PASYWNYM²

HOUSE WITH WINTER GARDEN

Project Documentation

Certified
Passive House
Passive House Institute
| classic | plus | premium |

New built detached single family house,
constructed in 2016 in Dabrowa Chotomowska, Poland

1.Abstract

Year of construction	2016	Space Heating	**15** kWh/(m²a)
U-value external wall	0.083 W/(m²K)		
U-value basement ceiling	0.111 W/(m²K)	Primary Energy Renewable (PER)	25 kWh/(m²a)
U-value roof	0.073 W/(m²K)	Generation of renewable energy	65 kWh/(m²a)
U-value window	0.80 W/(m²K)	Non-renewable Primary Energy (PE)	53kWh/(m²a)
Heat recovery	81,8%	Pressure test n50 /	0.22/h
Special features	Photovoltaic instalation 10 kWp, First polish Passive House Plus.		

1.1. Brief descripiton

The house is designed to maximize the comfort of living. The highlight of the project is a south-facing winter garden that is an extension of the living room. Winter garden connects the interior of the house with its exterior creating a natural buffer zone, where the whole family can experience nature in any weather conditions. The House with Winter Garden is the first Polish building being certified in the Passive House Plus standard.
The building is designed for a family of four. The functional layout is as follows: the living room, dining room, and kitchen are located on the ground floor on the south side of the building. Along the north facade, there is a bathroom with a sauna, technical room and home office (with windows facing east). Master bedroom, children's bedrooms, and two additional bathrooms are located on the first floor.

The timber-frame building is constructed using the I-joist system to reduce thermal bridges.

1.3 Responsible project participants

Architecture and building physics: Pasywny M2, Agnieszka Figielek
Building services
MVHR design and supply: BR Engineers, Bartosz Radomski
Renewables: Solar array, Immersun units and electrics: Bison Energy
Structural engineer: Roman Pilch
Craftsperson / parties involved:
Bartosz Królczyk - advisor
Certifying body: Passivhaus Institut, Darmstadt
Certification ID: 6282 (Passive House Database)

2. Views of the building

View of the west facade

View of the south facade

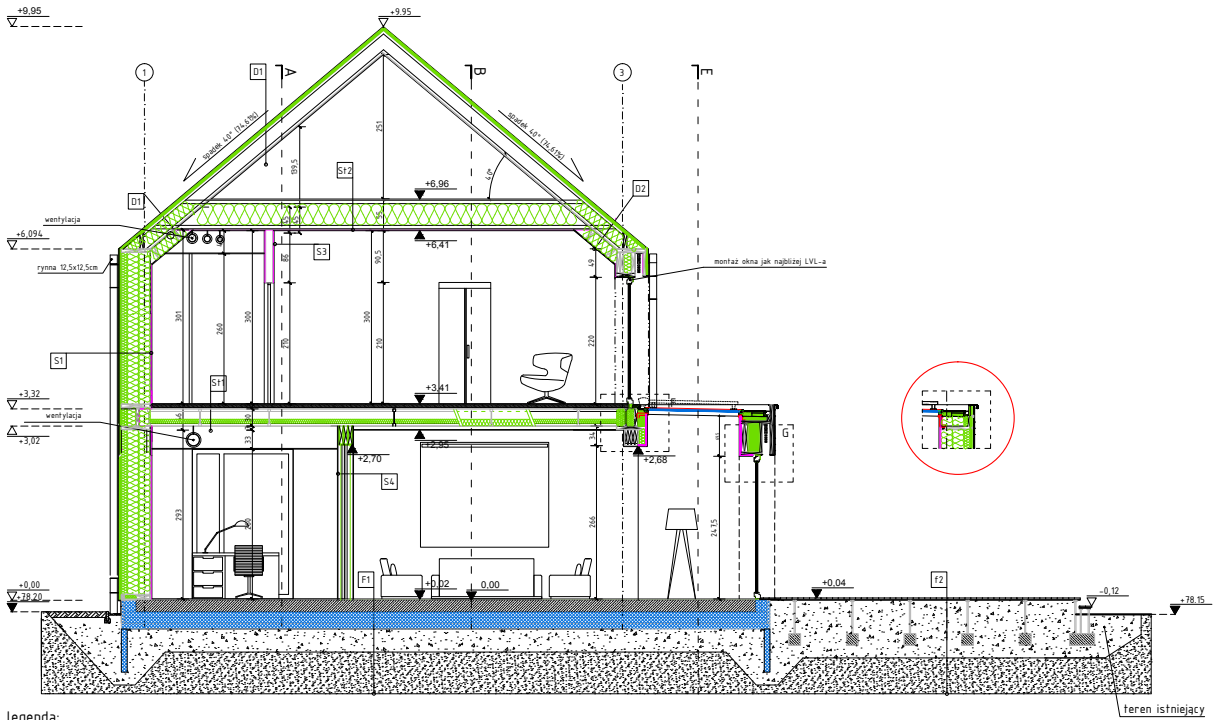
View of the building during construction period

