Passive House Technical Report

Passive House Consultant: Frédéric Loyau - Thermal engineering consultant / trainer– 02 54 94 62 18
contact@fiabitat.com www.fiabitat.com

Architect: Roland Jelh

Constructor: Boisdicy

This passive detached house was built in 2013 in Chablis (Bourgogne, France) by a timber construction company specialised in ecological and low energy building techniques. It was granted Passive House Certification in early 2014, and was the first certified passive house to be built in the Bourgogne area. The project was carried out by Mr. Grosbety, at the time mayor of the town, who was eager to promote the development of passive housing in his community and region.

More information is available here: www.bddmaisonpassive.fr ID 4020

U-value outside wall:	0,111 W / (m²K)	PHPP Heat demand: 14 kWh / (m²a)
U-value roof:	0,104 W / (m²K)	
U-value ground slab:	0,157 W / (m²K)	PHPP PE demand: 109 kWh /(m²a)
U-value window:	0,78 W / (m²K)	
Heat recovery: 84%		Pressure test: 0,41 h^{-1}

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1- Contents

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2- Assignments undertaken by Fiabitat engineering consultants / Thermal engineer Frédéric LOYAU

- Energy system optimisation (thermo-technical building simulations & guidance report)
- Validation of detailed plans provided by project manager Boisdicy
- PHPP editing (document relative to Passive House Certification standards)
- Dimensioning of dual-flow centralised mechanical ventilation system
- Air tightness test during construction
- Air tightness test at commissioning
- Passive House Certification application

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3- Building description

GENERAL INFORMATION

Building type: detached residential house (Passive House new build)
Location: France - (Bourgogne)
Description: This passive detached house was built in 2013 in Chablis (Bourgogne, France) by a timber construction company specialised in ecological and low energy building techniques. It was granted Passive House Certification in early 2014, and was the first certified passive house to be built in the Bourgogne area. The project was carried out by Mr. Grosbety, at the time mayor of the town, who was eager to promote the development of passive housing in his community and region.
Number of apartments/units: 1
Treated Floor Area according to PHPP: 111 m^2
Construction type: timber construction
Year of construction: 2013

OTHER PARTIES INVOLVED

Building services: Boisdicy
Building physics: Fiabitat Concept
Tradesmen/organisation granting certification: La Maison Passive France

MECHANICAL SYSTEMS

Ventilation: Zehnder ComfoAir 350
The dual-flow ventilation system installed in the building is certified at 84% efficiency (according to EN 13141-7 (PHI)) and has a very low energy requirement: 0,34 Wh/m3
Heating installation: via ventilation system, by electric battery.
Domestic water heating system: AUER Xiros 150L thermo-dynamic water tank

PHPP VALUES

Air tightness: **n_{50} = 0.41 h^{-1}**
Pressure test value:
Annual heating demand: **14 kWh / (m^2a)** calculated according to PHPP.
Heating load: **14 W/m^2**
Primary energy requirement: **109 kWh / (m^2a)** for heating installation, domestic hot water, household electricity and auxiliary electricity, calculated according to PHPP.

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3- Building description

THERMAL ENVELOPE

N°	Building element	Composition (with λ in W/m².K) From exterior to interior	Coeff. U* (W/m².K)
1	Ceiling	Fermacell [0,320 W/(mK)], 13mm Air space service shaft [0,98 W/(mK)], 160mm Cellulose Fibre [0,04 W/(mK)] between rafters 200 mm Ouate cellulose [0,04 W/(mK)] 200 mm	U-value = 0.104 W/(m²K)
2	Slab on ground floor	Tiled flooring [1,400 W/(mK)], 70mm Reinforced concrete slab [2.3 W/(mK)], 120mm PUR [0,023 W/(mK)], 140mm	U-value = 0.157 W/(m²K)
3	Roof	Fermacell [0,320 W/(mK)], 13mm Wood wool [0,039 W/(mK)], 60mm OSB [0,13 W/(mK)] Loose wood wool [0,038 W/(mK)] + I beam heel (10% bois), w78 mm Laine bois vrac [0,038 W/(mK)] + I beam web (2% bois), w162 mm	U-value = 0.111 W/(m²K)
4	Frames	Smartwin wood/aluminium openings Solar factor = 0.6 south facade and 0.5 other facades	U_f-value = 0.91 W/(m²K)
5	Glazing	Triple glazing on south facade Solar factor = 0.6 on south facade Other facades	U_g-value = 0.6 W/(m²K) g -value = 60 % U_g-value = 0.5 W/(m²K) g -value = 53 %
6	Door	Solid door, main entrance: Clima Top Plus Solid door between equipment room and house: Clima Top Eco	U_d-value = 0.68 W/(m²K) U_d-value = 1 W/(m²K)

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4- Photos - Exterior

South view

Est View

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4- Photos - Exterior

North view

West View

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5- Photos - Interior

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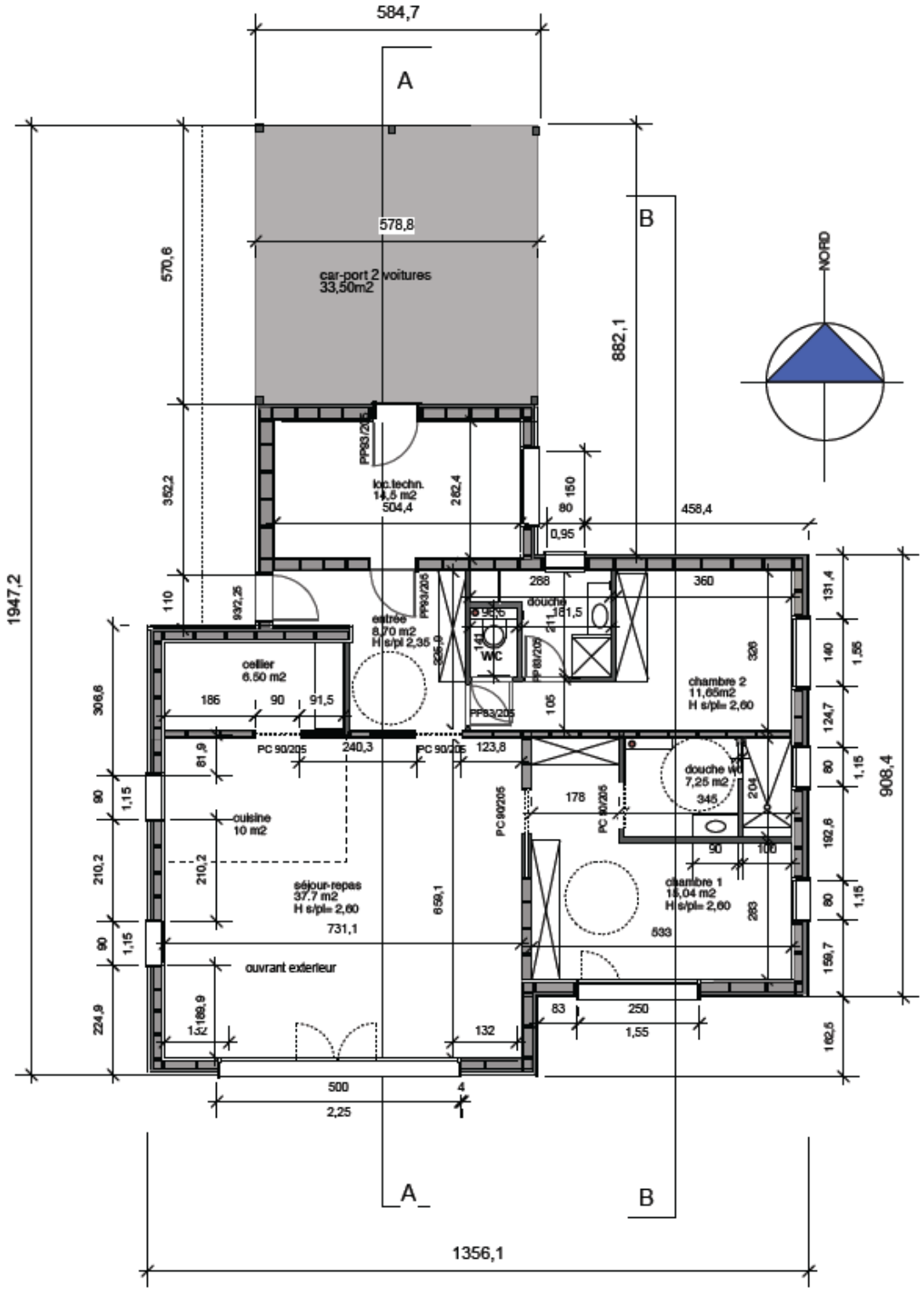
6- Technical drawings - conception to construction

