Passive House Object Documentation

3336 Country Road 3, Lyndhurst, Ontario, Canada
Passive House ID 4448

Project designer	Chris Straka	vertdesign.ca
Passive House Consultant	Stephen Magneron	homesol.ca

U-Value exterior wall 0.069 W/(m2K)	PHPP annual heat demand 15 kWh/(m2a)
U-Value basement floor 0.079 W/(m2K)	
U-Value roof 0.065 W/(m2K)	PHPP primary energy demand 96 kWh/(m2a)
U-Value window 0.81 W/(m2K)	
Heat recovery efficiency 84%	Pressure test n50 0.35/h

1.2 Brief Description... Passive House Lyndhurst, Ontario, Canada

This house has 225m^2 of living space that is nestled in the trees overlooking the Black Rapids just outside the town of Lyndhurst, Ontario. The building has two levels with a walk-out basement. It is precisely south facing with deep overhangs that, in combination with the surrounding trees, result in 0% Frequency of Overheating. This house as been occupied since the end of 2015. The homeowners were determined to certify this project under the Passive House Standard to show people that it can be achieved in this climate.

1.3 Responsible project participants

Architect	Chris Straka, VERT plan.design.build http://vertdesign.ca/
Building systems	Stuart Fix, ReNü Building Science Inc. http://renubuildingscience.com/
Building physics and Passive House project planning	Stephen Magneron, Homesol Building Solutions Inc. http://homesolbuildingsolutions.com/
Construction management	Marilynn Wykes and Arlene Rasmussen
Builder	Mark Raison, Crane Building Services
Certifying body	Passive House Institute Darmstadt www.passiv.de The Passive House Academy http://www.passivehouseacademy.com/
Certification ID	Project-ID (www.passivehouse-database.org) 4448

Author of project documentation — Stephen Magneron
http://homesolbuildingsolutions.com/

Date, Signature 22 November, 2016

2 Exterior and interior photos

The West-facing side.

West side **of the Passive House in Lynhurst, Ontario with a two-car garage and an enclosed porch that are both exterior of the thermal envelope.** (Photograph: Wykes)

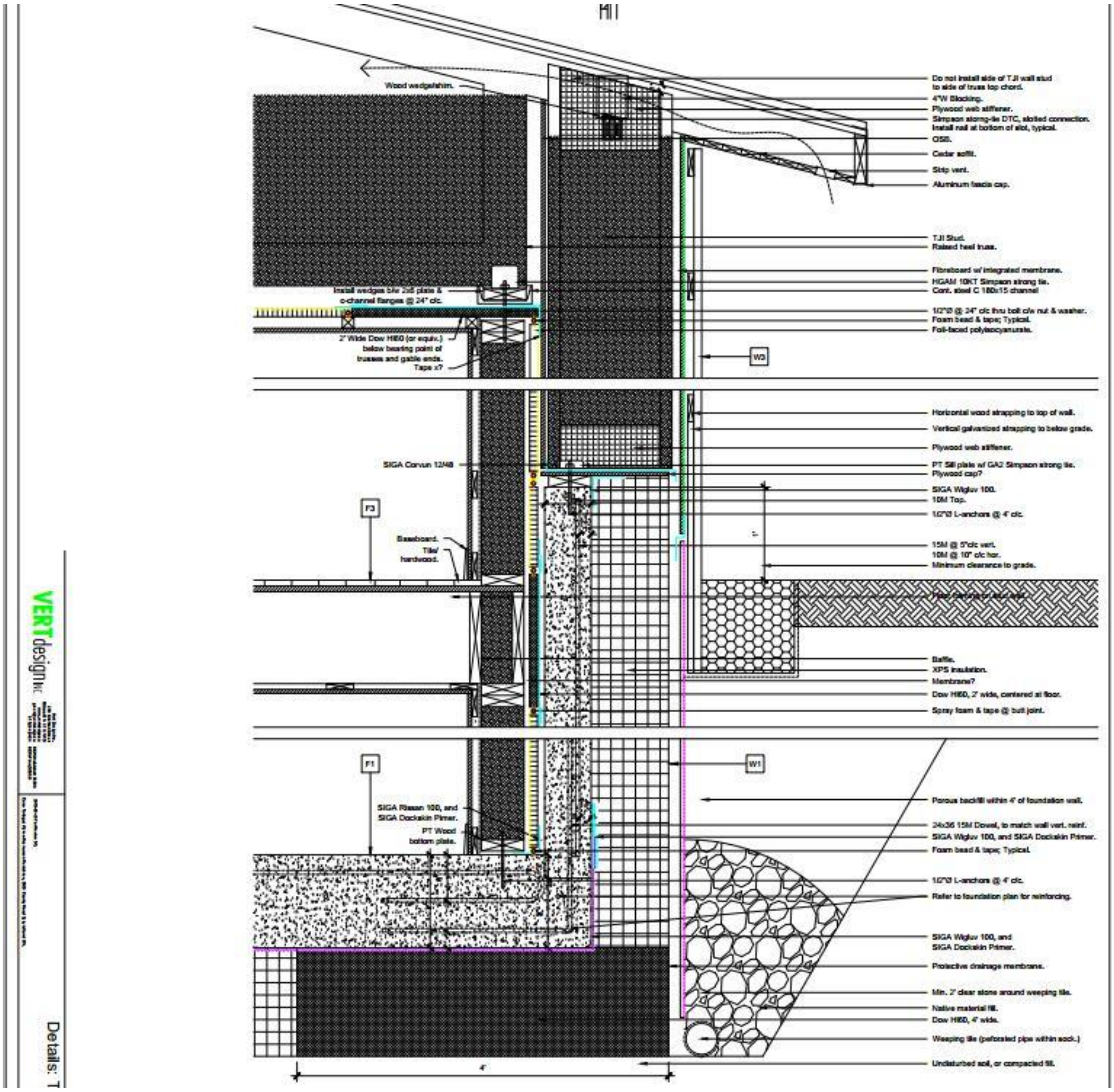
Picture of the Passive House in Lyndhurst, Ontario from the *Southwest side*; showing the deep overhangs and the walk-out basement.

Passive House in Lyndhurst, Ontario, view from the *East*: showing the deep overhangs and the walk-out basement during construction.

