Project Documentation
Gebäude-Dokumentation

1 Abstract / Zusammenfassung

Office building in Montecchio di Vallefoglia (PU), Italy

1.1 Data of building / Gebäudedaten

Year of construction/ Baujahr	2018	**Space heating / Heizwärmebedarf**	**11 kWh/(m²a)**
U-value external wall/ U-Wert Außenwand	0.142 W/(m²K)		
U-value basement ceiling/ U-Wert Kellerdecke	0.172 W/(m²K)	**Primary Energy Renewable (PER) / Erneuerbare Primärenergie (PER)**	59 kWh/(m²a)
U-value roof/ U-Wert Dach	0.097 W/(m²K)	**Generation of renewable energy / Erzeugung erneuerb. Energie**	87 kWh/(m²a)
U-value window/ U-Wert Fenster	0.72 W/(m²K)	**Non-renewable Primary Energy (PE) / Nicht erneuerbare Primärenergie (PE)**	125 kWh/(m²a)
Heat recovery/ Wärmerückgewinnung	81.5 %	Pressure test n_{50} / Drucktest n_{50}	0.22 h-1
Special features/ Besonderheiten	Photovoltaic system shared with the factory. In spite of its special geometry and orientation towards north, the building achieves the Passivhaus Standard, Plus Class.		

1.2 Brief Description

Megabox is an office building and a landmark for the community on the Adriatic coast. “Pleasant and comfortable for those who work there, because while working everybody must live in a healthy environment. We want to be an example for other companies”. This was the client Ivano Angeli’s vision for this project.

The building was built in a development area where its main façade is exposed towards north, while other facades are completely shaded by neighbour warehouses with an amazing reduction of solar gains. In spite of following challenging boundary conditions, the project goal was hitting the PH target.

Starting from an architectural project without any Passivhaus perspective, among all analysed variants, PASSIVHAUS turned out to be the most convenient solution with a very high economic savings during the building lifetime compared to other variants such as the “market standard” and the “nZEB”.

In the end, the overall reduction cost was more than 50 €/m² TFA compared with the other common building solutions (under same comfort conditions).

1.3 Responsible project participants / Verantwortliche Projektbeteiligte

Architect/ Entwurfsverfasser	GA works – Geometra Gianluca Aiudi Via Montecchio, 1 – 61025 Montecchio (PU), Italy
Implementation planning/ Ausführungsplanung	
Building systems/ Haustechnik	Ing. Simone Giulianelli Via Toscanini, 31 – 61121 Pesaro (PU), Italy
Structural engineering/ Baustatik	
Building physics/ Bauphysik	Dr. Phys. Francesco Nesi – ZEPHIR Passivhaus Italia www.passivhausitalia.com
Passive House project planning/ Passivhaus-Projektierung	Dr. Phys. Francesco Nesi – ZEPHIR Passivhaus Italia www.passivhausitalia.com
Construction management/ Bauleitung	Progetto Legno s.r.l. Italia www.case-in-legno-progettolegno.it
Certifying body/ Zertifizierungsstelle	Energiehaus – Barcelona (ES) www.energiehaus.es
Certification ID/ Zertifizierungs ID	Project-ID (www.passivehouse-database.org) ID 6307

Author of project documentation / Verfasser der Gebäude-Dokumentation	ZEPHIR Passivhaus Italia – Dr. Phys. Francesco Nesi www.passivhausitalia.com

Date, Signature/
Datum, Unterschrift

19.03.2020

2 Views of the Office Building in Montecchio di Vallefoglia (PU), Italy

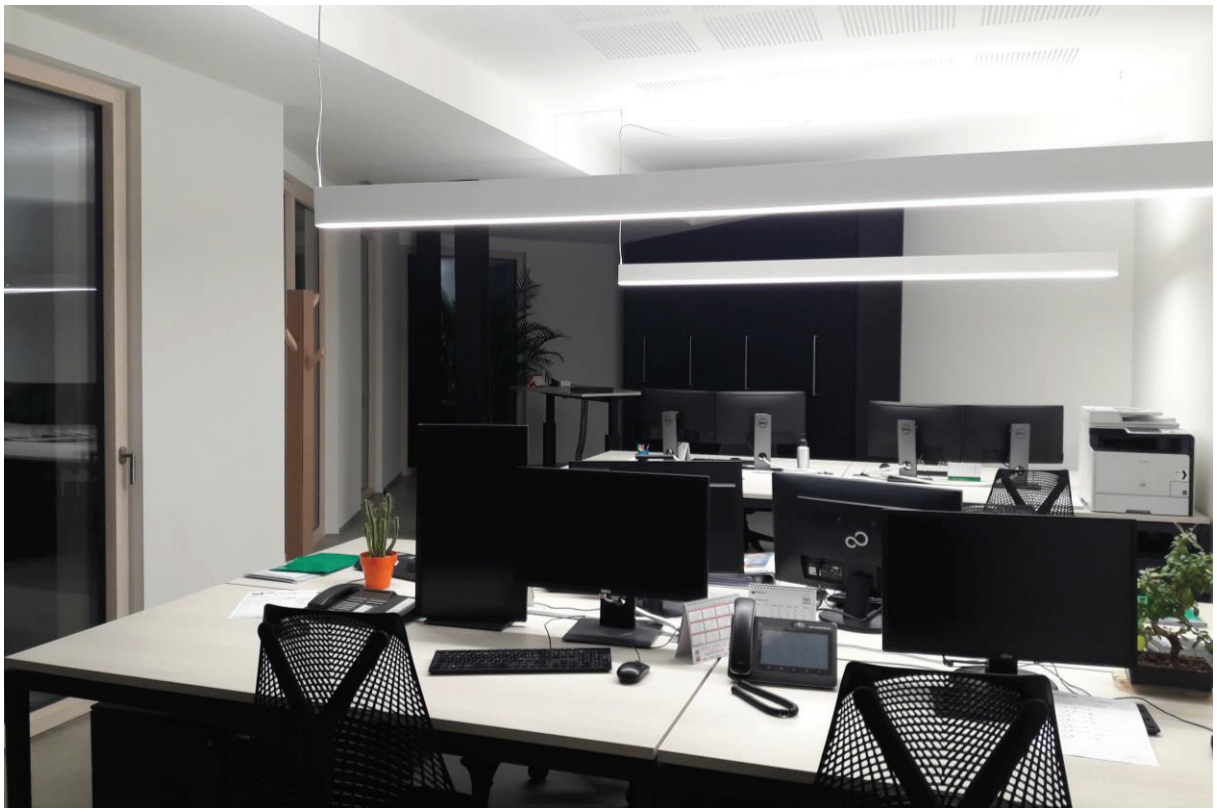
View of the Office Building and the Megabox Factory in Montecchio di Vallefoglia (PU), Italy.

