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# PASSIVE HOUSE SERVICES HEPA FILTER INSTALLATION TO ZEHNDER HRV Q350



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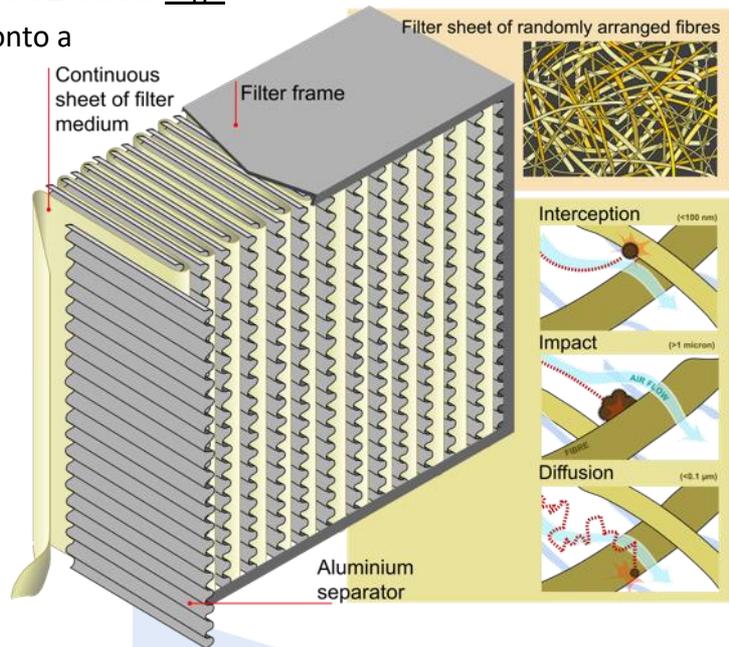


## Introduction

This report documents the installation of a Zehnder High Efficiency Particulate Air (HEPA<sup>1</sup>) filter onto a standard Q350 HRV in a Certified Passive House Low Energy Building (Noonameena) PHI Project id 5437.

## Why install a HEPA filter?

Recent significant fire events across Australia (and the world) have seen a dramatic increase in smoke haze in many areas of the country. This was especially evident in Sydney and the east coast of Australia during the fires of the summer of 2019/2020.



There are a number of reports including the one referenced below<sup>2</sup> in the public domain discussing the impact of bushfire smoke on the health and wellbeing of folks affected by these fires. The data points to unhealthy levels of  $< 2.5\text{ }\mu\text{m}$  (PM<sub>2.5</sub>) and the effect on our health. This report does not intend to address these in any detail other than to say in serious smoke events the adoption of a quality HEPA filter combined with a well balance HRV system will provide significant reduction of  $< \text{PM}_{2.5}$  inside and improved internal air quality in a Passive House. The HEPA H11 filter is designed to pass a maximum of 5% of 0.1 micron particles per litre of air.

We experienced the residual smoke from the bush fires referred to above for quite some time. We could smell the smoke inside, but it was significantly better inside than out during those heavy days.

To date we have not had a smoke event with the HEP filter installed, so are unable to measure or experience the effectiveness of the installation in thos conditions. Power consumption increases (see table at the rear of the document) while maintaining required air volumes, a small price to pay in theses extreme events.

<sup>1</sup> Source of image Wikipedia

<sup>2</sup> [Medical Journal of Australia](#)

