

# Mechanical Ventilation : How much is enough? Can there be Too Much?

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Resnet Meeting 2/20/07



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# Thanks To:

- U.S. DOE Building America program, especially George James and Ed Pollock for their sustained support
- Ken Fonorow, Neil Moyer, David Beal, John Sherwin and other colleagues for their contributions



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# Vent Priorities

- Source Control (VOC and Moisture)
- Spot Exhausts in kitchen and bath
- Whole House Mechanical Ventilation
- Supplemental Dehumidification in hot, humid climates (Improved a/c controls may not be enough)



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# Why Ventilate Mechanically?

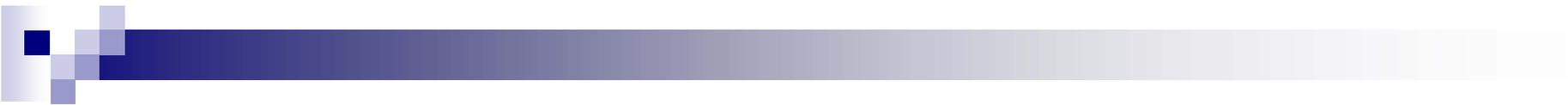
- Odor Control
- Health Benefits
- Moisture Control
- Building Pressurization in Humid Climates
- Relying on homeowners to open windows can lead to complaints and allergy problems



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# Odor Control

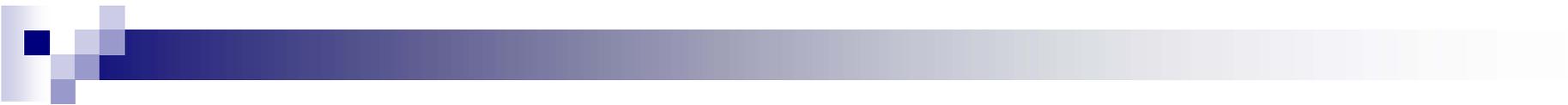
- Was and still is the primary reason for whole house ventilation. ~5 to 10 cfm/person minimum required depending on level of mixing and bio-effluents



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# Health Benefits

- In dry climates (Northern Europe etc.) some data shows lower rates of sick leave and occupant satisfaction in office buildings with higher ventilation rates ~20 cfm/person



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# Moisture Control

- In all climates, during dry cold periods, ventilation reduces moisture in homes preventing condensation and growth of mold, mildew etc.
- During humid periods, w/o supplemental dehumidification, ventilation can exacerbate interior humidity
- Optimum is  $RH \leq 50\%$  on a daily average basis for dust mite control



