

Project Documentation

Detached single family house in Castrillón (Asturias),
Spain



1 Abstract



South-west facade

1.1 Data of building

Year of construction	2021	Space heating	13.4 kWh/(m ² a)
Area	154.5 m ²		
U-value external wall	0.16 W/(m ² K)	Space cooling	-
U-value basement ceiling	0.149 W/(m ² K)	Primary Energy Renewable (PER)	54 kWh/(m ² a)
U-value roof	0.166 W/(m ² K)	Generation of renewable energy	0 kWh/(m ² a)
U-value window	0.94 W/(m ² K)	Non-renewable Primary Energy (PE)	88 kWh/(m ² a)
Heat recovery	84 %	Pressure test n ₅₀	0.5 h-1
Special features	mechanical heat recovery ventilation system and air-to-water heat pump		

1.2 Brief Description ...

Passive House Piedras Blancas

This detached single family house is located in Castrillón (Asturias), a village in the north of Spain. It has been built under Passivhaus standards that are based on heating and cooling energy balance, airtightness, ventilation, waterproofing and electrical loads.

This house has a floor area of 293 m² distributed over two levels and oriented to the south-west. On ground floor we can find the kitchen, the living and dining room, three bathrooms, two bedrooms and the laundry. On the first floor there are three bedrooms and a bathroom. The garage is next to the house and connected to the entrance of the building.

To meet the requirements of the Passivhaus standard, windows are manufactured with exceptionally high R-values and combine triple-pane insulated glazing with air seals and specially developed thermal break window frames.

The design integrates a mechanical heat recovery ventilation system with a heat recovery rate of over 80% to maintain air quality.

To reduce the heat transfer through the walls, roof and floor compared to conventional buildings, a wide range of thermal insulation materials have been used to provide the required low U-values and special attention has been given to eliminate thermal bridges.

1.3 Responsible project participants / Verantwortliche Projektbeteiligte

Architect/ Entwurfsverfasser	Marcos Baptista Riesgo http://www.imzom.com
Implementation planning/ Ausführungsplanung	Cevisa Viviendas Eficientes en Madera S.L.
Building systems/ Haustechnik	Ansoltec S.L.
Structural engineering/ Baustatik	Cevisa Viviendas Eficientes en Madera S.L.
Building physics/	Lucía Fernández Pérez
Passive House project planning/ Passivhaus-Projektierung	Lucía Fernández Pérez
Construction management/ Bauleitung	Cevisa Viviendas Eficientes en Madera S.L.
Certifying body/ Zertifizierungsstelle	VAND www.vandarquitectura.info
Certification ID/ Zertifizierungs ID	30917_VAND_PH_20210505_NDA
Database ID	ID 6801
Author of project documentation / Verfasser der Gebäude-Dokumentation	Lucía Fernández Pérez
Date, Signature/ Datum, Unterschrift	

