Project Documentation
Park Passivhaus – ID 6422

Abstract

Single family home in Somerville, Massachusetts

Building Data

Year of construction	2013	**Space heating**	**14 kWh/(m²a)**
U-value external wall	0.101 W/(m²K)		
U-value floor	0.093 W/(m²K)	Primary Energy Renewable (PER)	47 kWh/(m²a)
U-value roof	0.074 W/(m²K)	Generation of renewable energy	68 kWh/(m²a)
U-value window	0.814 W/(m²K)	Non-renewable Primary Energy (PE)	80 kWh/(m²a)
Heat recovery	84 %	Pressure test n_{50}	0.4 h-1
Special features	Solar collectors for hot water generation, Solar PV panels for electricity generation, rainwater collection.		

Project Description

Park Passivhaus Somerville, MA, USA

Park Passivhaus is a single family home, built in 2012/2013 on an urban infill lot in Somerville, MA, USA. It is a two-storey home with an open floor plan, 3 bedrooms, no basement and a Treated Floor Area of about 122 m^2 (1317 ft^2). Orientation is almost ideal, facing slightly south, south-west, with no windows on the east and one window on the west side.

Foundation is a combination of an external stem wall and an inner shallow ring beam, thermally separated with mineral wool. External wall construction is a double stud wall with ~14.5" of dense packed cellulose. There are 2 smart membranes in the envelope - outside membrane is acting as a weather resistant barrier (WRB) and secondary air barrier (with high PERM rating). Inside membrane is serving as a primary air barrier and has a low PERM rating to reduce vapour diffusivity into the wall. Membranes and windows are all taped with tapes for airtightness.
Windows are tilt and turn, wood frame, Alu-clad with triple pane IGU units.

Heating and cooling are provided by a mini-split heat pump system consisting of one condenser and two indoor evaporator units. Domestic hot water is heated by a Solar Thermal system and the whole house is ventilated with an HRV.

For the last 7 years, the house has been performing on target and above expectations. With the addition of a small PV system in 2016, it has been Net Positive!

Whole construction process is illustrated on the Park Passivhaus Blog.

Responsible project participants

Architect	Simon Hare, Declan Keefe - Placetailor www.placetailor.com
Implementation planning	Placetailor www.placetailor.com
Building systems	James Drysdale - Placetailor www.placetailor.com
Structural engineering	Dan Bonardi – Dan Bonardi Consulting Engineers http://db-ce.com/
Building physics	Vladimir Pezel – eMod Studio www.emodstudio.com
Passive House project planning	Travis Anderson – Placetailor www.placetailor.com
Construction management	Travis Anderson – Placetailor www.placetailor.com

Certifying body

Passive House Institute Darmstadt
www.passiv.de

Certification ID

6422	Project-ID (www.passivehouse-database.org)

Author of project documentation

Vladimir Pezel – eMod Studio, www.emodstudio.com

Date	Signature
10. Sep. 2020.	

