

## Passive House - Project Documentation



Single detached family house, Tauranga, NZ (Passive House database 6043)

Architecture: eHaus-Vlada Acimovic

Building physics: eHaus-Vlada Acimovic

Building Services: eHaus-Vlada Acimovic

Structural engineering: David Mulholland Consulting Engineer Ltd

U-Value of the exterior walls: 0.221 W/(m<sup>2</sup>K).

U-Value of the floor slab: 0.183 W/(m<sup>2</sup>K)

U-Value of the roof: 0.142 W/(m<sup>2</sup>K)

U-Value of the window frame: 1.15 W/(m<sup>2</sup>K)

U-Value of the glazing: 1.12 W/(m<sup>2</sup>K)

PHPP Space heating demand: 15 kWh/(m<sup>2</sup>a)

PHPP Primary energy: 89 kWh/(m<sup>2</sup>a)

Pressurisation test n<sub>50</sub> : 0.4/h-1

Heat recovery efficiency: 82.4 %

## 2.2 Short Description of the construction task:

Single level family home was built in 2017-2018 .The main idea to designing the house was to follow PassivHaus design premise from the beginning. Compact shape with concentration the glazing on the North with minimal fenestration on the South side of the house. Small footprint with 3 bedrooms and open plan living but with flexible space planning fulfilled client`s expectation.

Cost-effective solutions, and practical ways to minimise construction waste brought the additional value to the project

## 2.3 Elevations:

NORTH ELEVATION



WEST ELEVATION



SOUTH ELEVATION



EAST ELEVATION

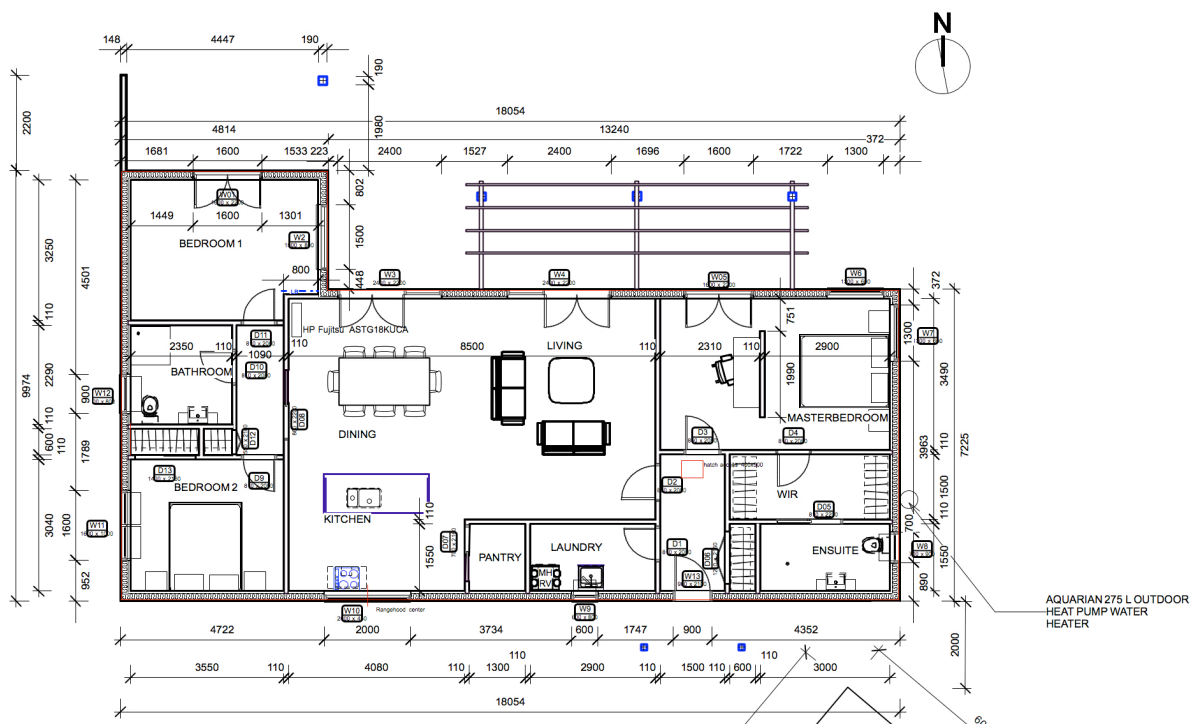
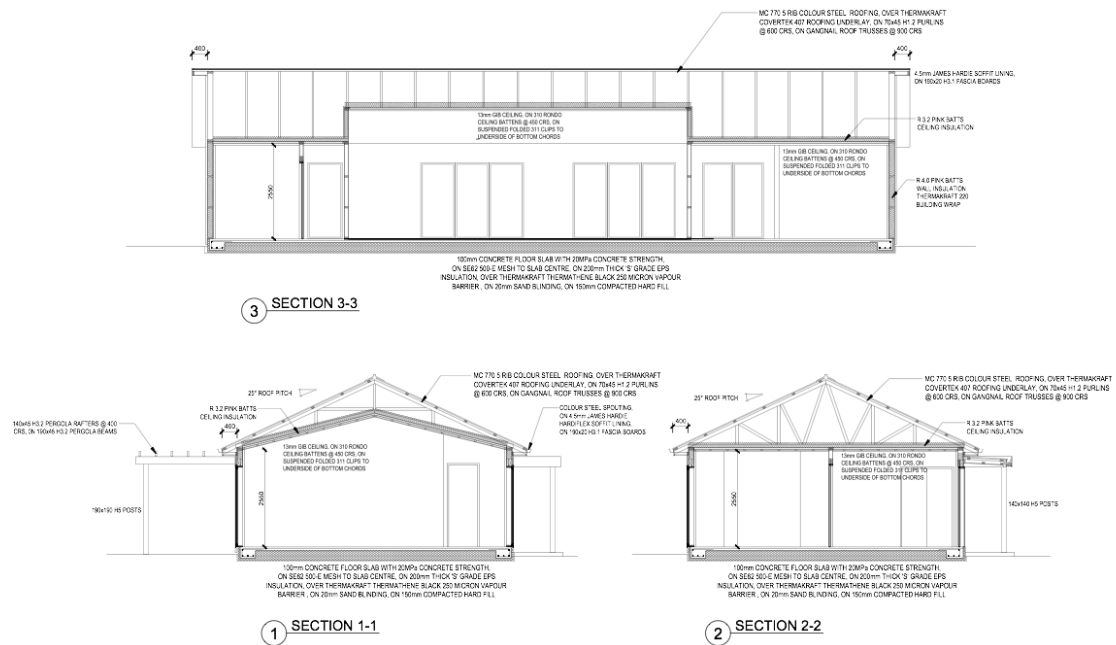




