

# Project Documentation – Detached single family house in Llanes (Asturias), Spain



## 1 Abstract



Source: VAND arquitectura

### 1.1 Data of building

|                                         |                                                             |                                   |                        |
|-----------------------------------------|-------------------------------------------------------------|-----------------------------------|------------------------|
| Year of construction/                   | 2020                                                        | Space heating                     | <b>13</b><br>kWh/(m²a) |
| Area                                    | 216.70 m²                                                   |                                   |                        |
| U-value external wall                   | 0.227 W/(m²K)                                               | Space cooling                     | <b>3</b><br>kWh/(m²a)  |
| U-value ventilated façade external wall | 0.248 W/(m²K)                                               |                                   |                        |
| U-value floor                           | 0.470 W/(m²K)                                               | Primary Energy Renewable (PER)    | 33 kWh/(m²a)           |
| U-value inclined roof                   | 0.171 W/(m²K)                                               | Generation of renewable energy    | - kWh/(m²a)            |
| U-value window                          | 1.02 W/(m²K)                                                | Non-renewable Primary Energy (PE) | 54 kWh/(m²a)           |
| Heat recovery                           | 82.8 %                                                      | Pressure test n <sub>50</sub>     | 0.22 h-1               |
| Special features                        | There is a compact unit for ventilation+DHW+heating/cooling |                                   |                        |

## 1.2 Brief Description of the Project

Single-family Passivhaus house located in the vicinity of Llanes, Asturias, on a sloped plot. The building has a floor area of 216.70 m<sup>2</sup> distributed over two levels.

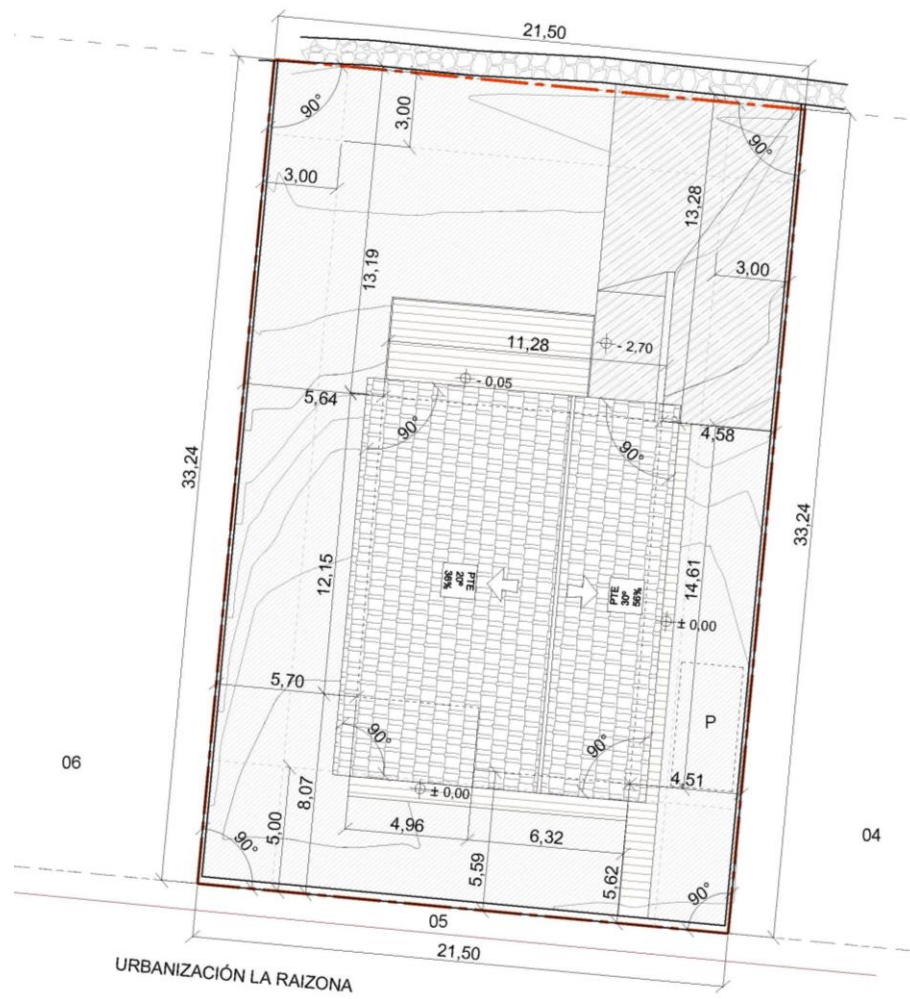
On the ground floor are the living room, kitchen, facilities room, two bedrooms and two bathrooms. On the first floor are three more bedrooms, other small living room and two bathrooms.

It is located in Llanes (Asturias), with a warm-temperate coastal climate.

g



Site plan. Source: Google Earth



Situation plan. Source: VAND Arquitectura

### 1.3 Responsible project participants

|                                                                                          |                                                                                                                                           |  |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--|
| Architect/<br>Entwurfsverfasser                                                          | VAND Arquitectura                                                                                                                         |  |
| Implementation planning/<br>Ausführungsplanung                                           | VAND Arquitectura                                                                                                                         |  |
| Building systems/<br>Haustechnik                                                         | VAND Arquitectura                                                                                                                         |  |
| Structural engineering/<br>Baustatik                                                     | VAND Arquitectura                                                                                                                         |  |
| Building physics/<br>Bauphysik                                                           | VAND Arquitectura                                                                                                                         |  |
| Passive House project<br>planning/<br>Passivhaus-Projektierung                           | Diana Jiménez López                                                                                                                       |  |
| Construction management/<br>Bauleitung                                                   | VAND Arquitectura                                                                                                                         |  |
| Certifying body/ Zertifizierungsstelle                                                   | Passivhaus Institute                                                                                                                      |  |
| Certification ID/ Zertifizierungs ID                                                     | 38125                                                                                                                                     |  |
| Project-ID (www.passivehouse-database.org)<br>Projekt-ID (www.passivehouse-database.org) | 7229<br><a href="https://passivehouse-database.org/index.php?lang=en#d7229">https://passivehouse-database.org/index.php?lang=en#d7229</a> |  |
| Author of project documentation /<br>Verfasser der Gebäude-Dokumentation                 | Diana Jiménez López                                                                                                                       |  |
| Date, Signature/<br>Datum, Unterschrift                                                  |                                                                                                                                           |  |

Madrid, 19<sup>th</sup> of september 2023



## 2 Pictures of the project

### 2.1 Exterior photographs



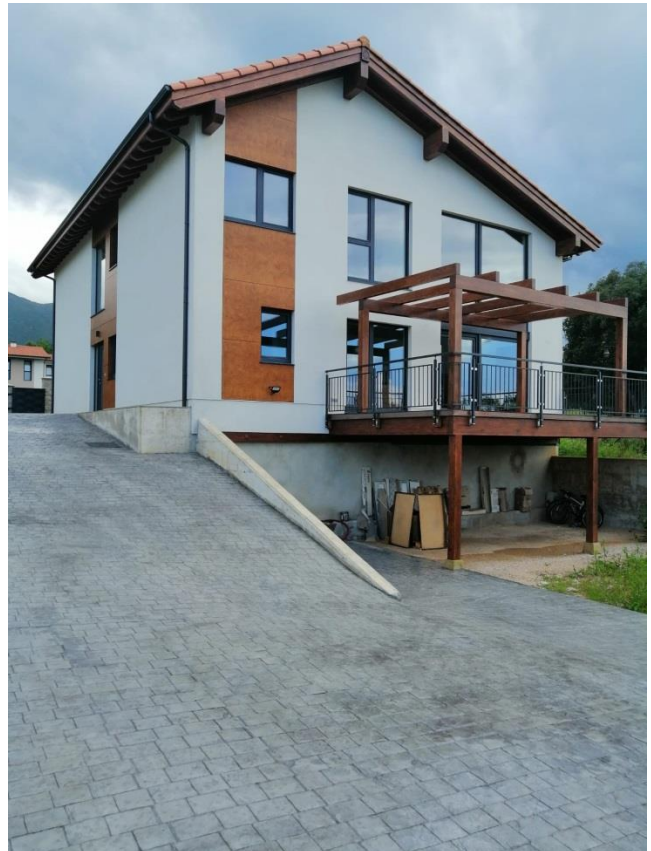
South elevation. Source: VAND Arquitectura



West elevation. Source: VAND Arquitectura



East elevation. Source: VAND architectura



North elevation. Source: VAND Architectura

## 2.2 Interior photographs



Living room in first floor. Source: VAND arquitectura



Living room in ground floor. Source: VAND arquitectura



Living room in ground floor. Source: VAND arquitectura



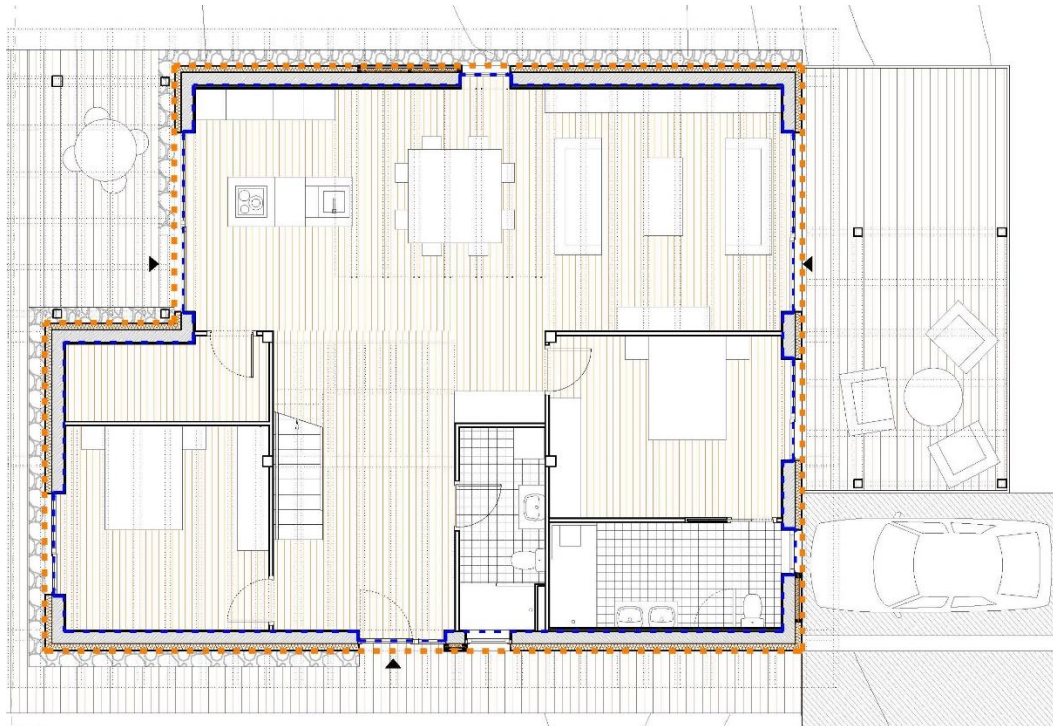
Double height in hall and bathroom. Source: VAND Arquitectura



