Joseph Lstiburek, Ph.D., P.Eng, ASHRAE Fellow

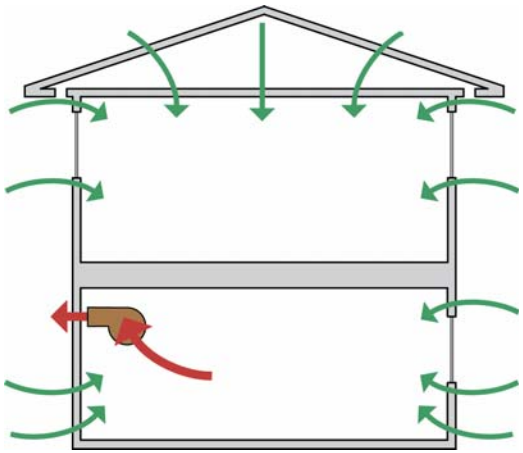
Building Science

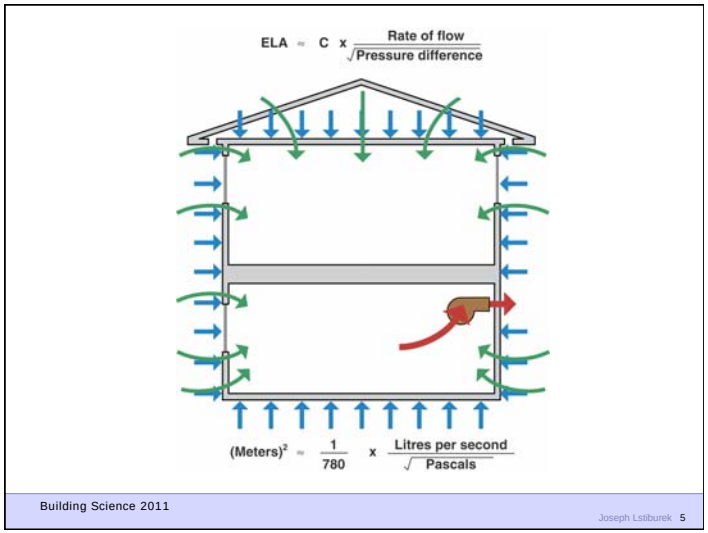
IAQ and Airtightness

presented by www.buildingscience.com

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





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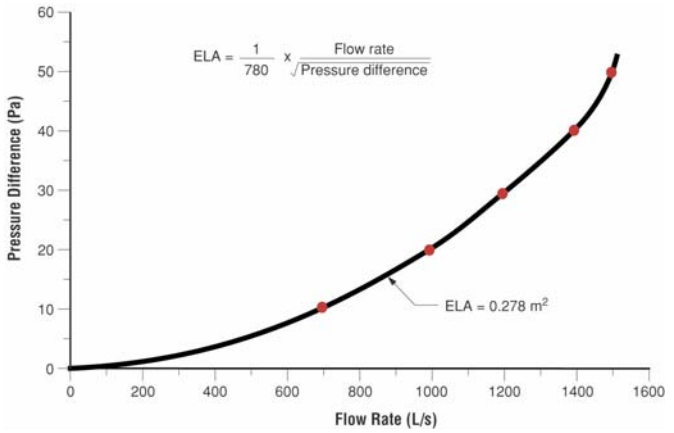

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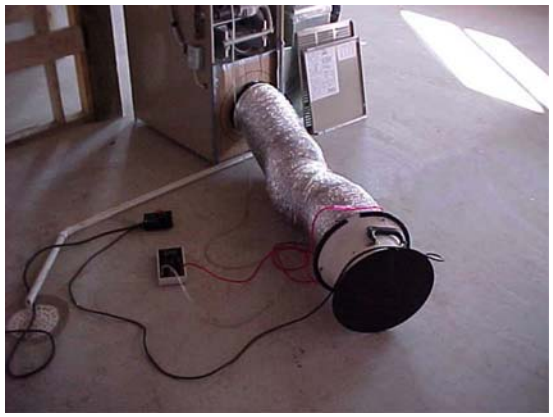

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Duct Leakage Should Be Less Than 5% of Rated Flow As Tested by Pressurization To 25 Pascals

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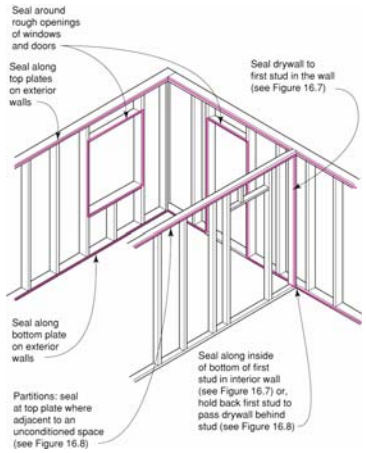

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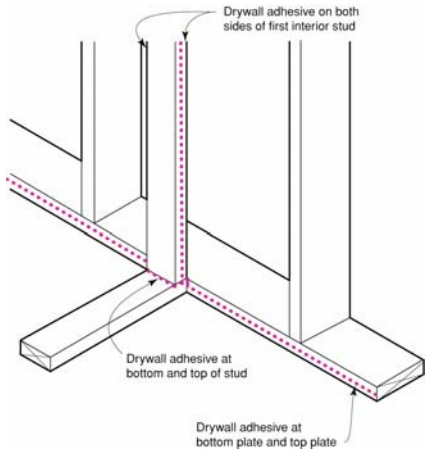

