Build Tight - Ventilate Right
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How Tight?
What’s Right?
Air Barrier Metrics

Material 0.02 l/(s-m2) @ 75 Pa
Assembly 0.20 l/(s-m2) @ 75 Pa
Enclosure 2.00 l/(s-m2) @ 75 Pa

0.35 cfm/ft2 @ 50 Pa
0.25 cfm/ft2 @ 50 Pa
0.15 cfm/ft2 @ 50 Pa
Getting rid of big holes: 3 ach@50
Getting rid of smaller holes: 1.5 ach@50
Getting German: 0.6 ach@50
Best

As Tight as Possible - with -
Balanced Ventilation
Energy Recovery
Distribution and Mixing
Source Control - Spot exhaust ventilation
Filtration
Material selection
Dilution Is Not The Solution To Indoor Pollution
Source Control
Aubin, D., Won, D.Y., Schleibinger, H., 2010
Formaldehyde sample concentration versus PFT measured outside air exchange rate over the test day

Formaldehyde concentration (ug/m^3)

Outside air exchange rate over 24 h test day (ach)
Dilution For People
Source Control For The Building
Ventilation Rates Are Based on Odor Control

Health Science Basis for Ventilation Rates is Extremely Limited
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Almost Nothing Cited Applies to Housing
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The Applicable Studies Focus on Dampness
ASHRAE Standard 62.2 calls for 7.5 cfm per person plus 0.03 cfm per square foot of conditioned area

Occupancy is deemed to be the number of bedrooms plus one
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Occupancy is deemed to be the number of bedrooms plus one

Outcome is often bad – part load humidity problems, dryness problems, energy problems
IRC 2015 calls for 7.5 cfm per person plus 0.01 cfm per square foot of conditioned area

Occupancy is deemed to be the number of bedrooms plus one
Relative Humidity (RH) %

- Uncomfortably Dry*
- Comfort Range*
- Uncomfortably Wet*

Target Range

Winter Summer
Recommended Range of Relative Humidity
Above 25 percent during winter
Below 70 percent during summer
Building Science Corporation

Diagram: Air handling system with supply, return, motorized damper, outside air filter, dehumidifier, and condensate overflow pan.
Diagram showing air flow in a building with labeled sections for return air, supply air, bedroom, bath, heat exchange ventilator, kitchen, and interlocked kitchen hood make-up air. The diagram illustrates the flow of exhaust air and outside air.
Exhaust air
Outside air
Exhaust air
Interlocked kitchen hood make-up air
Mechanical Systems
Mechanical Systems
Cooling System To Make It Cold
Mechanical Systems
Cooling System To Make It Cold
Dehumidification System To Make It Dry
Mechanical Systems

Cooling System To Make It Cold
Dehumidification System To Make It Dry
Heating System To Make It Warm
Mechanical Systems
Cooling System To Make It Cold
Dehumidification System To Make It Dry
Heating System To Make It Warm
Energy Recovery System To Keep It Cold and Dry and Warm and Comfortable
Mechanical Systems
Cooling System To Make It Cold
Dehumidification System To Make It Dry
Heating System To Make It Warm
Energy Recovery System To Keep It Cold and Dry and Warm and Comfortable
Distribution System To Make It Uniform
Mechanical Systems
Cooling System To Make It Cold
Dehumidification System To Make It Dry
Heating System To Make It Warm
Energy Recovery System To Keep It Cold
and Dry and Warm and Comfortable
Distribution System To Make It Uniform
Range Hoods Are A Special Kind of Hell
Don’t Try to Combine Them......
**Cooling System** makes it cold

**Dehumidification System** makes it dry

**Heating System** makes it warm

**ERV** keeps it cold and dry and warm and comfortable

**Distribution System** makes it uniform
Kitchen Exhaust Hoods
Unconditioned make-up air 60 - 70% of hood exhaust
Move cabinets farther apart.

Hood wider than cook top and extended outboard past head space.

Move hood up to provide headroom.

Interlocked make-up air.
Clothes Dryers
Fireplaces