# Project Documentation – Shotover Passive House

## 1 Description of project

Single detached dwelling in Shotover country, Queenstown

*North Elevation*

### 1.1 Building data

| | | | |
|---|---|---|---|
| Year of construction | 2017 | Space Heating | 13 kWh/(m²a) |
| U-value external wall | 0.152 W/(m²K) | Primary Energy Renewable (PER) | 37 kWh/(m²a) |
| U-value floor | 0.095 W/(m²K) | Generation of renewable energy | 0 kWh/(m²a) |
| U-value roof | 0.100 W/(m²K) | Non-renewable Primary Energy (PE) | 85 kWh/(m²a) |
| U-value window/doors | 0.97 W/(m²K) | Pressure test n50 | 0.49 1/h |
| Heat Recovery | 77.7% | | |

## 1.2 Brief description of the construction task

The project is a single detached dwelling for a private client. The site is located in a new subdivision in the Wakatipu Basin west of Queenstown. The house itself faces 15 degrees off true north and is 2 storeys with an attached double garage. Immediately to the north of the house is a recreational area.

## 1.3 Responsible project participant

| | |
|---|---|
| Architecture | Energy Architecture NZ Ltd |
| Building services | Climate House Ltd |
| Building physics | Energy Architecture NZ Ltd |
| Structural engineering | Batchelar McDougall Consulting |
| Construction management | Climate House Ltd |
| | |
| Certifying body | Sustainable Engineering Ltd |
| Certification ID | ID: 5573 |
| Author of project documentation | Energy Architecture NZ Ltd |