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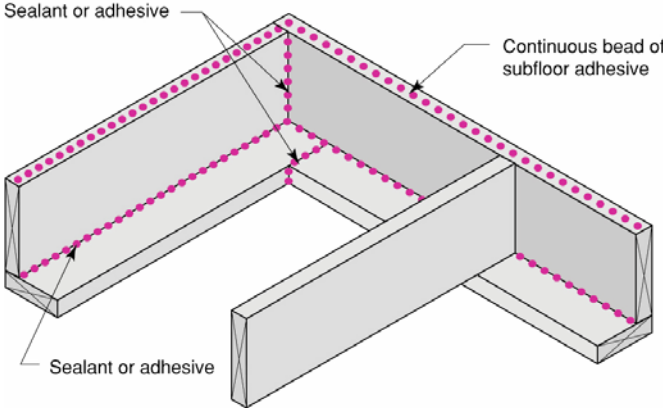

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Sealed Combustion Appliances

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Three Types of Controlled Ventilation Systems

Exhaust Ventilation
Supply Ventilation
Balanced Ventilation

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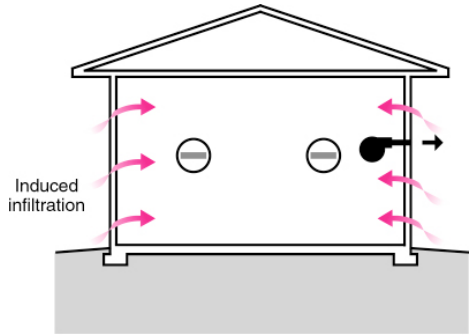

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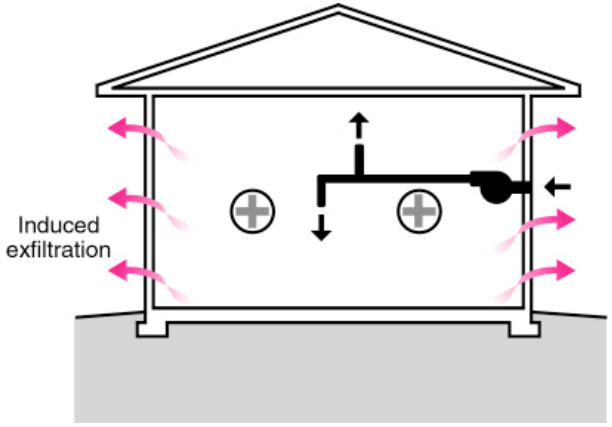

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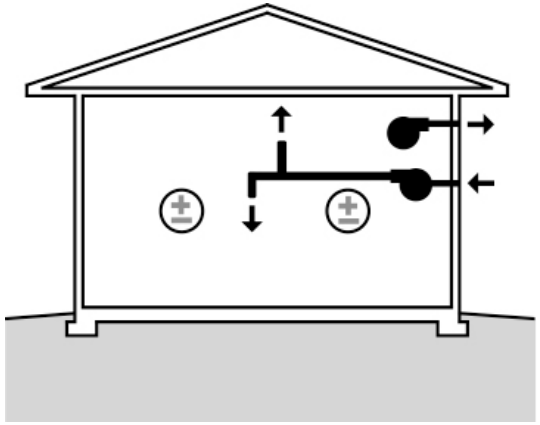

