

Passivhaus Documentation – BOLEA/QUEMENER HOUSE

Single family house, 24 avenue Saint-Roch 43140 SAINT DIDIER EN VELAY, France

(Passivhaus Database 5306)



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The BOLEA/QUEMENER Passivhaus project started in July 2014, with the architectural conception and PHPP thermal study.

The works for this wood frame building began in January 2015 and were achieved in February 2016, followed by the measurement of the ventilation flow rate.

The Passivhaus certification process was engaged after a while, in March 2017. The certification for the house occurred in July 2017.

Our studies and advices allowed to improve the house performance and comfort, especially concerning:

- The thermal envelope (choice for insulating elements and windows, thermal bridges optimisation, solar gains optimisation, solar protections, airtightness treatment, ...)
- The ventilation system (choice for equipment, sizing of air flow rate, acoustic designing, ...)
- The heating system (heat power, choice for equipment, ...)

KEY FEATURES

Two storey wood frame construction with an unheated annex (outside the thermal envelope, on the North side), solar thermal panels for hot water:

U-value external walls	0.143 W/m ² .K	PHPP space heat demand	12.70 kWh/m ² .year
U-value floor	0.174 W/m ² .K	PHPP Primary energy demand	93 kWh/m ² .year
U-value roof	0.087 W/m ² .K	Pressure test n ₅₀	0.29
U-value window	0.85 W/m ² .K	Heat recovery	83.4%

BRIEF PROJECT DESCRIPTION

The BOLEA/QUEMENER Passivhaus is a four-bedroom 139 m² detached dwelling which was conceived for private clients, who wanted to build for themselves and their children an energy efficient home.

Their choice for a wooden frame structure was motivated by their research for an environmental friendly construction, with the lowest grey energy.

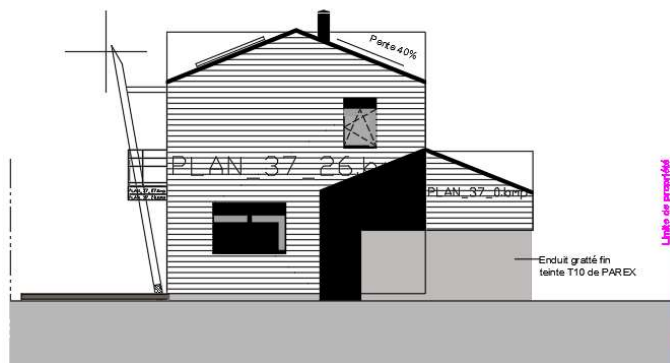
On the site, the building replaced an ancient house, which was demolished.

