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Building Science

Covid Construction Changes
Comming

Mechanical Systems

Mechanical Systems

Cooling System To Make It Cold

Mechanical Systems

Cooling System To Make It Cold

Dehumidification System To Make It Dry

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Cooling System To Make It Cold

Dehumidification System To Make It Dry

Heating System To Make It Warm

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Energy Recovery System To Keep It Cold
and Dry and Warm and Comfortable

Mechanical Systems

Cooling System To Make It Cold

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Distribution System To Make It Uniform

Mechanical Systems

Cooling System To Make It Cold

Dehumidification System To Make It Dry

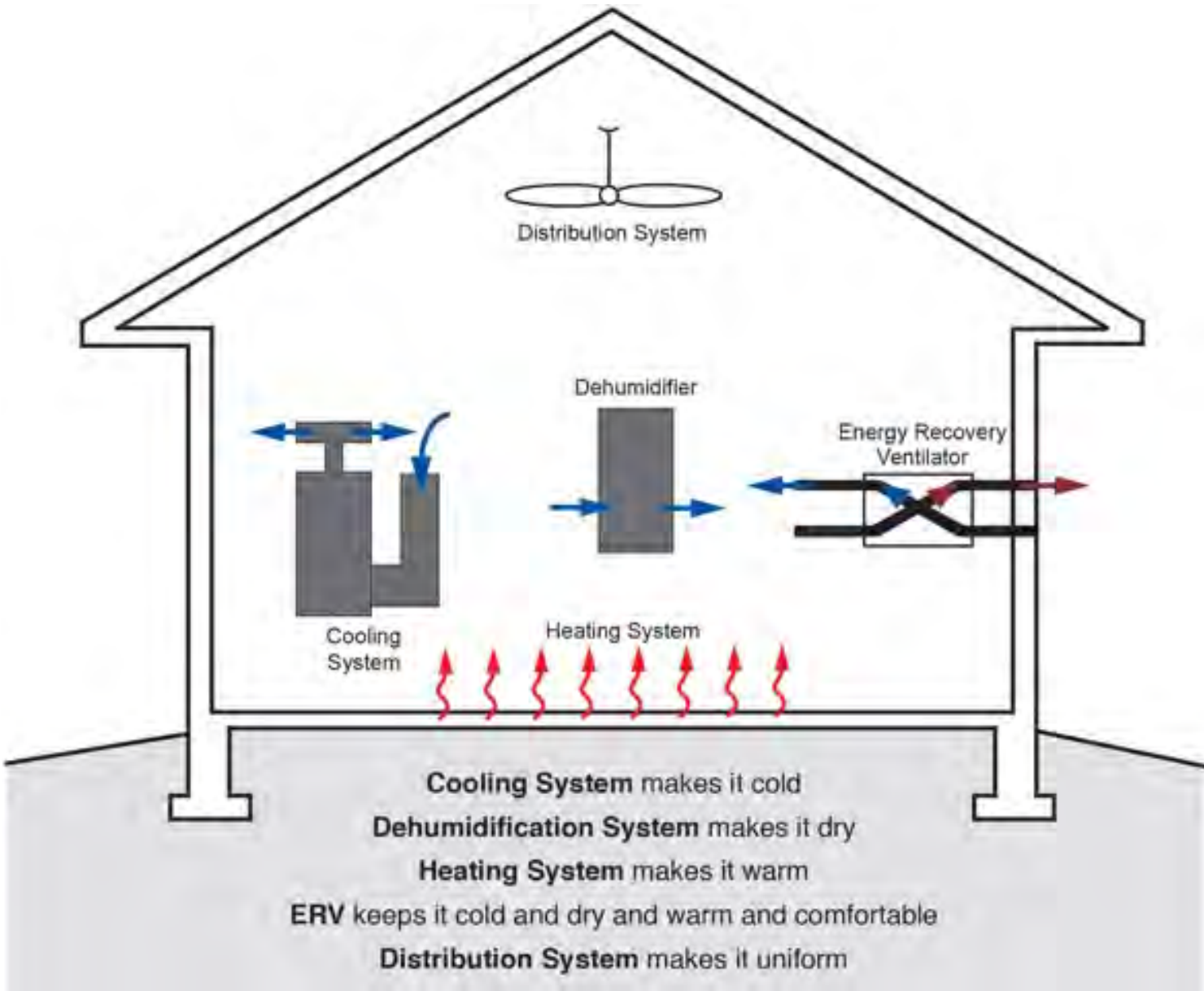
Heating System To Make It Warm

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.....



Build Tight - Ventilate Right

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How Tight?
What's Right?

Air Barrier Metrics

Material	0.02 l/(s-m ²) @ 75 Pa
Assembly	0.20 l/(s-m ²) @ 75 Pa
Enclosure	2.00 l/(s-m ²) @ 75 Pa 0.25 cfm/ft ² @ 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