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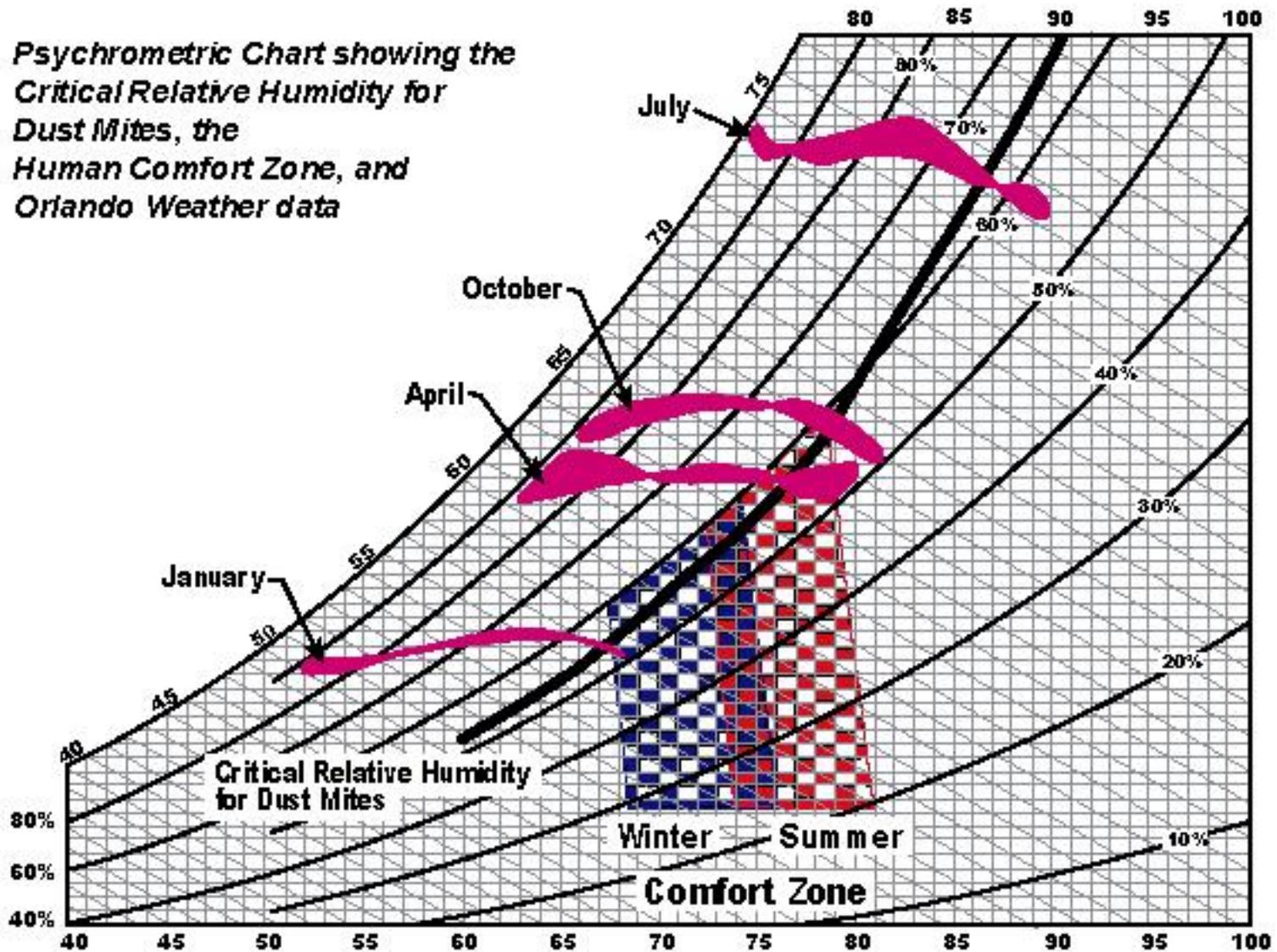


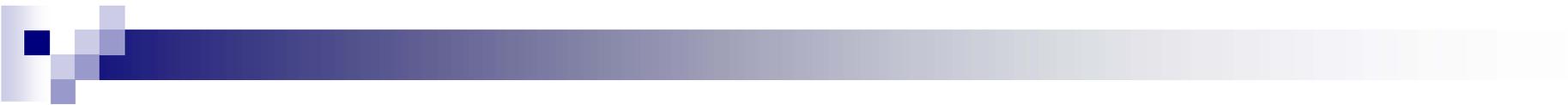


**Dust Mite – Blomia Tropicalis**



*Psychrometric Chart showing the Critical Relative Humidity for Dust Mites, the Human Comfort Zone, and Orlando Weather data*





# Pressurization

- In hot, humid climates homes should be pressurized by whole house ventilation.
- This will minimize unplanned moisture, radon and soil gas intrusion into the home through convective processes



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# BAIHP Approach

- Custom Homes with whole house dehumidification – ventilate at ASHRAE 62.2 or greater rates so long as RH  $\leq 50\%$
- Production homes w/o supplemental dehumidification in Florida – use run time vent