INNER VIEWS

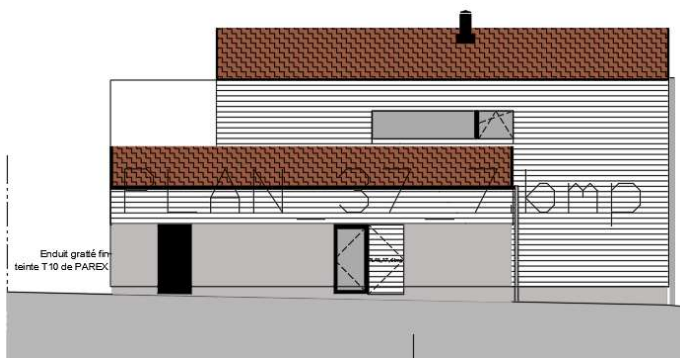


ELEVATIONS

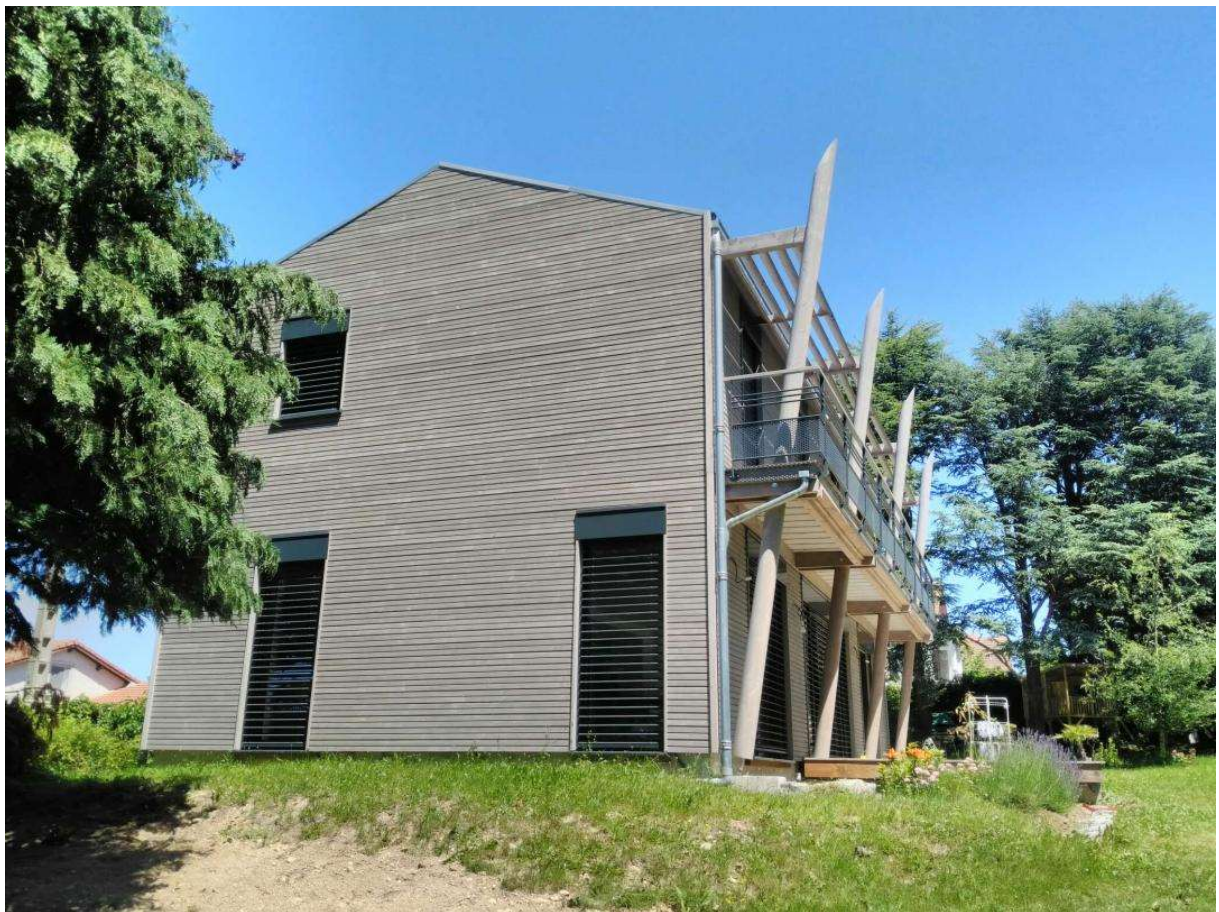
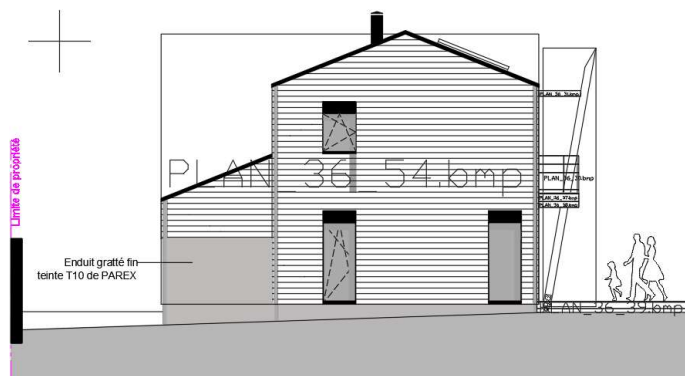
East



