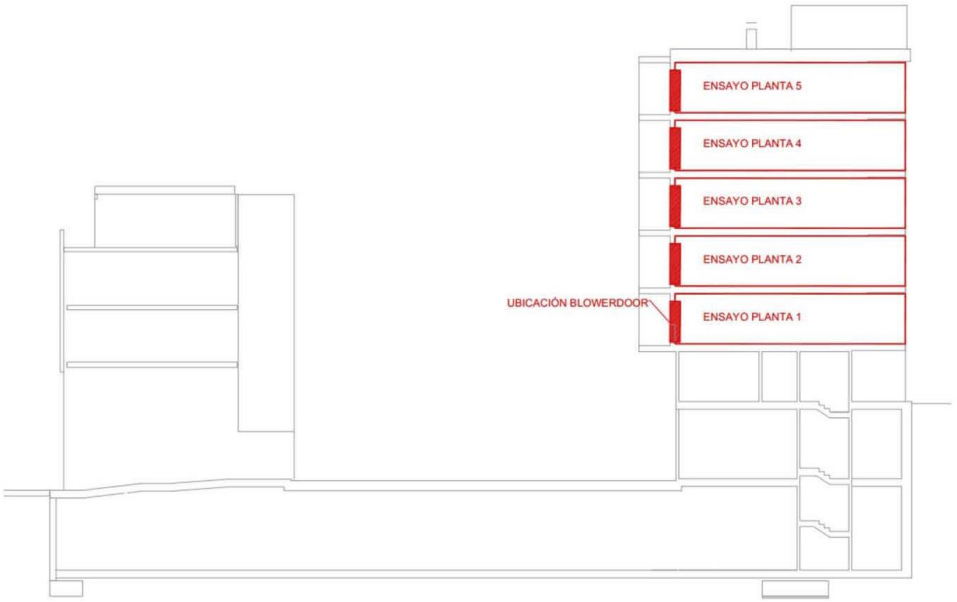


Ilustración 2 Planificación de ensayos BlowerDoor / Hermeticidad

5.1 BlowerDoor test results

Planta 1 – 5 viviendas			
	Despresurización	Presurización	Media
Volumen de aire filtrado. V_{50}	200 m³/h	176 m³/h	188 m³/h
Tasa de renovación. n_{50}	0.29 1/h	0.26 1/h	**0.28 1/h**
Coeficiente de flujo de aire. C_{env}	8.8 m³/(h·Pa^n)	11.1 m³/(h·Pa^n)	
Coeficiente de aire filtrado. CL	8.6 m³/(h·Pa^n)	10.8 m³/(h·Pa^n)	
Exponente de flujo de aire. n	0.805	0.713	
Límite de confianza	0.99923	0.99742	

Planta 2 – 5 viviendas			
	Despresurización	Presurización	Media
Volumen de aire filtrado. V_{50}	172 m³/h	162 m³/h	167 m³/h
Tasa de renovación. n_{50}	0.25 1/h	0.24 1/h	**0.25 1/h**
Coeficiente de flujo de aire. C_{env}	12.6 m³/(h·Pa^n)	10.2 m³/(h·Pa^n)	
Coeficiente de aire filtrado. CL	12.2 m³/(h·Pa^n)	10.0 m³/(h·Pa^n)	
Exponente de flujo de aire. n	0.676	0.713	
Límite de confianza	0.99314	0.99250	

Planta 3 – 5 viviendas			
	Despresurización	Presurización	Media
Volumen de aire filtrado. V_{50}	179 m³/h	173 m³/h	176 m³/h
Tasa de renovación. n_{50}	0.27 1/h	0.26 1/h	**0.26 1/h**
Coeficiente de flujo de aire. C_{env}	10.9 m³/(h·Pa^n)	17.6 m³/(h·Pa^n)	
Coeficiente de aire filtrado. CL	10.7 m³/(h·Pa^n)	16.9 m³/(h·Pa^n)	
Exponente de flujo de aire. n	0.721	0.593	
Límite de confianza	0.99319	0.99550	