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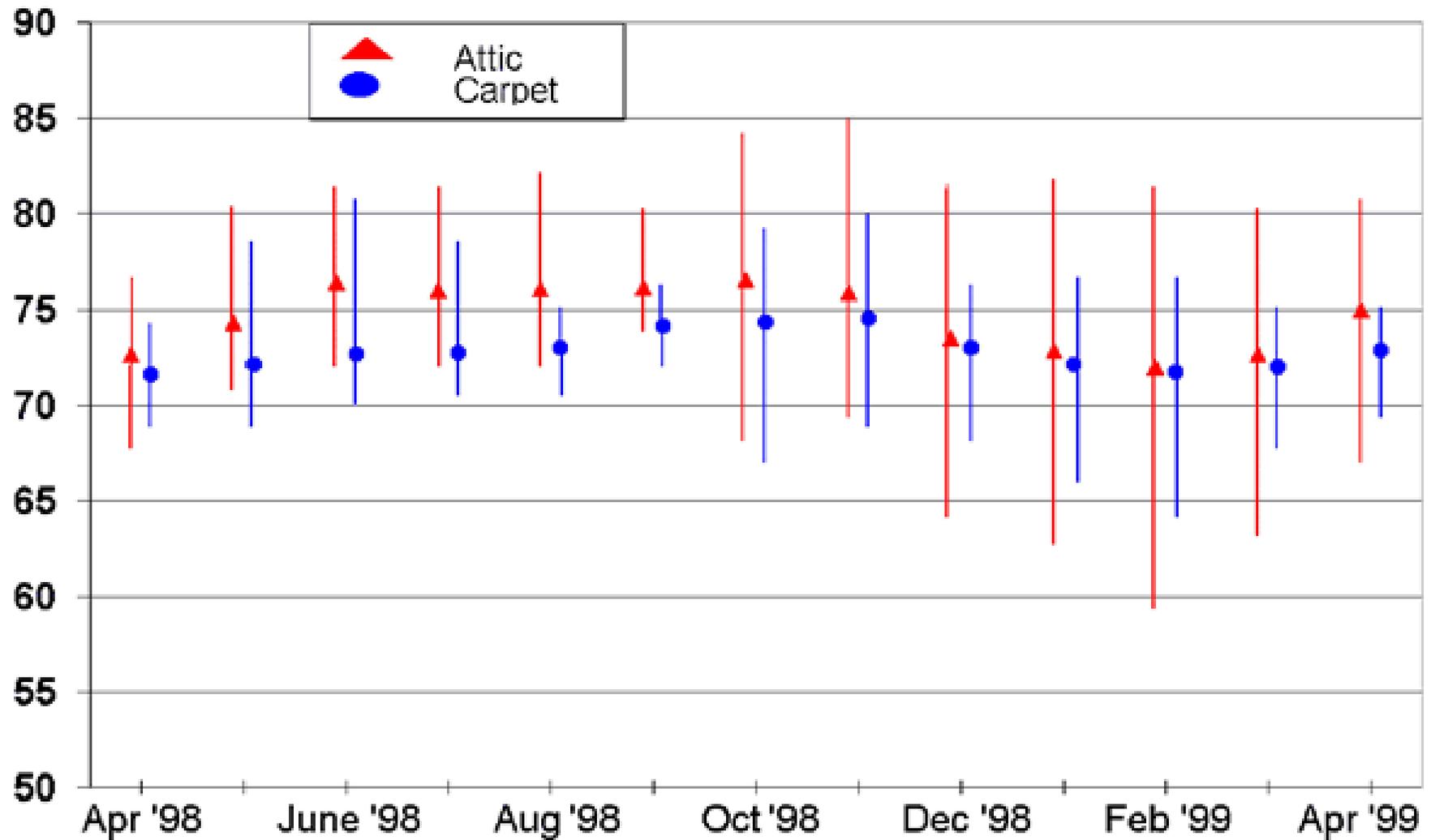
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# Custom Home in Orlando: Health House 97 - 4Tons for 3,600 SF (zoned)