1. House Images

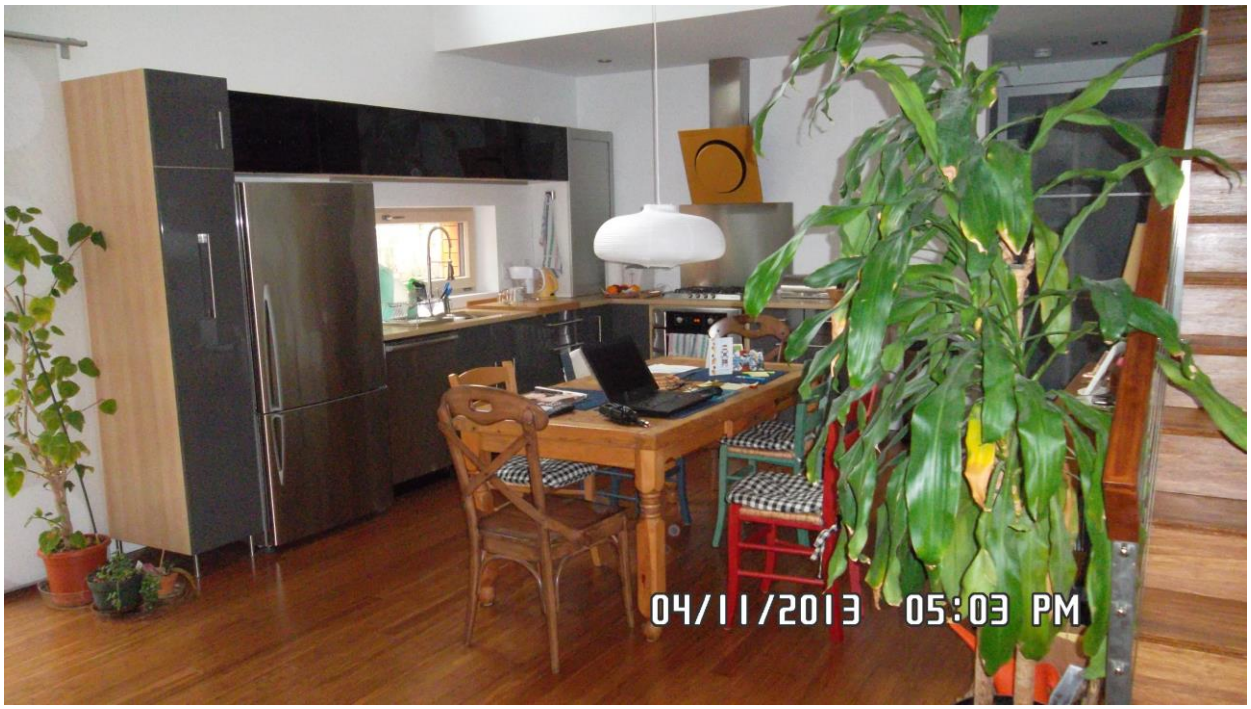
Exterior

South-west elevation

South elevation

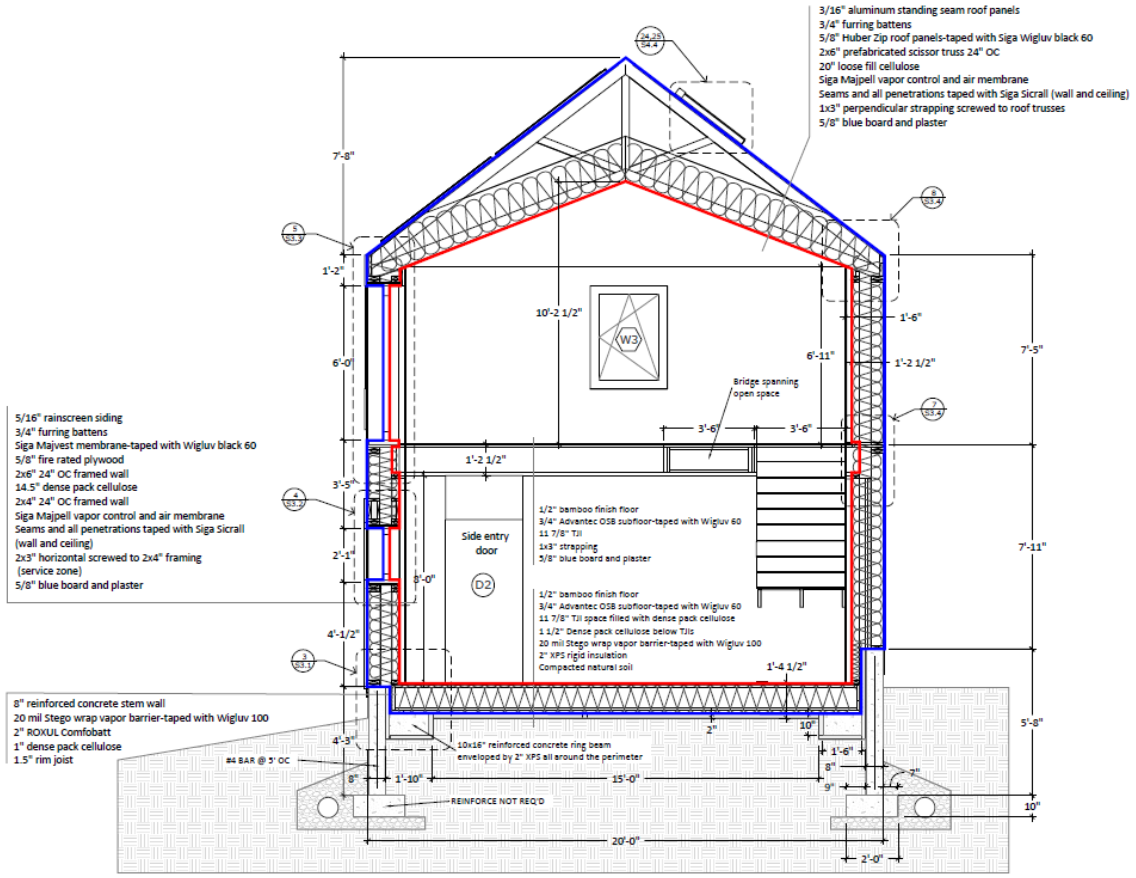
North elevation

Interior

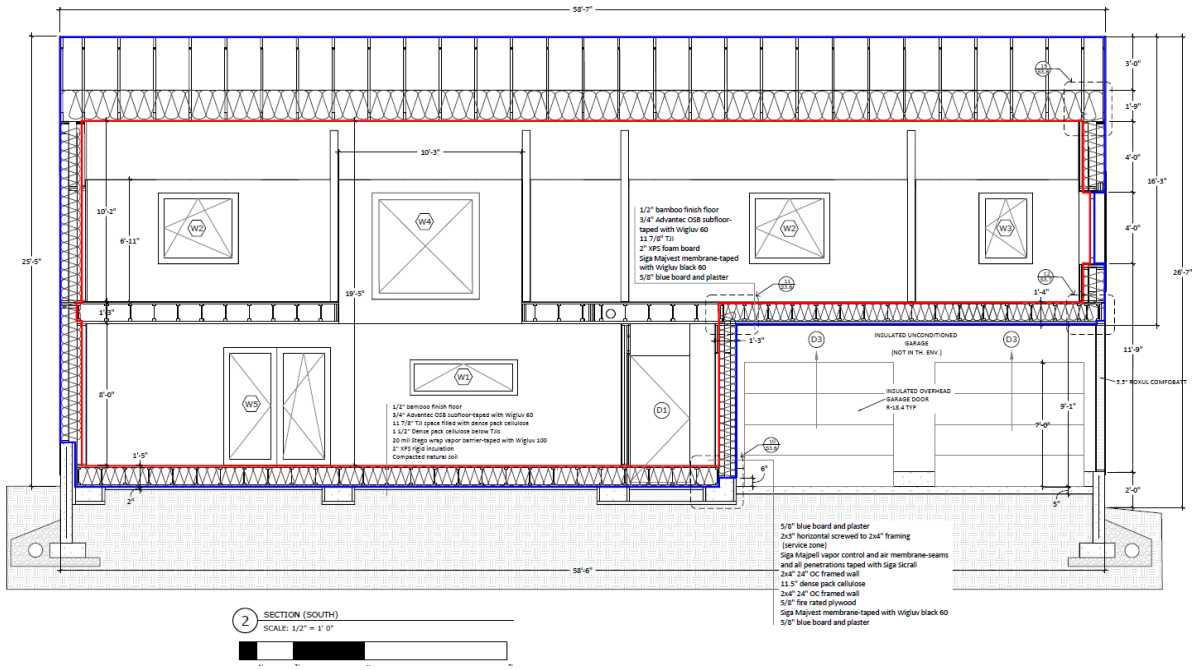


2. Cross-sections

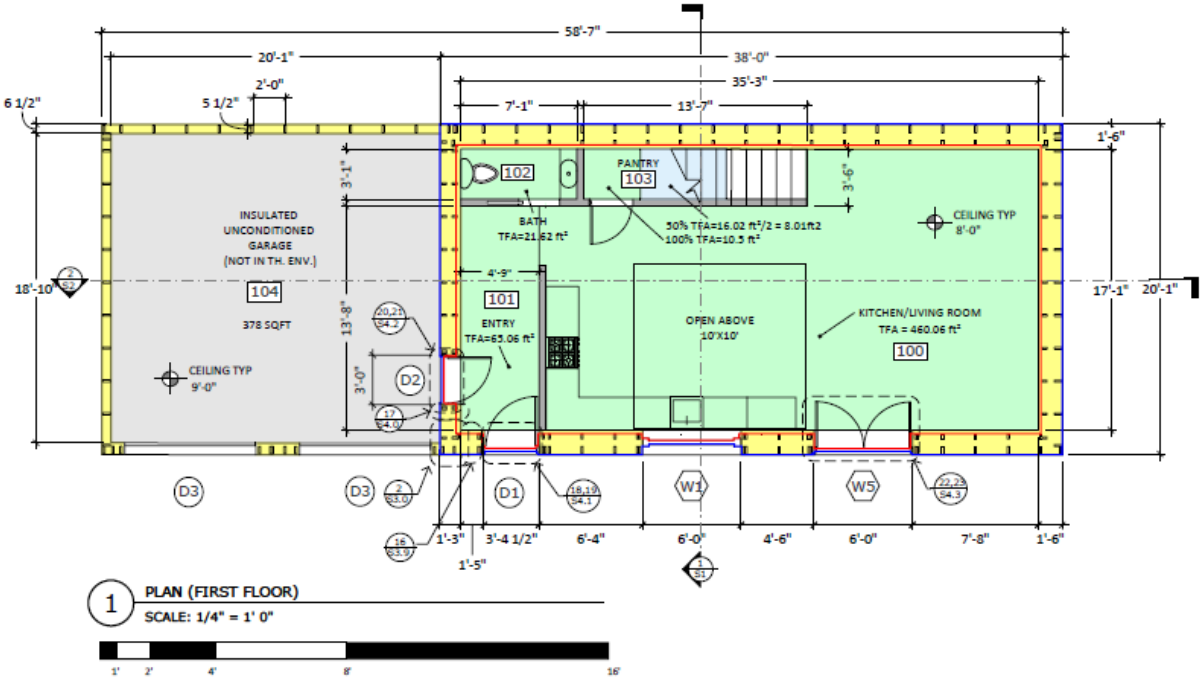
Cross-section north-south



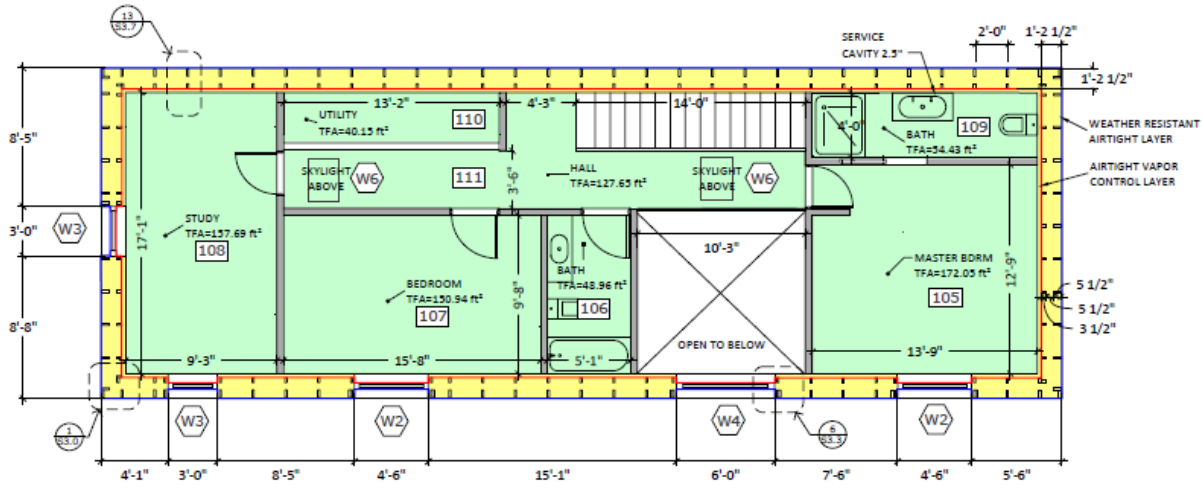
Cross-section east-west



Plan views

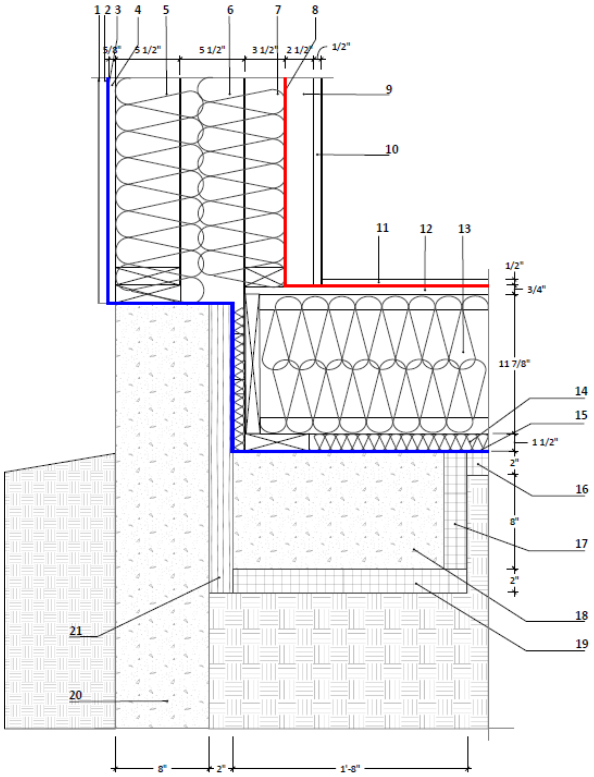


1 PLAN (FIRST FLOOR)
SCALE: 1/4" = 1' 0"



3. Construction – floor

Floor is constructed from 11 7/8” TJI floor joists that are resting on the interior concrete ring beam. The floor structure is floating 2” off the ground, with the space between and below the joists filled with dense pack cellulose. Separating the cellulose and the ground is a 20-Mil Stego plastic sheet serving as a below grade class-A air and vapour barrier.