Planta 4 – 5 viviendas			
	Despresurización	Presurización	Media
Volumen de aire filtrado. V_{50}	170 m³/h	154 m³/h	162 m³/h
Tasa de renovación. n_{50}	0.25 1/h	0.24 1/h	**0.24 1/h**
Coeficiente de flujo de aire. C_{env}	10.1 m³/(h·Pa^n)	6.2 m³/(h·Pa^n)	
Coeficiente de aire filtrado. CL	9.8 m³/(h·Pa^n)	6.1 m³/(h·Pa^n)	
Exponente de flujo de aire. n	0.729	0.825	
Límite de confianza	0.99354	0.99468	

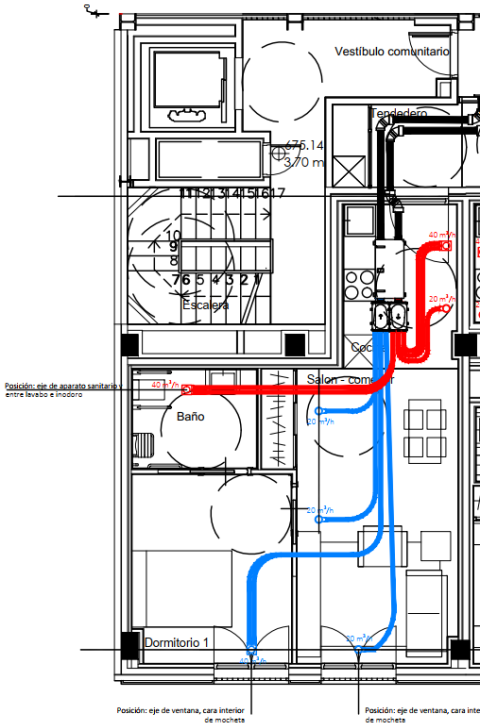
Planta 1 – 5 viviendas			
	Despresurización	Presurización	Media
Volumen de aire filtrado. V_{50}	129 m³/h	122 m³/h	125 m³/h
Tasa de renovación. n_{50}	0.19 1/h	0.18 1/h	**0.18 1/h**
Coeficiente de flujo de aire. C_{env}	7.3 m³/(h·Pa^n)	9.4 m³/(h·Pa^n)	
Coeficiente de aire filtrado. CL	7.2 m³/(h·Pa^n)	9.1 m³/(h·Pa^n)	
Exponente de flujo de aire. n	0.739	0.663	
Límite de confianza	0.99405	0.99106	

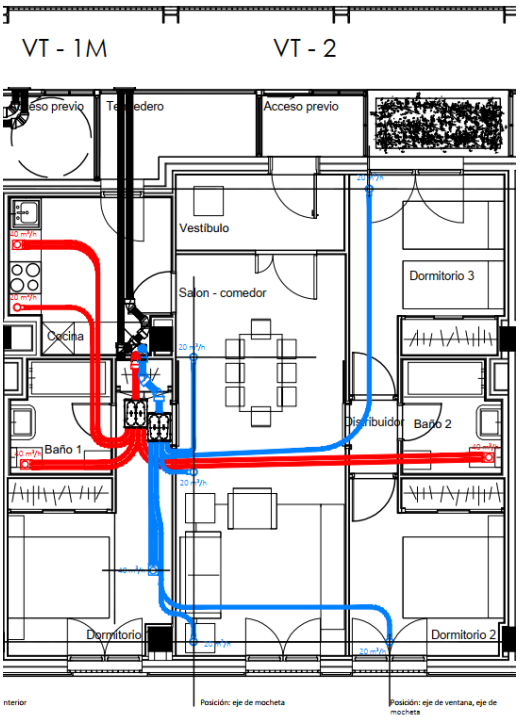
The test has been carried out by: Hobeki

