Project Documentation

1. Description

Single villa in Cesate (MI), Italy

1.1 Data of building

Year of construction	2019	Space heating	**14** kWh/(m²a)
U-value external wall	0.126 W/(m²K)		
U-value basement ceiling	0.114 W/(m²K)	Primary Energy Renewable (PER)	39 kWh/(m²a)
U-value roof	0.13 W/(m²K)	Generation of renewable energy	24 kWh/(m²a)
U-value window	1.09 W/(m²K)	Non-renewable Primary Energy (PE)	80 kWh/(m²a)
Heat recovery	86 %	Pressure test n50	0.6 h-1
Special features	Photovoltaic Solar Installation, rainwater utilisation		

1.2 New Villa Romeo/Scalavicci

Passive House in Cesate (MI)

The passive house is a single villa built in the municipality of Cesate (MI) to date completed and inhabited by the owners Mr Romeo Mauro and Mrs. Scalavicci Chiara.

From the beginning of the design, the customers had expressed their willingness to build the building according to Passivhaus standards.

The building has a total living area of 196.74 square meters arranged on two floors summarily composed of the main rooms on the ground floor with kitchen, living room, bathroom, three bedrooms and laundry room while on the first floor there is a bedroom with private bathroom, a large attic space with function as a relaxation area and direct access to a large terrace.

The land on which the construction was built is a private residential area with a rectangular dimension and the largest dimension oriented along the north / south axis, a situation that has required greater attention in the distribution of the windows and the relative shading/sun protection in order to obtain a good compromise of summer and winter efficiency.

The construction was made of wood with a frame structure with external EIFS and internal insulated plasterboard counterwall, the roof is also in wood structure with external insulation connected without interruption to the external coat of the vertical walls.

The plant consists of an air/water heat pump for winter and summer air conditioning with an emission system consisting of radiant floor panels, the heat pump itself also produces hot sanitary water connected to a 280-liter storage tank. During the summer, the heat pump must reverse the cycle when it passes from the room cooling function to the production of domestic hot water but the interruption of the cooling function is compensated by the inertia of the emission system.

Air exchange is guaranteed by controlled mechanical ventilation with heat recovery unit and dehumidifier, finally a photovoltaic system with a peak power of 4.5 kW was installed.

1.3 Responsible project participants

architectural project	Studio d’Arch. Boni e Novelli – Arch. Boni Paolo Via Garibaldi 129, Carpenedolo (BS)
Structural engineering	Ing. Lorenzo Comini Via Brodena 10, Lonato del Garda (BS)
Passive House project planning Building physics and construction management	Geom. Claudio Novelli Via Garibaldi 129, 25010 - Carpenedolo (BS) – Italy
Thermotechnical designer	Zeroenergia / ing. Alessandro Lombardi Termotecnico piazza Martiri della Libertà 11 25014 Castenedolo, Italy
Certifying body	Energy Plus Project piazzetta San Marco, 7/8 31053 Pieve di Soligo, Italy
Certification ID	26428_Marco Filippi_PH_20200421_MF Passivhaus database ID no. 6327

