
AprilAire

Established in

1954

750+
Employees

Complete whole-home IAQ product portfolio

Fresh Air Ventilation | High-Efficiency Air Filtration | Humidity Control | IAQ Control | Radon Mitigation | UVC

State-of-the-Art Technology Center driving product innovation

5 YEAR WARRANTY

MADE IN USA

Agenda and Learnings

01 How to interpret and apply Fresh Air Requirements in new construction

02 Learn how to identify and recommend the correct Ventilation Solution for climate, code and specific construction features.

03 Key IAQ considerations for building and design

04 Consumer awareness of IAQ and embracing ventilation as a healthy air solution

Do I Need to Ventilate?

Understanding fresh air requirements in new construction.

Yes, and here are the main reason's why.

CODE REQUIREMENTS

- IMC, IRC, IECC
- ASHRAE Standards
    - 62.1 (Commercial Vent Rates)
    - 62.2 (Residential Vent Rates)
    - 90.1 (Energy Standard for buildings except low rise residential buildings, less than 4 stories high)

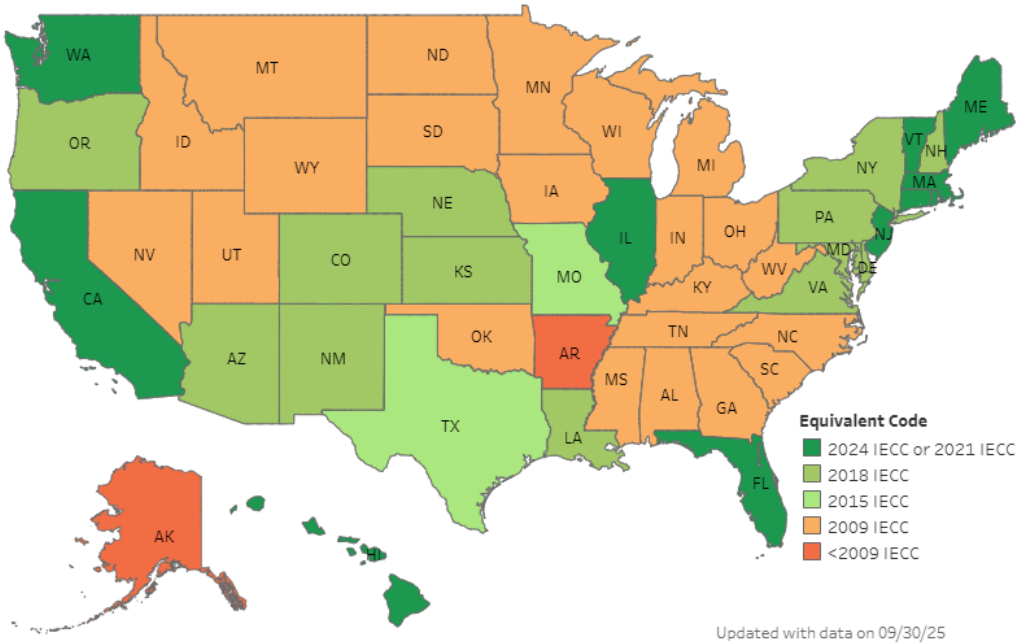
TIGHTER CONSTRUCTION

- Better controlled indoor environment = lower load
- Less natural air exchanges
- Limited IAQ Control
    - Stagnant Air that contains VOC, dust, bacteria, viruses, pollen, CO2
    - Lingering Odors
    - Trapped Moisture

INNOVATION STANDARDS

- LEED (Leadership in Energy & Environmental Design)
- Energy Star
- RESNET (Residential Energy Services Network)
- Consumer Concerns - *"Healthy Air Aware"*
- Healthy Home Standards

New Construction Codes



The IMC and IRC tell you **how much** air the home and occupants need

The IECC tells you **how efficient** the ventilation units must be.

SOURCE: https://www.energycodes.gov/state-portal

IECC Ventilation Requirements

2021 IECC Standards

1. Homes in Climate Zones 1 & 2 must have tested air leakage rates not exceeding 5 ACH50,
2. Homes in Climate Zones 3-8 must have tested air leakage rates not exceeding 5 ACH50
3. Homes in Climate Zones 7 & 8 requires HRV or ERV [Minimum Sensible Heat Recovery Efficiency of 65% at 32° at a flow greater than or equal to the deign airflow]
4. The building shall be provided with mechanical ventilation in accordance with the IRC, IMC as applicable or with other approved means of ventilation.
5. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating
6. Mechanical ventilation system fans shall meet the following efficacy requirements:

TABLE R403.6.2 WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

FAN LOCATION	AIRFLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)
HRV, ERV	Any	1.2 cfm/watt
In-line supply or exhaust fan	Any	3.8 cfm/watt
Other exhaust fan	< 90	2.8 cfm/watt
Other exhaust fan	≥ 90	3.5 cfm/watt
Air-handler that is integrated to tested and *listed* HVAC equipment	Any	1.2 cfm/watt

For SI: 1 cubic foot per minute = 28.3 L/min.

a. Design outdoor airflow rate/watts of fan used.

https://codes.iccsafe.org/content/IECC2021P2/chapter-4-re-residential-energy-efficiency#IECC2021P2_RE_Ch04_SecR403.6.3

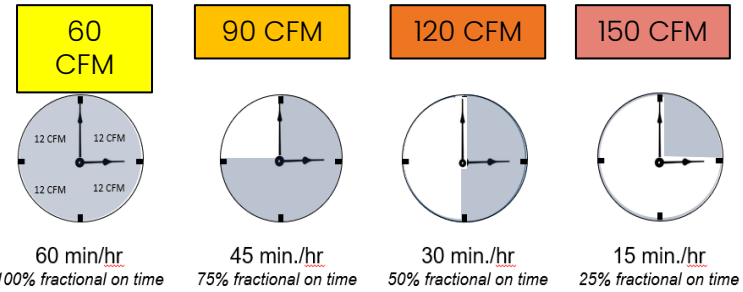
IRC Ventilation Requirements

ASHRAE 62.2 Standard [Calculation] describes the minimum requirements to achieve acceptable IAQ via dwelling-unit ventilation, local mechanical exhaust, and source control

Continuous Rate:

Floor Area (ft^2)	Number of Bedrooms				
	0-1	2-3	4-5	6-7	>7
<1500	30	45	60	75	90
1501-3000	45	60	75	90	105
3001-4500	60	75	90	105	120
4501-6000	75	90	105	120	135
6001-7500	90	105	120	135	150
>7500	105	120	135	150	165

Intermittent Rate:



Fresh Air Airflow Required (CFM) = [House Square Footage x **0.01**]+[Number of bedrooms + 1] x 7.5

0.01 = ASHRAE 62.2.2010

0.03 = ASHRAE 62.2.2015+

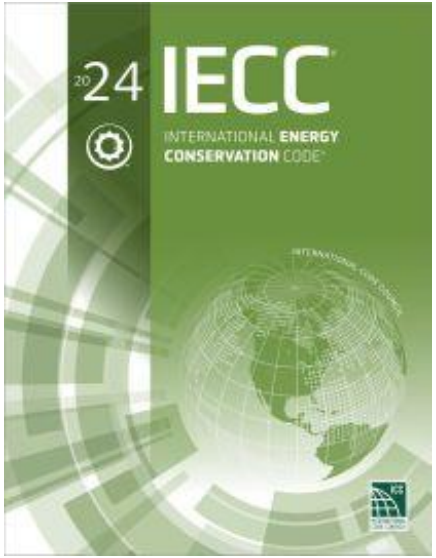
IECC Ventilation Requirements

Upcoming 2024 IECC Standards

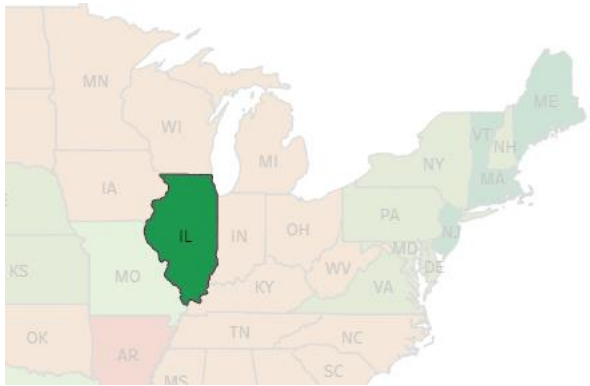
R402 Building Thermal Envelope Air Leakage (Technical & Organizational changes)
- Clarify the max allowed for each path & home type
- Increased stringency:
- R405 & R406:
    - 5 ACH50 drops to 4.0 ACH50
- Prescriptive:
- 5 ACH50 drops to 4.0 ACH50 in CZ 0-2
- 3 ACH50 drops to 2.5 ACH50 in CZ 6-8

R403.6.1 Heat or energy recovery ventilation
- Expands requirement into CZ 6

The main requirement over previous years is that the efficacy (cfm/watt) has gone 2.8 to 3.8 for powered supply vent and its 1.2 for ERV.



Illinois Specific Exceptions



R403.6.6.3 Mechanical Ventilation Rate. The whole-house mechanical ventilation system shall provide outdoor air at a continuous rate as determined in accordance with Table R403.6.6.3 (1) or Equation 4-0.

