Putting the V back in HVAC
V is for Ventilation

A system or means of providing fresh air.

Webster New Collegiate Dictionary
Benjamin Franklin

“I am certain that no air is so unwholesome as air in a closed room that has been often breathed and not changed.”
“Traditional heating and cooling systems in U.S. homes have not addressed the fresh air ventilation needs for home occupants. Homes experience inadequate ventilation because they rely on infiltration and natural ventilation rather than controlled mechanical ventilation systems.”

Program Needs for Indoor Environments Research (PNIER)
US EPA Planning Document
Common Callbacks

(Houses that work - EEBA)

- High interior humidity
- Poor indoor air / mold problems
- Wet basements, crawlspaces or slabs
- Comfort problems / drafts
- High energy bills
US buildings consume roughly 10% of the world’s energy, every day!
Map of DOE's Proposed Climate Zones

- Dry (B)
- Moist (A)
- Marine (C)

All of Alaska in Zone 7 except for the following:
Boroughs in Zone 8:
- Bethel
- Dillingham
- Fairbanks N. Star
- Nome
- North Slope

Northwest Arctic
Southeast Fairbanks
Wade Hampton
Yukon-Koyukuk

Zone 1 includes Hawaii, Guam, Puerto Rico, and the Virgin Islands

Warm-Humid Below White Line

March 24, 2003
The Better Built House

Everything you need to know but were.....
Characteristics of Better Buildings

- Very tight construction
- Carefully insulated
- Mechanical ventilation
- Point them at the sun
- Reduced moisture problems
- Good indoor air quality
- Energy efficient
- Greater comfort
- Durable / low maintenance
- Moisture control
- Radon control
- Pest barriers
- HVAC: heating, cooling, ventilation, filtration
- Combustion and garage isolation
- Healthy building materials
- Commissioning the building
How houses work

House as a system

Heat, air and moisture flows
Insanity .............
Continuing to do things
the same, and somehow
expecting a different
outcome.
Air Flows

High pressure → Low pressure

To have air flow - a pressure difference and a hole.

Pressure in houses is caused by:
- Wind Effect
- Stack Effect
- Flue or mechanical Effect
Uncontrolled air leakage exfiltrating moisture into an insulated wall or roof cavity creates rot & decay.
Indoor Air Quality...

Understanding sources and solutions
Fact:

1 in 3 people have an allergy severe enough to seek medical attention on a routine basis.

—American Lung Association
Fact:

On average, we spend more than 90% of our time in buildings, much of it in the home.

World Health Organization
Fact:

91% of new home buyers are concerned about indoor air quality. And are willing to pay $5,000+ in add-ons to assure greater control of their indoor environment.

— Builder Magazine, Honeywell and Professional Builder Magazine
The Nature of IAQ & Health

Everyone is affected, some more than others

- Age – the very young and the elderly
- General health – the immune system
- Duration of exposure
- Level of pollutant concentration
Indoor air is affected by:

- Outdoor air
- Building materials
- Mechanical equipment
- The foundation (moisture, soil gases)
- Home furnishings
- Lifestyle - how people live in their home; hobbies, pets, cleaning and personal care
Pollutant Sources

External
- Outdoor air
- Attached garages
- Soil gases (radon)
- Exterior applied insecticides

Internal
- Building materials
- Combustion equipment
- Occupant Activities
  - cooking
  - cleaning
  - hobbies
- Furnishings
- Mold & other biologicals
Moisture is the key to MOLD GROWTH.
Molds

- Spores (seeds)
- Plant materials (Beta-1,3 glucans)
- Mycotoxins
- Smells (fungal volatiles)
Spores (seeds) are everywhere..........

Factors that affect the germination and growth of molds are:

- nutrients
- presence of oxygen
- temperature
- water
Strategies to Control Moisture

- **No leaks**
- **Manage interior humidity levels**
  - Install and operate ventilation system
  - Exhaust from kitchen and baths
  - Vent dryers
- **Warm surface temperatures**
  - Increase insulation
  - Avoid thermal bridges
  - Use low e, warm edge windows
Combustion Safety

Rule # 1 – don’t kill your customer!

- Sealed combustion equipment
- Power vented water heater
- Direct vent fireplaces
- Vented gas cooking appliances
- Separating the house from the garage
- Install CO Detectors
Water heater safety: the good, the bad, and the ugly
The Garage to house Connection
IAQ Strategies

1. Eliminate
2. Seal
3. Ventilate
4. Filter
Ventilation...

Methods, amounts & strategies
More customers / more business
the debate continues…

- More customers?
- More product to existing customers?
- Why not grow your business doing more $ with your existing customers?
Why Ventilate?