LEVEL PLAN



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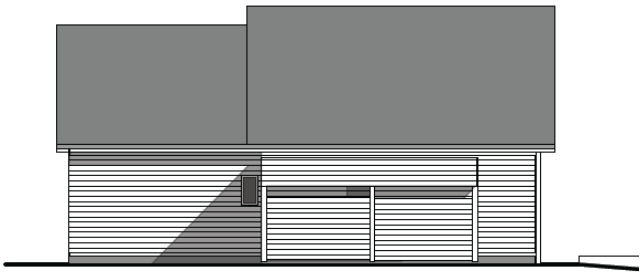
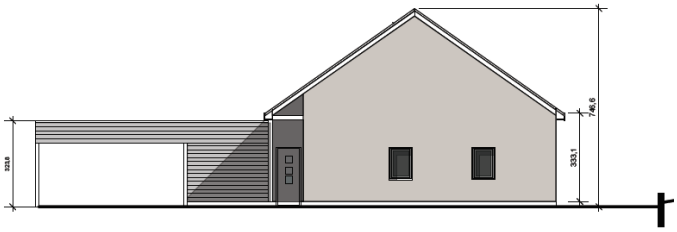
6- Technical drawings - conception to construction

ELEVATION PLAN

South Elevation



North Elevation



West Elevation

East Elevation

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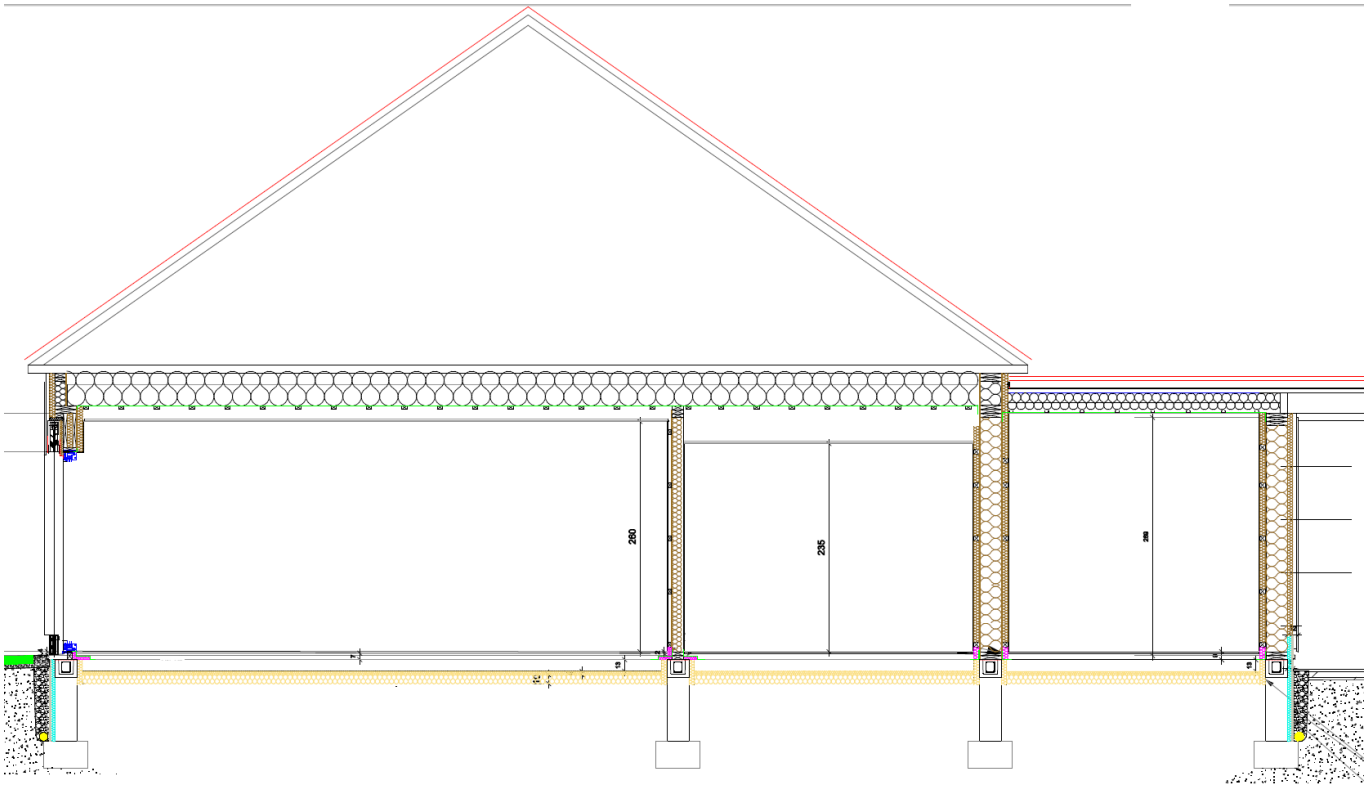
6- Technical drawings - conception to construction

CROSS SECTION



Roof building up external to internal
Cellulose Fiber [0,04 W/(mK)] between framework 200 mm
Cellulose Fiber [0,04 W/(mK)] 200 mm
Vapor barrier «Pro clima Intello Plus »
Air space service shaft [0,98 W/(mK)], 160mm
Fermacell [0,320 W/(mK)], 13mm

Wall building up external to internal
Siding or plaster according facades Wood wool [0,039 W/(mK)], 60mm
Loose wood wool [0,038 W/(mK)] + I beam heel (10% bois), w78 mm
Loose wood wool [0,038 W/(mK)] + I beam web (2% bois), w162 mm
OSB [0,13 W/(mK)]
Wood wool [0,039 W/(mK)], 60mm
Fermacell [0,320 W/(mK)], 13mm

Floor build up external to internal
PUR [0,023 W/(mK)], 140mm
Reinforced concrete slab [2.3 W/(mK)], 120mm
Tiled flooring [1,400 W/(mK)], 70mm

External windows and doors
Triple glazed, argon filled, engineered timber/aluminium windows and door with a PU thermal break
Whole windows = 0.80 W/(m^2K)