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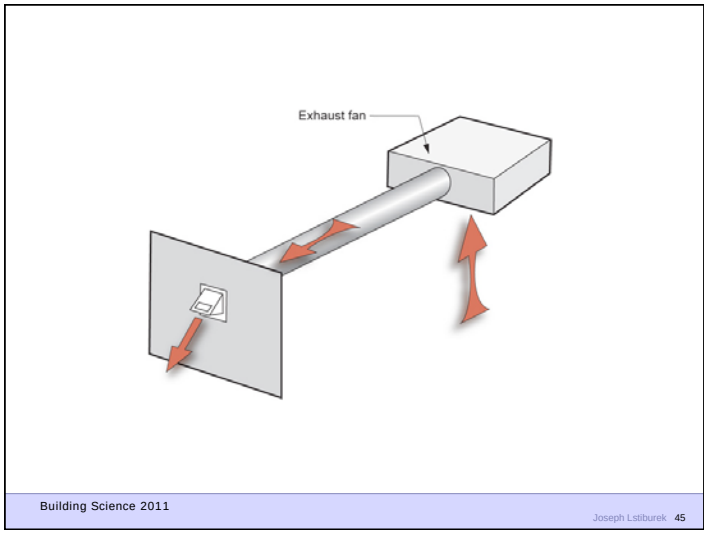
Exhaust fan
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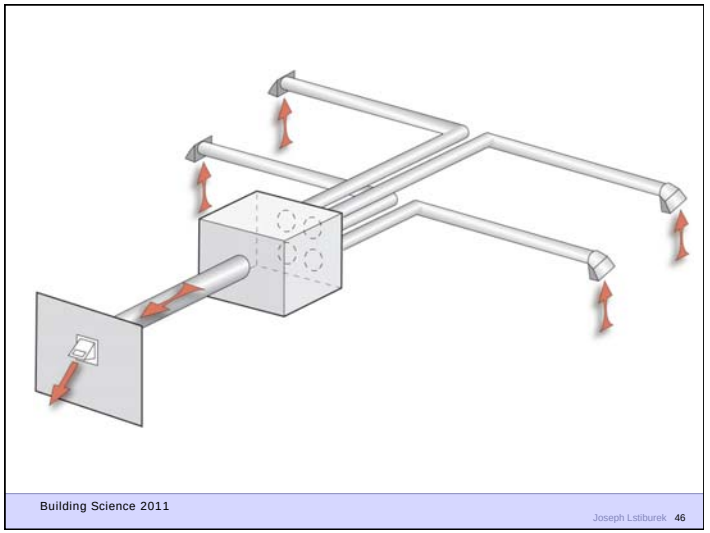
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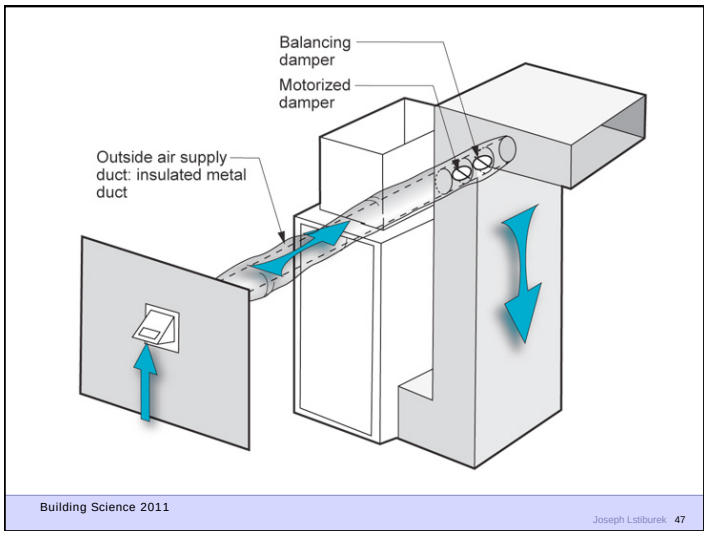
Balancing damper
Motorized damper
Outside air supply duct: insulated metal duct
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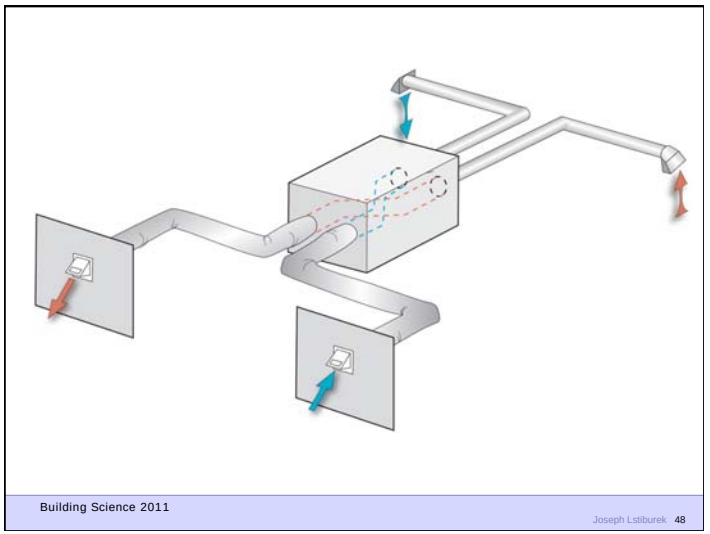
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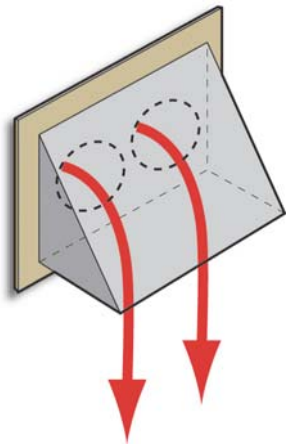
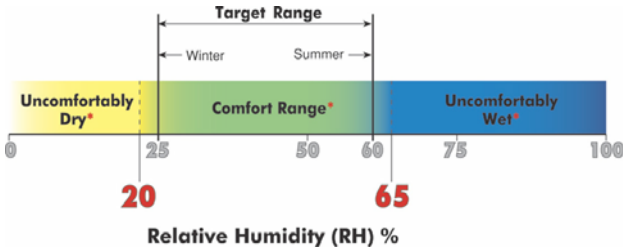
ASHRAE Standard 62.2 calls for 7.5 cfm per person plus 0.01 cfm per square foot of conditioned area