6 Ventilation

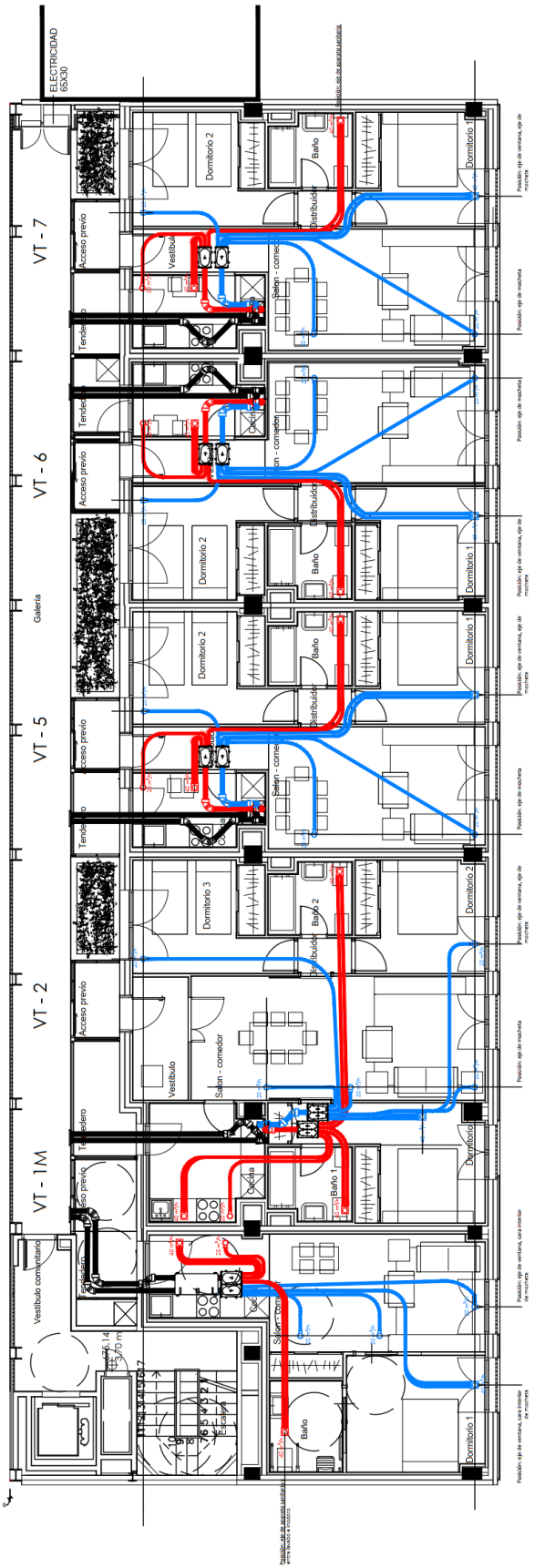
6.1 Ventilation planning

or comfort ventilation with high efficiency heat recovery, 21 Zehnder Comfoair 180 units and 4 Zehnder Comfoair 200 units have been used. The installation has been carried out vertically, integrating into kitchen furniture, with a flow range between 90-145 m3/h with F7 filters on intake and G4 on equipment return. In this way, fresh air is obtained that favors well-being, maximizes comfort, energy saving and the absence of mold and bacteria. The equipment with Passivhaus component certificate, obtain a heat recovery with an efficiency of 82% (>75%) and an electrical consumption of 0.27 W/h/m3.





Ventilation 1 D (Source: RLA) Ventilation 3 D (Source: RLA)



First floor (Source: RLA)

6.2 Construction phase

(Source: RLA)

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
90-145 m^3/h	**0.30 /h**	**82 %**	**80.7 %**	**0.27 Wh/m^3**

Ventilation unit (Source: RLA)

7 Building Services

7.1 Heating/cooling

Energy-efficient heating and cooling air conditioning system consisting of an outdoor unit located on the roof and a Split-type indoor unit in the living room of the dwellings with a capacity of 3.5 kW of cooling and 3.7 kW of power of heating,. Temperature control is carried out by means of a thermostat located in the main room. This system provides a high level of comfort with a minimum noise level, avoiding the aesthetic impact of air conditioning equipment. In heating, PHI recommends having an auxiliary heating supply and an electric heated towel rail with a power of 750 w is installed in bathrooms

7.2 Domestic hot water

Centralized production of ACS outside of the thermal envelope ,with condensing boiler , 60kW class6 P= 67 Kw, Vaillant , support with renewable energy with a coil exchanger and two 1000l tanks Thermal energy panels are installed to fulfill the requirements of building standards.8 solar panels have been installed in two rows, with an individual capacity area of 2,51 m2 and a 9kW heat dissipater per row. It is backed up by condensating boiler , with a coil exchanger and two 1000l tanks