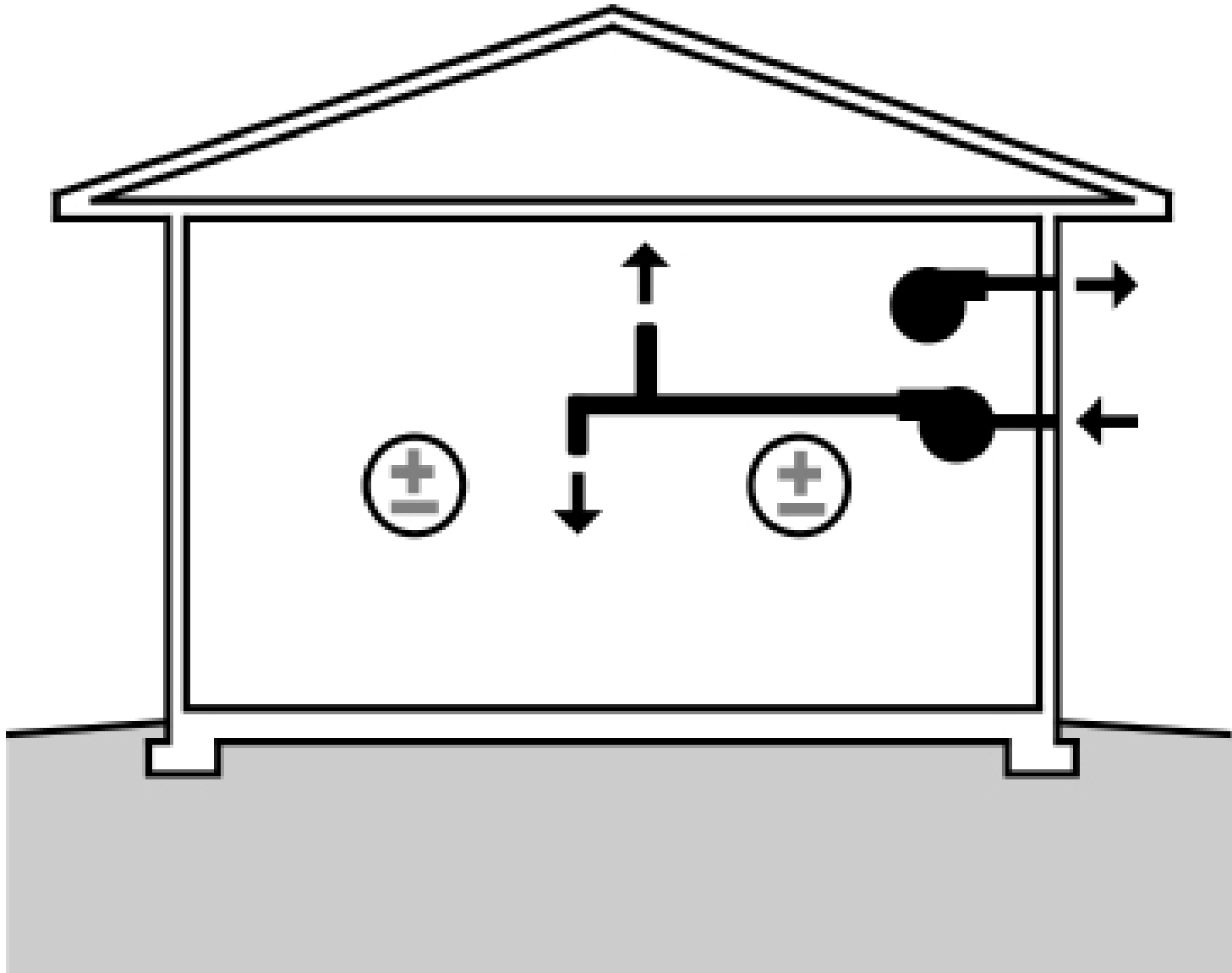
Energy Recovery

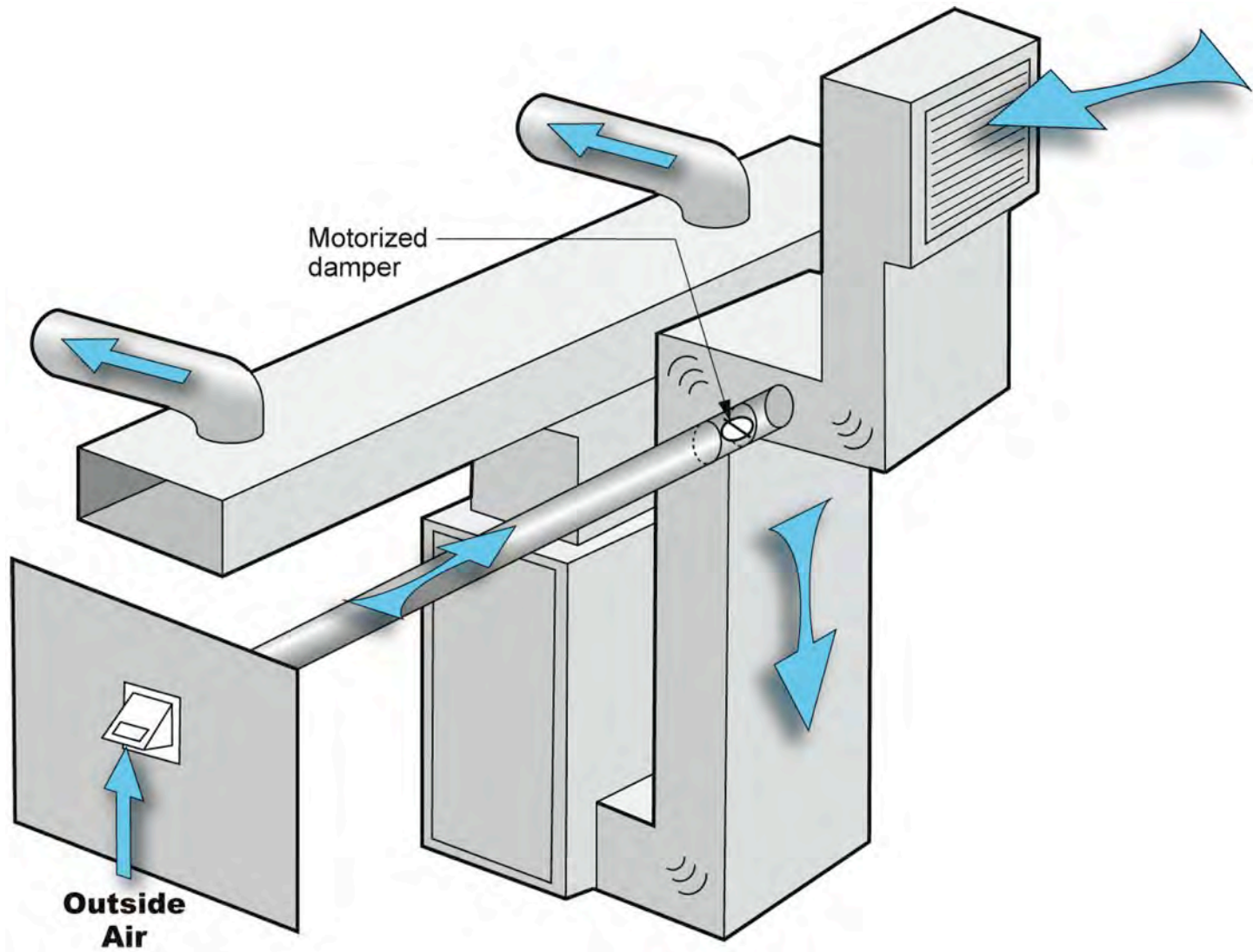
Distribution and Mixing

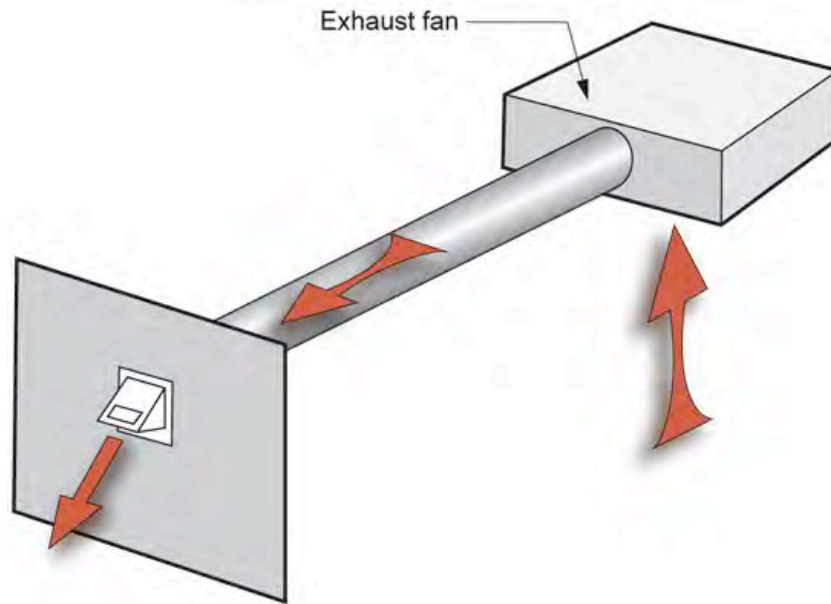
Source Control - Spot exhaust ventilation