1. 5/16" rainscreen siding
2. 3/4" furring battens
3. Siga Majvest membrane-taped with Wigluv black 60
4. 5/8" fire rated plywood
5. 2x6" 24" OC framed wall
6. 14.5" dense pack cellulose
7. 2x4" 24" OC framed wall
8. Siga Majpell vapor control and air membrane
Seams and all penetrations taped with Siga Sicrall
9. 2x3" horizontal screwed to 2x4" framing (service zone)
10. 5/8" blue board and plaster
11. 1/2" bamboo finish floor
12. 3/4" Advantec OSB subfloor-taped with Wigluv 60
13. 11 7/8" TJI - space filled with dense pack cellulose
14. 1 1/2" dense pack cellulose below TJIs
15. 20 mil Stego wrap vapor barrier-taped with Wigluv 100
16. 2" XPS rigid insulation
17. 2" XPS rigid insulation
18. 10x16" reinforced concrete ring beam
19. 2" XPS foam board
20. 8" reinforced concrete stem wall
21. 2" ROXUL Comfobatt

Assembly no.	Building assembly description					Interior insulation?
02ud	Floor					

Heat transmission resistance [m²K/W]

Orientation of building element	3-Floor	interior Rsi	0.17
Adjacent to	2-Ground	exterior Rse:	0.00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Finish floor	0.158		0.000		0.000	13
Advantec OSB subfloor	0.131		0.000		0.000	19
Dense pack cellulose	0.038	Wood cord	0.131		0.000	35
Dense pack cellulose	0.038		0.000	OSB web	0.103	232
Dense pack cellulose	0.038	Wood cord	0.131		0.000	35
Dense pack cellulose	0.038		0.000		0.000	38
XPS foam board	0.029		0.000		0.000	51
	0.000		0.000		0.000	0

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
89%	9.6%	1.6%	42.2 cm

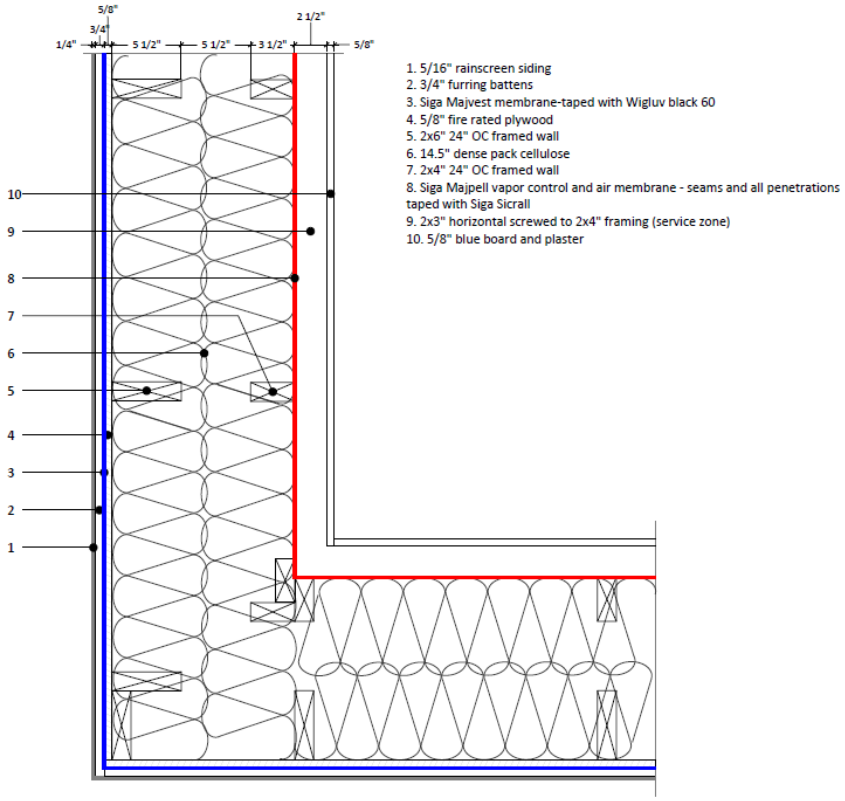
U-value supplement: 0.00 W/(m²K)

U-value: 0.093 W/(m²K)


FOAMULAR
R-50

4. Construction – External wall

External wall is a double wall construction, made with a 2x6” external and a 2x4” internal stud wall, separated by 5 ½”, for a total insulation thickness of 14 ½”. It features two smart membranes, WRB on the outside, and primary air barrier and a Vapour Control Layer on the inside. A service cavity inside of the primary air barrier provides space for all service installations.



Assembly no.	Building assembly description					Interior insulation?
01ud	Wall					

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Plaster	0.401		0.000		0.000	3
Blue board	0.256		0.000		0.000	16
Air	0.144		0.000	Wood 2x3 batten	0.131	64
Dense pack cellulose	0.038	Wood 2x4 stud	0.131		0.000	89
Dense pack cellulose	0.038		0.000		0.000	140
Dense pack cellulose	0.038	Wood 2x6 stud	0.131		0.000	140
Fire rated plywood	0.120		0.000		0.000	16
	0.000		0.000		0.000	0