- Outdoor air is always cleaner than indoor air.
- To control humidity.
- To control pollutants.
  - People - respiration (primarily CO₂), body odor, water vapor, cooking, hobbies, parties, pets.
Goals of Mechanical Ventilation

Stale air out, fresh air in

- To control moisture in buildings (source control)
- To reduce pollutants in the home (dilution)
- To filter the incoming air

- Ventilate for people (continuous)
- Supplementary ventilation (intermittent, as needed for “special events”)

- Distributed, quiet, comfortable, controlled
How Much Ventilation?

- **ASHRAE: Standard 62-2**
  - So much per person (bedrooms)
  - Additional ventilation based on Floor Area

- **Other factors:**
  - Moisture generation rates,
  - Source strength of pollutant,
  - Occupant sensitivity
Whole house ventilation

- Every home needs the capacity for mechanical ventilation to dilute pollutants
  - over and above natural leakage and opening windows
  - There are exceptions are for warmer climates where it is expected windows will be open for extended periods

- 7.5 cfm per bedroom (+1) + 0.01 cfm/ft² Floor Area
  - Add additional capacity if it is known there will be more people
Ventilation Sizing Example

This minimal ventilation capacity controls moisture, odors and other pollutants.

Ventilation Capacity

4 bedrooms + 1 x 7.5 cfm + 26.4 cfm

= 63.9 CFM
Types of Mechanical Ventilation

- Exhaust-Only
- Supply-Only
- Balanced System
Builders want ventilation solutions for their homes.

Solutions that work in the home, not in the box - installed.
Exhaust Ventilation
Exhaust Ventilation

- Exhaust the moisture and pollutants at the source
- Use quiet, efficient, “tested” fans
- Be cautious about backdrafing, houses are getting tighter
Minimum bathroom fan specifications

Choose fans that are:

- HVI rated, not less than 50cfm.
- Have a sound rating not greater than 3.0 sones.
- If intended for continuous use, a sound rating of 1.0 sone is req’d.
Properly sized fan and duct (5” dia.)

Insulated duct, air tight details
Central Exhaust Fan

- A central fan can reduce noise levels and encourage extended operation times.
- Locate the fan in unoccupied areas, accessible for maintenance.

Graphics Courtesy of Building Science Corp.
Central Exhaust Fan
Specify fans that are under 1.0 sones to ensure people will leave them running
Supply Ventilation
Supply Only Ventilation

- A fresh air duct into the air handler return - typically 6”
- Use dampers & timers to control the ventilation (independent of heating & cooling cycles)
- Use ECM motors
- Supply only ventilation will tend to pressurize homes – this can be good or bad depending on climate and heating choices.
HVAC in crawl space

- Must be filtered
- Fresh air inlets tied to HVAC systems must have a MERV 6 or better filter

Diagram details:
- Return duct
- Central return at first floor
- Balancing damper
- 6" insulated outside air duct
- Filter assembly
- Canvas connection (soft connection)
- Slab
- Conditioned crawl space
- Main supply trunk
- Furnace
Distribution of fresh air is essential for good IAQ with all systems!
Balanced Ventilation
HRV / ERV
the LUNGS of the Home

Recover as much as 70% - 80% of the energy from the exhaust air stream
Exhaust ducted – fresh air through forced-air heating
Fully ducted system
Fully ducted system – Slab on grade
Integrated space, DHW and ventilation systems ...

- Heat distribution
  - forced air / Radiant floor
- Domestic hot water
- Energy recovery ventilation
- Cooling if required
Balancing procedure with airflow stations

Balance airflows within +/-10% for proper operation
Other balancing procedures

- Individual manufacturers may have different balancing methods:
  - Some use pressure taps built into the door.
  - Some use fan speed adjustments rather than dampers.
Timer switches for the kitchen and bathrooms

Control Options
Main controls
(some with dehumidistats)
Outside hoods

This style of hood allows excellent airflow.

Exhaust air out

Fresh air in

A Special Hood:
Some specialized hoods don’t need the 6’ clearance from exhaust.

This style of hood tends to be very restrictive on airflow.
Consumer Alert for "air purifiers"

The medical staff of Consumers Union and Consumer Reports has issued warnings on Sharper Image's Ionic Breeze and four other leading brands of ionic air cleaners. These devices may emit harmful levels of ozone. Consumers should be aware that brief exposure to ozone aggravates asthma and decreases lung function.

Prolonged exposure can cause permanent lung damage and can deaden the sense of smell.
Changing the Course of Housing
The opportunity

- America needs healthy, energy efficient houses
- Healthy homes need good ventilation
- You’re in a great industry, with great products
- You are well placed to take advantage of the opportunities
- There is money to be made
- Go get it!
Put the V back in your HVAC business
Thank You!
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