View of the north facade

View of the south facade

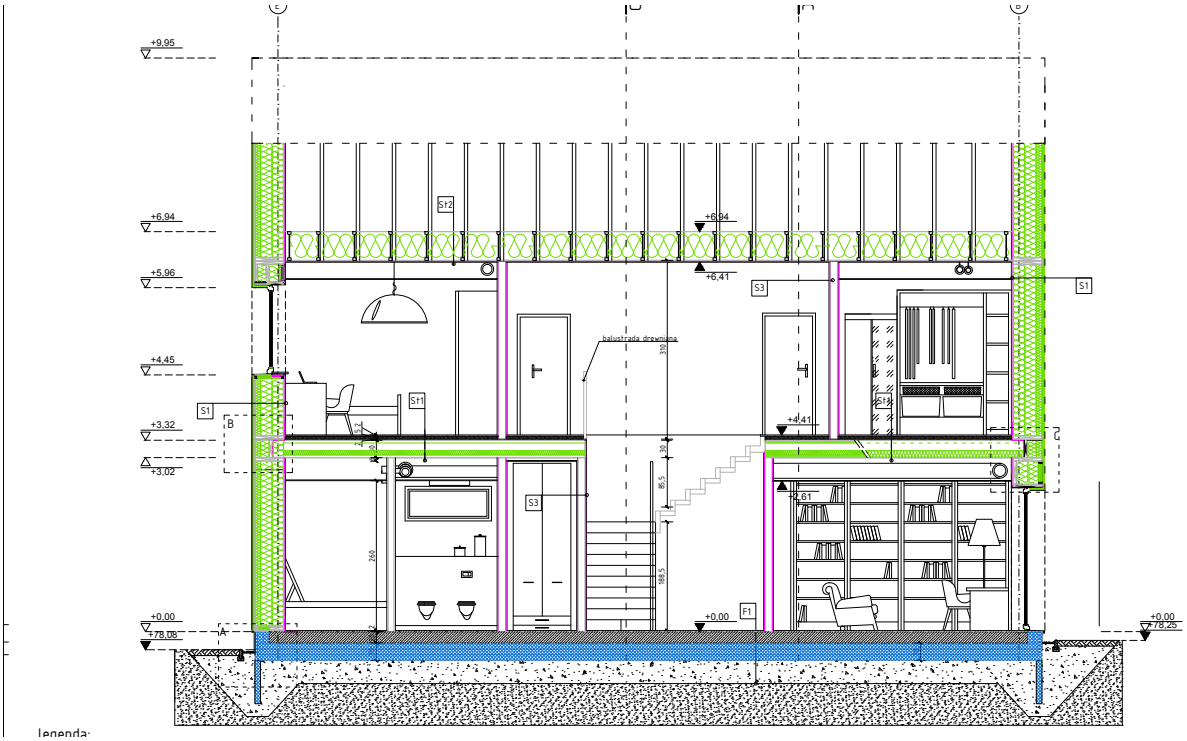
View of the winter garden

3. Sectional drawnings

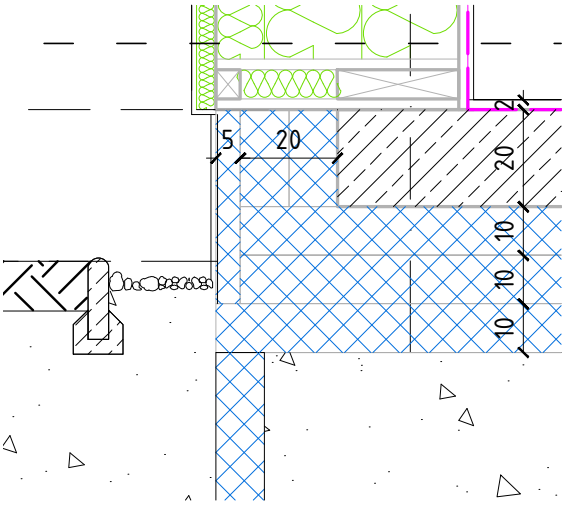


Cross section running from North to South via winter garden

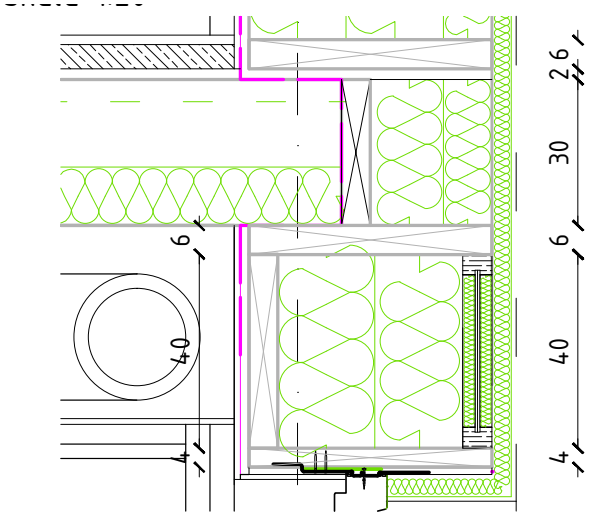
Cross section running from North to South shown in perspective



