Mark Elton

HEAT RECOVERY VENTILATION | AN ARCHITECT’S PERSPECTIVE

Mechanical Ventilation Heat Recovery
(counter flow heat exchanger with an efficiency of greater than 75%)

Supply to dwelling +45°C (+50°C max due to safety reasons) at a min ventilation rate of 1m³/(hr.m²)

Extract from dwelling +20°C
WE NEED AIR TIGHT FABRIC

compact building form

draught-free construction with continuous air barrier

thermal bridge-free construction

supper insulation via a continuous thermal envelope

summer shading

operable windows

extract air

night purge ventilation in summer

optimum winter solar gains

extract air

intake air

whole house mechanical ventilation with heat recovery

triple-glazed PH-standard fenestration

supply air

supply air

extract air

exhaust air

HRV
WHY DO WE NEED HRV?

- Energy
- Reliability
- Health

Exhaled 3742 times, boiled 1 litre of water, watered flowers, sneezed 3 times, washed 2 pairs of socks, cried for 1.6 minutes from peeling onions... hmm ... by my calculation the window should be opened by 2.5cm for 4.3 minutes to give the right cross flow ventilation.
WHY DO WE NEED HRV?

‘natural ventilation’

... is it really the healthy option?
SUCCESSFUL HRV DESIGN STARTS WITH THE ARCHITECT

- **Essential** part of Passivhaus design
- Crucial design considerations
  - location of heat exchanger (filter access, noise break out, length of intake/exhaust)
  - design of the duct layout (inlet design, fabric integration, silencers, return paths)
  - diffuser/vent/inlet strategy (coanda effect, cascade design)
  - efficiency (balanced supply and extract, summer bypass)
  - controls (simple, visible, feedback)
SUCCESSFUL HRV DESIGN STARTS WITH THE ARCHITECT

• **Essential** part of Passivhaus design

• Crucial design considerations
  – location of heat exchanger (filter access, noise break out, length of intake/exhaust)
  – design of the duct layout (inlet design, fabric integration, silencers, return air paths)
  – diffuser/vent/inlet strategy (coanda effect, cascade design)
  – efficiency (balanced supply and extract, summer bypass)
  – controls (simple, visible, feedback)

Ditchingham Passivhaus – Parsons & Whittley

Denby Dale Passivhaus – Green Building Store
SUCCESSFUL HRV DESIGN STARTS WITH THE ARCHITECT

- **Essential** part of Passivhaus design
- Crucial design considerations
  - location of heat exchanger (filter access, noise break out, length of intake/exhaust)
  - design of the duct layout (inlet design, fabric integration, silencers, return air paths)
  - diffuser/vent/inlet strategy (coanda effect, cascade design)
  - efficiency (balanced supply and extract, summer bypass)
  - controls (simple, visible, feedback)
SUCCESSFUL HRV DESIGN STARTS WITH PHPP

- Choose certified HRV units
- Input design parameters
- Instant feedback on modelled performance
- Can be used as sole heating source?

Effective Heat Recovery Efficiency of the Ventilation System with Heat Recovery

- Central unit within the thermal envelope.
- Central unit outside of the thermal envelope.

Effective Heat Recovery Efficiency

\[ \eta_{hr} \]

\[ \eta_{hr} = \frac{Q_{recovered}}{Q_{in}} \]

Effective Heat Recovery Efficiency Subsoil Heat Exchanger

\[ \eta_{shx} \]

\[ \eta_{shx} = \frac{Q_{recovered}}{Q_{in}} \]

Certified Heat Recovery Units

<table>
<thead>
<tr>
<th>No.</th>
<th>Heat Recovery Unit</th>
<th>Heat Recovery Efficiency</th>
<th>Electric Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User defined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Compact unit as selected in Compact work</td>
<td>Kg/a</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Reo-Boxx CONFORT - ARREX</td>
<td>85%</td>
<td>0.35</td>
</tr>
<tr>
<td>7</td>
<td>Confoair 500 - StorkAir</td>
<td>60%</td>
<td>0.42</td>
</tr>
</tbody>
</table>

\[ \Psi \text{-value Supply or Ambient Air Duct} \]

- Nominal Width: 150 mm
- Insul. Thickness: 25 mm
- Reflective? Please mark with an "X".
- Yes
- No
- Thermal Conductivity: 0.04 W/(mK)
- Nominal Air Flow Rate: 51 m³/h

\[ \Psi \text{-value Extract or Exhaust Air Duct} \]

- Nominal Width: 150 mm
- Insul. Thickness: 25 mm
HRV MYTHS?

• HRV uses too much energy - Passivhaus and PHPP performs as predicted. Designed right, it is a fraction of energy saved.

• HRV systems are too noisy - Passivhaus requirement. Racecourse found no discernible noise breakout!

• Indoor air quality suffers with HRV - Passivhaus HRV is healthier. Camden PH improved on external air quality!

• A house needs natural ventilation to be healthy - Wolverhampton schools improved pupil alertness. Interserve office reduced sickness absence. Racecourse reduced asthma and arthritis.
HRV CHALLENGES?

• Integrated design.
  
  Architect has to lead

• IAQ source control.
  
  Specification of materials crucial

• Controls and user interface.
  
  Consider change of filters, boost button, summer mode etc

• Overheating.
  
  Design for night purging - intuitive, stratified and secure venting