1.4 Views of the Building

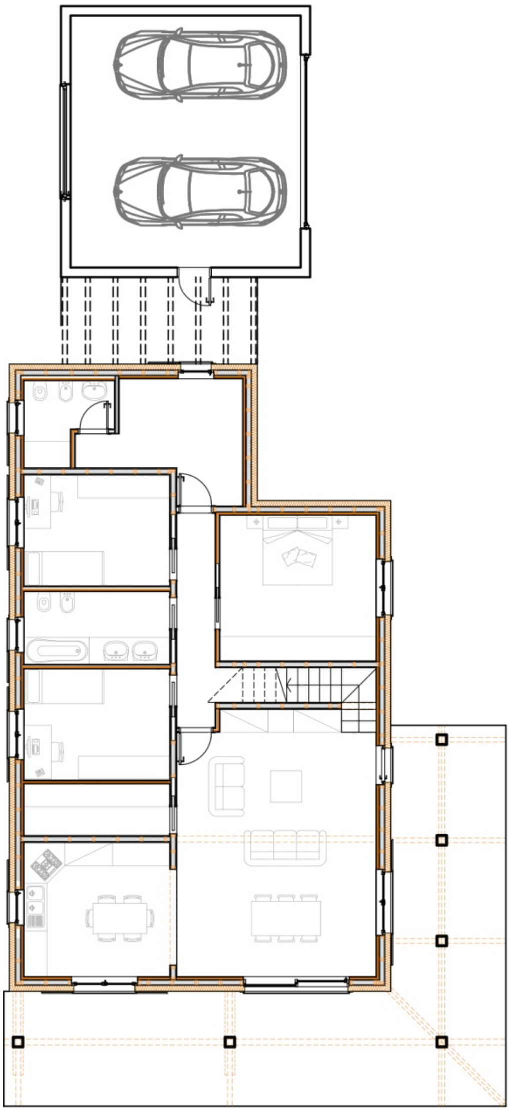
North/Est view

South/West view

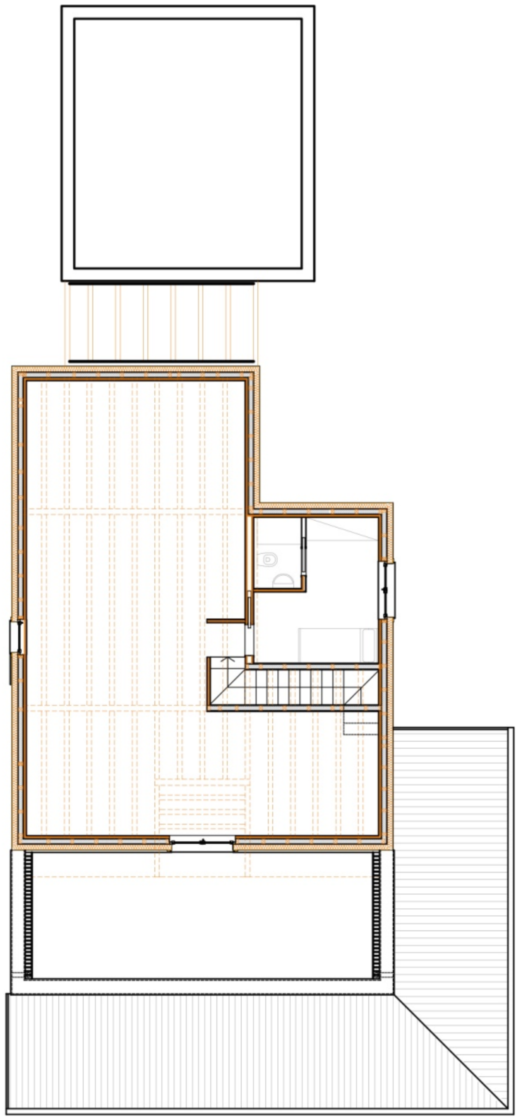
1.5 Interior view

2. Executive project

2.1 Building plans

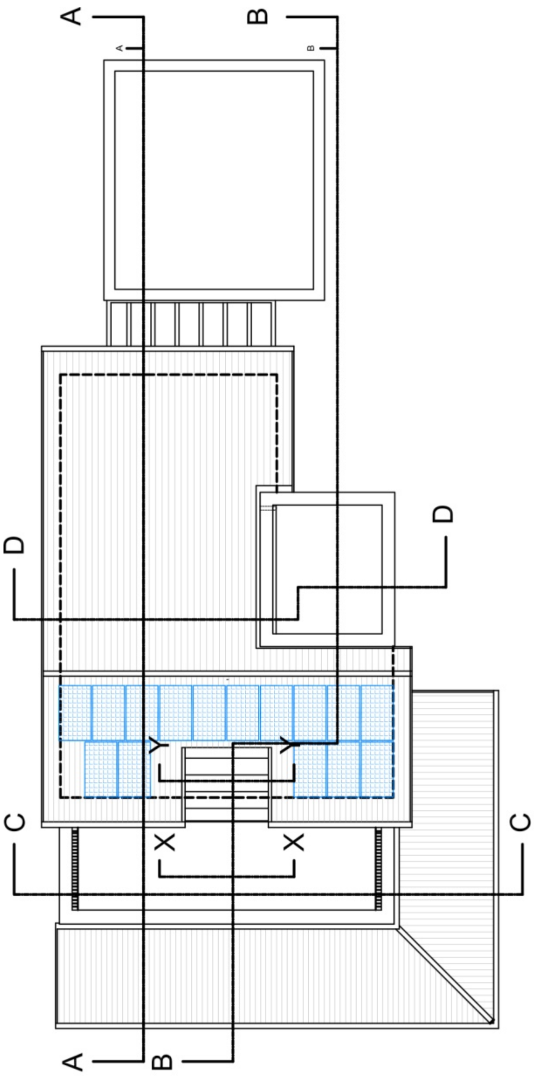


FIRST FLOOR PLANT

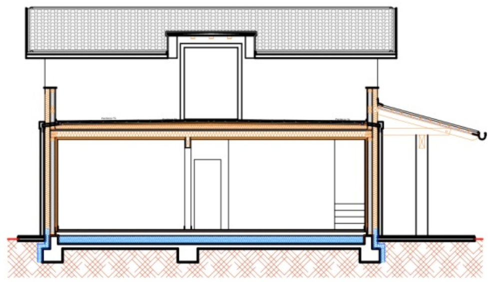


SECOND FLOOR PLANT

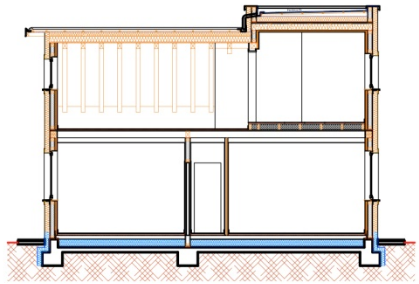
2.2 Roof plan and section



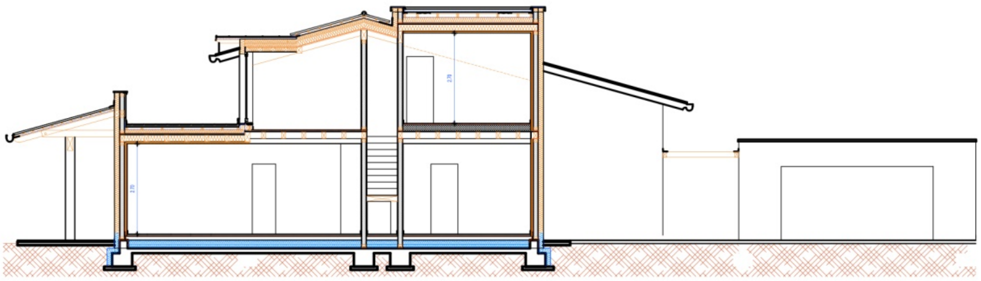
ROOF PLANT



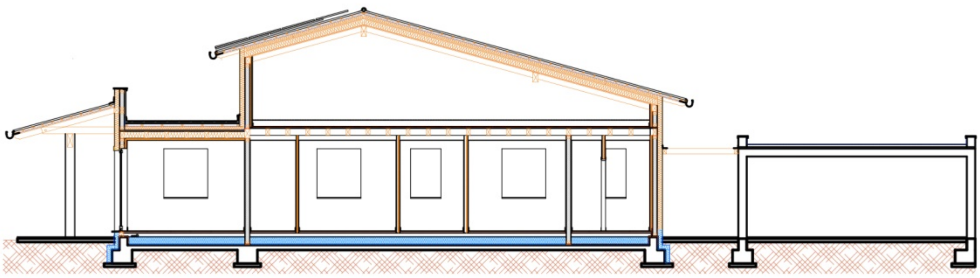
SECTION C-C



SECTION D-D



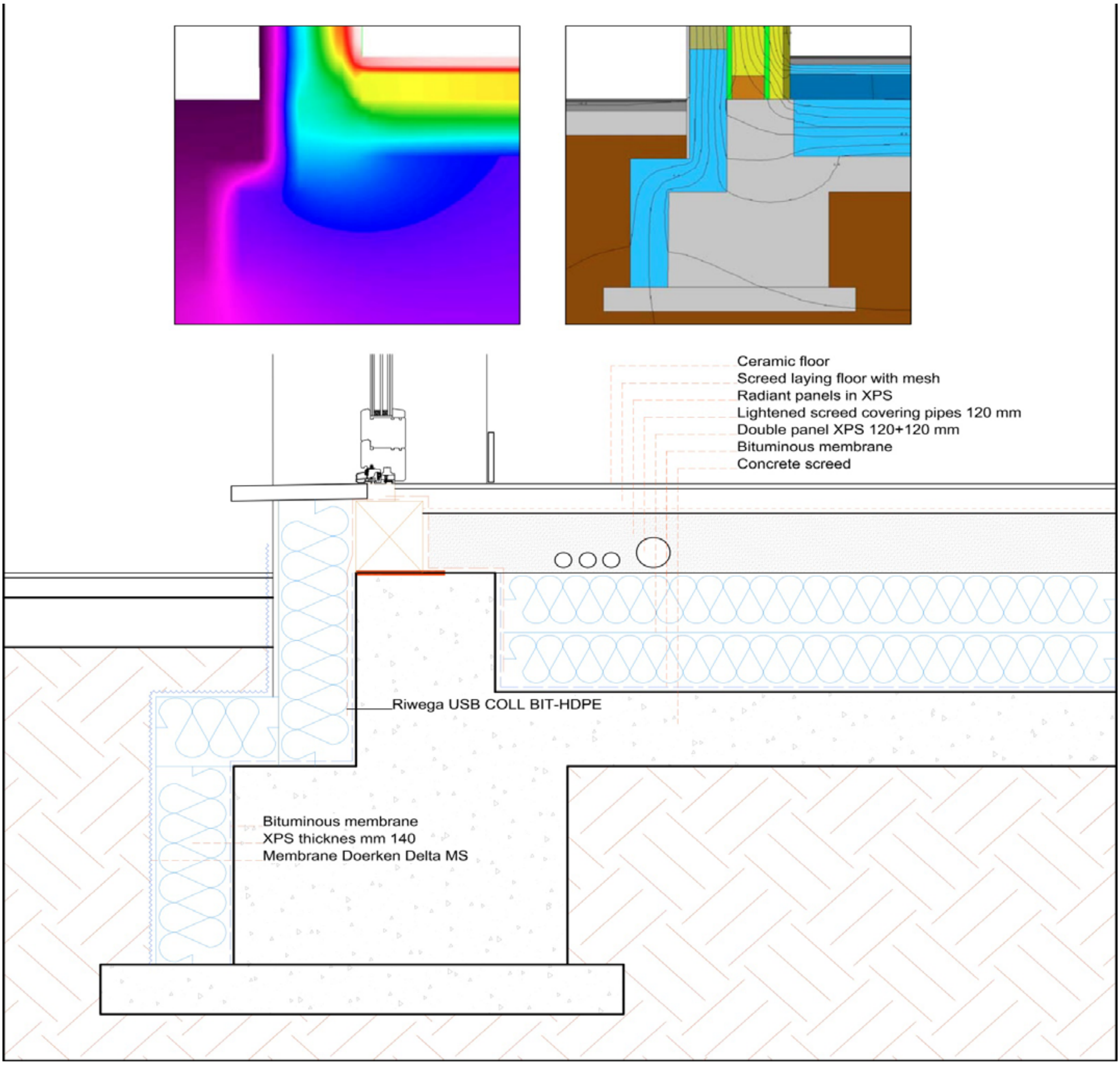
SECTION B-B



SECTION A-A

3 Construction details