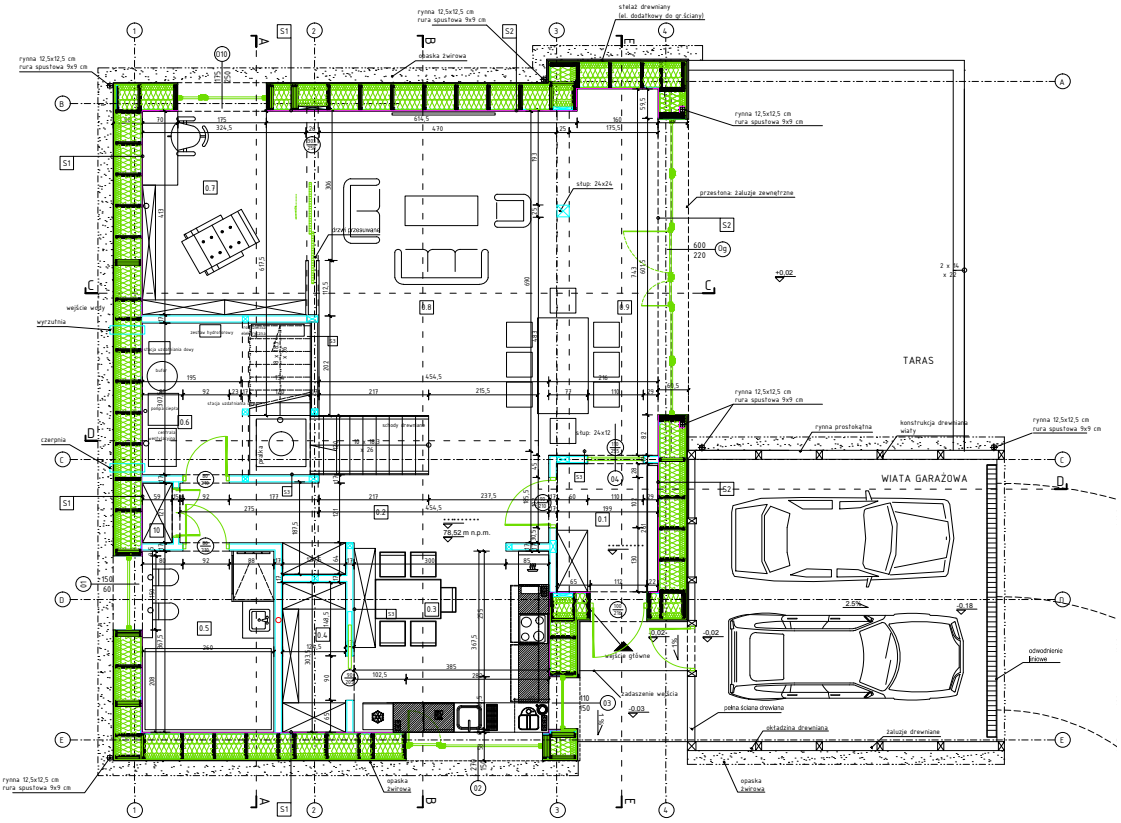
Cross section running from East to West



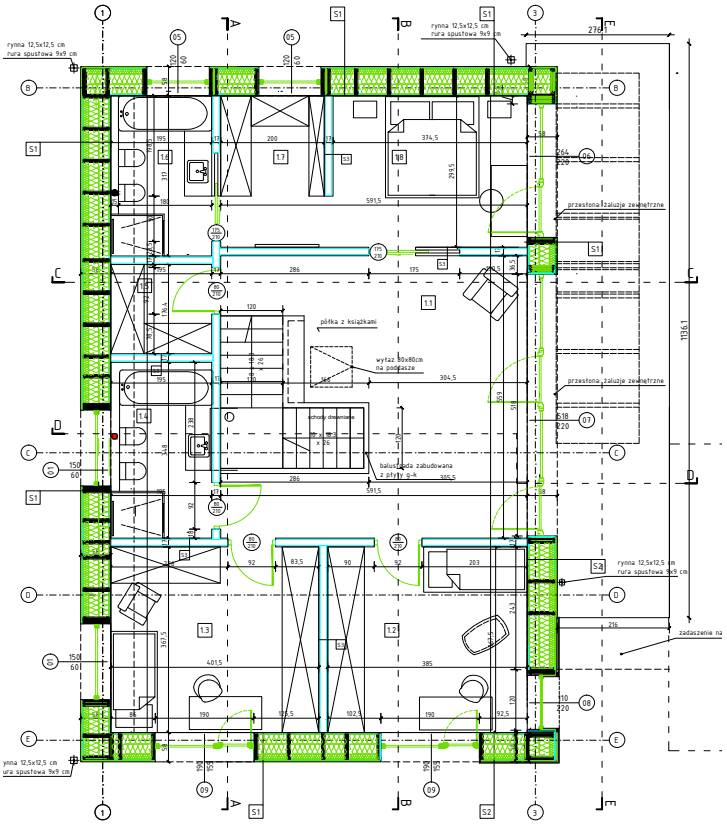
Foundation slab



Window-slab connection



Ground floor plan



First floor plan

Ground floor:

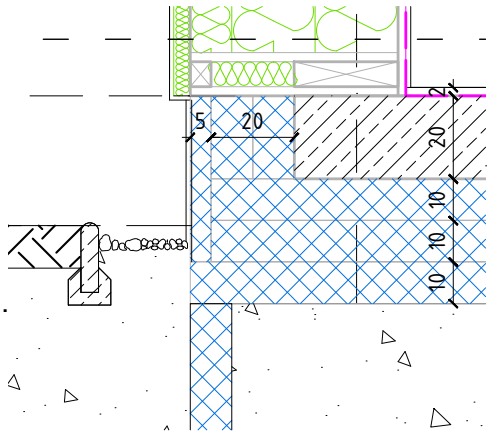
The open-plan living room conected with dining room and kitchen are located on the south facade of the building. Service room and the bathroom lare located on the north facade and act as a thermal buffer.

First floor:

The functional layout of the first floor also reflects the idea of thermal zoning. Large, south facade glazing contrast with small windows on the northern side.

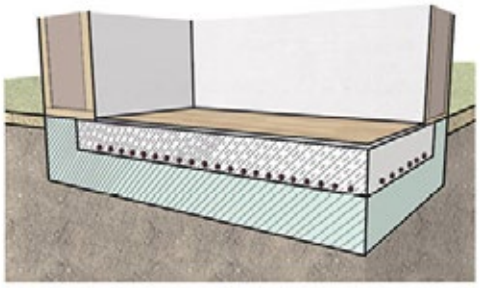
5. Construction

5.1. Ground floor



Basement floor / floor slab
-300 mm insulation XPS
-250 mm reinforced concrete slab
U-value = 0.111 W/(m2K)

Foundation slab was highly insulated with polistyrane. What is more, wall foundation was divided into two parts in order to eliminate thermal bridges.

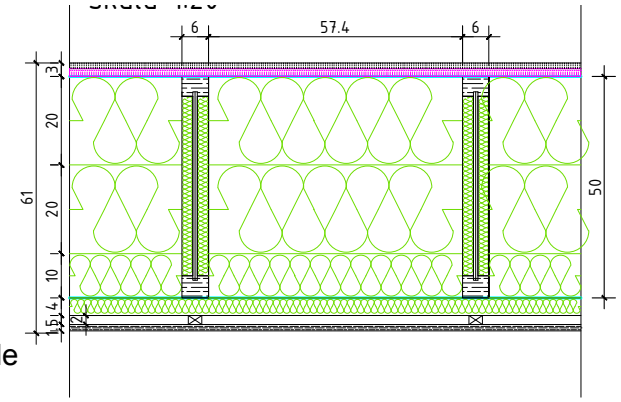


5.2. Externall wall

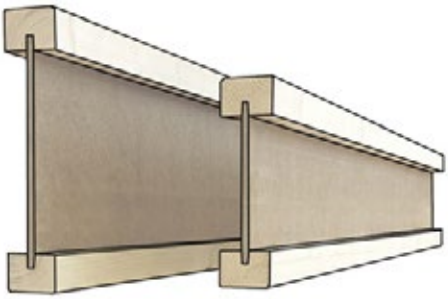
Layers:

- 10 mm plaster
- 40 mm wood fiber wool
- 500 mm wood fiber wool/I-studs
- 18 mm OSB
- 15 mm plasterboard

U-value = 0.083 W/(m2K)



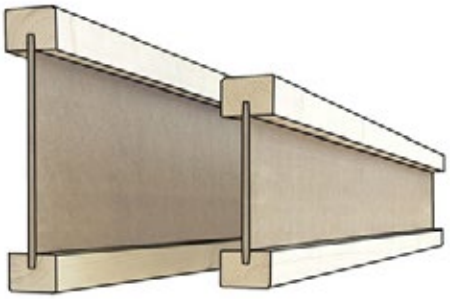
Construction materials are made from renewable material -wood. I-studes are manufactured and join in the prefabricated wall elements in the nearby factory and then transported to the building site.