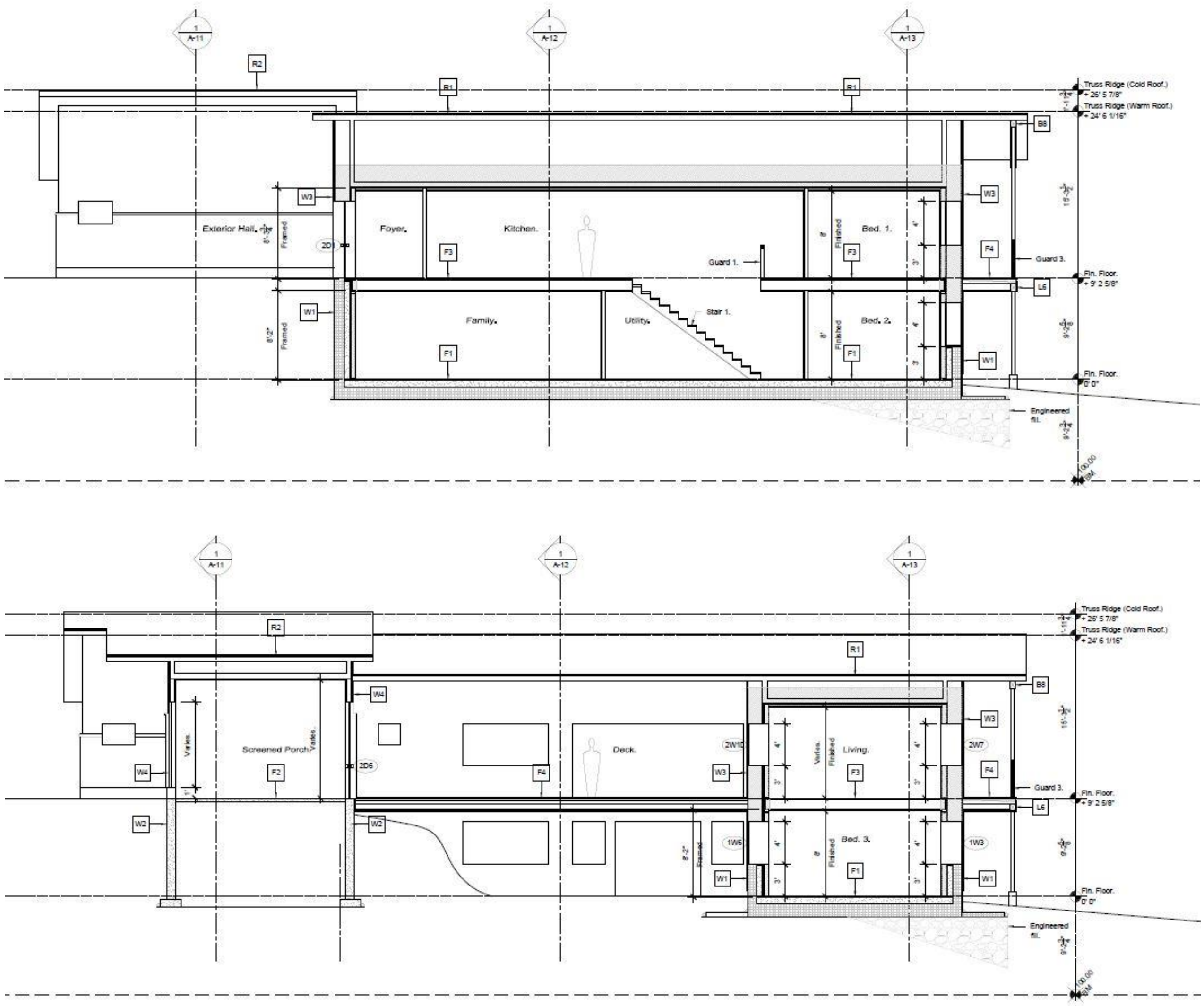
Passive House in Lyndhurst, Ontario, view from the *North*: showing the depth of grade on this façade, as well as the two condensers for the ductless mini splits during construction.

Interior view from the living room towards the dining room and kitchen shows the open layout which seems to merge directly into the terrace through the amply-sized south-facing glazed area.

3 Cross section



Cross-section through the Passive House in Lyndhurst, Ontario. The thermal envelope with excellent uninterrupted insulation is clearly recognisable.



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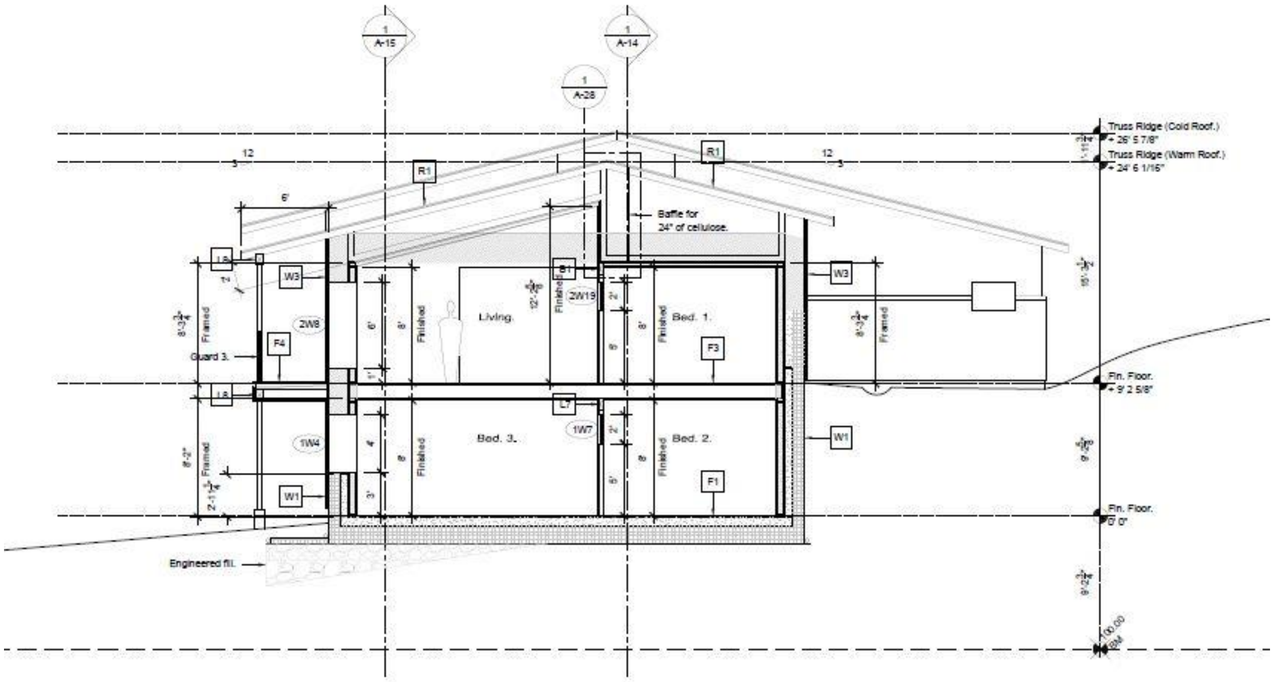
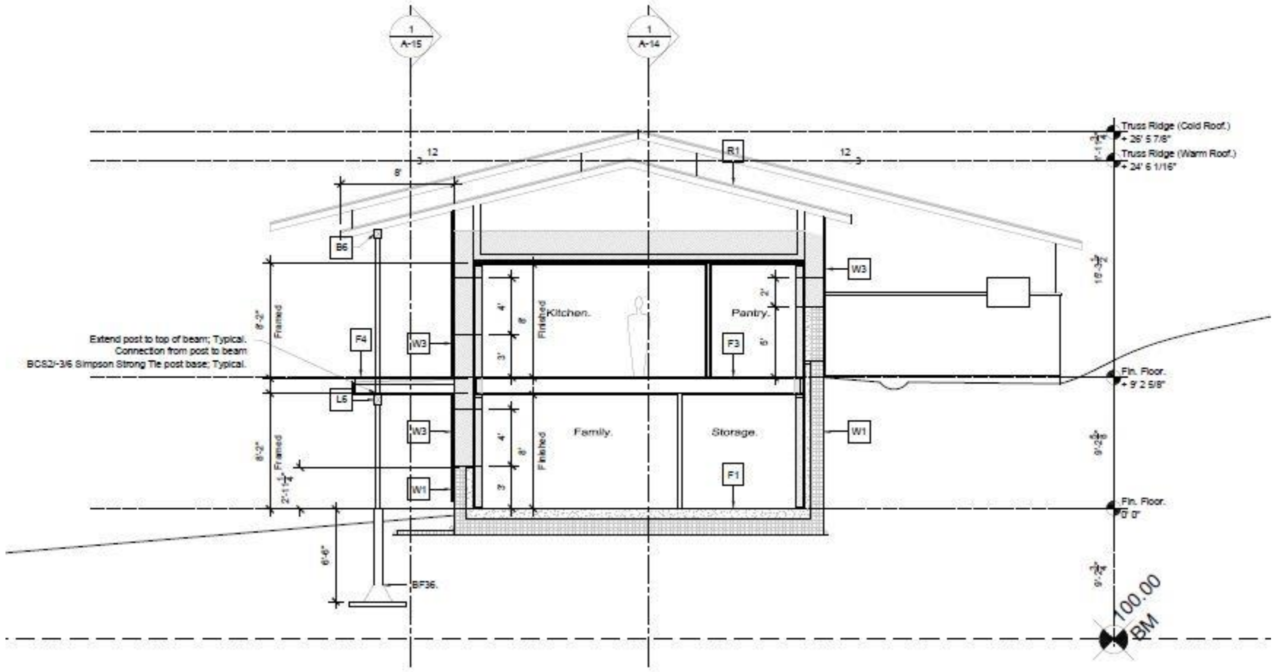
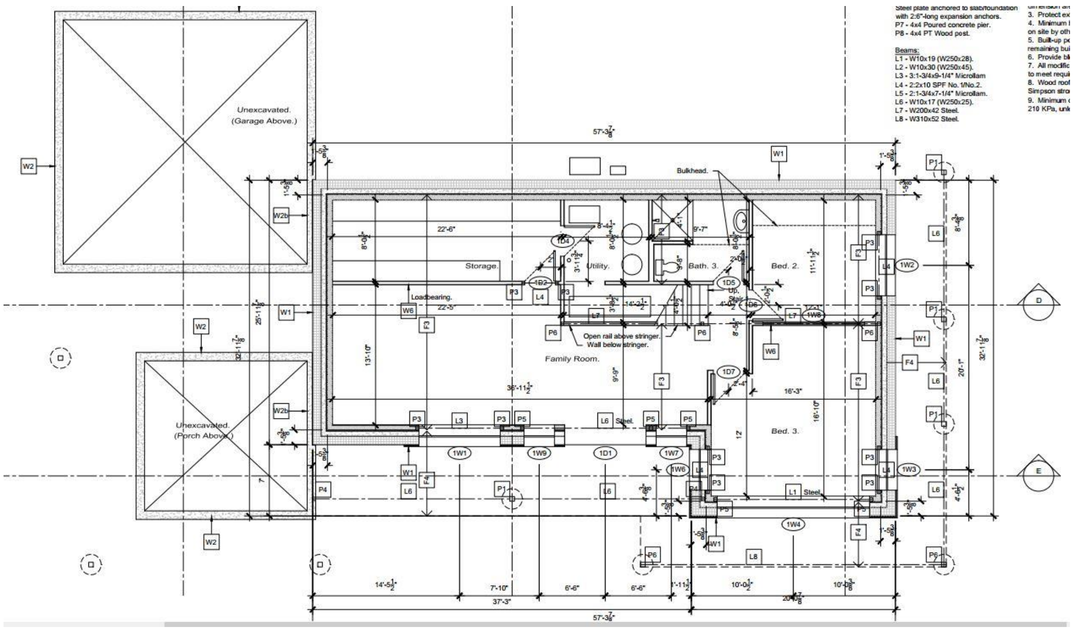