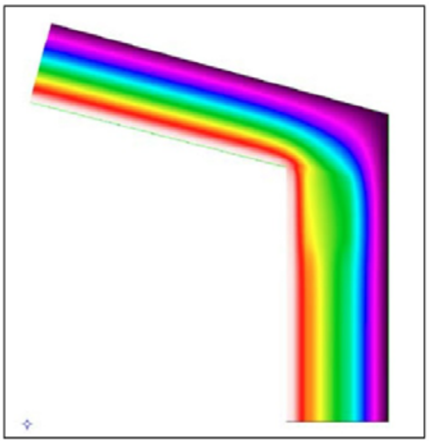
3.1 Slab on grade		Stratigraphy (high to low)
material	thickness mm	
Tiles	10	**U-value: 0,1142**
Screed + radiant floor pipes	40	
XPS for radiant floor	30	
lightened screed	120	
XPS	120	
XPS	120	
Concrete	150	

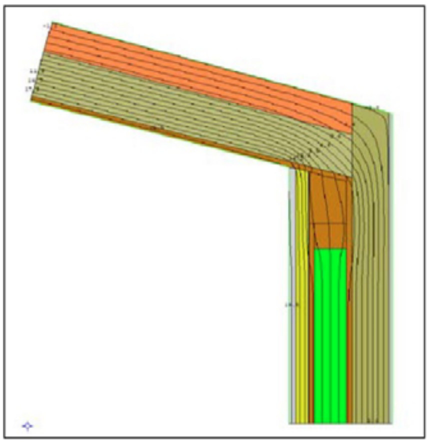


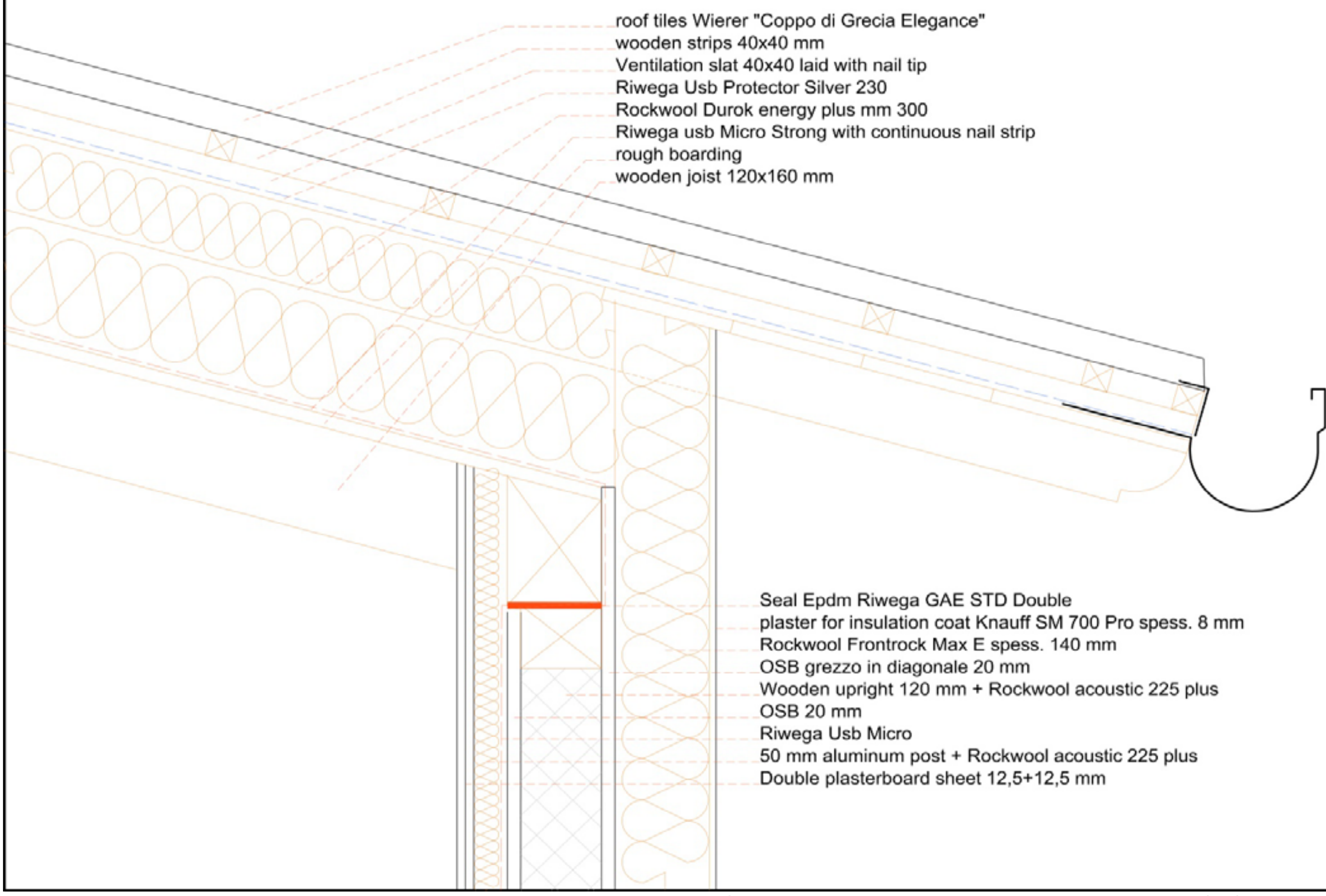
3.2 external wall

Stratigraphy (in to out)

material	thickness mm	
plasterboard	25	U-value: 0,1257
Rockwool Acoustic 225 plus/ aluminum uprights	50	
OSB	18	
Rockwool Acoustic 225 plus/ wood uprights	120	
OSB	18	
Insulating coat Rockwool Frontrock max E	140	
Smoothing plaster	10	