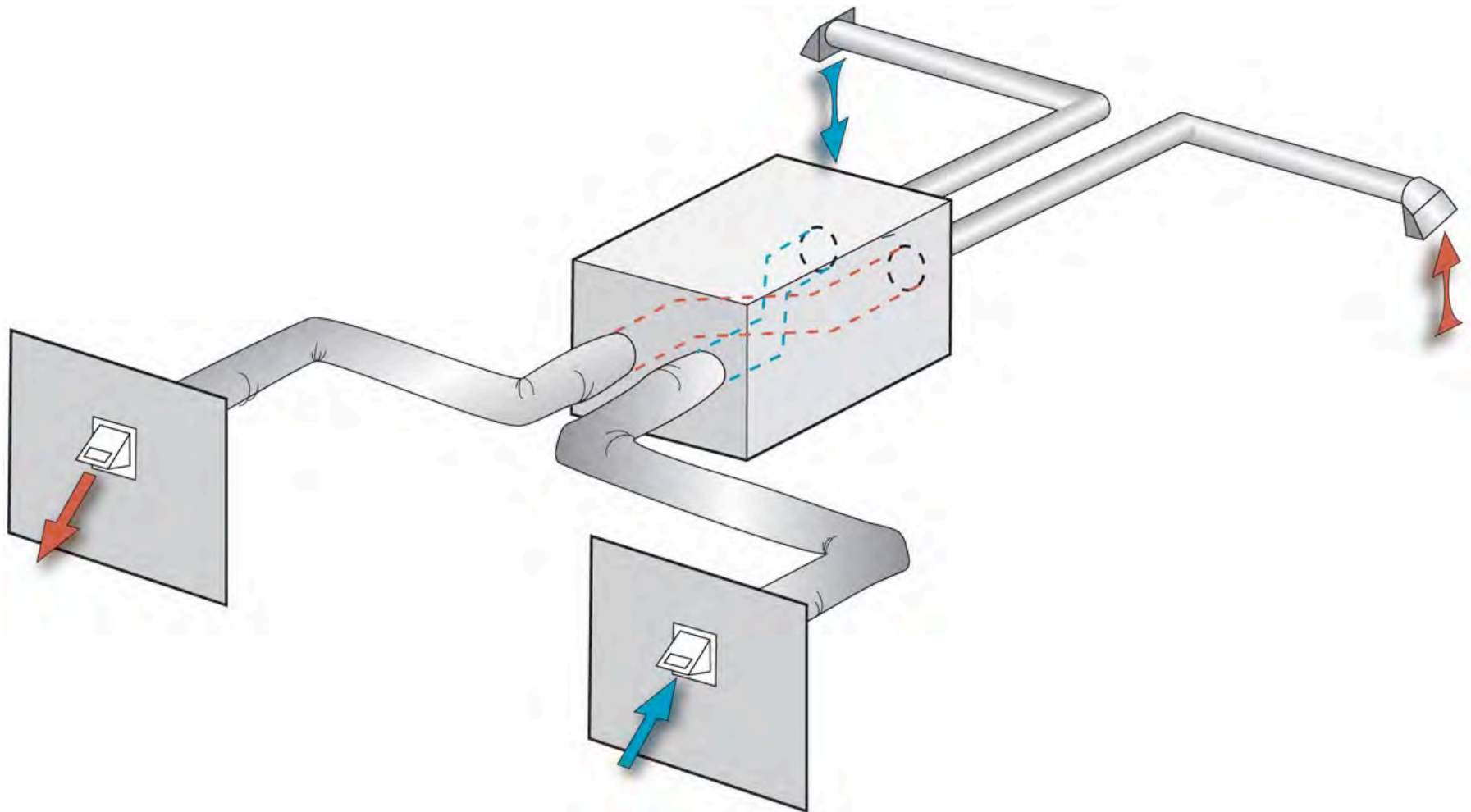
Filtration

Material selection









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The Applicable Studies Focus on Dampness

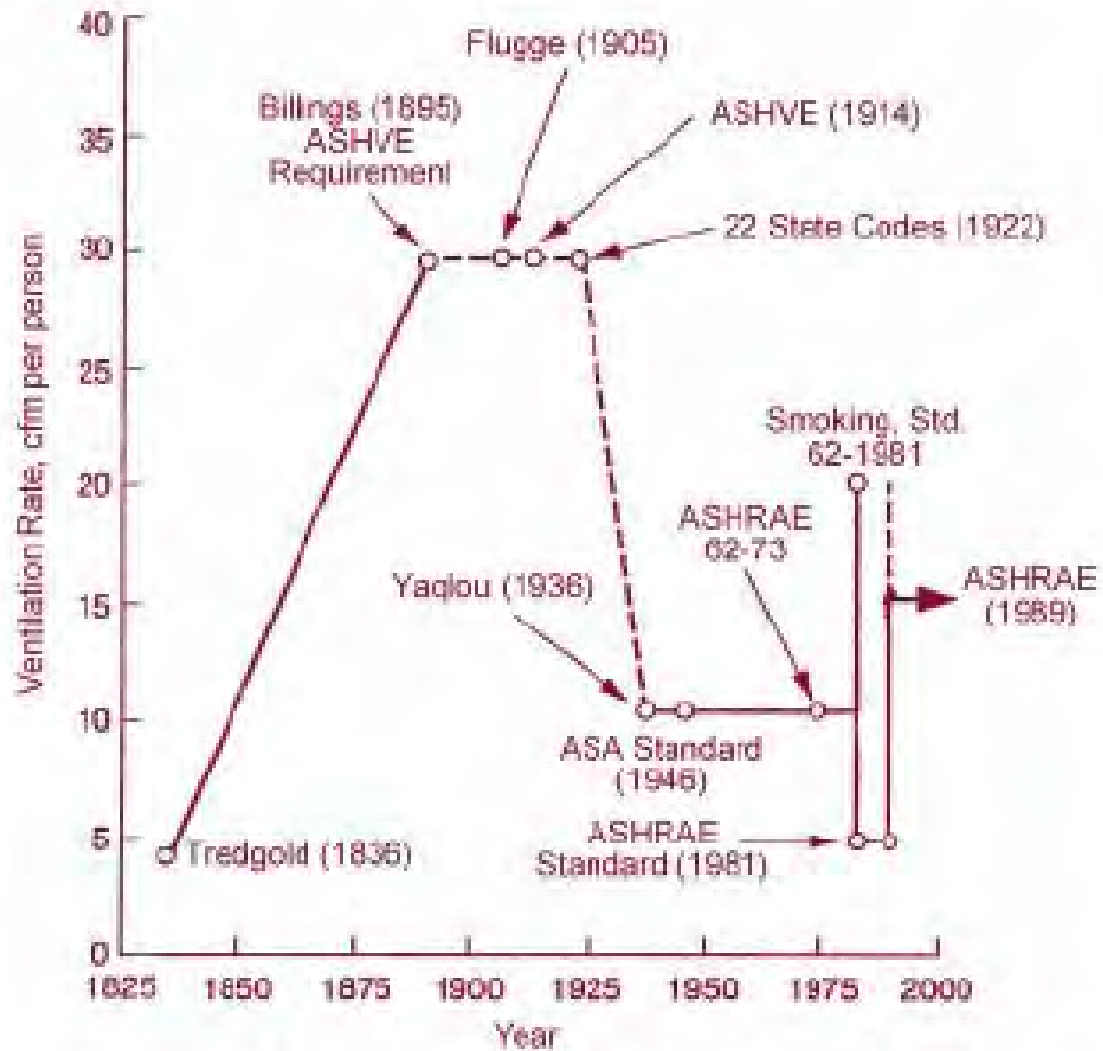


Figure 1: Minimum ventilating rate history.