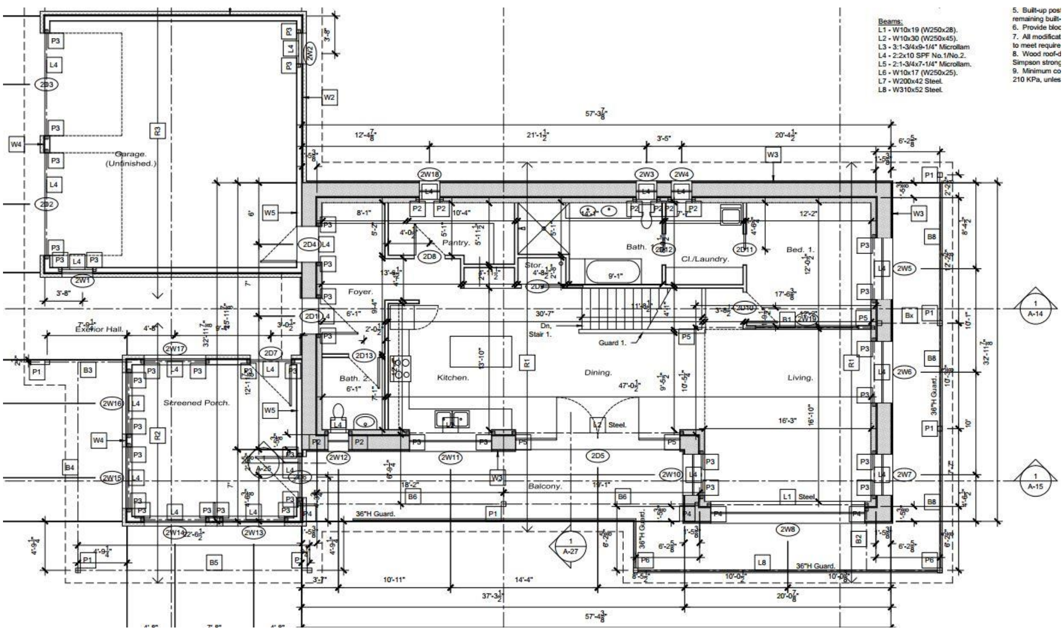


Cross-section through the Passive House in Lyndhurst, Ontario. The thermal envelope with excellent uninterrupted insulation is clearly recognisable.

4 Floor plans



Basement - The basement has a family room, bedroom 3 (with south facing windows), bedroom 2 (with east facing windows), and the mechanical and storage rooms, which are windowless and against the north wall.

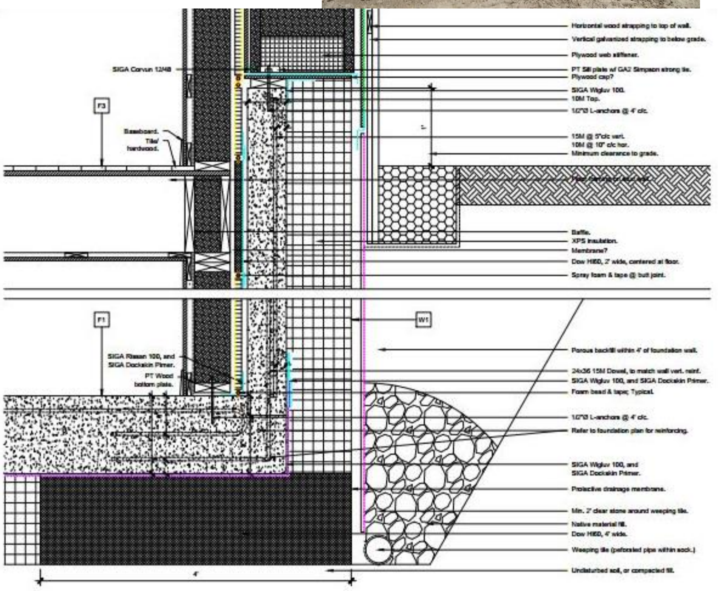


Main floor – The main floor plan has the main living spaces, i.e. kitchen, dining and living rooms with south facing windows, as well as the main bedroom, which has east facing windows. The main bathroom, pantry and foyer are against the north wall. The main entrance is facing west and is protected under a deep overhang between the garage and enclosed porch.