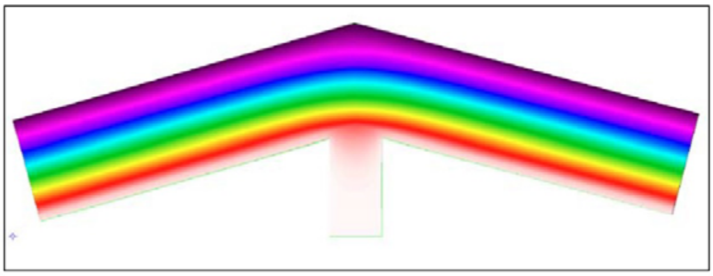


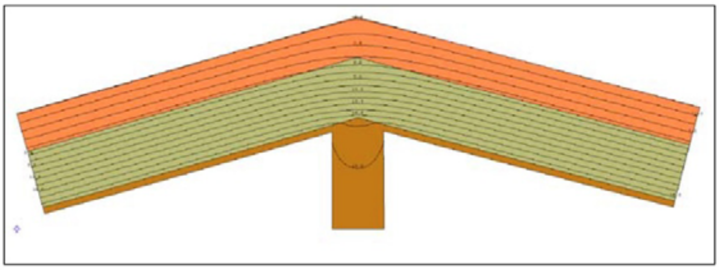


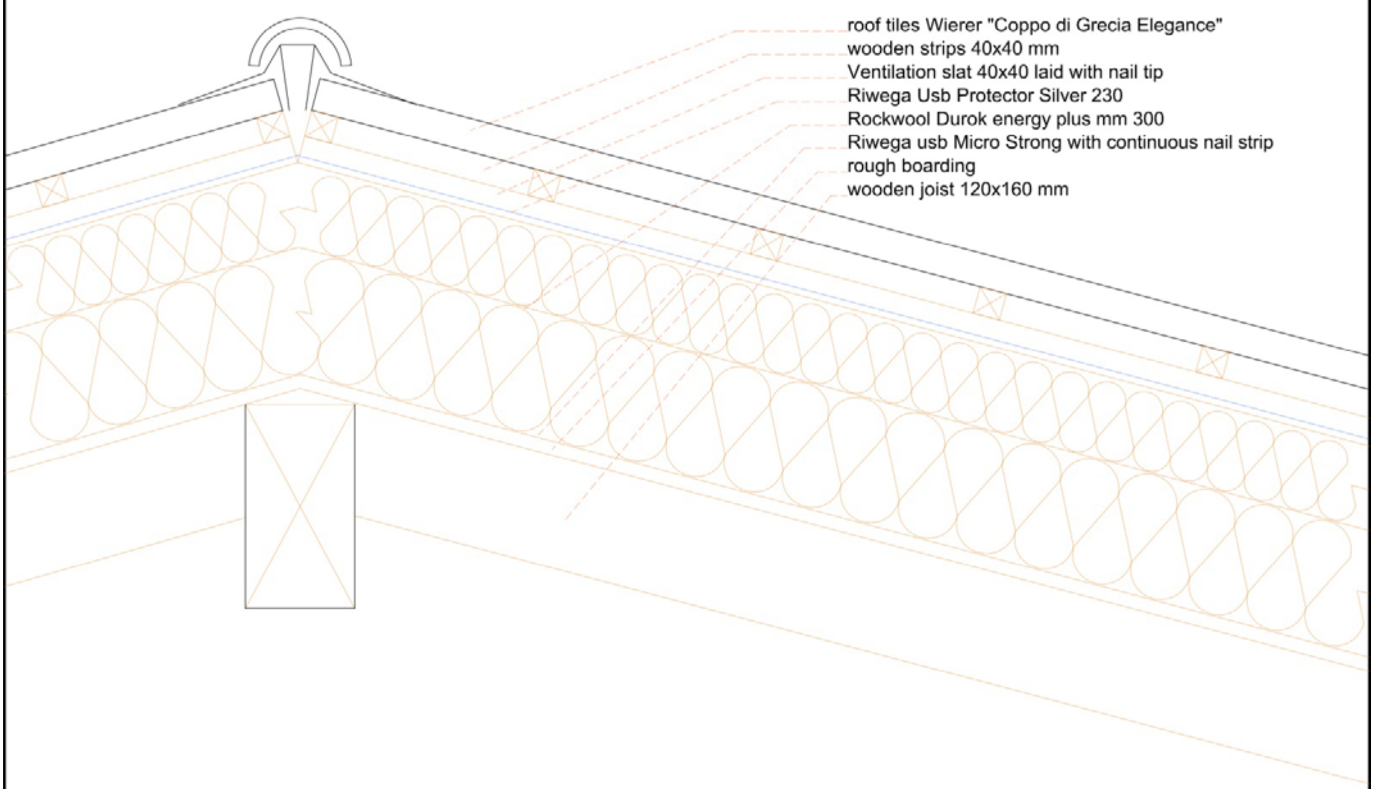


3.3 Pitched roof

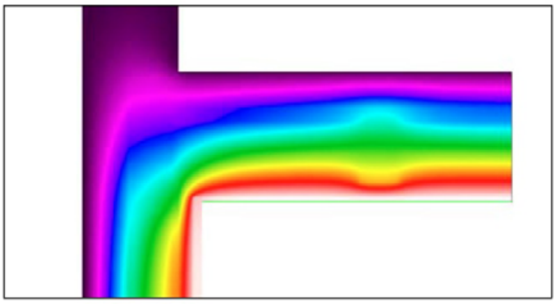
material	thicknes mm	Stratigraphy (high to low)
Wooden boards	20	**U-value: 0,1303**
Rockwool Durok energy plus	180	
Rockwool Durok energy plus	120	