## Orlando Health House Temperatures

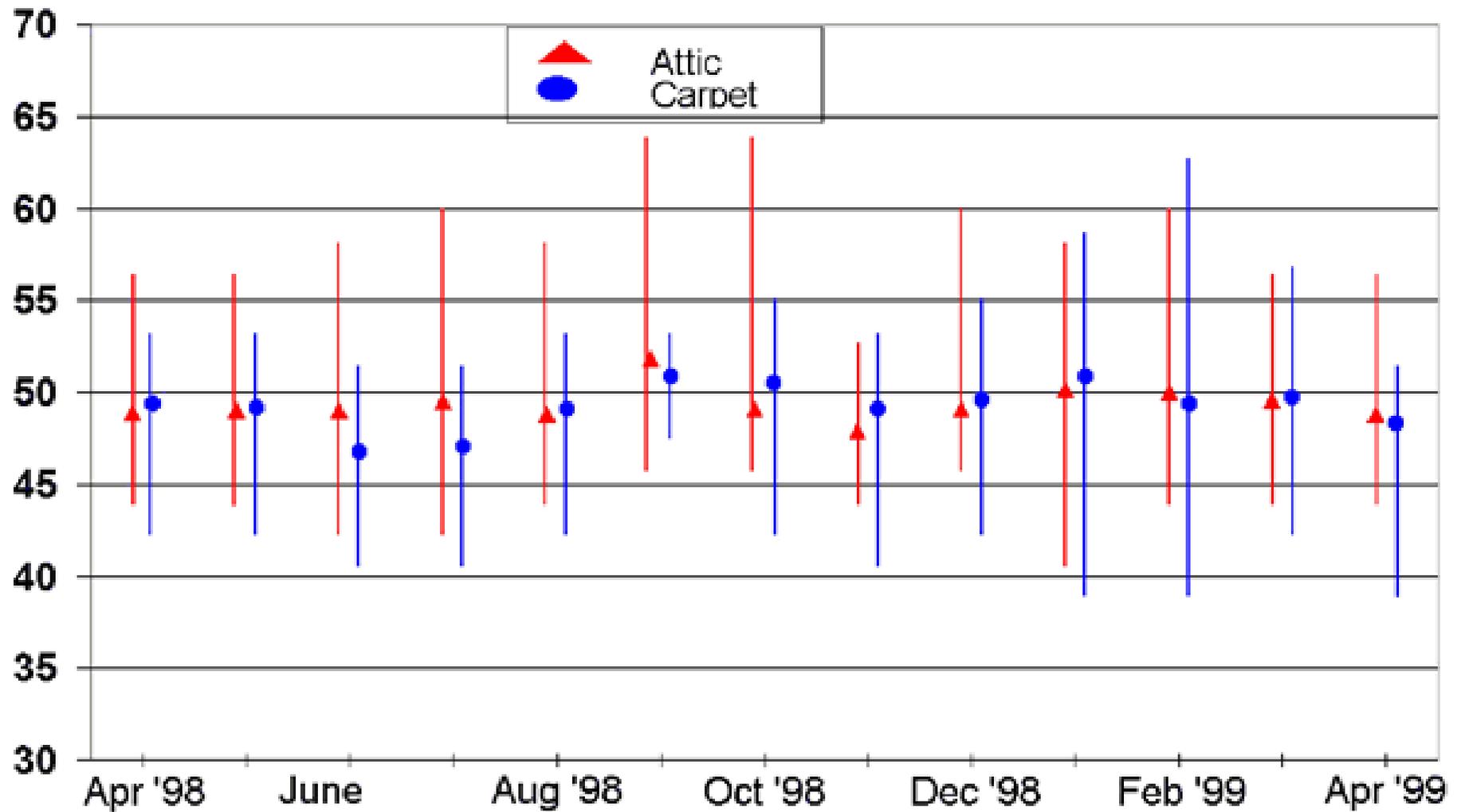


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## Orlando Health House RH



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# Production Homes

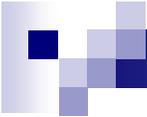
- In the late 90s some occupants complained of odors in some new homes
- In response a simple positive pressure vent system has been installed in hundreds of new homes since 1999
- This work led by Ken Fonorow (FL H.E.R.O.)



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# Typical Home



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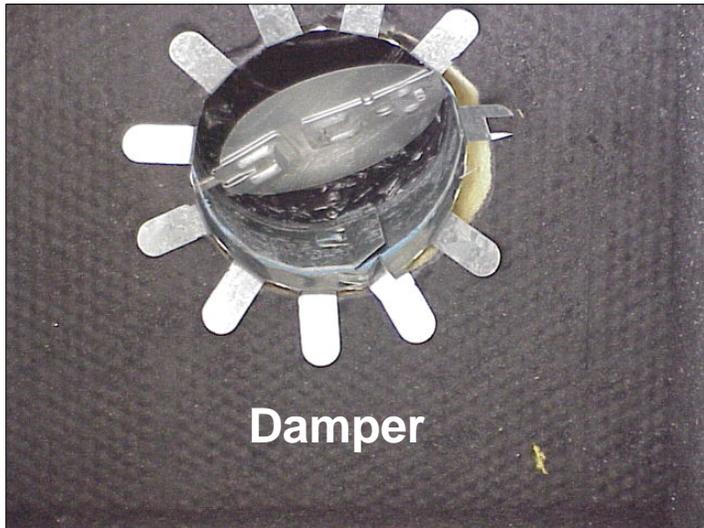
2nd system inlet can be side-by-side or separate