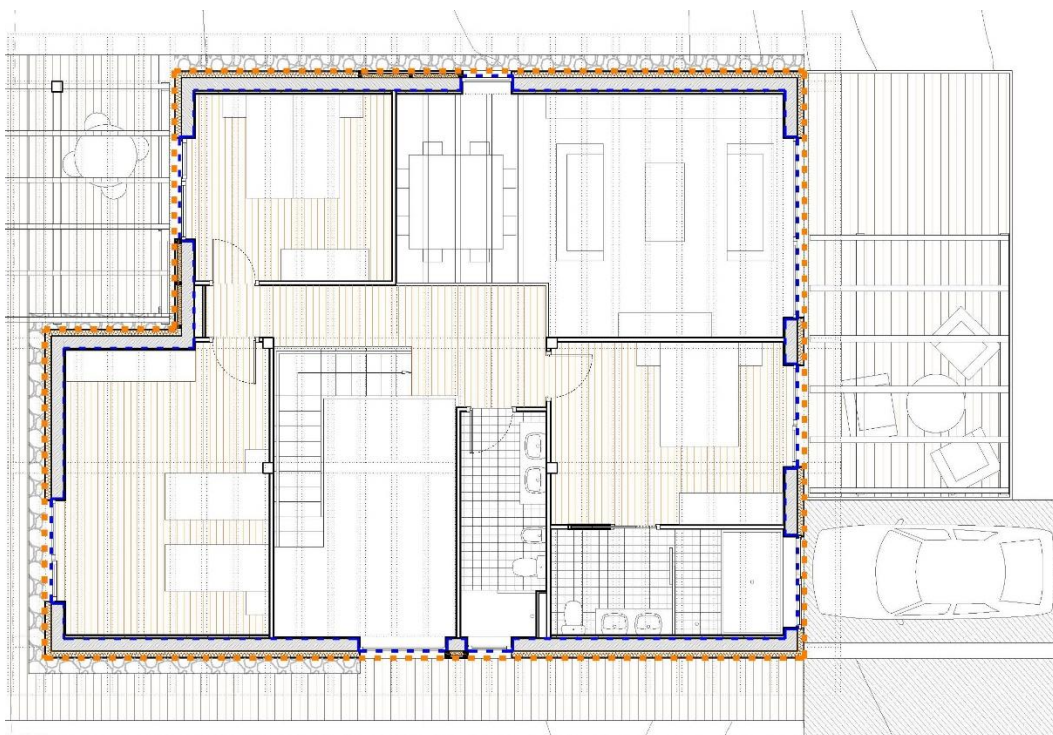
Kitchen. Source: VAND Arquitectura

### 3 Plans

Thermal envelope (orange line) and airtight envelope (blue line) are shown in the following plans:

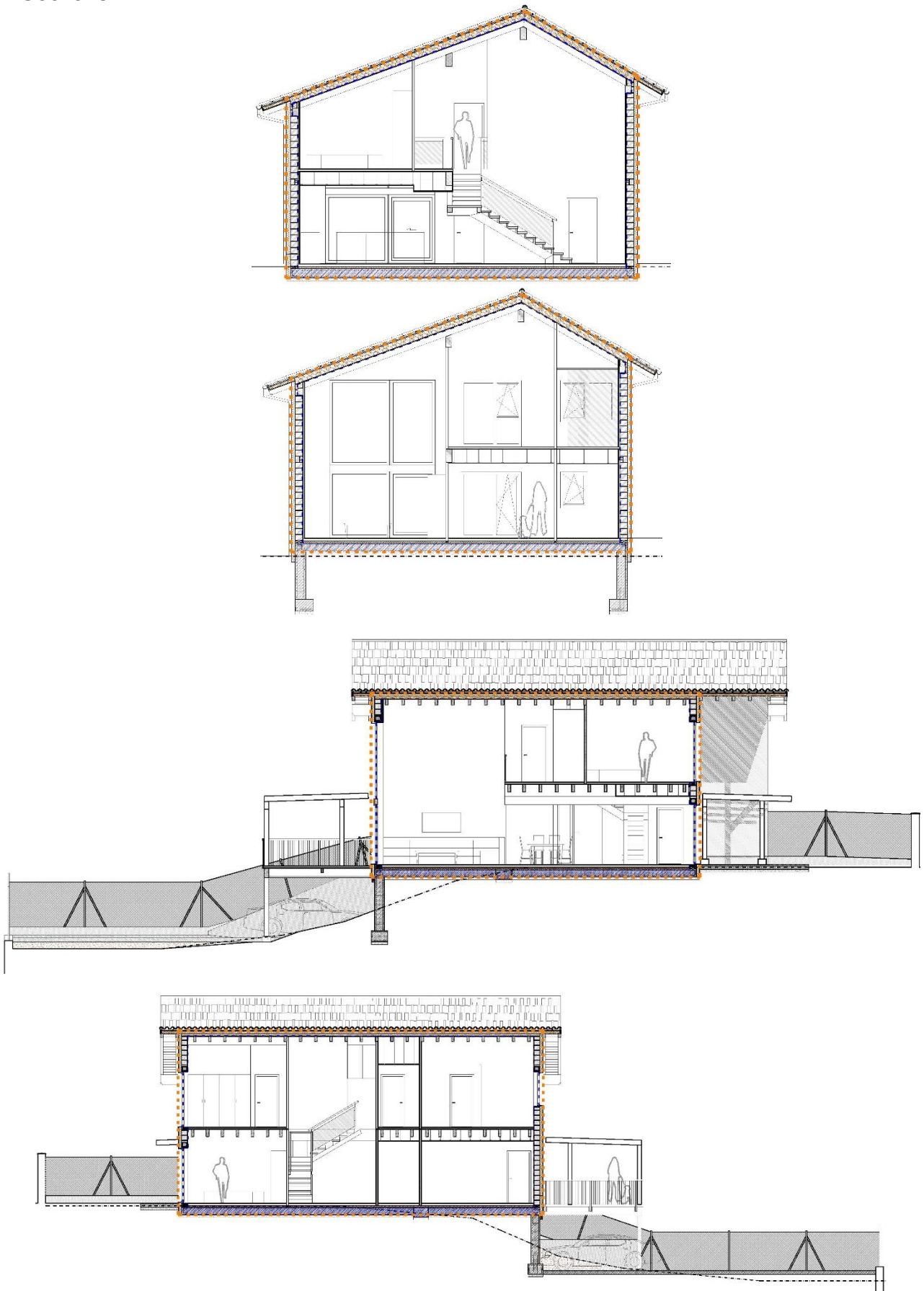


Ground floor. Source: VAND Arquitectura



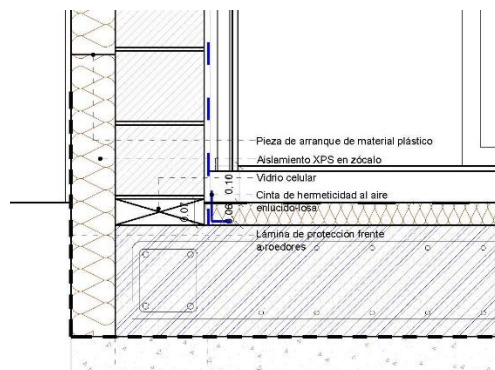
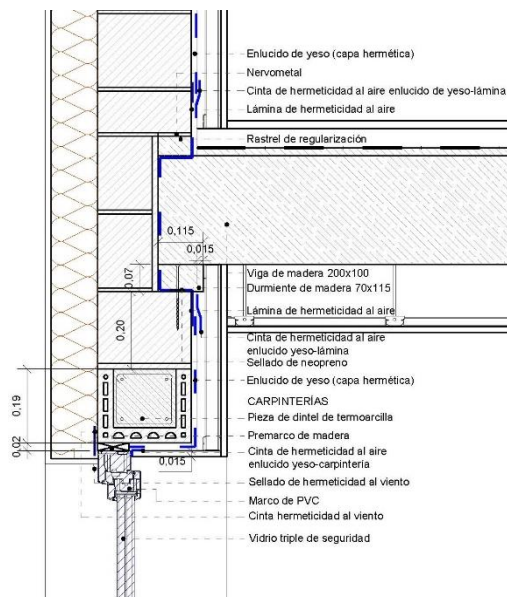
First floor. Source: VAND Arquitectura

## Sections:



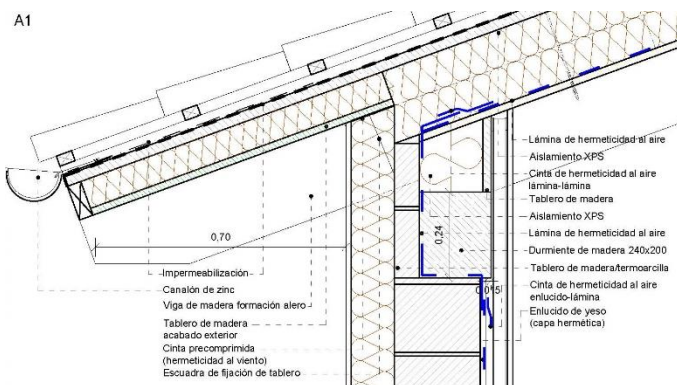
Sections. Source: VAND Arquitectura

Construction details:



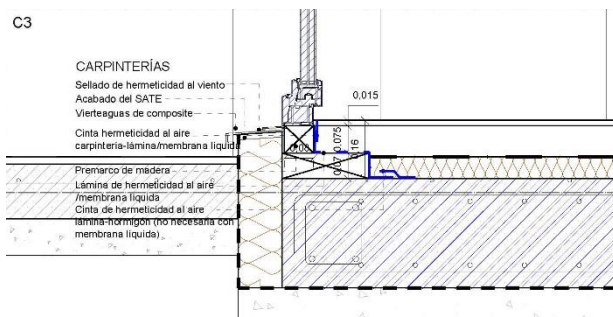
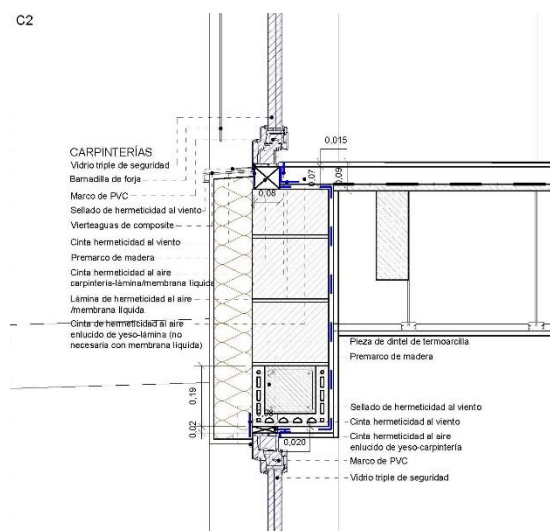
Windows top installacion+exterior wall-ceiling.  
Source: VAND Arquitectura