Ventilation rate in cubic feet per minute = (0.01 x total square foot area of house) + [7.5 x (number of bedrooms +1)] Equation 4-0

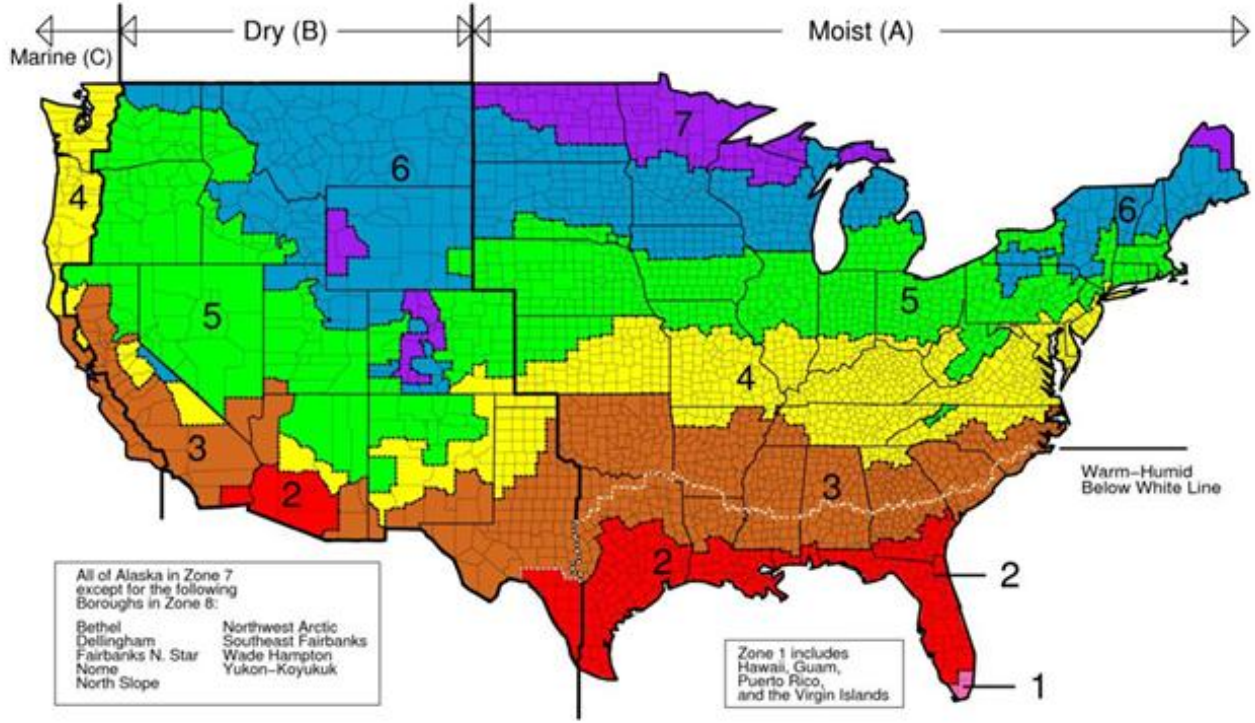
Exceptions:

1. Ventilation rate credit. The minimum mechanical ventilation rate determined in accordance with Table R403.6.6.3(1) or Equation 4-0 shall be reduced by 30 percent, provided that both of the following conditions apply:
   - 1.1 A ducted system supplies ventilation air directly to each bedroom and to one or more of the following rooms:
     - 1.1.1. Living room.
     - 1.1.2 Dining room.
     - 1.1.3 Kitchen.
   - 1.2 The whole-house ventilation system is a balanced ventilation system.
2. Programmed intermittent operation. The whole-house mechanical ventilation system is permitted to operate intermittently where the system has controls that enable operation for not less than 25 percent of each 4-hour segment and the ventilation rate in Table R403.6.6.3(1), by Equation 4-0 or by Exception 1 is multiplied by the factor determined in accordance with Table R403.6.6.3(2)

Reduce ventilation rate with a balanced system (E/HRV)