View of the Office Building and the Megabox Factory in Montecchio di Vallefoglia (PU), Italy.

North view of the Office Building in Montecchio di Vallefoglia (PU), Italy.

North view of the Office Building in Montecchio di Vallefoglia (PU), Italy.

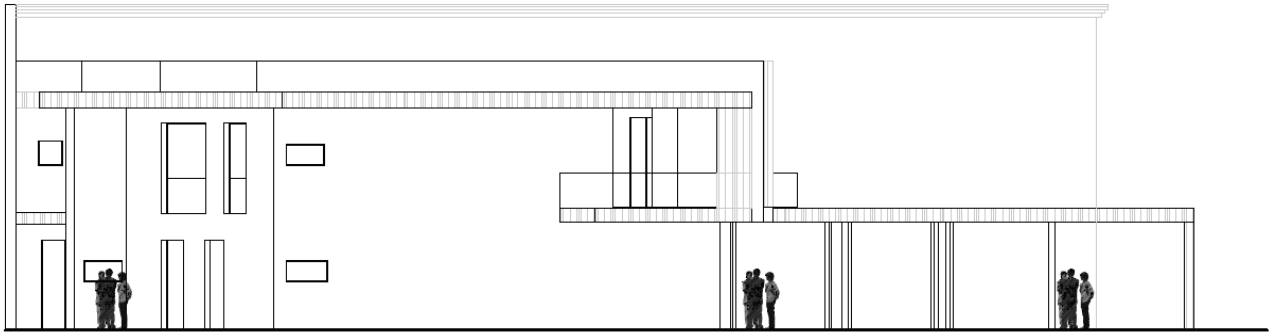
Internal view of the Office Building in Montecchio di Vallefoglia (PU), Italy.



Internal view of the Office Building in Montecchio di Vallefoglia (PU), Italy.

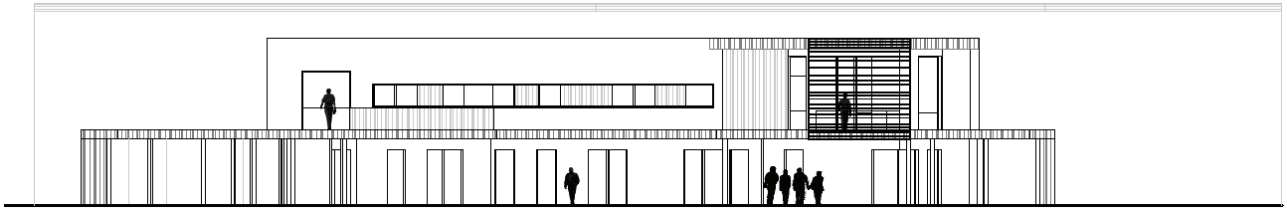
3 Section drawings of the Office Building in Montecchio di Vallefoglia (PU), Italy

