MVHRs – The solution or another thing to go wrong?

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Part of the BRE Trust

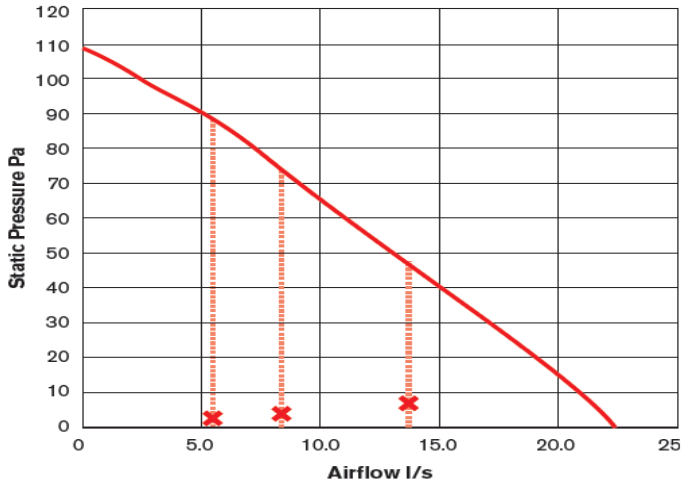
MVHRs – why chose a complex system? KISS

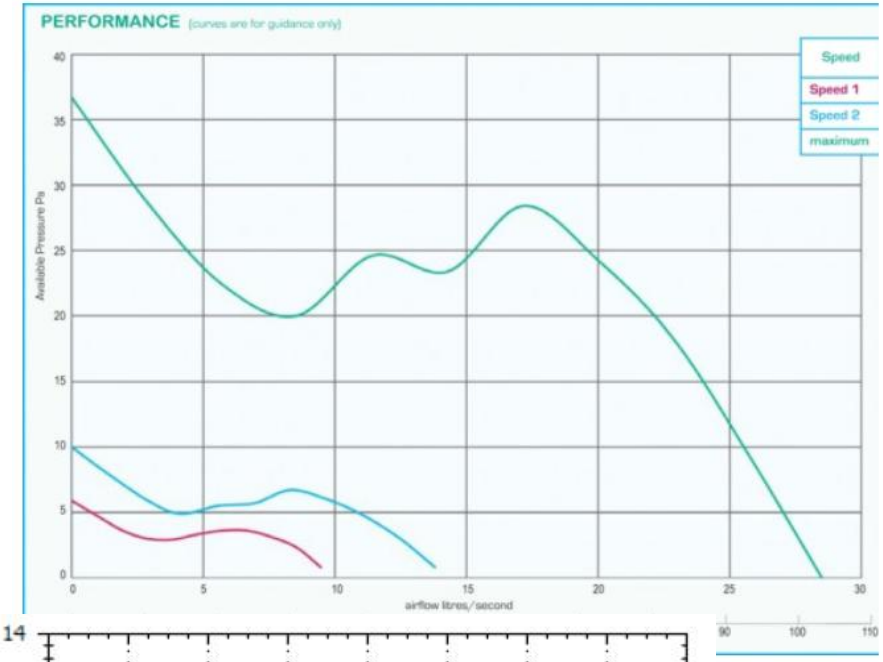
- **System 1 & 2**
  - Ventilation left to chance.

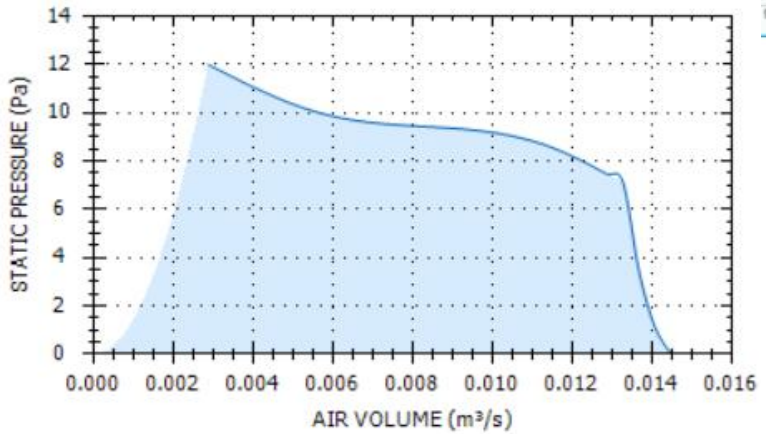
- The conclusions of a review of the future for IAQ in UK housing were:
  - Ventilation rates of at least 0.5 ach are necessary.
  - Infiltration (natural ventilation) will not effectively meet this requirement, therefore mechanical ventilation will be required.

MVHRs – why chose a complex system? KISS

- **System 3**
  - Central MEV
  - Decentralised MEV (dMEV)
    - Are they really up to it?







MVHRs – why chose a complex system? KISS

- **Build tight, ventilate right**
  - The Building Regulations assume fresh air is delivered to the ‘living’ rooms and exhaust air extracted from the ‘wet’ rooms.
- **System 3 or PIV**
  - Supply location and rate, or extract location and rate largely uncontrolled.
- **The solution – balanced ventilation – KISS for IAQ**

MVHRs – why chose a complex system? KISS

- **Balanced ventilation – options:**
  - PIV and MEV
  - Central balanced MV
  - Local (single room) balance ventilation with heat recovery
  - Central MVHR

MVHRs – why chose a complex system? KISS

- **Why MVHR?**
  - Ventilation load is becoming a very significant percentage of overall heating load as fabric insulation and airtightness levels become better.
  - A house should be comfortable as well as low energy. Reduction of draughts if designed properly.
- **MVHRs, KISS? definitely not and must be regarded as part of the *Building Services*, like; gas, electricity, plumbing, etc.**

One negative is the lack of ability to control temperature of rooms individually – some residents complain that they love the lack of cold, low heating bills, but the bedrooms are a bit too warm..

MVHRs – Who specifies and designs the system?

