Successful Home Ventilation Strategies for Code Compliance

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U.S. Department of Energy
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Successful Home Ventilation Strategies for Code Compliance

Course Number: EC15-W06

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Course Description

In this session participants will learn about ventilation for residential buildings with a focus on indoor air quality and code compliance.
Instructors will demonstrate how to

- Calculate whole house ventilation requirements
- Identify options and best practices to meet ventilation needs
- Discuss future energy code requirements and how they impact a home's ventilation requirements

Learning Objectives

At the end of the this course, participants will be able to:

- Understand ventilation requirements per ASHRAE 62.2 and the IRC
- Explain the importance of ventilation in new home construction and how ventilation affects indoor air quality
- Discuss the types of ventilation: positive, negative or balanced and the appropriate application of each type within a home
- Identify how to effectively deliver the appropriate amount of ventilation airflow
- Review the air tightness requirements for current and future energy codes and the impact of those requirements on ventilation

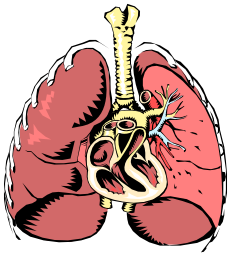
About Southface

Topics Covered

- Using IRC and ASHRAE 62.2-20xx to determine ventilation air requirements
- Other items required by 62.2
- Strategies and products for achieving proper ventilation
- Airflow testing
- Potential issues with ventilation
- Future directions

What's the Purpose of Ventilation?

- Provide fresh air for the occupants



- Dilute pollutants

Keys to good Indoor Air Quality

1. Eliminate (remove pollutant source)
2. Separate (seal or contain pollutants)
3. **Ventilate** (dilute pollutants)
4. Filter (clean and remove pollutants)

"Pollutants need a Pathway to People…"

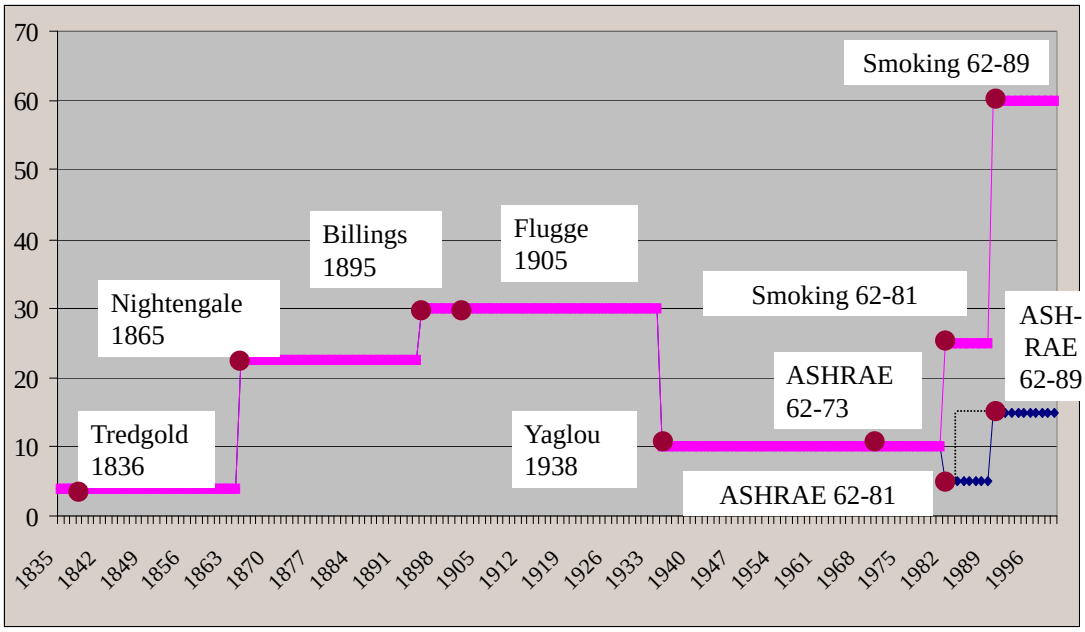
"…and are pushed by positive pressure!"

Ventilation and IAQ

- Outdoor air ventilation addresses most indoor air quality issues
  - Sick building syndrome
  - Moisture and mold problems
  - Second hand tobacco smoke
  - Material outgassing
  - Multiple Chemical Sensitivity

- Ventilation dilutes pollutants!
- Good ventilation strategy doesn't ignore energy and comfort!!