Occupancy is deemed to be the number of bedrooms plus one

Occupant Rate + Building Rate

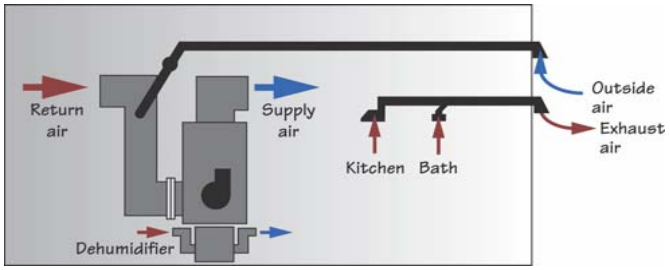




Recommended Range of Relative Humidity

25 percent during winter

60 percent during summer



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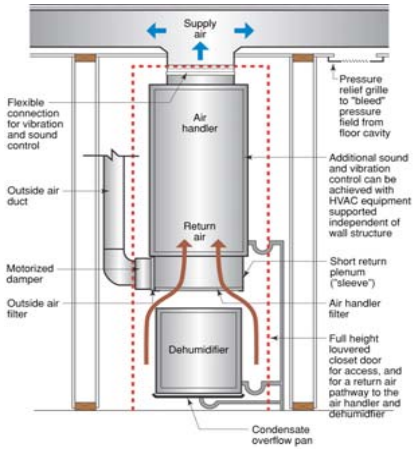

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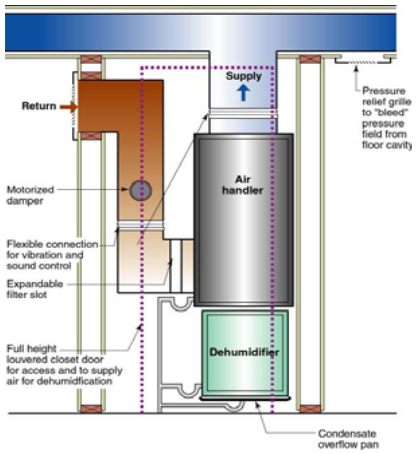

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Figure 3.12
Ductwork and Air Handlers in Basements
- No air pressure differences result in a house with an air handler and ductwork located in a basement if there are no leaks in the supply ducts, the return ducts or the air handler and if the amount of air delivered to each room equals the amount removed

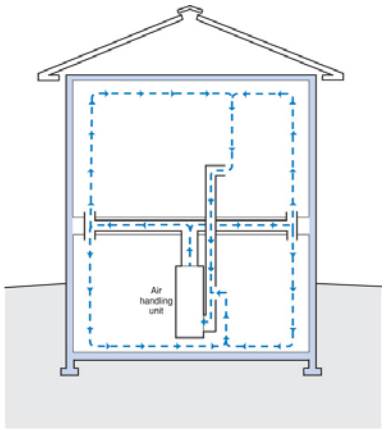

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Figure 3.13
Ductwork and Air Handlers in Vented Attics
- No air pressure differences result in a house with an air handler and ductwork located in a vented attic if there are no leaks in the supply ducts, the return ducts or the air handler and if the amount of air delivered to each room equals the amount removed

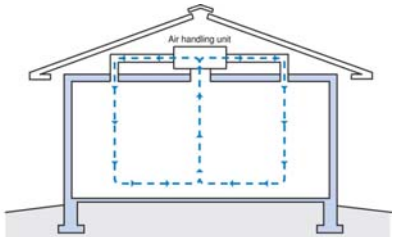

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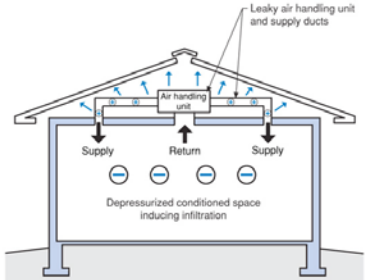
Figure 3.15
Leaky Ductwork and Air Handlers in Vented Attics
- Supply ductwork and air handler leakage is typically 20% or more of the flow through the system



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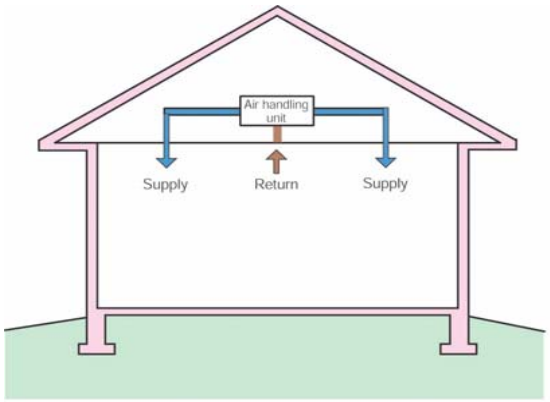

Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.