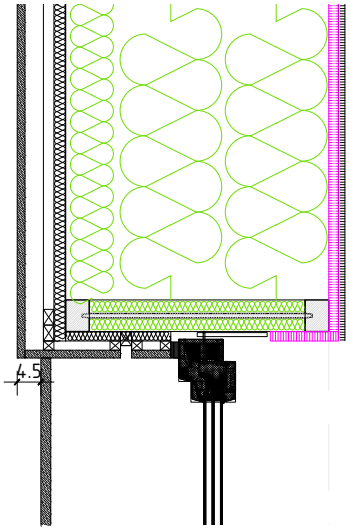
5.3. Roof

Layers:
- roof tile
- 40 mm wood fiber wool
- 300 mm wood fiber wool/ scantling
- 18 mm OSB
- 200 mm wood fiber wool/ I-studs
- 13 mm plasterboard

Roof was constructed using prefabricated I-studes, with insulation - both between the studs and on the top of them.



5.4. Windows



Layers:

- 10 mm plaster
- 40 mm wood fiber wool
- 500 mm wood fiber wool/I-studs
- 18 mm OSB
- 15 mm plasterboard

U-value = 0.083 W/(m2K)

High quality windows were used in the project - Energeto 8000 I passiv; CI-System with Vinyl window frame, insulated by PU-foam (0,030 W/(mK)), reinforced by Polyamide with 25% glassfibre (0,30 W/(mK)).

6. Air tightness

The airtightness strategy was to ensure a single layer of airtightness by the use of tapes, grommets and fittings. OSB board were used as airtight layer, all joints and penetrations were sealed with tapes.
Care was taken to protect this during the casting and polishing of the concrete slab.
The windows were installed in an exterior subframe, with all connections between sheathing, subframe, and window frame being sealed with tape.

Certificate

about the BlowerDoor Test

Object:

Budynek jednorodzinny
ul.Modrzewiowa 22
Dąbrowa Chotomowska
05-123 Dąbrowa Chotomowska

Test Date: 12.08.2016
Air change rate (n50) at 50 Pascal
according to EN 13829, Method A

n50 = 0,22 1/h

Regulation complied with: PN_EN 13829

n50 ≤ 0,6 1/h

The test results meet the regulation.

2016-08-21

PASS Doradztwo Energetyczne Tęczowa 9, Góra
Tarnowo Podgórne
Katarzyna Jarocka tel. 795 435 837

BlowerDoor Test

EN 13829, Method A

Building Test Info and Air-Moving Equipment

Building Information

Building:	Budynek jednorodzinny
	ul.Modrzewiowa 22
Address:	Dąbrowa Chotomowska
	05-123 Dąbrowa Chotomowska
Year of Construction:	2016
Test Date:	12.08.2016

Customer Information

Name:	Przemysław Romaniuk
Address:	ul. Czarneckiego 71
	05-120 Legionowo
Phone:	
Fax:	

Business Info

Name:	PASS Doradztwo Energetyczne	Technician	Katarzyna Jarocka
	Tęczowa 9, Góra	Phone:	795 435 837
Address:	Tarnowo Podgórne	Fax:	
	tel. 795 435 837		

Test Method

Method:	A Test of a building in use
Standard:	Following EN 13829
Note:	

Test object:

Test object:	Budynek konstrukcji szkieletowej [system Steico], posadowiony na płycie fundamentowej.		
Internal Volume V:	662 m³	Error: +/- 5 %	Calculation Reference Values:
Net Floor Area A_F:	214 m²		see appendix
Envelope Area A_E:	495 m²		
Type of Ventilation:	Yes	mechaniczna z odzyskiem	
Type of Heating System:	pompa ciepła/ogniwa PV		
Type of Air Conditioning:	pasywne chłodzenie - pompa ciepła		

Additional Information you will find in "Comments".

Air-moving Equipment

Device:	Minneapolis BlowerDoor Modell 4, APT				
Serial Numbers:	Fan:	CE 2880	Pressure Gauge:	DG-700	Calibration:
Other Devices:					

BlowerDoor Test

Test Standard EN 13829, Method A

Minneapolis BlowerDoor Modell 4 - Tectite Express 3.6.7.0

Object:	Budynek jednorodzinny ul.Modrzewiowa 22 05-123 Dąbrowa Chotomowska	Technician:	Katarzyna Jarocka
		Date:	12.08.2016

Temperature and Wind Conditions

Inside Temperature:		20 °C	Wind Force:		2
Outside Temperature:		18 °C	Number of exterior pressure taps:		1
Barometric Pressure:	(Standard):	101325 Pa	Building Wind Exposure:		B
			Uncertainty because of Wind (Table Geißler):		**2 %**

Depressurization

Zero Flow	Δp_{01+}	Δp_{01-}	Δp_{02+}	Δp_{02-}
(baseline)	-	-0,2 Pa	0,8 Pa	-0,6 Pa

Pressurization

Zero Flow	Δp_{01+}	Δp_{01-}	Δp_{02+}	Δp_{02-}
(baseline)	0,1 Pa	-0,1 Pa	0,1 Pa	-0,1 Pa