- **Specification of MVHR systems**
  - outside Passivhaus designs almost non existent. Typically; MVHR to meet AD-F. Occasionally required SFP and thermal efficiency values set out.

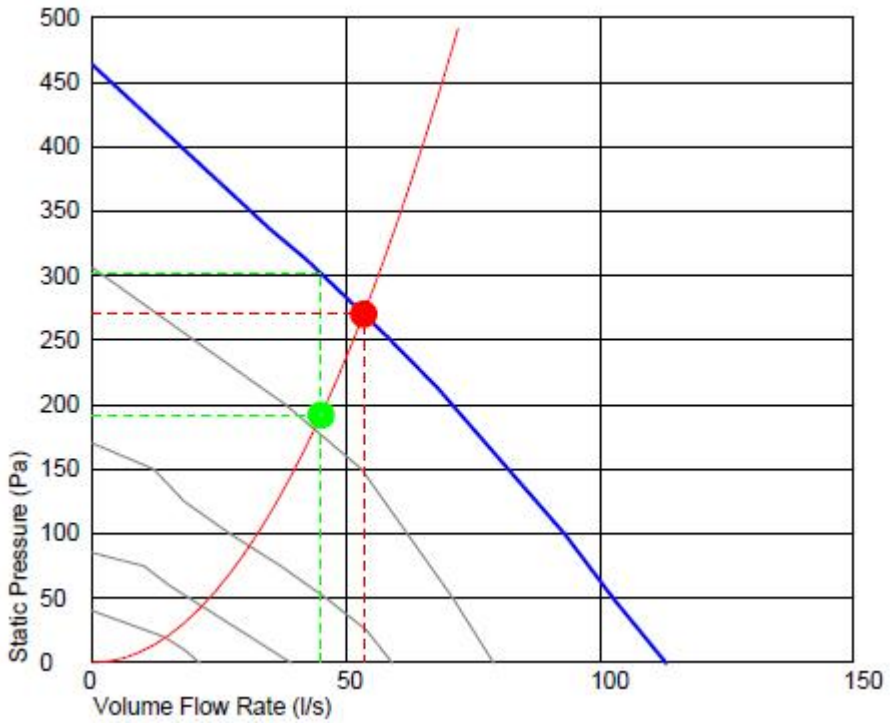
- **Design of MVHR systems**
  - M&E consultant
  - Importer/distributor
  - MVHR manufacturer

MVHRs – Who specifies and designs the system?

- **Design of MVHR systems**
  - Developer….M&E consultant….MVHR manufacturer….

THIS DRAWING IS FOR ILLUSTRATION PURPOSES ONLY. IN PREPARING THIS INFORMATION *the designer* HAS REFERRED TO RECOGNISED GUIDELINES SET OUT WITHIN THE BUILDING REGULATIONS AND OTHER RELEVANT ADVISORY DOCUMENTS AND ACKNOWLEDGES THAT THIS DOES NOT IN ANYWAY DEMONSTRATE COMPLIANCE WITH SUCH REGULATIONS.

Required Duty:	45 l/s @ 192 Pa
Actual Duty:	53 l/s @ 270 Pa
Actual at Required Flow:	45 l/s @ 302 Pa
Motor Input Power:	0.157 kW
Specific Fan Power:	2.948 W/(l/s)



Ventilation rates

– Mould potential increases as moisture content of air outside increases.

– AD-F – '*sized for the winter period. Additional ventilation may be required during warmer months and it has been assumed that the provision for purge ventilation (e.g. opening windows) could be used*.'

PUBLISHED DOCUMENT

PD CEN/TR 14788:2006

Ventilation for buildings — Design and dimensioning of residential ventilation systems

Table F.2 — Bedroom air temperature 16 °C

Air flow rate	Outdoor temperature -5 °C				Outdoor temperature 0 °C				Outdoor temperature +10 °C			
	Humidity		Risk?		Humidity		Risk?		Humidity		Risk?	
dm^3/s	g/kg	% RH	Cond	Mould	g/kg	% RH	Cond	Mould	g/kg	% RH	Cond	Mould
36,4	3,8	34	N	N	5,0	44	N	N	8,8	78	N	N
20,7	4,5	40	N	N	5,6	50	N	N	9,5	83	N	Y
14,4	5,0	45	N	N	6,2	55	N	N	10,0	88	Y	Y
10,8	5,6	50	N	N	6,8	60	N	N	10,6	93	Y	Y
6,9	6,8	60	N	N	7,9	70	Y	Y	11,6	100	Y	Y
3,8	8,7	77	Y	Y	9,7	86	Y	Y	13,2	100	Y	Y