Solar panels, tanks and Boiler (Source:RLA)

8 PHPP Results

Casa Pasiva Comprobación

Edificio:	CARABANCHEL 34		
Calle:	AVD DEL EURO, 49		
CP / Ciudad:	28054	MADRID	
Provincia/País:	MADRID	ESPAÑA	
Tipo de edificio:	RESIDENCIAL EN BLOQUE		
Datos climáticos:	ES0001b-Madrid		
Zona climática:	4: Cálida-templada	Altitud de la localización:	669 m
Propietario / cliente:	EMVS		
Calle:	PALOS DE LA FRONTERA,13		
CP / Ciudad:	28012	MADRID	
Provincia/País:	MADRID	ES-España	

Arquitectura:	RUIZ LARREA & ASOCIADOS		
Calle:	CLAUDIO COELLO, 43, ESCALERA EXT 2º		
CP / Ciudad:	28001	MADRID	
Provincia/País:	MADRID	ESPAÑA	
Consult. energética:	DIEGO MARTINEZ VÉLEZ - ANTONIO GOMEZ		
Calle:	CARDENAL SEGURA, 23, 2D		
CP / Ciudad:	9003	BURGOS	
Provincia/País:	BURGOS	ESPAÑA	

Ingeniería:	DIEGO MARTINEZ VELEZ		
Calle:	CARDENAL SEGURA, 23, 2D		
CP / Ciudad:	9003	BURGOS	
Provincia/País:	BURGOS	ES-España	
Certificación:	VAND ARQUITECTURA		
Calle:	FINISTERRE, 8, PLANTA BAJA		
CP / Ciudad:	28029		
Provincia/País:	MADRID	ES-España	

Año construcción:	2019	Temp. interior invierno [°C]:	20,0	Temp. interior verano [°C]:	25,0
Nr. de viviendas:	25	Ganancias internas de calor (GIC); caso calefacción [W/m²]:	3,0	GIC caso refrig. [W/m²]:	3,0
Nr. de personas:	38,5	Capacidad específica [Wh/K por m² de SRE]:	140	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	1368,5					
Calefacción	Demanda de calefacción	kWh/(m²a)	9	≤		15	-	Sí
	Carga de calefacción	W/m²	8	≤		-	10	
Refrigeración	Demanda refrigeración & deshum.	kWh/(m²a)	7	≤		15	15	Sí
	Carga de refrigeración	W/m²	6	≤		-	11	
	Frecuencia de sobrecalentamiento (> 25 °C)	%	-	≤		-		-
	Frecuencia excesivamente alta humedad (> 12 g/kg)	%	0	≤		10		Sí
Hermeticidad	Resultado ensayo presión n_{50}	1/h	0,2	≤		0,6		Sí
Energía Primaria no renovable (EP)	Demanda EP	kWh/(m²a)	98	≤		100		Sí
Energía Primaria Renovable (PER)	Demanda PER	kWh/(m²a)	107	≤		-	-	-
	Generación de Energía Renovable (en relación con área de la huella del edificio proyectado)	kWh/(m²a)	9	≥		-	-	

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

Confirmo 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.