# 2 Photographs

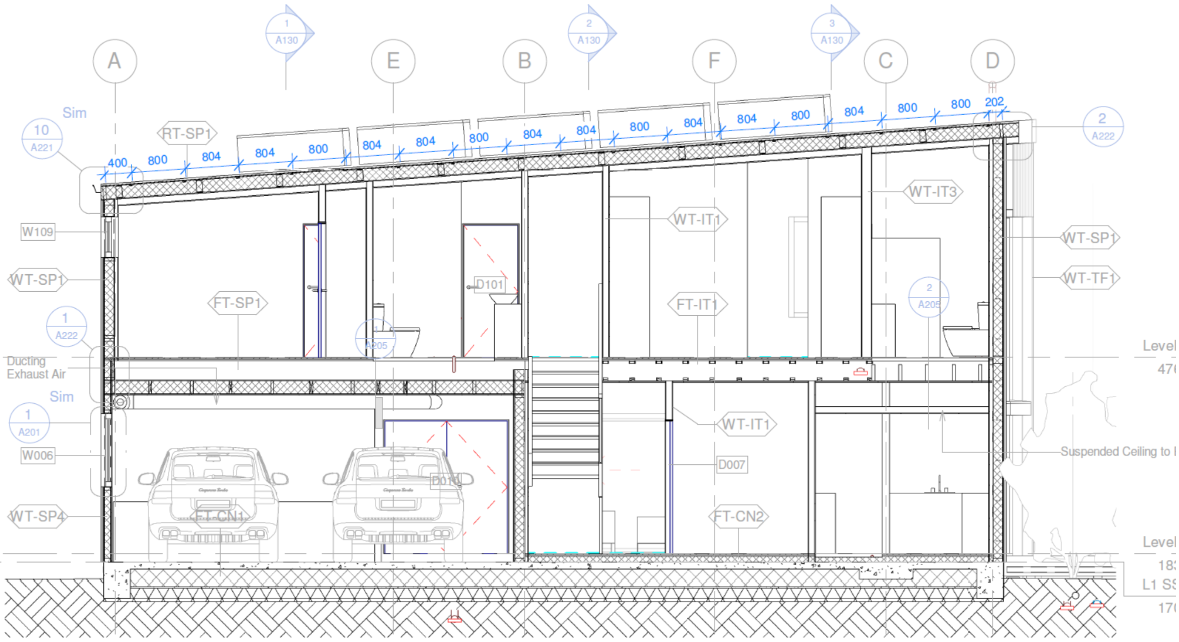
*East Elevation*

*West Elevation*

*South Elevation (Just prior to completion)*

*Entrance (Just prior to completion)*

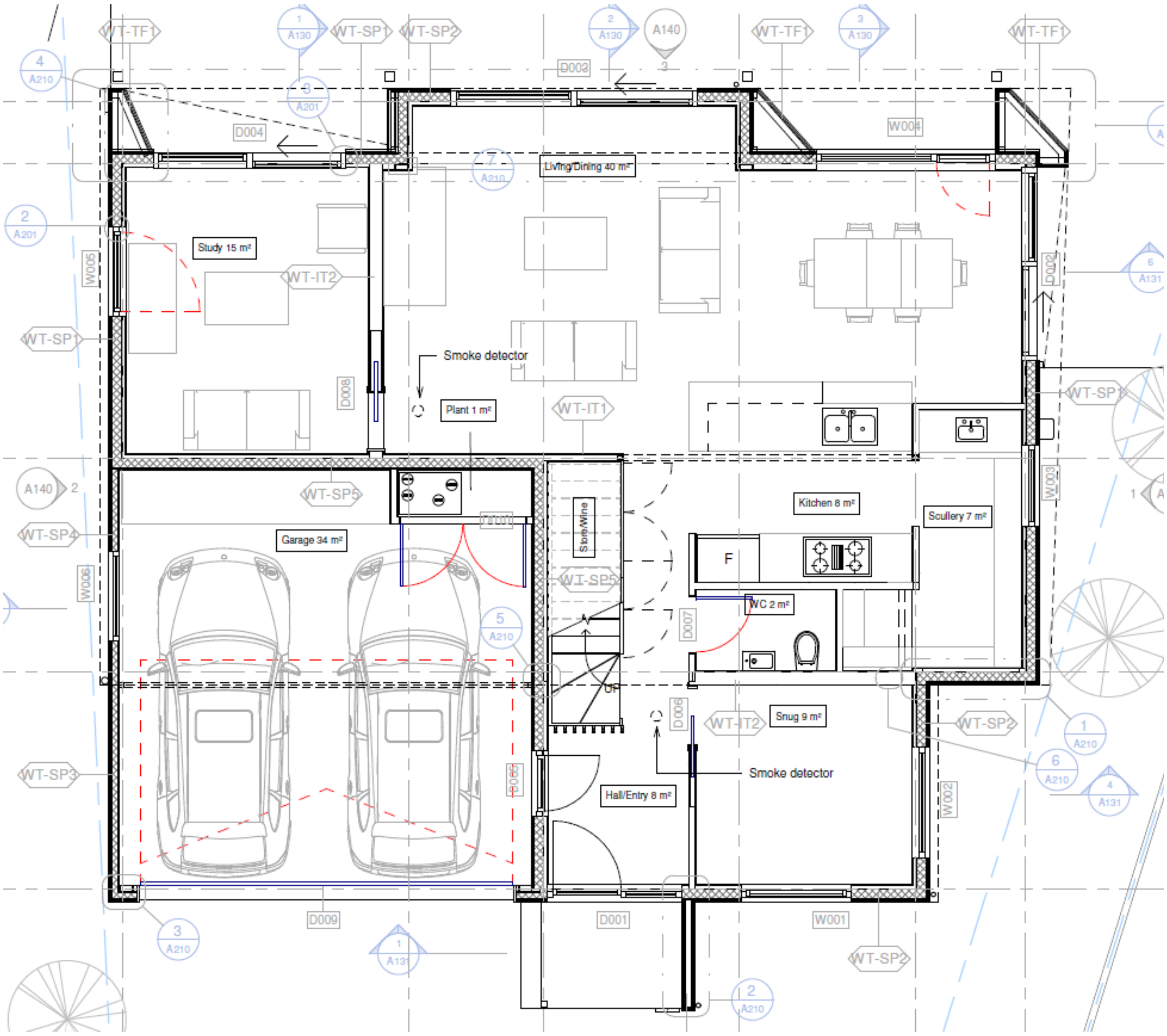
# 3 Sectional drawing with description




*Typical Section*

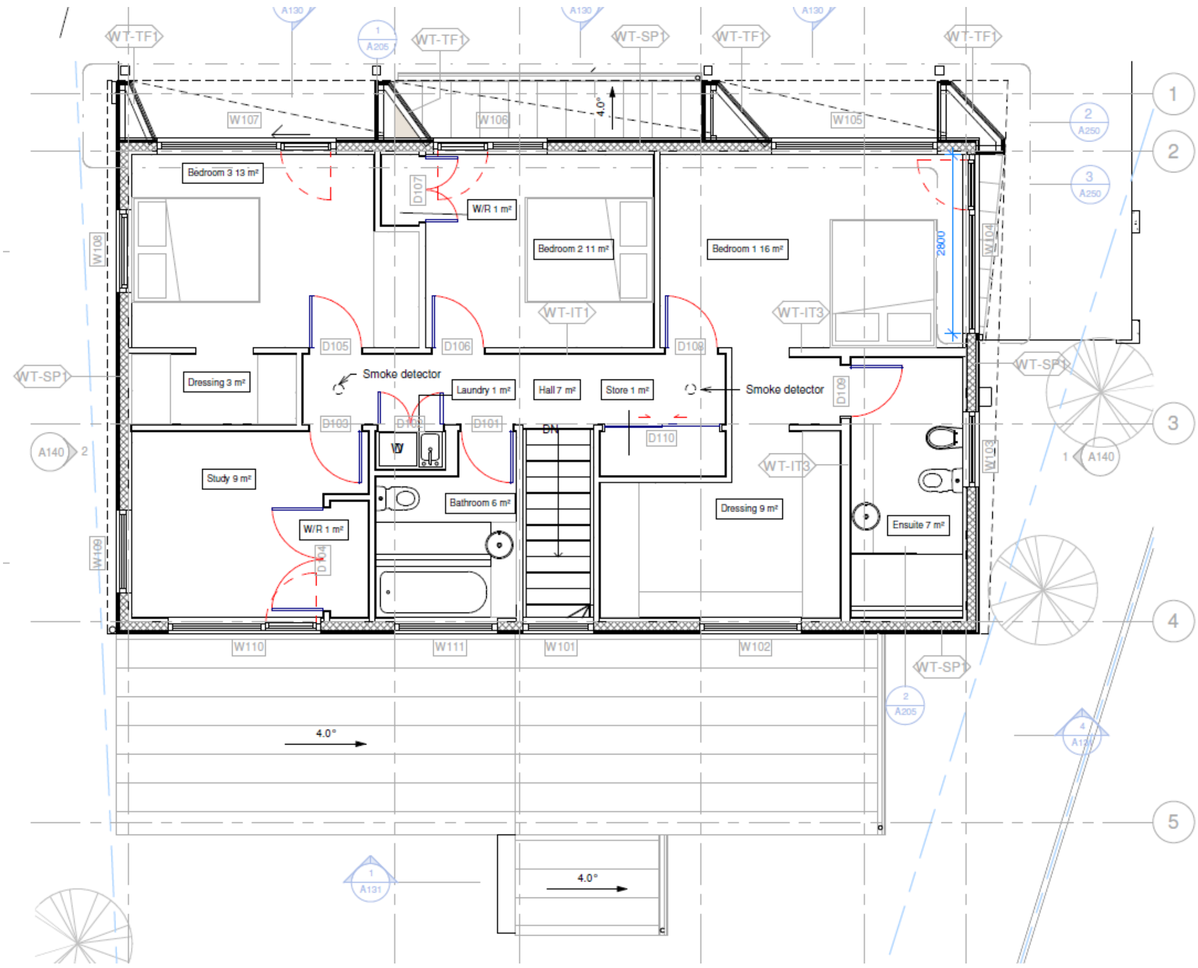
The thermal envelope is fairly simple, the main challenge been the inclusion of a double garage within the dwelling (but outside the thermal envelope). The main roof sits over the whole of the first floor. A smaller, lower roof covers some of the garage, entrance and snug.

## 4 Floor plans with description




*Ground floor plan*

The ground floor plan contains the living spaces, kitchen, an office, WC and the garage (outside the thermal envelope). The location of the garage presented some challenges in terms the surface area and of detailing. The MVHR is located in the garage. The north elevation has some non-structural elements to provide shading