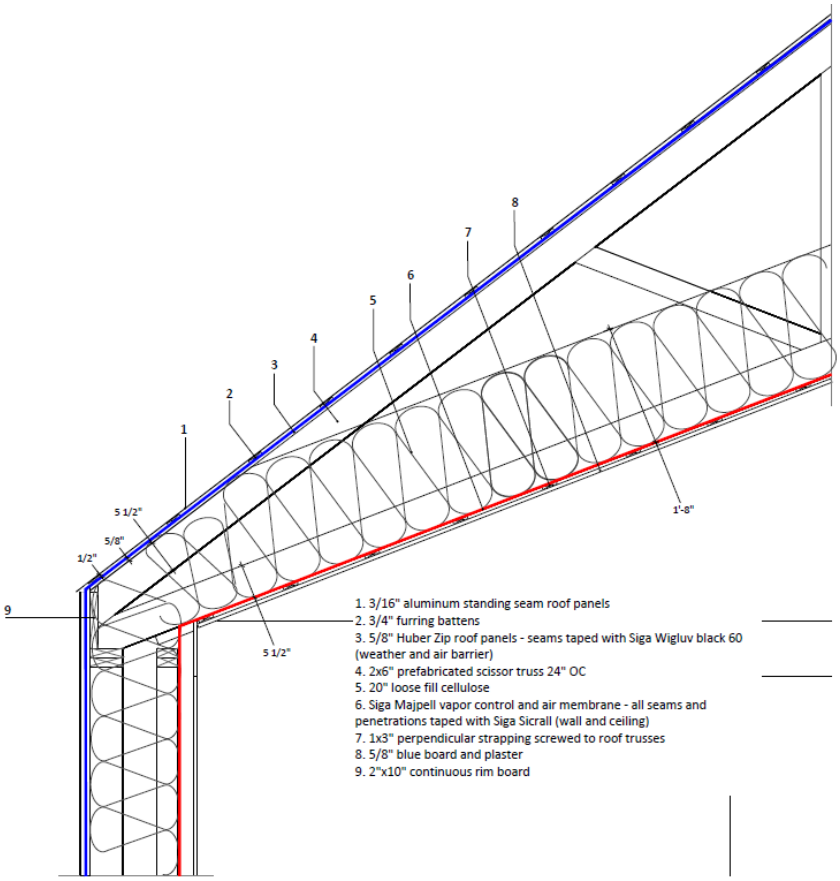
Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
88%	6.3%	6.3%	46.7 cm

U-value supplement: 0.00 W/(m²K)

U-value: 0.101 W/(m²K)

5. Construction – Roof

Roof is constructed from pre-engineered scissor trusses, filled with 20” of loose fill cellulose. It is covered with the taped Zip System roof sheathing and sealed on the inside with a smart membrane (primary air barrier and VCL).



Assembly no.	Building assembly description					Interior insulation?
03ud	Roof					

Heat transmission resistance [m²K/W]

Orientation of building element	1-Roof	interior Rsi	0.10
Adjacent to	3-Ventilated	exterior Rse:	0.10

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Plaster	0.401		0.000		0.000	3
Blue board	0.256		0.000		0.000	16
Air	0.144		0.000	Wood 3x1 strapping	0.131	19
Loose fill cellulose	0.039	Wood 2x6 truss beam	0.131		0.000	140
Loose fill cellulose	0.039		0.000		0.000	368
Air	2.060		0.000		0.000	335
Huber Roof sheathing	0.103		0.000		0.000	16
	0.000		0.000		0.000	0

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	6.3%	3.1%	89.7 cm

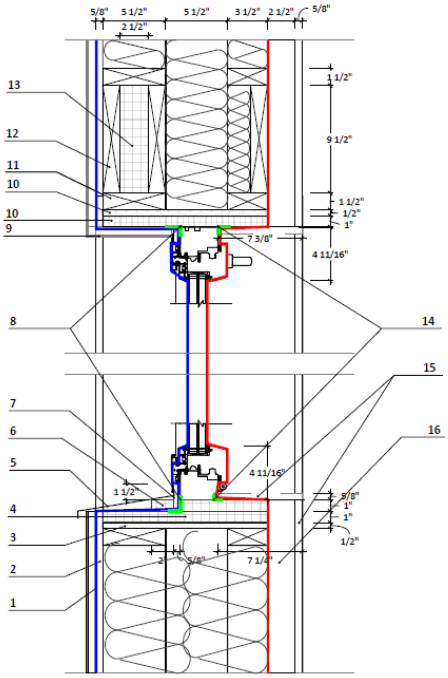
U-value supplement: 0.00 W/(m²K)

U-value: 0.074 W/(m²K)

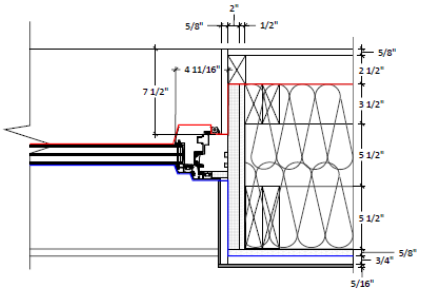
6. Window installation

Windows are triple-pane, wood frame, alu-clad, tilt-turn provided by Makrowin.
Window models are MW88 (operable) and MW84 (fixed) Classic.

- Operable windows Uf: 1.0 W/(m^2.K)
- Fixed window Uf: 1.17 W/(m^2.K)
- IGU type: SGG XN, triple pane, with Swiss Spacer V-16mm
- Glass g-value: 0.54 W/(m^2.K)
- U glass Ug: 0.589 W/(m^2.K)



1. Siga Majvest membrane-taped with Wigluv black 60
2. 5/8" fire rated plywood
3. 1/2" plywood window buck
4. 2" XPS rigid insulation (R5/in Typ)
5. Aluminum window sill screwed into the window frame
6. 1"x2" XPS rigid insulation over window frame
7. 1/2"x3/4" XPS rigid insulation over window frame
8. Siga Wigluv black 60 taped between Siga Majvest and window frame
9. 5/15" aluminum panel rainscreen siding
10. 1" XPS rigid insulation
11. 1.5" header sill
12. 2"x10" header
13. 2 1/2" EPS insulation
14. Siga Corvum 60 tape between Siga Majpell and window frame
15. 5/8" blue board and plaster
16. 2 1/2" service cavity



7. Airtight envelope

Airtight envelope is ensured by:

- Exterior walls: two smart membranes – air and weather resistant barrier (WRB) on the outside and air and vapour control layer (VCL) membrane on the inside.
- Floor: 20-Mil Stego wrap taped to outside WRB and taped OSB floor sheathing taped to the inside VCL.
- Roof: taped Zip roof sheathing as WRB and VCL membrane on the ceiling.

Final average (pressurization/depressurization) blower door test result: 0.43 ACH50.