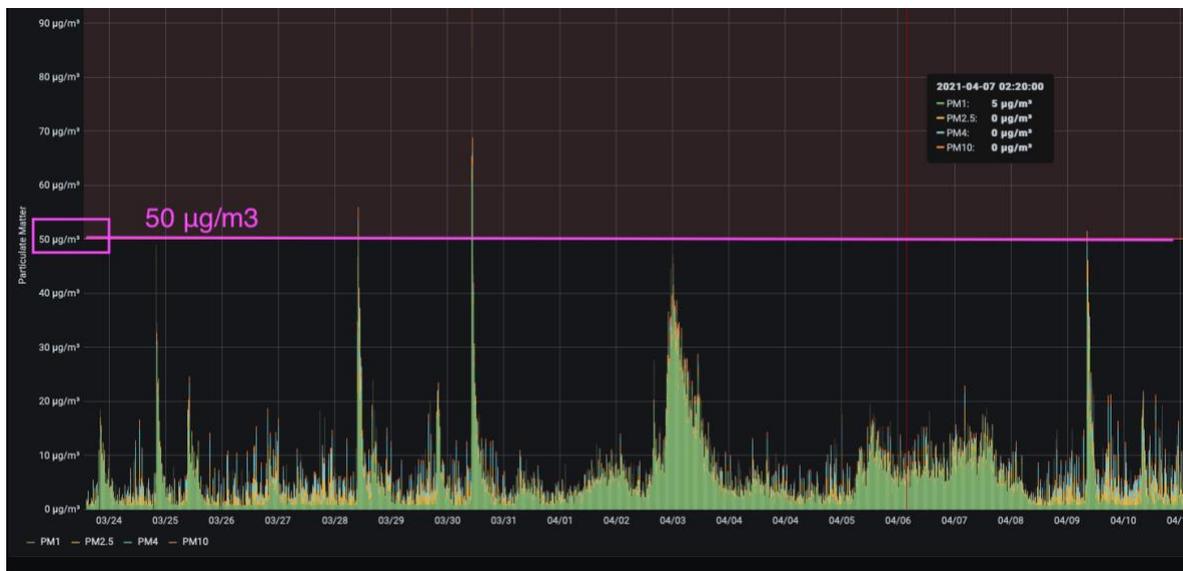
## Local Data

Cameron Munro has created a presentation on the bush fire smoke and Passive House performance that can be provided on request.

Noonameena has one of Cameron’s special sensor packs that monitors the air quality inside the building (unfortunately I have nothing that measures outside air quality to this level). The data in the table below shows the days before, during and after the main fire events in the summer of 2019/2020 in Central Victoria. The red circle shows the impact of the fires in early January 2020. 50 ug/m<sup>3</sup> is the pink line in both charts, WHO guidelines for safe habitable levels is 25 ug/m<sup>3</sup>.



The second chart below is data from the last 3 weeks (April 2021) with no smoke. Remember these are inside measurements. House remains at very low levels of PM infiltration. Most events that ramp up can correlated to windows and door being left open by an AirBnB guest who decided they needed more fresh air..... and we are in the country, so you can see what happens when the house is ‘open’. They left having realised that the house works best when closed. 😊



## Base Installation

Noonameena is a strawbale home in Central Victoria (Australia). It is a PHI Certified Low Energy Building and has been lived in for the past 3.5 years.

We have a Zehnder Q350 installed with 8 exhaust and 6 supply vents throughout the 3-bedroom, TFA 179m<sup>2</sup> home. We have run the house at 160m<sup>3</sup>/h in 'normal' mode and boost at 310m<sup>3</sup>/h. Normally we have 2 adults and 2 dogs in the home. Standard HRV F7 and G4 filters are installed.