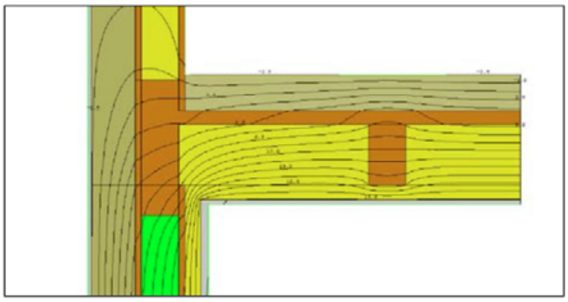


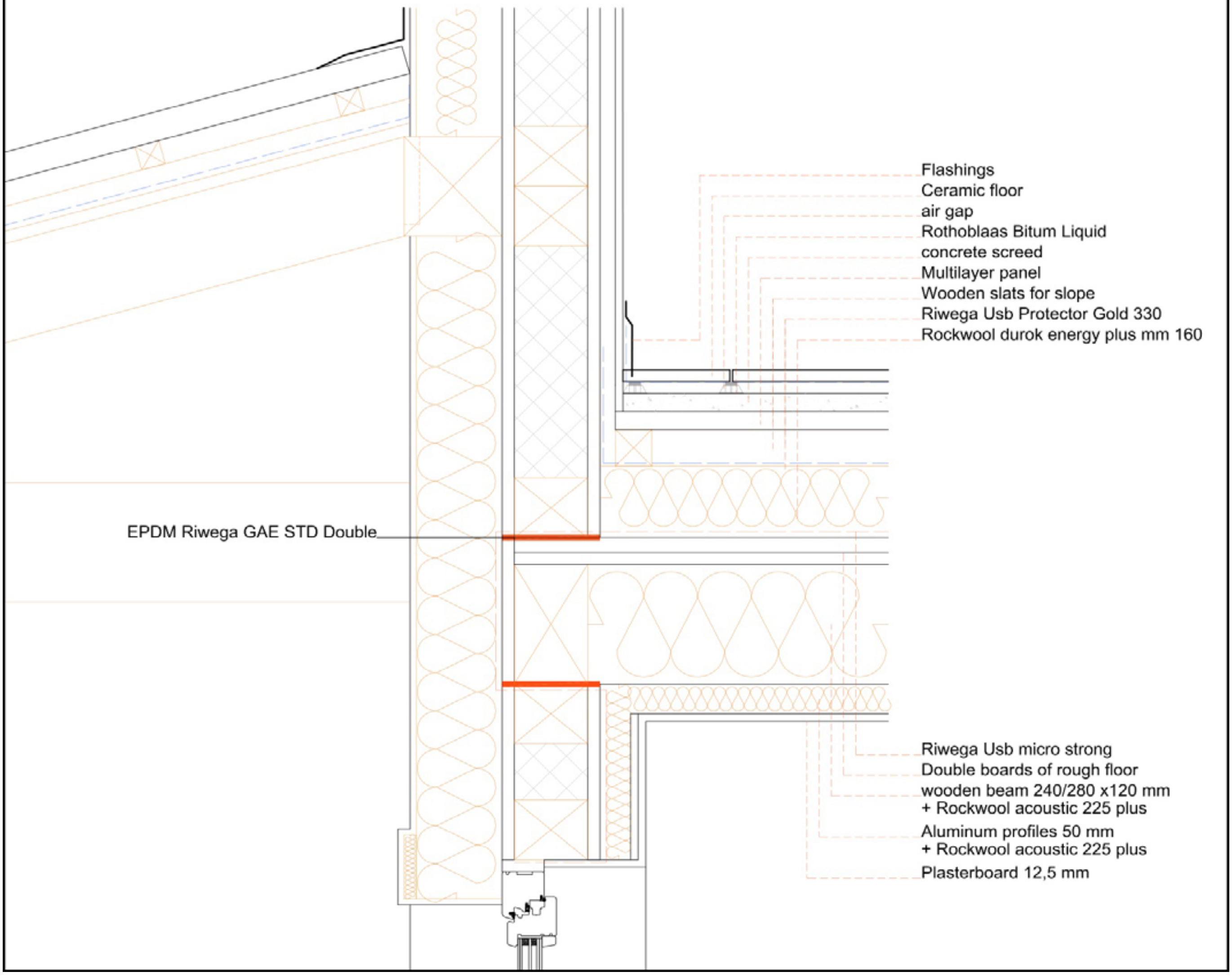




3.4 Flat roofing (Terrace)		Stratigraphy (high to low)
material	thicknes mm	
Plasterboard	13	U-value: 0,1004
Rockwool Acoustic 225 plus/ aluminum profiles	50	
Rockwool Acoustic 225 plus/ wooden joists	200	
OSB	30	
Rockwool Durok energy plus	160	







4.4 Windows and installation

The wooden frames produced by the QRLegno model "Natura78" were chosen, mounted on insulated counterframes of the "Termocassa" model by the Vanin company. The frame has an average Uf thermal transmittance of 1.2 W / m²K.
The windows are a triple low emission glass with the following stratigraphy:

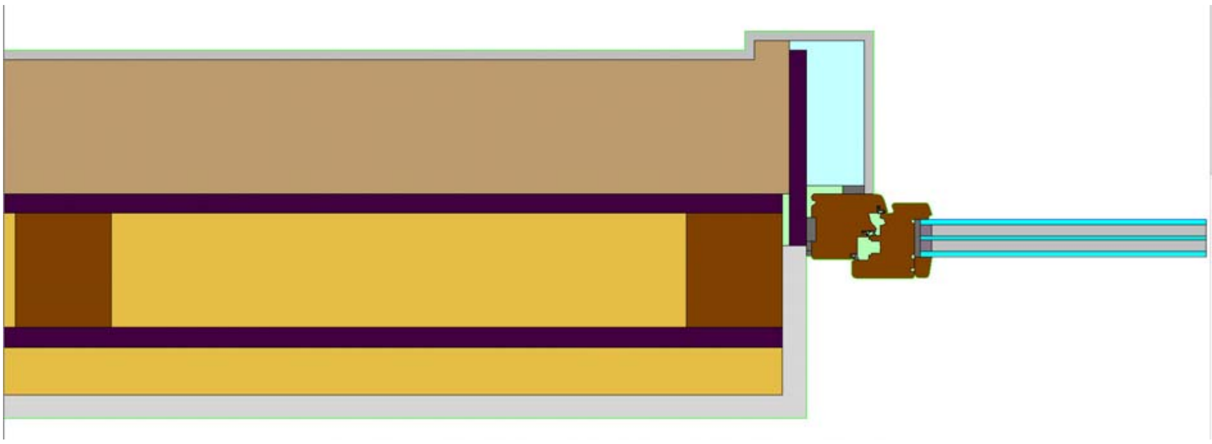
1. Stratobel 33.1 (3 mm Planibel Clearlite + 0.38 mm PVB Clear + 3 mm iplus 1.0)
2. 12 - mm Argon 90%
3. mm Planibel Clearvision
4. 12 mm Argon 90% 5 Stratobel 33.1 (3 mm
5. iplus 1.0 pos.5 + 0.38 mm PVB Clear + 3 mm Planibel Clearlite)

From the data sheet, the thermal transmittance is equal to Ug [W / (m².K)] 0.67 with a solar factor g [%] 41.

The entrance door supplied by the company Gasperotti model Klima A-HE70 with thermal transmittance U [W/(m².K)] 0.88.

All the profiles of the windows have been overlapped as much as possible by the external coat in order to improve the installation conditions and all the hooks of the window components have been calculated to obtain Uf, ψ_g and $\psi\_{installation}$ for each node.

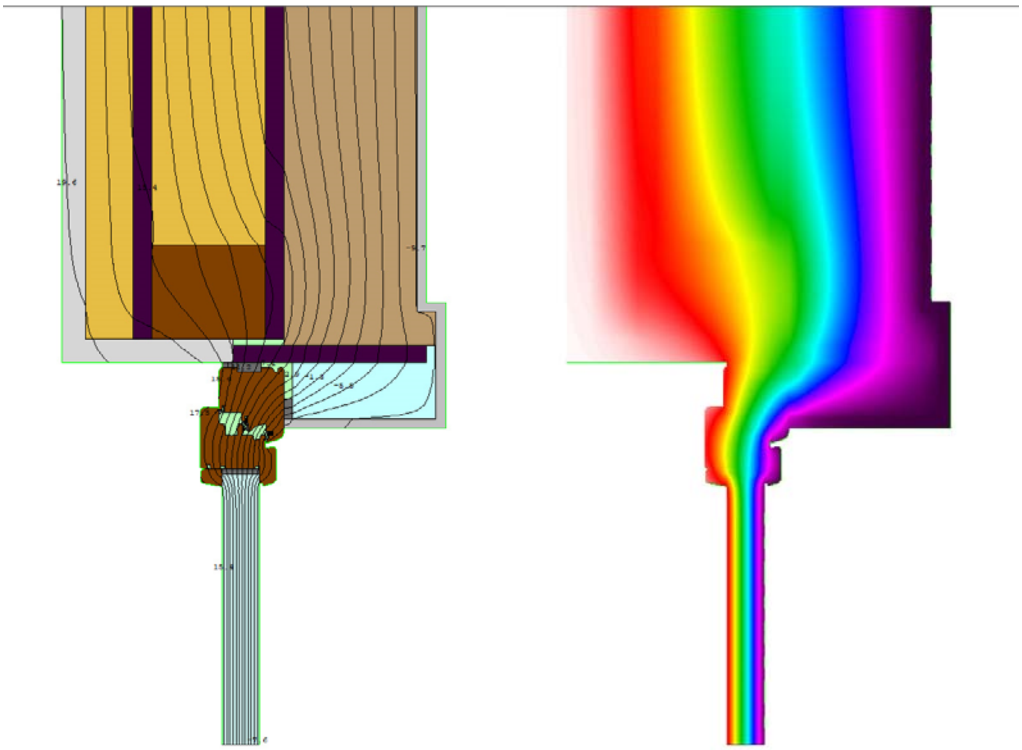
Below is a representation of the window installation structure referred to the side shoulders.



