New homes – damp, mouldy and overheating. Why?

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Damp, mouldy and overheating – the future.

- The performance gap – potentially a larger gap in satisfaction with the indoor comfort and IAQ than in energy use.

- The message from the mechanical ventilation industry very much focused on IAQ agenda and problems of low ventilation.

- Awareness of developers and social housing providers increased regarding overheating over the past few years

- Is there a link?
The conclusions of the 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.
- Energy use requirements will tend to suggest MVHR is the most appropriate system.
- MVHRs are not without problems and these must be addressed if they are to be rolled out across the future housing stock.
Damp and mouldy

– The Building Regs. AD-F suggests a range of means of achieving effective ventilation:
  – System 1 – Natural plus intermittent fans.
  – System 2 – Passive stack.
  – System 3 - MEV – continuous extract.
  – System 4 – MVHR continuous supply and extract.

– Overall ventilation rates all ‘minimum’ and ‘sized for winter period’.
Damp and mouldy

- 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.’

Ventilation for buildings — Design and dimensioning of residential ventilation systems

Table F.2 — Bedroom air temperature 16 °C

<table>
<thead>
<tr>
<th>Air flow rate</th>
<th>Outdoor temperature -5 °C</th>
<th>Outdoor temperature 0 °C</th>
<th>Outdoor temperature +10 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>dm³/s</td>
<td>Humidity</td>
<td>Risk?</td>
<td>Humidity</td>
</tr>
<tr>
<td>g/kg</td>
<td>% RH</td>
<td>Cond</td>
<td>Mould</td>
</tr>
<tr>
<td>36.4</td>
<td>3.8</td>
<td>34</td>
<td>N</td>
</tr>
<tr>
<td>20.7</td>
<td>4.5</td>
<td>40</td>
<td>N</td>
</tr>
<tr>
<td>14.4</td>
<td>5.0</td>
<td>45</td>
<td>N</td>
</tr>
<tr>
<td>10.8</td>
<td>5.6</td>
<td>50</td>
<td>N</td>
</tr>
<tr>
<td>6.9</td>
<td>6.8</td>
<td>60</td>
<td>N</td>
</tr>
<tr>
<td>3.8</td>
<td>8.7</td>
<td>77</td>
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</table>

Table F.3 — Bedroom air temperature 20 °C

<table>
<thead>
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<th>Air flow rate</th>
<th>Outdoor temperature -5 °C</th>
<th>Outdoor temperature 0 °C</th>
<th>Outdoor temperature +10 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>dm³/s</td>
<td>Humidity</td>
<td>Risk?</td>
<td>Humidity</td>
</tr>
<tr>
<td>g/kg</td>
<td>% RH</td>
<td>Cond</td>
<td>Mould</td>
</tr>
<tr>
<td>36.4</td>
<td>3.9</td>
<td>27</td>
<td>N</td>
</tr>
<tr>
<td>20.7</td>
<td>4.6</td>
<td>32</td>
<td>N</td>
</tr>
<tr>
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<td>40</td>
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<td>7.1</td>
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<tr>
<td>3.8</td>
<td>9.4</td>
<td>64</td>
<td>Y</td>
</tr>
</tbody>
</table>
Damp and mouldy – why now?

– Infiltration very significantly decreased. Ventilation now approaching the old mantra; ‘Build tight, ventilate right’.

– But do we ventilate right?
  – System 1 – Natural plus intermittent fans.
  – System 2 – Passive stack.
  – System 3 - MEV – continuous extract.
  – System 4 – MVHR continuous supply and extract.
Damp and mouldy – the future

- 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%.
Damp and mouldy – the future

- Is System 4 the most appropriate system?
  - Maintenance of:
    - The fan unit.
    - The filters.
    - The ducts.

- 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.
Overheating – why?

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

– Why do we have a problem in modern dwellings?
Overheating - why?

- The heat balance is simple:

  Heat gains = heat losses + heat rejected

UK dwellings – not been a problem ….. well, maybe loft conversions …
Overheating – why?

– Fabric insulation – well insulated and getting better

– Airtightness – good and getting better

– Glazing and shading – balance of daylight and gains

– Internal gains / usage patterns – defined by building user and overall little little changed

– Thermal mass – move towards lower mass with timber frame, plasterboard lining on walls and partitions, etc.
Overheating – why?

– The heat balance is simple:
  
  \[ \text{Heat gains} = \text{heat losses} + \text{heat rejected} \]

But how do we reject heat from dwellings and most UK buildings?

  Ventilation – natural or mechanically driven

Ventilation of buildings is for the provision of fresh air and removal of pollutants; moisture, odours, etc.

\textit{Purge ventilation} is intermittent, i.e. required only when such occasional activities occur. \textit{Purge ventilation} provisions may also be used to improve thermal comfort, although this is not controlled under the Building Regulations.
Overheating – why?

- Ventilation as a means of heat rejection
  - Type of windows
  - Ability to achieve purge ventilation overnight
Overheating – why?

HOME IS WHERE THE HEAT IS

"We’ve forgotten how to design for natural ventilation in dwellings – we’ve lost the art"

Michael Swainson

CIBSE Journal August 2014

Is this really good design?
Overheating – why?

Is this really good design?
Damp, mouldy and overheating – not that is a performance gap!

- Is there a link between IAQ and overheating?
  
  - Clearly AD-F background ventilation rates are minimum, not the value to just achieve with a fan running flat out.
  
  - AD-F works for design conditions – cold and relatively low absolute moisture content, but what about warmer/wetter periods?
  
  - Purge ventilation – designers/developers see in only in terms of AD-F, but occupants see it in terms of thermal comfort. There is a serious problem with windows not viewed as part of ‘comfort provision’ i.e. building services.
Overheating homes. Why?

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