5 Construction details of the envelope and Passive House technology

5.1 Slab

The slab was assembled with 356mm of XPS rigid foam under a 325mm structural concrete slab. The avoidance of thermal bridging was achieved with the connection of 254mm of EPS rigid foam on the exterior of the concrete wall. In addition, a 1200mm wing of 102mm EPS was installed horizontally on the south, east and west walk-out walls, where the wall and slab insulation meet.

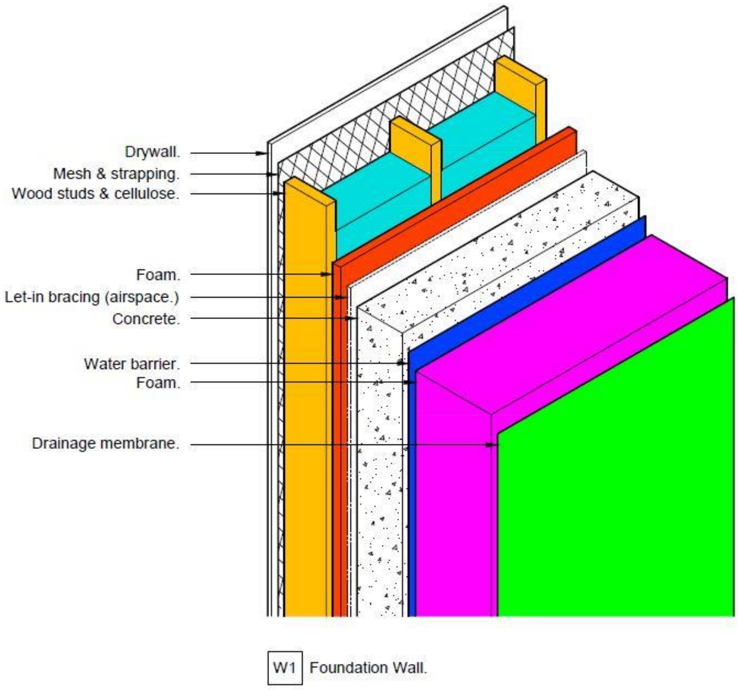


Basement slab	325mm concrete slab, 356mm XPS	U-value 0.079 W/(m²K)

5.2 Foundation walls

Foundation wall assembly: The foundation wall was assembled with 12.5mm gypsum, 140mm timber frame wall (as the load bearing component) with mineral wool insulation between, 25mm foil-faced Polyisocyanurate, 152mm concrete and 254mm EPS.

The concrete acts more as a retaining wall than a loadbearing wall. The timber wall takes the load from the roof and floor above. This was specified by the structural engineer due to the use of I-joists on the exterior walls above. The I-joist rest on the concrete wall. The foil-faced Polyisocyanurate was taped to be the air barrier.

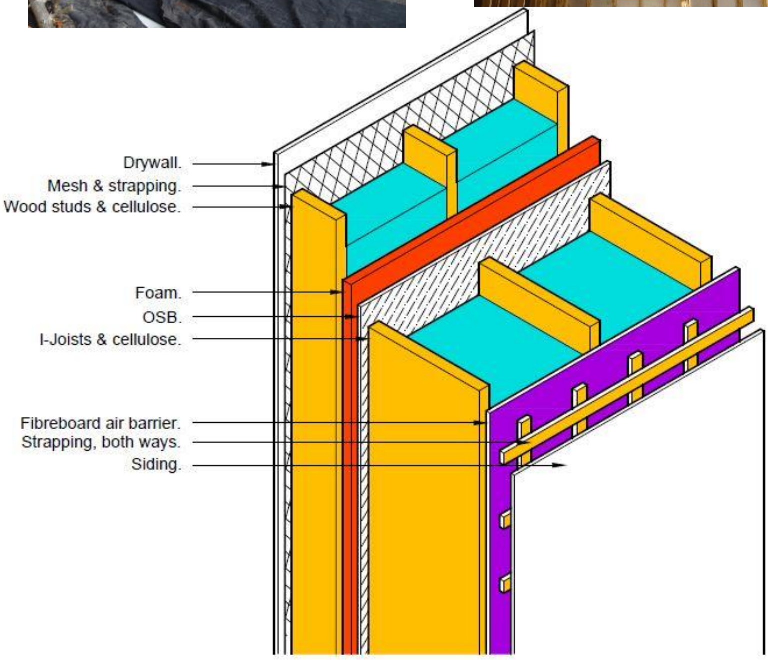


Foundation wall	12.5mm Gypsum, 140mm timber framing with mineral wool insulation, 25mm foil-faced Polyisocyanurate, 152mm concrete, 254mm EPS.	U-value 0.074 W/(m²K)

5.3 Exterior walls

Exterior wall assembly. The load bearing wall is a 140mm timber framing with mineral wool insulation between the studs with 25mm foil-faced Polyisocyanurate, 13mm OSB, then 406mm I-joist with cellulose. The use of the I-joist is a very unconventional method of exterior insulation in Canada. The structural engineer did not allow it to be load bearing, and was also hesitant to have it cantilevered completely over the EPS on the exterior of the foundation wall below. It is for that reason that the foundation wall insulation is split, and the timber framed wall is the primary load bearing wall.