Sets of Measurement

Ring	Building Pressure	Fan Pressure	Fan Flow V_r	Tolerance
O ABCDE	[Pa]	[Pa]	[m³/h]	[%]
Δp_{01}	-0,2			
C	-69	81	187	-0,35
C	-65	73	177	-0,18
C	-60	65	167	0,79
C	-54	55	152	-0,39
C	-49	47	141	-0,04
C	-44	40	130	-0,03
C	-41	35	121	0,93
C	-34	26	103	-0,91
C	-30	21	93	0,10
D	-27	47	85	0,10
Δp_{02}	-0,5			

Correlation Coefficient r:		*1,000*	Confidence interval	
C_{env}	[m³/(h Pa^n)]	6	max. 6	min. 5
C_L	[m³/(h Pa^n)]	6	max. 6	min. 5
n	[-]	0,82	max. 0,83	min. 0,81

Ring	Building Pressure	Fan Pressure	Fan Flow V_r	Tolerance
O ABCDE	[Pa]	[Pa]	[m³/h]	[%]
Δp_{01}	0,0			
C	67	77	181	-0,07
C	65	74	177	1,19
C	59	62	163	0,01
C	54	53	150	-0,66
C	49	45	137	-1,33
C	43	39	128	0,45
C	40	34	120	0,75
C	34	26	103	-0,58
C	29	21	92	-0,44
C	24	16	80	0,71
Δp_{02}	-0,1			

Correlation Coefficient r:		*1,000*	Confidence interval	
C_{env}	[m³/(h Pa^n)]	6	max. 7	min. 6
C_L	[m³/(h Pa^n)]	6	max. 7	min. 6
n	[-]	0,81	max. 0,82	min. 0,79

Results

V =	662 m³	A_F =	214 m²	A_E =	495 m²

	V_{50}	Uncertainty	n_{50}	Uncertainty	w_{50}	Uncertainty	q_{50}	Uncertainty
	m³/h	%	1/h	%	m³/m²h	%	m³/m²h	%
Depressurisation	**143**	+/- 7 %	0,22	+/- 9 %	0,67	+/- 9 %	0,29	+/- 9 %
Pressurisation	**143**	+/- 7 %	0,22	+/- 9 %	0,67	+/- 9 %	0,29	+/- 9 %
Average	**143**	+/- 7 %	**0,22**	+/- 9 %	**0,67**	+/- 9 %	**0,29**	+/- 9 %

Regulation complied with: **PN_EN 13829**

Maximum allowable:	**0,6**	1/h				

The test results meet the regulation.

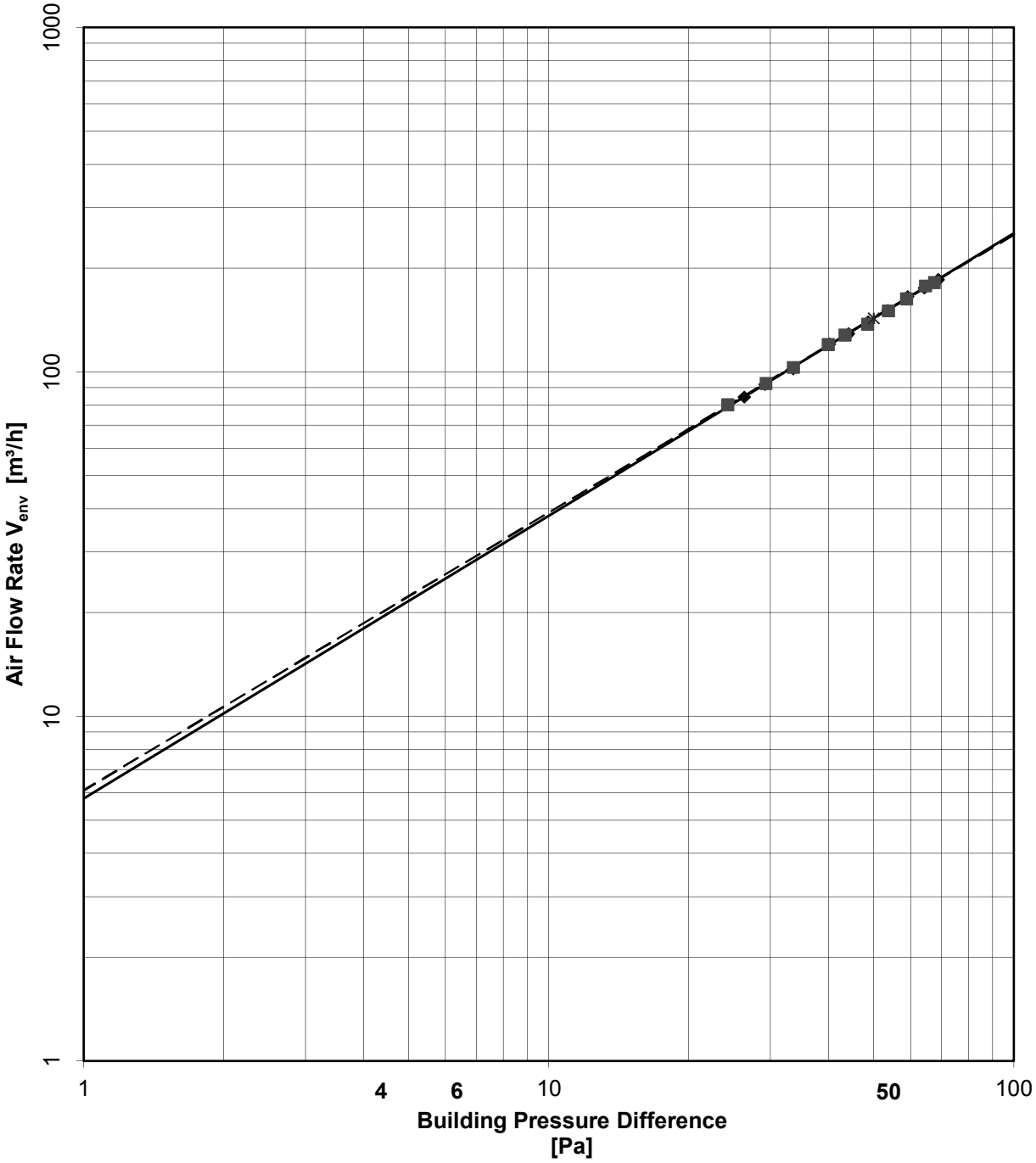
Note: The result does not exclude faults in the construction.