Table F.3 — Bedroom air temperature 20 °C

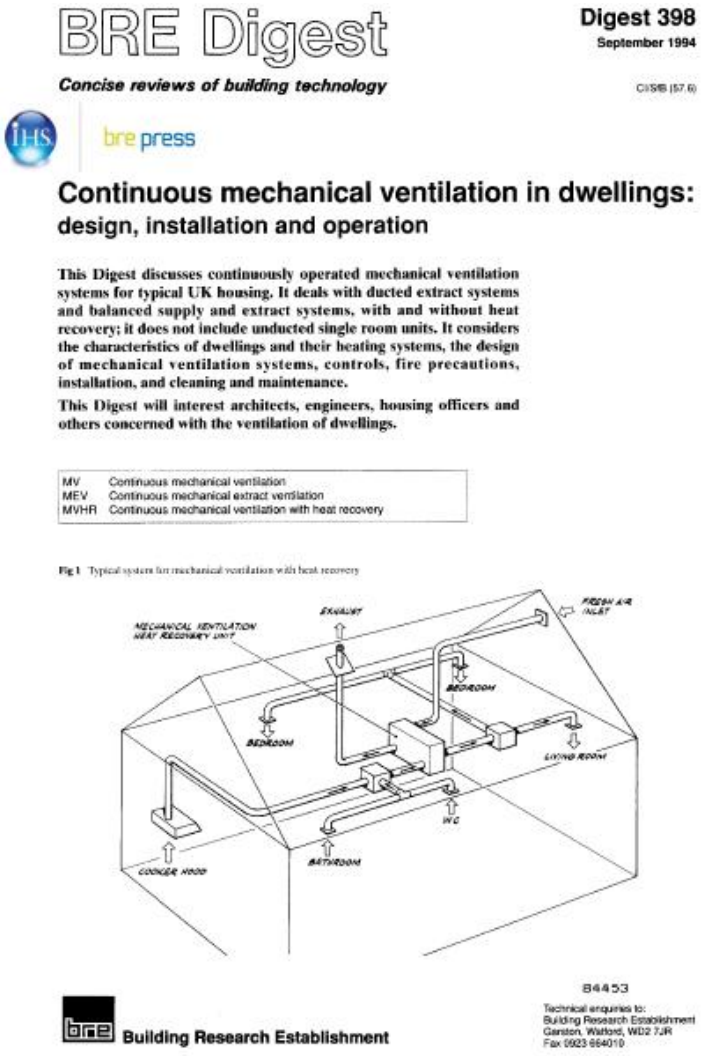
Air flow rate	Outdoor temperature -5 °C				Outdoor temperature 0 °C				Outdoor temperature +10 °C			
	Humidity		Risk?		Humidity		Risk?		Humidity		Risk?	
dm^3/s	g/kg	% RH	Cond	Mould	g/kg	% RH	Cond	Mould	g/kg	% RH	Cond	Mould
36,4	3,9	27	N	N	5,1	35	N	N	8,9	61	N	N
20,7	4,6	32	N	N	5,8	40	N	N	9,6	66	N	N
14,4	5,2	36	N	N	6,4	44	N	N	10,2	70	N	N
10,8	5,8	40	N	N	7,0	48	N	N	10,8	74	N	N
6,9	7,1	49	N	N	8,2	57	N	N	12,0	82	Y	Y
3,8	9,4	64	Y	Y	10,5	72	Y	Y	14,1	96	Y	Y

Ventilation rates

- Based on AD-F, we should not be sizing for '*minimum*', we should remember that this is the minimum a system will operate at, not the only operating point.

- Implications:
  - Sizing.
  - Noise.
  - Controls.

- Home Quality Mark, system capable of:
  - Each bedroom has 2 occupants.
  - Boost of additional 25%.



BRE Digest

Digest 398
September 1994

Concise reviews of building technology

bre press

Continuous mechanical ventilation in dwellings: design, installation and operation

This Digest discusses continuously operated mechanical ventilation systems for typical UK housing. It deals with ducted extract systems and balanced supply and extract systems, with and without heat recovery; it does not include unducted single room units. It considers the characteristics of dwellings and their heating systems, the design of mechanical ventilation systems, controls, fire precautions, installation, and cleaning and maintenance.

This Digest will interest architects, engineers, housing officers and others concerned with the ventilation of dwellings.

MV	Continuous mechanical ventilation
MEV	Continuous mechanical extract ventilation
MVHR	Continuous mechanical ventilation with heat recovery

Fig 1 Typical system for mechanical ventilation with heat recovery

84453

Building Research Establishment

Technical enquiries to:
Building Research Establishment
Garston, Watford, WD2 7JR
Fax 0923 664010

Ventilation rates – purge?

- **Purge ventilation in AD-F**
  - Purge ventilation to provide intermittent removal of pollutants.
  - If purge vent can not be achieved through opening of windows – use extract ventilation fan achieving an extract rate of 4 ach.

Clearly no MVHR system would be able to do eight times the background ventilation rate.

- Ventilation can also be used to control temperature …. MVHRs and overheating..

MVHRs and overheating

- The causes of overheating:
  - Heat balance
  - Heat gains
    - Internal
    - External
  - Heat losses
    - Heat storage
    - Heat rejection

- The heat balance is simple:

  Heat gains = heat losses + heat rejected

But can an MVHR reject heat? and a is summer by-pass effective?

MVHRs

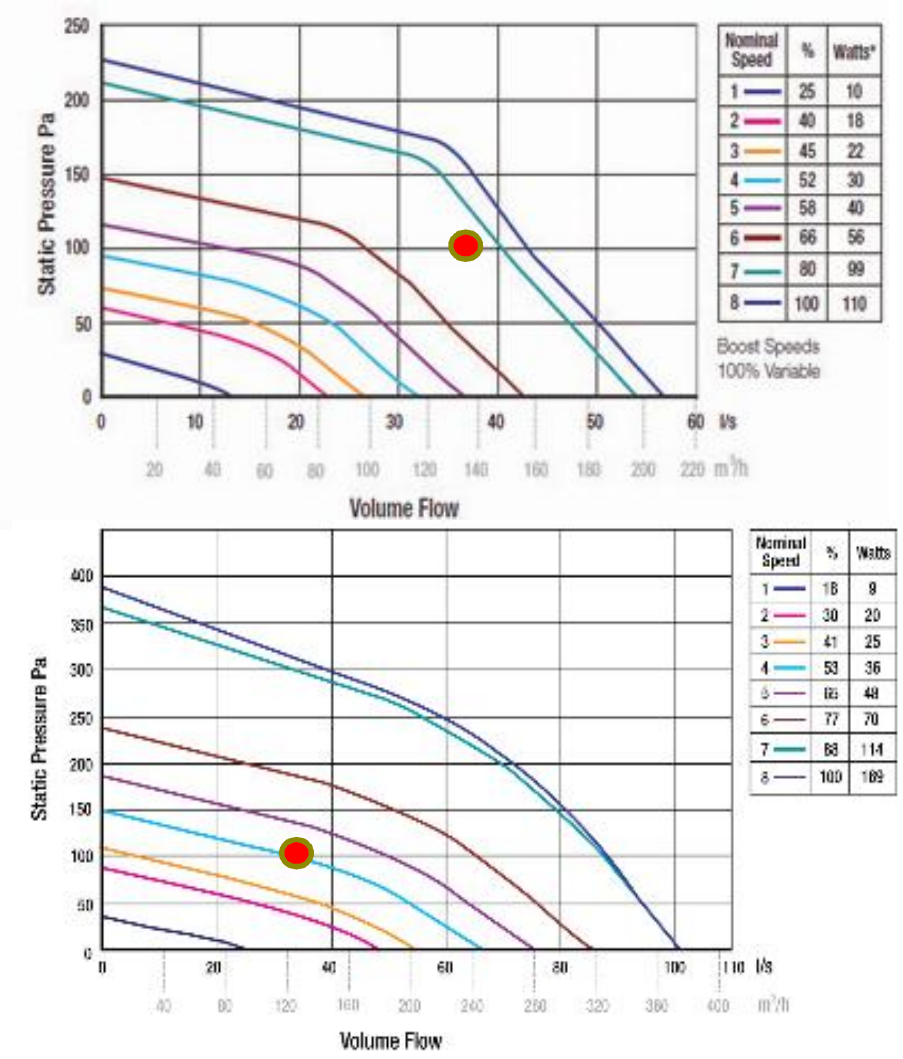
– What size of MVHR?