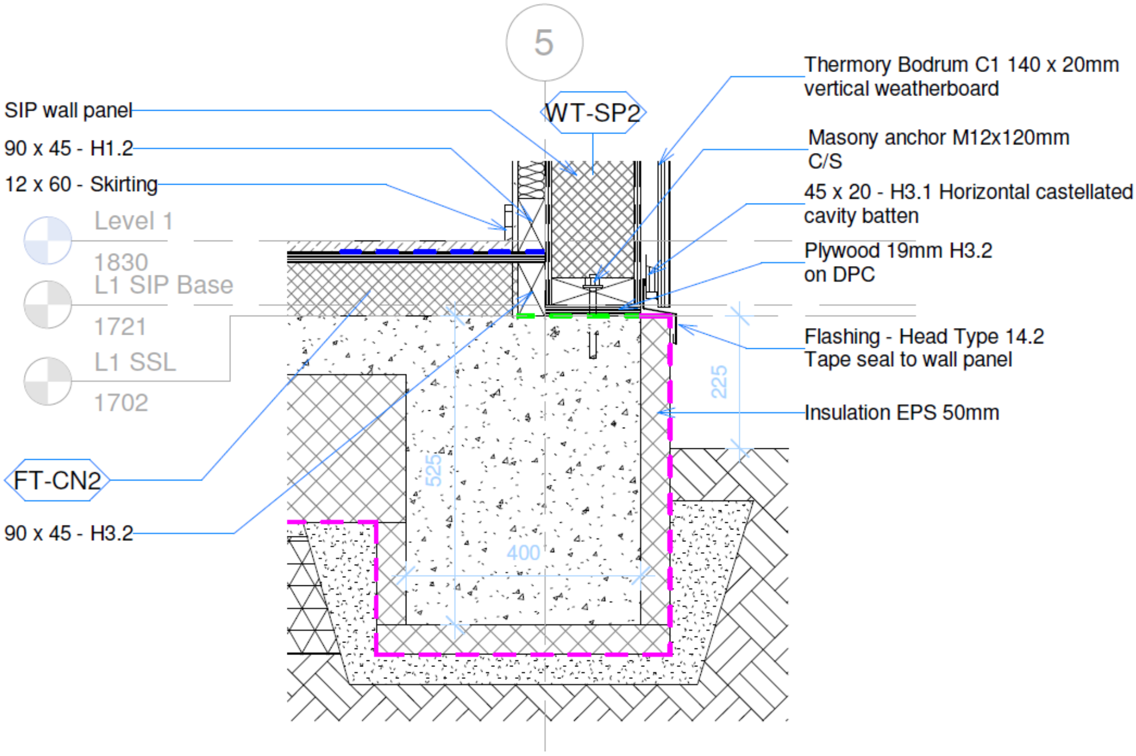



*First floor plan*

The First floor contains, bedrooms, bathrooms and a second study. The north elevation has some non-structural elements to provide shading

# 5 Construction details of the envelope

## 5.1 Description of the construction of the floor slab



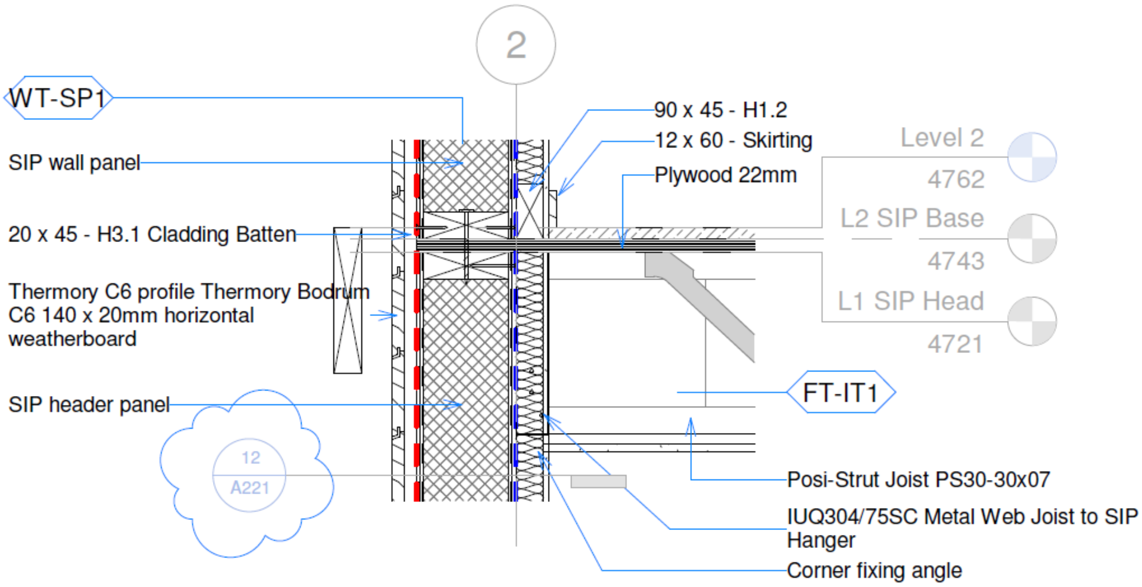

*Typical Foundation Edge*

The floor is a 100mm concrete slab with 90mm PUR insulation overlay and 250mm EPS under the slab.
U-value 0.095 W/(m²K)
The overlay PUR insulation helps to minimize thermal bridging as the SIP panel cannot overhang the edge of the slab for perimeter insulation continuity.

*Under slab and perimeter insulation, prior to concrete pouring.*

*Edge of overlay insulation build up visible prior to installation of doors*

## 5.2 Description of the construction of the exterior walls

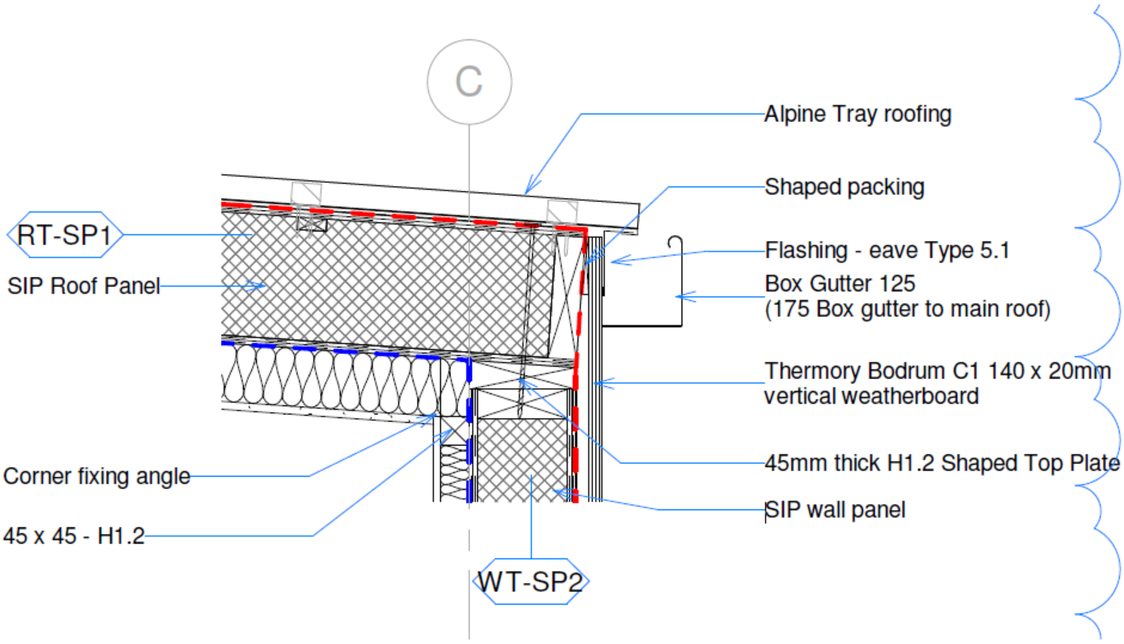



*Typical mid-floor detail*

External walls were constructed with 165mm PUR core SIP panels, with 45mm battens/insulation and plasterboard to the interior and 20mm cladding battens and timber weatherboards to the exterior. U-value 0.152 W/(m²K)