Section AA



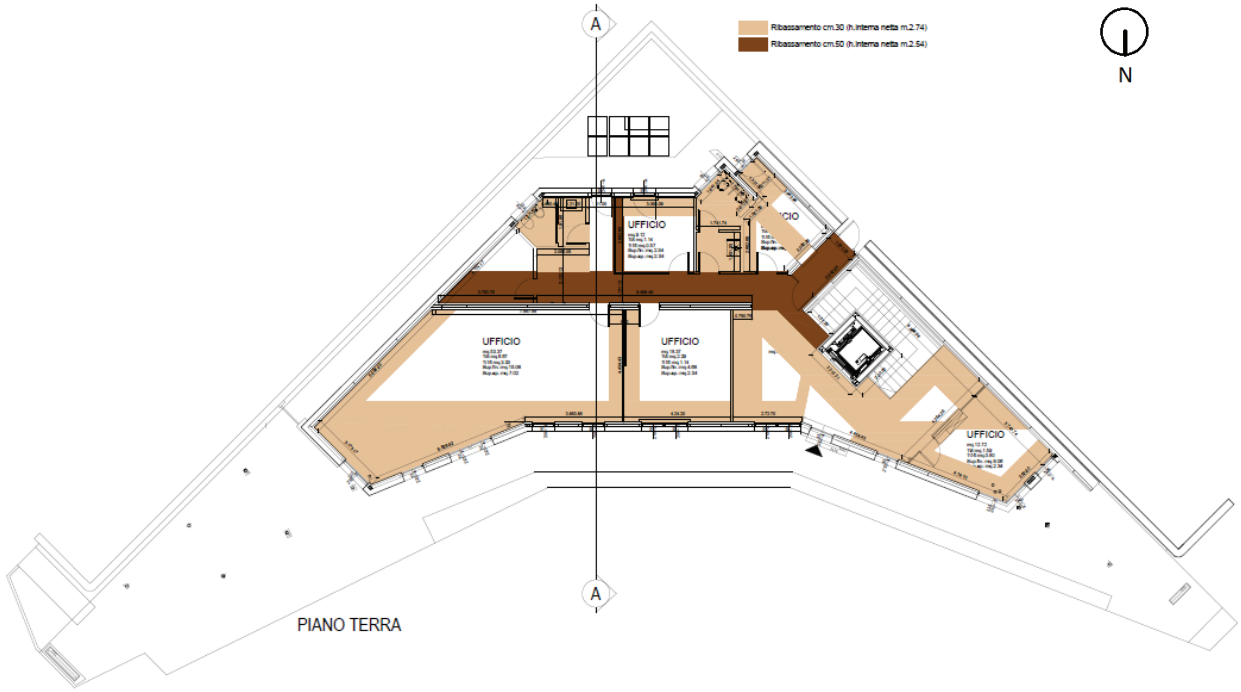
South-East Elevation

South-West Elevation

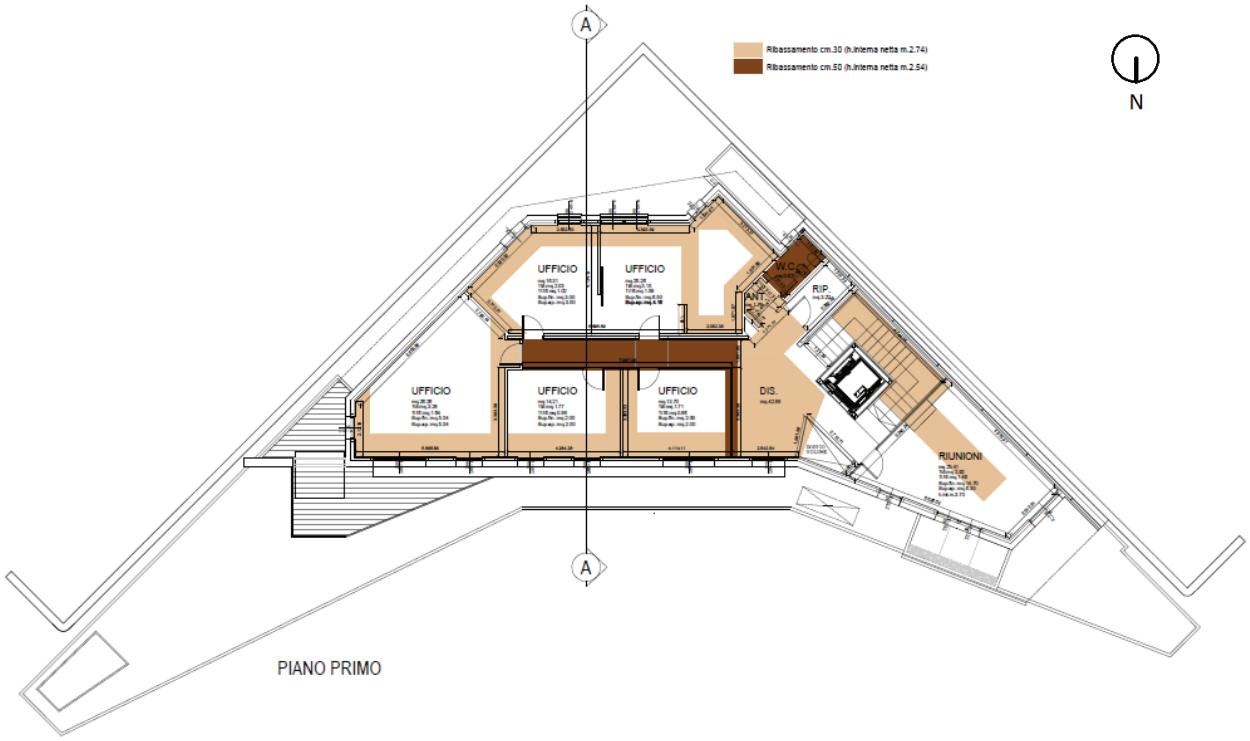


North Elevation

4 Floor plans of the Office Building in Montecchio di Vallefoglia (PU), Italy



Ground floor plan



First floor plan

5 Building assemblies of the Office Building in Montecchio di Vallefoglia (PU), Italy

5.1 Floor slab

Elemento n°			Coib. interna?
08ud	Floor slab		

Resistenza termica liminare [m²K/W]

Orientamento elemento costruttivo	3-Pavimento	R_{si} interna	0.13
verso	2-Terreno	R_{se} esterna	0.00

Sezione 1	λ [W/(mK)]	Sezione 2 (opzionale)	λ [W/(mK)]	Sezione 3 (opzionale)	λ [W/(mK)]	Spessore [mm]
Floor finishing	1.200					10
Screed	1.400					50
Insulation	0.027					150
Insulated screed	0.700					100
Concrete slab	2.100					250

% Sezione 1	% Sezione 2	% Sezione 3	Totale
100%			56.0 cm

Maggiorazione valore U: W/(m²K)

Valore U: 0.167 W/(m²K)

5.2 External wall

Elemento n°	Descrizione elemento costruttivo	Coib. interna?
01ud	External wall	

Resistenza termica liminare [m²K/W]

Orientamento elemento costruttivo	2-Parete	R_{si} interna	0.13
verso	1-Aria esterna	R_{se} esterna	0.04

Sezione 1	λ [W/(mK)]	Sezione 2 (opzionale)	λ [W/(mK)]	Sezione 3 (opzionale)	λ [W/(mK)]	Spessore [mm]
Gypsum fibre board	0.173					13
Acoustic insulation	0.037	Alluminium Structur	160.000			50
XLAM	0.130					100
Mineral wool	0.035					200
Plaster	0.800					15