Oviedo, 6th of October 2021



2 Pictures of the project

2.1 Exterior photographs



South-west view



North-west facade



North-east facade



South-east facade

2.2 Interior photographs



Entrance view



Kitchen view

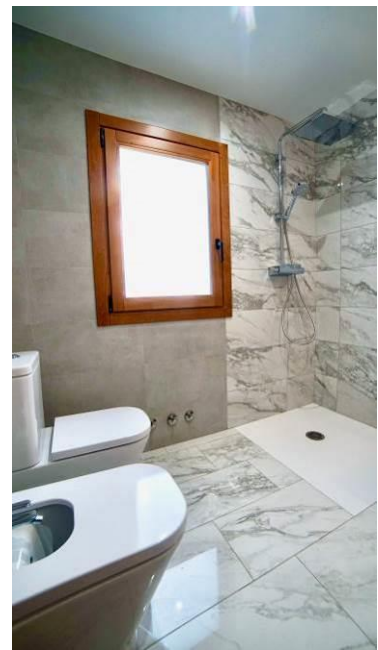


Living room view



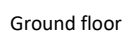
First floor view



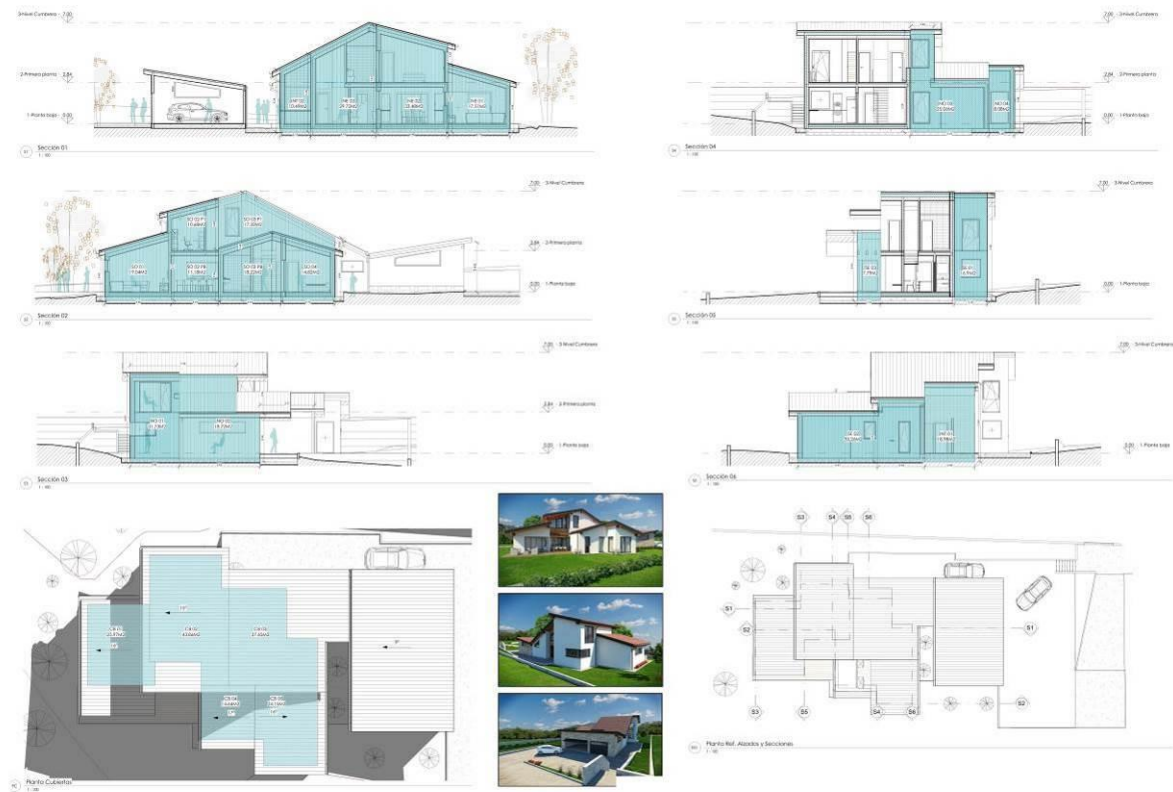


Bathrooms view

3.1. Architectural plans

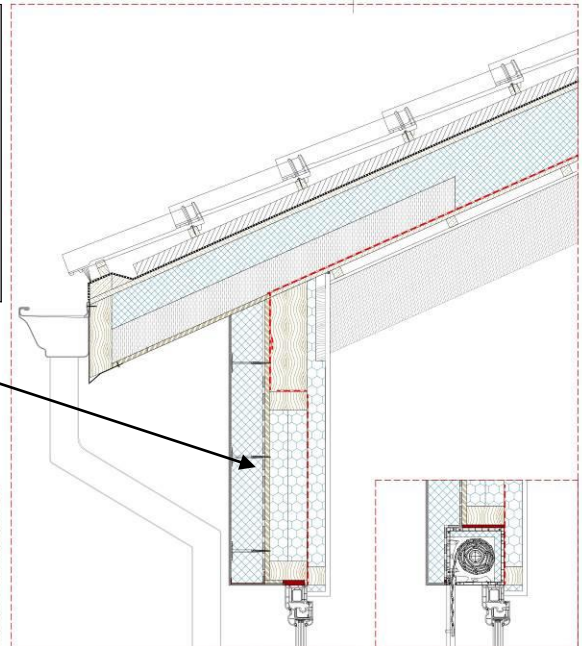


3.2. Airtight Envelope

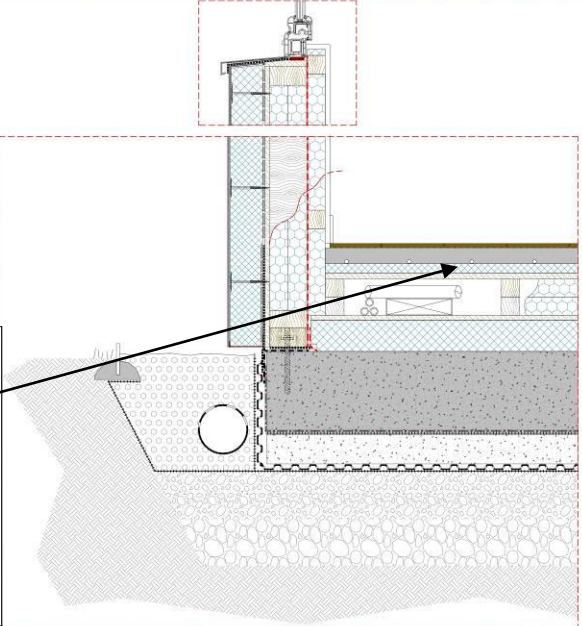


4 Technical details of the construction

Nº elem. cons.	01ud	Denominación de elemento constructivo	CERRAMIENTO EXTERIOR SATE	¿Aislamiento interior?	
Inclinación del elemento	2-Muro	Resistencia térmica superficial [m ² K/W]			
Adyacente a	1-Aire exterior	interior R _{si}	0,13		
		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)]
SATE	0,250				
EPS GRAFITADO	0,032				
OSB	0,130				
LANA DE ROCA	0,037	RASTRELES MADERA	0,130		
BARRERA DE VAPOR	0,300			RASTRELES MADERA	0,130
LANA MINERAL	0,037				
PLACA YESO LAM	0,250				
Porcentaje superficie parcial 1	46%	Porcentaje superficie parcial 2	29,8%	Porcentaje superficie parcial 3	24,8%
Suplemento al valor-U	0,01 W/(m ² K)			Valor-U:	0,160 W/(m ² K)