*Ground floor SIP panels in place*

## 5.3 Description of the construction of the roof

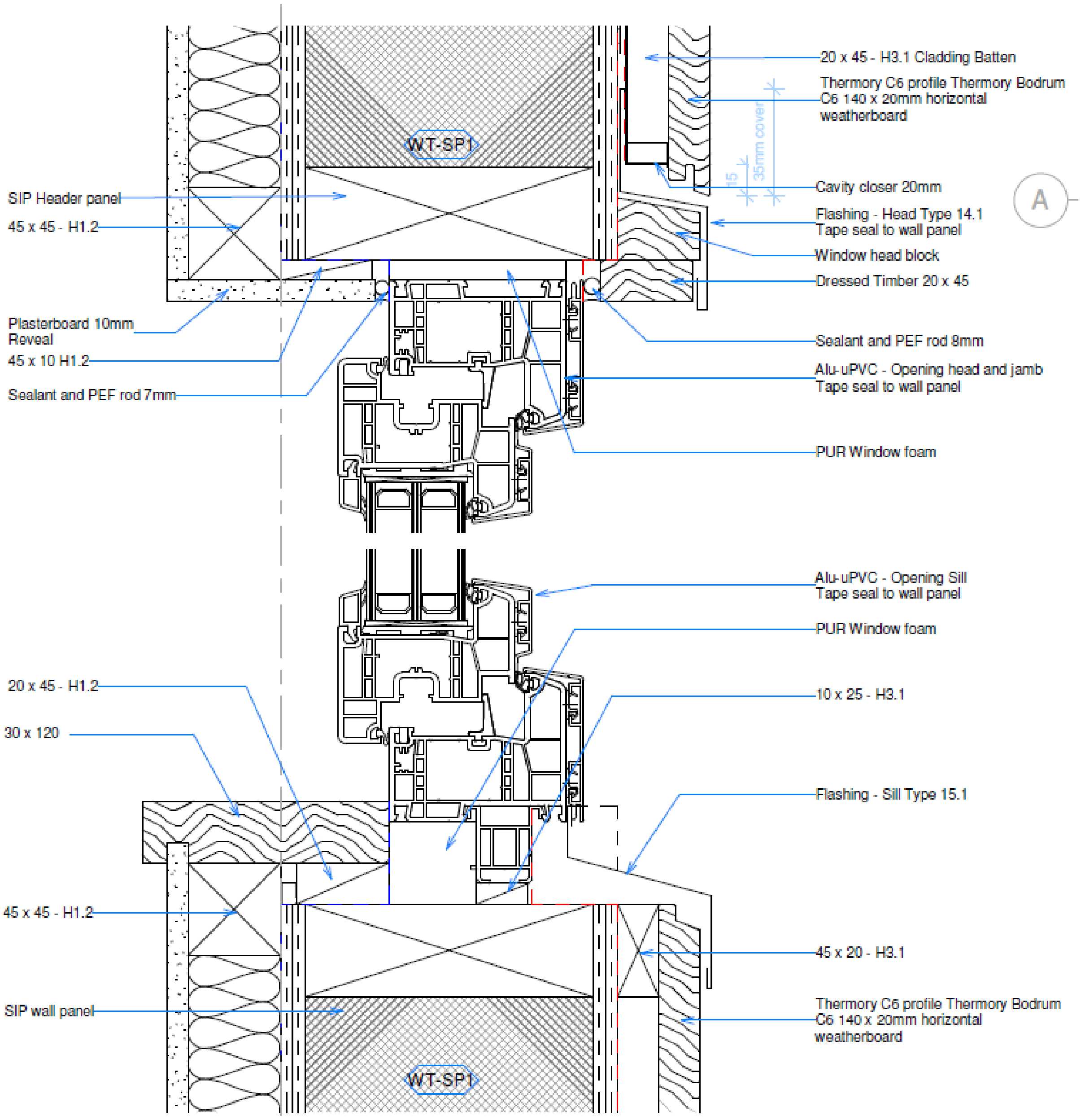



*Typical eave detail.*

Roofs were constructed with 215mm PUR core SIP panels, with 90mm battens/insulation and plasterboard to the interior and tray roofing to the exterior. U-value 0.100 $W/(m^2K)$