% Sezione 1	% Sezione 2	% Sezione 3	Totale
92%	8.3%		37.8 cm

Maggiorazione valore U: W/(m²K)

Valore U: 0.136 W/(m²K)

Elemento n°		Coib. interna?
04ud	External Wall vs warehouse	

Resistenza termica liminare [m²K/W]

Orientamento elemento costruttivo	2-Parete	R_{si} interna	0.13
verso	3-Ventilato	R_{se} esterna	0.13

Sezione 1	λ [W/(mK)]	Sezione 2 (opzionale)	λ [W/(mK)]	Sezione 3 (opzionale)	λ [W/(mK)]	Spessore [mm]
Plaster	0.800					15
Wood	0.173					13
Acoustic insulation	0.037					50
XLAM	0.130					100
Mineral wool	0.035					200
Plaster	0.800					15
Air	1.080					200

% Sezione 1	% Sezione 2	% Sezione 3	Totale
100%			59.3 cm

Maggiorazione valore U: W/(m²K)

Valore U: 0.119 W/(m²K)

5.3 Roof

Elemento n°		Coib. interna?
05ud	Roof	

Resistenza termica liminare [m²K/W]

Orientamento elemento costruttivo	1-Tetto	R_{si} interna	0.13
verso	1-Aria esterna	R_{se} esterna	0.04

Sezione 1	λ [W/(mK)]	Sezione 2 (opzionale)	λ [W/(mK)]	Sezione 3 (opzionale)	λ [W/(mK)]	Spessore [mm]
Wood	0.130					120
Mineral wool	0.035					200
OSB/3	0.120					15
Gravel	2.000					50
Mineral wool	0.035	Wood	0.130			150

% Sezione 1	% Sezione 2	% Sezione 3	Totale
90%	10.0%		53.5 cm

Maggiorazione valore U: W/(m²K)

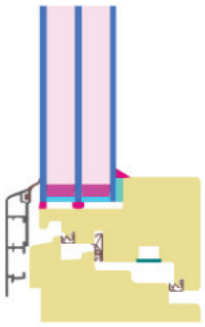
Valore U: 0.095 W/(m²K)

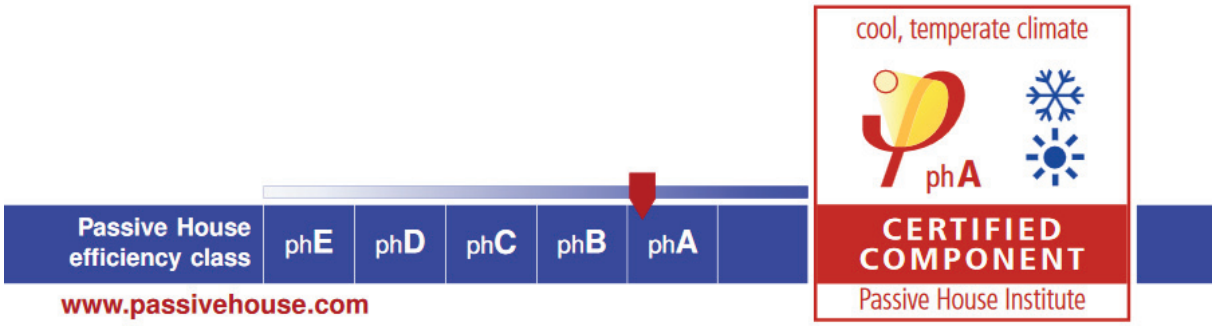
5.4 Windows and window installations

Windows installed in Office Building in Montecchio di Vallefoglia are Passivhaus Certificate Windows, Purista by OPTIWIN.

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

Comfort	$U_W = 0.79$	$\leq$	0.80 W/(m² K)
	$U_{W,installed}$	$\leq$	0.85 W/(m² K)
	with U_g	=	0.70 W/(m² K)
Hygiene	$f_{Rsi=0.25}$	$\geq$	0.70

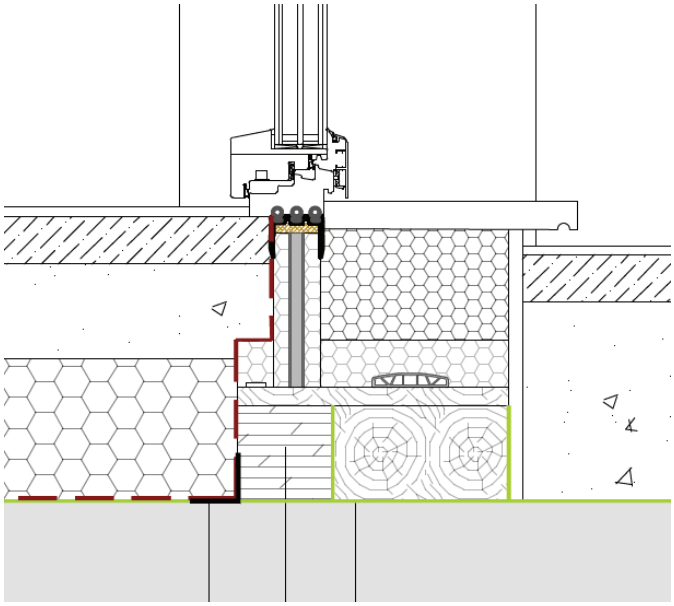




Frame values		Frame width b_f mm	U-value frame U_f W/(m² K)	Ψ-panel edge Ψ_g W/(m K)	Temp. Factor $f_{Rsi=0.25}$ [-]
Top	(to)	92	0.76	0.023	0.71
Side	(s)	92	0.76	0.023	0.71
Bottom	(bo)	92	0.94	0.023	0.71
Mullion flying	(fm)	109	0.94	0.022	0.71
Spacer: Super Spacer TriSeal / T-Spacer Premium				Secondary seal: Polyurethan	

Window installation details were designed to reduce thermal bridges and verify the absence of mould and condensation growth.