Date of Test: 1/11/2013 Test File: 15 Park Place Test

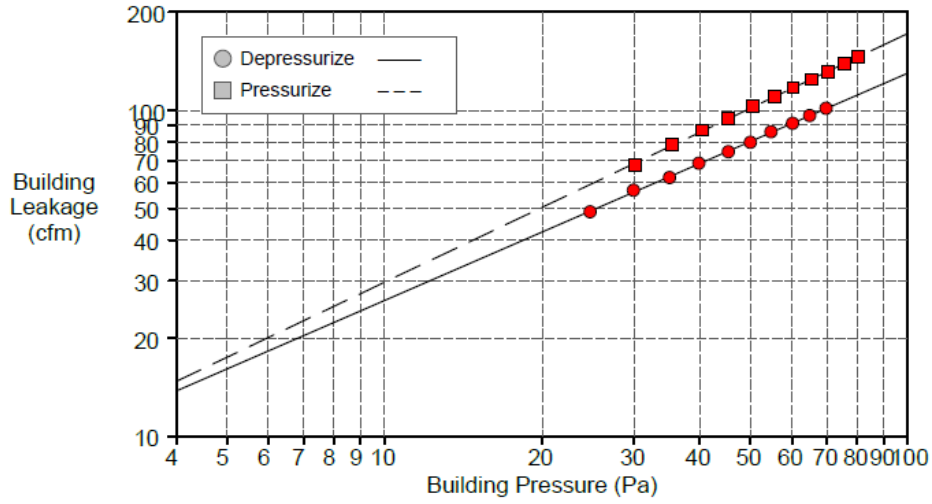
Technician: Nicholas Abreu
Project Number: 15 Park Place

Signature:

Customer: Placetailor
67 Dudley Street
Roxbury, MA 02119
Phone: 617-639-0633
Fax:

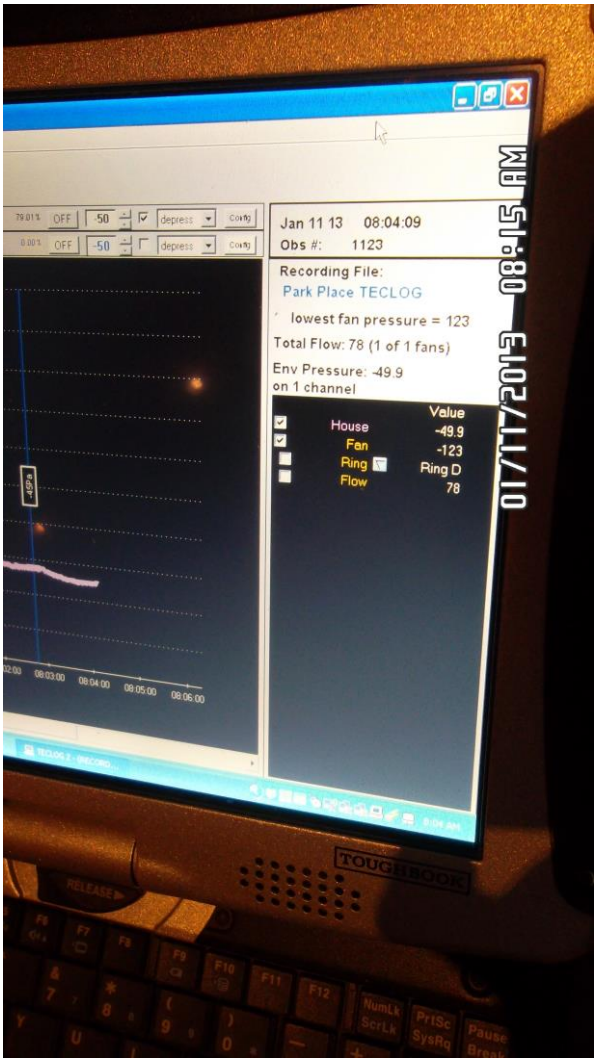
Building Address: 15 Park Place
Somerville, MA 02144

Test Results at 50 Pascals:	Depressurization	Pressurization	Average
cfm (Airflow)	80 (+/- 0.6 %)	101 (+/- 0.5 %)	91 (+/- 0.4 %)
ACH50	0.38	0.48	0.43
cfm/ft² (Floor Area)	0.0609	0.0770	0.0689
cfm/ft² (Surface Area)	0.0154	0.0194	0.0174
Leakage Areas:			
Canadian EqLA @ 10 Pa (in²)	7.7 (+/- 2.5 %)	8.7 (+/- 2.6 %)	8.2 (+/- 1.8 %)
in²/ft² Surface Area	0.0015	0.0017	0.0016
LBL ELA @ 4 Pa (in²)	3.9 (+/- 4.0 %)	4.2 (+/- 4.0 %)	4.0 (+/- 2.8 %)
in²/ft² Surface Area	0.0008	0.0008	0.0008
Building Leakage Curve:			
Flow Coefficient (C)	5.2 (+/- 6.2 %)	5.1 (+/- 6.1 %)	5.2 (+/- 4.3 %)
Exponent (n)	0.698 (+/- 0.016)	0.763 (+/- 0.015)	0.730 (+/- 0.011)
Correlation Coefficient	0.99959	0.99965	
Test Standard:	E779-10		
Test Mode:	Depressurization and Pressurization		