Control ventilation with intermittent runtime on fresh air ventilator

Climate Zone Explanations



https://www.energy.gov/eere/buildings/climate-zones

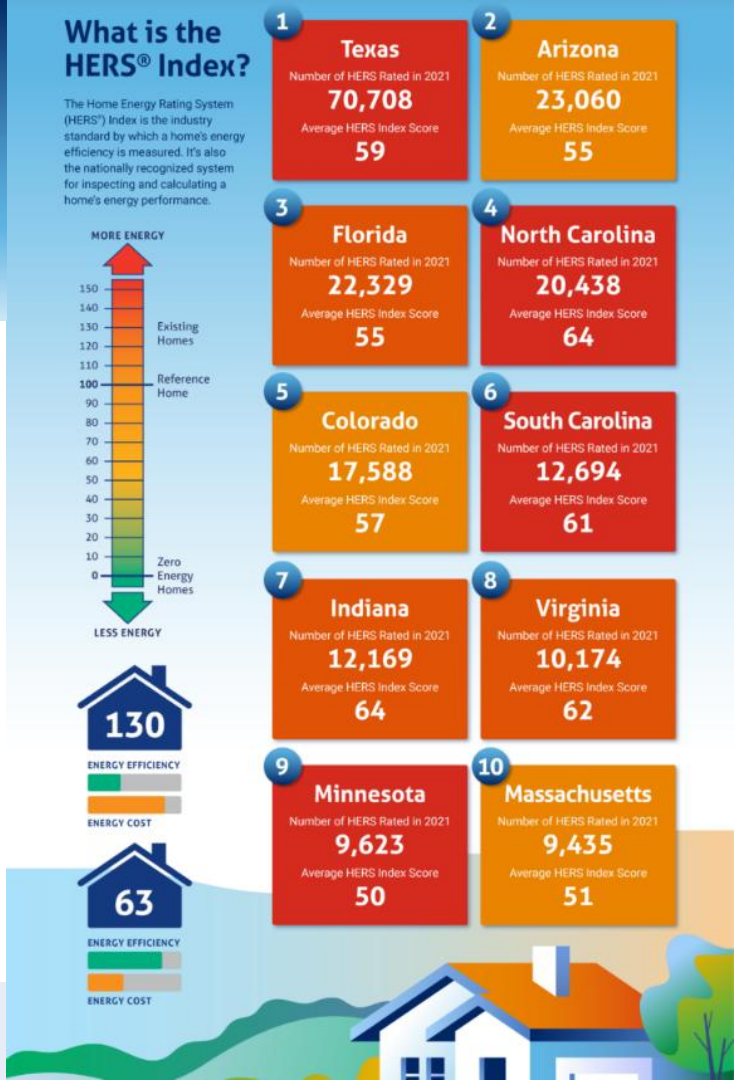
HERS Index

Who is RESNET?

RESNET is a recognized national standards – making body for the building energy efficiency rating and certification systems in the United States. RESNET created and maintains the HERS Index to allow for easy comparison of energy performance of homes.

RESNET HERS INDEX

Ventilation: A HERs score is way of looking at a home total energy performance. Ventilation products can have minute, or very large impacts on a HERs score depending on other variables.



Blower Door Test Results

The airtightness of existing homes can vary dramatically based on the construction style, age and region. The chart below shows the relative tightness of homes based on the ACH50.

0 - 1.5 ACH Very tight
1.5 - 3 ACH Tight
3 - 5 ACH Moderately tight

5 - 7 ACH Loose
7 - 10 ACH Very loose
10 + ACH Extremely loose

Refer to the International Energy Conservation Code (IECC) tor climate zone specific maximum allowable ACH50 values.

*TEC- The Energy Conservatory
https://energyconservatory.com/wp-content/uploads/2017/08/Test-Results-and-Sample-Test-Forms-Guide-.pdf

What about existing homes?

Consumer Concerns

Health issues

Viruses, VOCs, PM, RH

Making homeowners aware of Healthy Air

Home Upgrades

New doors, windows, insulation

Reduced infiltration

Comfort Issues

Hot/Cold Spots

Stale/Stagnant Air

Odors

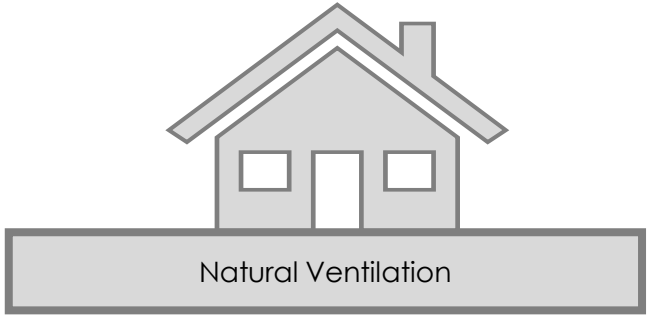
Humidity Issues

Identifying these issues in existing homes are the key to selling [the right] ventilation solutions.
Existing homes deserve to be just as healthy as new homes.