All windows were aligned to the external surface of the cross laminated panels in order to reduce the thermal bridge and maximize the solar gains. Dimensions, number and orientation of windows were accurately designed to achieve the requirements of Passivhaus Standard and reduce construction costs.



Airtightness layer

6 Description of the airtight envelope; documentation of the Blowerdoor test result

All building details were studied to guarantee the continuity of airtightness layer. In particular, an airtightness membrane is installed on the the interior surface of the xlam wall, it is than connected to the concrete slab and to the membrane of the roof. Each interruption is sealed with suitable airtight tape.

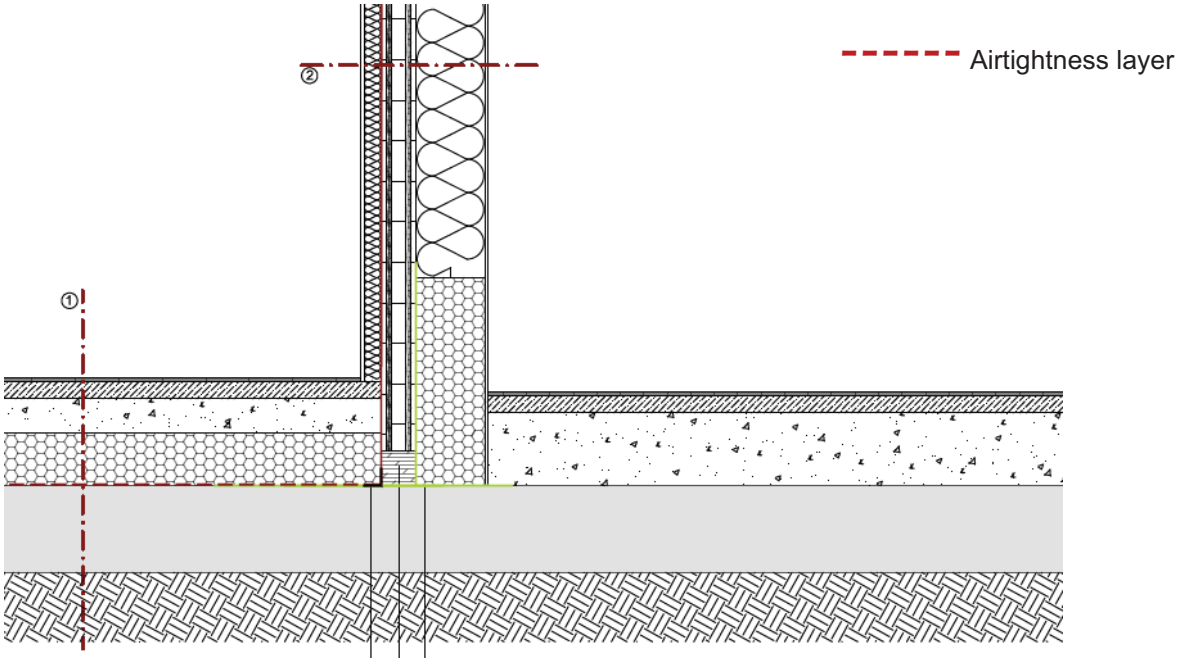
Two Blower Door Tests were carried out during the construction phase: the first when windows and airtightness layer were installed and the last when the entire building was finished.

The result of the Blower Door Test is n_{50} = 0.22 1/h.

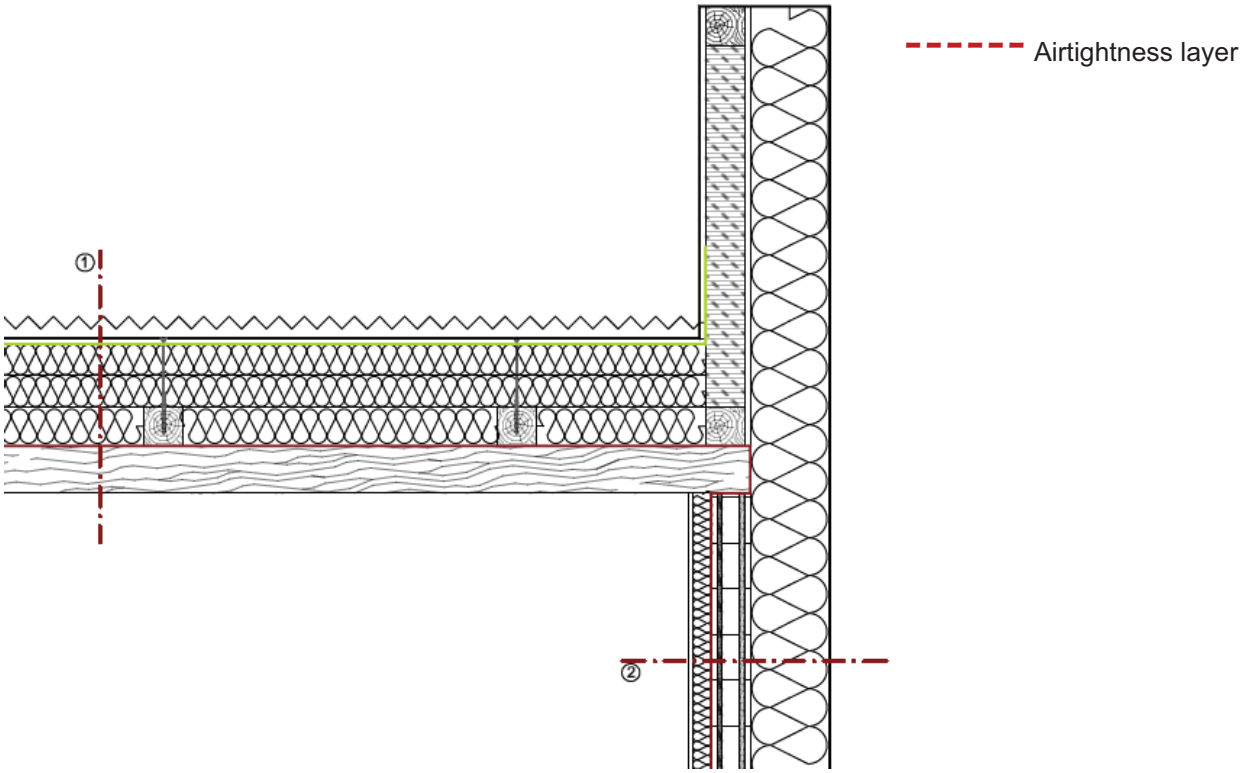
retrotec FanTestic	version:5.9.27	Azienda: A+ Energy Solutions SRL
Test dato: 2019-02-18	Tecnico: Dott. Ing. Luigi Balloni	
Client:	MEGA IMMOBILIARE s.r.l. (P.IVA: 00290360411)	
Building Lot Number:	-	
Indirizzo dell'edificio:	Via Madonna dell'Arena in Frazione Montecchio - 61022 Vallefoglia (PU)	