*Roof panel installation*

## 5.4 Description of the window sections including installation drawing

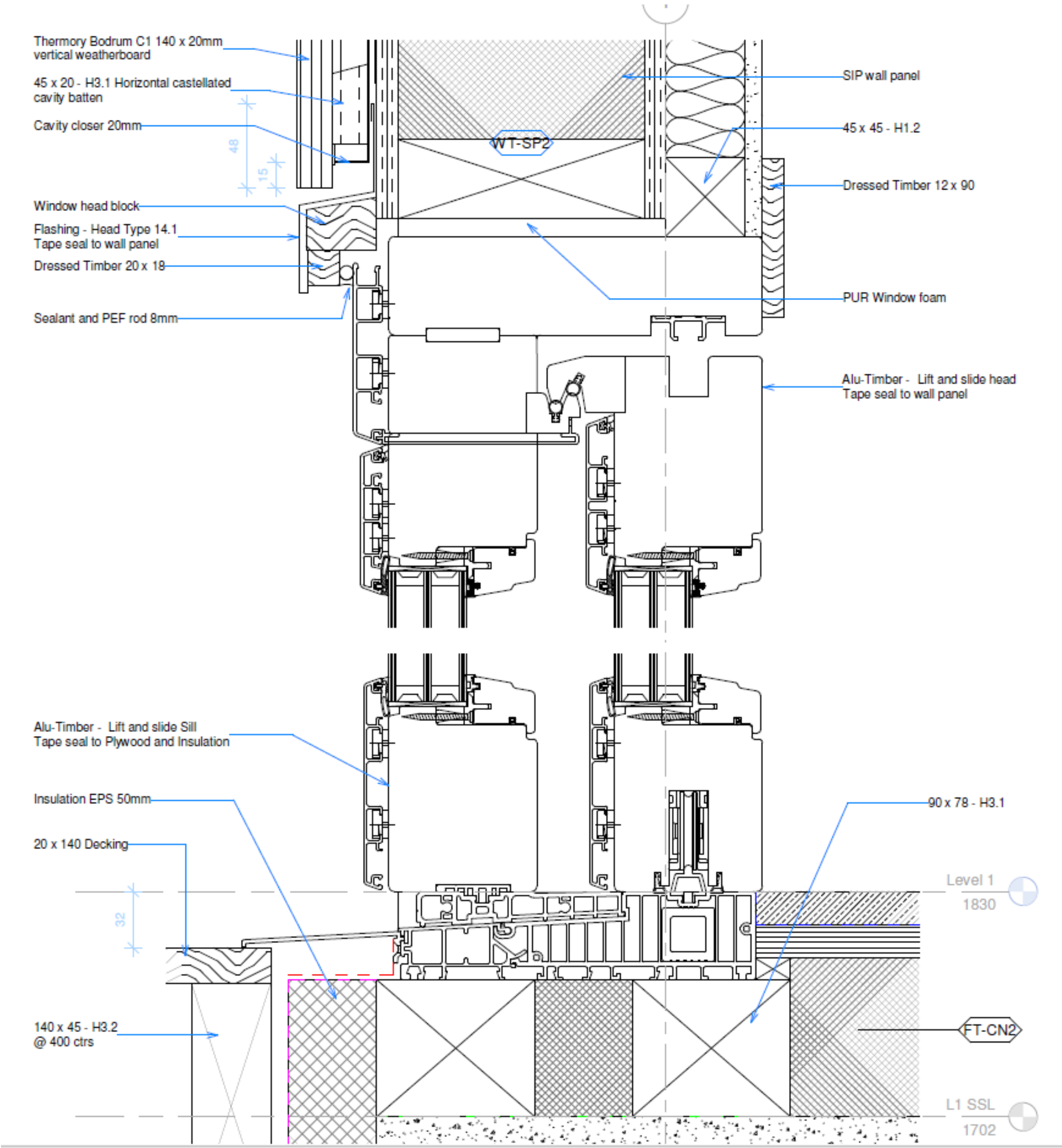



*Typical window head and sill detail*

Windows are aluminium clad uPVC frame with triple low-e glazing. Uf 0.79 W/(m²K).
kneer-suedfenster KF 714 S WD-P
Thermal protection glass 4:/18/4/18/:4
Ug 0,5/ g 0.53

*Installed window, prior to installation of internal insulation and linings. OSB airtightness layer.*

## 5.5 Description of the sliding door sections including installation drawing




*Typical sliding door head and sill detail*

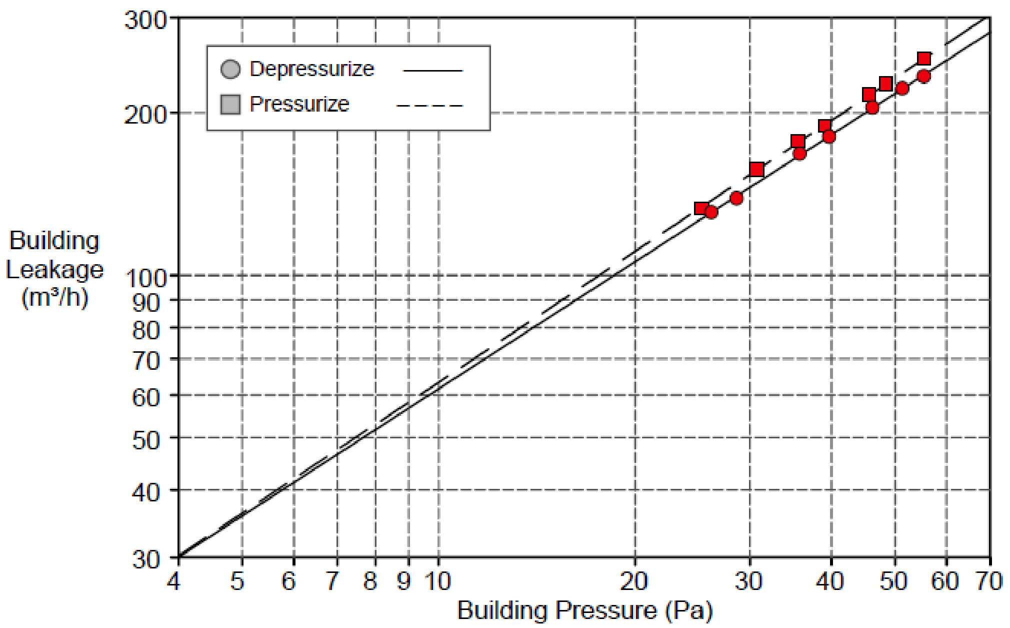
Sliding doors are aluminium clad timber frame with triple low-e glazing. Uf 1.1 W/(m²K).
kneer-suedfenster Alu-wood lift and slide door 115
Thermal protection glass 6ESG:/16/6/14/:6ESG
Ug 0,6/ g 0.53

*Installed sliding door*

## 6 Description of the airtight envelope

Interior OSB layer of SIP panels forms the airtightness layer for the roof and walls (photo previous). The plywood overlay form the airtightness layer to the floor. All joints were tape sealed.
Pressure test n50 result was 0.49 1/h

| | Depressurization | Pressurization | Average |
|---|---|---|---|
| **Test Results at 50 Pascals:** | | | |
| V50: Airflow (m³/h) | 217 ( +/- 0.6 %) | 232 ( +/- 0.5 %) | 224 |
| n50: Air Changes per Hour (1/h) | 0.47 | 0.50 | 0.49 |
| w50: m³/h/m² Floor Area | 1.21 | 1.30 | 1.26 |
| q50: | | | |
| **Leakage Areas:** | | | |
| Canadian EqLA @ 10 Pa (cm²) | 68.8 ( +/- 3.4 %) | 70.7 ( +/- 2.8 %) | 69.7 |
| LBL ELA @ 4 Pa (cm²) | 32.4 ( +/- 5.5 %) | 32.6 ( +/- 4.5 %) | 32.5 |
| **Building Leakage Curve:** | | | |
| Air Flow Coefficient (Cenv) | 10.1 ( +/- 8.7 %) | 9.9 ( +/- 7.1 %) | |
| Air Leakage Coefficient (CL) | 10.2 ( +/- 8.7 %) | 9.9 ( +/- 7.1 %) | |
| Exponent (n) | 0.782 ( +/- 0.023 ) | 0.806 ( +/- 0.019 ) | |
| Correlation Coefficient | 0.99967 | 0.99980 | |
| Test Standard: | EN 13829 | | |
| Test Mode: | Depressurization and Pressurization | | |
| Type of Test Method: | A | | |
| Regulation complied with: | Passive House n50 ≤ 0.6 | | |