Business Info: Katarzyna Jarocka
PASS Doradztwo Energetyczne Tęczowa 9, Góra
tel. 795 435 837

Date, Sign

Stamp

BlowerDoor Air Leakage Graph
Object: Budynek jednorodzinny ul.Modrzewiowa 22



◆ (Air Flow) Depressurisation [m³/h]

■ (Air Flow) Pressurisation [m³/h]

——— Regression line Depressurisation [m³/h]

– – – Regression line Pressurisation [m³/h]

✳ Air Flow Rate at 50 Pa [m³/h]

BlowerDoor Test

EN 13829, Method A

Zero-Flow (Baseline) and Accuracy

Object:	Budynek jednorodzinny ul.Modrzewiowa 22	Technician:	Katarzyna Jarocka
	05-123 Dąbrowa Chotomowska	Date:	12.08.2016

Depressurization

	Zero Flow Pressure Difference	
Reading	**At the Beginning**	**At the End**
1	-0,3	-1,1
2	-0,3	-0,3
3	-0,3	-0,3
4	-0,3	-0,8
5	-0,3	-1,1
6	-0,3	-0,3
7	-0,3	-0,4
8	-0,3	-0,4
9	-0,3	-0,8
10	-0,3	0,3
11	-0,2	1,3
12	-0,3	-0,4
13	-0,2	-0,5
14	-0,2	-0,5
15	-0,3	-0,5
16	-0,2	-0,5
17	-0,2	-0,5
18	-0,2	-0,6
19	-0,2	-0,6
20	-0,2	-0,6
21	-0,2	-0,6
22	-0,1	-0,7
23	-0,1	-0,6
24	-0,1	-0,7
25	-0,1	-0,7
26	-0,2	-0,8
27	-0,1	-0,8
28	-0,2	-0,9
29	-0,1	-0,9
30	-0,2	-0,9

Pressurization

	Zero Flow Pressure Difference	
Reading	**At the Beginning**	**At the End**
1	0,0	0,2
2	0,0	0,2
3	0,0	0,1
4	0,0	0,1
5	0,1	0,1
6	0,1	0,0
7	0,1	0,0
8	0,1	0,0
9	0,1	0,0
10	0,1	0,0
11	0,2	0,0
12	0,2	0,0
13	0,1	-0,1
14	0,1	-0,1
15	0,1	-0,1
16	0,1	-0,1
17	0,1	-0,1
18	0,1	-0,1
19	0,1	-0,1
20	0,1	-0,1
21	0,0	-0,1
22	0,0	-0,1
23	0,0	-0,1
24	0,0	-0,1
25	-0,1	-0,1
26	-0,1	-0,1
27	-0,1	-0,2
28	-0,2	-0,2
29	-0,2	-0,1
30	-0,1	-0,1

Average of the positive and negative Values of Zero Flow Pressure Difference

	Δp_{01+}	Δp_{01-}	Δp_{02+}	Δp_{02-}
Average	-	-0,2	0,8	-0,6

	Δp_{01+}	Δp_{01-}	Δp_{02+}	Δp_{02-}
Average	0,1	-0,1	0,1	-0,1

Average of all Values of Zero Flow Pressure Difference

Zero Flow	Δp_{01} [Pa]	Δp_{02} [Pa]
(baseline)	-0,2	-0,5

Zero Flow	Δp_{01} [Pa]	Δp_{02} [Pa]
(baseline)	0,0	-0,1

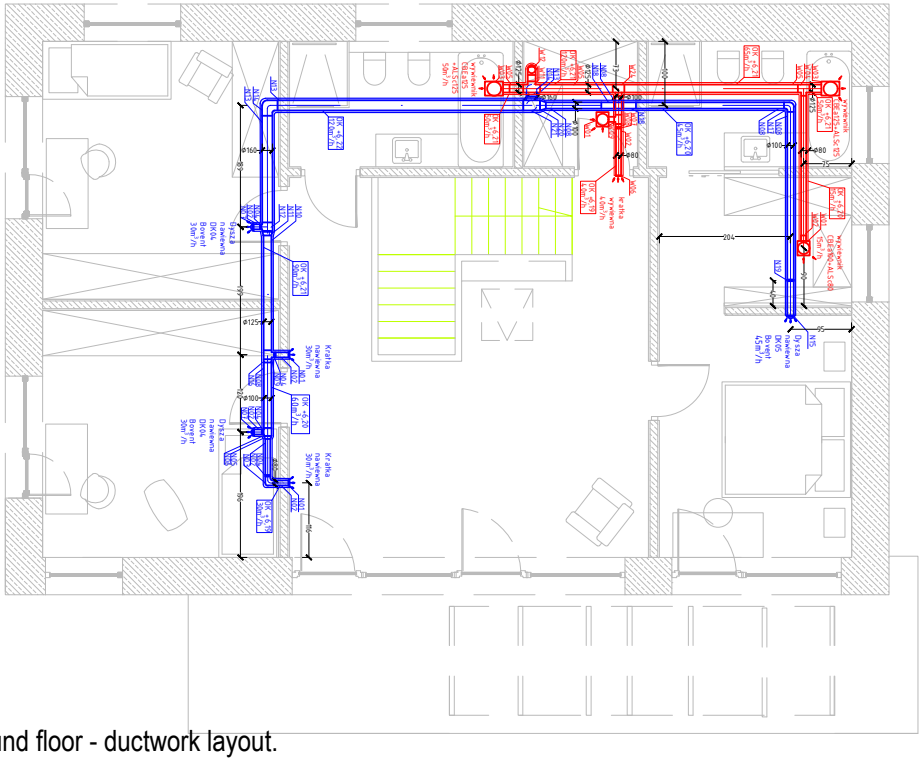
Note:

Accuracy (Proposal Germany: FLiB-Supplement 11/2001)