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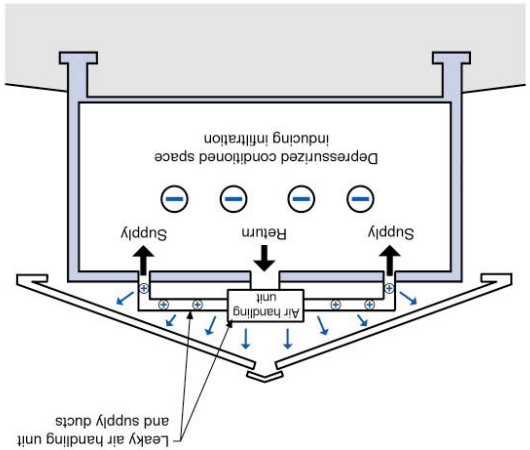

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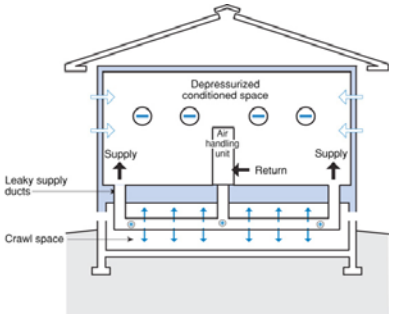

Figure 3.16
Leaky Supply Ductwork in Vented Crawl Space
- Air pressurization pattern with mechanical system ducts in the crawl space

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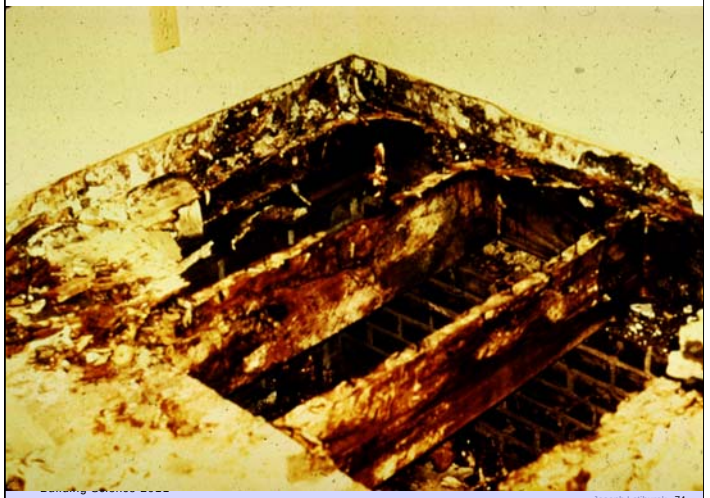

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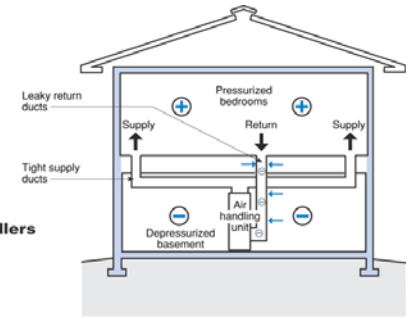

Figure 3.14
Leaky Ductwork and Air Handlers in Basements
- Air pressurization patterns in a house with leaky ductwork in the basement

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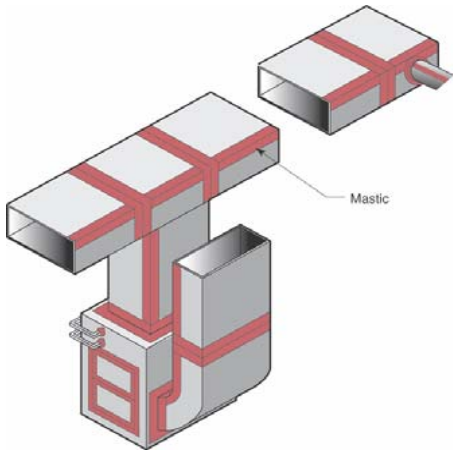

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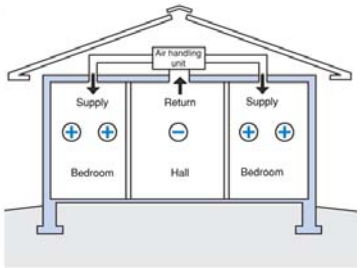
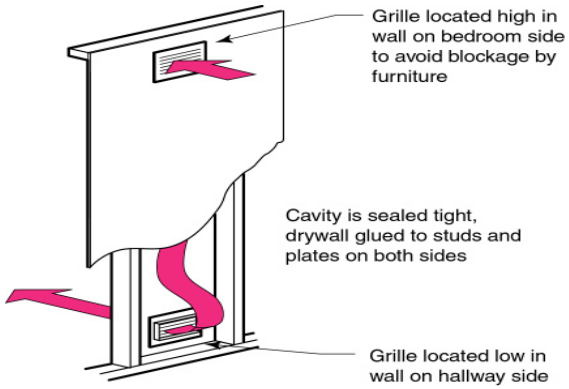
Figure 3.18
Insufficient Return Air Paths

- Pressurization of bedrooms often occurs if insufficient return pathways are provided; undercutting bedroom doors is usually insufficient; transfer grilles, jump ducts or fully ducted returns may be necessary to prevent pressurization of bedrooms
- Master bedroom suites are often the most pressurized as they typically receive the most supply air
- When bedrooms pressurized, common areas depressurize; this can have serious consequences when fireplaces are located in common areas and subsequently backdraft





