New homes – damp, mouldy and overheating. Why?

Mich Swainson
BRE HVAC Engineering
swainsonm@bre.co.uk

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Part of the BRE Trust

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?**

Damp and mouldy

- 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*.'

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

Damp and mouldy – why now?

- Infiltration very significantly decreased. Ventilation now approaching the old mantra; '***Build tight, ventilate right***'.

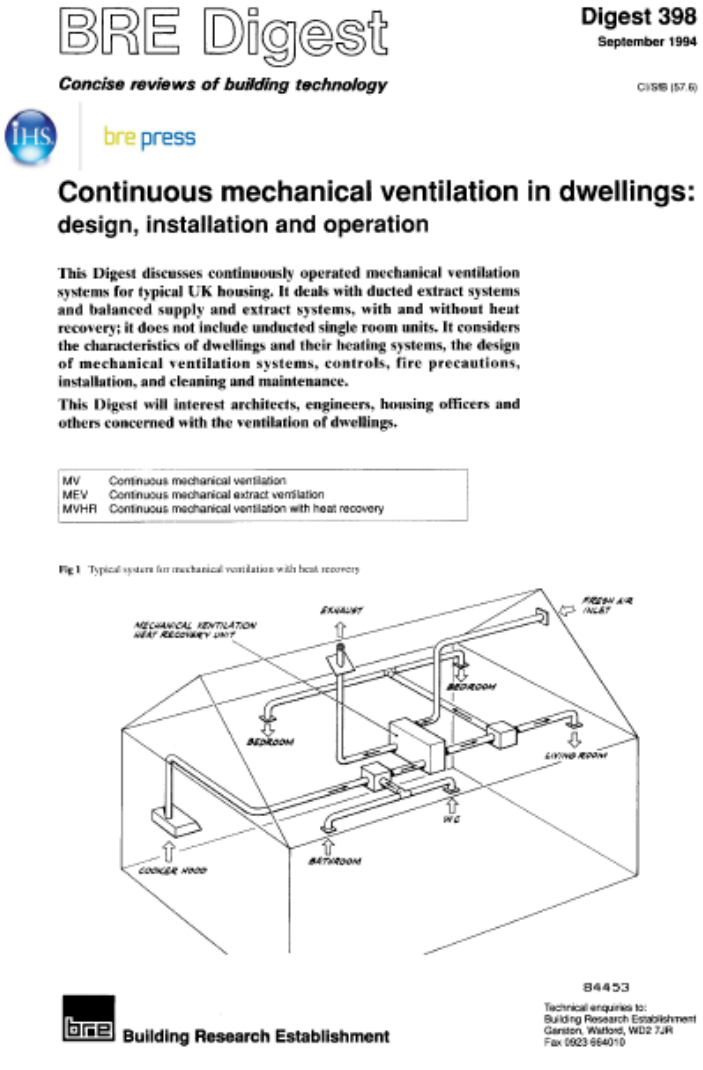
- But do we *ventilate right ?*
  - System 1 – Natural plus intermittent fans.
  - System 2 – Passive stack.
  - System 3 - MEV – continuous extract.
  - System 4 – MVHR continuous supply and extract.

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%.



BRE Digest

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Concise reviews of building technology

CI/SfB (57.6)

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

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Building Research Establishment

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

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?

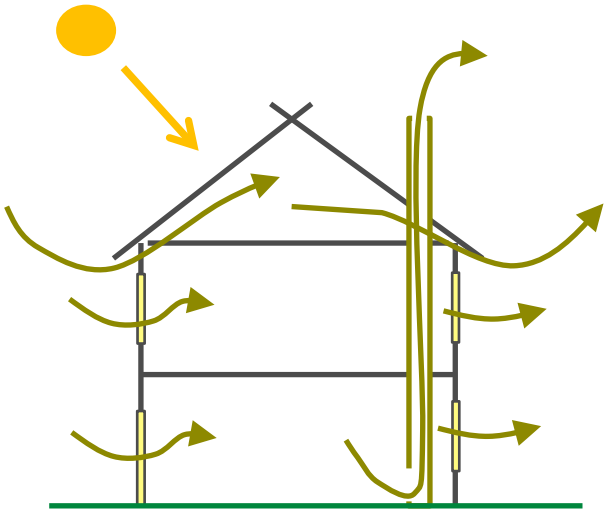
- The causes of overheating:
  - Heat balance
  - Heat gains
    - Internal
    - External
  - Heat losses
    - Heat storage
    - Heat rejection

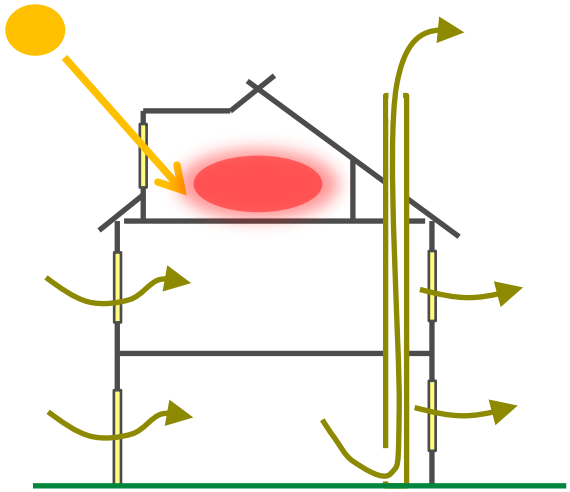
- Why do we have a problem in modern dwellings?