Identification of materials:

- Light blue "Termocassa" XPS
- Dark violet OSB
- Dark brown Wood
- Light brown Rockwool Frontrock max E
- Ocher Rockwool acoustic 225 plus
- Gray inside Double plasterboard sheet 12,5+12,5 mm
- Gray external side Plaster for insulation coat Knauff SM 700 Pro spess. 8 mm

Below is the calculation scheme and the results relating to the prevalent case in the upper horizontal position of the windows:



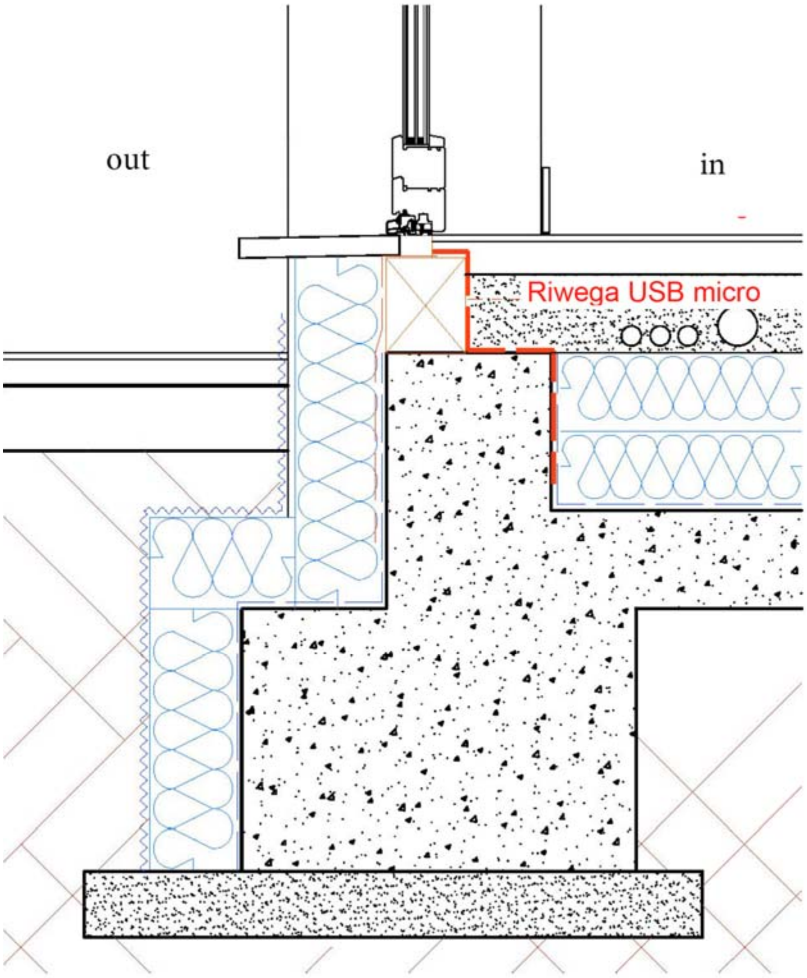
U_f	1.1057	W/m²K
U_g	0.67	W/m²K
U wall	0.1257	W/m²K
ψ_g	0.0328	W/mK
ψ installation	0.0513	W/mK

Below is the table with the results of the calculations for each type of installation:

WINDOWS						
	Description	Position		Ψ glass	Ψ inst	
A	Sill	Windows		0,0326	0,0123	W/mk
B	doorstep	Windows		0,0366	0,0542	W/mk
C	shoulder window	Windows		0,0421	0,0767	W/mk
D	lintel opening with shutters	Windows with shutters		0,0328	0,0513	W/mk
E	lintel opening with sunblind	Windows with sunblind		0,196	0,0888	W/mk
SLIDING WINDOWS						
	Description	Position		Ψ glass	Ψ inst	
F	Internal sliding lifting shoulder	Windows with sunblind		0,0313	0,0591	W/mk
G	Fixed external sliding lifting shoulder	Windows with sunblind		0,0427	0,0489	W/mk
H	Internal sliding lifting threshold	Windows with sunblind		0,0342	0,082	W/mk
I	Fixed external lifting threshold	Windows with sunblind		0,0501	0,0705	W/mk
L	Internal sliding lifting lintel	Windows with sunblind		0,0442	0,0535	W/mk
M	Lifting lintel with fixed external door	Windows with sunblind		0,0426	0,0512	W/mk

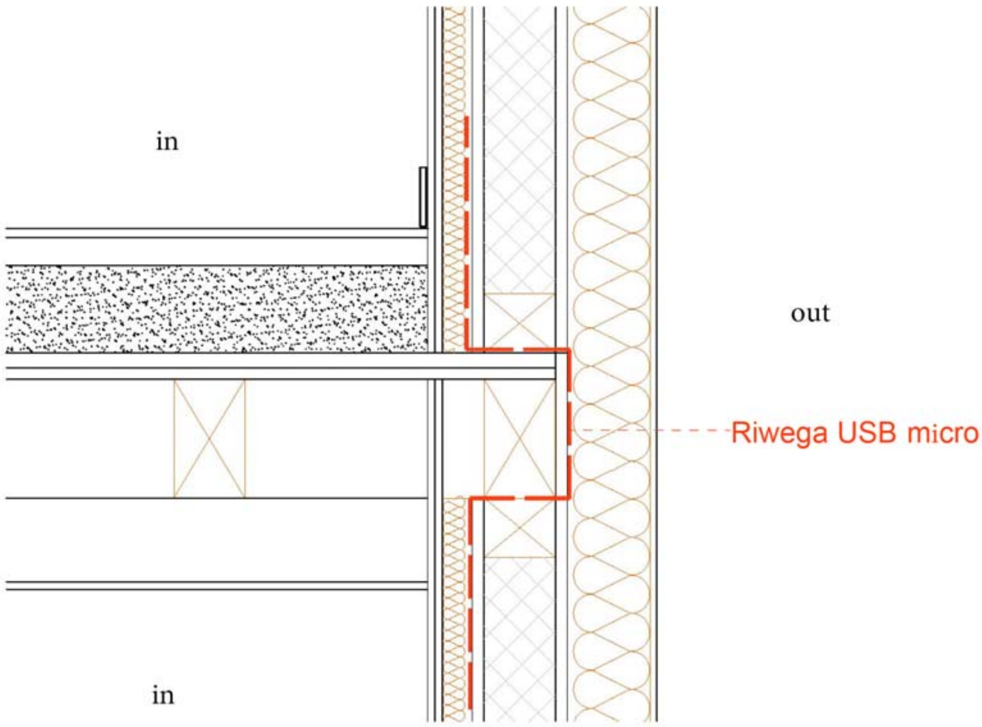
5 Description of the airtight envelope

The airtight layers were identified in the design process and clearly outlined in the executive drawings with preliminary indications and on-site control of the correct installation. The elements such as pipes or ducts that pass through the airtight layer were defined during the design phase by limiting the number to a minimum, the systems were defined in the preliminary phase to prevent these elements from affecting the air tightness by checking the correct application during installation.
The airtight layer starts from the structure of the concrete floor connected to the OSB panels of the walls with a fully taped Riwega USB micro sheet.