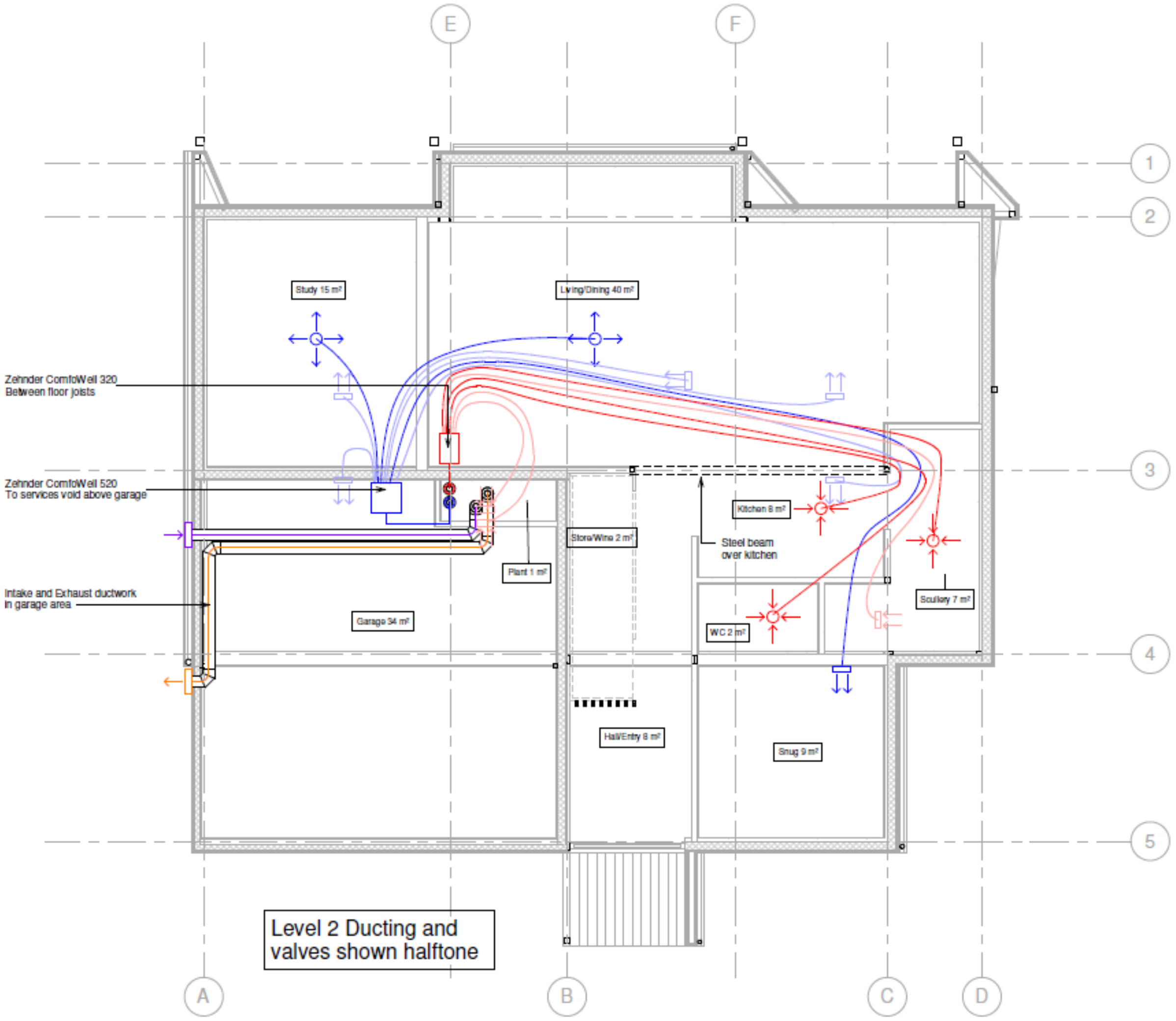

*Final pressure test results*

*Photo of blower door test in progress*

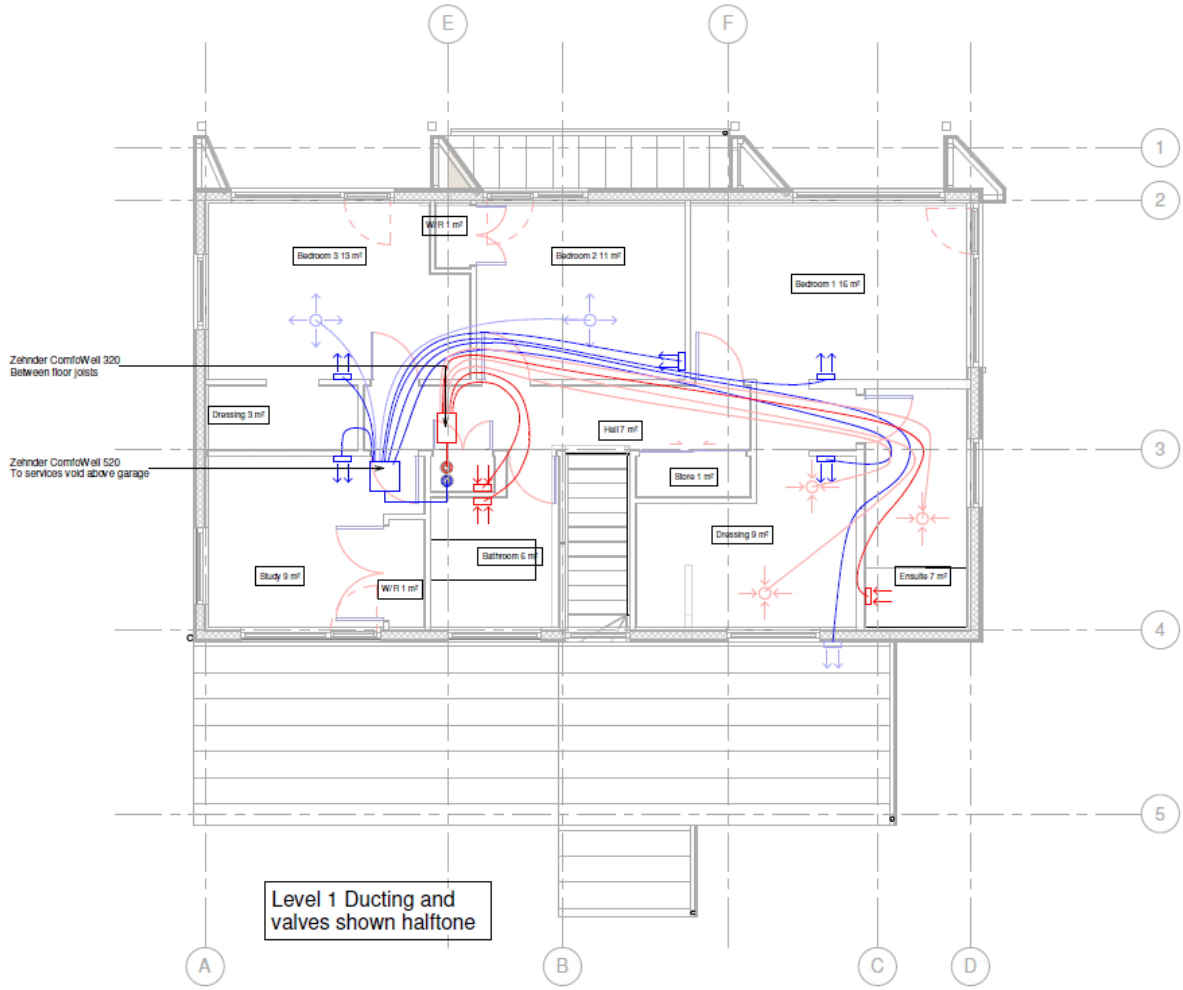
## 7 Description of the planning of the ventilation ductwork