2.4 Pictures of the interior



## 2.6 Floor plan





## 2.7 Construction details

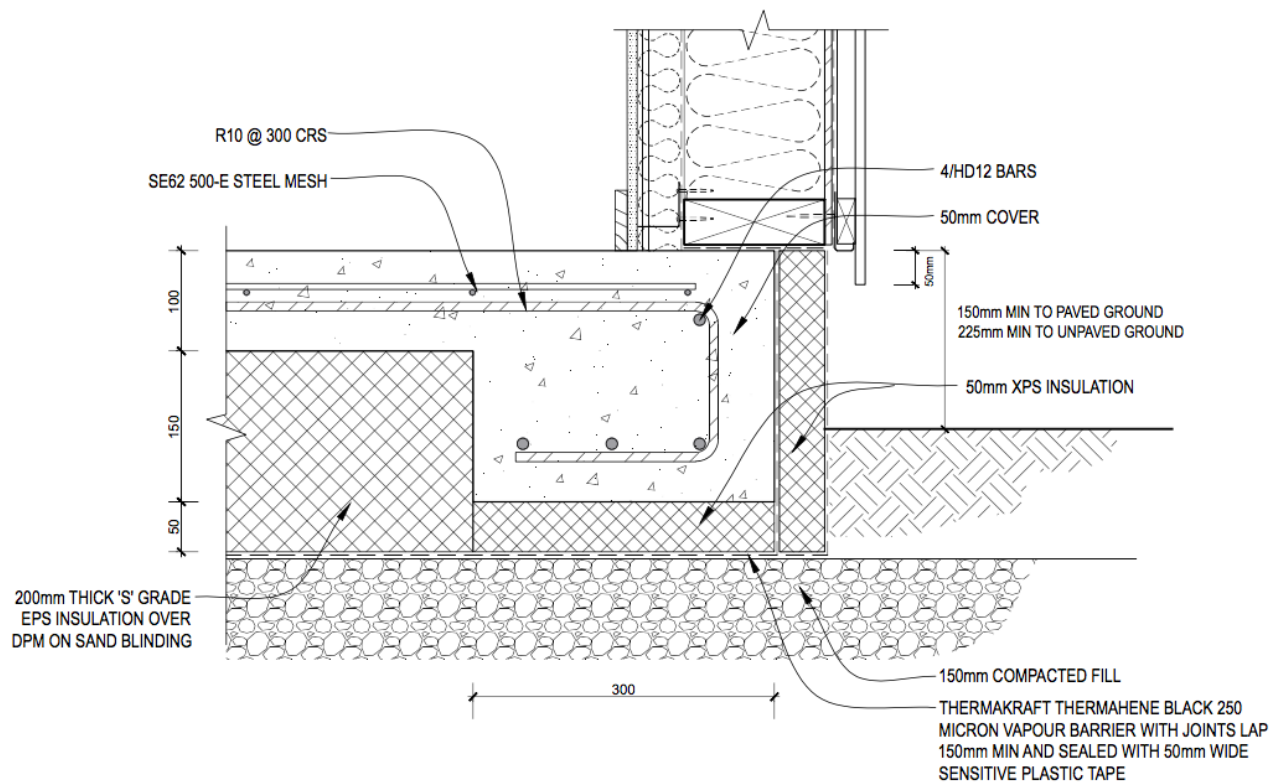
### 2.7.1 Footings and slab:

- DPC 1mm

- EPS (038) 200 mm

- Reinforced Concrete 100mm

$$\left. \begin{array}{l} \text{DPC 1mm} \\ \text{EPS (038) 200 mm} \\ \text{Reinforced Concrete 100mm} \end{array} \right\} U\text{-value} = 0.183 \text{ W/(m}^2\text{K)}$$

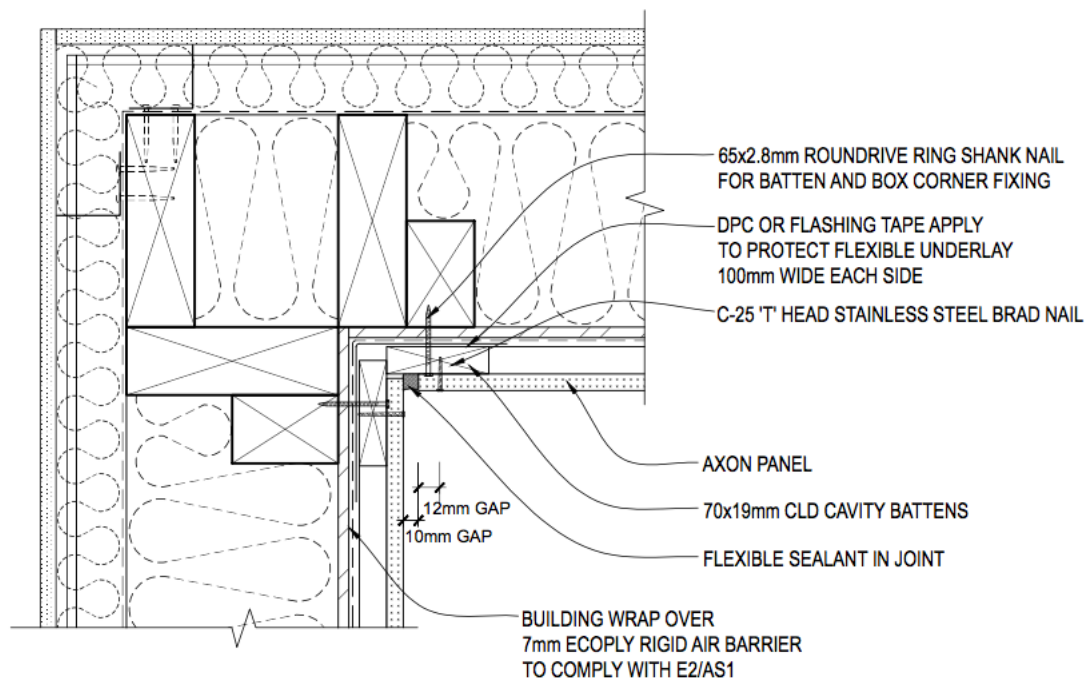


U-value of the floor slab of  $0.24 \text{ W/(m}^2\text{.K)}$  achieved by expanded polystyrene insulation. The concrete floor slab is typical eHaus slab floating on top of the structural insulation and links to 140 mm timber stud walls.

### 2.7.2 Exterior walls:

- Cladding
- Plywood 8 mm
- Pink Batts Ultra R 4.0 (035) 140 mm
- Pink Batts Ultra R 1.0 (040) 40 mm
- Plaster Board 10mm

$$\left. \begin{array}{l} \text{Pink Batts Ultra R 4.0 (035) 140 mm} \\ \text{Pink Batts Ultra R 1.0 (040) 40 mm} \end{array} \right\} U\text{-value} = 0.221 \text{ W/(m}^2 \text{ K)}$$



The external walls made of 140 mm timber frame( insulated with Pink Batts Ultra R 4.0 140 mm ) with EcoPLY rigid barrier outside.Service cavity 45 mm( insulated with Pink Batts Ultra R 1.0 40 mm ) is installed to the interior side of the wall