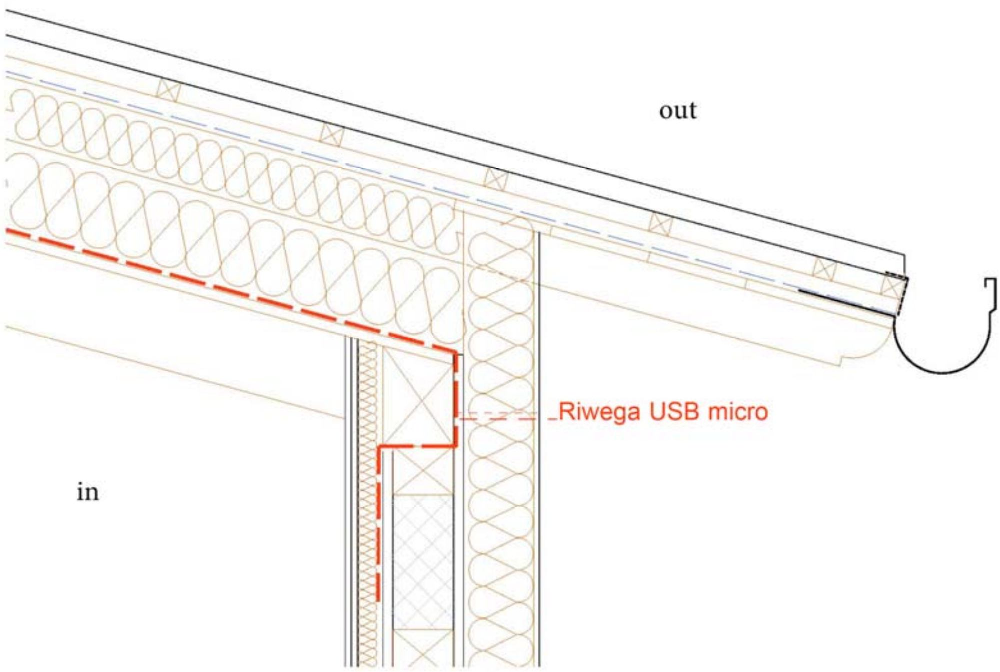


The taping continues on the vertical walls near all the joints of the OSB panels and near the perimeter of all the windows up to the first floor slab.

Near the passage from the ground floor to the upper floor, before the laying of the floor, the sheet was taped in the upper part of the wall, it was turned up on the outside and the laid floor was turned up inside on the base of the recovery of the walls on the first floor.



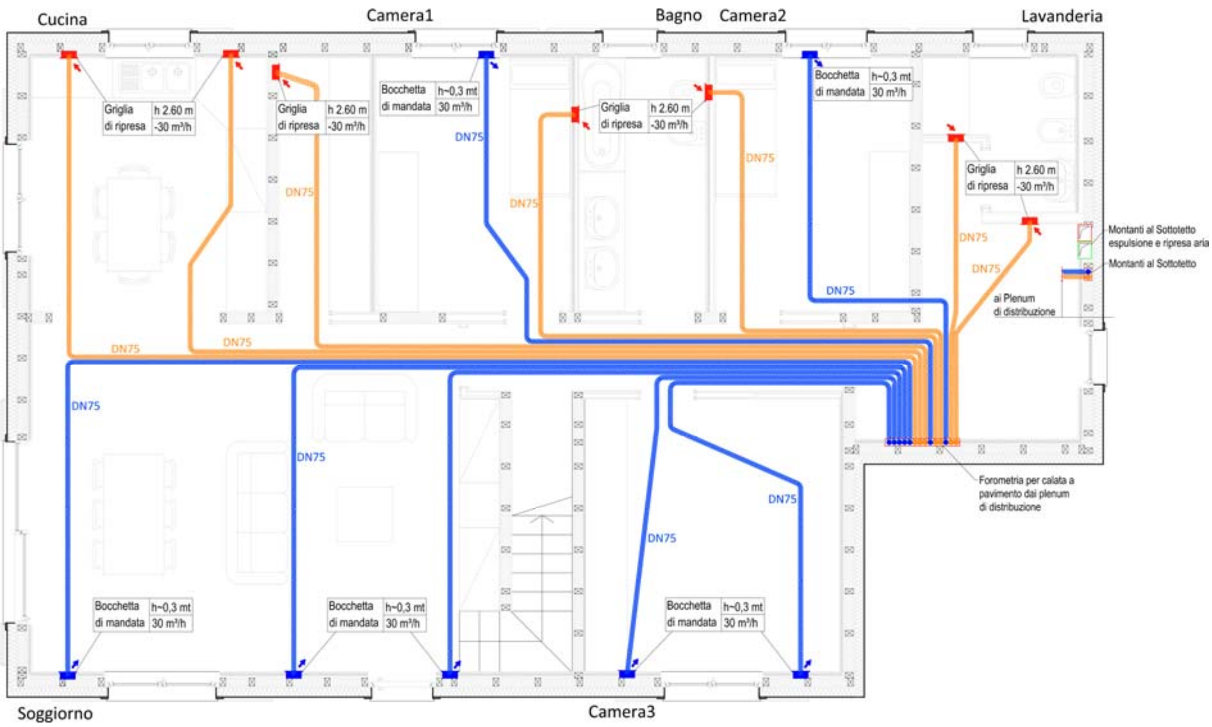
On the first floor, the sheet was taped to the internal OSB panels and the air tightness continues up to the level of coverage with the internal OSB panels taped in their joints. Near the covering wall node, the airtight layer continues with the Riwega USB sheet micro-taped by the internal OSB panels of the wall which, seamlessly, continues in the covering placed between the wooden boarding and the insulation layer of rock wool.



Screws and fixings passing the airtight sheet were made with the help of nail tip strips.

6 Planning of ventilation ductwork

The principle of the three Zones, Extraction, Supply and transit was used for the villa. A mechanical ventilation machine with a Zehnder ComfoAir Q350 certified heat recovery unit was used with a h HR = 90% coupled with a Zehnder Comfodew350 dehumidifier.
Below is the diagram of the distribution of the pipes for Controlled Mechanical Ventilation of the main floor:



The heat pump is located in a dedicated plant room with the distribution that uses the corridor located in the center of the building in order to minimize the length of the pipes.