Historical Minimum Ventilation Rates
(cfm/person)



Is it possible to build a house “too tight”?

Where does the “fresh” air come from?

ATTIC

Insulation fibers, dust, coal soot, rodent scat

OUTSIDE

Pollen, auto fumes, dust, moisture

GARAGE

Carbon monoxide, pesticides, gasoline, fertilizers

CRAWLSPACE

Mold, dust, lead, radon, moisture, termiticide

Build tight, Ventilate right

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Commercial: Rules for Good Ventilation

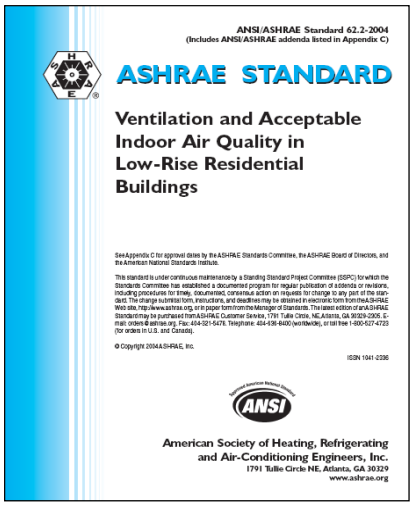
- Provide filtered and dehumidified outdoor air to the breathing space
- Bring in outdoor air from a clean source
- Vary amount of ventilation based on the number of occupants and process loads
- Designs systems that separate ventilation and space conditioning
- Utilize heat/energy recovery to reduce system size and ventilation energy costs

ASHRAE Standard 62

ASHRAE 62-1989 (old!)

- Whole house: 0.35 $ACH_{Natural}$, or 15 cfm per person
- Kitchen: 100 cfm intermittent or 25 cfm continuous or operable window
- Bath: 50 cfm intermittent or 20 cfm continuous or operable window

ASHRAE 62.2-2013
7.5 cfm/person + 3 cfm / 100 s.f.



ASHRAE 62.2-2004,7,10

- 7.5 cfm per person

PLUS

- 1 cfm for every 100 s.f. of conditioned space

62.2-2010 Single Family Ventilation

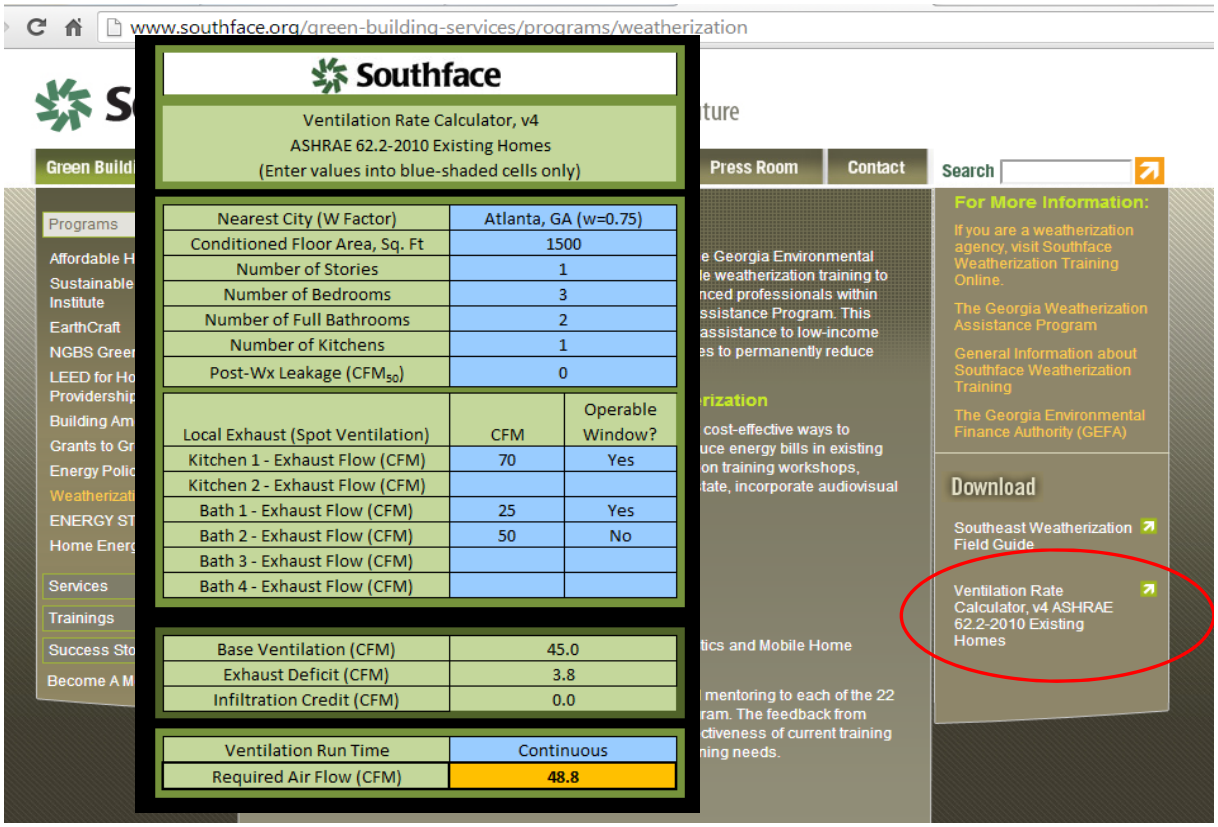
$$CFM_{fan} = (0.01 \times A_{floor}) + (7.5 \times (\#\ bedrooms + 1)) +$$
(alternative compliance supplement)
- (Infiltration credit)