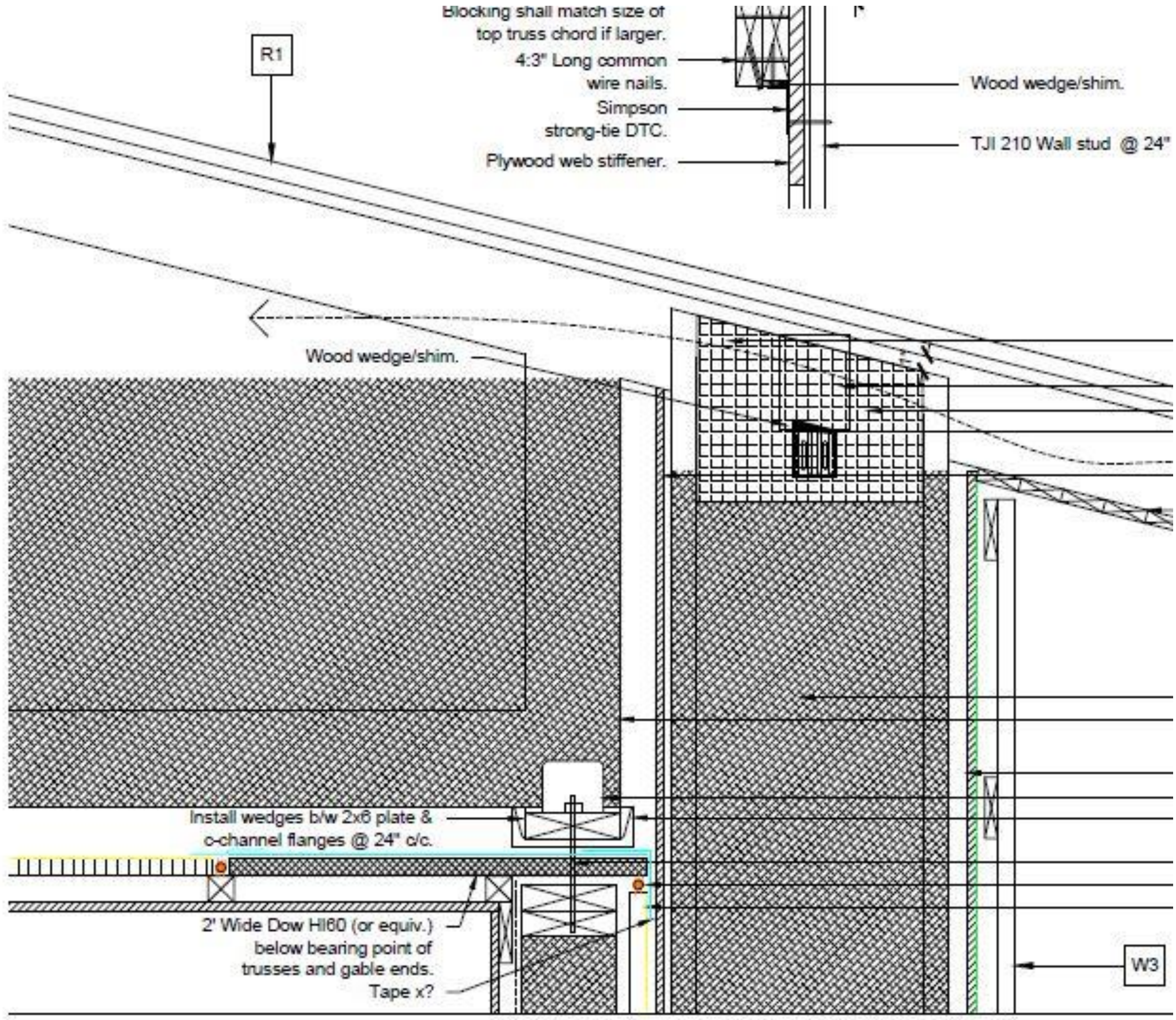
The Polyisocyanurate could be installed, sealed and air tested before the I-joists were installed.



W3 Exterior Wall.

Exterior wall	12.5mm gypsum, 140mm timber frame with mineral wool insulation, 25mm foil-faced Polyisocyanurate, 13mm OSB, 406mm I-joist with cellulose, 13mm wood fibreboard.	U-value 0.069 W/(m²K)