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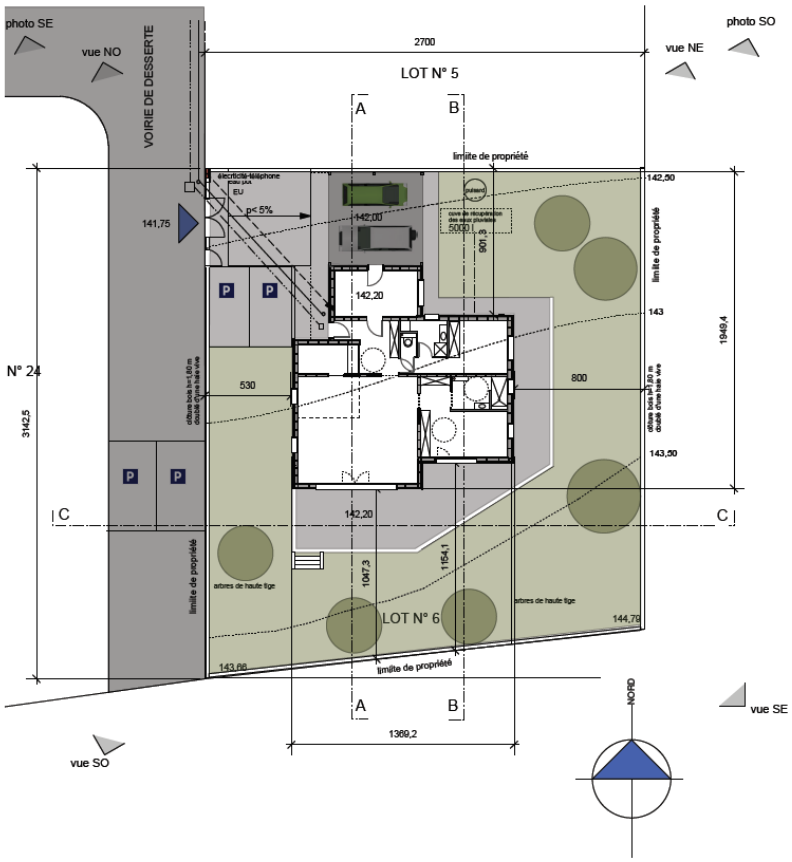
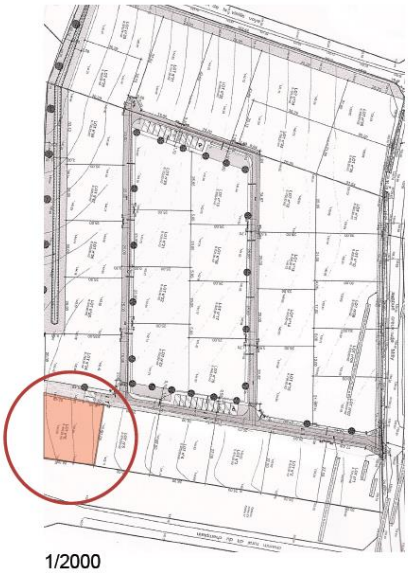
7- Layout plan





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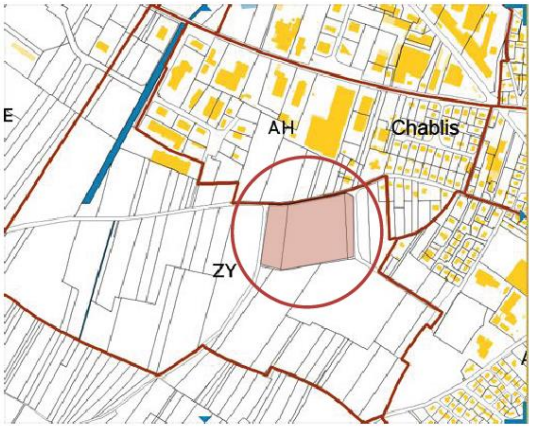


1/10000

CADASTRE: lotissement de la vieille voie
SECTION ZY
LOT N°6

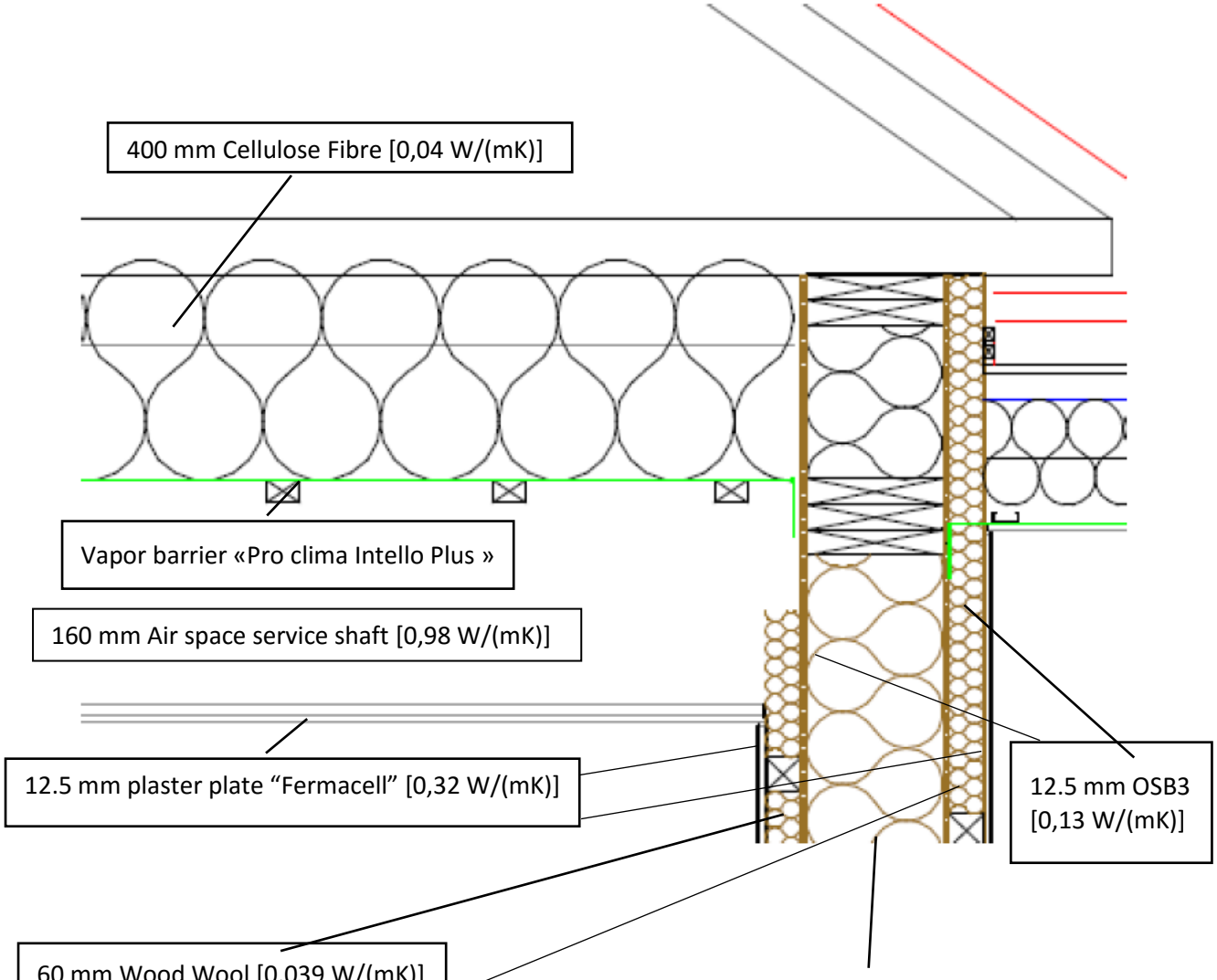
SURFACE: 806,65 m2

SC clos du calvaire 89800 ADFREMONT vu, le Maître d'Ouvrage	projet de maison individuelle 89800 CHABLIS permis de construire	apd 30/11/2012 1/2000-1/10000
Roland JEHL - urbi & orbi 89000 Auxerre - 03 86 42 86 50 Jean-Patrick Magles - architecte vu, le Maître d'Oeuvre	Plan de situation	P-0.1

8- Construction details – building envelope and techniques

OUTER WALL/CEILING JUNCTION

Roof U-value = 0.104 W/(m²K)



Wall U-value = 0.111 W/(m²K)

The ceiling of the house, containing an attic which has not been converted, is insulated with 400mm of cellulose wadding. A vapour barrier with variable permeability holds the insulating material and provides the airtight membrane for this part of the building. The membrane reaches down as far as the wooden wall bracing panels. It is held in place with battens to which the plasterboard fixings are attached, onto which the *Fermacell* ceiling panels are secured. This allows a space of 160mm for the dual ventilation duct, which also serves to diffuse heat in the house.