www.siga.ch
SIGA-Majpell 5


01/11/2013 08:09 AM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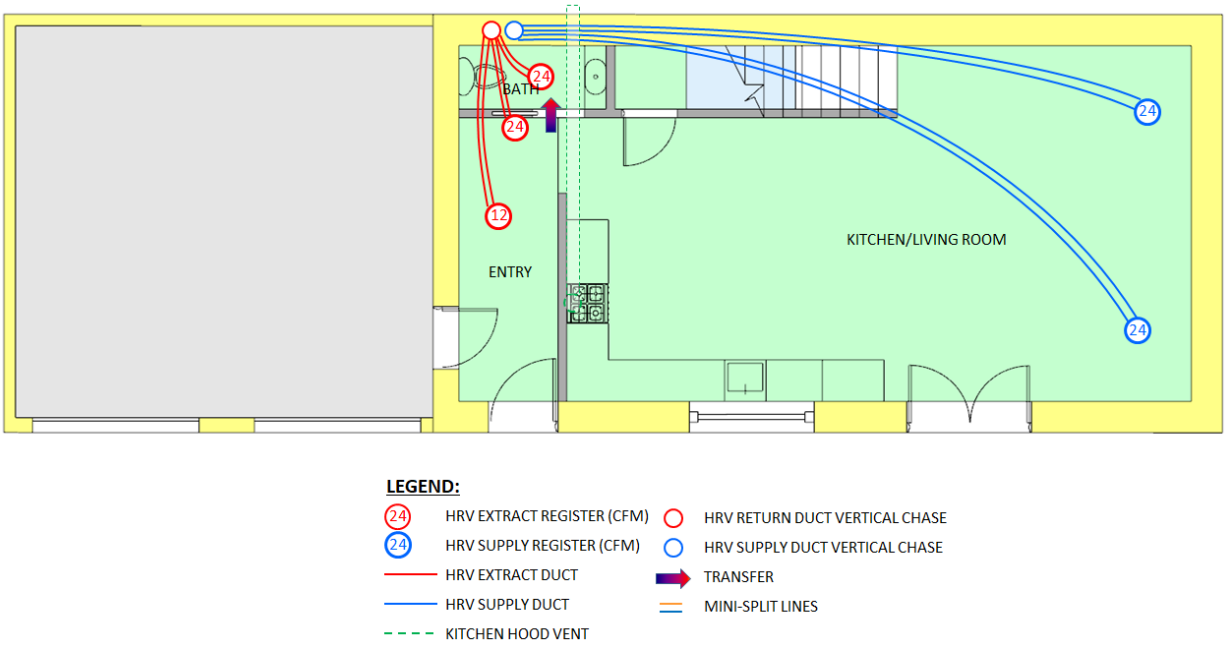
Jan 11 13 08:04:09
Obs #: 1123
Recording File:
Park Place TECLOG
lowest fan pressure = 123
Total Flow: 78 (1 of 1 fans)
Env Pressure: -49.9
on 1 channel
House
Fan
Ring
Flow
Value
-49.9
-123
Ring D
78
TOUGHBOOK

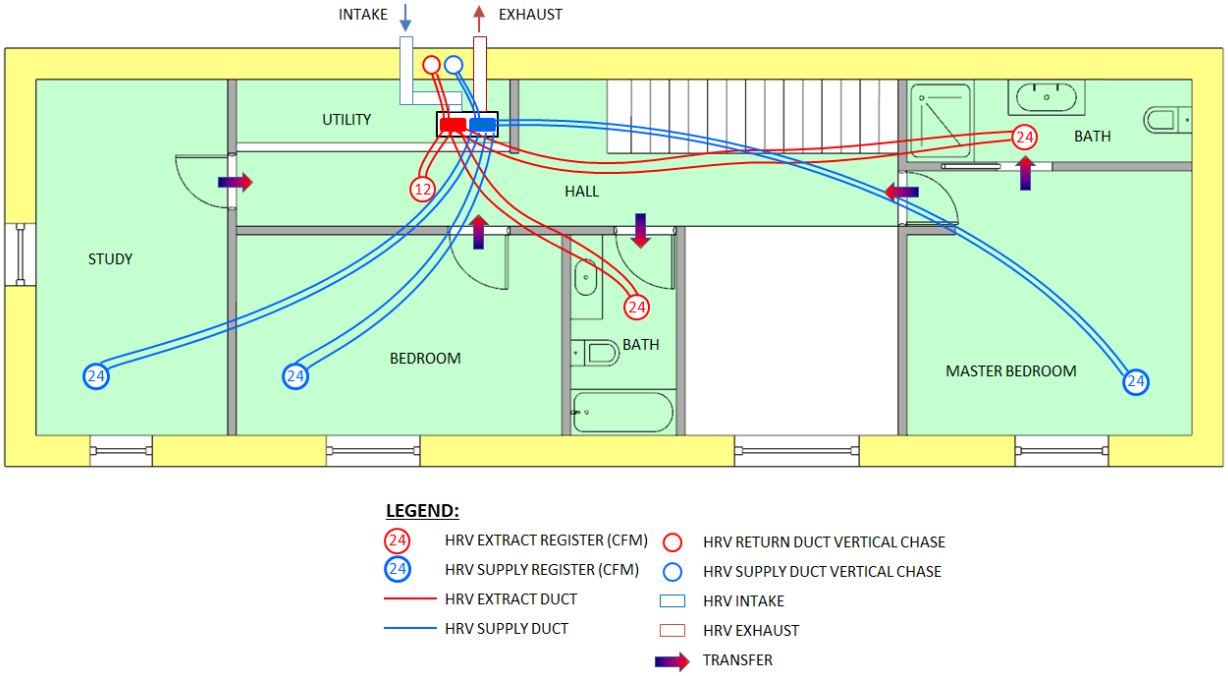
8. Ventilation system

Fresh supply and extract air is provided by a network of Zehnder ComfoTubes and supply and extract valves.

Lower level ventilation plan



Upper level ventilation plan




SIGA-Majpell 5
www.siga.ch


SIGA-Majpell 5
www.siga.ch

9. Ventilation Unit

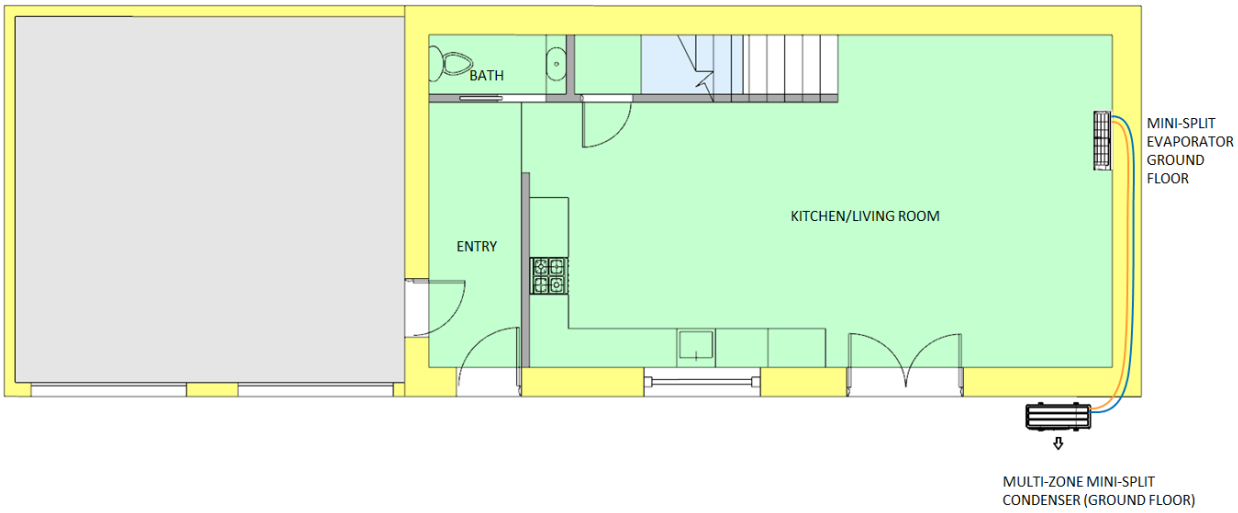
Mechanical ventilation with heat recovery is provided by a Zehnder ComfoAir 350 HRV unit.