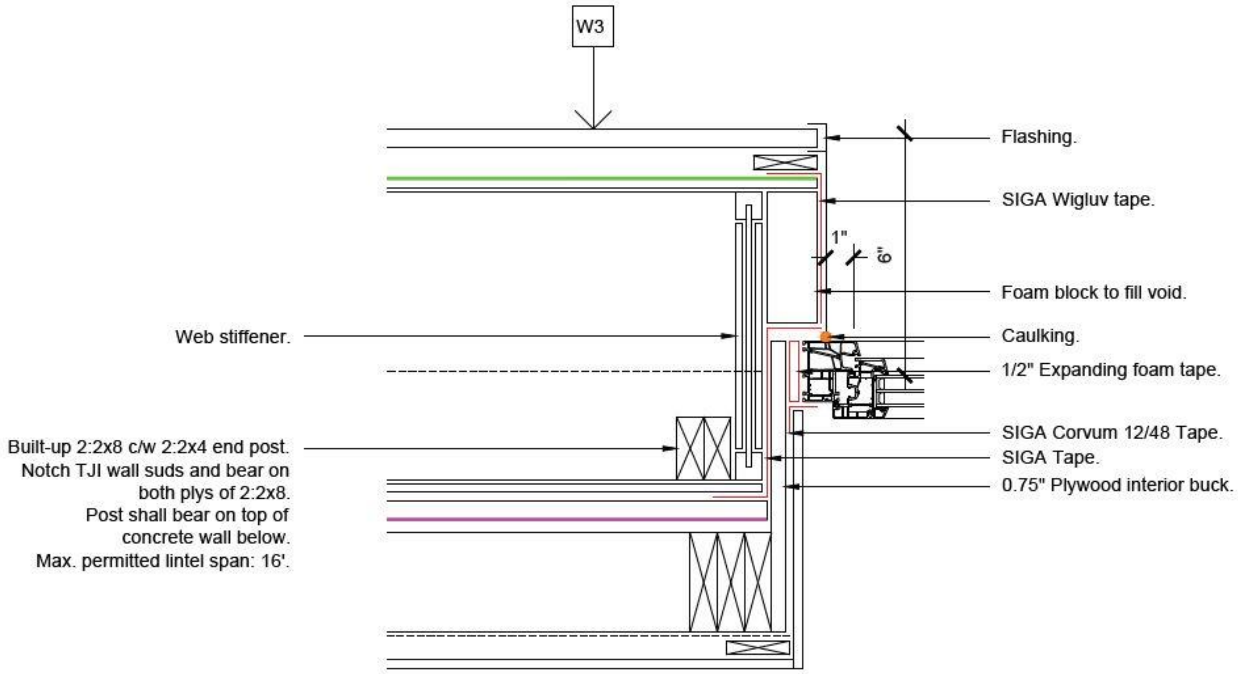
5.4 Roof



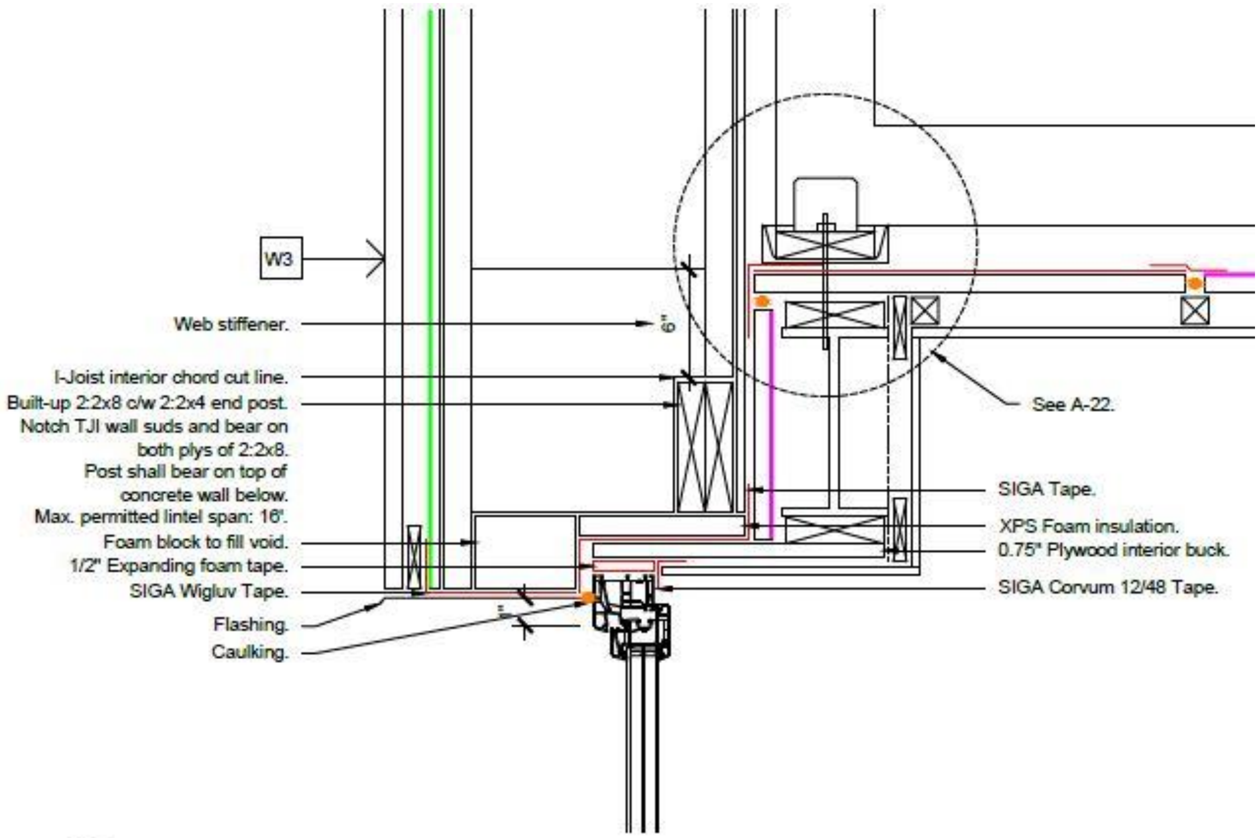
Roof build-up of the Passive House in Lyndhurst, Ontario. The construction of the roof for the flat and sloped ceilings were virtually identical. The 610mm of cellulose makes up most of the insulation, with the 25mm foil-faced Polyisocyanurate adding a little more thermal resistance, as well as being the air barrier.

Roof	12.5mm gypsum, strapping, 25mm foil-faced Polyisocyanurate, Attic trusses with 610mm cellulose insulation.	0.065 W/(m²K)

5.5 Windows



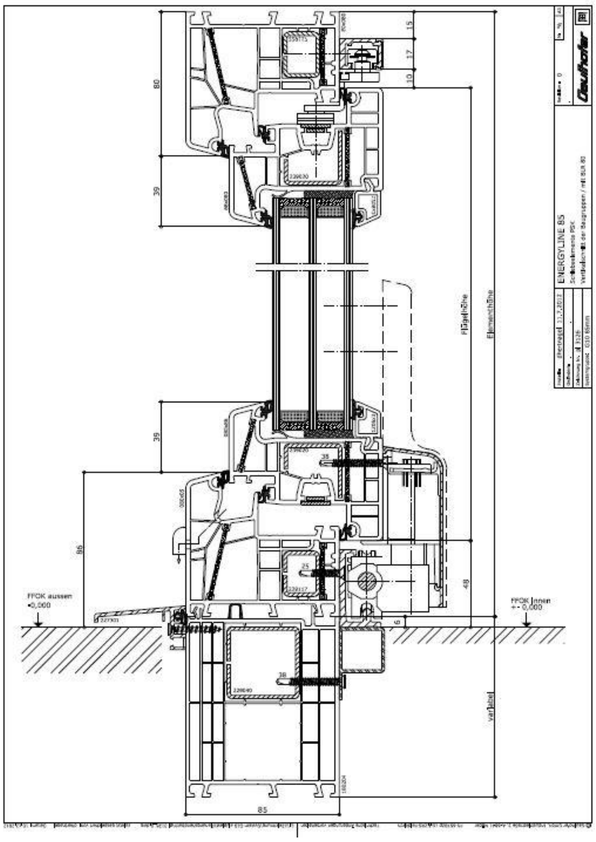
2 A-20 Typical: Plan Detail @ Window Jamb.
2" = 1'-0"



1 A-20 Typical: Section Detail @ Window Header.
2" = 1'-0"

Gaulhofer triple glazed Energyline85 Plus uPVC windows were used. The window performance was tuned to maximise solar heat gain in the winter and reduce overheating in the summer. The g-Value for the north, east and west windows is 0.51, and for the south 0.61. The U_g value (in the centre of the glass) for the north, east and west windows is 0.50 W/(m²K) and for the south it is 0.60 W/(m²K). The frames from Gaulhofer are uPVC Tilt and Turn that have a U_f 0.79 W/(m²K). The Psi-spacer had been calculated to be 0.036 W/(mK). The calculated U_w-value in the PHPP ranged from 0.72 to 1.01 W/(m²K).



The windows were installed 152mm in from the exterior siding on double plywood bucks with 25mm XPS between. This allowed for a deep interior sill, but still allows the possibility to over-insulated the frame from the exterior with a block of XPS foam. The larger windows required additional supports.

Window data

Window	Triple low-e glazing filled with argon gas. uPVC window frames with	0.72-1.01 W/(m²K)

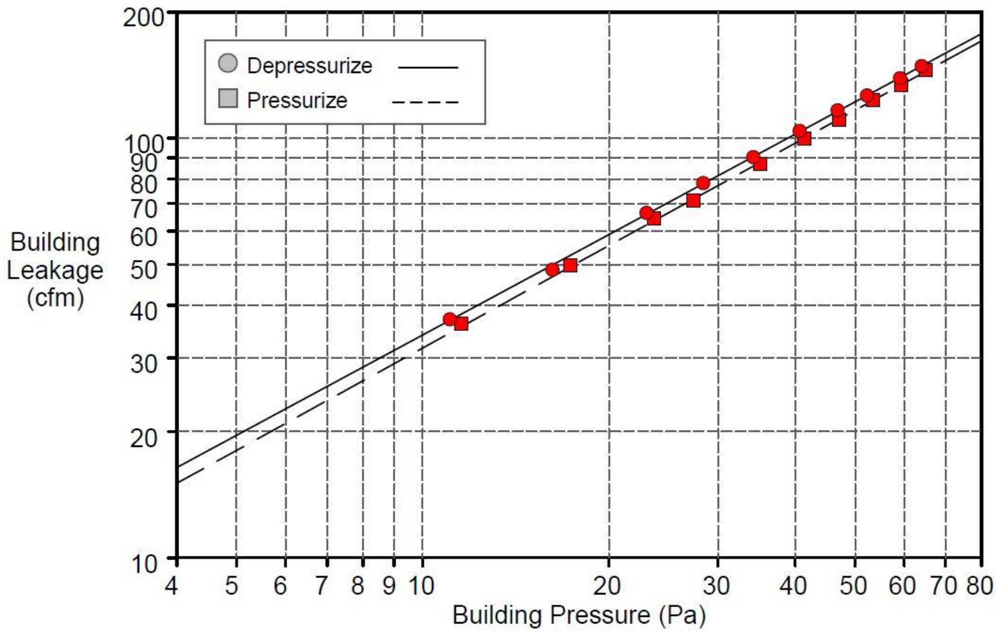
6 Air tightness

The foil-faced Polyisocyanurate, with the joints taped, is the air barrier for the walls and roof. This was then transferred to the concrete slab, and to the window bucks and windows.