## 2.7.4 Insulation of the Roof /Ceiling

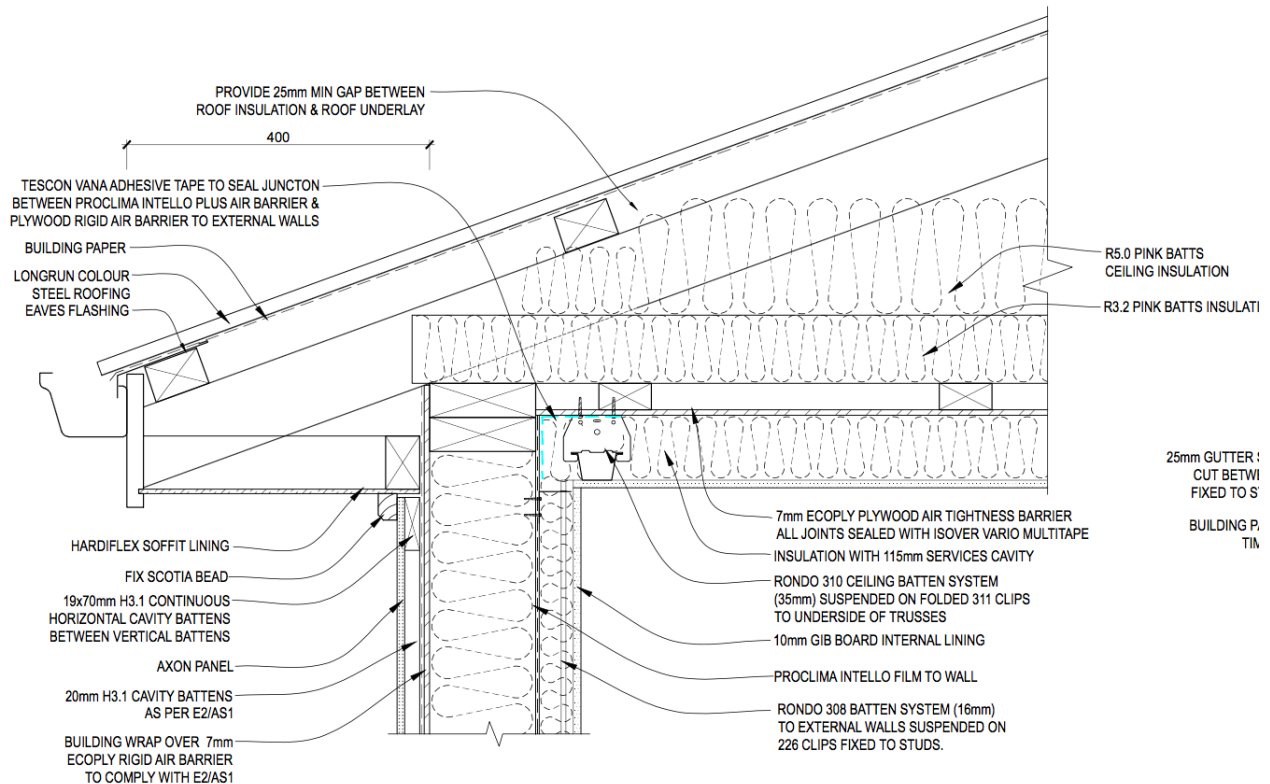
- Colour Steel roofing .55mm
- Fibreglass Layer 1 (044) 220mm

- Fibreglass Layer 2 (032) 90mm



U-value = 0.142 W/(m<sup>2</sup>K)

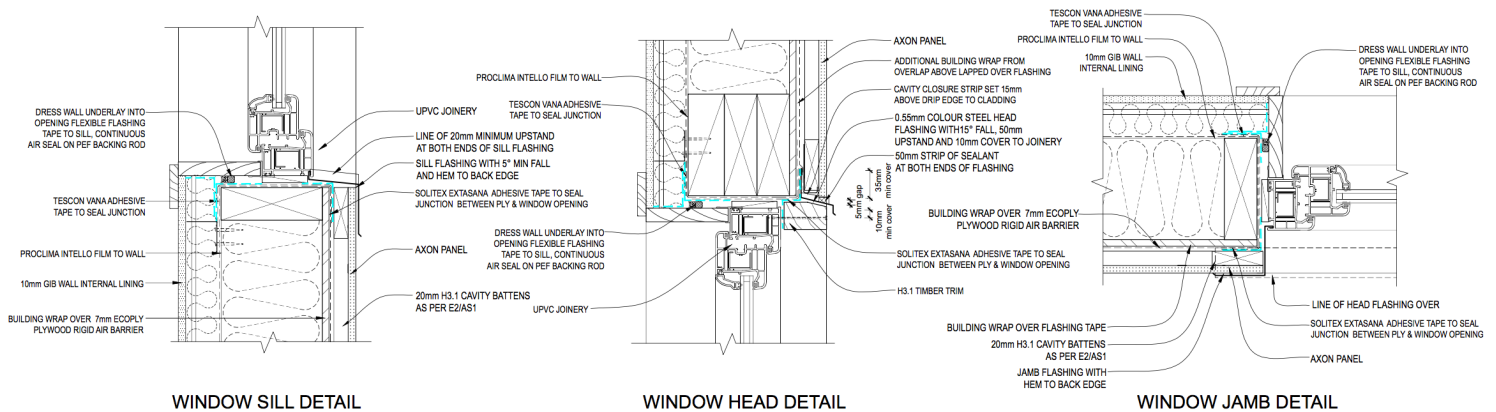
- Air tight membrane 1mm
- Rondo battens 35mm
- Plaster Board 10mm



The U-value of the roof of 0.145 W/(m<sup>2</sup> K) was achieved by using two layers of high efficiency fiberglass insulation.