North

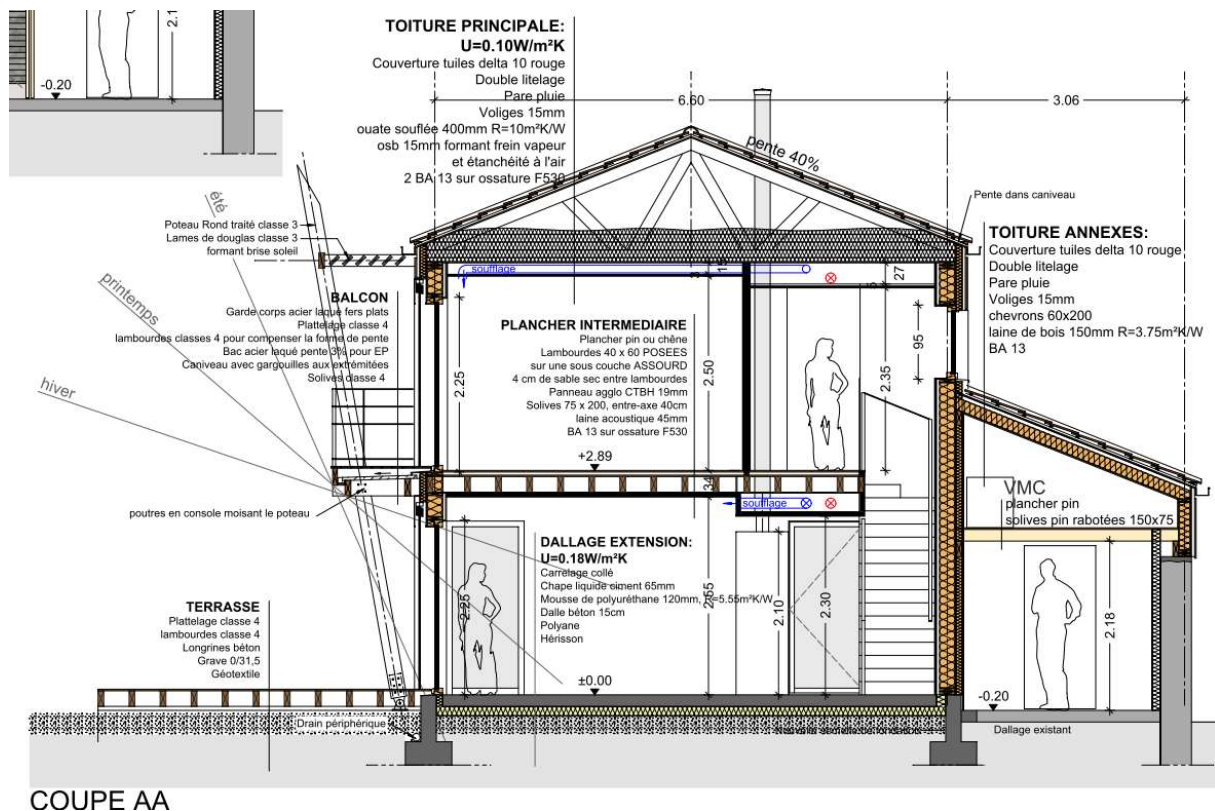


West



South

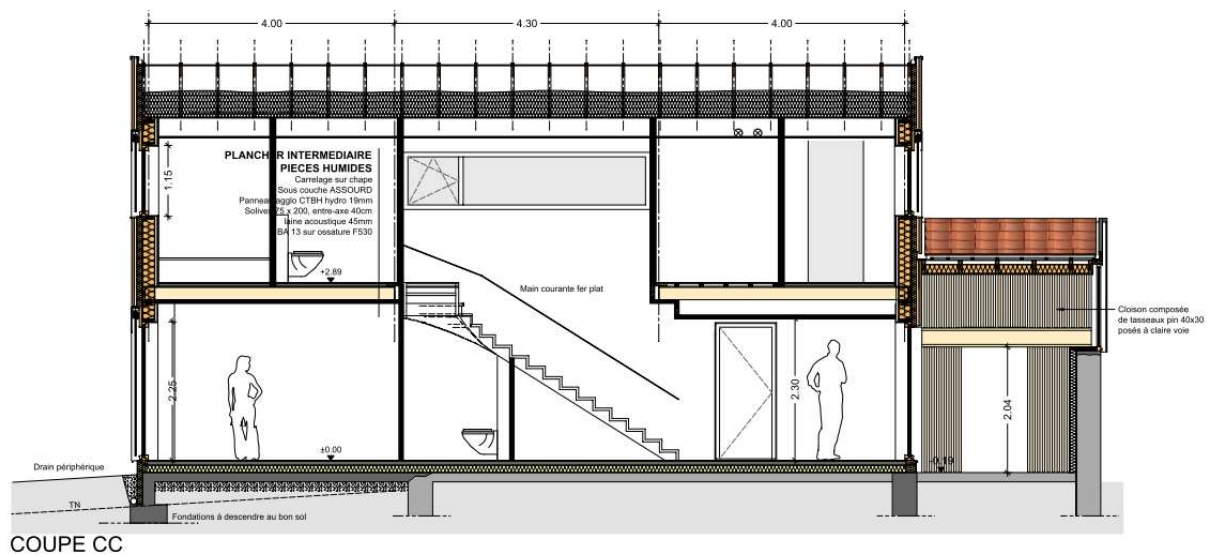




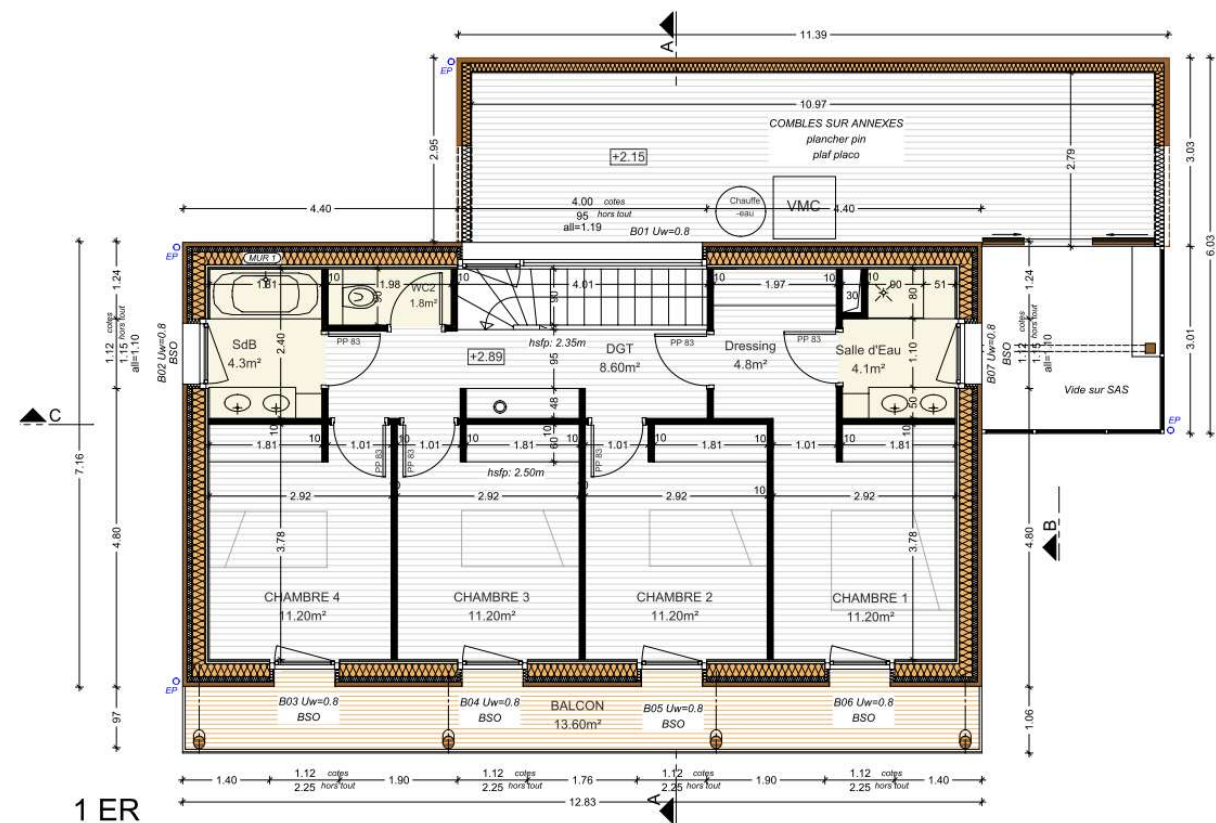
COUPE AA



COUPE BB

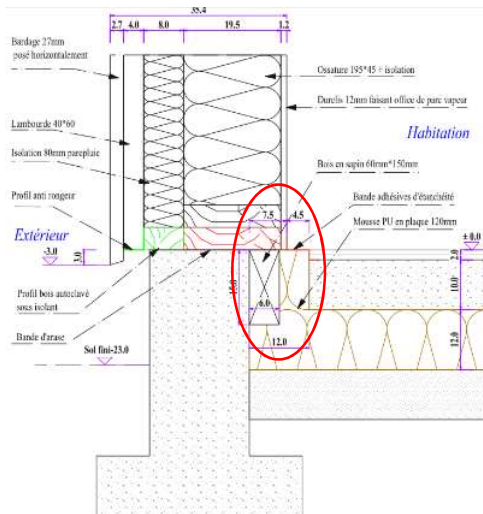


Ground floor plan



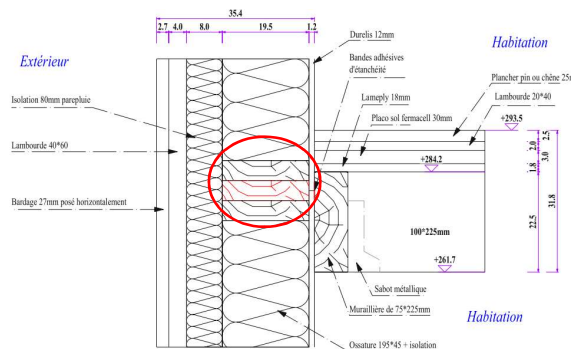
CONSTRUCTION DETAILS

Ground floor details



To help minimise thermal bridge, an insulating block was inserted along the side of the concrete slab (circled in red).