Below is an excerpt of the main features:

<u>ComfoAir Q350 HRV,</u>

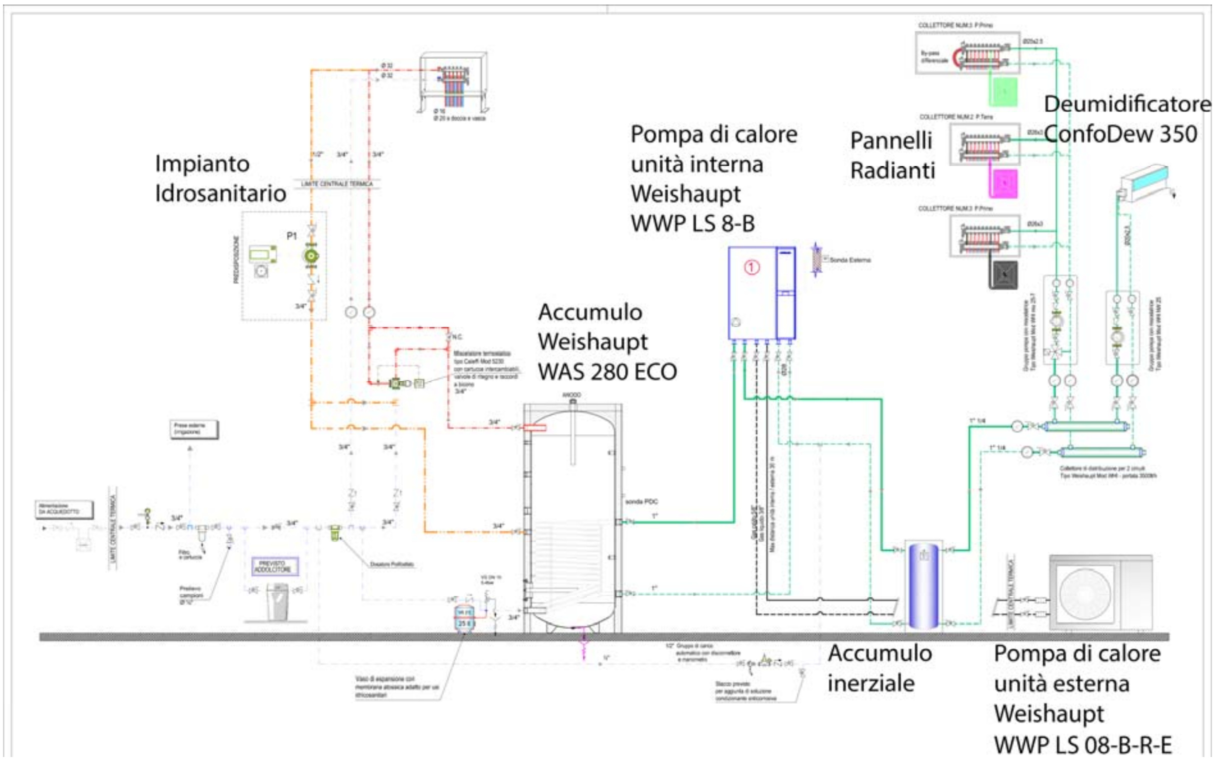
	Component id: 0956vs03 Manufacturer: Zehnder Group Zwolle B.V. Air flow range from: 70 m3/h To: 270 m3/h Heat recovery rate: 90 % Specific electric power: 0.24 Wh/m3 Efficiency ratio: 0.73 Humidity recovery: 0 % Sound level of unit: 43.0 dB(A) Climate zones: Cool, temperate	Leakage Internal leakage: 0.27 % External leakage: 0.28 % Acoustic duct Outdoor air: 39.2 dB(A) Supply air: 52.1 dB(A) Extract air: 39.2 dB(A) Exhaust air: 51.6 dB(A)

Thermal power plant and VMC photographs

7 Systems

7.1 Mechanical systems

The system is a system with an Air-Water heat pump, Weishaupt Mod. WWP LS 08-B R-E outdoor unit and Weishaupt Mod. WWP LS 8-B indoor unit dedicated to winter air conditioning, summer air conditioning and DHW production.
The machine is connected to the floor radiant panel emission system, powers the ConfoDew 350 dehumidifier, and the Weishaupt WAS 280 ECO storage tank to provide the service of domestic hot water.
The temperature of each room is controlled by a dedicated thermostat operating on the single radiant floor circuit of that room.
Below is an excerpt of the plant layout:



7.2 Electrical systems

The electrical system is characterized by the use of LED lighting systems with both single points and recessed strips in the false ceiling, consumption is the classic one of a single residential unit.
A photovoltaic system is installed which, adapting to the architectural shape, makes the most of the inclined roof pitch with optimal exposure characterized by a deviation of 11 ° south and an inclination of about 17 ° with respect to the plane.
Taking advantage of the maximum available surface of the water table, 15 300Wp JAM60S01-305 / PR monocrystalline modules were installed connected to the plant room with the SolarEdge HDWave single-phase inverter model SE5000H connected to the system and to the public grid.

8 PHPP calculations

The calculation was carried out with PHPP 9 with climatic data from Milan which geographically is at an air line distance of less than 10 km beyond having completely compatible orographic characteristics and altitude above sea level.
Below is a summary of the main results:

Passive House Verification

Building:	Residenza Romeo Scalavicci		
Street:	Via Piave 167		
Postcode/City:	20020	Cesate	
Province/Country:	MILANO	IT-Italy	
Building type:			
Climate data set:	IT0010b-Milano		
Climate zone:	4: Warm-temperate	Altitude of location:	150 m
Home owner / Client:	Mauro Romeo e Chiara Scalavicci		
Street:	via Piave 165/D		
Postcode/City:	20020	Cesate	
Province/Country:	MILANO	IT-Italy	

Architecture:	Studio d'Architettura Boni e Novelli		Mechanical engineer:	Zeroenergia / ing. Alessandro Lombardi		
Street:	Via Garibaldi 129		Street:	piazza Martiri della Libertà 11		
Postcode/City:	25013	Carpenedolo	Postcode/City:	25014	Castenedolo	
Province/Country:	BRESCIA	IT-Italy	Province/Country:	BRESCIA	IT-Italy	
Energy consultancy:	Studio d'Architettura Boni e Novelli		Certification:	Energy Plus Project		
Street:	Via Garibaldi 129		Street:	piazzetta San Marco 7/8		
Postcode/City:	25013	Carpenedolo	Postcode/City:	31053	Pieve di Soligo	
Province/Country:	BRESCIA	IT-Italy	Province/Country:	TREVISO	IT-Italy	

Year of construction:	2019	Interior temperature winter [°C]:	20,0	Interior temp. summer [°C]:	25,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,4	IHG cooling case [W/m²]:	2,4
No. of occupants:	3,1	Specific capacity [Wh/K per m² TFA]:	60	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

		Unit	Value		Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	196,7				
Space heating	Heating demand	kWh/(m²a)	14,2	≤	15	-	yes
	Heating load	W/m²	9,0	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	9,0	≤	18	18	yes
	Cooling load	W/m²	5,3	≤	-	10	
	Frequency of overheating (> 25 °C)	%	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg)	%	0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/h	0,60	≤	0,6		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	80	≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	39	≤	60	60	yes
	Generation of renewable energy (in relation to pro-jected building footprint area)	kWh/(m²a)	24	≥	-	-	

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Task:	First name:	Surname:	Passive House Classic?	yes
2-Certifier	Marco	Filippi		Signature:
Certificate ID	**Issued on:**	**City:**		
26428_Marco Filippi_PH_20200421_MF	21.04.2020	Pieve di Soligo, Treviso, Italy		

Project data imported from designPH 1.1.5 PHPP9 display.code: PHIDE_150317_294133072_en09

9 Construction costs

The construction costs are approximately € 1722 / m2 referring to the commercial area calculated only on the building with a percentage of 35% of the accessories such as porches and terrace, excluding the discovered appliances from the calculation which may constitute a variable that cannot be compared with other situations.