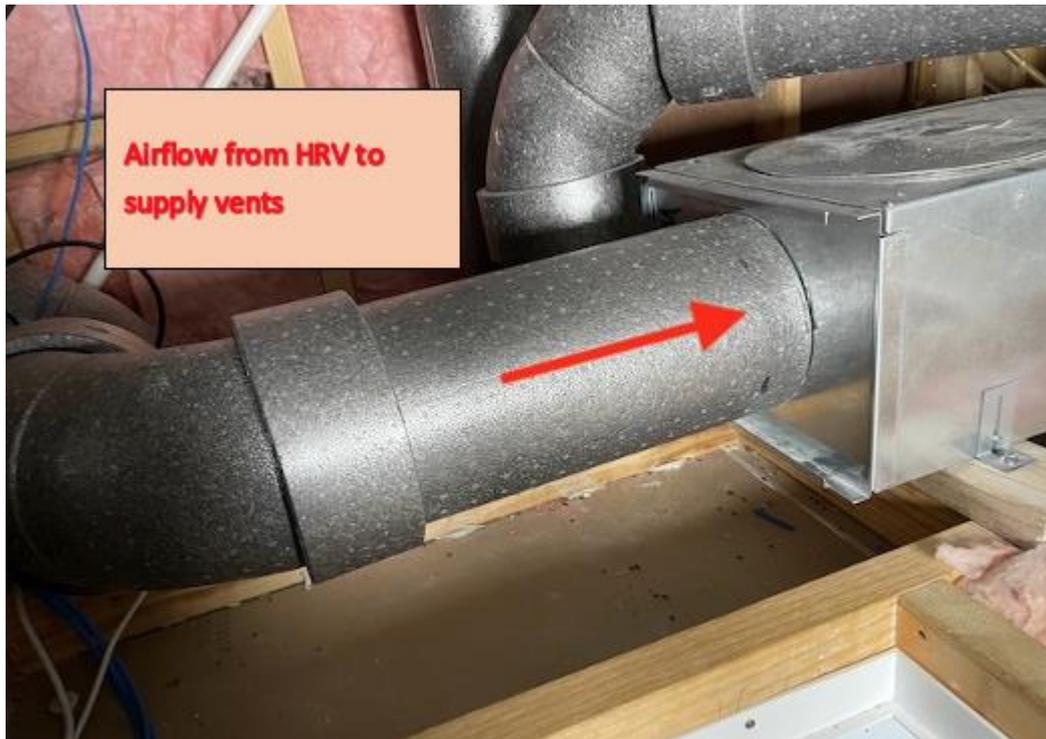
The system is located in the ceiling void above the laundry and uses 90mm Zehnder flexi pipe directly to each vent via manifolds attached to the attenuator located next to the machine. The external vents are located ~1.5m from the unit with differing pipe lengths between the unit and the manifolds.

My installation does not lend itself to a full layout image, too dark and is in a confined space. I have shown below an image of example installation showing where the HEPA filter is in relation to the HRV and the supply lines. Basically, it sits on the outbound side of the HRV (having been through the heat exchanger module and the two filters inside the HRV its self).



The system was balanced when commissioned and has been running beautifully. I do not show all aspects of the installation and am just focusing on the supply side and HEPA install.

Below is a photo of the supply side of the HRV and its attenuator which has the supply manifold attached (before the HEPA housing was installed).



### The HEPA filter

The HEPA filter (H11) was supplied by Fantech and fits Zehnder's CW320 filter housing which connects with the standard sliding connection system Zehnder use. The filter is mounted in sturdy aluminum casing with a black rubber like cushion on one side. I removed this to fit the filter in the housing.



## The Housing

The housing is standard Zehnder fare with the 'slip on' bracket keepers that provide a square and sound connection, compressing the standard black foam seal. No screws required and a firm fit. A flip top lid is provided for accessing the filter without the need to undo the keepers or any pipework.