Intermediate floor details

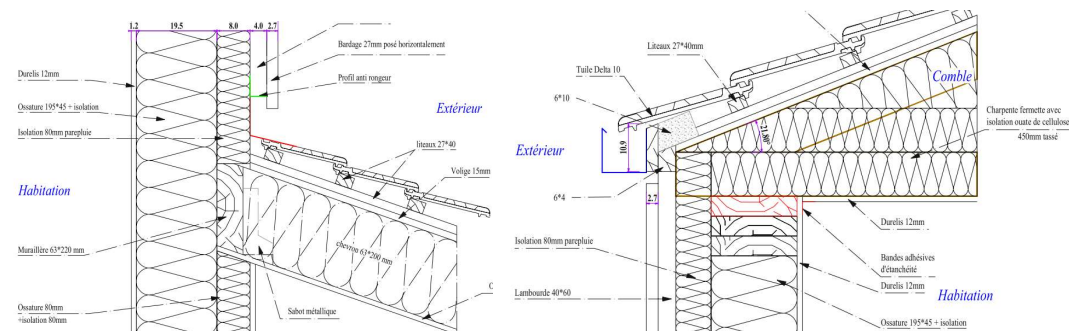


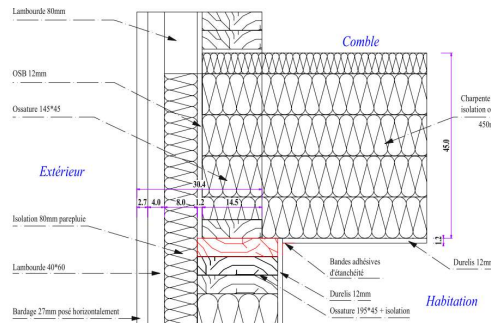
The wooden ledger (circled in red) connects the intermediate floor with the walls (and his thermal bridge is reduced thanks to the outer insulating board), meanwhile it allows a continuous inner “skin” (Durelis panel), which is important to ensure an excellent airtightness.

Partition/dividing walls and connections to other elements

There are no partition walls, only light dividing walls. They don't interrupt the external wall insulating elements and are fixed to the concrete slab at ground floor. Therefore, there are no thermal bridges.