Name	Description	Depressurisation		Pressurisation	
a	Accuracy of the device to measure airflow rate	+/- 4 %		+/- 4 %	
b	Accuracy building pressure	+/- 3 %	50 Pa	+/- 3 %	50 Pa
c	Uncertainty because of wind	+/- 2 %		+/- 2 %	
d	Uncertainty barometric pressure (standard or measured)	+/- 5 %		+/- 5 %	
e	Uncertainty leaving out a depressurazition or pressurazition	+/- 0 %		+/- 0 %	
g	Uncertainty reference values	+/- 5 %		+/- 5 %	
only info	Random error of the airflow rate	+/- 0 %		+/- 1 %	

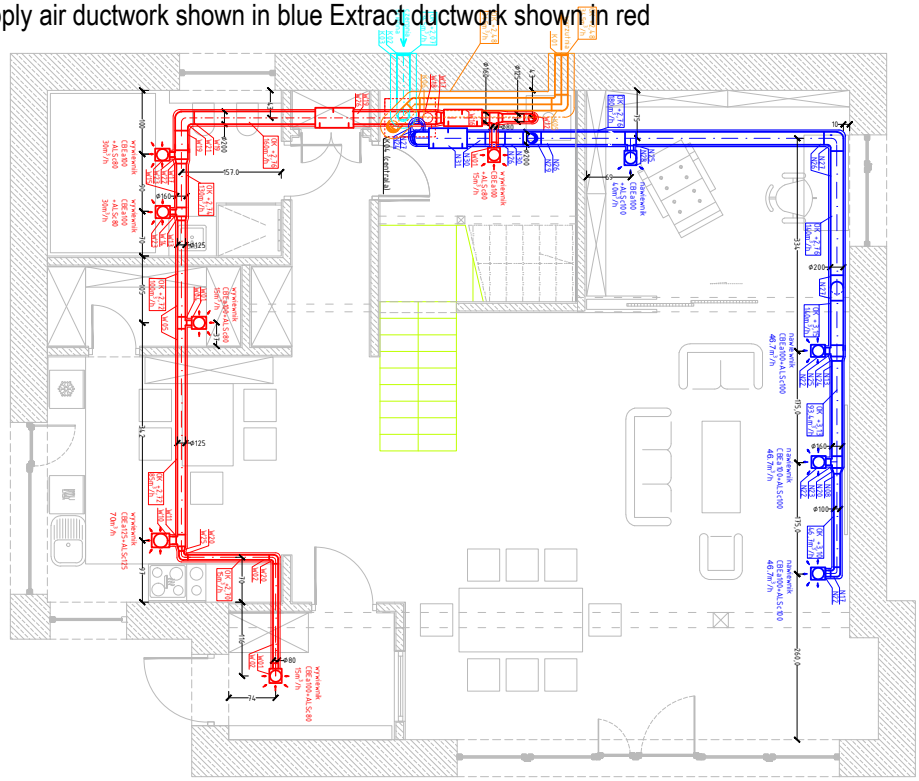
7. Ventilation system

Design of the ventilation system was carried out by Bartosz Radomski, certifed Passive House service designer. He used a Paul Novus (F) 300 unit. The MVHR unit has an effective heat recovery performance of 81,8%.



Ground floor - ductwork layout.

Supply air ductwork shown in blue Extract ductwork shown in red



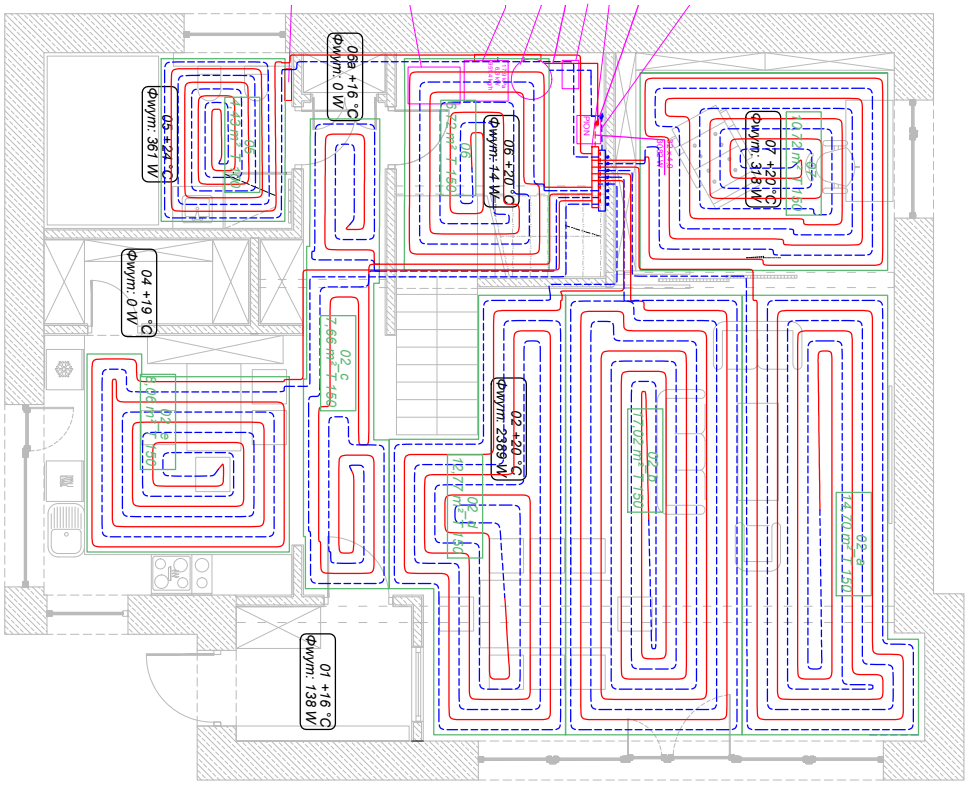
First floor - ductwork layout.