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 changed
- Thermal mass – move towards lower mass with timber frame, plasterboard lining on walls and partitions, etc.

Overheating – why?

– The heat balance is simple:

Heat gains = heat losses + heat rejected

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

Ventilation – natural or mechanically driven

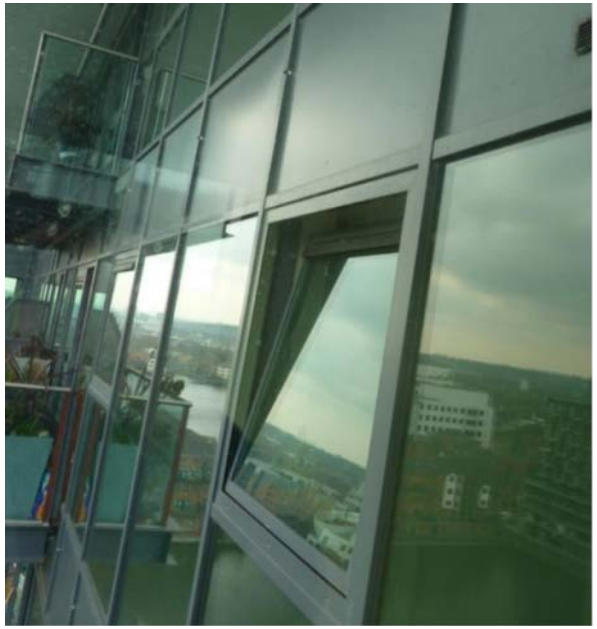
Ventilation of buildings is for the provision of fresh air and removal of pollutants; moisture, odours, etc.

AD-F 2010 states:

Purge ventilation is intermittent, i.e. required only when such occasional activities occur. ***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

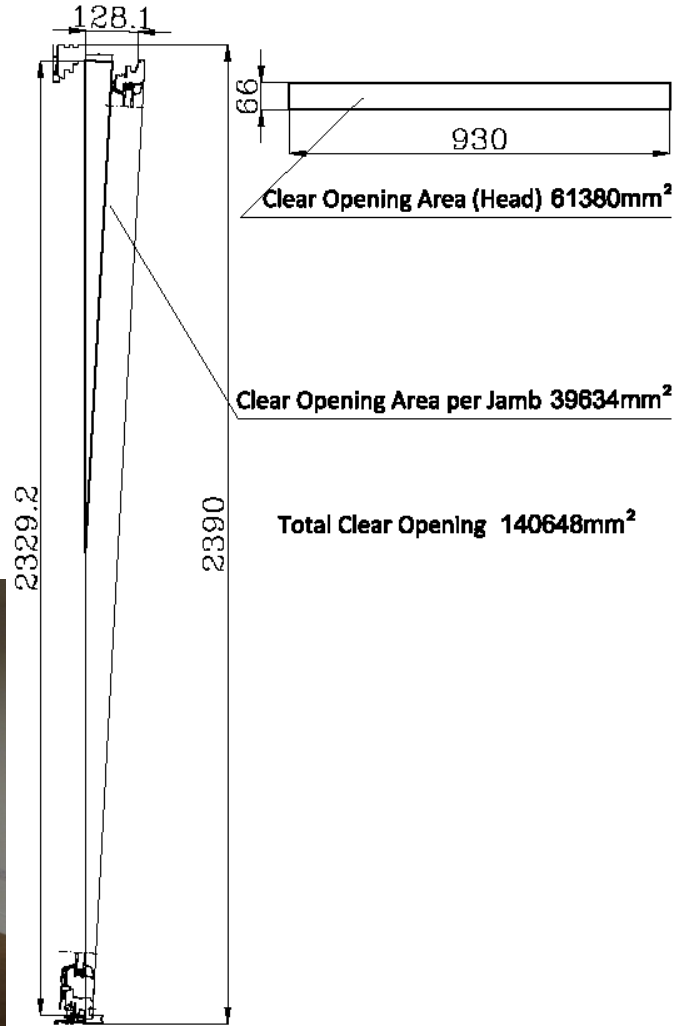
> We've forgotten how to design for natural ventilation in dwellings – we've lost the art
> **Michael Swainson**

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?

Mich Swainson
BRE HVAC Engineering
swainsonm@bre.co.uk

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