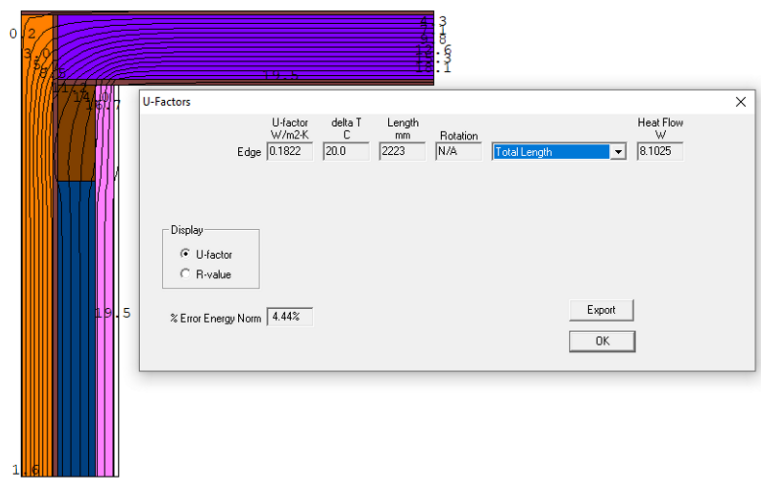
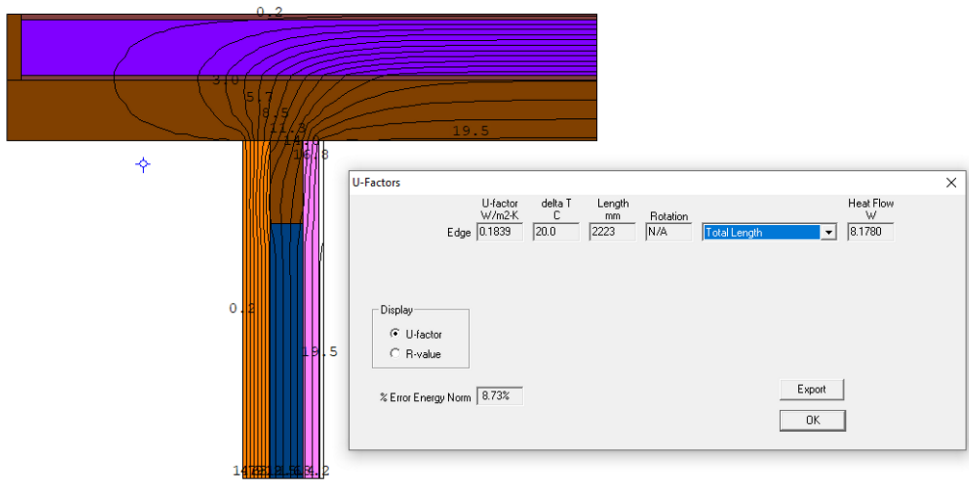
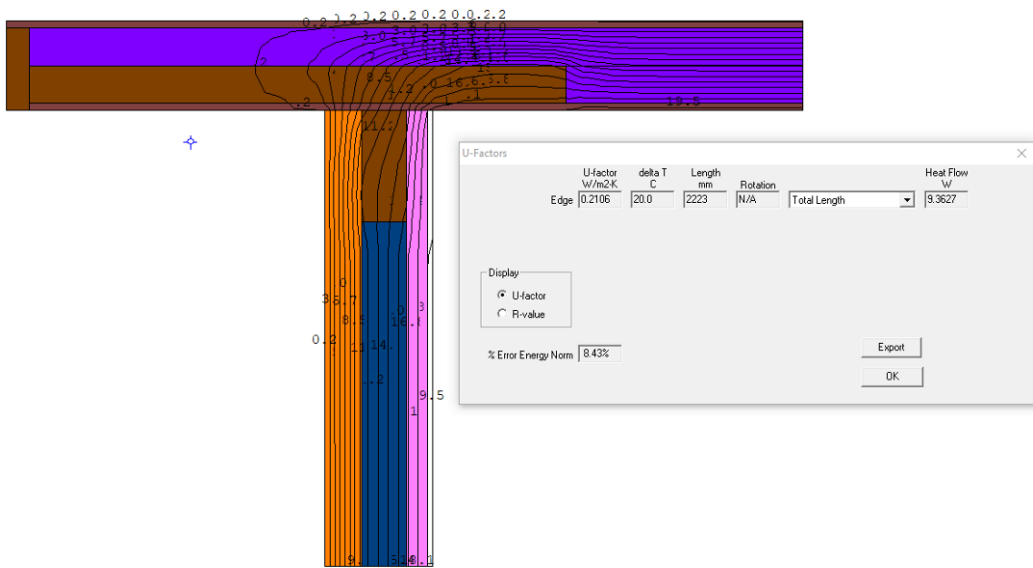
Nº elem. cons.	02ud	Denominación de elemento constructivo	CERRAMIENTO EXTERIOR MADERA	¿Aislamiento interior?	
Inclinación del elemento	2-Muro	Resistencia térmica superficial [m ² K/W]			
Adyacente a	1-Aire exterior	interior R _{si}	0,13		
		exterior R _{se}	0,04		
Superficie parcial 1	λ [w/(m·K)]	Superficie parcial 2 (opcional)	λ [w/(m·K)]	Superficie parcial 3 (opcional)	λ [w/(m·K)]
TABLA MADERA	0,130				
EPS GRAFITADO	0,032	RASTRELES MADERA	0,130		
OSB	0,130				
LANA DE ROCA	0,036			RASTRELES MADERA	0,130
LANA MINERAL	0,037	RASTRELES MADERA	0,130		
YESO LAMINADO	0,250				
Porcentaje superficie parcial 1	45%	Porcentaje superficie parcial 2	24,8%	Porcentaje superficie parcial 3	29,8%
Suplemento al valor-U	W/(m ² K)			Valor-U:	0,178 W/(m ² K)