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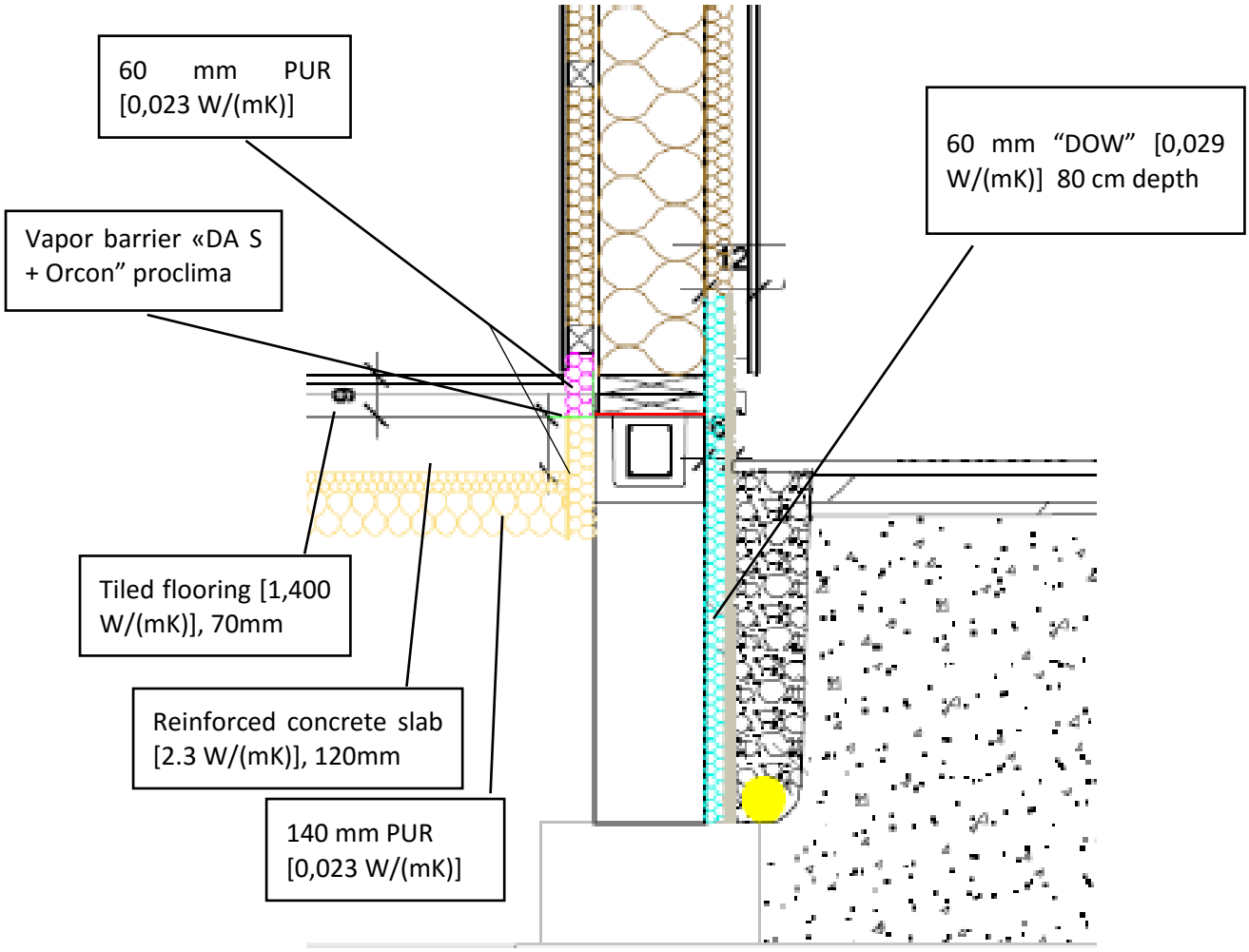
8- Construction details – building envelope and techniques

OUTER WALL/GROUND FLOOR SLAB JUNCTION

Wall U-value = 0.111 W/(m²K)



Floor U-value = 0.157 W/(m²K)

The slab-on grade floor has a 140mm underside layer of polyurethane insulation. This under-slab insulation provides a good thermal mass which improves comfort in summer and in winter stocks solar energy from the south-facing bay windows. An additional 80cm layer of surrounding vertical insulation protects the basement walls from frost. On the inside of the house, the underfloor insulation reaches the inner wall insulation, with the floating slab system preventing any thermal bridging at the junction. Air-tightness is provided by a *DA S* membrane which is glued to both the slab and the wooden wall bracing panels, and is then covered with the screed coat.

The timber frame walls are built with 220mm I beams which are insulated with wood fibre. There is an additional inner and outer layer of 60mm wood fibre insulation. Air-tightness is ensured by applying adhesive tape at the junctions of the wooden bracing panels, which also allows the walls to provide a vapour barrier. The outer finish is either rendering or timber cladding, depending on the walls.

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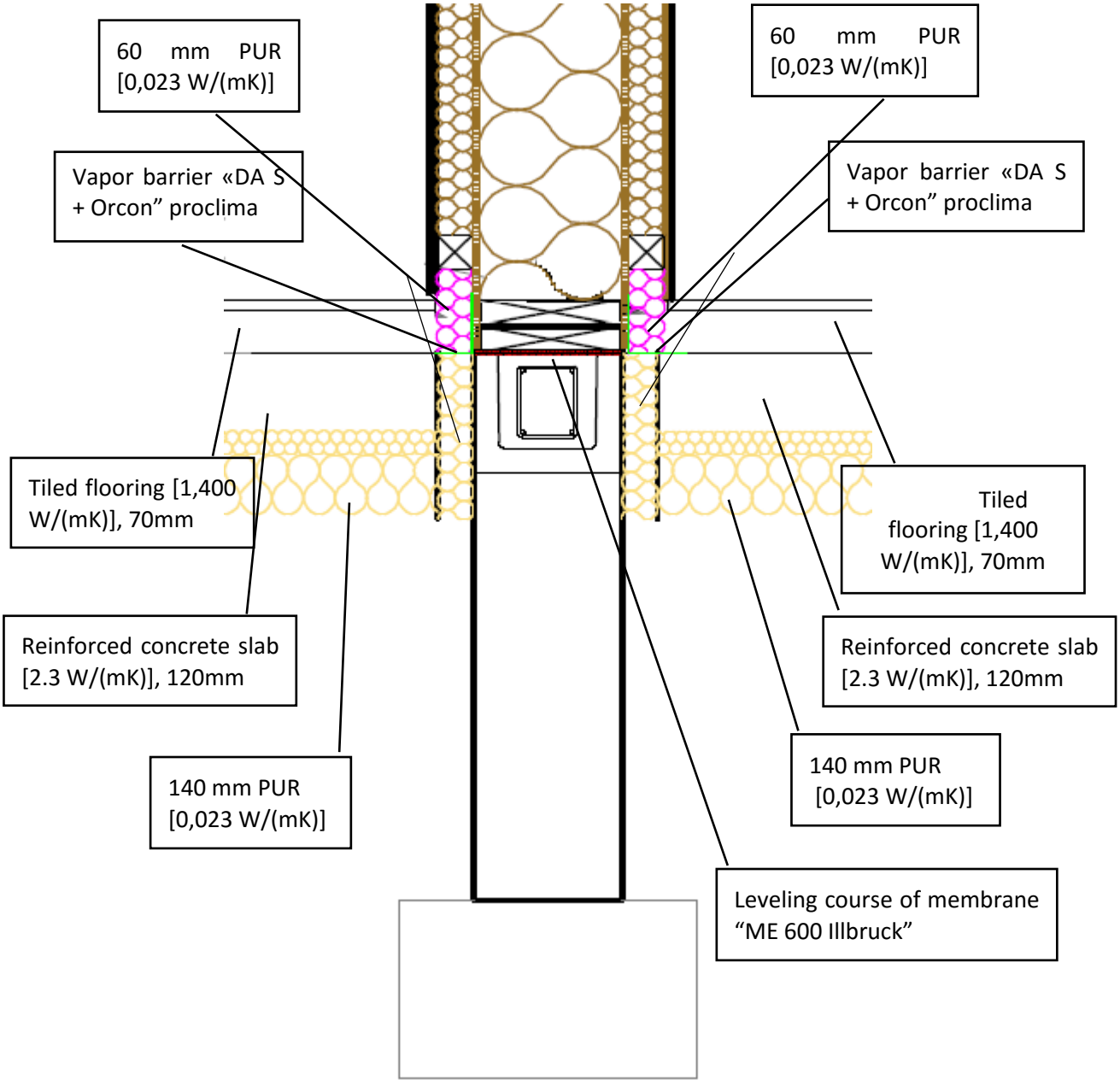
8- Construction details – building envelope and techniques