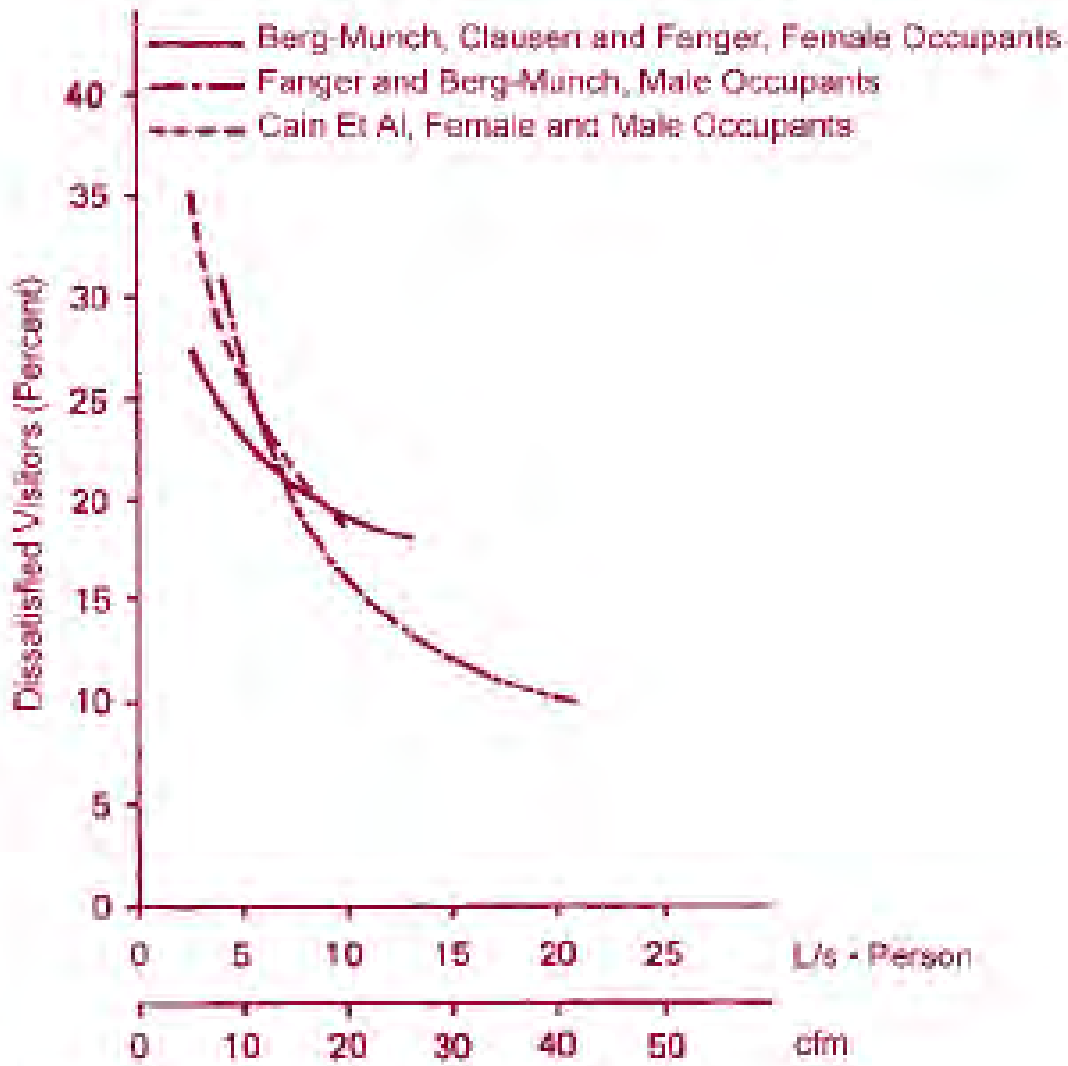


Figure 2: Odor acceptance.

House

2,000 ft²

3 bedrooms

8 ft. ceiling

Volume: 16,000 ft³

.35 ach 93 cfm

.30 ach 80 cfm

.25 ach 67 cfm

.20 ach 53 cfm

.15 ach 40 cfm

House

2,000 ft²

3 bedrooms

8 ft. ceiling

Volume: 16,000 ft³

Ventilation Rates

.35 ach	93 cfm	62 - 73	5 cfm/person	20 cfm
.30 ach	80 cfm		10 cfm/person	40 cfm
.25 ach	67 cfm	62 - 89	15 cfm/person	60 cfm
.20 ach	53 cfm		.35 ach	90 cfm
.15 ach	40 cfm	62.2 - 2010	7.5 cfm/person + 0.01	50 cfm
		62.2 - 2013	7.5 cfm/person + 0.03	90 cfm

Office

Occupant Density

15/1000 ft² (67 ft²/person)
15 cfm/person

62 - 89

5/1000 ft² (200 ft²/person)
17 cfm/person

62.1 - 2007

Correctional Facility Cell

Occupant Density

20/1000 ft² (48 ft²/person)
10 cfm/person

62.1 – 2007

C.P. Yaglou

Harvard School of Public Health

1936

1955

150 ft³ → 20 cfm/person

300 ft³ → 12 cfm/person

C.P. Yaglou

Harvard School of Public Health

1936

1955

150 ft³ → 20 cfm/person 18.75 ft² 106 occupants

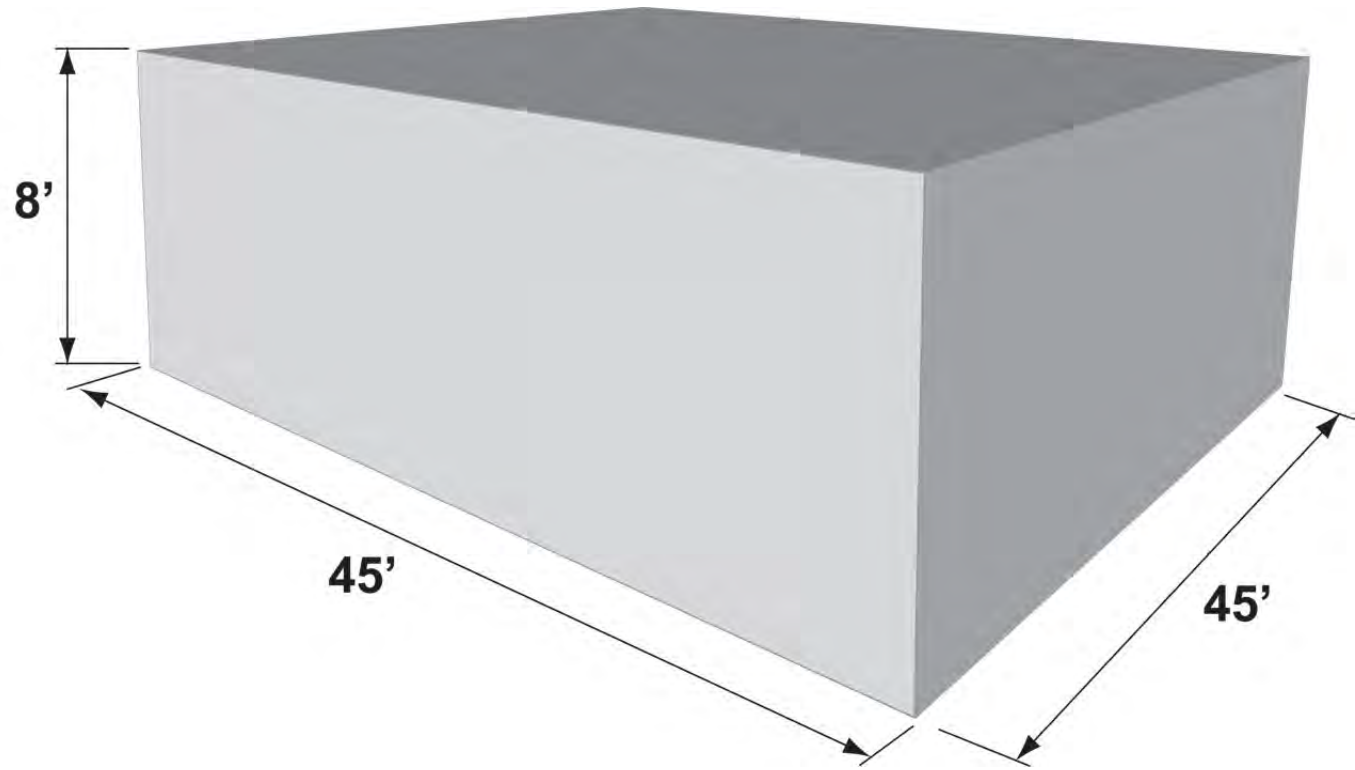
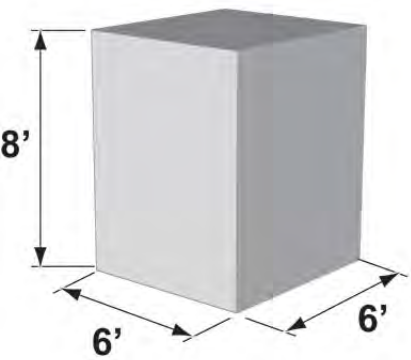
300 ft³ → 12 cfm/person 37.5 ft² 53 occupants