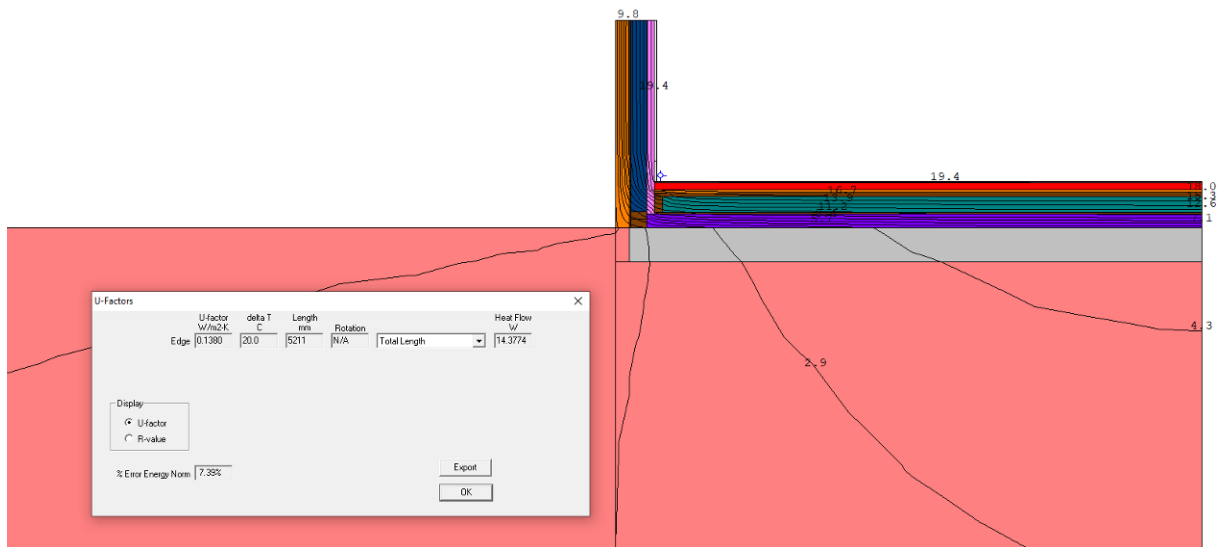
Nº elem. cons.	03ud	Denominación de elemento constructivo	SOLERA (TARIMA)	¿Aislamiento interior?	
Inclinación del elemento	3-Suelo	Resistencia térmica superficial [m ² K/W]			
Adyacente a	2-Terreno	interior R _{si}	0,13		
		exterior R _{se}	0,00		
Superficie parcial 1	λ [w/(m·K)]	Superficie parcial 2 (opcional)	λ [w/(m·K)]	Superficie parcial 3 (opcional)	λ [w/(m·K)]
TARIMA	0,130				
MORTERO ANHIDRITA	1,700				
EPS	0,037				
TABLERO	0,130				
LANA DE ROCA	0,037	RASTRELES MADERA	0,130		
TABLERO	0,130				
XPS	0,036				
LOSA HORMIGON	2,300				
Porcentaje superficie parcial 1	85%	Porcentaje superficie parcial 2	14,8%	Porcentaje superficie parcial 3	
Suplemento al valor-U	W/(m ² K)			Valor-U:	0,149 W/(m ² K)