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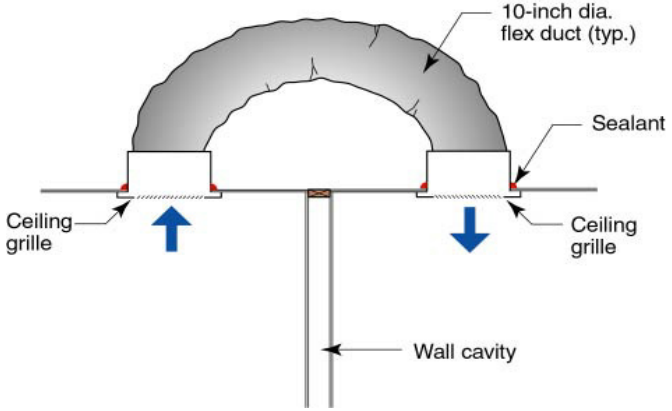

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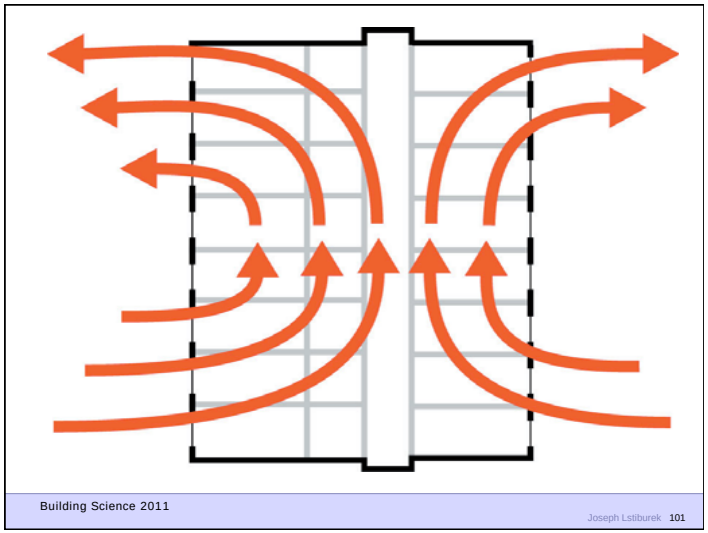

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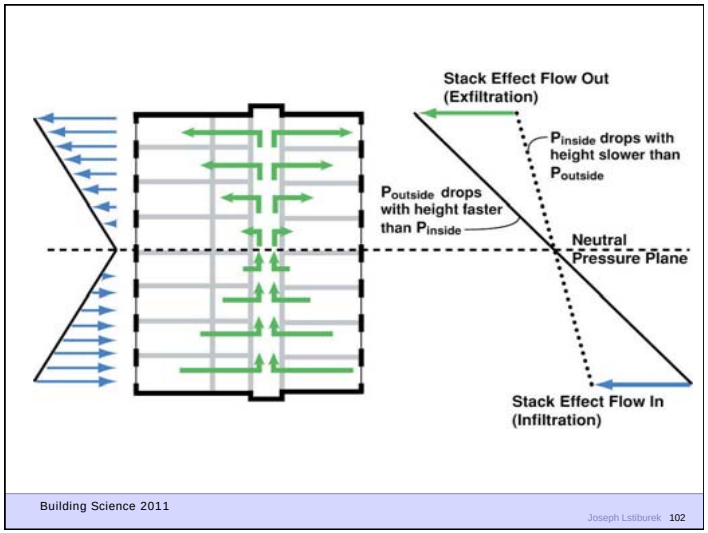

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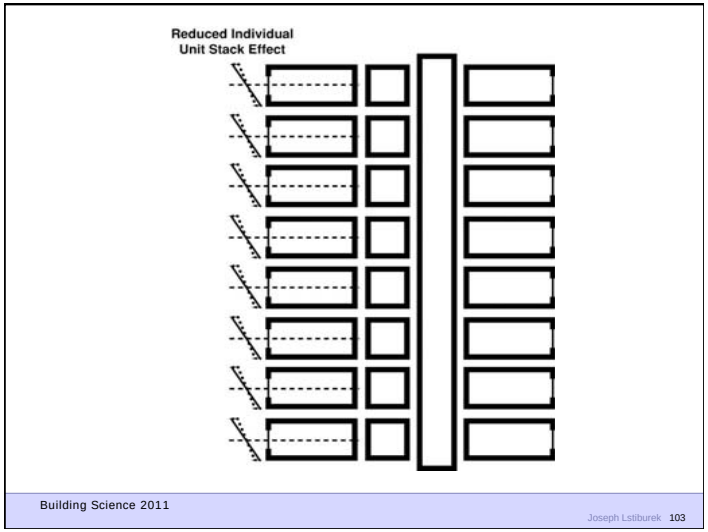