## 2.7.5 Windows installation details

To achieve the passive house standard, the windows were provided by EcoWindows . The ECO PVC series is manufactured in Germany .The windows are double glazed, glass from Veridian PlaniTherm XN (glass 4 mm clear /spaces 16 filled 90% Ar/ 4 mm XN glass ) with an U-value of 1.10W/(m²k) and a g-Value of 0.65 .The window frames have been entered in as UPVc with a thermal performance minimum target of 1.2W/(m²k). The frames are not



PH certified but they are calculated to ISO 10077-2

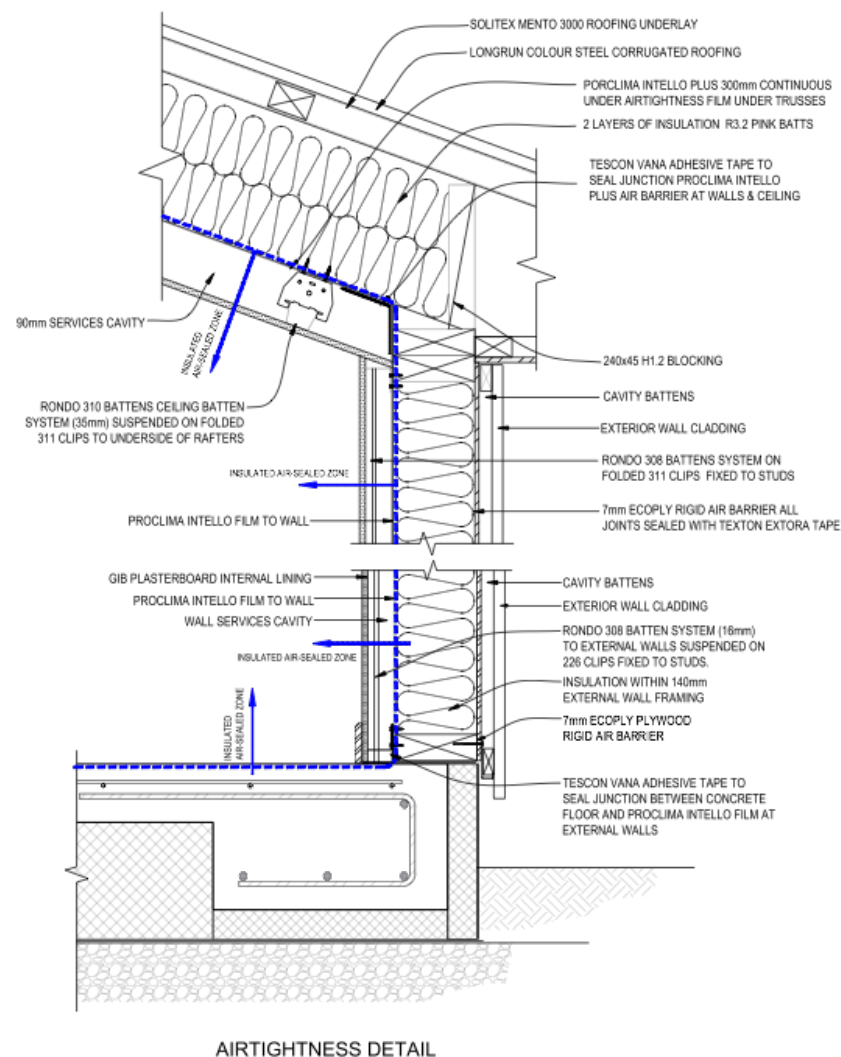




## 2.7.6 Airtightness and pressure test documentation

The junction zones - between the exterior walls and concrete floor and with the windows or the roof were indicated as delicate positions . The junction between the roof and the exterior walls has been achieved with an airtightness membrane (Pro- Clima Intello Plus) sealed with Tescon Vana adhesive tape at walls and ceiling .Tescon Vana adhesive tape was used to seal junction between concrete floor and pro Clima Intel film at external walls