Exterior wall-floor slab. Source: VAND Arquitectura



Roof eaves. Source: VAND Arquitectura

Roof eaves (with beam). Source: VAND Arquitectura



Windows top and bottom installation.  
Source: VAND Arquitectura

Window bottom installation-floor slab. Source: VAND Arquitectura

## 4 Technical details of the construction

### 4.1 Exterior walls

|                                 |                                       |                                         |                         |                                 |                         |                        |
|---------------------------------|---------------------------------------|-----------------------------------------|-------------------------|---------------------------------|-------------------------|------------------------|
| Nr. elem. cons.                 | Denominación de elemento constructivo |                                         |                         |                                 |                         | ¿Aislamiento interior? |
| 01ud                            | Fachada SATE                          |                                         |                         |                                 |                         |                        |
| Inclinación del elemento        |                                       | Resistencia térmica superficial [m²K/W] |                         |                                 |                         |                        |
| 2-Muro                          |                                       | interior R <sub>si</sub> 0,13           |                         |                                 |                         |                        |
| Adyacente a 1-Aire exterior     |                                       | exterior R <sub>se</sub> 0,04           |                         |                                 |                         |                        |
| Superficie parcial 1            | λ <sub>e</sub> [W/(mK)]               | Superficie parcial 2 (opcional)         | λ <sub>e</sub> [W/(mK)] | Superficie parcial 3 (opcional) | λ <sub>e</sub> [W/(mK)] | Espesor [mm]           |
| Enlucido de yeso                | 0,570                                 |                                         |                         |                                 |                         | 15                     |
| Bloque de tremoarquilla         | 0,280                                 |                                         |                         |                                 |                         | 240                    |
| RockSATE Duo Plus               | 0,035                                 |                                         |                         |                                 |                         | 120                    |
| Biocalce                        |                                       |                                         |                         |                                 |                         |                        |
| Cappotto+Biocalce               | 0,495                                 |                                         |                         |                                 |                         | 17                     |
| Silicato Puro 1                 |                                       |                                         |                         |                                 |                         |                        |
|                                 |                                       |                                         |                         |                                 |                         |                        |
|                                 |                                       |                                         |                         |                                 |                         |                        |
|                                 |                                       |                                         |                         |                                 |                         |                        |
| Porcentaje superficie parcial 1 |                                       | Porcentaje superficie parcial 2         |                         | Porcentaje superficie parcial 3 |                         | Total                  |
| 100%                            |                                       |                                         |                         |                                 |                         | 39,2 cm                |
| Suplemento al valor-U           |                                       | Valor-U:                                |                         |                                 |                         |                        |
| 0,006 W/(m²K)                   |                                       | 0,227 W/(m²K)                           |                         |                                 |                         |                        |

|                                 |                                       |                                         |                         |                                 |                         |                        |
|---------------------------------|---------------------------------------|-----------------------------------------|-------------------------|---------------------------------|-------------------------|------------------------|
| Nr. elem. cons.                 | Denominación de elemento constructivo |                                         |                         |                                 |                         | ¿Aislamiento interior? |
| 02ud                            | Fachada ventilada                     |                                         |                         |                                 |                         |                        |
| Inclinación del elemento        |                                       | Resistencia térmica superficial [m²K/W] |                         |                                 |                         |                        |
| 2-Muro                          |                                       | interior R <sub>si</sub> 0,13           |                         |                                 |                         |                        |
| Adyacente a 3-Ventilada         |                                       | exterior R <sub>se</sub> 0,13           |                         |                                 |                         |                        |
| Superficie parcial 1            | λ <sub>e</sub> [W/(mK)]               | Superficie parcial 2 (opcional)         | λ <sub>e</sub> [W/(mK)] | Superficie parcial 3 (opcional) | λ <sub>e</sub> [W/(mK)] | Espesor [mm]           |
| Enlucido de yeso                | 0,570                                 |                                         |                         |                                 |                         | 15                     |
| Bloques de termoarcilla         | 0,280                                 |                                         |                         |                                 |                         | 240                    |
| RockSATE Duo Plus               | 0,035                                 | Rastreles madera                        | 0,130                   |                                 |                         | 75                     |
| RockSATE Duo Plus               | 0,035                                 |                                         |                         |                                 |                         | 50                     |
| Biocalce                        |                                       |                                         |                         |                                 |                         |                        |
| Cappotto+Biocalce               | 0,495                                 |                                         |                         |                                 |                         | 17                     |
| Silicato Puro 1                 |                                       |                                         |                         |                                 |                         |                        |
|                                 |                                       |                                         |                         |                                 |                         |                        |
|                                 |                                       |                                         |                         |                                 |                         |                        |
| Porcentaje superficie parcial 1 |                                       | Porcentaje superficie parcial 2         |                         | Porcentaje superficie parcial 3 |                         | Total                  |
| 88%                             |                                       | 12,50%                                  |                         |                                 |                         | 39,7 cm                |
| Suplemento al valor-U           |                                       | Valor-U:                                |                         |                                 |                         |                        |
| 0,018 W/(m²K)                   |                                       | 0,248 W/(m²K)                           |                         |                                 |                         |                        |

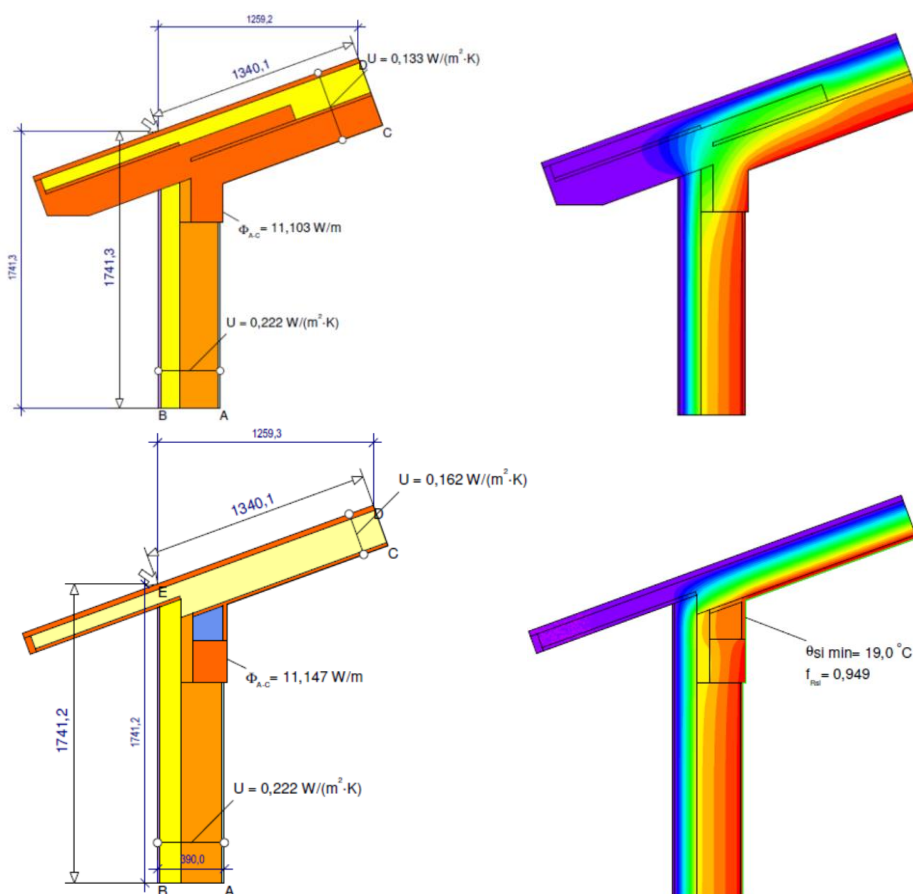
## 4.2 Basement wall

|                                 |            |                                 |            |                                         |            |                        |  |
|---------------------------------|------------|---------------------------------|------------|-----------------------------------------|------------|------------------------|--|
| Nr. elem. cons.                 |            | 04ud                            |            | Losa                                    |            | ¿Aislamiento interior? |  |
| Inclinación del elemento        |            | 3-Suelo                         |            | Resistencia térmica superficial [m²K/W] |            |                        |  |
| Adyacente a                     |            | 2-Terreno                       |            | interior R <sub>si</sub>                |            | 0,13                   |  |
|                                 |            |                                 |            | exterior R <sub>se</sub>                |            | 0,00                   |  |
| Superficie parcial 1            | λ [W/(mK)] | Superficie parcial 2 (opcional) | λ [W/(mK)] | Superficie parcial 3 (opcional)         | λ [W/(mK)] | Espesor [mm]           |  |
| Pavimento de gres               | 2,300      |                                 |            |                                         |            | 15                     |  |
| Mortero de cemento              | 1,800      |                                 |            |                                         |            | 75                     |  |
| XPS                             | 0,033      |                                 |            |                                         |            | 60                     |  |
| Losa de hormigón                | 2,300      |                                 |            |                                         |            | 300                    |  |
|                                 |            |                                 |            |                                         |            |                        |  |
|                                 |            |                                 |            |                                         |            |                        |  |
|                                 |            |                                 |            |                                         |            |                        |  |
|                                 |            |                                 |            |                                         |            |                        |  |
| Porcentaje superficie parcial 1 | 100%       | Porcentaje superficie parcial 2 |            | Porcentaje superficie parcial 3         |            | Total                  |  |
|                                 |            |                                 |            |                                         |            | 45,0 cm                |  |
| Suplemento al valor-U           |            |                                 |            | Valor-U:                                |            | 0,470 W/(m²K)          |  |

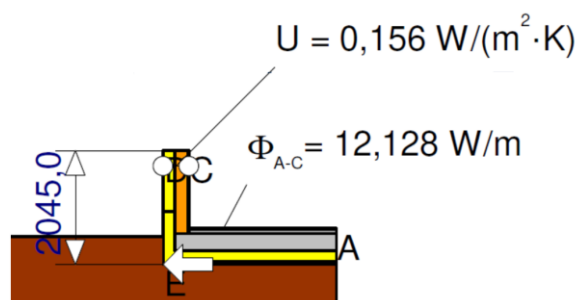
## 4.3 Roof

|                                      |            |                                 |            |                                         |            |                        |  |
|--------------------------------------|------------|---------------------------------|------------|-----------------------------------------|------------|------------------------|--|
| Nr. elem. cons.                      |            | 03ud                            |            | Cubierta                                |            | ¿Aislamiento interior? |  |
| Inclinación del elemento             |            | 1-Techo                         |            | Resistencia térmica superficial [m²K/W] |            |                        |  |
| Adyacente a                          |            | 3-Ventilada                     |            | interior R <sub>si</sub>                |            | 0,13                   |  |
|                                      |            |                                 |            | exterior R <sub>se</sub>                |            | 0,13                   |  |
| Superficie parcial 1                 | λ [W/(mK)] | Superficie parcial 2 (opcional) | λ [W/(mK)] | Superficie parcial 3 (opcional)         | λ [W/(mK)] | Espesor [mm]           |  |
| Tablero hidrófugo                    | 0,160      |                                 |            |                                         |            | 22                     |  |
| XPS                                  | 0,035      |                                 |            |                                         |            | 200                    |  |
| Tablero de madera (acabado interior) | 0,160      |                                 |            |                                         |            | 22                     |  |
|                                      |            |                                 |            |                                         |            |                        |  |
|                                      |            |                                 |            |                                         |            |                        |  |
|                                      |            |                                 |            |                                         |            |                        |  |
|                                      |            |                                 |            |                                         |            |                        |  |
| Porcentaje superficie parcial 1      | 100%       | Porcentaje superficie parcial 2 |            | Porcentaje superficie parcial 3         |            | Total                  |  |
|                                      |            |                                 |            |                                         |            | 24,4 cm                |  |
| Suplemento al valor-U                |            | 0,011 W/(m²K)                   |            | Valor-U:                                |            | 0,171 W/(m²K)          |  |