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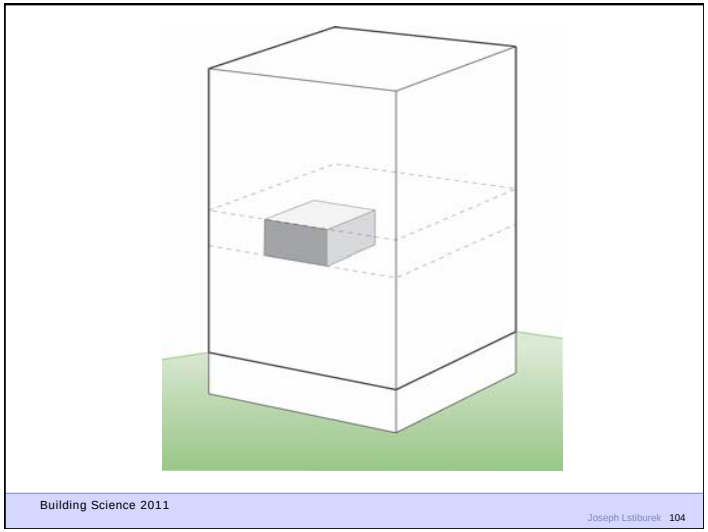

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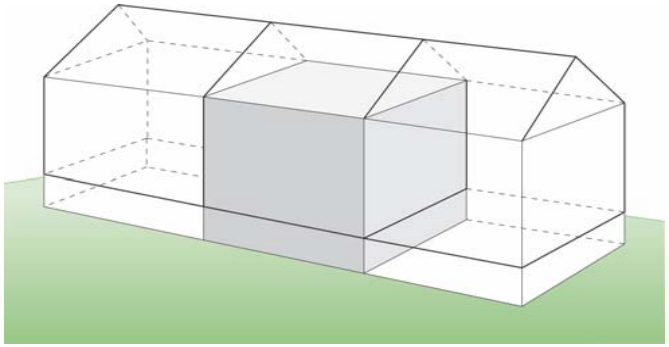

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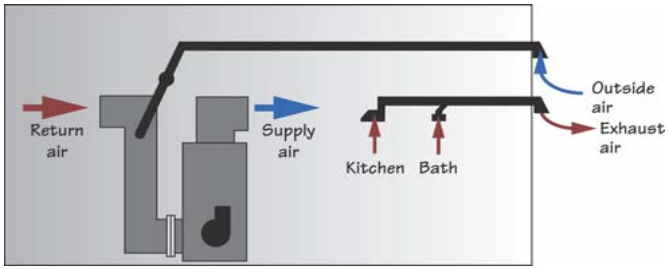

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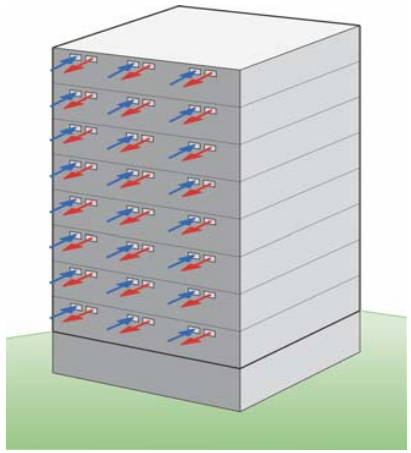

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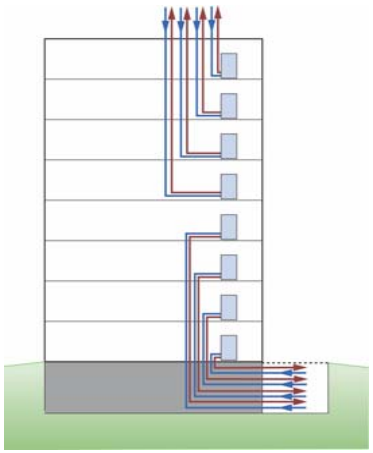

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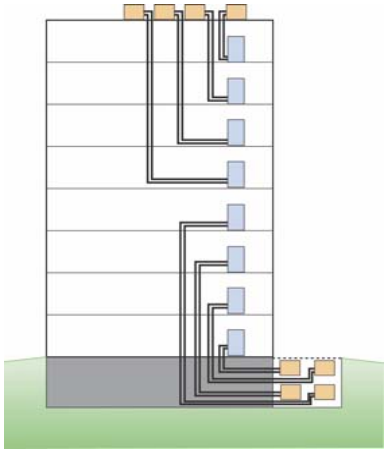

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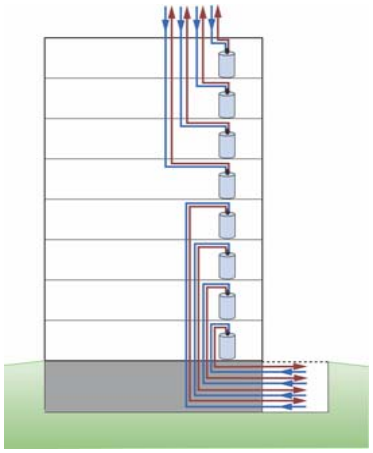

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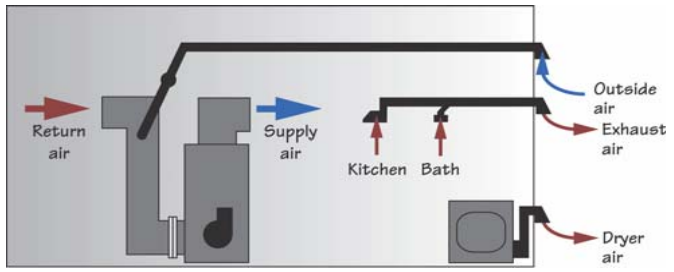