## Outside Air Ventilation

Objective: Deliver filtered outside air to return side of AHU

Outside Air Inlet: Standard boot with small duct installed at porch or soffit with filter back grille (usually 1'X1')



Outside Air Path:  
Ducted from inlet back to return air side of AHU

Damper adjusted to achieve desired air flow  
(air flow measured and damper adjusted during final set up)



## **Jump Ducts**

Objective: Provide return air path from private rooms when doors are closed

Keeps house and room air pressure neutral preventing mechanically induced infiltration

Jump Duct Detail:

Inoperable grill in bedroom and main body of the house connected to the central return, connected by a small duct

# Smaller Homes



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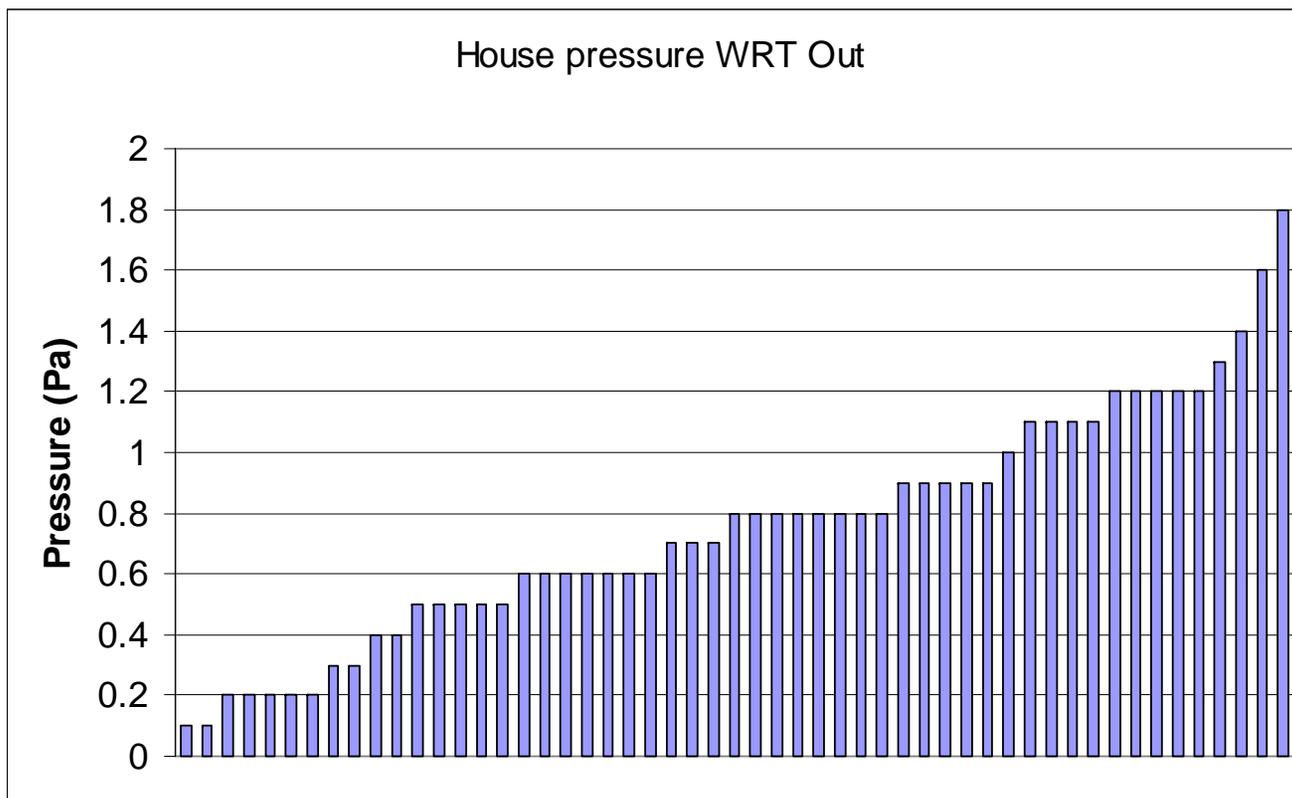
Great Location for OA Intake is ceiling of entry porch