The initial air test result was 0.34 ACH @ 50Pa. While the final air test is an average 0.35 ACH @ 50Pa. Below are photos of the air sealing process.

Date of Test: 2015-11-11	Technician:	Stephen Magneron	
Test File: Wykes air test - FINAL	Project Number:		
Customer: Marilynn Wykes & Arlene Rasmussen 3336 Counrty Road 3 Lyndhurst, ON K0E 1N0 Phone: Fax:	Building Address:		

	Depressurization	Pressurization	Average
Test Results at 50 Pascals:			
V50: cfm Airflow	122 (+/- 0.4 %)	117 (+/- 0.5 %)	119
n50: 1/h Air Change Rate	0.36	0.34	0.35
w50:			
q50: cfm/ft² Envelope Area	0.0165	0.0157	0.0161
Leakage Areas:			
Canadian EqLA @ 10 Pa (in²)	10.0 (+/- 1.8 %)	9.3 (+/- 2.0 %)	9.6
in²/ft² Surface Area	0.0013	0.0013	0.0013
LBL ELA @ 4 Pa (in²)	4.7 (+/- 2.9 %)	4.3 (+/- 3.1 %)	4.5
in²/ft² Surface Area	0.0006	0.0006	0.0006
Building Leakage Curve:			
Air Flow Coefficient (Cenv) (cfm/Pa^n)	5.4 (+/- 4.5 %)	4.9 (+/- 4.8 %)	
Air Leakage Coefficient (CL) (cfm/Pa^n)	5.5 (+/- 4.5 %)	4.9 (+/- 4.8 %)	
Exponent (n)	0.795 (+/- 0.012)	0.811 (+/- 0.013)	
Correlation Coefficient	0.99984	0.99982	
Test Standard:	EN 13829		
Test Mode:	Depressurization and Pressurization		
Type of Test Method:	B		
Regulation complied with:			



7 Ventilation

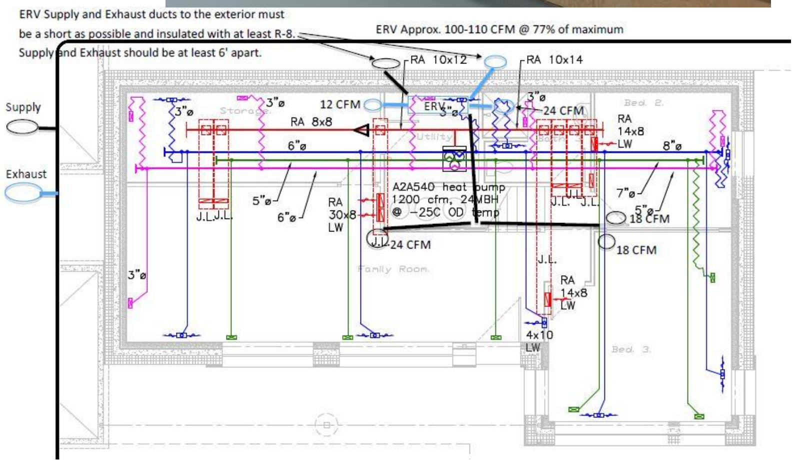
To greatly reduce the ventilation losses, a Zehnder ComfoAir 550 was chosen with a heat recovery rate of 84% and electric efficiency of 0.31 Wh/m^3. A ComfoFond geo exchange/sub-soil heat exchanger was also installed as the primary defrost mechanism as well as to provide a little bit of cooling in the summer.

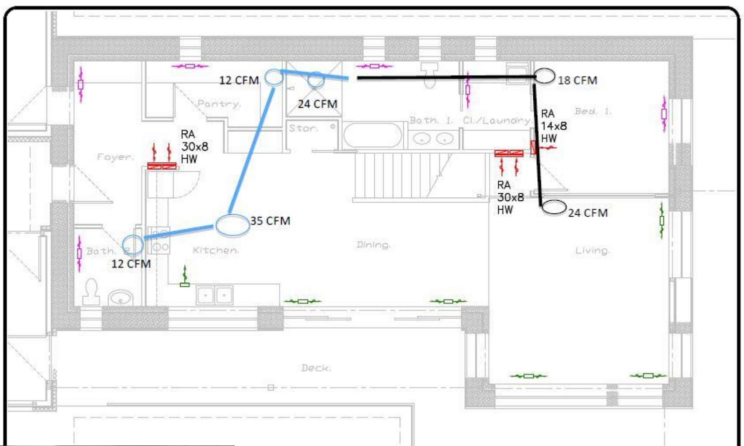
Supply air is delivered to rooms including the bedrooms, living room and storage room.

Extract air rooms include bathrooms, WCs, laundry and the kitchen.

Deliver of air is via Zehnder's proprietary ducting system.

The system's flow and balancing was performed by Zehnder America.





PH COMMISSIONING REPORT

Customer:	Marilynn Wykes	Date:	11/11/15
Address:	3336 County Road 3	Order Number:	3-0199-04.1
City, State, Zip	Lyndhurst, Ontario K0E 1N0	Outdoor Temp:	42F
Commissioning Agent:	Barry Stephens		
Installer:		Date:	

zehnder
always around you

540 Portsmouth Avenue
Greenland, NH 03840 USA

VENTILATION MEASUREMENTS

RETURN AIR	Planned CFM			Measured CFM				
	Low	Medium	High	Low	Medium	High	Valve Type	Valve Position or ComfoSet Disk 0-4
1. Lower-Bath 3		24		17	24	34	STB-1	
2. Upper- Bath 1		24		17	24	34	STB-1	
3. U- Laundry		12		11	14	20	STB-1	
4. U-Kitchen		36		23	33	49	STB-2	
5. U- Bath 2		12		11	15	21	STB-1	
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								
SUM:	0	108	0	79	110	158		

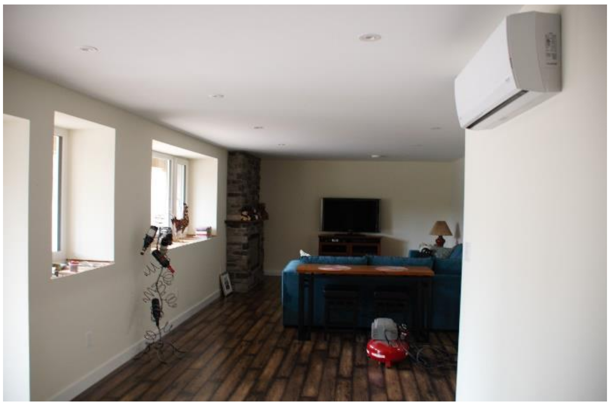
SUPPLY AIR	Planned CFM			Measured CFM				
	Low	Medium	High	Low	Medium	High	Valve Type	Valve Position or ComfoSet Disk 0-4
1. Lower- Storage		12		12	13	17	KE	
2. L- Bed 2		24		17	23	34	KE	
3. L- Bed 3		24		17	25	36	KE	
4. L- Family Rm		12		15	22	25	KE	
5. Upper- Bed 1		24		13	20	35	KE	
6. U- Living Rm		12		7	11	13	CLD	
7.								
8.								
9.								
10								
11								
12.								
13.								
14.								
SUM:	0	108	0	81	114	160		

Trim	Low	Medium	High
Ventilator Setting Fresh Air:	31	46	65
Ventilator Setting Return Air:	32	44	62

Comfort Temperature	26C
Weather	Clear-Cool
Filter Condition	Clean

8 Heating and cooling

The heating, cooling and dehumidification of this house will be provided by two Fujitsu ductless mini-split air source heat pumps. One was installed on each floor. This form of point-source heating and cooling is unconventional in Canada, so the municipal official required that each room have electrical rough-in provided for the future installation of electric resistance baseboard heaters. After the first winter, the municipal official experienced the performance of the building and did not require the installation of the baseboard heaters.