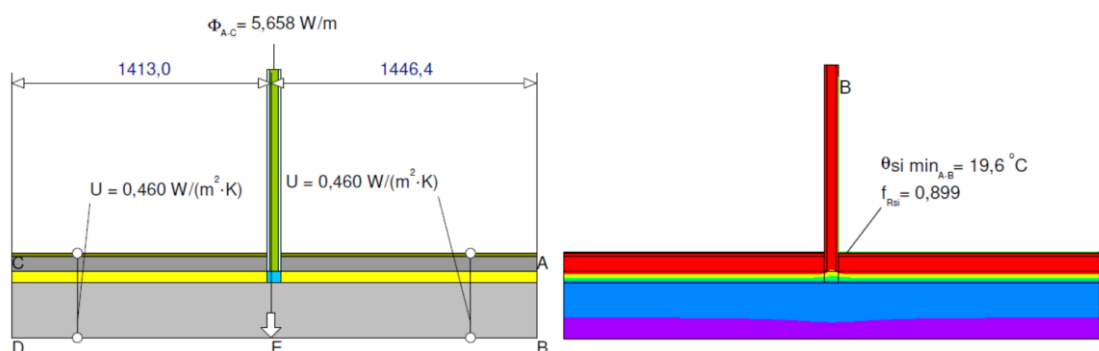
## 4.4 Connection details



Roof - Wall. Source: VAND Architectura



Wall - Ground. Source: VAND Architectura



Partition wall - Ground. Source: VAND Architectura

## 4.5 Windows

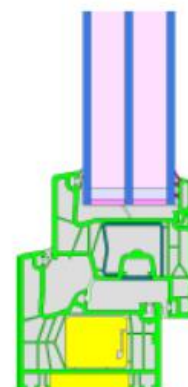
### 4.5.1 Window Frame

Category: Window Frame  
Manufacturer: PROFINE IBERIA S.A.  
UNIPERSONAL - SISTEMAS  
KÖMMERLING,  
Camarma de Esteruelas,  
Spain  
Product name: KÖMMERLING 76

This certificate was awarded based on the following criteria for the warm, temperate climate zone

Comfort  $U_W = 0.99 \leq 1.00 \text{ W/(m}^2 \text{ K)}$   
 $U_{W, \text{installed}} \leq 1.05 \text{ W/(m}^2 \text{ K)}$   
with  $U_g = 0.90 \text{ W/(m}^2 \text{ K)}$

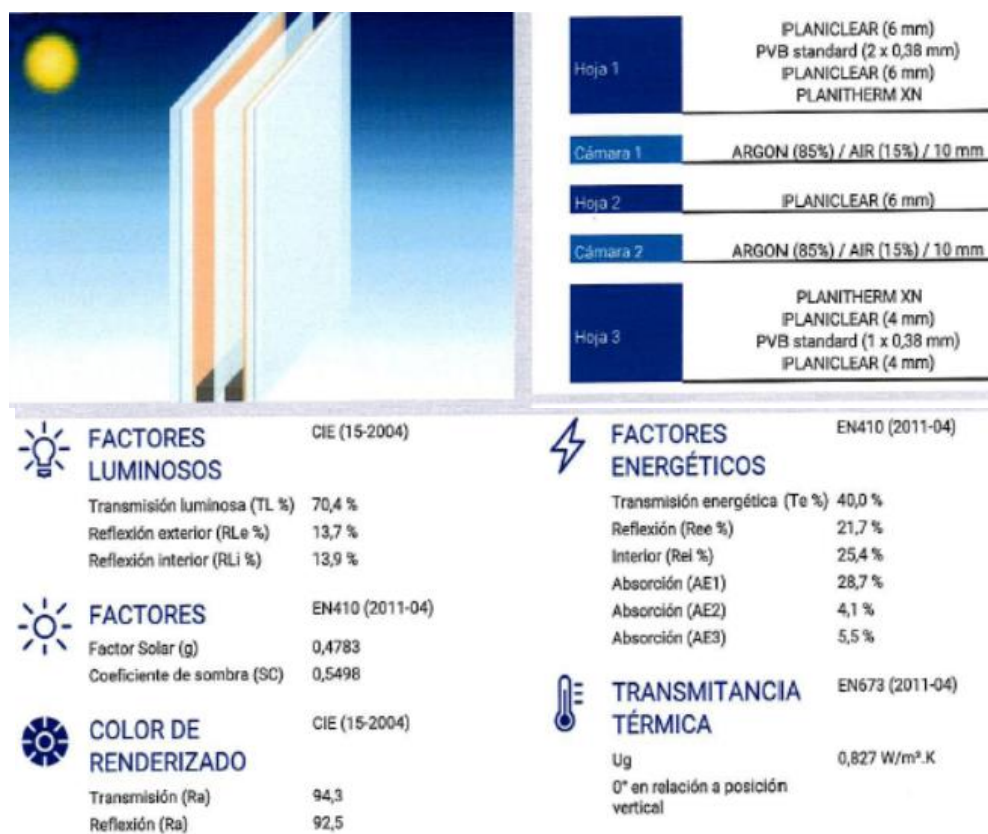
Hygiene  $f_{R_{Si}=0.25} \geq 0.65$

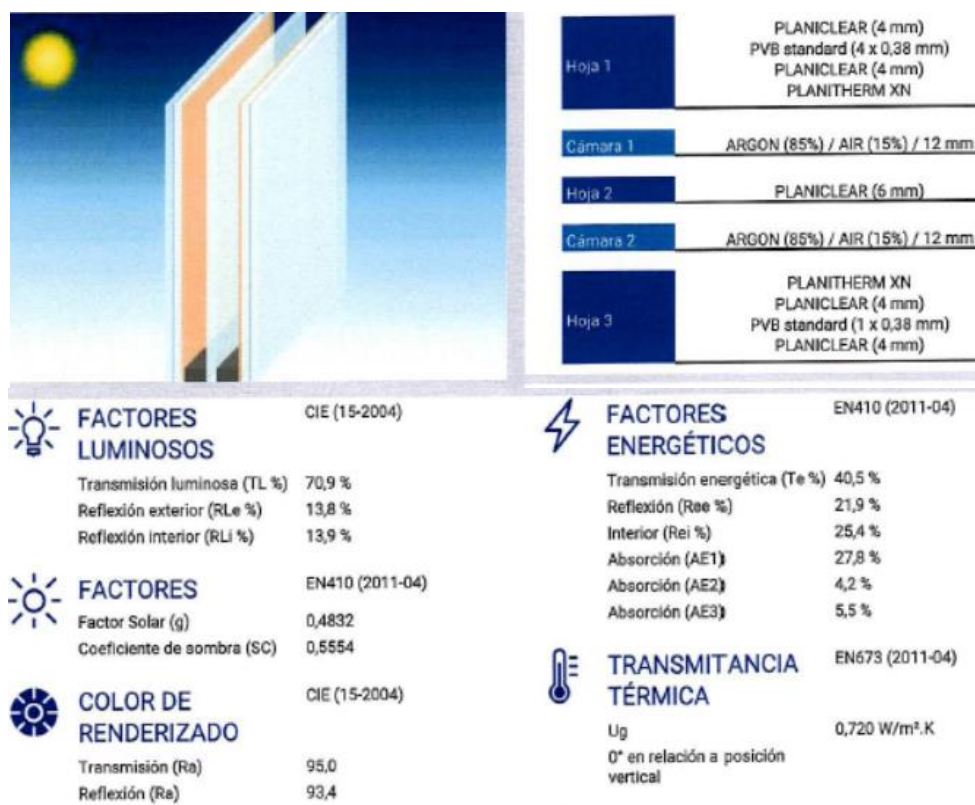


[www.passivehouse.com](http://www.passivehouse.com)



## 4.5.2 Glass

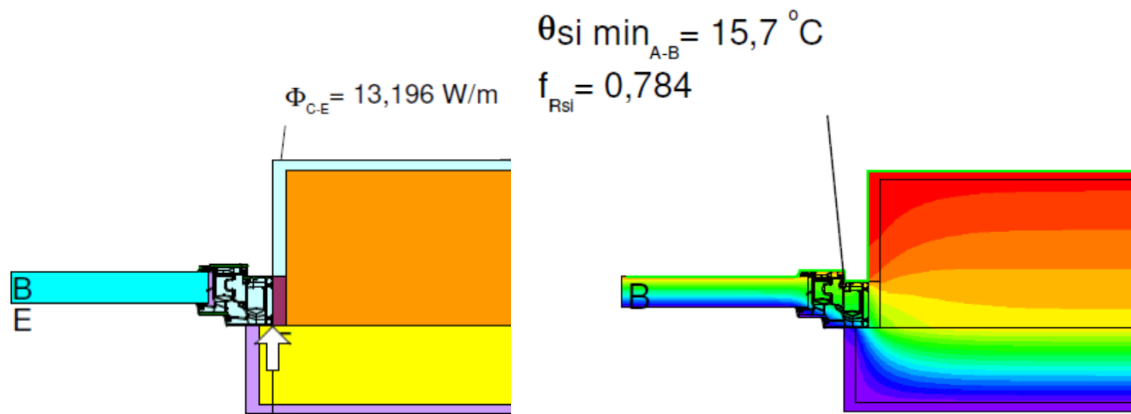




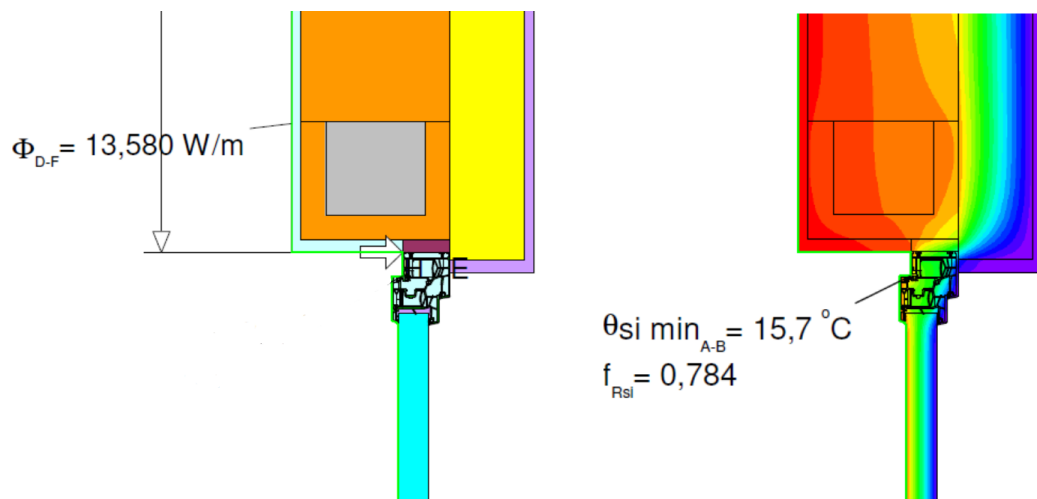
### 4.5.3 Shadow elements

There are internal blinds in bedrooms and living rooms to provide solar protection during the summer. They were not introduced in PHPP, to consider the worst scenario.