Caratteristiche Edificio	
File informatico:	EN13829-EU 2019-02-18 1227
Volume netto, V[m³]:	1.027
Altezza involucro [m]:	7
Superficie[{m²]:	0
Superficie involucro, $A_{T\ BAT}$[{m²]:	0
Altitudine [m]:	45
Esposzione al vento involucro	
Accuratezza delle misure	0%

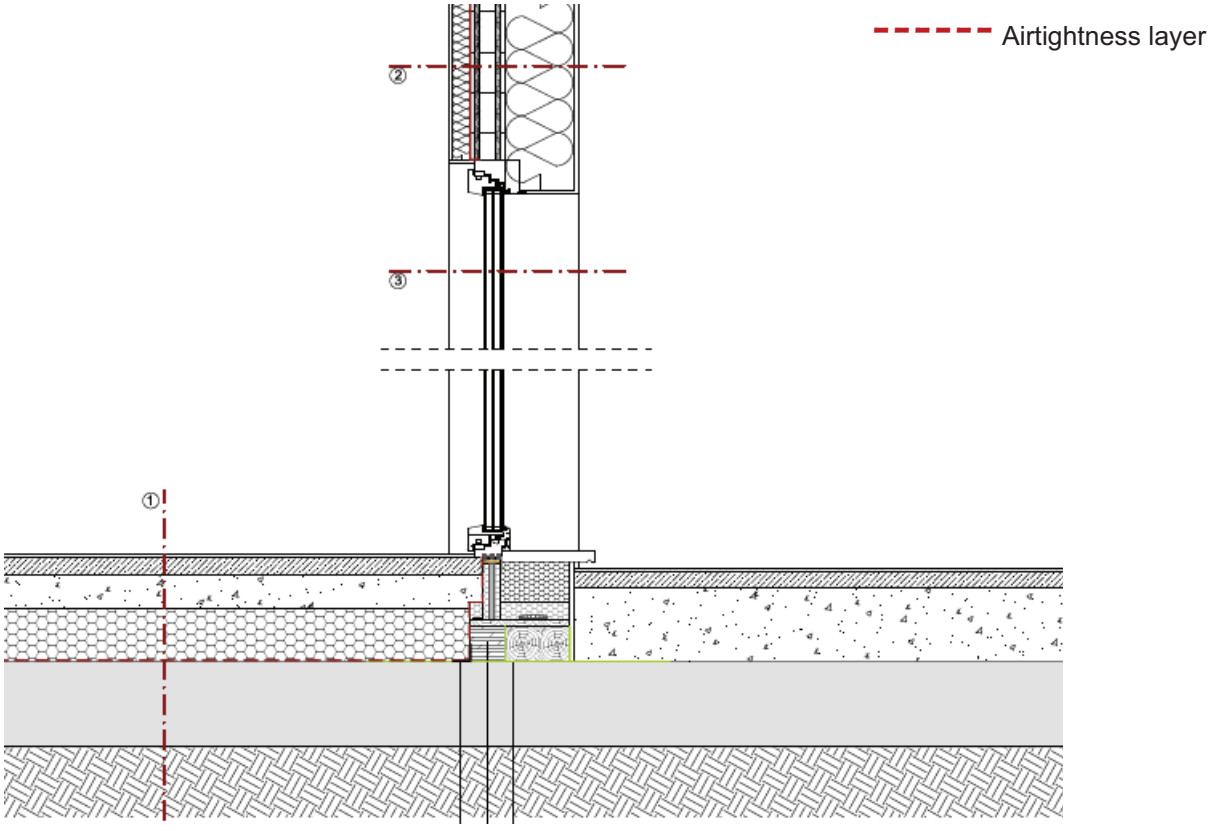
Risultati	
Flusso d'aria a50Pa, [m³/h]	223,5
Ricambi d'aria orari a50Pa, n_{50} [/h]	0,22
Permeabilità a 50 Pa, [m³/h/m²]	
Portata specifica infiltrazione a50 Pa, [m³/h/m²]	
Effective leakage area at 50 Pa, [cm²]	68,15
Equivalent leakage area at 50 Pa, [cm²]	112,0
Leakage per Envelope Area at 50 Pa, [cm²/m²]:	
Leakage per Floor Area at 50 Pa, [cm²/m²]:	