### Air tightness detail



Airtightness detail exterior wall - Pro Clima Intello Plus with Tescon Vana tape



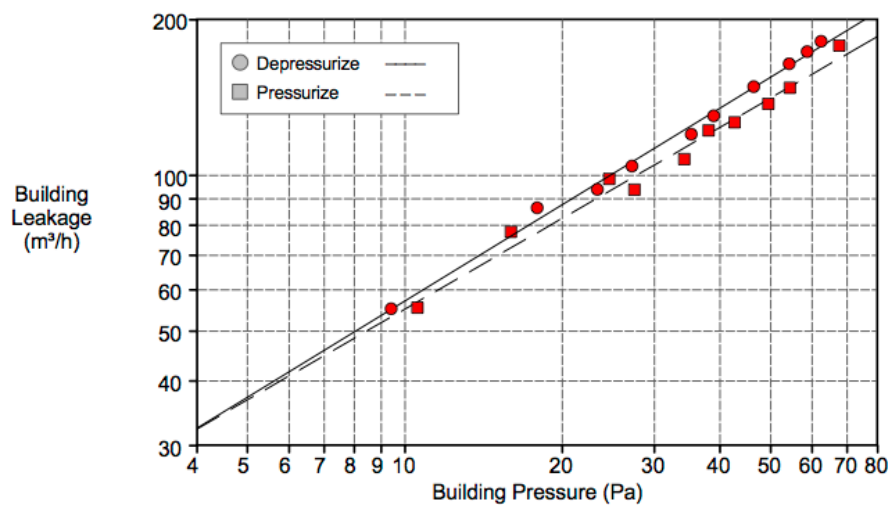


## Results of the AirTightness test

### BUILDING LEAKAGE TEST

Date of Test: 17/12/2018 Test File: EBOP01 Final Test Report  
Technician: Baden Brown  
Project Number: EBOP01  
Customer: Hartmann/Spranger Building Address: 123 Leyland Road  
123 Leyland Rd  
Whakamarama  
Phone: 07 777 0113  
Fax:

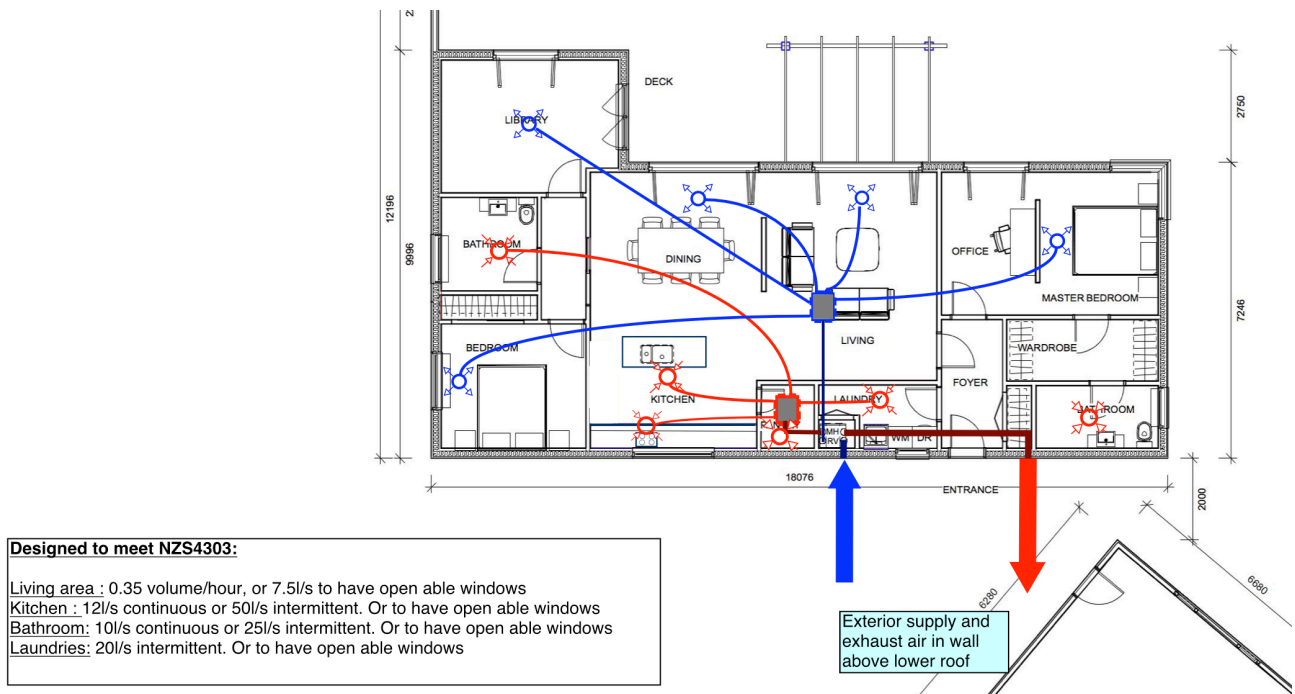
	Depressurization	Pressurization	Average
<b>Test Results at 50 Pascals:</b>			
V50: m <sup>3</sup> /h50 (Airflow)	155 (+/- 2.6 %)	141 (+/- 4.5 %)	148
n50: 1/h (Air Change Rate)	0.45	0.41	0.43
w50: m <sup>3</sup> /(h·m <sup>2</sup> Floor Area)	1.15	1.05	1.10
q50: m <sup>3</sup> /(h·m <sup>2</sup> Envelope Area)	0.32	0.29	0.31
<b>Leakage Areas:</b>			
Canadian EqLA @ 10 Pa (cm <sup>2</sup> )	63.8 (+/- 4.8 %)	61.6 (+/- 8.3 %)	62.7
cm <sup>2</sup> /m <sup>2</sup> Surface Area	0.13	0.13	0.13
LBL ELA @ 4 Pa (cm <sup>2</sup> )	35.0 (+/- 7.9 %)	34.9 (+/- 13.9 %)	34.9
cm <sup>2</sup> /m <sup>2</sup> Surface Area	0.07	0.07	0.07
<b>Building Leakage Curve:</b>			
Air Flow Coefficient (Cenv) m <sup>3</sup> /(h·Pa <sup>n</sup> )	13.7 (+/- 12.9 %)	14.4 (+/- 22.8 %)	
Air Leakage Coefficient (CL) m <sup>3</sup> /(h·Pa <sup>n</sup> )	13.8 (+/- 12.9 %)	14.4 (+/- 22.8 %)	
Exponent (n)	0.619 (+/- 0.037)	0.583 (+/- 0.065)	
Correlation Coefficient	0.99739	0.99084	
Test Standard:	EN 13829		
Test Mode:	Depressurization and Pressurization		
Type of Test Method:	B		
Regulation complied with:			