9 PHPP calculations

The Passive House Planning Package (PHPP) results are as follows:

Space heating demand	15.06 kWh/(m²a)
Space heating load	10.26 W/m²
Primary Energy	96 kWh/(m²a)
Airtightness	0.35 ACH @ 50Pa

Passive House verification

Building:	Casa Tortuga
Street:	3336 Country Road 3
Postcode/City:	Lyndhurst, ON, K0E 1N0
Country:	Canada
Building Type:	Residential
Climate:	Ottawa
Home Owner(s) / Client(s):	Marilynn Wykes & Arlene Rasmussen
Street:	3336 Country Road 3
Postcode/City:	Lyndhurst, ON, K0E 1N0
Architect:	Vert plan.design.build
Street:	279 Crichton St
Postcode/City:	Ottawa, ON, K1M 1W3
Mechanical System:	Stuart Fix, ReNü Building Science Inc.
Street:	52 Airport Road
Postcode/City:	Edmonton, Alberta, T5G 0W7 | C. 780.554.8192 | sfix@renubuildings.com

Year of Construction:	2015	Interior Temperature:	20.0	°C
Number of Dwelling Units:	1	Internal Heat Gains:	2.1	W/m²
Enclosed Volume V_e:	751.7			
Number of Occupants:	6.4			

Specific building demands with reference to the treated floor area — use: Monthly method

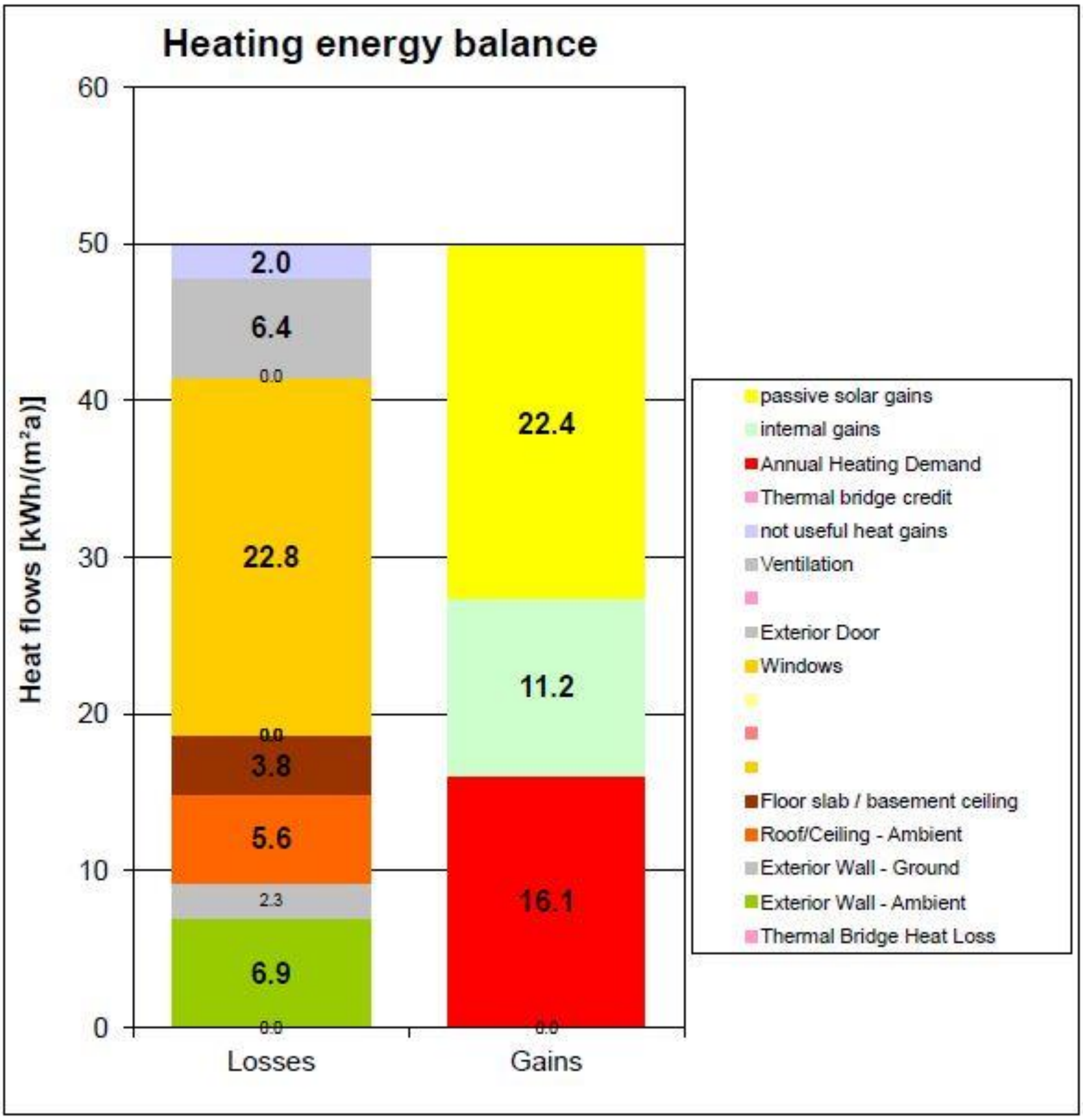
				Requirements	Fulfilled?*
	Treated floor area	225.1	m²		
Space heating	Annual heating demand	15.06	kWh/(m²a)	15 kWh/(m²a)	yes
	Heating load	10.26	W/m²	10 W/m²	yes
Space cooling	Overall specific space cooling demand		kWh/(m²a)	-	-
	Cooling load		W/m²	-	-
	Frequency of overheating (> 25 °C)	0.0	%	-	-
Primary Energy	dehumidification, DHW, cooling, household electricity	96	kWh/(m²a)	120 kWh/(m²a)	yes
	DHW, space heating and auxiliary electricity	45	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	0.4	1/h	0.6 1/h	yes

* empty field: data missing; '-': no requirement

Passive House? yes

We 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 application.

Name:	Bob	Registration number PHPP:	
Surname:		Issued on:	
Company:		Signature:	



The heating demand balance of the Passive House in Lyndhurst, Ontario, calculated using the PHPP.

The windows account for almost half of the heat losses, and the exterior walls account for a 15% of these.

Almost half of the losses are compensated again by the passive solar gains through the windows.

Internal heat gains account for about 22%, while the heating only accounts for the remaining 32% of just over 16.1 kWh/(m²a) using the Annual method.

10 Construction and Operational Costs

Information not available.