These terms are zero for new construction

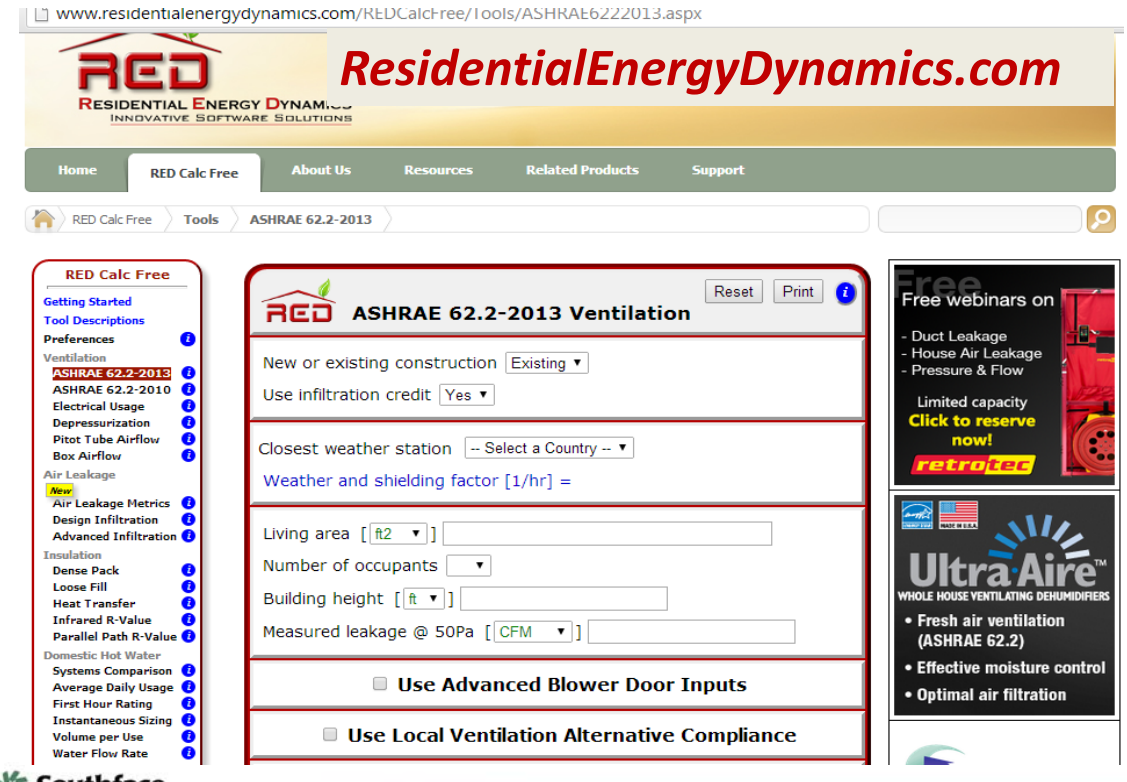
OR

Floor Area (ft^2)	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

Southface 62.2-2010 Ventilation Calculator Tool



62.2-2013 MF Calculator



A few general observations…

- IAQ and ventilation issues are very subjective
- Code compliance is more complex – 2012 IRC/IECC
- Industry experts do not all agree
- Occupant behavior plays a large roll
- Ventilation requirements can vary depending on type of construction
  - Single family or multifamily
  - New construction or renovation
- ASHRAE 62.2 version use status
  - Programs are transitioning from 2007 to 2010
  - Many programs use 2010
  - 2013 is not in widespread use at this time

EarthCraft- 2007
LEED v3-2007
LEED v4-2010
NGBS- 2007
ENERGY STAR- 2010

Again, Why Mechanical Ventilation?