### 7.1.1 Ventilation layout

Most services (including MVHR ductwork) were installed to the intermediate floor, which was formed using open web timber trusses. The Compact unit was located in the garage. Ceiling valves were used to introduced and extract air from ground floor roofs. Wall mounted valves (low level for supply and high level for extract) were used for first floor rooms




*1. Ground floor ventilation layout*

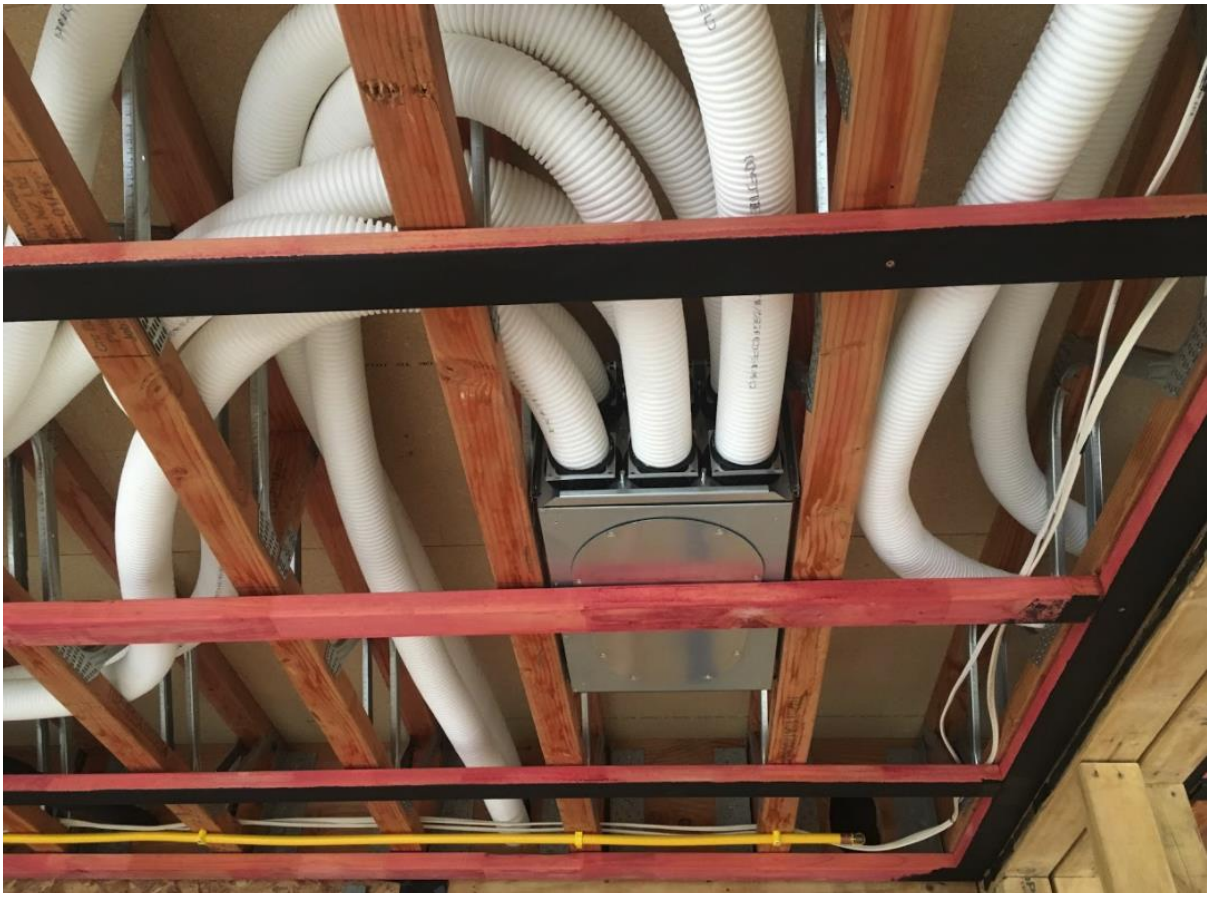



*2. First floor ventilation layout*

## 7.1.2 Description of the planning for the central unit

| | |
|---|---|
| ventilation system make | Nilan Compact P |
| effective heat recovery efficiency | 77.7% |
| electrical efficiency | 0.4 Wh/m³) |

*3. Nilan compact P in garage*



*4. Supply air manifold between joist in intermediate floor.*

## 8 Description of the heat supply system

Nilan Compact P compact unit in garage. Supply air heating and domestic hot water.

Refer image 20.