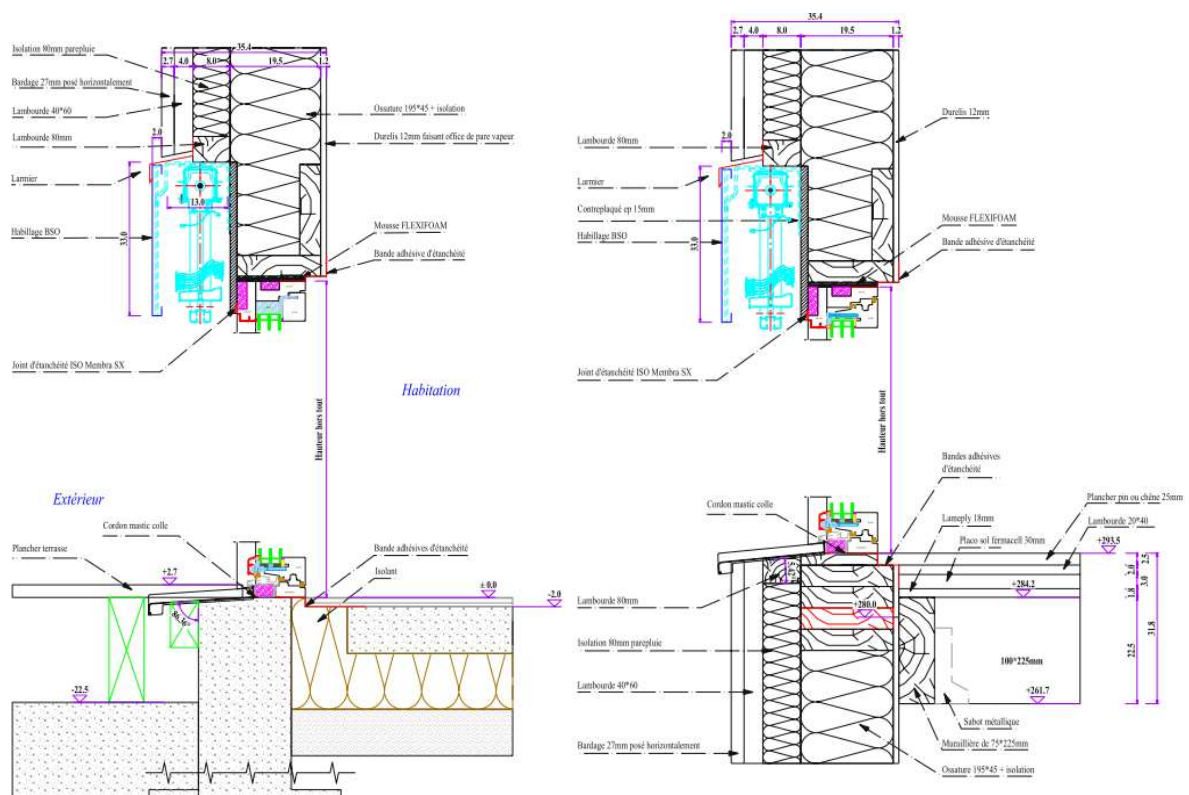
Roof section

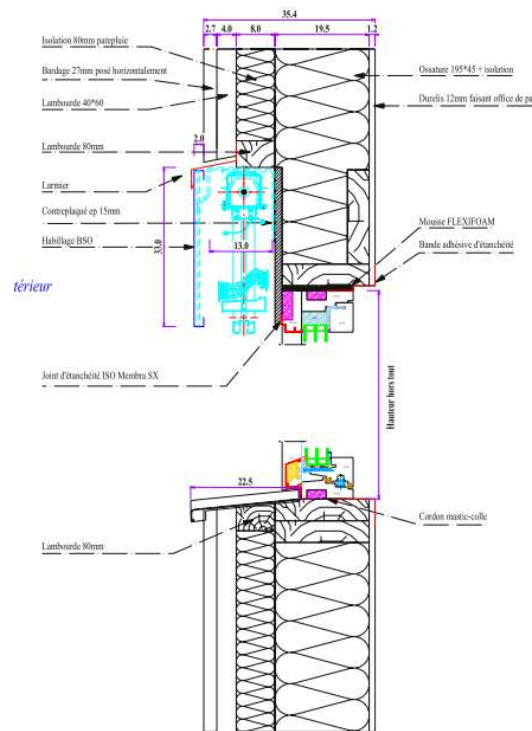




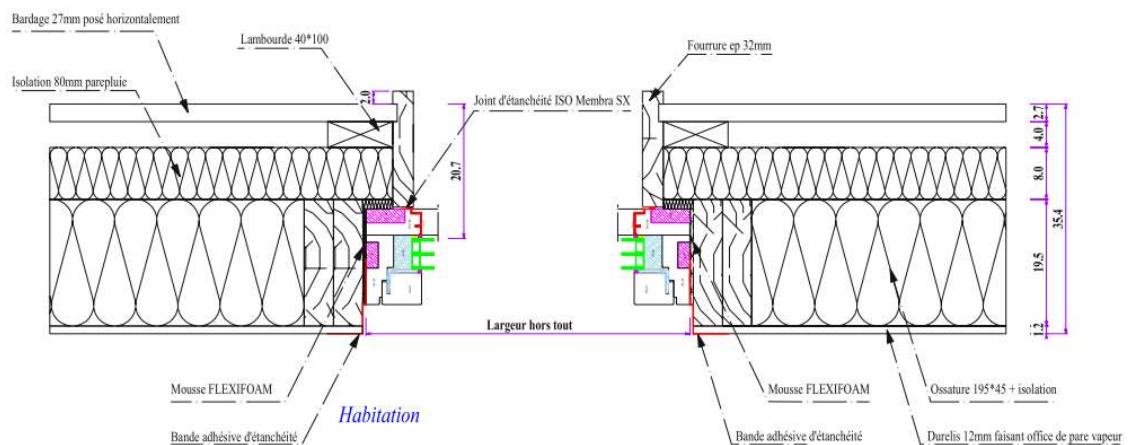
These connections were the result of a cooperative work with the carpenter : the goal was to reduce the thermal bridges.

Windows





Extérieur



Again, a collaborative work with the carpenter (who had the task to install the windows during the works) resulted in efficient details, with reduced thermal bridges and optimised solar gains.

The windows were made by Menuiseries ANDRE company, the model is called Smartwin Classic and is PHI certified :

Zertifikat

Passivhaus geeignete Komponente

für kühl gemäßigtes Klima, gültig bis 31.12.2015

Passivhaus Institut
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY

Kategorie: **Fensterrahmen**
Hersteller: **pro Passivhausfenster GmbH**
83080 Oberaudorf, GERMANY
Produkt: **smartwin**

Folgende Behaglichkeitskriterien wurden für die Zuerkennung des Zertifikates geprüft:

Mit $U_g = 0,70 \text{ W/(m}^2\text{K)}$ und bei einem Fenstermaß von $1,23 \text{ m} \times 1,48 \text{ m}$ ergibt sich:

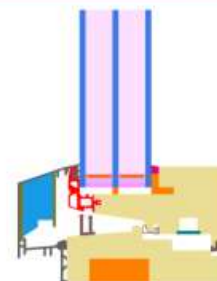
$$U_w = 0,78 \text{ W/(m}^2\text{K)} \leq 0,80 \text{ W/(m}^2\text{K)}$$

Einschließlich der Einbauwärmebrücken erfüllt das Fenster folgende Bedingung, vorausgesetzt der Einbau erfolgt wie im Datenblatt angegeben bzw. thermisch gleich- oder höherwertig.

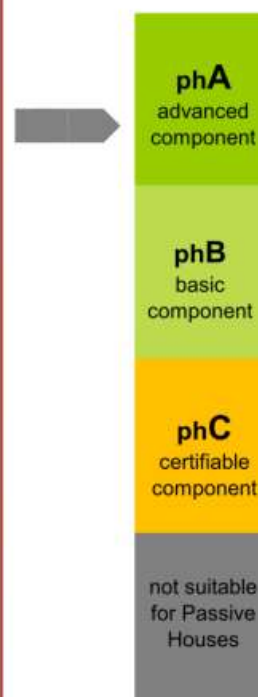
$$U_{w, \text{eingebaut}} \leq 0,85 \text{ W/(m}^2\text{K)}$$

Folgende Rahmenkennwerte wurden ermittelt:

	U_f -Wert [W/(m ² K)]	Breite [mm]	Ψ_g [W/(mK)]	$f_{Rsi=0,25}$ [-]
Abstandhalter			SwisspacerV*	
Unten	0,91	86	0,025	0,70
Seitlich/oben	0,70	86	0,026	



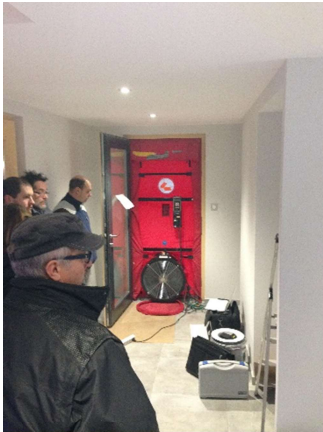
Passivhaus Effizienzklasse



Concerning the glazing, It is a Glaströsch Silverstar on every window, with the following characteristics :

- $U_g = 0.639 \text{ W/m}^2\text{K}$
- g-value = 63.13%

AIRTIGHTNESS STRATEGY & AIR TEST RESULT



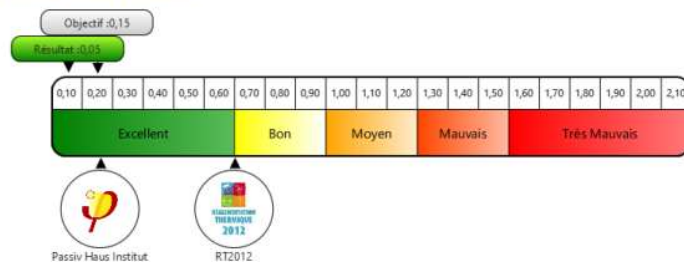
We used a continuous set of Durelis Vapourblock panels (see details above), a specially treated wooden panel with excellent airtightness, to ensure that no air leaks could occur through external walls and roof. These panels were connected with a special adhesive and also with the ground slab.

Moreover, every element (ducts, sleeves, ...) that crosses the heated envelope was treated with a special weldable pipe grommet.

The result is very efficient:

Résultat de la perméabilité à l'air du bâtiment	
$n_{50} = 0,29 \text{ h}^{-1}$	
Intervalle : $\pm 8,26 \%$ [0,27, 0,32]	
$Q_{4\text{Pa-surf}} = 0,05 \text{ m}^3/(\text{h} \cdot \text{m}^2)$	
Intervalle : $\pm 11,00 \%$ [0,05, 0,06]	
Pressurisation	Dépressurisation
Exposant du débit d'air	
$n = 0,84$	$n = 0,76$
Intervalle : $\pm 6,58 \%$ [0,79, 0,90]	Intervalle : $\pm 7,87 \%$ [0,70, 0,82]
Coefficient de fuite d'air en $\text{m}^3/(\text{h} \cdot \text{Pa}^n)$	
$C_t = 4,38$	$C_t = 5,65$
Intervalle : $\pm 18,54 \%$ [3,64, 5,27]	Intervalle : $\pm 20,78 \%$ [4,59, 6,94]
Coefficient de débit d'air en $\text{m}^3/(\text{h} \cdot \text{Pa}^n)$	
$C_{\text{env}} = 4,45$	$C_{\text{env}} = 5,69$
Intervalle : $\pm 18,55 \%$ [3,70, 5,35]	Intervalle : $\pm 20,77 \%$ [4,63, 7,00]
Surface équivalente de fuite	
$AL = 15,21 \text{ cm}^2$	$AL = 17,47 \text{ cm}^2$
Pour $C_d = 1$	Pour $C_d = 1$