Supply air ductwork shown in blue Extract ductwork shown in red

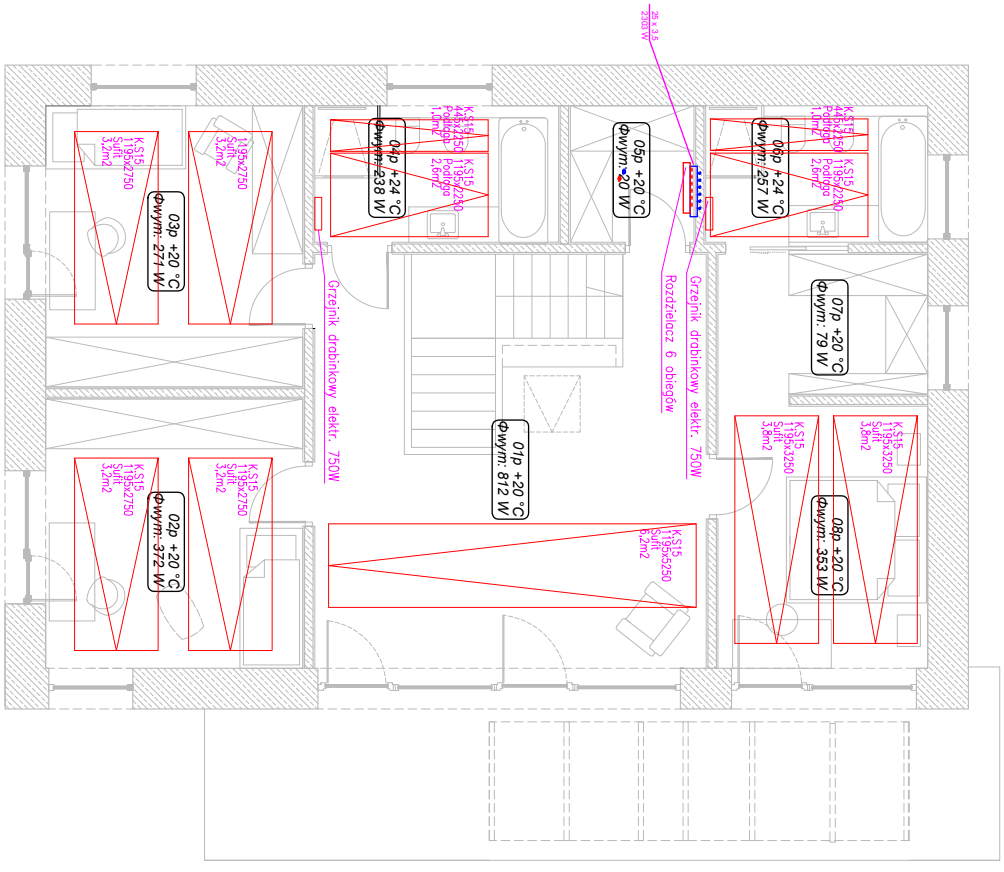
8. Heating system

As a passive house, the building requires minimal amout of energy for heating. The heating system and water heating supply is provided by air source heat pump with internal storage tank.The device is Waterkotte, Basic Line Ai1 Air. COP=3,7.

Ground floor - floor heating layout



First floor - floor heating layout



Service room

Heating system

9. PHPP verification

budynek pasywny-Ocena

obiekt:	Budynek jednorodzinny z wiatą		
ulica:	Modrzewiowa		
kod pocztowy / miejscowość	05-123	Dąbrowa Chotomowska	
prowincja / kraj	Polska	PL-Polska	
typ obiektu:	budynek jednorodzinny		
dane klimatyczne:	PL0003a-Warszawa		
strefa klimatyczna:	2: zimny	wysokość standardowa:	78,52 m
inwestor:	Anna Jakubowska Romaniuk i Przemysław Romaniuk		
ulica:	Czarnieckiego 71		
kod pocztowy / miejscowość	05-120	Legionowo	
prowincja / kraj	Polska		

architektura:	Pasywny M2 Agnieszka Figielek	**alacje sanitarne:**	BR Engineers Bartosz Radomski
ulica:	Janusza Zeylanda 6/11	ulica:	Krańcowa 62/27
kod pocztowy / miejscowość	60-366 Poznań	wy / miejscowość	61-036 Poznań
prowincja / kraj	Polska	prowincja / kraj	Polska
doradztwo energetyczne:	Bartosz Królczyk	**certyfikacja:**	
ulica:	Szydłowska 3/36	ulica:	
kod pocztowy / miejscowość	60-651 Poznań	wy / miejscowość	
prowincja / kraj	Polska	prowincja / kraj	

rok budowy:	2016	temperatura wewnętrzna zimą [°C]:	20,0	temp. wewnętrzna latem [°C]:	25,0
ilość mieszkań:	1	wewnętrzne źródła ciepła (WZC) ogrzewanie [W/m²]:	2,3	WZC chłodzenie [W/m²]:	2,3
ilość osób:	3,1	char. pojemność [Wh/K na m² UPO]:	60	chłodzenie mechaniczne	

Wskaźniki budynku odniesione do umownej powierzchni ogrzewanej na rok

					kryteria	kryteria alternatywne	spełnione?[2]
	Umowna powierzchnia ogrzewana m²	209,4					
ogrzewanie	zapotrzebowanie na ciepło do ogrzewania kWh/(m²a)	15	≤		15	-	tak
	obciążenie ogrzewcze W/m²	13	≤		-	10	
obciążenie ogrzewcze	chłodzenie + zapotrzebowanie na osuszanie kWh/(m²a)	-	≤		-	-	-
	obciążenie chłodnicze W/m²	-	≤		-	-	
	częstotliwość przegrzewania (> 25 °C) %	2	≤		10		tak
	częstość podwyższonej wilgotności (> 12 g/kg) %	0	≤		20		tak
szczelność powietrzna	wymiana powietrza podczas próby ciśn. n50 1/h	0,2	≤		0,6		tak
nieodnawialna energia pierwotna (EP)	zapotrzebowanie EP kWh/(m²a)	53	≤		-		-
odnawialna energia pierwotna (PER)	zapotrzebowanie PER kWh/(m²a)	25	≤		45	30	tak
	wytworzenie odnawialnej energii (na powierzchnię nadbudowy) kWh/(m²a)	65	≥		60	39	

[2] puste pole: brak danych; '-': brak wymagań

Zapewniam, że wprowadzono tutaj wartości zgodnie z metodą PHPP na podstawie wskaźników budynku. Obliczenia PHPP są dołączone do Oceny.

budynek pasywny Plus? tak

funkcja	imię	nazwisko	podpis
2-certyfikowany			

wystawiono	miejscowość

Energy balance - heating (annual method)