- To help us remove chemical, physical and biological contaminants from living spaces
- As homes get tighter, random ventilation – air changes through infiltration – goes away
- Definition from 62.2-2010:

acceptable indoor air quality: air toward which a substantial majority of occupants express no dissatisfaction with respect to odor and sensory irritation and in which there are not likely to be contaminants at concentrations that are known to pose a health risk.

Good Indoor Air Quality is a Goal…

- ASHRAE 62.2 - 2010 states in Section 2.1: " Thermal comfort issues are **not** included in this standard."
- And in Section 2.2:

> **2.2** While acceptable IAQ is the goal of this standard, it will not necessarily be achieved even if all requirements are met
>
> a. because of the diversity of sources and contaminants in indoor air and the range of susceptibility in the population;
>
> b. because of the many other factors that may affect occupant perception and acceptance of IAQ, such as air temperature, humidity, noise, lighting, and psychological stress;
>
> c. if the ambient air is unacceptable, and this air is brought

ASHRAE 62.2-2010 Formula

New or Existing Buildings[2]:

$$CFM_{fan} = (A_{floor} / 100) + (7.5 \times (Number_{bedroom} + 1)) + (\text{alternative compliance supplement}) - (\text{Infiltration credit})$$

- Assumes 2 occupants in master bedroom and 1 each in the other bedrooms. Over this density, increase ventilation by 7.5 cfm/person
- Whole building, intermittently operating ventilation may be used under some conditions for compliance
- Ventilation air must come directly from the outdoors
- Credit is allowed for envelope air leakage in some cases, based on ASHRAE 62.2 and 136

How is Multifamily Different Than Single Family?

- MF requirements came later & are in **Addendum j** (2010)
- MF usually smaller conditioned floor area than SF, sometimes much smaller
- Exterior wall area usually much smaller
  - Impacts potential building envelope leakage area
  - Can impact exterior vent locations
- Implications of low-income housing
  - Occupants may not run the AC
  - Potentially not as educated on best ways to operate HVAC systems for comfort or energy savings
  - Sometimes not vested in the property

62.2-2010 MultiFamily Basics

- Ventilation formula for new construction is

$$CFM_{fan} = (0.03 \times A_{floor}) + (7.5 \times (\#\ bedrooms + 1))$$

- or use Table 8.2.1a (from Addendum J)

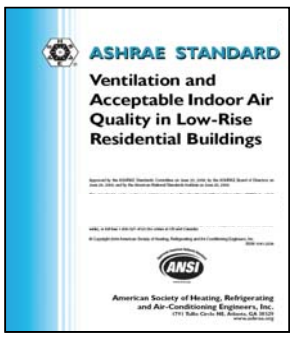
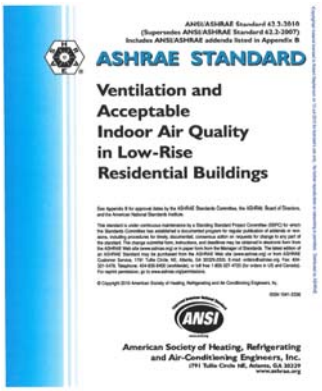


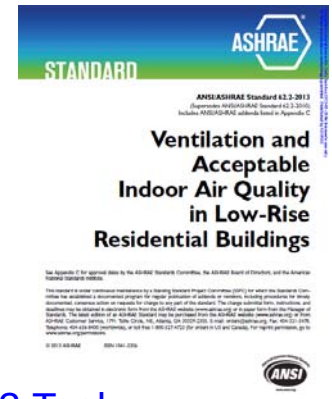
TABLE 8.2.1a (I-P)
Dwelling Unit Ventilation Air Requirements, cfm

Floor Area, ft²	Bedrooms				
	1	2	3	4	>5
<500	30	40	45	55	60
500–1000	45	55	60	70	75
1001–1500	60	70	75	85	90
1501–2000	75	85	90	100	105
2001–2500	90	100	105	115	120
2501–3000	105	115	120	130	135
3001–3500	120	130	135	145	150
>3501	135	145	150	160	165