Building detail: concrete slab-external wall



Building detail: roof-external wall



Building detail: French window installation

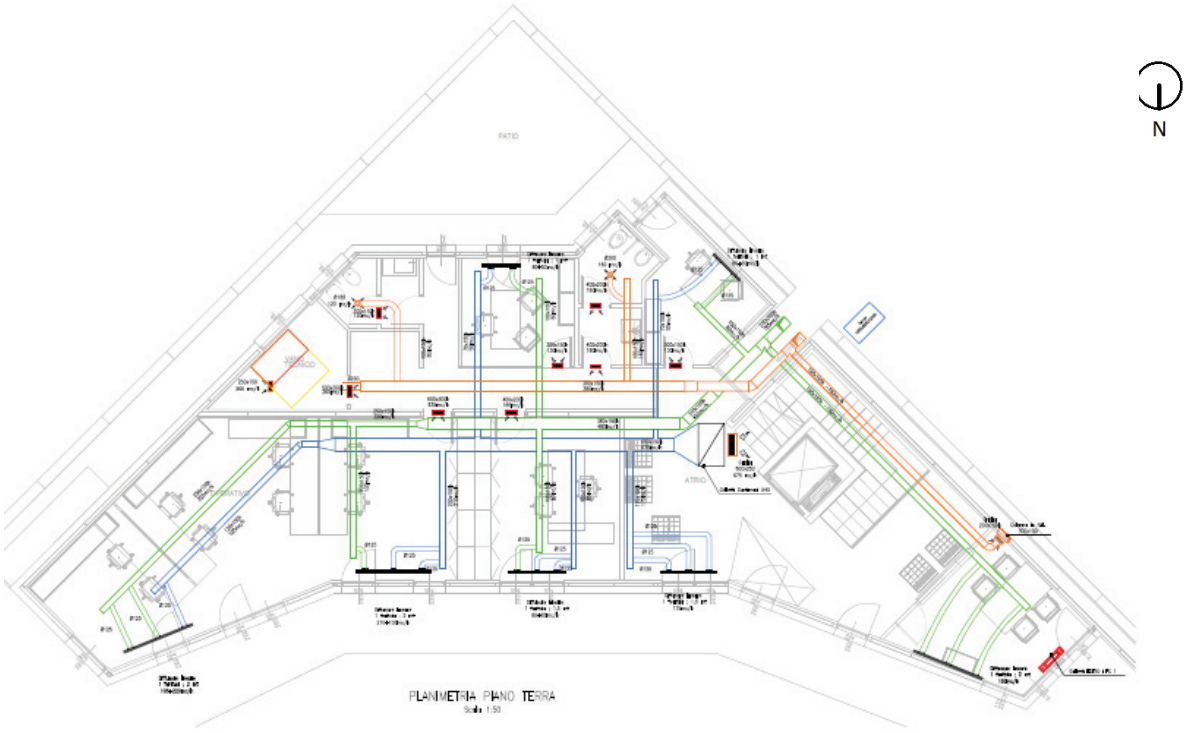
Pictures of the airtightness implementation

7 Ventilation, heating and cooling system

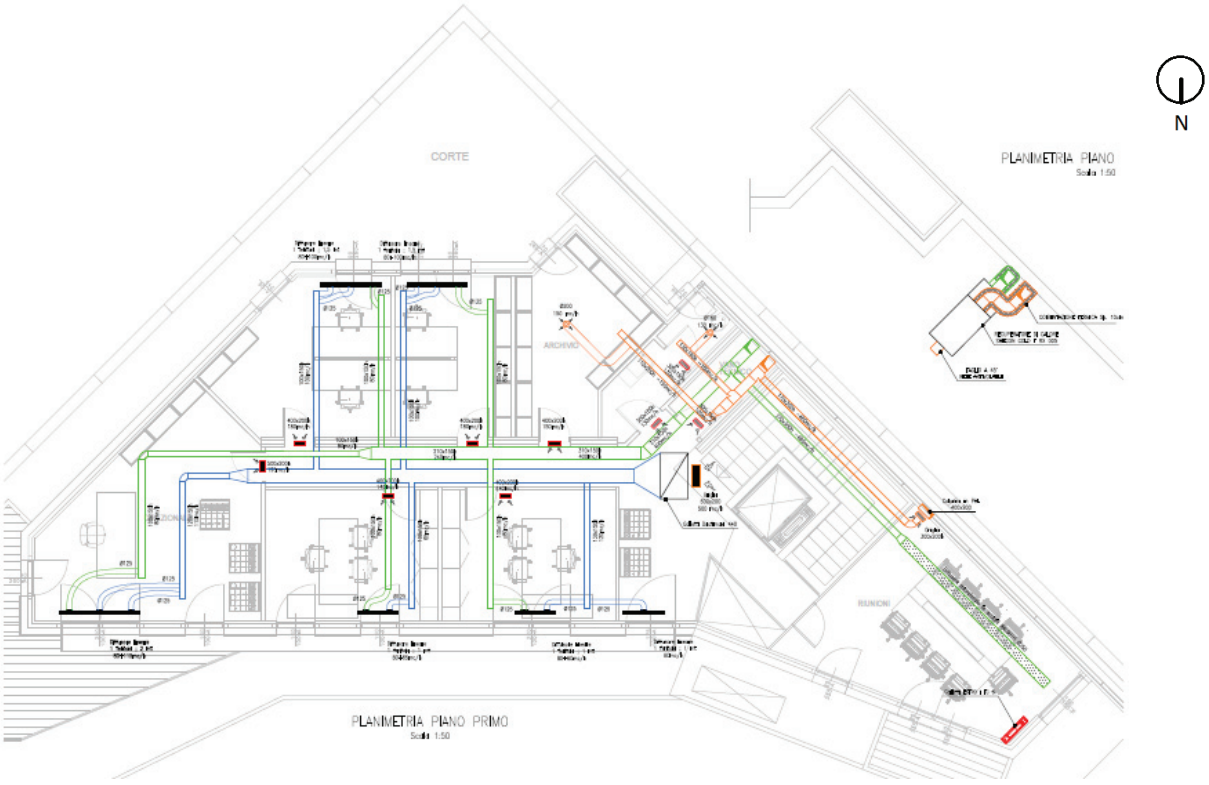
Megabox office building includes two meeting rooms with a completely different pattern of use if compared to the other offices of the building. To reduce investment costs and keep maintenance costs low, a centralised unit with variable air volume was chosen in order to guarantee the suitable air flow rate when needed in each room. The chosen ventilation unit is mod. LG 1400 by Pichler, with an 81% heat recovery efficiency.