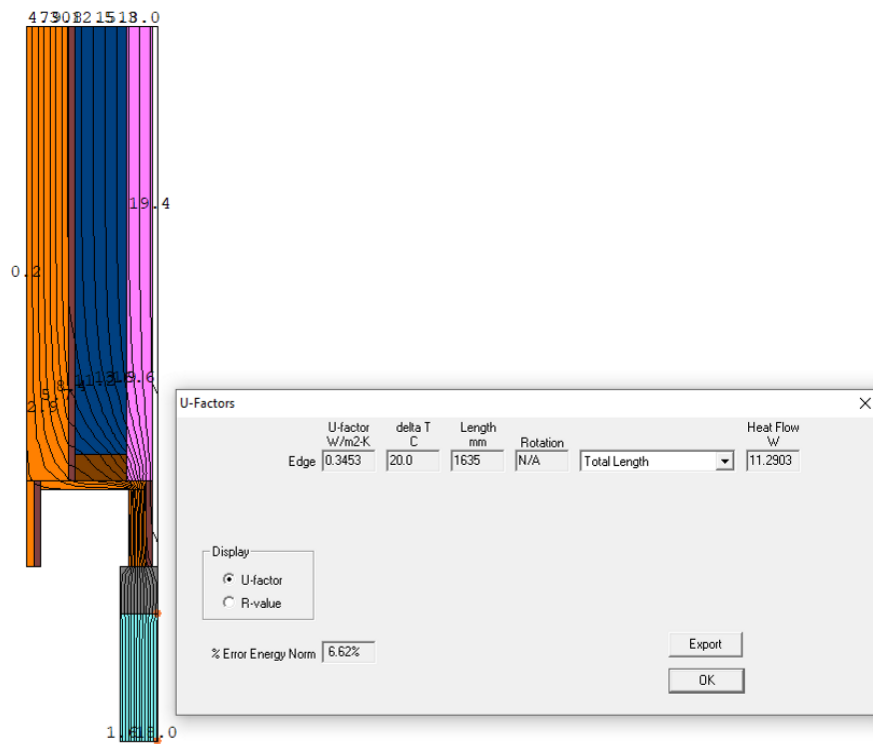
4.1. Thermal bridges



External wall - roof



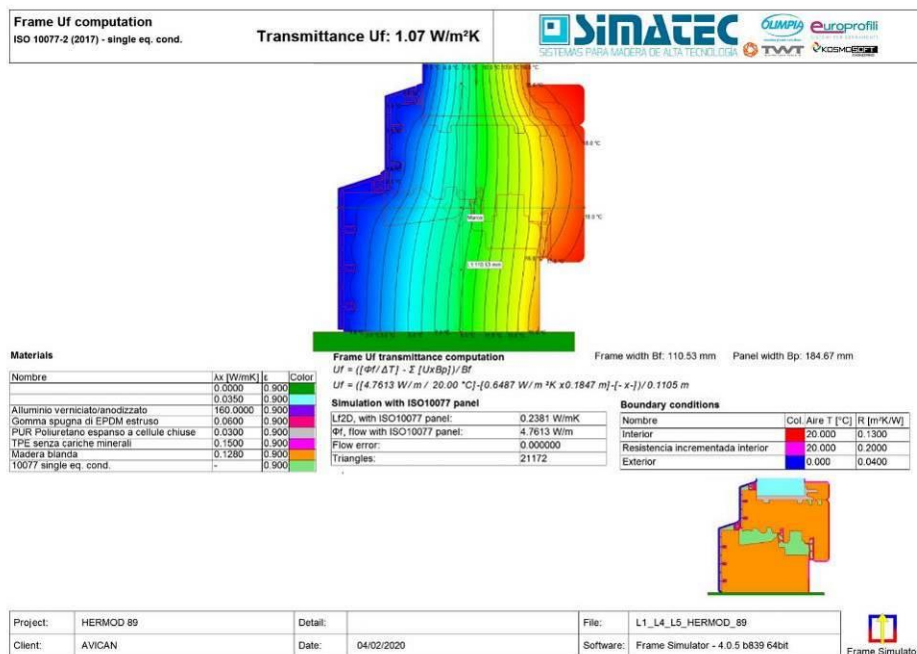
External wall – basement



Blinds

4.2. Window frame

Timber aluminium frame



4.3. Window glass

Excellent glazing with three panes:

TYPE	U - VALUE	G - VALUE
3+3/14/4/14/4+4	0,94	0,56
3+3/16/4/16/4	0,94	0,56
4/14/4/14/4+4	0,94	0,6
4/16/4/16/4	0,94	0,6

4.4. Shadow elements

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

4.5. Construction photographs



Foundation



Structure



Airtightness



Windows



Blinds

5 Airtightness

5.1. BlowerDoor test results



BlowerDoor GmbH
MessSysteme für Luftdichtheit

BUILDING LEAKAGE TEST

Date of Test: 10/03/2021 Test File: Piedras Blower informe 210310

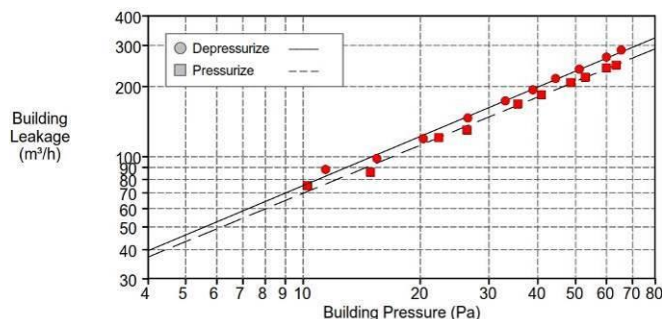
Technician: Marcos Baptista Riesgo
Project Number: 201704

Customer: Lucía Domínguez Noriega
Eduardo González Villares
C/ Juan de Austria, nº7, 4ºB
Raíces
Castrillón, Asturias 33450
Phone: 654923238
Fax:
Email: lucicarb@gmail.com

Building Address: Vivienda unifamiliar aislada
El Castro, nº5
San Miguel de Quiloño
Castrillón, Asturias 33450