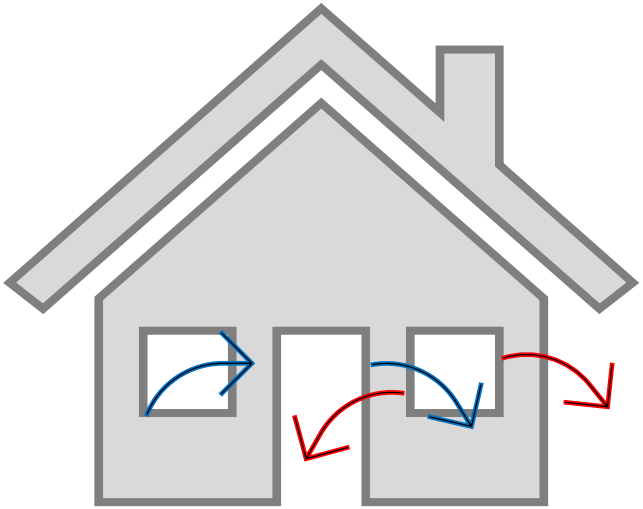
Equipment selection

Understanding fresh air requirements in new construction.

Four Types of Ventilation Systems



Natural Ventilation



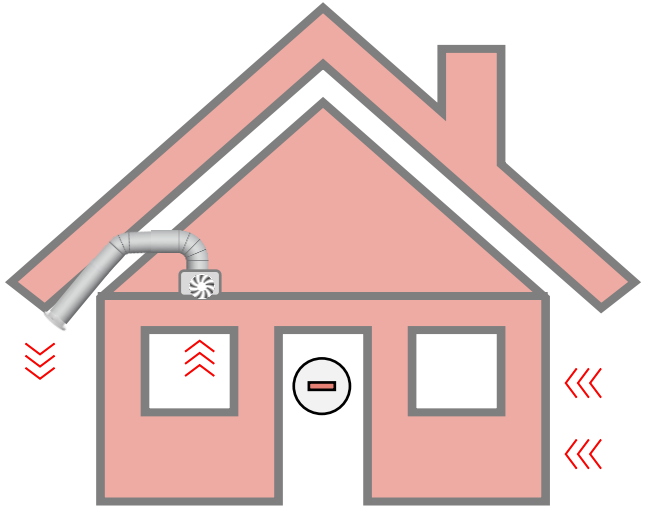
Utilizing products that are already in place – operable doors/windows

Something a homeowner does whenever possible to freshen the air in the home

Considerations:

- Uncontrolled (How much air do I need? Do I care?)
- Comfort: Unconditioned (Temperature, Humidity, poor AQI).
- Inefficient: Increased HVAC load has negative impact on utility bill.

Exhaust/Negative Pressure Ventilation



1 CFM In = 1 CFM Out

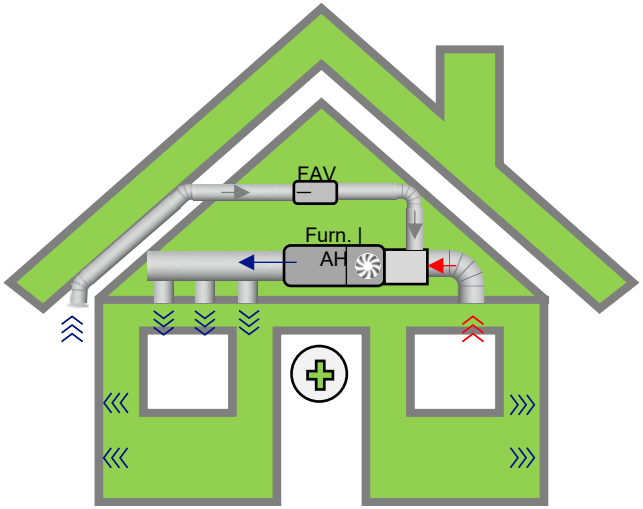
Air is exhausted (removed) from the home

- Fans run continuously at one speed for whole home ventilation, and a higher speed for spot ventilation (bath fan, range hood).

Considerations:

- Air is completely unfiltered
- Whatever contaminants are in the path of the inlet, become contaminants inside the home
- Attached Garages create issues
- Gas line penetration issues
- Hot water heater exhaust flue issues

Supply/Positive Pressure Ventilation



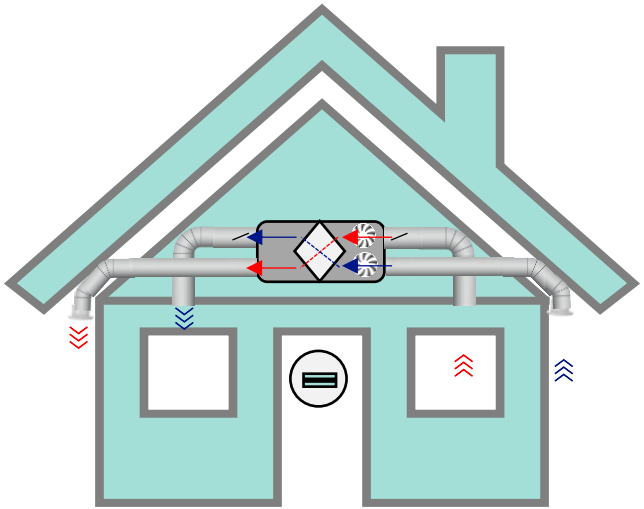
Home is under positive pressure by mechanically bringing in outdoor air.