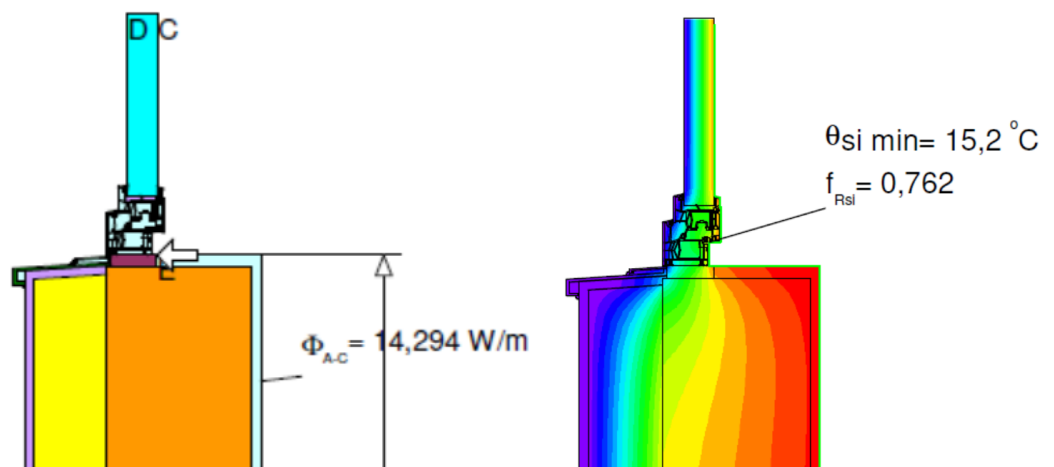
#### 4.5.4 Window installation detail



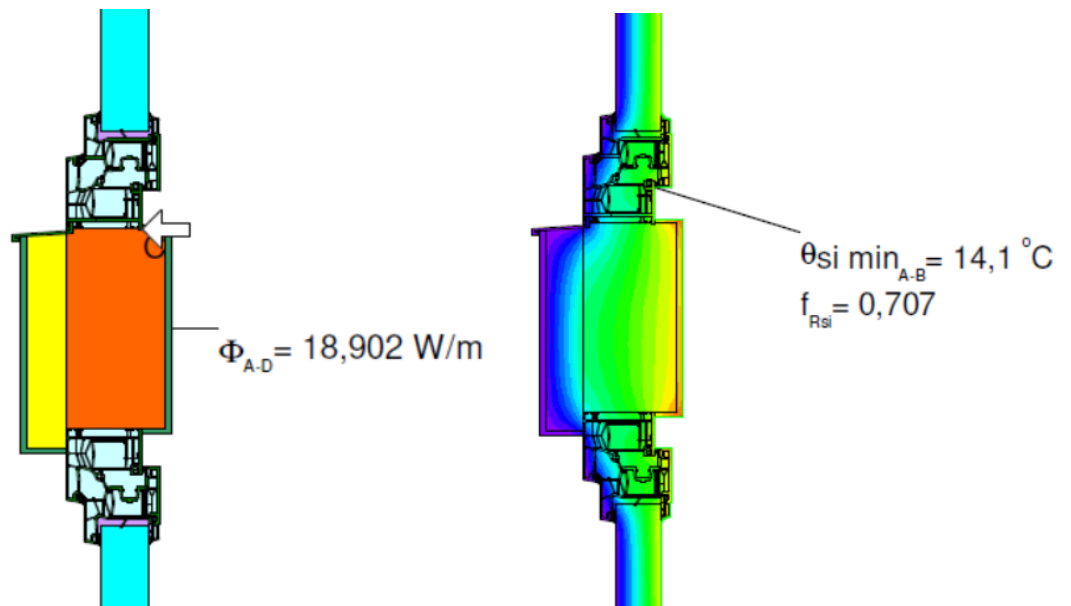
Top installation. Source: VAND Arquitectura



Lateral installation. Source: VAND Arquitectura

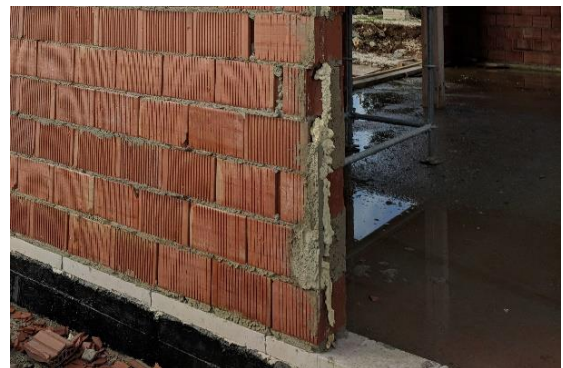


Bottom installation. Source: VAND Arquitectura



Double high windows. Source: VAND Arquitectura

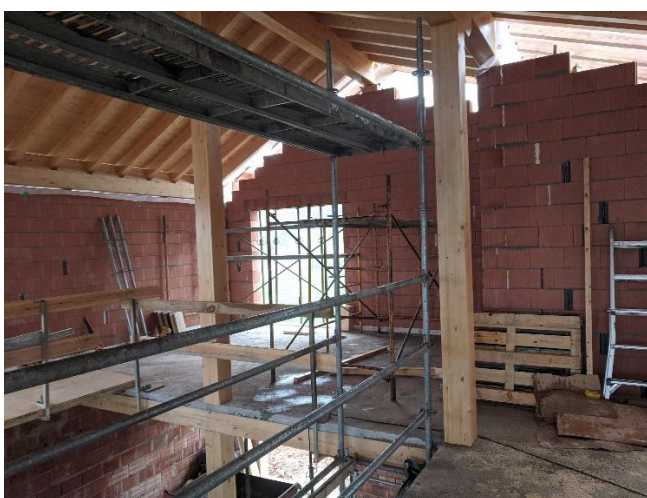
## 4.6 Construction phase



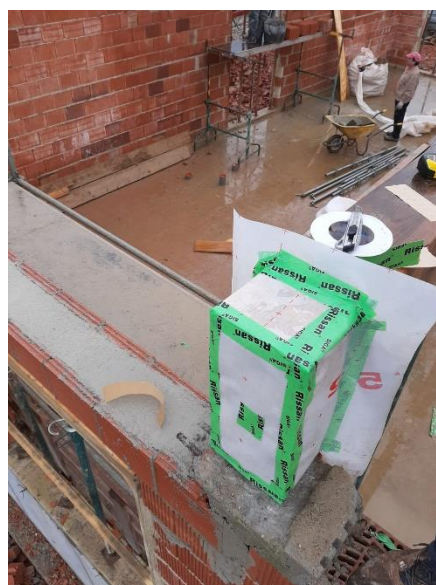
Wall - ground connection. Source: VAND Arquitectura



Floor slab insulation. Source: VAND Arquitectura



Walls. Source: VAND Arquitectura



Airtightness. Source: VAND Arquitectura



Wall insulation. Source: VAND Arquitectura

## 5 Airtightness

### 5.1 BlowerDoor test results



**BlowerDoor GmbH**  
MessSysteme für Luftdichtheit

#### TEST DE INFILTRACIONES DEL EDIFICIO

Fecha del Test: 22/07/2021 Archivo de Test: 20210722 blw agripino

Técnico: Nuria Díaz Antón

Número de proyecto: Casa Agripino y Dania

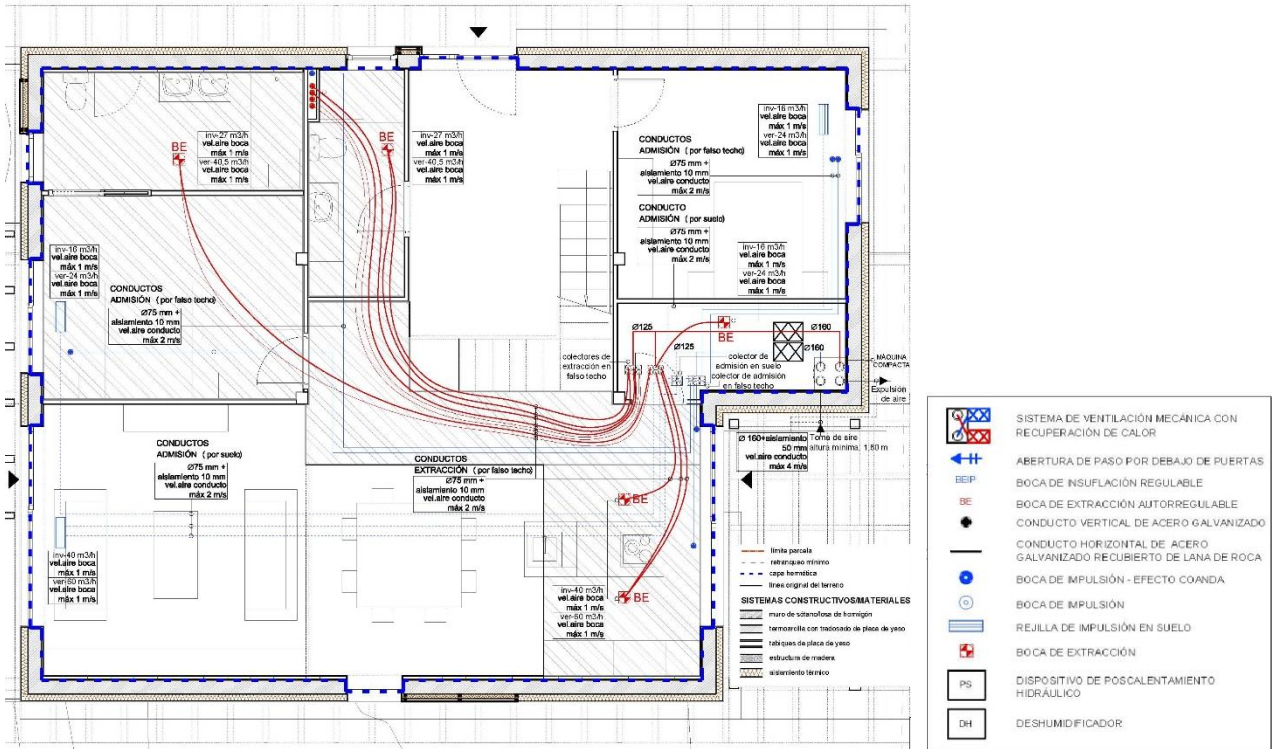
Cliente: Agripino López Lucas  
Calle Siroco 54  
- Madrid  
Teléfono:  
Fax:

Dirección del Edificio: Vivienda unifamiliar aislada  
Parcela 5, Urbanización La Raizona  
El Pancar  
Asturias - Llanes

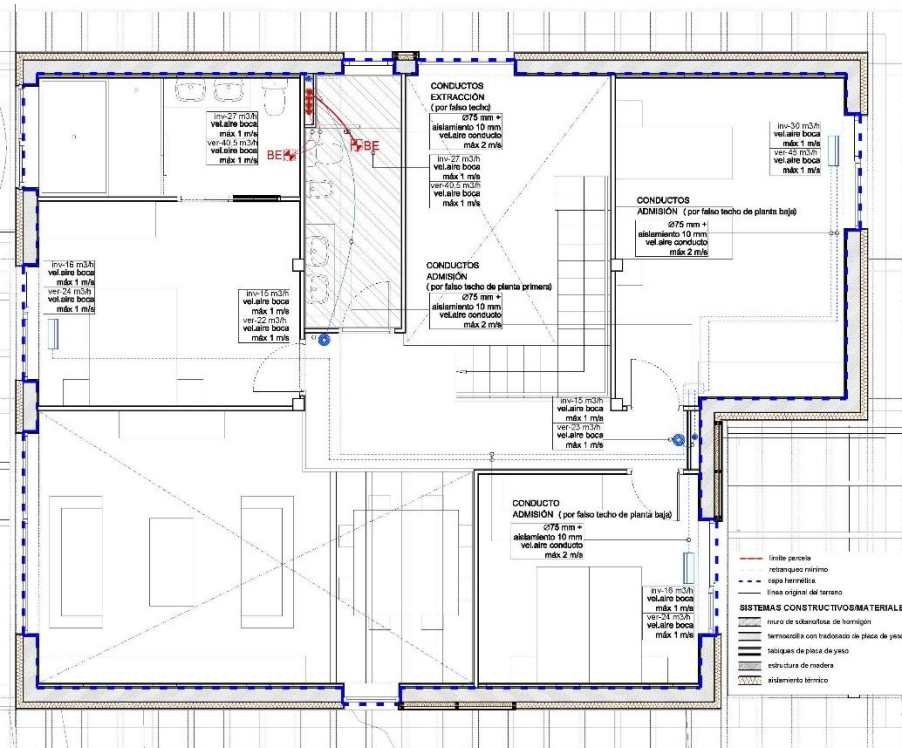
| Resultados del test a 50 Pa:                                              | <u>Despresurización</u>                 | <u>Presurización</u> | <u>Media</u> |
|---------------------------------------------------------------------------|-----------------------------------------|----------------------|--------------|
| q50 : m³/h (Caudal de Aire)                                               | 183 (+/- 0.9 %)                         | 162 (+/- 2.4 %)      | 172          |
| n50 : 1/h (Tasa de Renovación de Aire)                                    | 0.23                                    | 0.20                 | 0.22         |
| qF50 : m³/(h·m² Área del Suelo)                                           | 0.85                                    | 0.75                 | 0.80         |
| qE50 : m³/(h·m² Área de la Envolvente)                                    | 0.28                                    | 0.24                 | 0.26         |
| Áreas de Infiltraciones:                                                  |                                         |                      |              |
| ELA 50 : m²                                                               | 0.0056 (+/- 2.4 %)                      | 0.0049 (+/- 2.4 %)   | 0.0053       |
| ELA F50 : m²/m²                                                           | 0.0000258                               | 0.0000227            | 0.0000243    |
| ELA E50 : m²/m²                                                           | 0.0000084                               | 0.0000074            | 0.0000079    |
| Curva de Infiltraciones del Edificio:                                     |                                         |                      |              |
| Coeficiente de Caudal de Aire (C <sub>env</sub> ) m³/(h·Pa <sup>n</sup> ) | 13.3 (+/- 4.6 %)                        | 16.1 (+/- 12.2 %)    |              |
| Coeficiente de Infiltraciones (C <sub>L</sub> ) m³/(h·Pa <sup>n</sup> )   | 13.3 (+/- 4.6 %)                        | 16.0 (+/- 12.2 %)    |              |
| Exponente (n)                                                             | 0.671 (+/- 0.013)                       | 0.591 (+/- 0.034)    |              |
| Coeficiente de Determinación (r²)                                         | 0.99943                                 | 0.99493              |              |
| Norma del Test:                                                           | ISO 9972                                |                      |              |
| Modo del Test:                                                            | Despresurización y Presurización        |                      |              |
| Método del Test:                                                          | Método 1 - Test para el edificio en uso |                      |              |
| Objetivo del test:                                                        | Passivhaus n50 ≤ 0.6 1/h                |                      |              |

## 6 Ventilation

### 6.1 Ventilation planning



Ground floor. Source: VAND Arquitectura



First floor. Source: VAND Arquitectura

| VIVIENDA                | SRE                                           | OCUPACIÓN             |   |   |        |      |     |
|-------------------------|-----------------------------------------------|-----------------------|---|---|--------|------|-----|
| CAD Casa Agripino López | 216,695                                       | habitación individual | 0 | 4 | 2      |      |     |
|                         |                                               | habitación doble      | 2 | 1 |        |      |     |
|                         |                                               |                       |   |   |        |      |     |
| CAUDAL ESTÁNDAR         |                                               |                       |   |   | m3/h   | 1/h  |     |
| A                       | SRE*2,50m*0,3 renovaciones/hora               |                       |   |   | 162,52 |      |     |
| B                       | Nº personas*30 m3/h*0,77                      |                       |   |   | 46,20  |      |     |
| VALOR MAYOR             |                                               |                       |   |   | 162,52 | 0,30 |     |
|                         |                                               |                       |   |   |        |      |     |
| CAUDAL MÁXIMO           |                                               |                       |   |   | ud     | m3/h | 1/h |
| A                       | 30% superior al estándar                      |                       |   |   | 211,28 |      |     |
| B                       | extracción                                    |                       |   |   |        |      |     |
|                         | cocina                                        | 60                    |   | 1 | 180,00 |      |     |
|                         | baño (con bañera)                             | 40                    |   | 1 |        |      |     |
|                         | aseo (con o sin ducha)                        | 20                    |   | 3 |        |      |     |
|                         | almacén, trastero, cuarto instalaciones, etc. | 20                    |   | 1 |        |      |     |
| VALOR MAYOR             |                                               |                       |   |   | 211,28 | 0,39 |     |
|                         |                                               |                       |   |   |        |      |     |
| CAUDAL VERANO           |                                               |                       |   |   | m3/h   | 1/h  |     |
|                         | 50% superior al estándar                      |                       |   |   | 243,78 |      |     |
| VALOR                   |                                               |                       |   |   | 243,78 | 0,45 |     |
|                         |                                               |                       |   |   |        |      |     |
| CAUDAL BASE             |                                               |                       |   |   | m3/h   | 1/h  |     |
|                         | 30% inferior al estándar                      |                       |   |   | 113,76 |      |     |
| VALOR                   |                                               |                       |   |   | 113,76 | 0,21 |     |
|                         |                                               |                       |   |   |        |      |     |
| CAUDAL MÍNIMO           |                                               |                       |   |   | m3/h   | 1/h  |     |
|                         | aproximadamente 52% del estándar              |                       |   |   | 84,51  |      |     |
| VALOR                   |                                               |                       |   |   | 84,51  | 0,16 |     |

### 3. Distribución del aire

| Nr. | Nombre Estancia                | Superficie | Altura libre | Volumen Estancia | Caudales de aire |                  |                   | Renovaciones de aire | tipo de paso de aire                                          |
|-----|--------------------------------|------------|--------------|------------------|------------------|------------------|-------------------|----------------------|---------------------------------------------------------------|
|     | (cada válvula por separado)    | A          | h            | A x h            | V <sub>imp</sub> | V <sub>ext</sub> | V <sub>paso</sub> | n                    |                                                               |
|     |                                | m²         | m            | m³               | m³/h             | m³/h             | m³/h              | 1/h                  | (Ranura puerta, Rejilla puerta, Ranura cerco puerta, válvula) |
| 1   | Recibidor+escalera+descansillo | 19,95      | 6,88         | 137,3            |                  |                  | 177               | 1,29                 | Ranura puerta                                                 |
| 2   | Salón-comedor                  | 39,77      | 4,60         | 182,9            | 40               |                  |                   | 0,22                 | Ranura puerta                                                 |
| 4   | Dormitorio 01                  | 15,71      | 2,50         | 39,3             | 16               |                  |                   | 0,41                 | Ranura puerta                                                 |
| 5   | Dormitorio 02                  | 15,94      | 2,50         | 39,9             | 16               |                  |                   | 0,40                 | Ranura puerta                                                 |
| 6   | Cocina                         | 15,63      | 2,50         | 39,1             |                  | 40               |                   | 1,02                 | Ranura puerta                                                 |
| 7   | Baño 01                        | 6,19       | 2,50         | 15,5             |                  | 27               |                   | 1,74                 | Ranura puerta                                                 |
| 8   | Baño 02                        | 9,01       | 2,50         | 22,5             |                  | 27               |                   | 1,20                 | Ranura puerta                                                 |
| 9   | Cuarto instalaciones           | 6,01       | 2,50         | 15,0             |                  | 16               |                   | 1,06                 | Ranura puerta                                                 |
| 10  | Distribuidor 1                 | 10,48      | 3,39         | 35,5             | 15               |                  |                   | 0,42                 | Ranura puerta                                                 |
| 11  | Dormitorio 03                  | 15,94      | 4,37         | 69,6             | 16               |                  |                   | 0,23                 | Ranura puerta                                                 |
| 12  | Dormitorio 04                  | 13,84      | 2,93         | 40,6             | 16               |                  |                   | 0,39                 | Ranura puerta                                                 |
| 13  | Dormitorio 05                  | 21,94      | 3,96         | 86,8             | 30               |                  |                   | 0,35                 | Ranura puerta                                                 |
| 14  | Baño 03+jacuzzi                | 8,91       | 3,63         | 32,3             |                  | 27               |                   | 0,84                 | Ranura puerta                                                 |
| 15  | Baño 04                        | 6,90       | 3,76         | 25,9             |                  | 27               |                   | 1,04                 | Ranura puerta                                                 |
| 16  | Distribuidor 2                 | 10,48      | 3,39         | 35,5             | 15               |                  |                   | 0,42                 |                                                               |
| 17  |                                |            |              |                  |                  |                  |                   |                      |                                                               |
| 18  | VERANO (MÍN)                   |            |              |                  |                  |                  |                   |                      | 243,78                                                        |
| 19  | INVIERNO (MÍN)                 |            |              |                  |                  |                  |                   |                      | 162,52                                                        |
| 20  | m3/h por conducto redondo      |            |              |                  |                  |                  |                   |                      | 24                                                            |
| 21  | m3/h por conducto ovalado      |            |              |                  |                  |                  |                   |                      | 30                                                            |
|     | total:                         | 216,695    | ---          | 817,68           | 164,0            | 164,0            | ---               | 0,20                 |                                                               |