¿Casa Pasiva Classic? Sí

Función:	Nombre:	Apellido:	Firma:
2-Certificador	Nuria	Díaz Antón	

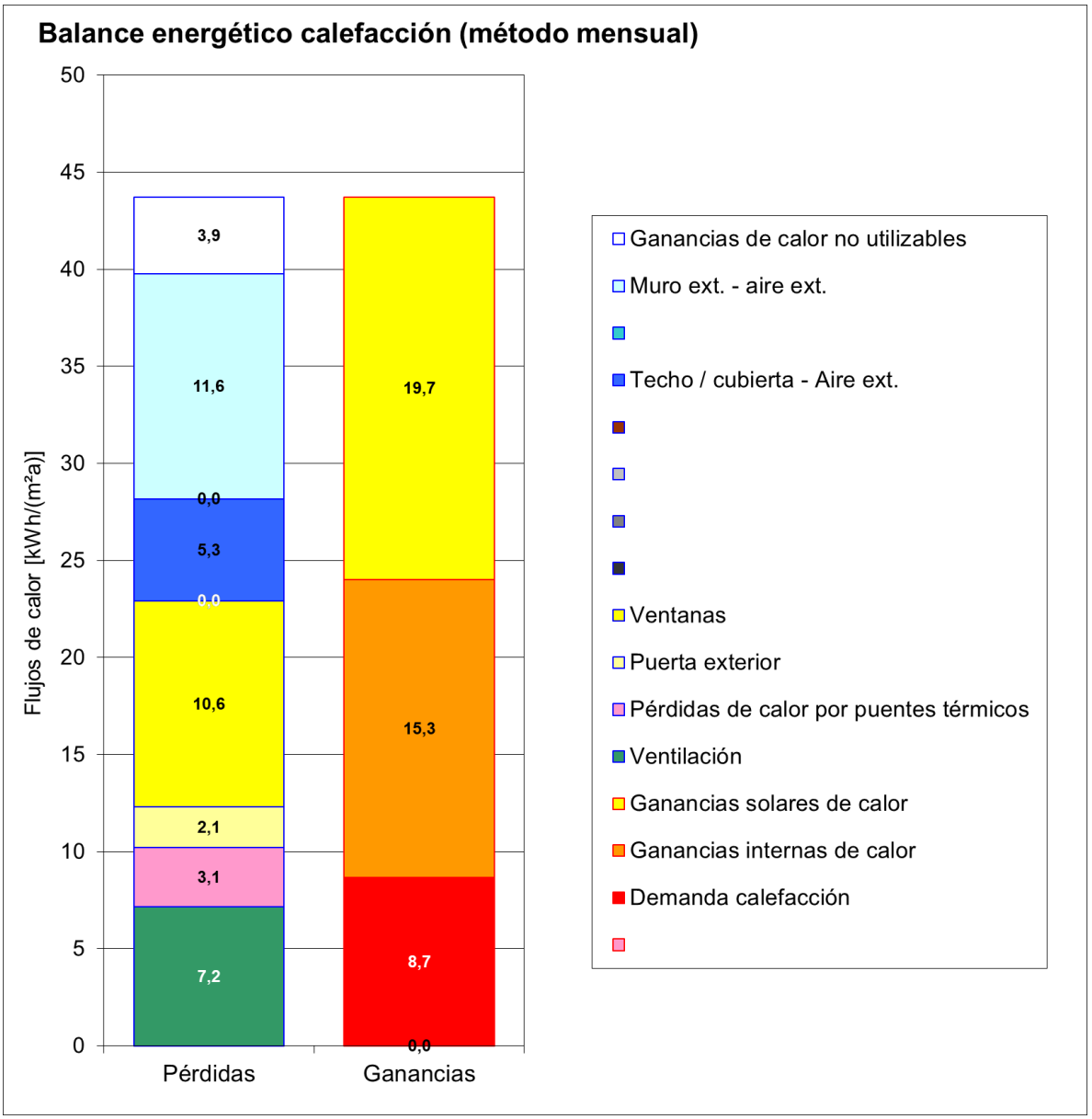
ID Certificado	Emisión:	Ciudad:
25563-25587_VAND_PH_20200306_ND	06/03/20	Madrid

Datos de proyecto importados desde desighPH 2.0.04

Código desplegado PHPP9: PEPES_131115_289048916_es09

Observaciones del certificador: En una vivienda el recuperador de calor se encuentra en una situación no recomendable con posibles problemas de ruido.

Energy balance heating


Balance energético calefacción (método mensual)
Flujos de calor [kWh/(m²a)]
50
45
40
35
30
25
20
15
10
5
0
3,9
11,6
0,0
5,3
0,0
10,6
2,1
3,1
7,2
19,7
15,3
8,7
0,0
Pérdidas
Ganancias
Ganancias de calor no utilizables
Muro ext. - aire ext.
Techo / cubierta - Aire ext.
Ventanas
Puerta exterior
Pérdidas de calor por puentes térmicos
Ventilación
Ganancias solares de calor
Ganancias internas de calor
Demanda calefacción

Energy balance cooling