INNER SHEAR WALL/GROUND SLAB JUNCTION

Floor U-value = 0.157 W/(m²K)



The under-slab insulation reaches up both sides of the basement walls (below the shear walls) as far as the insulation on either side of the inner wall. Air-tightness is provided by a *DA S* membrane and completed by a ME600 membrane on the level surface of the basement wall, at the junction with the bottom sill plates of the timber frame.

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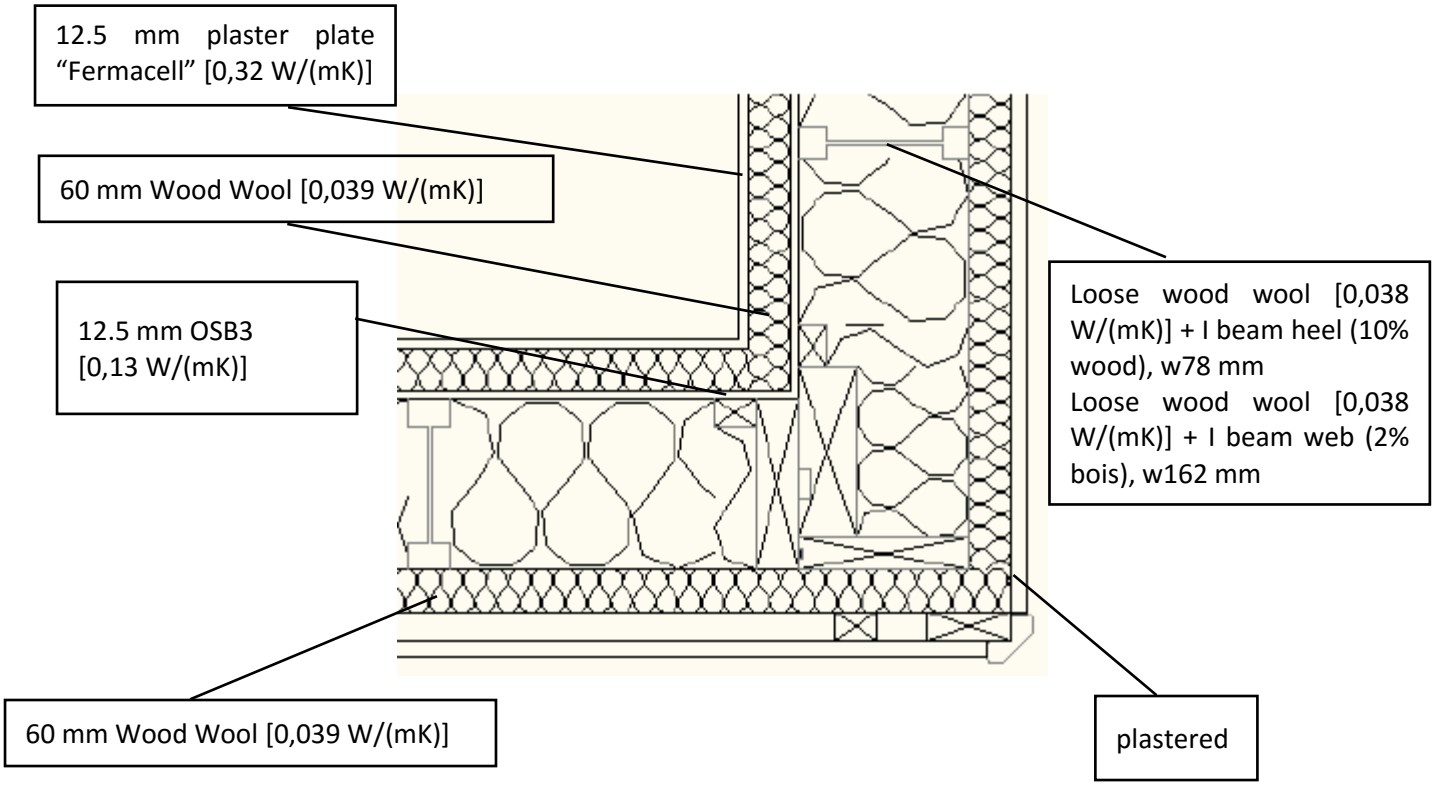
8- Construction details – building envelope and techniques

CORNER SECTION



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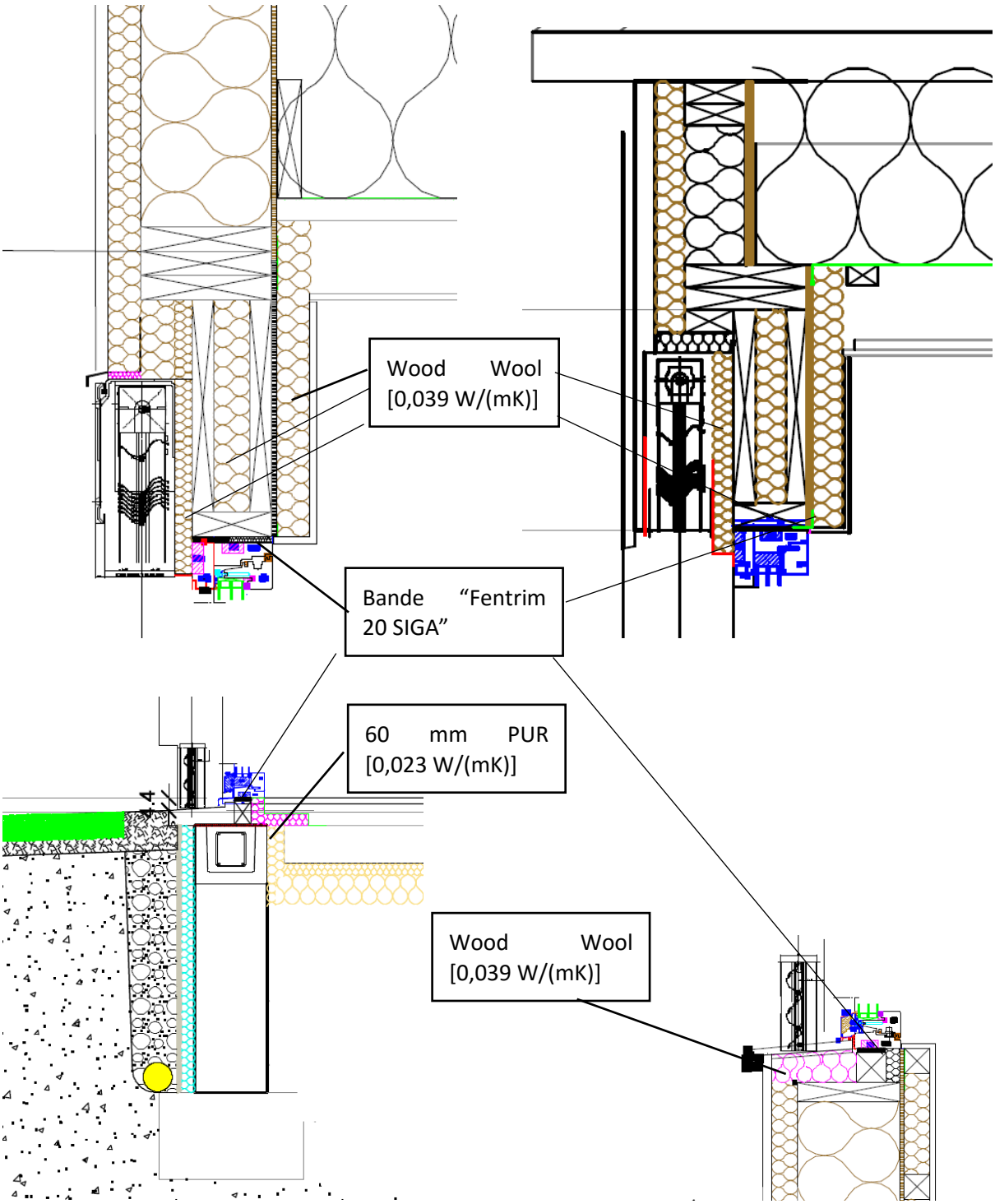
8- Construction details – building envelope and techniques