- Fresh air is distributed into the HVAC system via powered ventilators or dampered solutions that use the HVAC central fan.

Considerations:

- Fresh air is provided form a known source and distributed throughout the home.
- Ventilation controls on supply ventilators can improve IAQ while also preserving energy efficiency goals.
- Simple installation (one outdoor penetration).

Balanced Pressure Ventilation

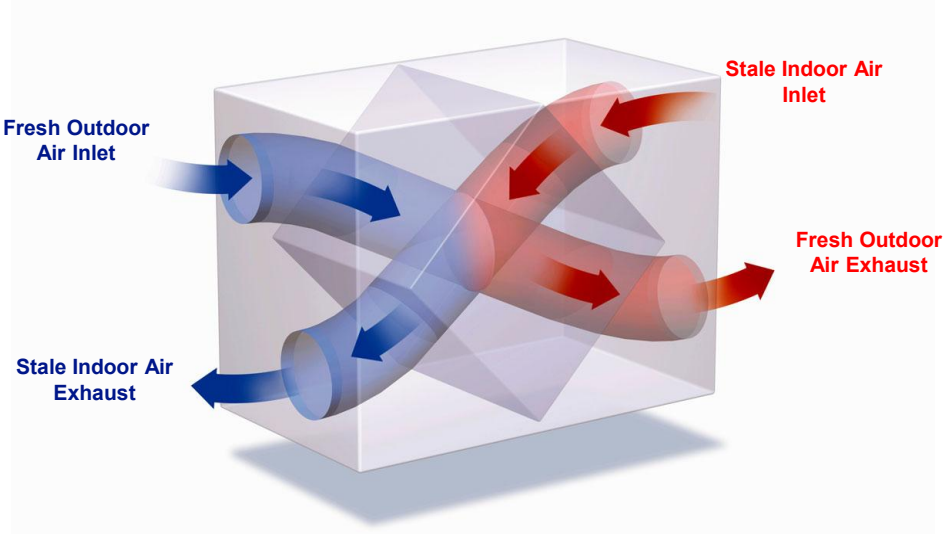


Air is forced into the home at the same rate that air is forced out of the home utilizing two fans delivering and removing the same CFM of air.

Considerations:

- Most common solution is an HRV or ERV.
- Often ducted to the HVAC system, but can be ducted to/from specific rooms.
- Lowest operating cost of any system, but highest installed cost
- Payback is dependent on heating/fuel cost and extremity of seasonal temperatures.

Energy or Heat Recovery Ventilation



- Air to Air Transfer thru an Energy Core
- Transfer of temperature only = HRV
- Transfer of temperature and moisture = ERV
- Utilizing the conditioned air from inside the home to “pre-condition” the outdoor air
- When installed & commissioned correctly = balanced system

The AprilAire Fresh Air Product Portfolio

CFIS

M# 8120X

Entry-level for supply ventilation solution. Cost effective but efficiency dependent on HVAC fan.

M# 8126X

Fan-Powered System

M# 8145 &
M# 8145NC

Need driven by desire for improved energy efficiency related to fan wattage under IECC 2021.

M# 8144NC

Ventilating Dehumidification System

M# E100V & 8190FF

Very tight homes in high-RH climate zones (CZ 1, 2, 3)

Energy Recovery Ventilation

IECC 2021, Energy Star 3.2 – associated with rebate dollars of $2500 - $5000 for ES and NZ homes.