– Two MVHRs same manufacturer, one small to medium and the other medium to large dwellings.

– Assume flow rate required is 37 l/s and system pressure ~ 100 Pa. a medium sized system.

– Small MVHR is at a fan speed of approx. 75% and pulling ~80 W

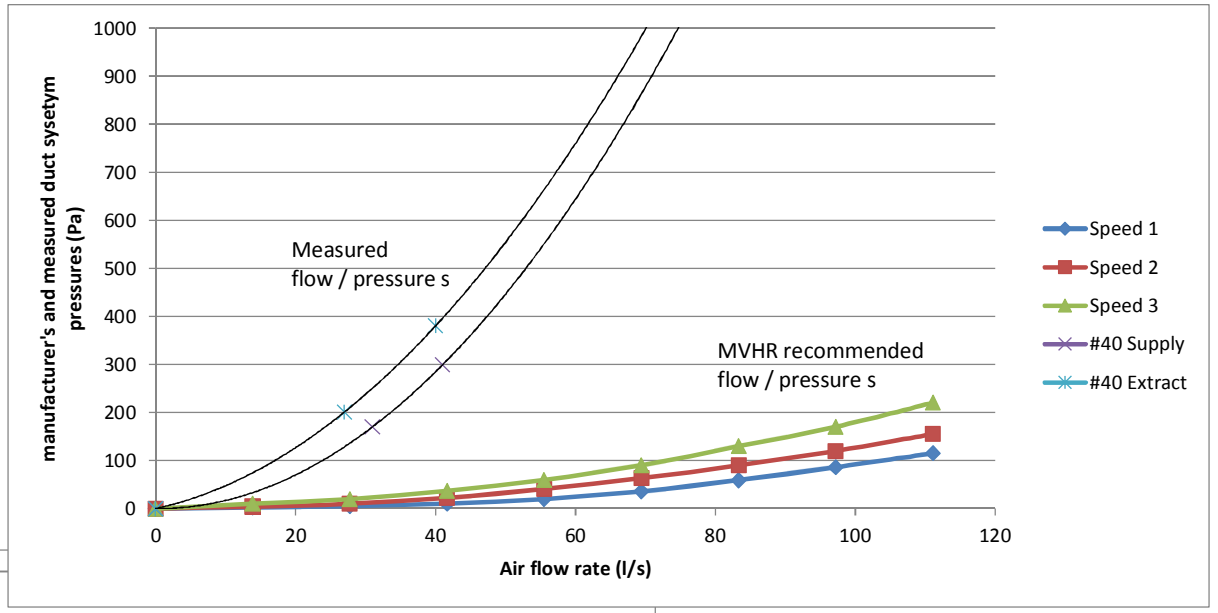
– Larger MVHR is at a fan speed of approx. 53% and pulling ~36 W

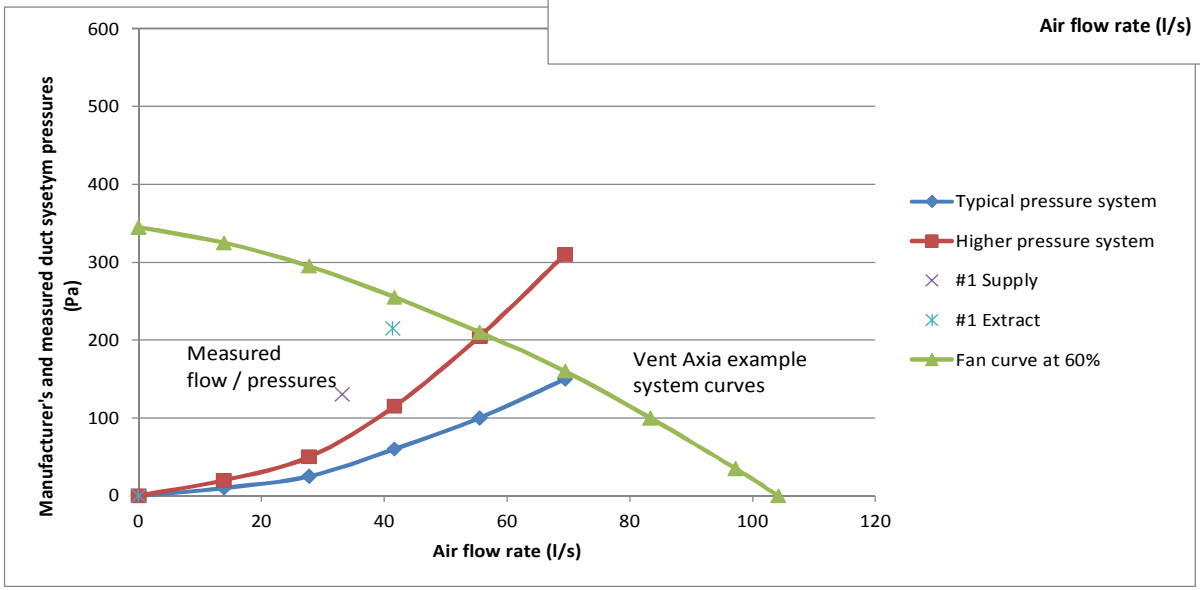


– Choice:– cost, noise, size, life span, etc.