## 2.7.7

### Ventilation unit and system design

The mechanical ventilation heat recovery unit is Zehnder, ComfoAir Q350 wall mounted with a heat recovery coefficient of 82.4% and power consumption at 100Pa of  $0.29\text{Wh/m}^3$ . The unit is located in the laundry and served the whole house. The unit supply air (in blue) to the living areas (living room, library, dining room and bedrooms) and extract air (in red) from the kitchen, the bathrooms, the pantry and the laundry. Transfer between supply and extract is via a 15mm undercut to the doors. The outdoor air intake is placed on the south wall at a height of 2.6 m above ground level. The extract air is located on the roof above the ventilation unit



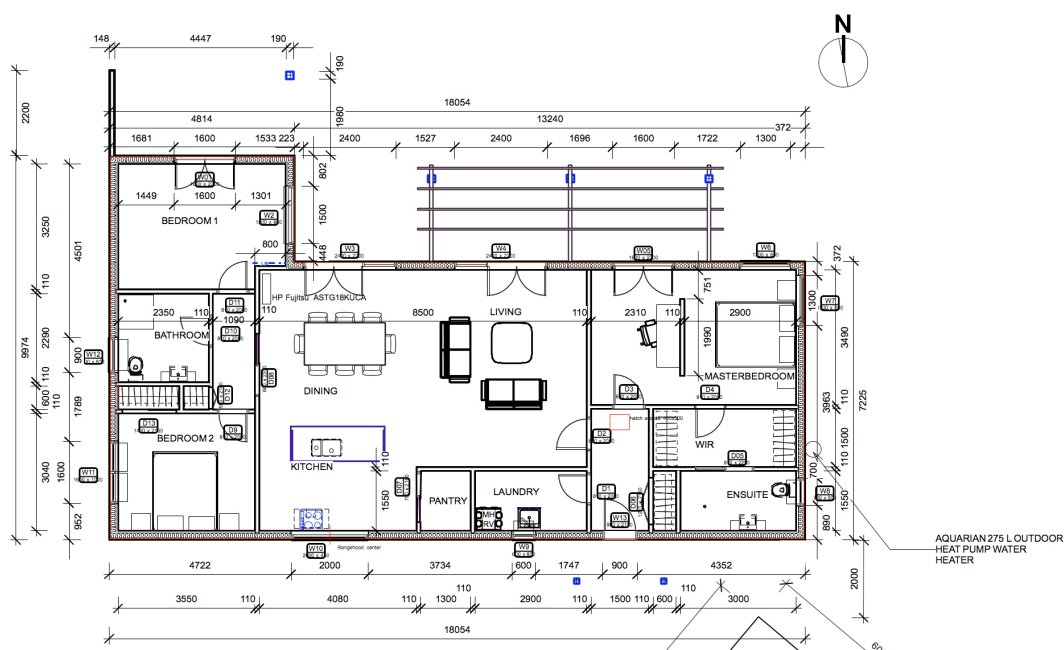
## 2.7.8 Heat Supply

The heat is provided by Heat pump Fujitsu model ASTG18KUCA. 6.0 kW. The domestic hot water heating system of this home uses Aquarian 275LE Outdoor Heat Pump water heater. Quick recovery for periods of high water use. Class A- low temperature operation.