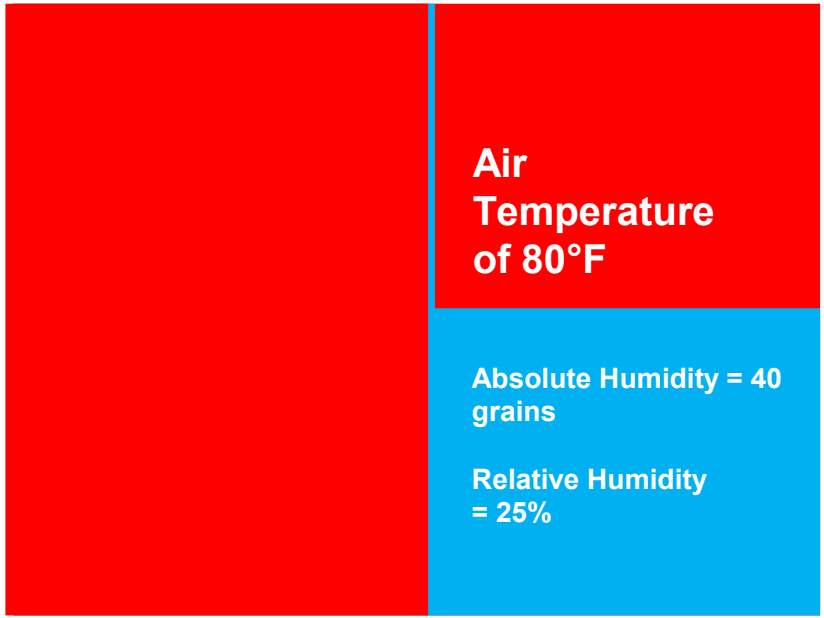
Building Healthy Homes

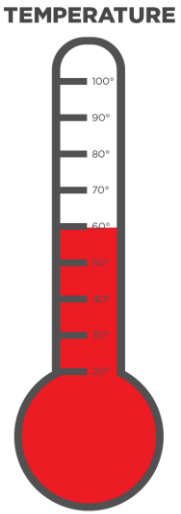
Items that impact indoor air quality before and after move-in.

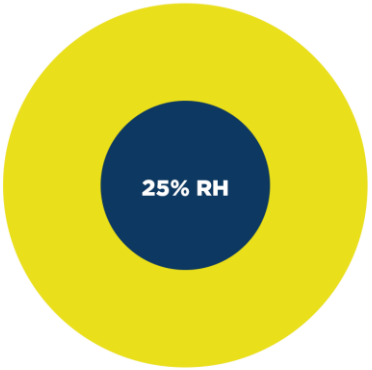
Comfort and Health in the long term

- Homes that are healthy on paper are not always perfect in practice.
- Many variables go into how a home performs after it's occupied. Homeowner habits, maintenance and sensitivity to air quality conditions are different.
- The correct IAQ solutions allow a healthy home regardless of the individual homeowner variables.
- Comfort, health & energy efficiency can be opposing forces.

Temperature, humidity and ventilation







Absolute Humidity = the actual amount of water vaper present in the air (expressed in grains)

Relative Humidity = is the amount of water vapor in the air compared to the amount of water vapor that the air can hold at any particular temperature (expressed as a percent)

Ventilation impact on humidity

- Ventilated air can add 60 – 105 pints per day into a home in humid climate zones (figure 2).
- Even if the air conditioner can handle the latent load when running – it obviously cannot when it's not running.
- "Shoulder seasons" in these climate zones (and all zones) have milder temperatures but high levels of humidity.
- Because temperature is mild, cooling calls are not frequent enough or long enough to handle latent load.

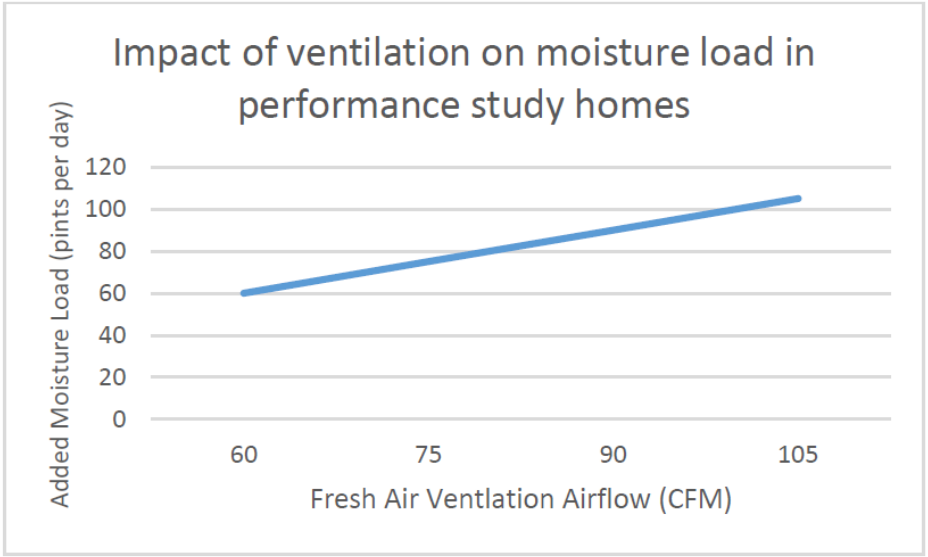


Figure 2 - Note direct correlation between ventilation airflow and increased indoor RH (moisture load)