- Airflow range: 71-293 m^3/h
- Heat recover rate: 84%
- Specific electric power: 0.29 Wh/m^3

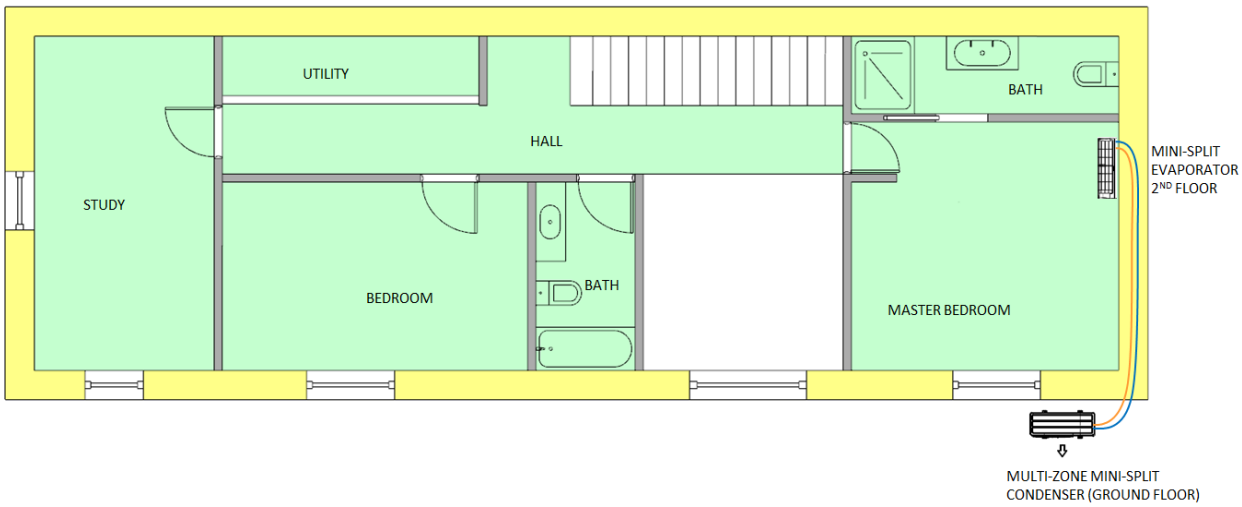
10. Heating and cooling system

Heating and cooling are provided by a Mitsubishi ductless mini-spit heat pump. It consists of a single condenser and two indoor evaporator units. One evaporator unit is installed on the lower level and the other on the upper level.

Lower level



Upper level



11. PHPP results

Passive House Verification

Building:	Park Passivhaus		
Street:	15 Park Pl		
Postcode/City:	02143	Somerville	
Province/Country:	MA	US-United States of America	
Building type:	Residential		
Climate data set:	US0035a-Boston		
Climate zone:	3: Cool-temperate	Altitude of location:	46 ft
Home owner / Client:	Aleksandra and Vladimir Pezel		
Street:	15 Park Pl		
Postcode/City:	02143	Somerville	
Province/Country:	MA	US-United States of America	

Architecture:	Placetailor		
Street:	67 Dudley St		
Postcode/City:	02199	Roxbury	
Province/Country:	MA	US-United States of America	
Energy consultancy:	eMod Studio		
Street:	15 Park Pl		
Postcode/City:	02143	Somerville	
Province/Country:	MA	US-United States of America	

Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			

Year of construction:	2013	Interior temperature winter [°F]:	68.0	Interior temp. summer [°F]:	77.0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [BTU/(hr.ft²)]:	0.80	IHG cooling case [BTU/(hr.ft²)]:	1.00
No. of occupants:	2.7	Specific capacity [BTU/F per ft² TFA]:	10.6	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area ft²	1317				
Space heating	Heating demand kBTU/(ft²yr)	4.42	≤	4.75	-	yes
	Heating load BTU/(hr.ft²)	4.22	≤	-	3.17	
Space cooling	Cooling & dehum. demand kBTU/(ft²yr)	1.58	≤	5.07	5.07	yes
	Cooling load BTU/(hr.ft²)	5.15	≤	-	3.30	
	Frequency of overheating (> 77 °F) %	-	≤	-		-
	Frequency of excessively high humidity (> 0.012 lb/lb) %	2.0	≤	10		yes
Airtightness	Pressurization test result n_{50} 1/hr	0.4	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand kBTU/(ft²yr)	25.22	≤	-		-
Primary Energy Renewable (PER)	PER demand kBTU/(ft²yr)	14.87	≤	14	15	yes
	Generation of renewable energy (in relation to projected building footprint area) kBTU/(ft²yr)	21.61	≥	19	20	

[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.

Passive House Plus? yes

Task:	First name:	Surname:	Signature:
1-Designer	Vladimir	Pezel	

12. Construction cost

Witheld by owners

13. User experiences

Owners are reporting an extermely comfortable environment, no cold spots, no drafts. They like it a bit warmer during long, cold Boston winters and keep the thermostat at 74F (23C). Mini-split system keeps up easily with the demand and the home still achieves Net Positive electrical energy balance during the year. The 4.8kW PV system added in 2016 is providing all the needed electrical energy and more. They are thinking of adding another load, perhaps a set of electric bycicles to use that excess energy.

14. Available references

Blog on the construction process and building experience:

https://parkpassivhaus.blogspot.com/