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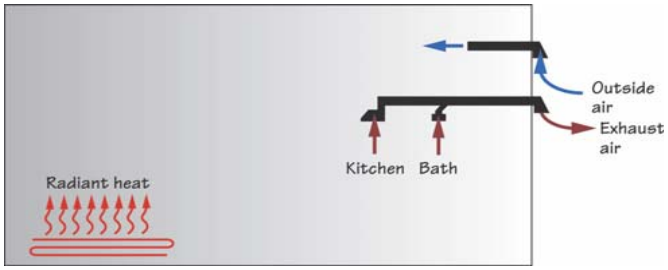

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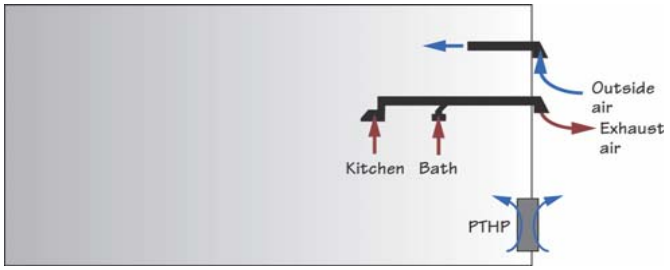

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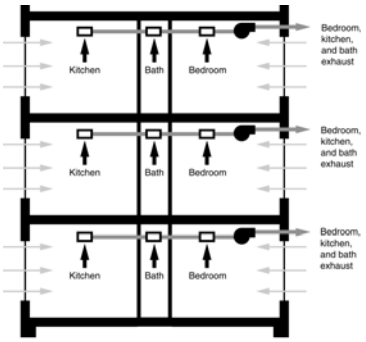

Distributed Ventilation

- Individual unit exhaust ventilation fan exhausts (during occupancy) from each bedroom, bathroom, and kitchen
- Operation of system is time of occupancy sensitive — on only when occupied

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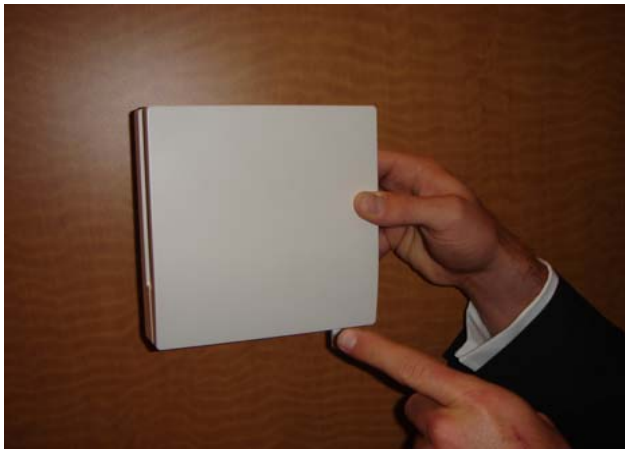

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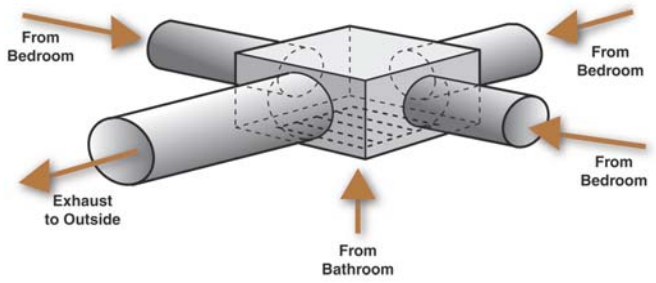

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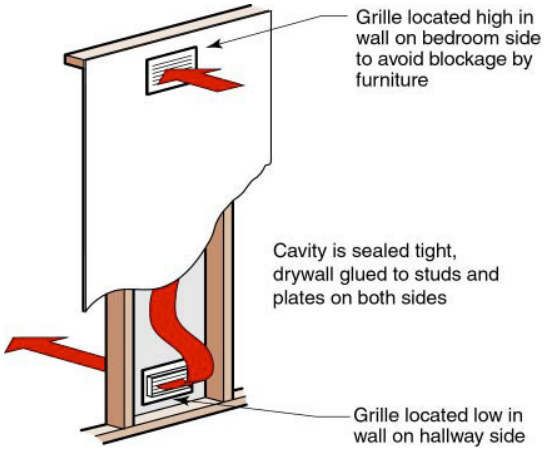

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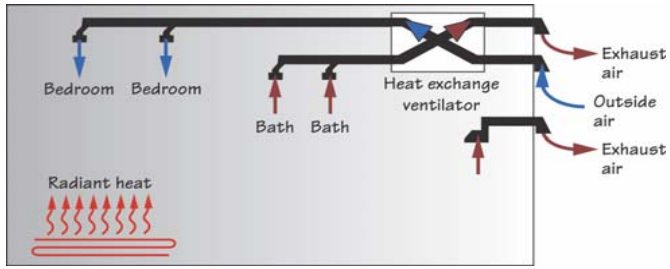

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