IMPLEMENTATION OF WINDOWS & DOORS

Lintel with Pivoting Sun Shade in rendered wall wall

Lintel with Pivoting Sun Shade in shingle



Bay window step

Windowsill on rendered or shingle wall

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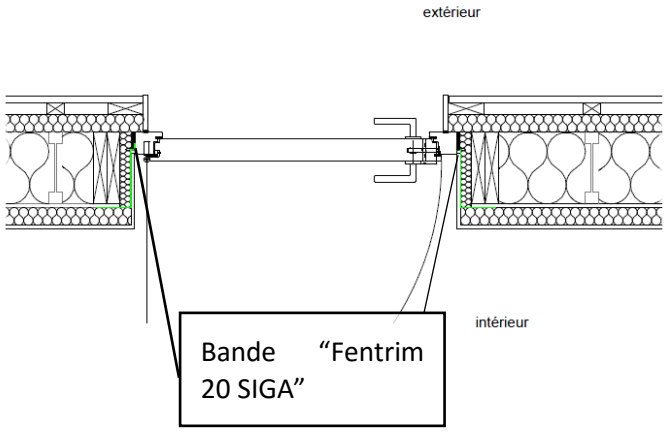
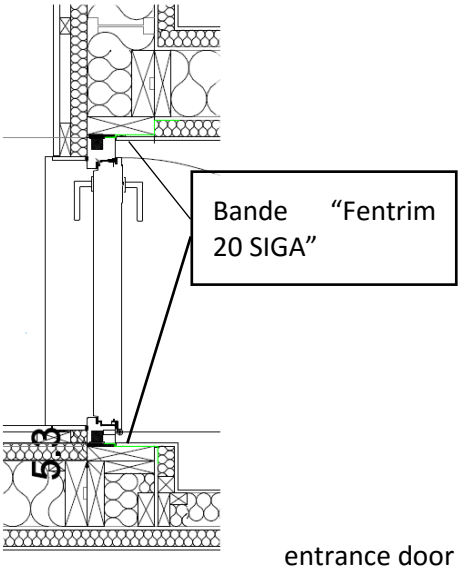
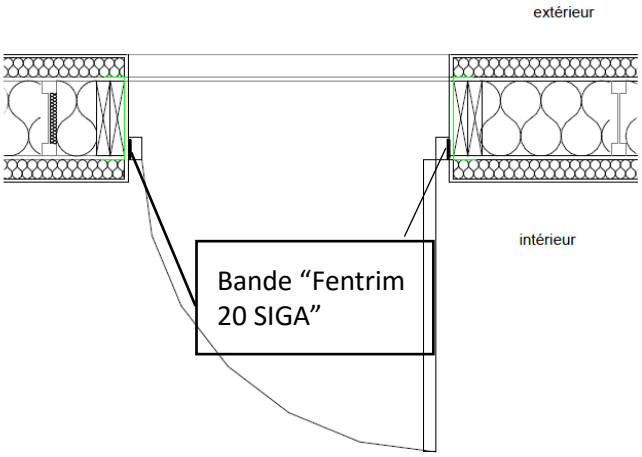
IMPLEMENTATION OF WINDOWS & DOORS



Service entrance between equipment room and exterior



Main entrance door



Entrance door to equipment room

External doors

Solid door, main entrance: Clima Top Plus
U_d-value = 0.68 W /(m^2K)

Solid door between equipment room and house: Clima Top Eco
U_d-value = 1 W/(m^2K)

External windows Smartwin
Triple glazed, argon filled, Ug = south 0.6 other elevation 0.5 W/(m^2K)
Engineered timber/aluminium windows with a PU thermal break Uf= 0.91 W/(m^2K)
Whole windows = 0.80 W/(m^2K)

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9-Air Tightness Tests

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BUILDING LEAKAGE TEST

FIABITAT CONCEPT
Ecoparc d'Affaires
Domaine de Villemorant
Neung sur Beuvron, France 41210
Phone: 02.54.94.62.10
Fax: 02.54.94.62.18

Date of Test: 18/11/2013
Test File: pres boidcy_chablis2

Technician: GAROT VINCENT

Customer: Société BOIDICY
16 chemin de Courboissy
DICY, France 89120
Phone:
Fax:

Building Address: Maison Passive - Grosbety
Rue de Voye
CHABRIS, France 89800

Test Results at 50 Pascals:

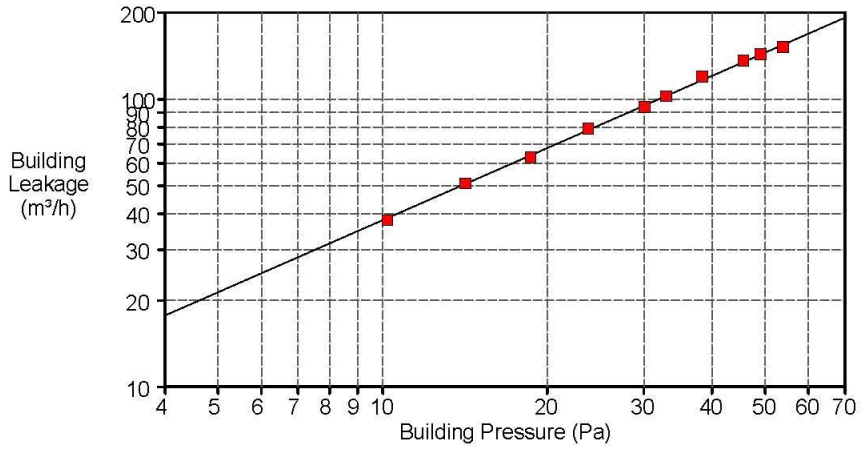
V50: Airflow (m³/h)	145 (+/- 0.6 %)
n50: Air Changes per Hour (1/h)	0.43
w50: m³/(h*m² Floor Area)	0.95
q50: m³/(h*m² Surface Area)	0.59

Leakage Areas: 42.5 cm² (+/- 2.1 %) Canadian EqLA @ 10 Pa or 0.17 cm²/m² Surface Area
19.1 cm² (+/- 3.4 %) LBL ELA @ 4 Pa or 0.08 cm²/m² Surface Area