# 9 PHPP results

## Passive House Verification

| | | | |
|---|---|---|---|
| Photo or Drawing | | Building: | |
| | | Street: | |
| | | Postcode/City: | 9304 Queenstown |
| | | Province/Country: | Otago NZ-New Zealand |
| | | Building type: | Detached residential |
| | | Climate data set: | NZ0006b-Queenstown |
| | | Climate zone: | 4: Warm-temperate; Altitude of location: 333 m |
| | | Home owner / Client: | |
| | | Street: | |
| | | Postcode/City: | |
| | | Province/Country: | |
| **Architecture:** | Energy Architecture NZ Ltd | **Mechanical system:** | Climate House Ltd |
| Street: | 1/202 Oriental Parade | Street: | 98 Jacks Point Rise |
| Postcode/City: | 6011 Wellington | Postcode/City: | 9371 Queenstown |
| Province/Country: | Wellington NZ-New Zealand | Province/Country: | Otago NZ-New Zealand |
| **Energy consultancy:** | Energy Architecture NZ Ltd | **Certification:** | Sustainable Engineering Ltd |
| Street: | 1/202 Oriental Parade | Street: | 76 Virginia Rd |
| Postcode/City: | 6011 Wellington | Postcode/City: | 4500 Whanganui |
| Province/Country: | Wellington NZ-New Zealand | Province/Country: | NZ-New Zealand |

| | | | | | |
|---|---|---|---|---|---|
| Year of construction: | 2016 | Interior temperature winter [°C]: | 20.0 | Interior temp. summer [°C]: | 25.0 |
| No. of dwelling units: | 1 | Internal heat gains (IHG) heating case [W/m²]: | 2.4 | IHG cooling case [W/m²]: | 2.4 |
| No. of occupants: | 3.0 | Specific capacity [Wh/K per m² TFA]: | 60 | Mechanical cooling: | |

**Specific building characteristics with reference to the treated floor area**

| | | | | | Criteria | Alternative criteria | Fullfilled?[2] |
|---|---|---|---|---|---|---|---|
| | Treated floor area | m² | 174.6 | | | | |
| **Space heating** | Heating demand | kWh/(m²a) | 12.99 | ≤ | 15 | - | yes |
| | Heating load | W/m² | 11.07 | ≤ | - | 10 | |
| **Space cooling** | Cooling & dehum. demand | kWh/(m²a) | - | ≤ | - | - | - |
| | Cooling load | W/m² | - | ≤ | - | - | |
| | Frequency of overheating (> 25 °C) | % | 6 | ≤ | 10 | | yes |
| | Frequency excessively high humidity (> 12 g/kg) | % | 0 | ≤ | 20 | | yes |
| **Airtightness** | Pressurization test result $n_{50}$ | 1/h | 0.6 | ≤ | 0.6 | | yes |
| **Non-renewable Primary Energy (PE)** | PE demand | kWh/(m²a) | 85 | ≤ | 120 | | yes |
| **Primary Energy Renewable (PER)** | PER demand | kWh/(m²a) | 37 | ≤ | - | - | - |
| | Generation of renewable energy | kWh/(m²a) | | ≥ | - | - | |

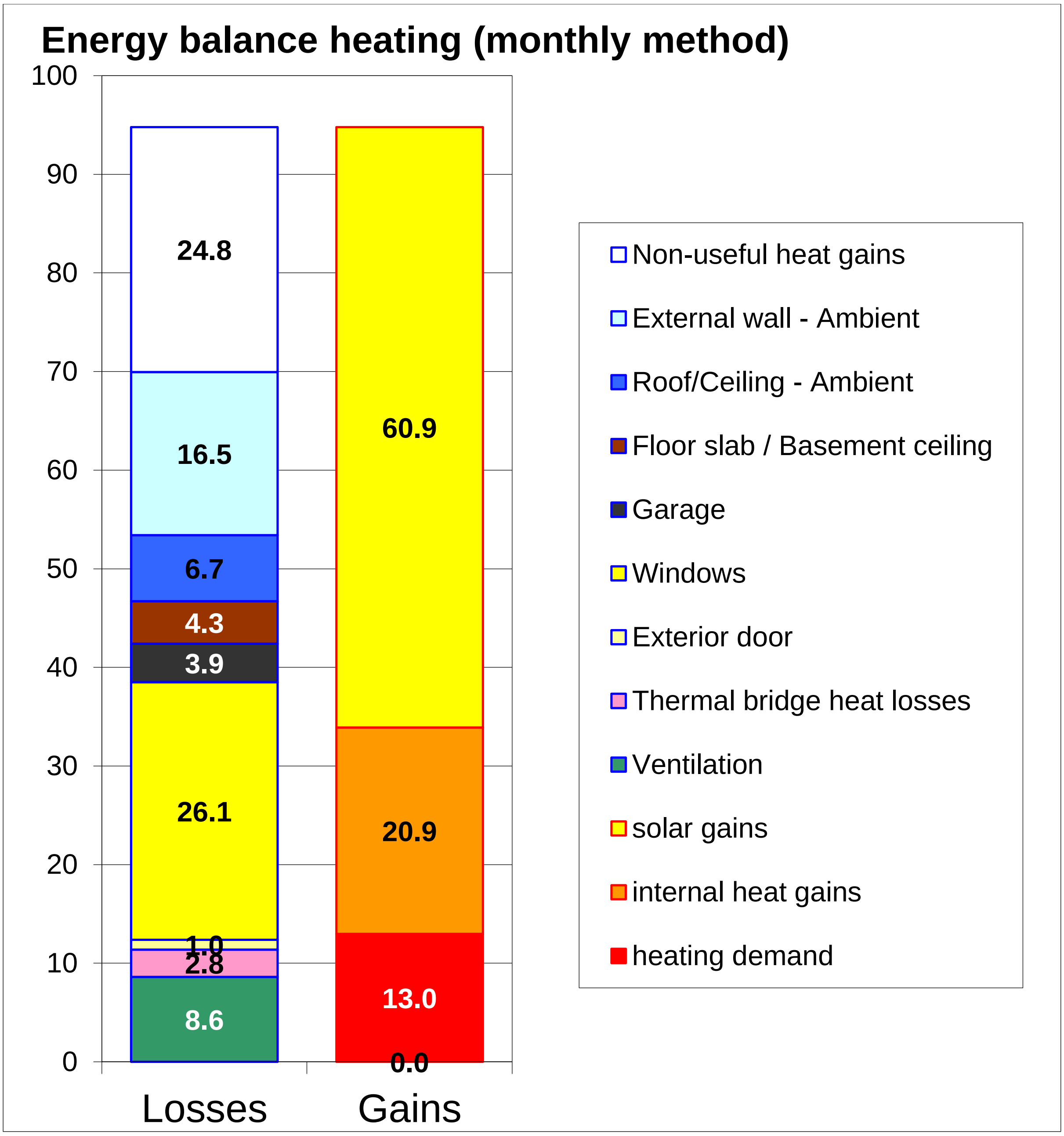
[2] Empty field: Data missing; '-': No requirement

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 Classic?** yes

| Task: | First name: | Surname: | Signature: |
|---|---|---|---|
| 1-Designer | Guy | Shaw | |
| | Issued on: 02/02/18 | City: Wellington | |

*5. PHPP verification sheet*




*6. PHPP Heating Tab*

The majority of the heat gain was from solar gain. Careful modelling of the overheating risk was undertaken, including best case & worse case scenarios. Additional shading during the construction phase and further recommendations have been made to control solar gain in summer months.