High Humidity from within

The average 4-person household creates 2.6 gallons of water daily. [78 gallons in a 30-day month]
Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10171418/

1

BREATHING/SWEATING

1.33 GALLONS PER DAY

2

SHOWERING/BATHING

.26 GALLONS PER DAY

3

COOKING

.22 GALLONS PER DAY

4

DISHWASHING

.11 GALLONS PER DAY

Source: Moisture Control in Buildings – Heinz R. Trechsel

In a well-built home, this moisture is trapped & can affect the indoor environment

Negative Pressurization

Negative pressure ventilation is essential as a spot solution locations like kitchens and bathrooms. But supply or balanced WHOLE-HOUSE ventilation ensures that make-up air is coming form the right place.

Healthy Air Aware Customers

Why IAQ matters to home buyers

Given a Choice...

Which glass of water would you give to your family?

It's Time to Care About Healthy Air

5X More Polluted

According to the EPA, the air inside your home can be 5x more polluted than the air outside. That's because homes are being built tighter, making it hard for your home to inhale and exhale.

30M Pollutants

Just one cubic foot of air can have more than 30 million air pollutants including dust, mold spores, allergens, and more. **These irritants can trigger asthma and allergy symptoms.**

Asthma Sufferers

25M+	1.7M	11M
Americans are living with asthma	Asthma-related emergency room visits	Missed workdays due to asthma

Sources: Environmental Protection Agency and American Lung Association

The average human takes approx. **20,000 breathes** every day! That equals **3000 lbs. of air!**

Here Are The Problems All Across North America

According to the EPA, people spend **90%+ of their time indoors**.

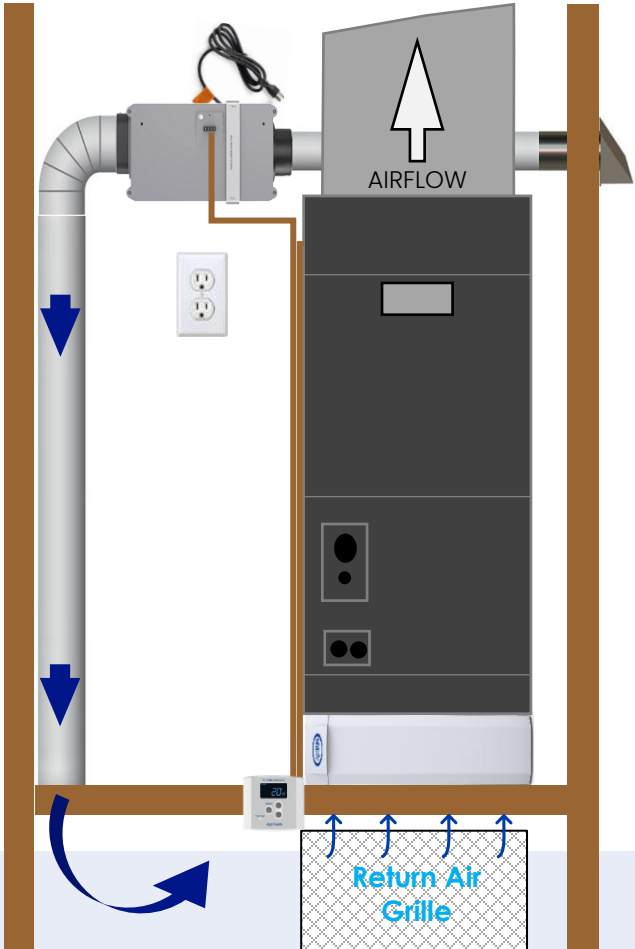
There is good news however and AprilAire is here to help!

Supply/Positive Pressure + High-Efficiency Filtration Study

ASHRAE

BERKELEY LAB
Lawrence Berkeley National Laboratory

Supply Ventilation and a MERV 13 filter on the central forced air system reduced indoor PM2.5 by 90% relative to outdoor when **operated at least 20 min each hour** or continuously at low speed. With a MERV 16 filter, the PM2.5 was reduced by 97%.



Singer, B.C., W.W.Delp, D.R. Black and I.S.Walker (2017) Indoor Air 27(4) 780-790

Hands Down the best solutions for these problems are:

- High-efficiency media air cleaners.
- Efficient, effective whole-house ventilation solution.

High-Efficient Filtration for Source Removal

Fresh Air Ventilation for Dilution & Air Replacement

Safe, healthy technologies that have been proven to work!

Thank You For Your Time Today!

Joseph Hillenmeyer
Sr. Product Manager – Ventilation
Joseph.Hillenmeyer@AprilAire.com