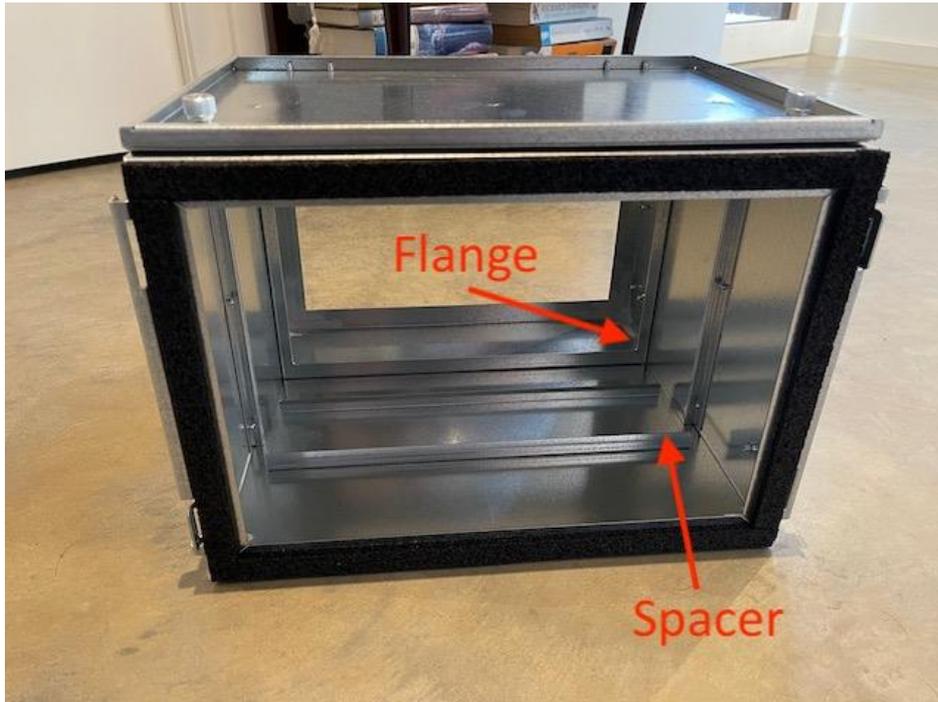
## Fitting the Filter

The CW320 housing does not seal the HEPA filter without some minor modifications and installation of some 'gasket' foam on one side of the filter. Given the intention is to be able to add the filter only when there is a smoke event, installing and removal should be simple and with easy access. The CW320 allows this easily.

## Modifying the housing

There are two spacer plates that come inside the housing unit. For this filter they are not required, however I did not remove (cut) the threads off that are bonded to the housing in the top and bottom sides of the housing. The nuts are not required either, and the threads can be left in place. Once the two spacer plates are removed, I decided that a rubber strip glued to the filter was not required as it would make removal of the filter in situ difficult and could be damaged.

There is a flange inside the box that is just the right size and position to install a rubber strip that the filter is installed against making it a snug and airtight fit.



I used some simple T section aluminum strips to provide a 'track' for the HRW side of the filter to keep the filter in place and square against the new rubber seals. The aluminum strips were riveted in place and foil tape used to cover the rivets avoiding any possible air leakage and or noise.

Rubber filter seals have double sided tape to keep the filter in place and sealed.





The completed filter installed in the housing can be seen below.