Heating and cooling will be provided by an air to air heat pump, only one device with a simple distribution duct system.

All supply and exhaust air ducts are placed within the plasterboard ceiling, so that air is supplied and extracted just below the ceiling. This allows a good circulation of air regardless of the position of the interior furnishings.



Ground floor plan – Ventilation, heating and cooling system



First floor plan – Ventilation, heating and cooling system

8 Electrical systems

The DHW demand of the office building is very low, the strategy chosen is that DHW is produced by 10 litre electrical heaters, one in each bathroom. Although heating boilers are less efficient than other heating systems, the low DHW demand of the office make this solution the most effective one from both energetic and economic points of view.

A 1500 m² PV plant is installed on the roof, the office building shares this PV plant with the neighbour factory; 780 modules with a nominal power of 270 kWp.

One of the main challenges to face in an office building is the overheating risk linked to all office equipment used in the building. The strategy chosen to reduce overheating risk was to install the server device outside the thermal envelope, in a server room located inside the neighbour factory.

9 PHPP calculations

PHPP version 9 was used for this project. Climate data were custom supplied by PHI for this specific project and then made available for the community. Result are summarized below:

Verifica Passivhaus

Edificio:	Edificio per uffici Megabox				
Via:	Via Madonna dell'Arena				
CAP/Città:	61020	Montecchio			
Provincia/Paese	PU	IT-Italia			
Tipo di costr.:	Edificio per uffici				
Set dati climatici:	ud—01-cervia dati PHI				
Zona climatica	4: Caldo temperato		Altitudine:	10 m slm	
Committente/i:	Megabox s.r.l.				
Via:	Via Toscana, 14				
CAP/Città:	61022	Montecchio di Vallefoglia			
Provincia/Paese	PU	IT-Italia			

Architetto:	GA works - Geometra Gianluca Aiudi		**Termotecnico/a:**	Ing. Simone Giulianelli	
Via:	Via Montecchio, 1		Via:	Via Toscanini, 31	
CAP/Città:	61025	Montecchio	CAP/Città:	61121	Pesaro
Provincia/Paese	PU	IT-Italia	Provincia/Paese	PU	IT-Italia
Consul. energ.:	ZEPHIR Passivhaus Italia		**Certificazione:**	Energiehaus	
Via:	Viale Dante Alighieri, 300		Via:	C/Ramón Turró 100, 3-3	
CAP/Città:	38057	Pergine Valsugana	CAP/Città:	8005	Barcelona
Provincia/Paese	TN	IT-Italia	Provincia/Paese	Catalunya	ES-Spagna

Anno di costr.:	2018	Temperatura interna inverno [°C]:	20.0	Temp. interna estate [°C]:	25.0
Nr. unità abitative:	1	Apporti termici interni (Appl) - riscaldamento [W/m²]:	3.8	Appl - raffrescam. [W/m²]	3.8
Nr. di persone:	12.0	Capacità specifica [Wh/K per m² di S_{utile}]:	60	Raffrescamento meccanico:	x

Indici riferiti alla superficie utile netta

				Criteri	Criteri alternativi	Conseguito?[2]
	Superficie utile netta m²	317.3				
Riscaldamento	Fabb. termico annuo per risc. kWh/(m²a)	11	≤	15	-	sì
	Carico termico W/m²	9	≤	-	10	
Raffrescamento	Fabb. frigorifero e di deumidif. kWh/(m²a)	16	≤	16	16	sì
	Carico frigorifero W/m²	11	≤	-	12	
	Frequenza di surriscaldamento (> 25 °C) %	-	≤	-		-
	Freq. superam. benessere igrometrico (> 12 g/kg) %	0	≤	10		sì
Tenuta all'aria	Risultato test Blower-Door n_{50} 1/h	0.2	≤	0.6		sì
Energia primaria non rinnovabile (EP)	Fabbisogno EP kWh/(m²a)	125	≤	-		-
Energia prim. rinnovabile (EPR)	Fabbisogno EPR kWh/(m²a)	59	≤	45	59	sì
	Prod. di energia rinn. (rif. impronta sostenibile edificata) kWh/(m²a)	87	≥	60	80	

[2] cella vuota: Dati mancanti; '-': nessun requisito

Extract from Verification sheet in PHPP

10 Construction costs

A significant economic convenience is demonstrated both for client and for construction company. On the one side the payback period is shorter for the client, on the other side the construction company has lower construction building costs: less windows and a simpler mechanical services design led to a high cost reduction, only partially balanced by the increased costs for the thermal envelope. In the end, the overall reduction cost was more than 50 €/m² TFA compared with the other common building solutions (under same comfort conditions)! Hence, using the LCCA in PHPP as a decision making strategy made the construction company get a good positioning in the high-level market sector with lower investment costs. This is the proof that in general PASSIVHAUS might not be associated with extra costs.