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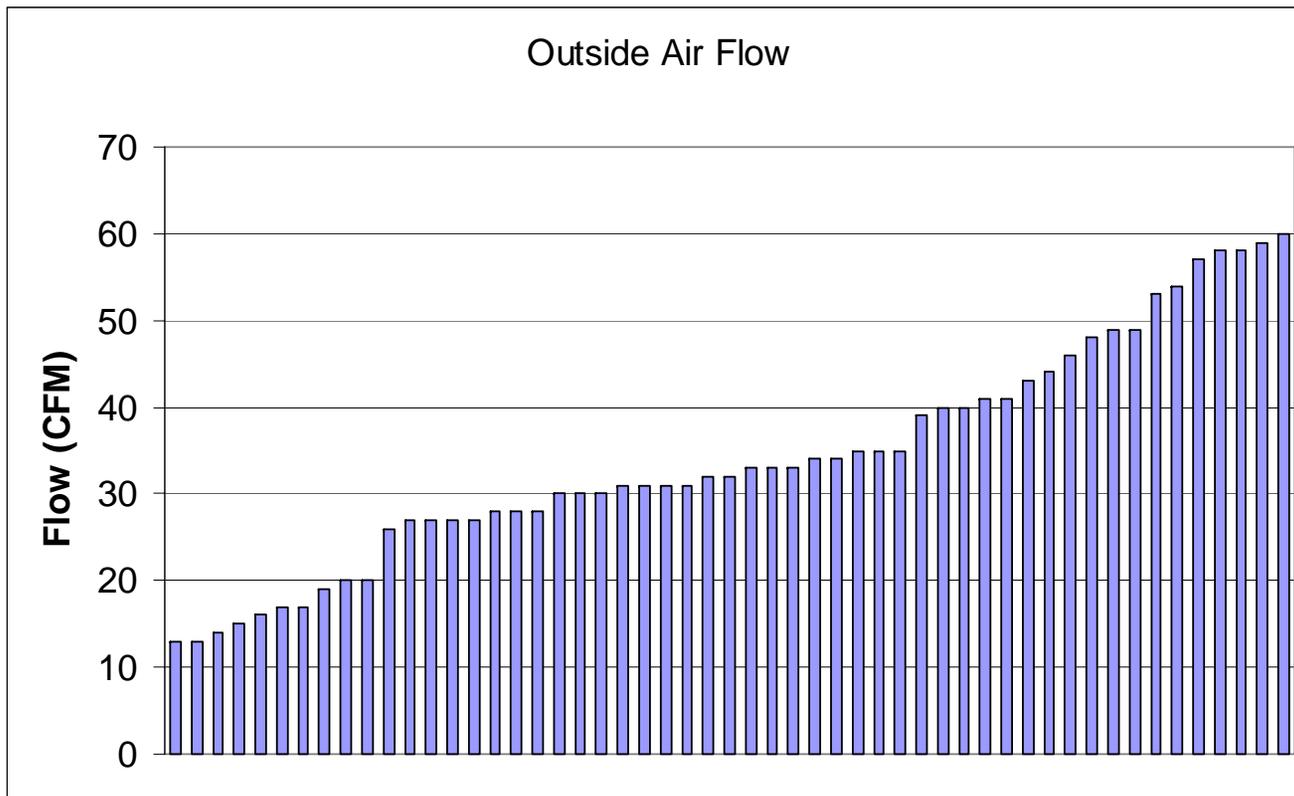
# Pressure Data from 54 Homes



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# Vent Data from 54 Homes



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# Data from 54 Homes

- No complaints regarding odor or humidity in these as well as ~500 other energy efficient homes in Gainesville, FL that Ken Fonorow has assisted in designing and commissioning since 1999
- Mechanical vent rate avg of 34 CFM when the ahu runs is significantly lower than 62.2 requirement



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# T and RH data for New Generation Homes by Kingon