Hot water heating system






Heating uni



Floor plan



## 2.8 PHPP results

Passive House Verification																																																																																				
				<b>Building:</b> Hartmann & Spranger Residence <b>Street:</b> _____ <b>Postcode/City:</b> 3179 Tauranga <b>Province/Country:</b> Bay of Plenty NZ-New Zealand <b>Building type:</b> single storey residence <b>Climate data set:</b> NZ0014a-Rotorua <b>Climate zone:</b> 4: Warm-temperate <b>Altitude of location:</b> 241 m																																																																																
				<b>Home owner / Client:</b> Marcus Spranger and Andrea Hartmann <b>Street:</b> _____ <b>Postcode/City:</b> 3179 Tauranga <b>Province/Country:</b> Bay of Plenty NZ-New Zealand																																																																																
				<b>Mechanical engineer:</b> ecoBuild Developments Ltd <b>Street:</b> 400 Victoria Avenue <b>Postcode/City:</b> 4500 Whanganui <b>Province/Country:</b> Manawatu-Wanganui NZ-New Zealand																																																																																
				<b>Certification:</b> Sustainable Engineering Ltd, Jason Quinn <b>Street:</b> 76 Virginia Rd <b>Postcode/City:</b> 4500 Whanganui <b>Province/Country:</b> Manawatu-Wanganui NZ-New Zealand																																																																																
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<b>Year of construction:</b> 2017 <b>No. of dwelling units:</b> 1 <b>No. of occupants:</b> 2.7				<b>Interior temperature winter [°C]:</b> 20.0 <b>Interior temp. summer [°C]:</b> 25.0 <b>Internal heat gains (IHG) heating case [W/m²]:</b> 2.5 <b>IHG cooling case [W/m²]:</b> 3.1 <b>Specific capacity [Wh/K per m² TFA]:</b> 84 <b>Mechanical cooling:</b> _____																																																																																
<b>Specific building characteristics with reference to the treated floor area</b>																																																																																				
<table border="1"> <thead> <tr> <th colspan="2"></th> <th>Treated floor area m²</th> <th></th> <th>Criteria</th> <th>Alternative criteria</th> <th>Fulfilled?<sup>2</sup></th> </tr> </thead> <tbody> <tr> <td rowspan="3">Space heating</td> <td>Heating demand kWh/(m²a)</td> <td>125.2</td> <td>≤</td> <td>15</td> <td>-</td> <td rowspan="3">yes</td> </tr> <tr> <td>Heating load W/m²</td> <td>10</td> <td>≤</td> <td>-</td> <td>10</td> </tr> <tr> <td>Space cooling</td> <td>Cooling &amp; dehum. demand kWh/(m²a)</td> <td>-</td> <td>≤</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td></td> <td>Cooling load W/m²</td> <td>-</td> <td>≤</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td></td> <td>Frequency of overheating (&gt; 25 °C) %</td> <td>1</td> <td>≤</td> <td>10</td> <td>-</td> <td>yes</td> </tr> <tr> <td></td> <td>Frequency of excessively high humidity (&gt; 12 g/kg) %</td> <td>0</td> <td>≤</td> <td>20</td> <td>-</td> <td>yes</td> </tr> <tr> <td>Airtightness</td> <td>Pressurization test result n<sub>50</sub> 1/h</td> <td>0.4</td> <td>≤</td> <td>0.6</td> <td>-</td> <td>yes</td> </tr> <tr> <td>Non-renewable Primary Energy (PE)</td> <td>PE demand kWh/(m²a)</td> <td>89</td> <td>≤</td> <td>120</td> <td>-</td> <td>yes</td> </tr> <tr> <td></td> <td>PER demand kWh/(m²a)</td> <td>39</td> <td>≤</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>Primary Energy Renewable (PER)</td> <td>Generation of renewable energy (in relation to pro-jected building footprint area)</td> <td>0</td> <td>≥</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table>												Treated floor area m²		Criteria	Alternative criteria	Fulfilled? <sup>2</sup>	Space heating	Heating demand kWh/(m²a)	125.2	≤	15	-	yes	Heating load W/m²	10	≤	-	10	Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-		Cooling load W/m²	-	≤	-	-	-		Frequency of overheating (> 25 °C) %	1	≤	10	-	yes		Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20	-	yes	Airtightness	Pressurization test result n <sub>50</sub> 1/h	0.4	≤	0.6	-	yes	Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	89	≤	120	-	yes		PER demand kWh/(m²a)	39	≤	-	-	-	Primary Energy Renewable (PER)	Generation of renewable energy (in relation to pro-jected building footprint area)	0	≥	-	-	-
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<sup>2</sup> Empty field: Data missing; '-': No requirement																																																																																				
<p>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.</p> <p>Task: 2-Certifier First name: Jason Surname: Quinn          Certificate ID: 21683_SENZ_PH_20190523_JEQ Issued on: 23/05/2019 City: Whanganui</p> <p>Passive House Classic? <b>yes</b> Signature: </p> <p></p>																																																																																				

The combination of carefully chosen design elements, space planning , minimised overheating with good climate was provided very good results

The air tightness result of 0.4 ACHn50 also assists this result.

Basic principles of PH design were applied from the beginning - the concept design stage started with idea how to ensure targeted design criteria and performances

## **2.9 Year of Construction and costs**

The construction started in 2017 and the owners moved in in December 2018 , final landscaping is in process. The owner wishes the construction costs to be private

## **2.10 Experiences**

The owners have been very happy with the home and how the house has been performing . Following words expressed how the client`s impression

*Loving the fact that we have a warm house, despite the quite chilly mornings which we already had every now and then! And you an definitely feel that it is so much drier. :)*