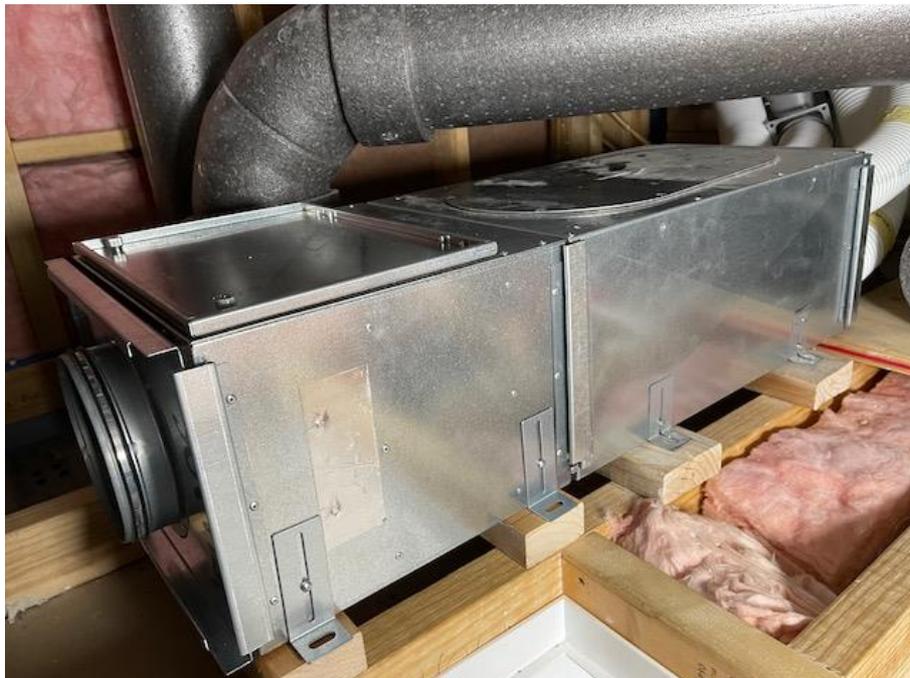




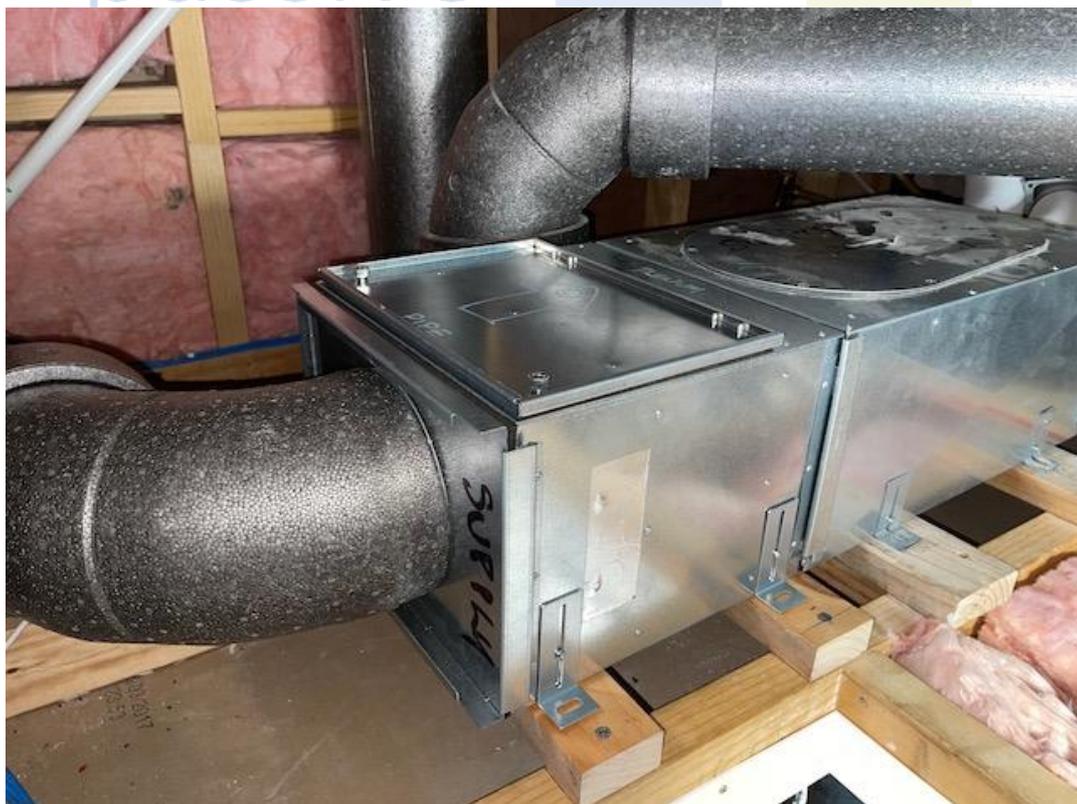
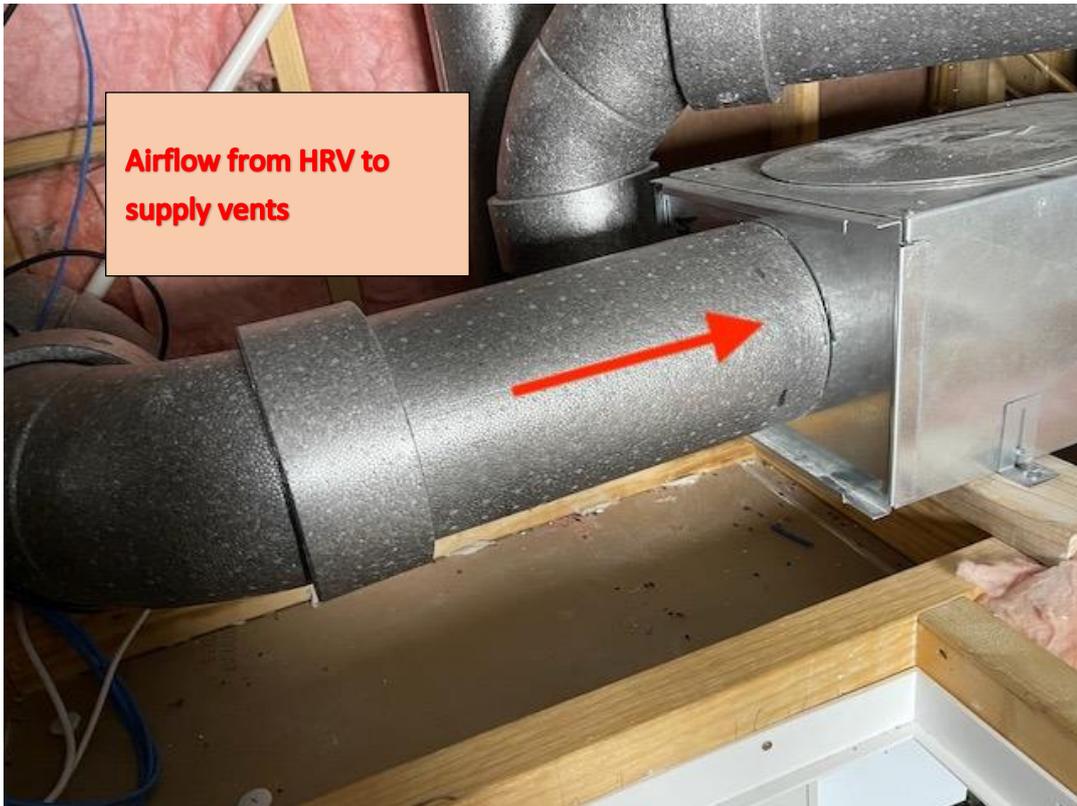
## Installing the housing