	Depressurization	Pressurization	Average
Test Results at 50 Pascals:			
q ₅₀ : m³/h (Airflow)	233 (+/- 3.0 %)	210 (+/- 3.1 %)	221
n ₅₀ : 1/h (Air Change Rate)	0.52	0.47	0.49
qF ₅₀ : m³/(h·m² Floor Area)	1.51	1.36	1.43
qE ₅₀ : m³/(h·m² Envelope Area)	0.37	0.33	0.35
Leakage Areas:			
ELA ₅₀ : m²	0.0071 (+/- 3.1 %)	0.0064 (+/- 3.1 %)	0.0067
ELA _{F50} : m²/m²	0.0000459	0.0000414	0.0000437
ELA _{E50} : m²/m²	0.0000113	0.0000102	0.0000107
Building Leakage Curve:			
Air Flow Coefficient (C _{env}) m³/(h·Pa ⁿ)	14.9 (+/- 14.4 %)	14.3 (+/- 15.1 %)	
Air Leakage Coefficient (C _L) m³/(h·Pa ⁿ)	15.0 (+/- 14.4 %)	14.4 (+/- 15.1 %)	
Exponent (n)	0.701 (+/- 0.041)	0.685 (+/- 0.043)	
Coefficient of Determination (r²)	0.99483	0.99417	

Test Standard: ISO 9972
Test Mode: Depressurization and Pressurization
Type of Test Method: Method 1 - Test of Building in use
Purpose of Test: Certificación Passivhaus n₅₀ ≤ 0.6 1/h



BUILDING LEAKAGE TEST Page 2 of 5

Date of Test: 10/03/2021 Test File: Piedras Blower informe 210310

Building Information

Internal Volume, V (m³) (according to ISO)	447.35
Net Floor Area, A _F (m²) (according to ISO)	154.48
Envelope Area, A _E (m²) (according to ISO)	628.04
Height (m)	2.89
Uncertainty of Dimensions (%)	2
Year of Construction	2021
Type of Heating	Suelo radiante
Type of Air Conditioning	N/A
Type of Ventilation	VMC
Building Wind Exposure	Highly Exposed Building
Wind Class	Strong Breeze

Equipment Information

Type	Manufacturer	Model	Serial Number	Custom Calibration Date
Fan	Energy Conservatory	Model 4 (230V)	CE5813	30/05/2017
Micromanometer	Energy Conservatory	DG1000	910	11/03/2020

6 Ventilation

There is a mechanical ventilation with heat recovery that provides a constant supply of fresh filtered air, maintaining the air quality whilst being practically imperceptible. This machine extracts the air from the polluted sources and supplies air to the “living” rooms.



Ventilation plans

Category: **Air handling unit with heat recovery**
 Manufacturer: **Siber Zone, S.L.U.**
 Spain
 Product name: **SIBER DF EXCELLENT 3 (Plus)**

Specification: Airflow rate < 600 m³/h
 Heat exchanger: Recuperative

This certificate was awarded based on the product meeting the following main criteria

Heat recovery rate $\eta_{HR} \geq 75\%$
 Specific electric power $P_{el,spec} \leq 0.45 \text{ Wh/m}^3$
 Leakage $< 3\%$
 Comfort Supply air temperature $\geq 16.5^\circ\text{C}$ at outdoor air temperature of -10°C

Airflow range
59–235 m³/h
Heat recovery rate
$\eta_{HR} = 84\%$ ¹⁾
Specific electric power
$P_{el,spec} = 0.26 \text{ Wh/m}^3$



7 Building Services

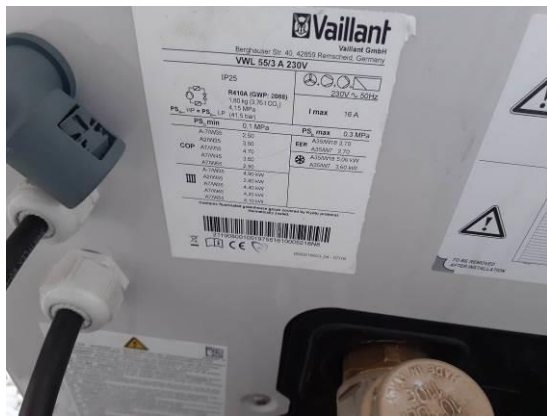
7.1 Heating

To provide heating, radiant floor has been installed and connected to an air-to-water heat pump that provides heat water.