Echelle comparative

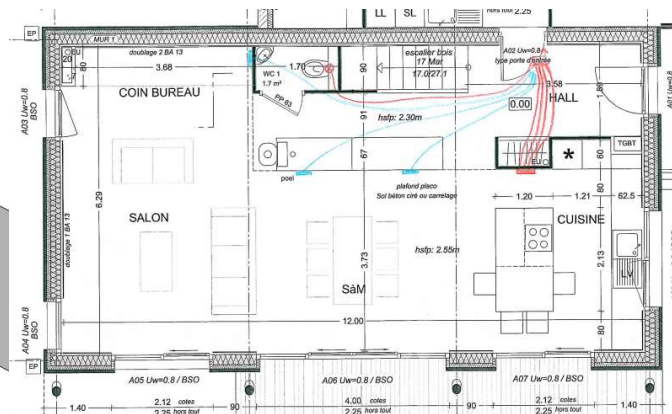
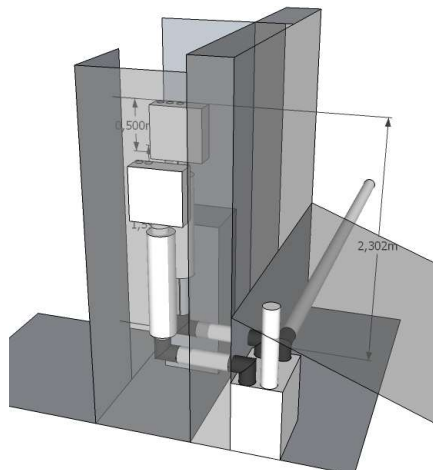
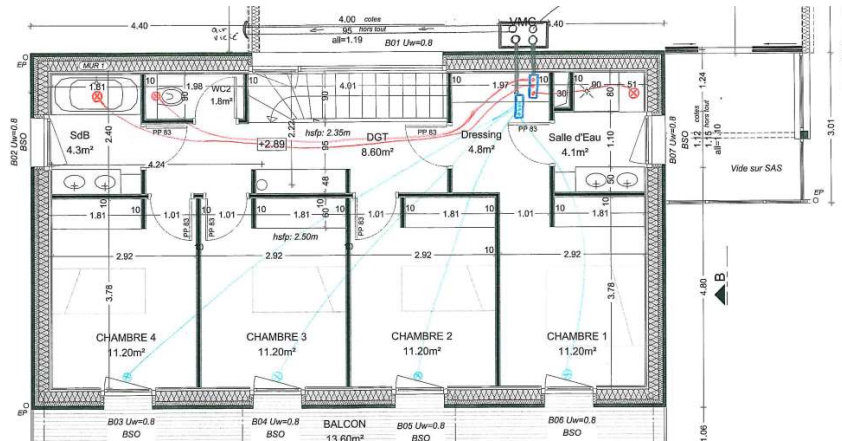


VENTILATION STRATEGY

A HELIOS KWL EC 270 unit was installed in the annex (due to limitation of space and noise reduction), very close to the external wall (see photos), so that the pipes are very short lengthened before penetrating the heated envelope.

The ducting system and noise dampers were installed in the heated envelope.

The unit is equipped with a pre-heating battery, to avoid freezing of the heat exchanger.



HEATING STRATEGY

With the same objective of reducing environmental impact, our clients opted for a wood stove (CONTURA C 850W, 4 kW heating power and airtightness tested), with a complementary heating system in the bathrooms (electric radiators).

The heating need for this house was calculated in PHPP as being 11.7 W/m² when the outside temperature is minus 7.2 degrees Celsius, which means a total demand of 1622 W.



VERIFICATION

Conception bâtiment passif

Projet: **Maison BOLEA/QUEMENER**
 Adresse: **24 avenue Saint-Roch**
 Code postal / localité: **43140 SAINT DIDIER EN VELAY**
 Pays: **France**
 Type de bâtiment: **Maison individuelle**
 Climat: **[FR] - Le Puy-En-Velay** Altitude du emplacement du bâtiment (m. au-dessus NZ): **831**

Maître(s) de l'ouvrage: **Mlle BOLEA et M. QUEMENER**
 Adresse: **24 avenue Saint-Roch**
 Code postal / localité: **43140 SAINT DIDIER EN VELAY**

Architecte:
 Adresse:
 Code postal / localité:

Bureau d'étu. fluides: **HELIASOL**
 Adresse: **15 allée des magnolias**
 Code postal / localité: **69390 VOURLLES**

Année de construction: **2015** Température intérieure en hiver: **20,0** °C Vol. est. du bâtiment V_{est}: **562,1** m³
 Nombre de logement: **1** Température intérieure en été: **25,0** °C Refroidissement mécanique:
 Nombre d'occupants: **4,0** Apports de chaleur internes en hiver: **2,1** W/m²
 Capacité therm. surf.: **84** Wh/K / m² surface habitable idem été: **2,4** W/m²

Caractéristiques du bâtiment par rapport à la surface de référence de l'énergie et de l'année		Critères	Respectés?*	
Chauffer	Surface de référence énergétique:	139,2 m ²		
	Besoin de chaleur de chauffage	12,70 kWh/(m ² ·a)	15 kWh/(m ² ·a)	oui
	Puissance de chauffage	12 W/m ²	10 W/m ²	-
Refroidir	Demande totale de refroidissement	kWh/(m ² ·a)	-	-
	Puissance de refroidissement	W/m ²	-	-
	Fréquence de surchauffe (> 25 °C)	0,0 %	-	-
Energie primaire	Chauffer, refroidir, climatisation, ECS, éclairage, électro-chauffage	93 kWh/(m ² ·a)	120 kWh/(m ² ·a)	oui
	ECS, chauffage et électricité auxiliaire	50 kWh/(m ² ·a)	-	-
	Réduction énergie prim. par la prod. d'élec. solaire	kWh/(m ² ·a)	-	-
Etanchéité à l'air	Test d'infiltrométrie n ₅₀	0,3 1/h	0,6 1/h	oui

* Calculé selon la norme EN 15601-1:2010

Bâtiment passif? **oui**

EXPERIENCE

The house has now been occupied for two years, and feedback from occupants has been very positive.

COSTS

The final cost of the project was not compiled by the client.