Ring calculation Source: VAND Arquitectura

1. Acta de caudales impulsión (IMP), extracción (EXT) y de pasos (PASO):

| Nr. | Nombre Estancia    | Proyecto                 |                          |                          | Medición 1               |                          | Medición 2               |                          | Medición 3               |                          | Tipo de válvula | Posición | Caudal de paso           | Medición acústica | clase de filtro | Filtro |
|-----|--------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-----------------|----------|--------------------------|-------------------|-----------------|--------|
|     |                    | V <sub>imp</sub><br>m³/h | V <sub>ext</sub><br>m³/h | V <sub>pas</sub><br>m³/h | V <sub>imp</sub><br>m³/h | V <sub>ext</sub><br>m³/h | V <sub>imp</sub><br>m³/h | V <sub>ext</sub><br>m³/h | V <sub>imp</sub><br>m³/h | V <sub>ext</sub><br>m³/h |                 |          | V <sub>pas</sub><br>m³/s | dB(A)             |                 |        |
| 1   | REC-ESC-DESCANSIL  |                          |                          | 38                       |                          |                          |                          |                          |                          |                          |                 |          |                          |                   |                 |        |
| 2   | SALÓN-COMEDOR      | 40                       |                          |                          | 47,1                     |                          | 41                       |                          | 41,7                     |                          | MARIPOSA        | MEDIA    | 0,8                      | 21                | ESPUMA          | SI     |
| 3   | DORMITORIO-1       | 16                       |                          |                          | 17,3                     |                          | 16,2                     |                          | 16                       |                          | MARIPOSA        | MEDIA    | 0,7                      | 20                | ESPUMA          | SI     |
| 4   | DORMITORIO-2       | 16                       |                          |                          | 16,01                    |                          | 15,7                     |                          | 15,8                     |                          | MARIPOSA        | MEDIA    | 0,7                      | 19                | ESPUMA          | SI     |
| 5   | COCINA-1           |                          | 20                       |                          |                          | 19,6                     |                          | 19,3                     |                          | 20,6                     | MARIPOSA        | MEDIA    | 0,9                      | 21                | ESPUMA          | SI     |
| 6   | COCINA-2           |                          | 20                       |                          |                          | 28,6                     |                          | 18,6                     |                          | 20,4                     | MARIPOSA        | 3,0      | 0,9                      | 21                | ESPUMA          | SI     |
| 7   | BAÑO-1             |                          | 27                       |                          |                          | 47,1                     |                          | 28,1                     |                          | 27,3                     | MARIPOSA        | MEDIA    | 0,9                      | 19                | ESPUMA          | SI     |
| 8   | BAÑO-2             |                          | 27                       |                          |                          | 47,6                     |                          | 29,1                     |                          | 27                       | MARIPOSA        | MEDIA    | 0,9                      | 19                | ESPUMA          | SI     |
| 9   | CUARTO INSTALACION |                          | 16                       |                          |                          | 14,7                     |                          | 15                       |                          | 16                       | MARIPOSA        | 2,0      | 0,7                      | 31                | ESPUMA          | SI     |
| 10  | DISTRIBUIDOR-1     | 15                       |                          |                          | 34,8                     |                          | 15                       |                          | 15,5                     |                          | MARIPOSA        | 2,0      | 0,7                      | 20                | ESPUMA          | SI     |
| 11  | DORMITORIO-3       | 16                       |                          |                          | 24                       |                          | 15,5                     |                          | 15,7                     |                          | MARIPOSA        | 4,0      | 0,7                      | 20                | ESPUMA          | SI     |
| 12  | DORMITORIO-4       | 16                       |                          |                          | 17,3                     |                          | 15,7                     |                          | 15,6                     |                          | MARIPOSA        | 4,0      | 0,7                      | 20                | ESPUMA          | SI     |
| 13  | DORMITORIO-5       | 30                       |                          |                          | 39,9                     |                          | 34                       |                          | 29                       |                          | MARIPOSA        | MEDIA    | 0,7                      | 20                | ESPUMA          | SI     |
| 14  | BAÑO JACUZZY       |                          | 27                       |                          |                          | 13,7                     |                          | 27                       |                          | 26                       | MARIPOSA        | MEDIA    | 0,8                      | 20                | ESPUMA          | SI     |
| 15  | BAÑO-4             |                          | 27                       |                          |                          | 26                       |                          | 27,6                     |                          | 27,6                     | MARIPOSA        | MEDIA    | 0,9                      | 19                | ESPUMA          | SI     |
| 16  | DISTRIBUIDOR-2     | 15                       |                          |                          | 12,4                     |                          | 15,2                     |                          | 15,1                     |                          | MARIPOSA        | 3,5      | 0,7                      | 20                | ESPUMA          | SI     |
| 17  |                    |                          |                          |                          |                          |                          |                          |                          |                          |                          |                 |          |                          |                   |                 |        |
| 18  |                    |                          |                          |                          |                          |                          |                          |                          |                          |                          |                 |          |                          |                   |                 |        |
| 19  |                    |                          |                          |                          |                          |                          |                          |                          |                          |                          |                 |          |                          |                   |                 |        |
| 20  |                    |                          |                          |                          |                          |                          |                          |                          |                          |                          |                 |          |                          |                   |                 |        |
|     | Total              | 164,00                   | 164,00                   | ---                      | 208,81                   | 197,30                   | 168,30                   | 164,70                   | 164,40                   | 164,90                   |                 |          | ---                      | ---               | ---             | ---    |

2. Balanceado de caudales totales

|                                   | Medición 1               |                          | Medición 2               |                          | Medición 3               |                          | Dibalance | Modo de regulación | Posición  | Medición acústica | clase de filtro | Filtro |
|-----------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-----------|--------------------|-----------|-------------------|-----------------|--------|
|                                   | V <sub>adm</sub><br>m³/h | V <sub>exp</sub><br>m³/h | V <sub>adm</sub><br>m³/h | V <sub>exp</sub><br>m³/h | V <sub>adm</sub><br>m³/h | V <sub>exp</sub><br>m³/h |           |                    |           | dB(A)             |                 |        |
| 1 Admisión de aire exterior (ADM) | 219                      | ---                      | 179                      | ---                      | 171                      | ---                      | 1%        | CENTRALITA         | 164m3/hr  | 29                | F7              | SI     |
| 2 Expulsión aire interior (EXP)   | ---                      | 221                      | ---                      | 175                      | ---                      | 169                      |           | CENTRALITA         | 164 m3/hr | 29                | G4              | SI     |

Commissioning of the installation. Source: VAND Arquitectura

## 6.2 Construction phase



Mechanic ventilation. Source: VAND Arquitectura

## 6.3 Ventilation unit

Selección de aparato de ventilación con recuperación de calor

Situación unidad ventilación

1-Dentro de la envolvente térmica

Selección aparato ventilación

| Ir a lista de aparatos de ventilación<br>1-Ordenar: COMO LISTA                            | Recuperación de calor<br>RC efectiva | Humedad<br>calor efva.<br>RC efectiva | Específico<br>RC efectiva<br>[Wh/m³] | Uso<br>[m³/h] | Protección contra<br>la congelación |
|-------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|---------------|-------------------------------------|
| 99ud-unidad compacta seleccionada en la hoja de cálculo                                   | 0,85                                 | n.a.                                  | 0,37                                 | n.a.          | n.a.                                |
| Conductancia ducto de admisión $\Psi$                                                     | W/(mK)                               | 0,780                                 |                                      |               |                                     |
| Longitud del ducto de admisión                                                            | m                                    | 1                                     |                                      |               |                                     |
| Conductancia del ducto de expulsión $\Psi$                                                | W/(mK)                               | 0,780                                 |                                      |               |                                     |
| Longitud del ducto de expulsión                                                           | m                                    | 1                                     |                                      |               |                                     |
| Temp. del cuarto de instalaciones                                                         | °C                                   |                                       |                                      |               |                                     |
| (Sólo introducir en el caso de que la unidad central está fuera de la envolvente térmica) |                                      |                                       |                                      |               |                                     |
| Implementación de la protección contra la congelación                                     |                                      |                                       |                                      |               | 2-Elec.                             |
| Límite de temperatura [°C]                                                                |                                      |                                       |                                      |               | -3                                  |
| Energía útil(kWh/a)                                                                       |                                      |                                       |                                      |               | 0                                   |
| Temperatura interior (°C)                                                                 |                                      |                                       |                                      |               | 20                                  |
| Temp. media exterior periodo calefacción                                                  |                                      |                                       |                                      |               | 11,3                                |
| Temp. media terreno (°C)                                                                  |                                      |                                       |                                      |               | 15,4                                |

Valor efectivo de recuperación de calor

$\eta_{HR,ef}$

82,8%

Category: **Compact Heat Pump System**  
 Manufacturer: **Stiebel Eltron GmbH & Co. KG,**  
**37603 Holzminden, Germany**  
 Product name: **LWZ 8 CS Premium**

This certificate was awarded based on the following criteria (limit values\*):

Thermal Comfort:  $\theta_{supply\ air} \geq 16,5^{\circ}\text{C}$   
 Heat Recovery of ventilation system:  $\eta_{WRG,eff} \geq 75\%$   
 Electric efficiency ventilation system:  $P_{el} \leq 0,45\text{ Wh/m}^3$   
 Air tightness (internal/external):  $V_{Leakage} \leq 3\%$   
 Total Primary Energy Demand (\*\*):  $PE_{total} \leq 55\text{ kWh/(m}^2\text{a)}$   
 Control and calibration (\*)  
 Air pollution filters (\*)  
 Anti freezing strategy (\*)  
 Noise emission and reduction (\*)

Measured values to be used in PHPP  
 useful air flow rates 160 to 230 m³/h

| Heating                                                         |                          | Test point 1 | Test point 3 | Test point 3 | Test point 4 |      |
|-----------------------------------------------------------------|--------------------------|--------------|--------------|--------------|--------------|------|
| Outside Air Temperature                                         | $T_{ext}$                | -7           | 2            | 7            |              | °C   |
| Thermal Output Heating Heat Pump                                | $P_{WP,Heiz}$            | 5.56         | 3.50         | 3.35         |              | kW   |
| COP number Heating Heat Pump                                    | $COP_{Heiz}$             | 2.82         | 3.49         | 3.84         |              | -    |
| Maximum available supply air temperature with Heat Pump only(*) |                          | 35           |              |              |              | °C   |
| Hot water                                                       |                          | Test point 1 | Test point 3 | Test point 3 | Test point 4 |      |
| Outside Air Temperature                                         | $T_{ext}$                | -7           | 2            | 7            | 20           | °C   |
| Thermal Output Heat Pump for heating up storage tank.           | $P_{DHW\ heating\ up}$   | 5.78         | 5.90         | 6.44         | 6.52         | kW   |
| Thermal Output Heat Pump for reheating storage tank             | $P_{DHW\ reheating}$     | 6.13         | 5.92         | 6.20         | 6.25         | kW   |
| COP Heat Pump for heating up storage tank                       | $COP_{DHW\ heating\ up}$ | 2.18         | 2.48         | 3.02         | 3.74         | -    |
| COP Heat Pump for reheating storage tank                        | $COP_{DHW\ reheating}$   | 2.14         | 2.70         | 2.87         | 3.43         | -    |
| Average storage tank temperature                                |                          | 49           |              |              |              | °C   |
| Specific storage heat losses                                    |                          | 1.51         |              |              |              | W/K  |
| Exhaust air addition (if applicable)                            |                          | 881          |              |              |              | m³/h |

(\*) detailed description of criteria and key values see attachment.