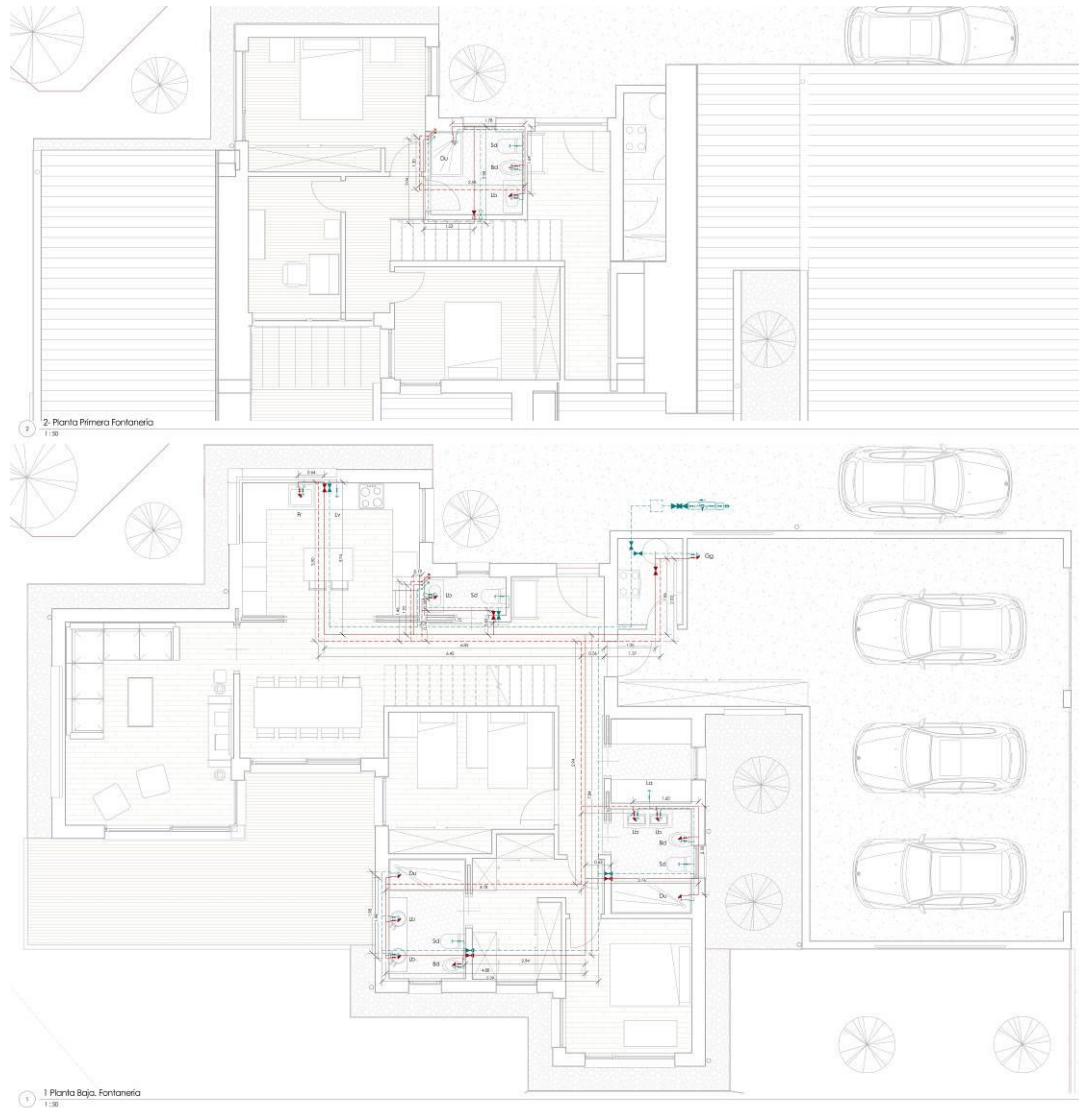


Radiant floor



7.2 Domestic hot water

Domestic hot water demand is covered by the same air-to-water heat pump. There is a 196 litres domestic hot water tank connected to the heat pump.



Domestic hot water plans



Domestic hot water tank

Energy balance cooling