Building Leakage Curve: Air Flow Coefficient (Cenv) = 5.6 (+/- 5.4 %)
Air Leakage Coefficient (CL) = 5.6 (+/- 5.4 %)
Exponent (n) = 0.833 (+/- 0.015)
Correlation Coefficient = 0.99875

Test Standard: EN 13829 Test Mode: Pressurization
Type of Test Method: A Regulation complied with:
Equipment: Model 4 (230V) Minneapolis Blower Door, S/N CE1630

Inside Temperature:	19 °C	Volume:	336 m³
Outside Temperature:	10 °C	Surface Area:	248 m²
Barometric Pressure:	101300 Pa	Floor Area:	153 m²
Wind Class:	1 Light Air	Uncertainty of Building Dimensions:	3 %
Building Wind Exposure:	Highly Exposed Building	Year of Construction:	2013
Type of Heating:			
Type of Air Conditioning:			
Type of Ventilation:	VMC DF		



BUILDING LEAKAGE TEST Page 2

Date of Test: 18/11/2013 Test File: pres boidcy_chablis2

Comments

a

Data Points: Depressurization:

Nominal Building Pressure (Pa)	Fan Pressure (Pa)	Nominal Flow (m³/h)	Temperature Adjusted Flow (m³/h)	% Error	Fan Configuration
0.0	n/a				
54.1	53.3	150	152	-1.7	Ring C
49.3	47.5	141	143	0.1	Ring C
45.8	43.1	134	136	1.2	Ring C
38.6	33.5	118	120	2.6	Ring C
33.2	24.8	101	103	-0.4	Ring C
30.3	20.9	92	94	-1.6	Ring C
24.0	39.0	78	79	0.9	Ring D
18.8	24.8	62	63	-1.7	Ring D
14.4	16.4	50	51	0.2	Ring D
10.4	54.2	37	38	-1.8	Ring E
0.3	n/a				

Test 1 Baseline (Pa): p01- = -0.3 p01+ = 0.3 p02- = -0.0 p02+ = 0.4

BUILDING LEAKAGE TEST Page 2

Date of Test: 18/11/2013 Test File: dep boidcy_chablis2

Comments

a

Data Points: Depressurization

Nominal Building Pressure (Pa)	Fan Pressure (Pa)	Nominal Flow (m³/h)	Temperature Adjusted Flow (m³/h)	% Error	Fan Configuration
0.0	n/a				
-55.1	50.3	145	142	0.0	Ring C
-50.2	43.5	135	132	-0.1	Ring C
-46.4	38.7	127	124	-0.1	Ring C
-41.1	31.5	114	111	-1.3	Ring C
-36.7	27.0	106	103	-0.4	Ring C
-30.5	57.8	95	92	3.2	Ring D
-25.0	40.8	80	78	1.2	Ring D
-20.4	28.8	67	65	-0.5	Ring D
-16.0	114.5	55	54	-0.9	Ring E
-9.7	49.7	36	35	-4.2	Ring E
-0.2	n/a				

Test 1 Baseline (Pa): p01- = -0.1 p01+ = 0.1 p02- = -0.2 p02+ = 0.0

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Technician: GAROT VINCENT

Customer: Société BOIDICY
16 chemin de Courboissy
DICY, France 89120
Phone:
Fax:

Building Address: Maison Passive - Grosbety
Rue de Voye
CHABRIS, France 89800

Test Results at 50 Pascals:

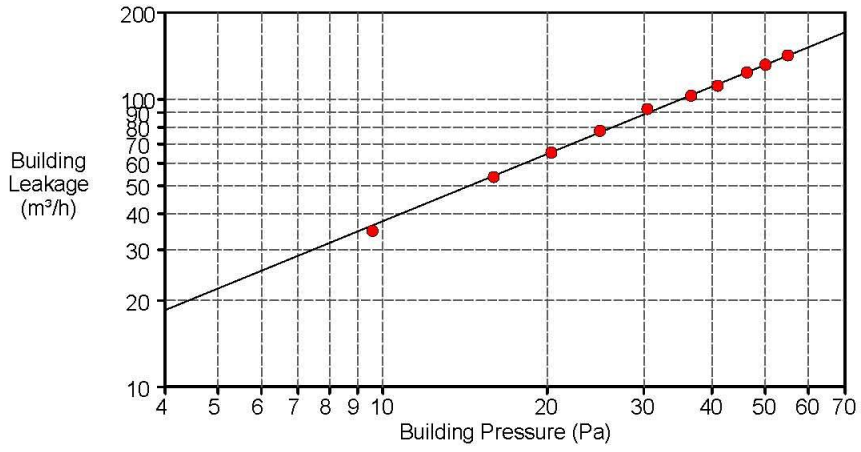
V50: Airflow (m³/h)	132 (+/- 0.5 %)
n50: Air Changes per Hour (1/h)	0.39
w50: m³/(h*m² Floor Area)	0.86
q50: m³/(h*m² Surface Area)	0.53

Leakage Areas: 42.1 cm² (+/- 1.7 %) Canadian EqLA @ 10 Pa or 0.17 cm²/m² Surface Area
19.9 cm² (+/- 2.8 %) LBL ELA @ 4 Pa or 0.08 cm²/m² Surface Area

Building Leakage Curve: Air Flow Coefficient (Cenv) = 6.3 (+/- 4.4 %)
Air Leakage Coefficient (CL) = 6.3 (+/- 4.4 %)
Exponent (n) = 0.777 (+/- 0.012)
Correlation Coefficient = 0.99905

Test Standard: EN 13829 Test Mode: Depressurization
Type of Test Method: A Regulation complied with:
Equipment: Model 4 (230V) Minneapolis Blower Door, S/N CE1630

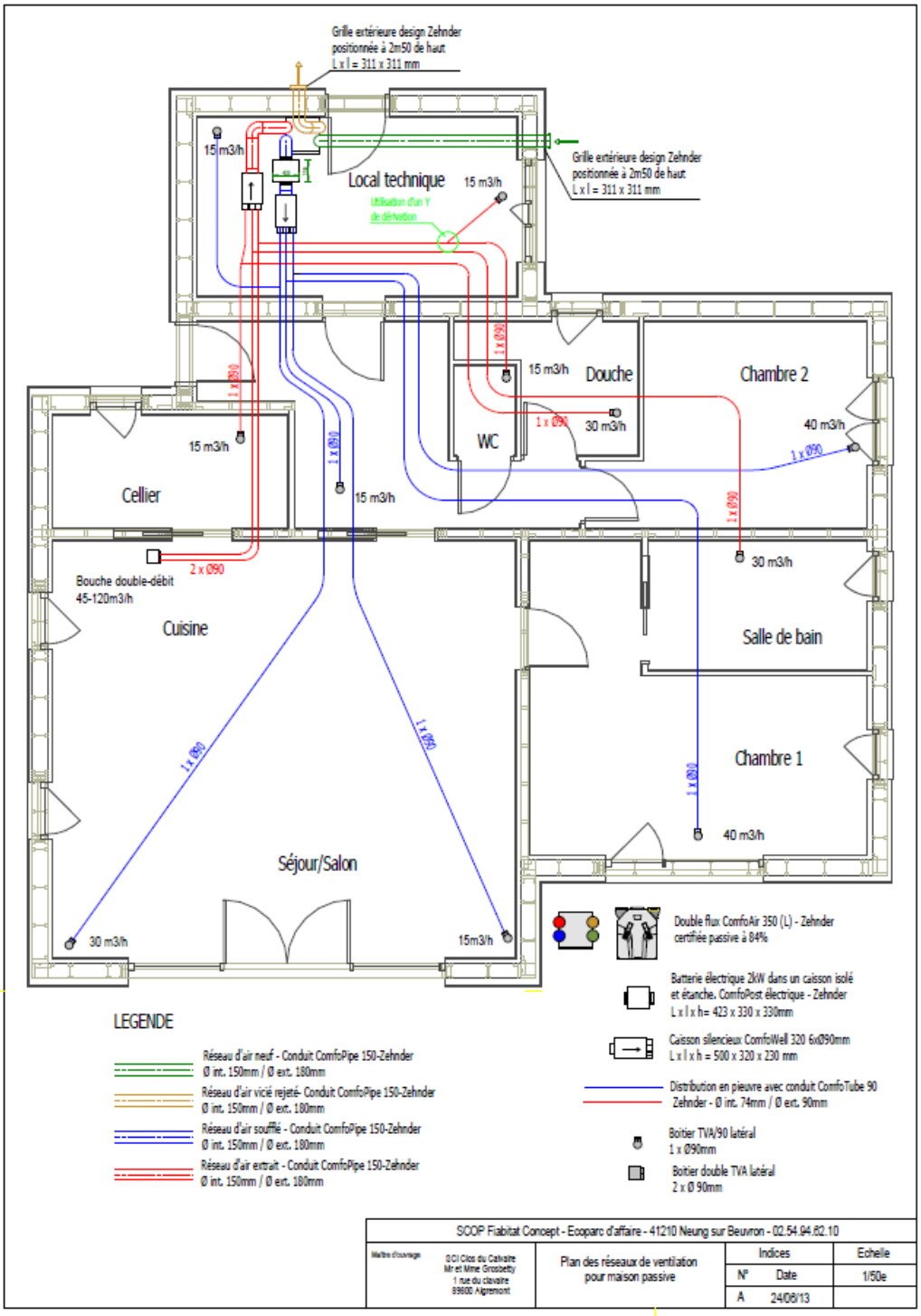
Inside Temperature:	19 °C	Volume:	336 m³
Outside Temperature:	10 °C	Surface Area:	248 m²
Barometric Pressure:	101300 Pa	Floor Area:	153 m²
Wind Class:	1 Light Air	Uncertainty of Building Dimensions:	3 %
Building Wind Exposure:	Highly Exposed Building	Year of Construction:	2013
Type of Heating:			
Type of Air Conditioning:			
Type of Ventilation:	VMC DF		