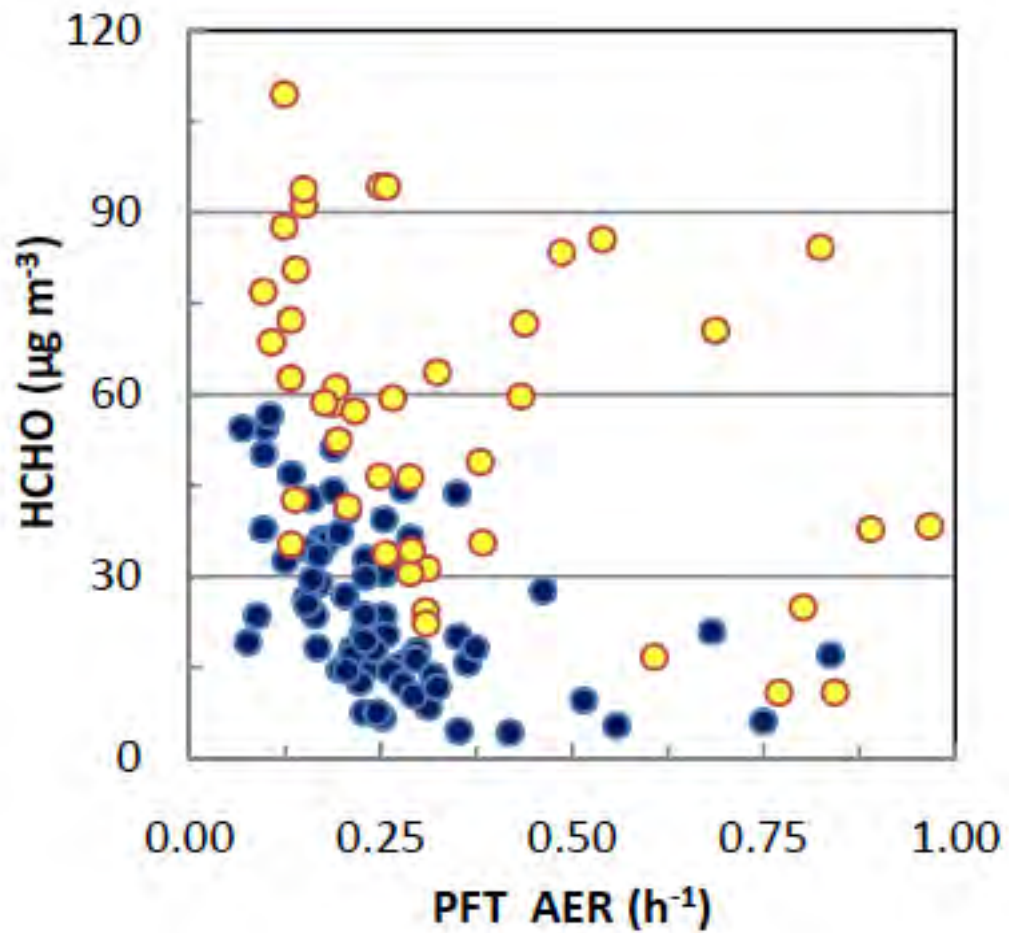
Experiment

470 ft³ → 59 ft²

200 ft³ → 25 ft²

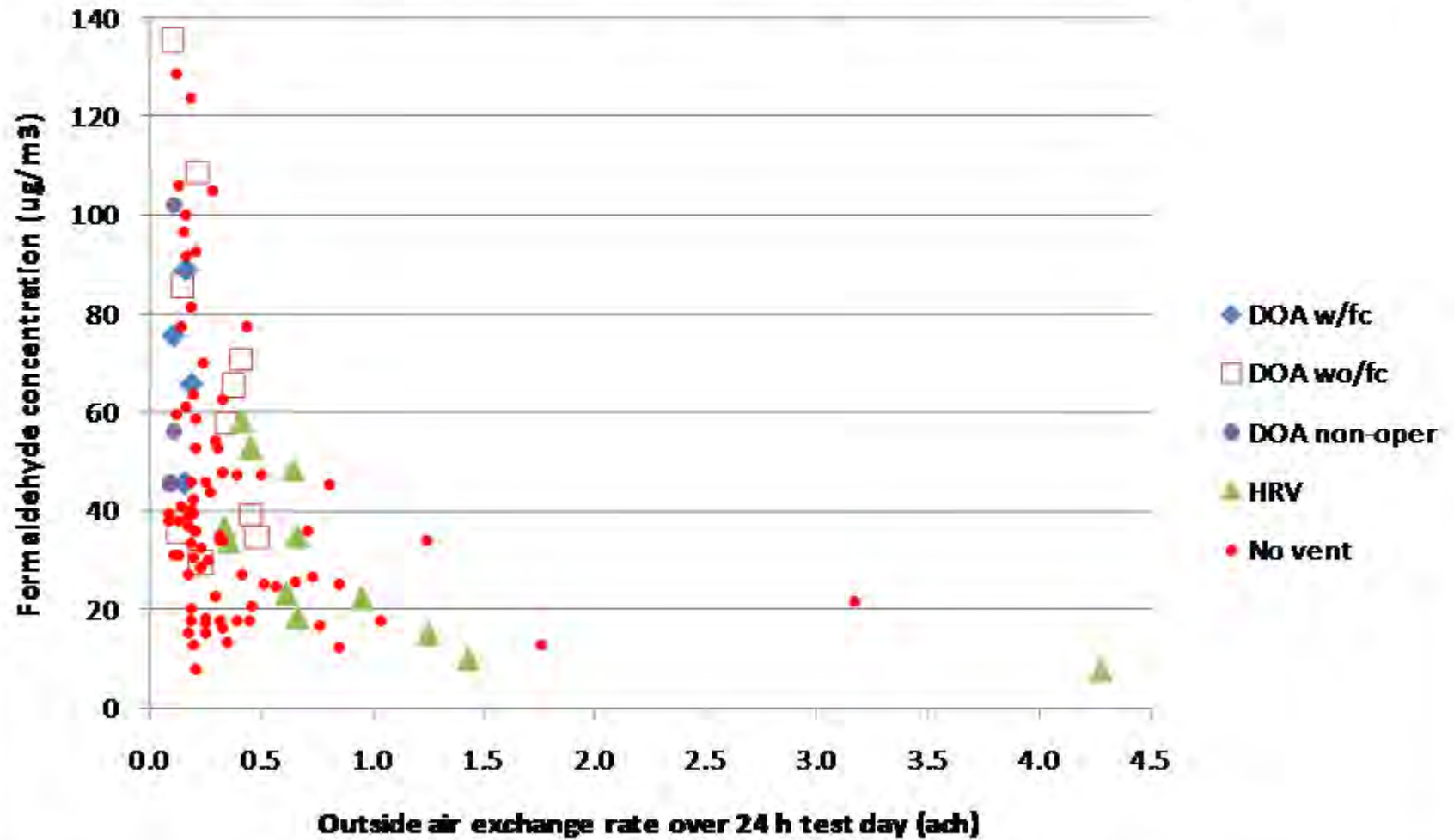
100 ft³ → 12 ft²





Aubin, D., Won, D.Y., Schleichinger, H., 2010

Formaldehyde sample concentration versus PFT measured outside air exchange rate over the test day