I must have known I would add a housing like this at some point as the section of pipe that needed removing was exactly the right length needed to fit the elbow straight on the flange for the new housing. No cutting required! I just rejiggered the attenuator to line things up so the pipes fitted squarely and resecured the flanges to the ceiling timbers.

On Fantech's advice I have not used tape to seal the 150mm foam pipes. Not required and it makes moving things about easy and quick.



Before and after images of the installation below.



I chose to install the housing just next to the manhole and directly to the attenuator. The screws (by hand) can be undone to flip the hinged 'lid' exposing the filter to install or remove.



## HRV Performance with and without the HEPA filter installed

Our Zehnder Q350 is installed with 8 exhaust and 6 supply vents throughout the 3-bedroom home. TFA is 179m<sup>2</sup>. 'Normal mode' is set at 160m<sup>3</sup>/h and boost is set to the maximum measured flow rate the unit will deliver with the HEPA filter installed which in our case is 275m<sup>3</sup>/h.

Fantech advises that the temperatures, flow rates and power consumption data provided by the Q Series unit can be used with confidence.

We recommissioned the machine with the HEPA filter installed and ran tests with the HEPA filter in and then ran the same test with it removed. This is now the normal configuration.

No other changes to the HRV were made with new standard F7 and G4 filters installed.

The table below provides an insight to the flow rates and power consumption in watts in both normal and boost mode tests.

The maximum measured flow rate the machine could provide with the filter installed is 275m<sup>3</sup>/h.

The power consumption impact of the HEPA filters based on our tests are shown in the table below.

ComfoAir Q350 HEPA Installation			Measured Maximum air flow 275 m <sup>3</sup> /h			
			Normal Preset 2 @ 160m <sup>3</sup> /h		Boost 275m <sup>3</sup> /h	
			No HEPA	With HEPA	No HEPA	With HEPA
Fans	Supply	Duty %	43	62	74	95
		Flow m <sup>3</sup> /h	164	164	267	267
	Exhaust	Duty %	46	46	79	76
		Flow m <sup>3</sup> /h	162	162	279	273
Power Consumption		Watts	37	48	102	146
Front panel messages			None	None	None	None

## Pricing

All labour was done by me and I would estimate given that I was making it up as I went along a reasonable installer with rubber strips and T flanges could do the housing work in an hour or so and then the making space for the housing on the attenuator will be very much site specific. My effort in the roof was less than 30 minutes if you take out the think time of an old man.... 😊

Costs vary by size of system. The following is guidance from Fantech:

- |                                       |                              |
|---------------------------------------|------------------------------|
| 1. Housings come in a number of sizes | Range from \$330-\$370 + GST |
| 2. H11 HEPA filter, gain vary in size | Range from \$270-\$340 + GST |
| 3. Foam strips, T sections and tape   | \$50.00                      |