(\*\*) for heating, domestic hot water (DHW), ventilation, auxiliary electricity in the reference building. explanation see attachment.

[www.passivehouse.com](http://www.passivehouse.com)

0873ch03

Heat Recovery  
 $\eta_{WRG,eff} = 85\%$

Electric efficiency  
 $0.37\text{ Wh/m}^3$

Air tightness  
 $V_{leak, internal} = 2.2\%$   
 $V_{leak, external} = 1.0\%$

Frost protection  
 down to  $-15^{\circ}\text{C}$

Total Primary Energy  
 Demand (\*\*)  
**32 kWh/(m²a)**



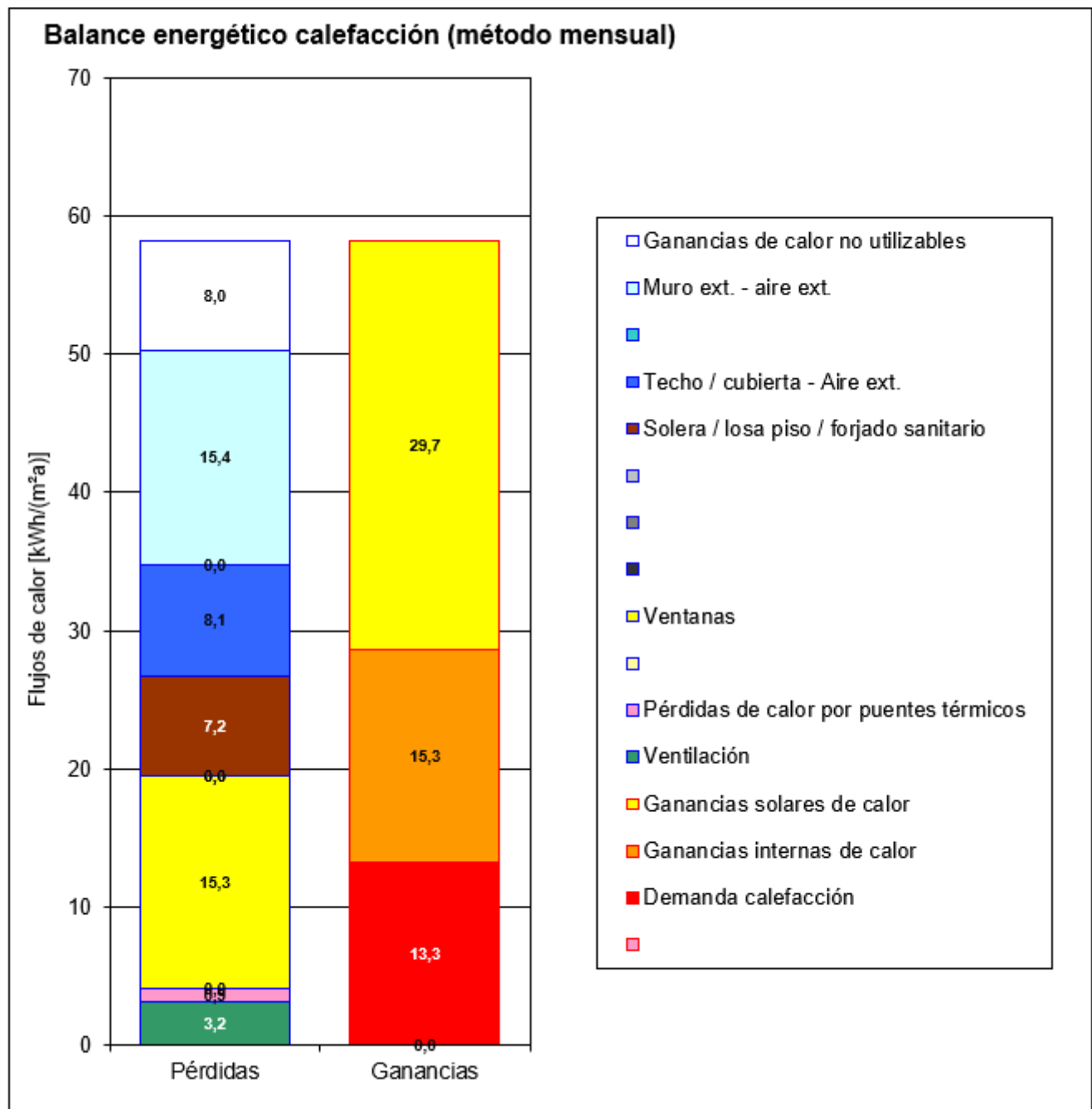


## 8 PHPP Results

| Casa Pasiva Comprobación                                                                                                                 |                                                                                             |           |       |   |                                                                                                                                                                                                                                                                                                                          |                        |                         |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------|-------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------|--|--|
|                                                         |                                                                                             |           |       |   | <b>Edificio:</b> CAD Casa Agripino López<br>Calle: Parcela 5, Urbanización La Raizosa, Pancar<br>CP / Ciudad: 33500 Llanes<br>Provincia/País: Asturias ES-España<br>Tipo de edificio: Vivienda unifamiliar<br>Datos climáticos: ES0032a-Santander<br>Zona climática: 4: Cálida-templada Altitud de la localización: 32 m |                        |                         |  |  |
|                                                                                                                                          |                                                                                             |           |       |   | <b>Propietario / cliente:</b> Agripino López Lucas<br>Calle: Siroco, 54<br>CP / Ciudad: 28042 Madrid<br>Provincia/País: Madrid ES-España                                                                                                                                                                                 |                        |                         |  |  |
|                                                                                                                                          |                                                                                             |           |       |   | <b>Ingeniería:</b> VAND Arquitectura<br>Calle: Finisterre, 8, local 2<br>CP / Ciudad: 28029 Madrid<br>Provincia/País: Madrid ES-España                                                                                                                                                                                   |                        |                         |  |  |
|                                                                                                                                          |                                                                                             |           |       |   | <b>Certificación:</b> Passivhaus Institut<br>Calle: Rheinstraße 44/46<br>CP / Ciudad: D-64283 Darmstadt<br>Provincia/País: Darmstadt DE-Alemania                                                                                                                                                                         |                        |                         |  |  |
| <b>Arquitectura:</b> VAND Arquitectura<br>Calle: Finisterre, 8, local 2<br>CP / Ciudad: 28029 Madrid<br>Provincia/País: Madrid ES-España |                                                                                             |           |       |   | <b>Consult. energética:</b> VAND Arquitectura<br>Calle: Finisterre, 8, local 2<br>CP / Ciudad: 28029 Madrid<br>Provincia/País: Madrid ES-España                                                                                                                                                                          |                        |                         |  |  |
| Año construcción: 2020<br>Nr. de viviendas: 1<br>Nr. de personas: 3,1                                                                    |                                                                                             |           |       |   | Temp. interior invierno [°C]: 20,0<br>Temp. interior verano [°C]: 25,0<br>Ganancias internas de calor (GIC); caso calefacción [W/m²]: 2,3<br>GIC caso refriger. [W/m²]: 2,3<br>Capacidad específica [Wh/K por m² de SRE]: 116<br>Refrigeración mecánica: x                                                               |                        |                         |  |  |
| <b>Valores específicos del edificio con referencia a la superficie de referencia energética</b>                                          |                                                                                             |           |       |   |                                                                                                                                                                                                                                                                                                                          |                        |                         |  |  |
| Calefacción                                                                                                                              | Superficie de referencia energética                                                         | m²        | 216,7 | ≤ | Criterio                                                                                                                                                                                                                                                                                                                 | Criterios alternativos | ¿Cumplido? <sup>2</sup> |  |  |
|                                                                                                                                          | Demanda de calefacción                                                                      | kWh/(m²a) | 13    |   |                                                                                                                                                                                                                                                                                                                          |                        |                         |  |  |
| Refrigeración                                                                                                                            | Carga de calefacción                                                                        | W/m²      | 9     | ≤ | -                                                                                                                                                                                                                                                                                                                        | 10                     | Sí                      |  |  |
|                                                                                                                                          | Demanda refrigeración & deshum.                                                             | kWh/(m²a) | 3     | ≤ | 15                                                                                                                                                                                                                                                                                                                       | 15                     | Sí                      |  |  |
|                                                                                                                                          | Carga de refrigeración                                                                      | W/m²      | 6     | ≤ | -                                                                                                                                                                                                                                                                                                                        | 10                     | -                       |  |  |
|                                                                                                                                          | Frecuencia de sobrecalentamiento (> 25 °C)                                                  | %         | -     | ≤ | -                                                                                                                                                                                                                                                                                                                        | -                      | -                       |  |  |
| Hermeticidad                                                                                                                             | Frecuencia excesivamente alta humedad (> 12 g/kg)                                           | %         | 0,01  | ≤ | 10                                                                                                                                                                                                                                                                                                                       | -                      | Sí                      |  |  |
|                                                                                                                                          | Resultado ensayo presión n <sub>50</sub>                                                    | 1/h       | 0,22  | ≤ | 0,6                                                                                                                                                                                                                                                                                                                      | -                      | Sí                      |  |  |
| Energía Primaria no renovable (EP)                                                                                                       | Demanda EP                                                                                  | kWh/(m²a) | 54    | ≤ | -                                                                                                                                                                                                                                                                                                                        | -                      | -                       |  |  |
|                                                                                                                                          | Demanda PER                                                                                 | kWh/(m²a) | 33    | ≤ | 60                                                                                                                                                                                                                                                                                                                       | -                      | -                       |  |  |
| Energía Primaria Renovable (PER)                                                                                                         | Generación de Energía Renovable (en relación con área de la huella del edificio proyectada) | kWh/(m²a) | -     | ≥ | -                                                                                                                                                                                                                                                                                                                        | -                      | Sí                      |  |  |

<sup>2</sup> Celda vacía: Falta dato; "-": Sin requerimiento

## Energy balance heating



## Energy balance cooling