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 and 2018 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

IRC 2021 and IMC 2021 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

Plus a 30 percent credit for balanced ventilation and distribution

3 Bedroom House – 2,500 ft²

30 cfm plus 75 cfm

105 cfm

3 Bedroom House – 2,500 ft²

30 cfm plus 25 cfm

55 cfm

3 Bedroom House – 2,500 ft²

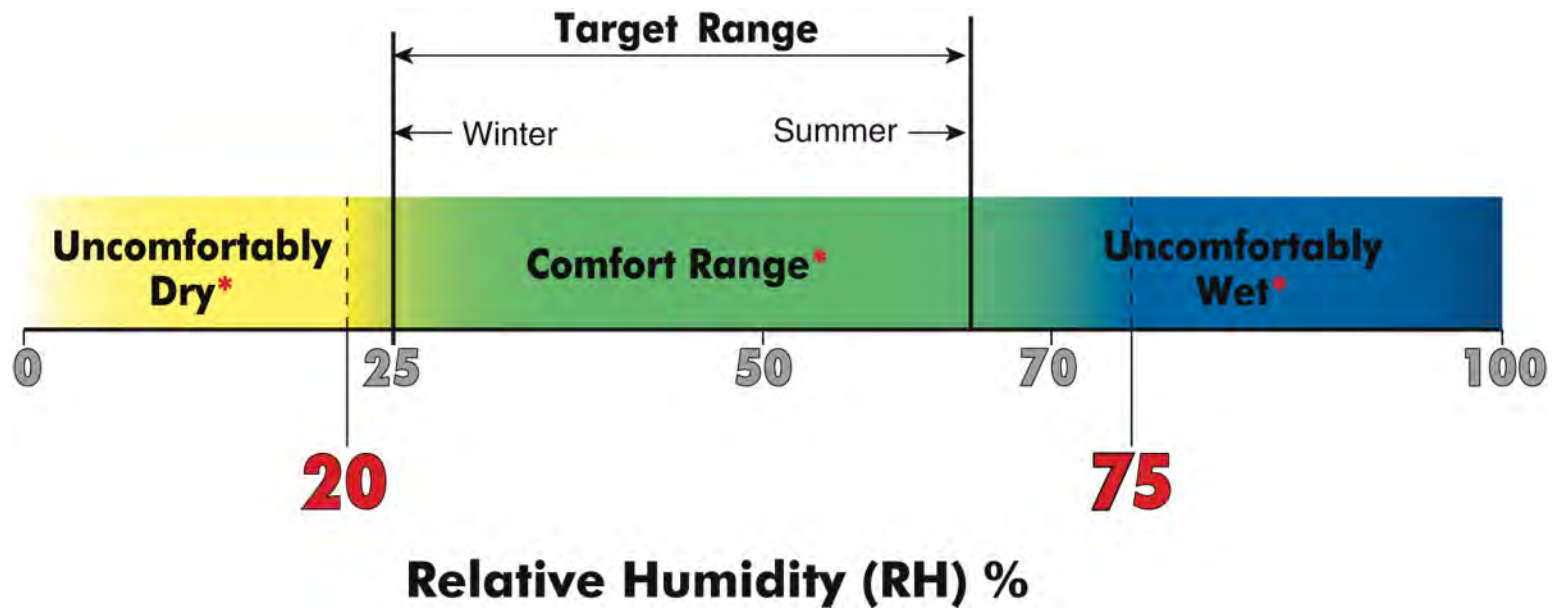
30 cfm plus 25 cfm

55 cfm

$55 \text{ cfm} \times 0.7 = 38.5 \text{ cfm}$

Dilution For People

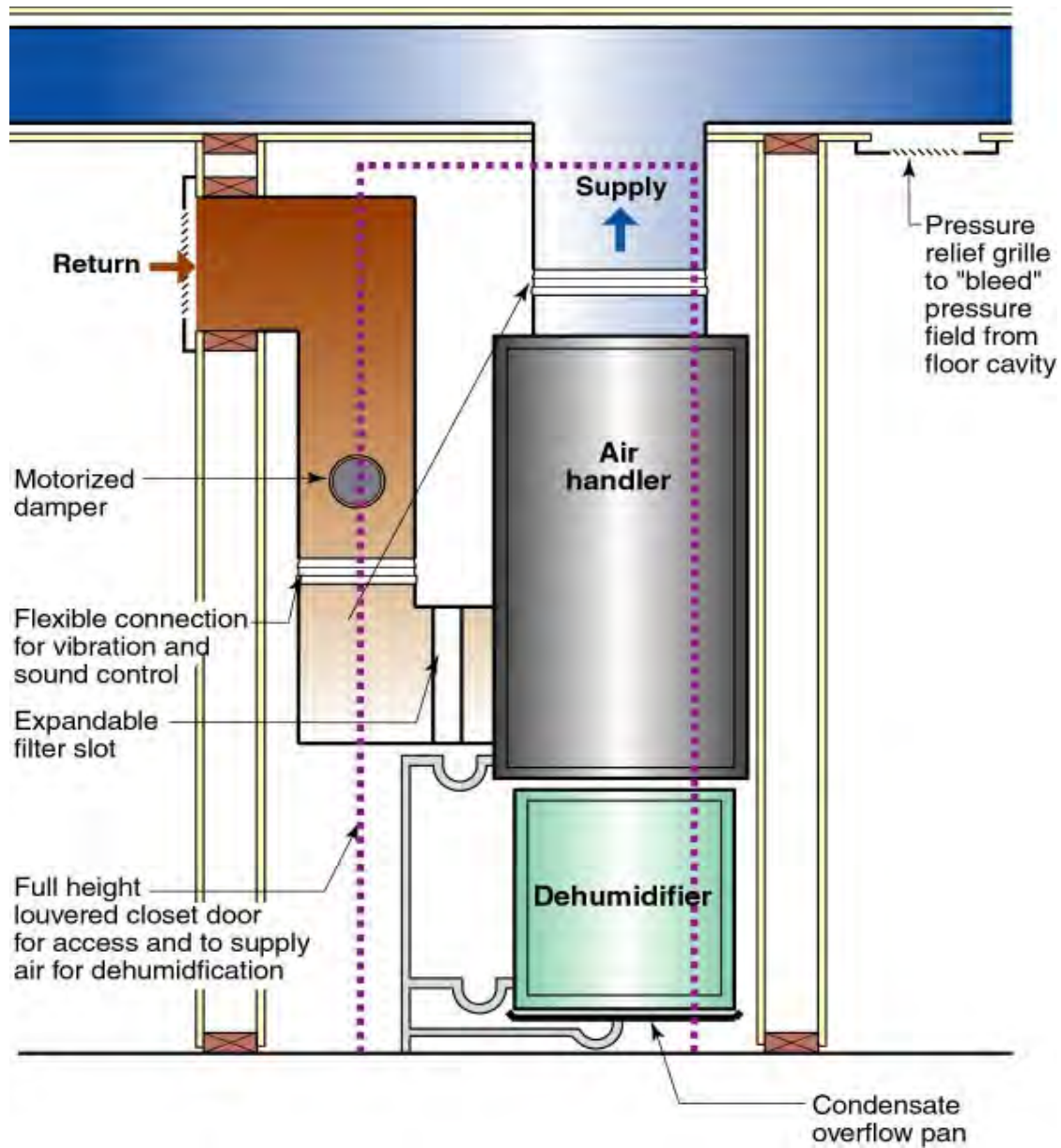
Source Control For The Building



Recommended Range of Relative Humidity