MVHRs

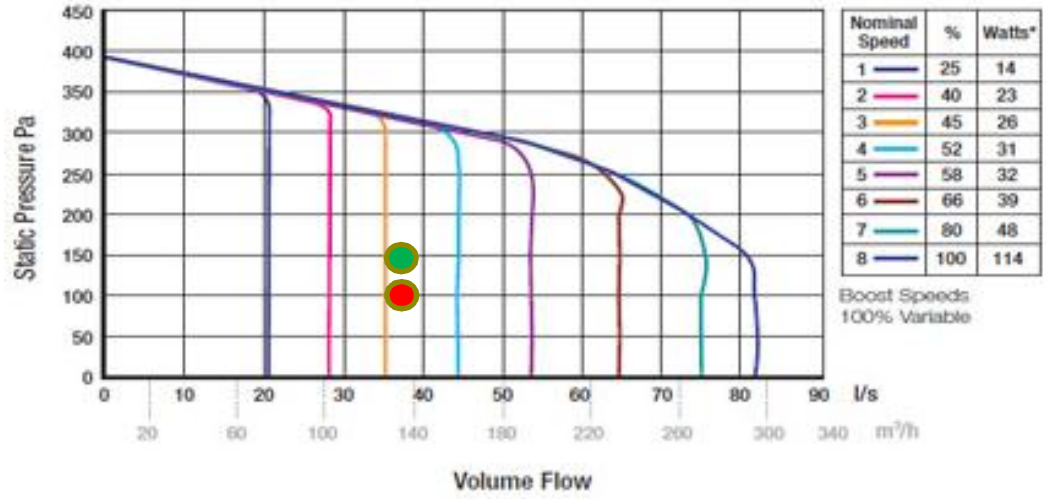
– Duct system design

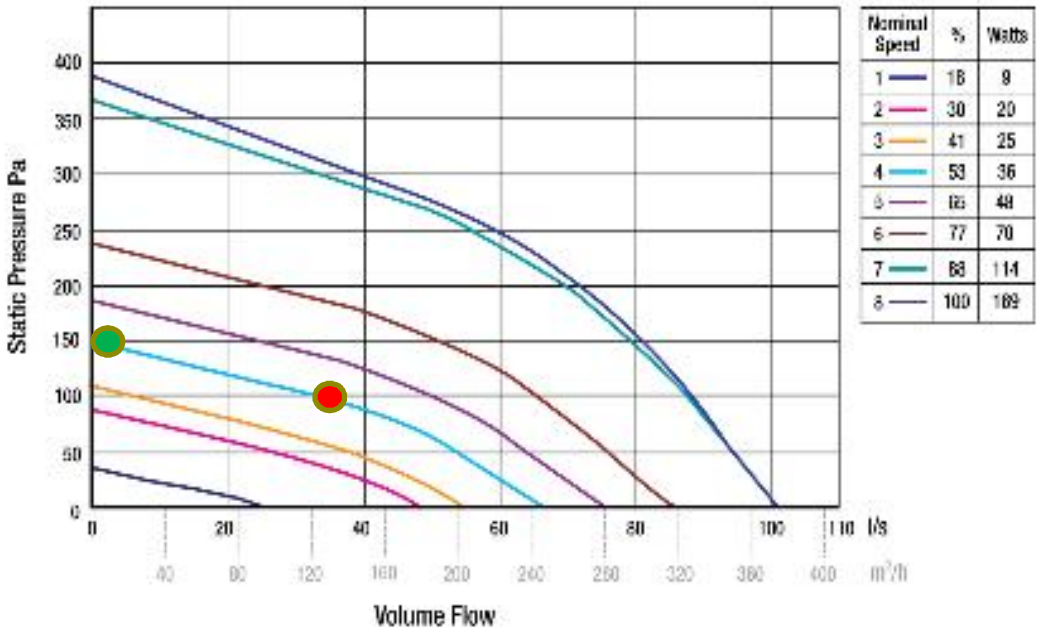




MVHRs

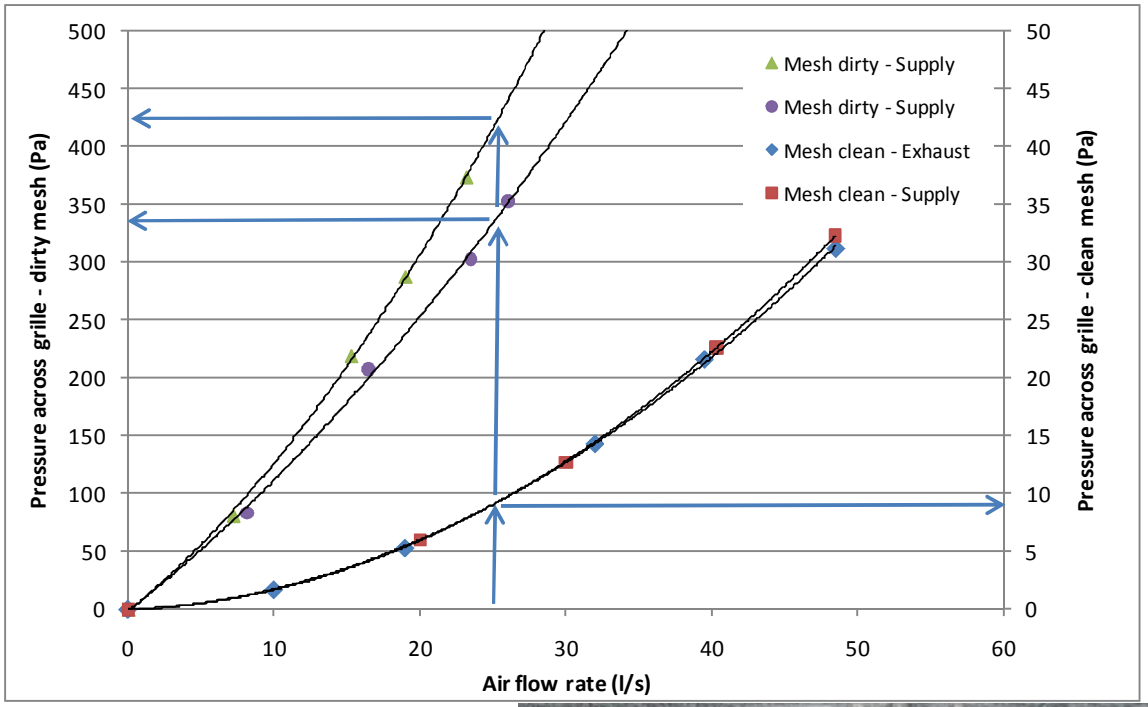
– Fan speed control, two basic options:
  – *Fixed fan speed*
  – *Constant volume*