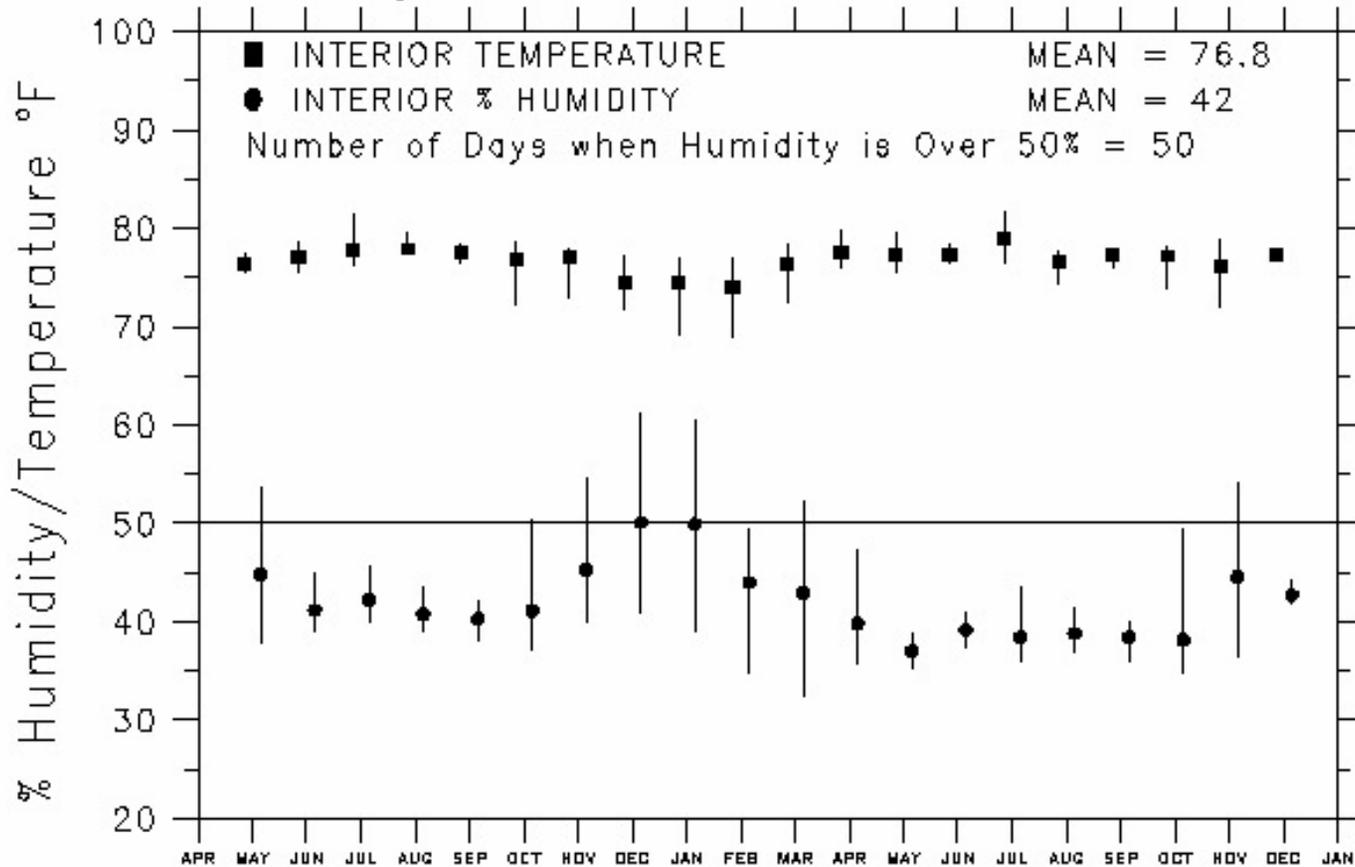
- 2481 sq. ft.
- No zoning
- 32 cfm runtime vent
- Vented attic
- Ft. Myers, FL



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## Kingon House Interior Conditions



3 May, 2005 to 4 December, 2006



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# Conclusions for energy efficient homes in hot-humid climates

- Without any whole house mechanical ventilation, some homeowner complaints are likely
- For best IAQ use ASHRAE 62.2 vent with supplemental dehumidification
- For homes w/o supplemental dehumidification, run time vent with rates <62.2 appears to result in good RH control and no odor or high RH complaints in over 500 homes
- Research continues and 62.2 may be revised



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Thank You