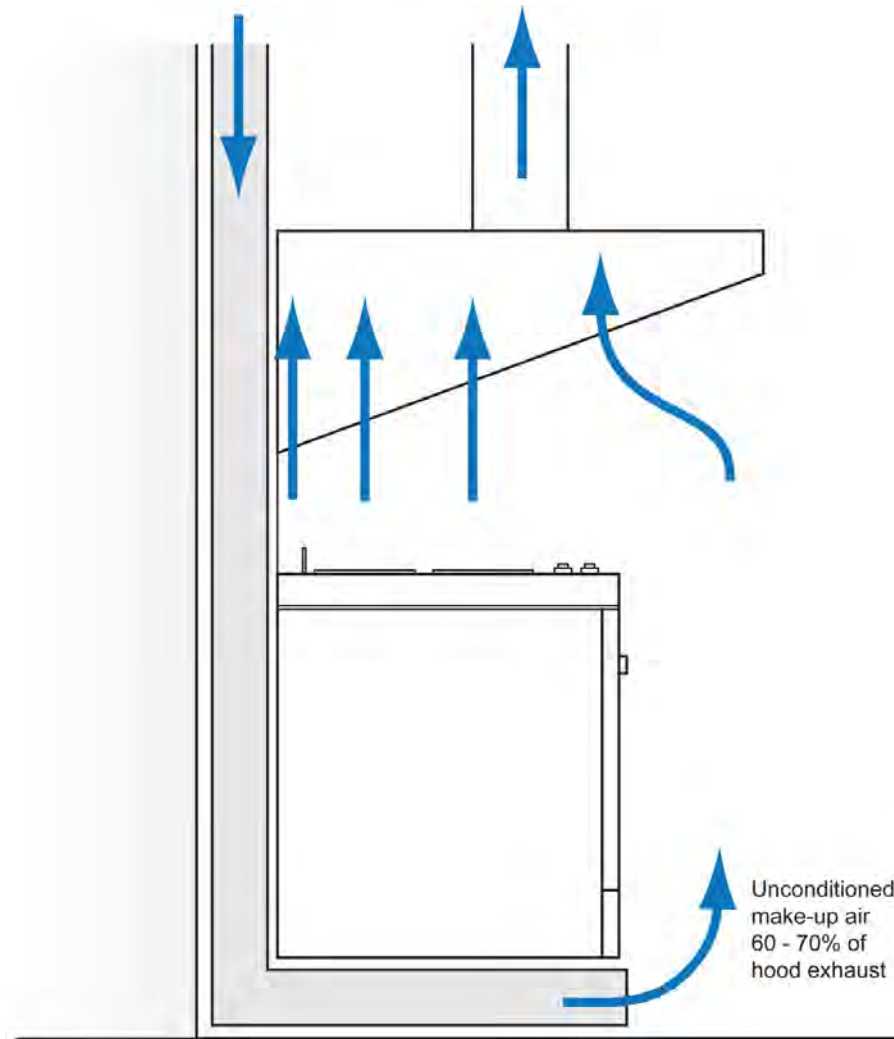
Above 25 percent during winter

Below 70 percent during summer

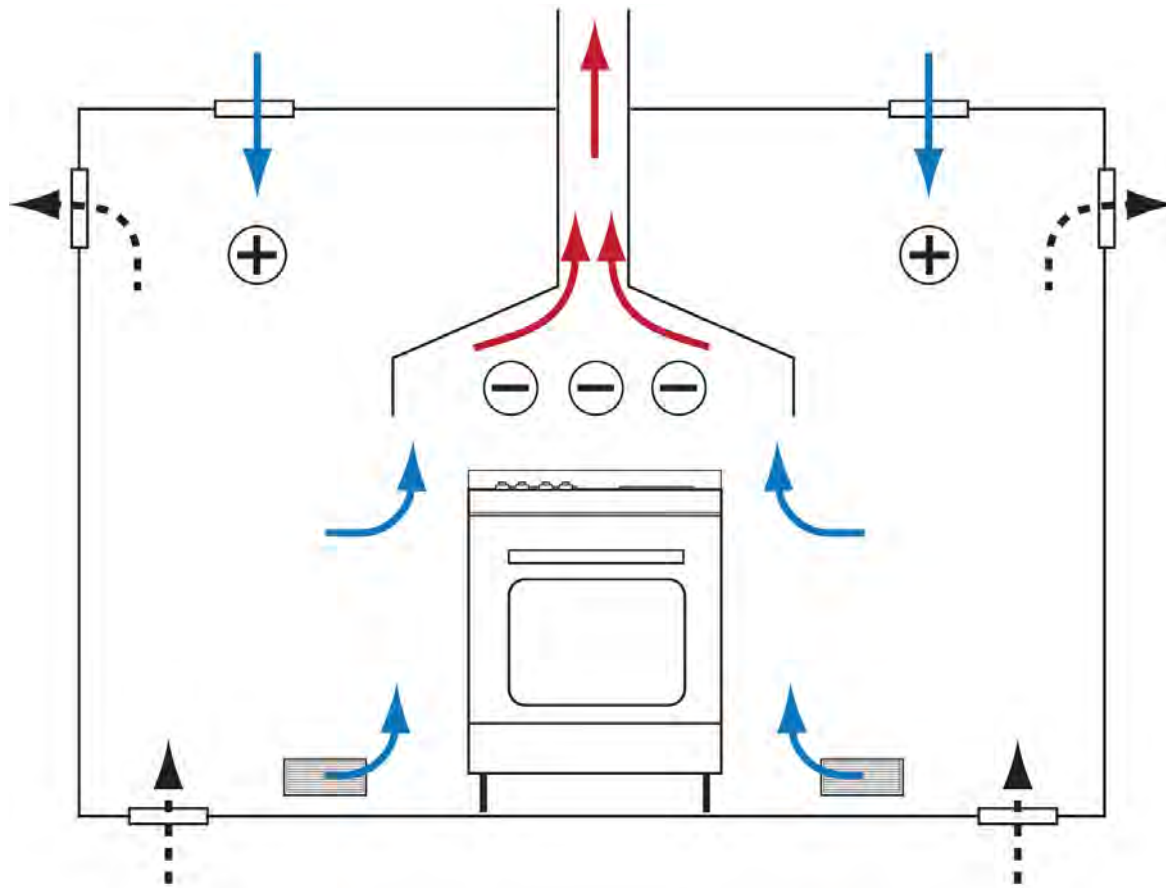


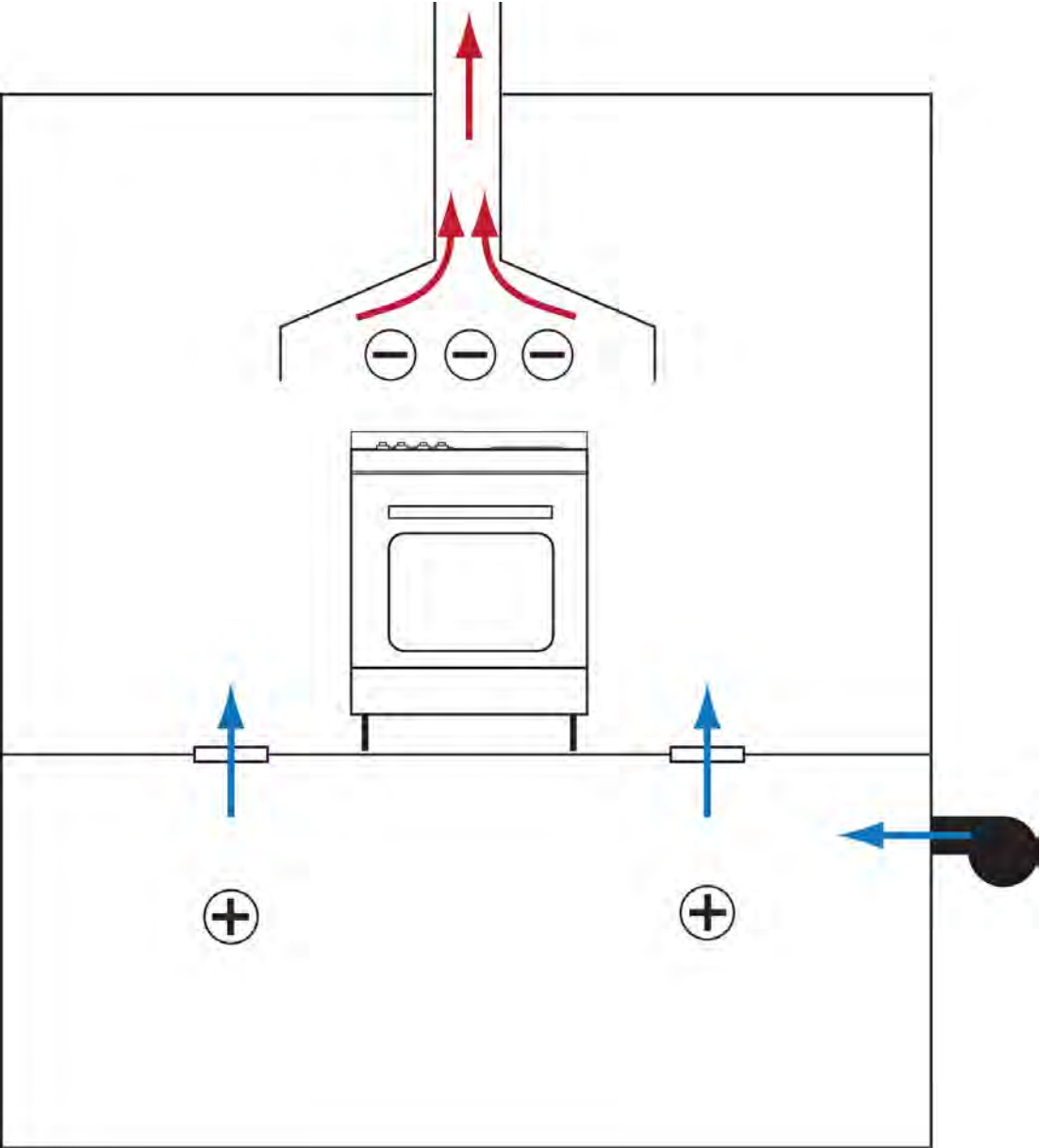


Kitchen Exhaust Hoods









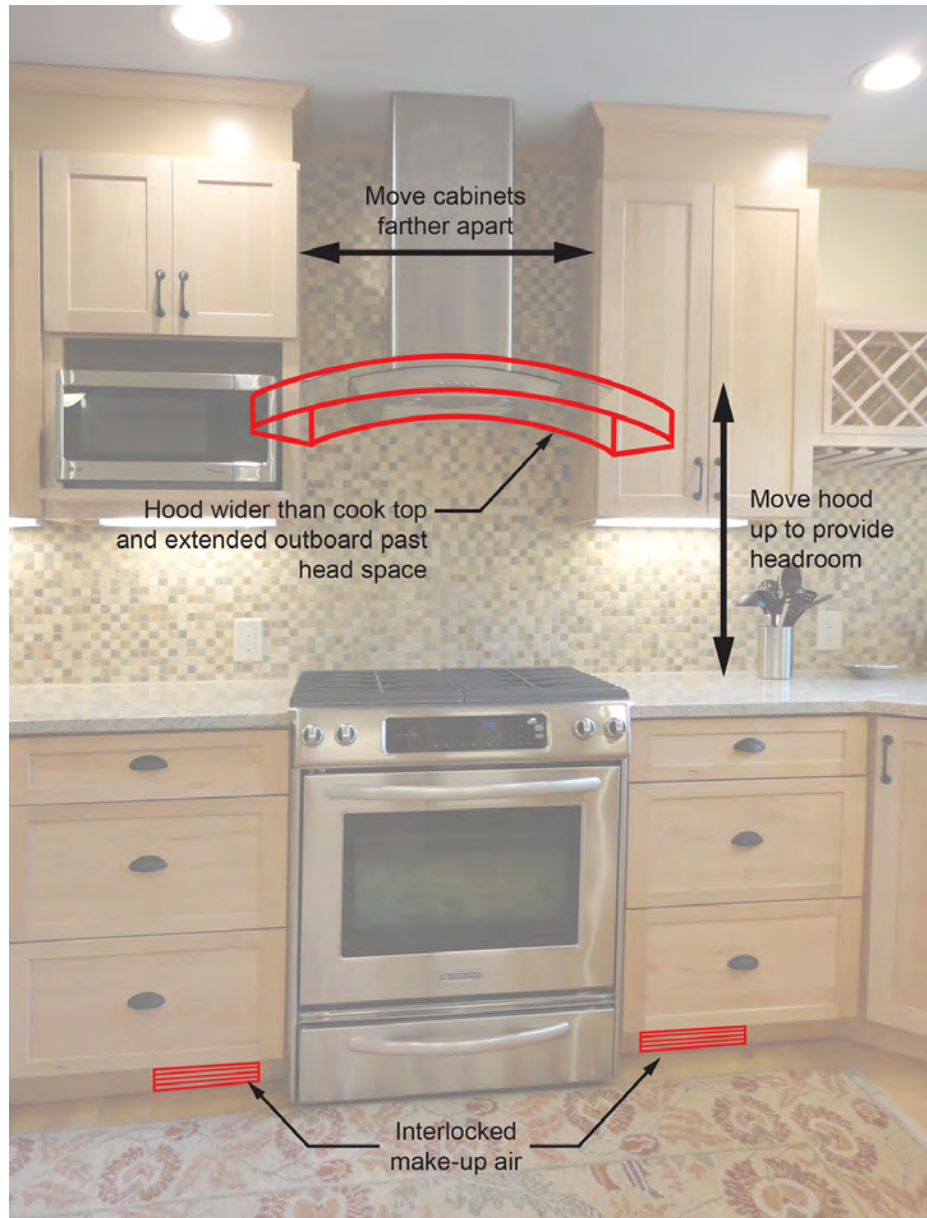
















Clothes Dryers





Fireplaces









Approaches