MVHRs

– Fly screens

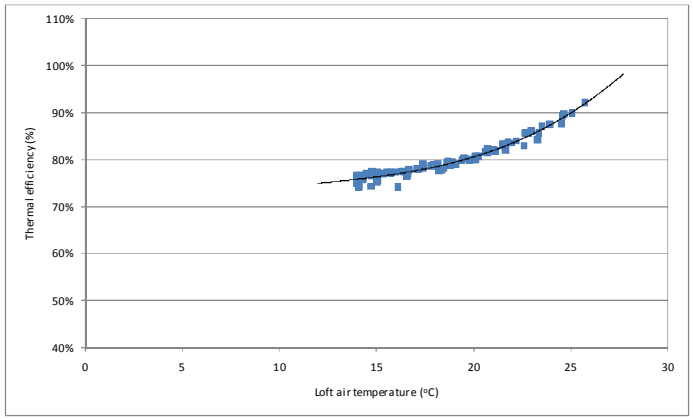


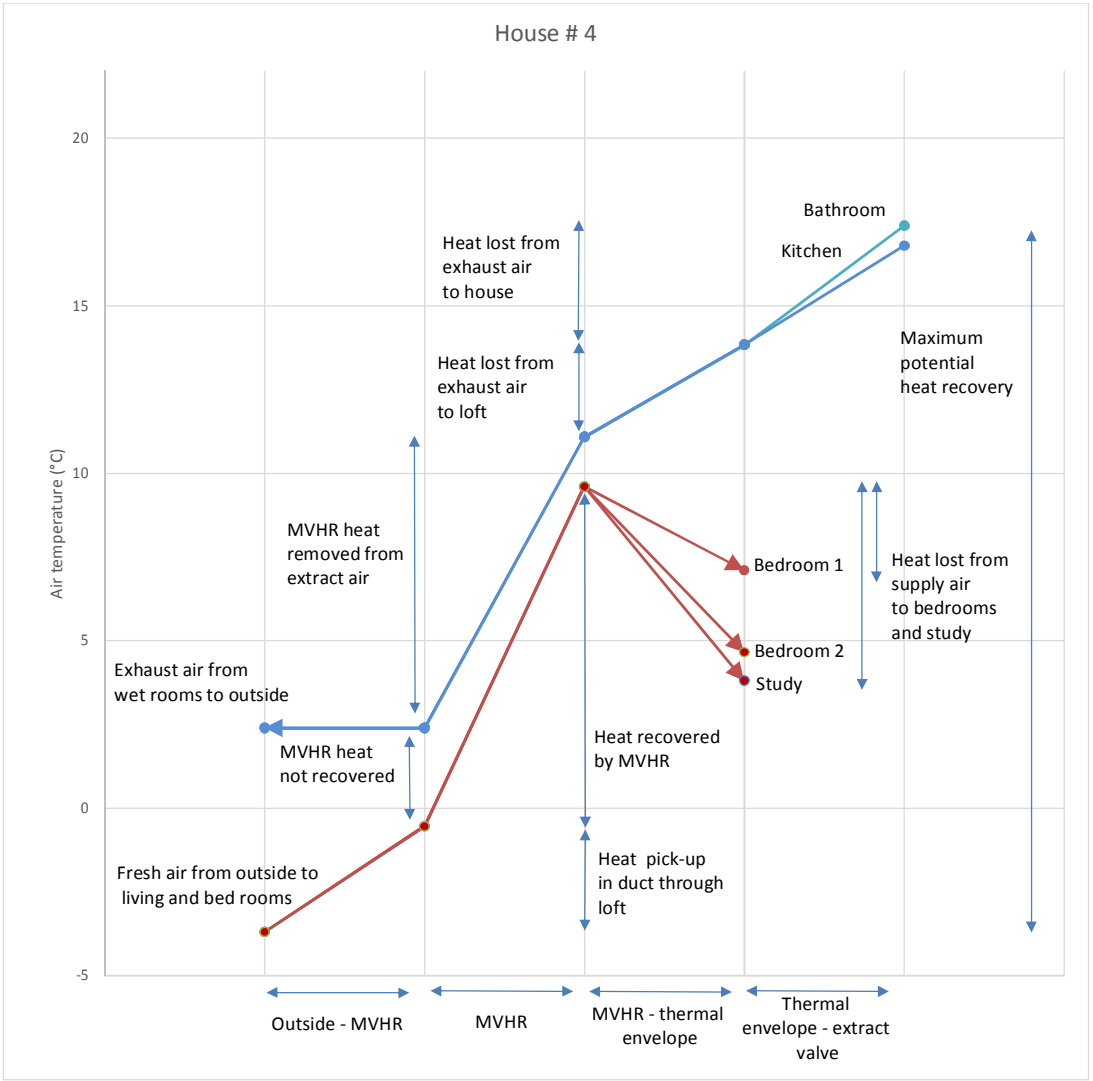
MVHRs

- Location – why does it matter?
  - Thermal performance and comfort

Outside the envelope – poor insulation on warm ducts

No additional insulation on

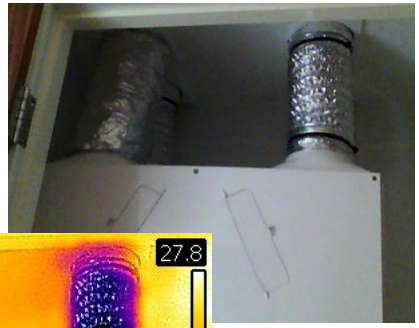


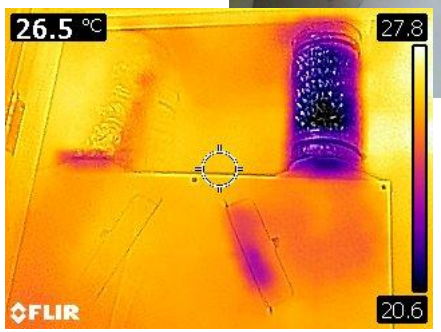


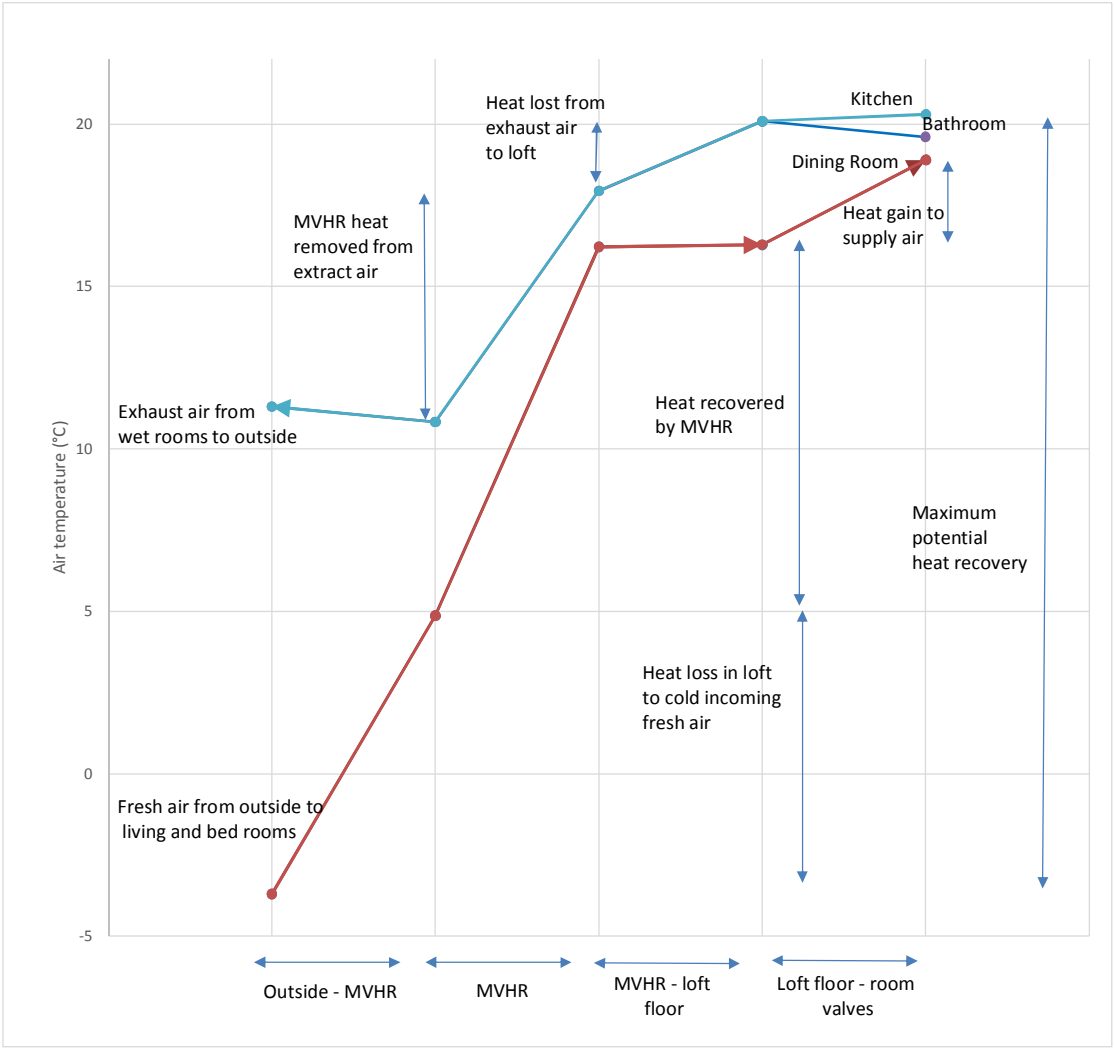