10-Ventilation System et Heat production

VENTILATION SYSTEM

All networks circulate within a consecrated technical area inside the building.



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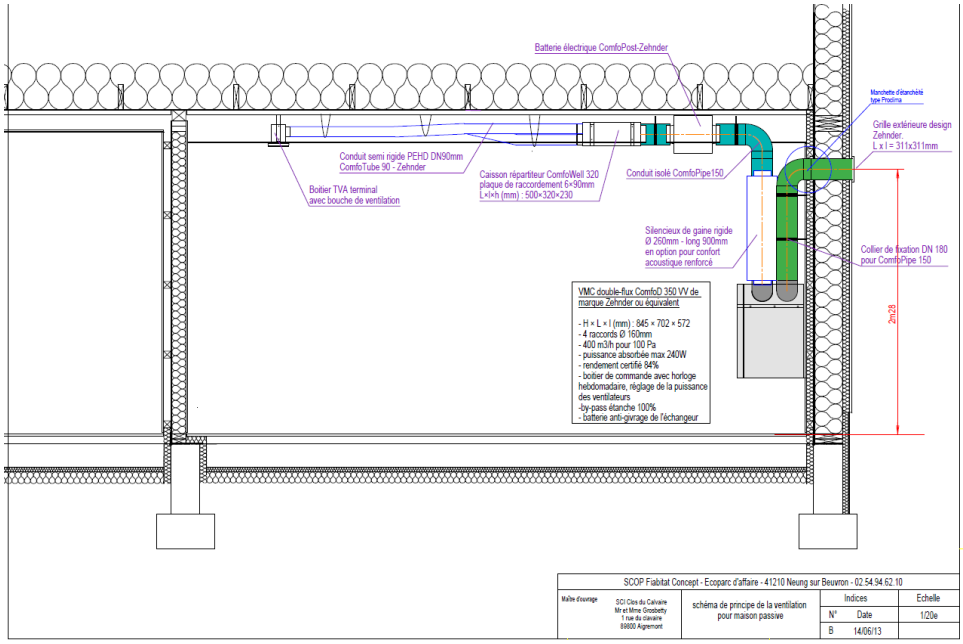
10-Ventilation System et Heat production

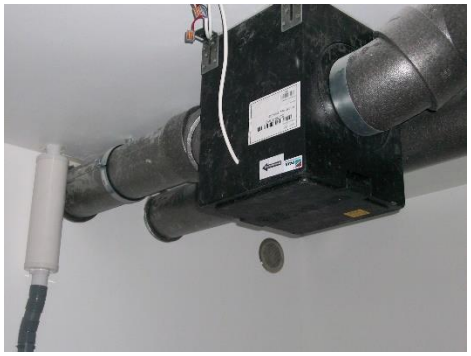
VENTILATION CONTROL UNIT



Ventilation: *Comfoair* 350 dual-flow, high-efficiency ventilation system (84% efficiency according to EN 13141-7 (PHI)) and low energy consumption: 0,34 Wh/m3

HEAT PRODUCTION

Heating system via ventilation network, with electric battery.



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11 - PHPP results : verification sheet

Projet:	SCI CLOS DU CALVAIRE	Version définitive
Localité et zone climatique:	YONNE	F - Auxerre
Adresse:	1, rue du calvaire	
Code postal / localité:	89800 AIGREMONT	
Pays:	France	
Type de bâtiment:	Maison individuelle	
Maître de l'ouvrage:	Mr GROSBETY	
Adresse:	1, rue du Calvaire	
Code postal / localité:	89800 AIGREMONT	
Architecte:	Roland Jehl	
Adresse:	13, quai de la marine	
Code postal / localité:	89000 AUXERRE	
Bureau d'étude fluides / techniques spéciales:	Fiabitat Concept (thermique + ventilation)	
Adresse:	Ecoparc d'affaires	
Code postal / localité:	41210 NEUNG sur BEUVRON	

Année de construction:	2013			
Nombre de logements:	1		Température intérieure:	20,0 °C
Volume extérieur du bâtiment V_e:	400,0	m³	Apports internes:	2,1 W/m²
Nombre d'occupants:	3,2			

Valeurs rapportées à la surface de référence énergétique

Surface de référence énergétique A_{RE}: 111,1 m²

	Méthode utilisée:	Méthode annuelle	Certification standard passif:	Critères respectés ?
Besoin de chaleur de chauffage annuel:	**14**	kWh/(m²a)	15 kWh/(m²a)	oui
Résultat du test d'infiltrométrie:	**0,6**	h^{-1}	0,6 h^{-1}	oui
Besoin en énergie primaire (ECS, chauffage, refroidissement, électricité auxiliaire et domestique):	**109**	kWh/(m²a)	120 kWh/(m²a)	oui
Besoin en énergie primaire (ECS, chauffage et électricité auxiliaire):	67	kWh/(m²a)		
Besoin en énergie primaire économisée par la production d'électricité photovoltaïque:		kWh/(m²a)		
Puissance de chauffage:	14	W/m²		
Surchauffe estivale:	2	%	sup. à 25 °C	
Besoin de refroidissement annuel:		kWh/(m²a)	15 kWh/(m²a)	
Puissance de refroidissement:	8	W/m²		

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12 – Construction costs

**Prices are tax inclusive*

Total: 2 792 euros/m2 floor space

Survey + air tightness test + certification: 4 311.60 euros
Landscaping (clearing, foundations, networks): 33 535.85 euros
Electricity: 5 020.81 euros
Framework + roof covering: 33 488 euros
Plumbing: 3 193.32 euros
Bathroom: 1 506.96 euros
Flooring and tiling: 10 321.48 euros
Painting: 17 605.12 euros
Timber building contractor: 200 928 euros

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