MVHRs

- Location – why does it matter?
  - Thermal performance

Inside the envelope – poor insulation on cold ducts



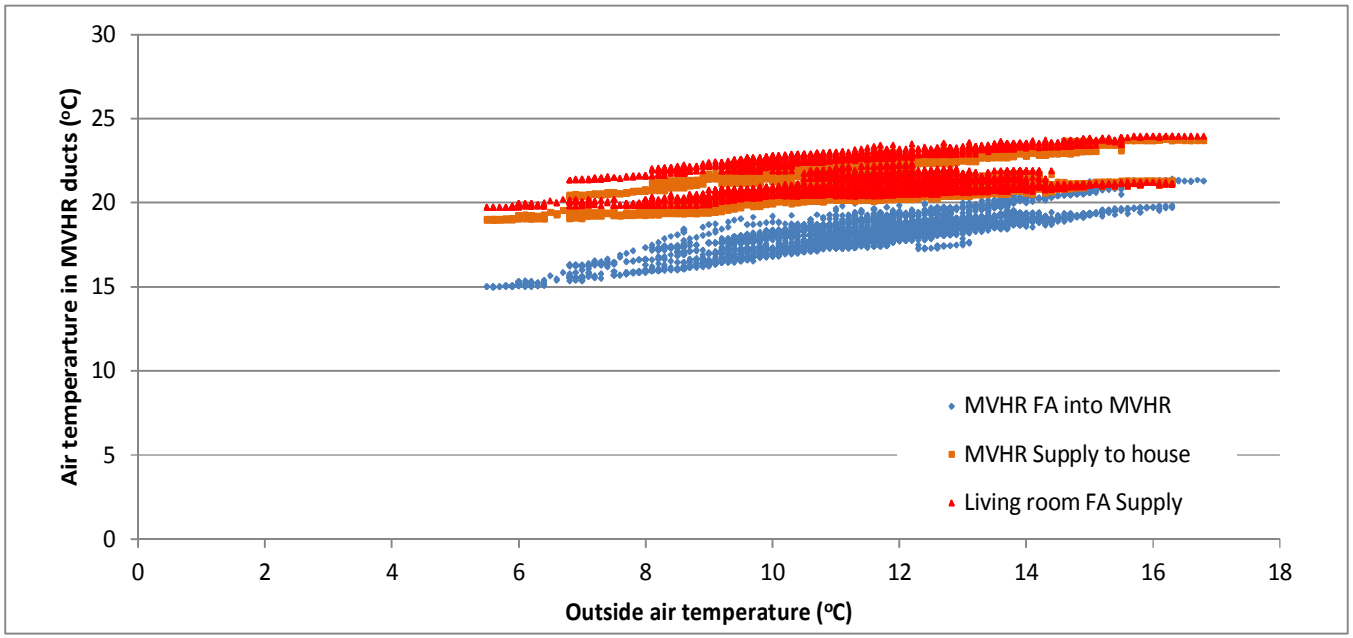




MVHRs

– Location – why does it matter?
  – Thermal performance - overheating

Inside the envelope – poor insulation on cold ducts



MVHRs

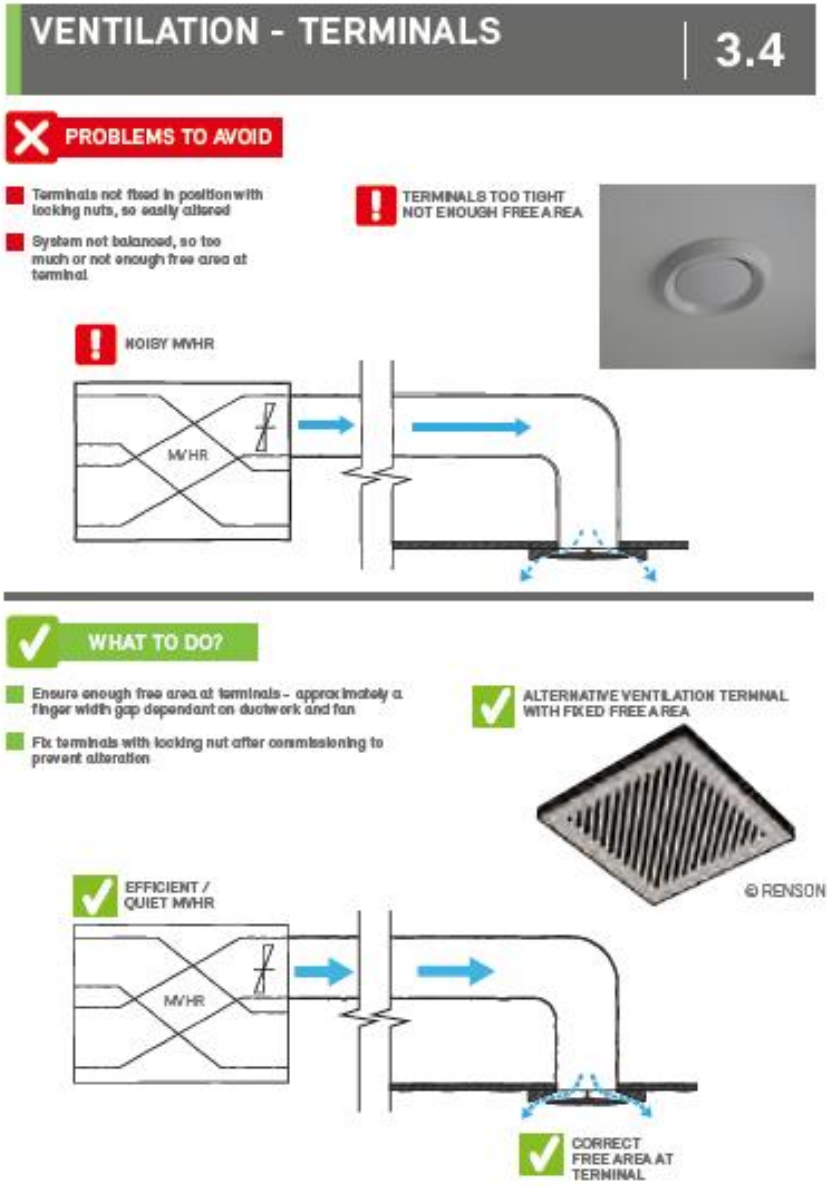
- Do we really need frost protection?
- Impact of poor strategy

MVHRs – The solution or another thing to go wrong?

– The lack of understanding and appreciation of ventilation as a ‘service’ is only very slowly being addressed..

!!!

The impacts of getting it wrong are very significant – ‘integrated design approach’ is required for all buildings, including the smallest dwellings.



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