62.2 MultiFamily 2010 vs. 2013

- MF included in Standard
- No other substantial changes to MF
- 62.2-2010 Addendum J for MF is very similar to 62.2-2013





ASHRAE 62.2-2013 Tool

62.2-2010j - MF New Construction (NC) Calculation

Base formula, step by step:

Multiply the number of bedrooms + 1 (or the number of people) by 7.5 CFM per person:

3BR: 4 people x 7.5 CFM/person = 30 CFM

Calculate 3 CFM per 100 square feet of floor area:

1200 sf: 0.03 x 1200 ft^2 required CFM = 36 CFM

Add them together:

30 CFM + 36 CFM = 66 CFM continuous

Compared to Table 8.2.1a

TABLE 8.2.1a (I-P)
Dwelling Unit Ventilation Air Requirements, cfm

Floor Area, ft^2	Bedrooms				
	1	2	3	4	>5
<500	30	40	45	55	60
500–1000	45	55	60	70	75
1001–1500	60	70	75	85	90
1501–2000	75	85	90	100	105
2001–2500	90	100	105	115	120
2501–3000	105	115	120	130	135
3001–3500	120	130	135	145	150
>3501	135	145	150	160	165

Calculation vs Table 8.2.1a

CFM requirements are always lower using the calculation, sometimes much lower!

3BR, 1500 sf	Table 8.2.1a	75 cfm	
	Calculation	75 cfm	
3BR, 1200 sf	Table 8.2.1a	75 cfm	12%
	Calculation	66 cfm	
3BR, 1001 sf	Table 8.2.1a	75 cfm	20%
	Calculation	60 cfm	

Existing MF Construction Calculations

CFM_{fan} = (0.03 x A_{floor}) + (7.5 x (*# bedrooms* + 1)) +
(alternative compliance supplement)
– ~~(Infiltration)~~

Break this down into 2 smaller steps:

1. Use the base formula to determine the whole house continuous requirements = 0.03 x A + 7.5 x # occupants
2. Calculate the alternative compliance supplement (local or spot ventilation deficit) – **for new units this is zero.**

Note: MF units are never allowed infiltration credit

Note: CFM must be measured for each exhaust fan

Types of Ventilation

- **Exhaust** only
  - Single or multiple ventilation fans
- **Supply** only
  - Outside air into building
  - Outside air into return plenum
  - Through wall
- **Balanced**
  - Fan in/fan out
  - ERV/HRV

Issues with Types of Ventilation

- **Exhaust** Only (**Negative** House Pressure)
  - Air comes from unknown sources
  - Not recommended for humid climate zones
- **Supply** Only (**Positive** House Pressure)
  - Through wall
  - Uses big fan to draw small amount of air
  - Good mixing with house air
  - More complex setup and operation
- **Balanced** (**Neutral** House Pressure)
  - ERV best but better ones are expensive
  - Inexpensive models have limited cfm capacity
  - Questionable latent capability

Exhaust only

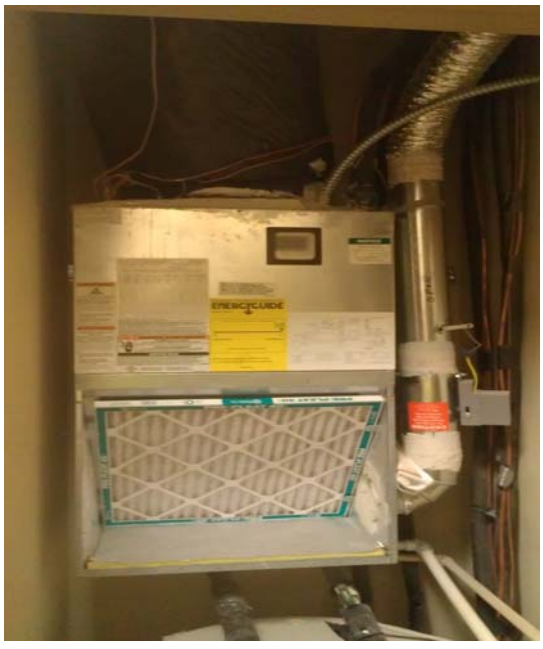
- Usually a larger CFM, more quiet bath exhaust fan with timer switch
- Costs around $75-$100-ish
- Ventilation layout and installation is critical to airflow
  - Oversize fan to be sure of airflow
    - If 50 cfm is required, spec 70 cfm fan

Exhaust only

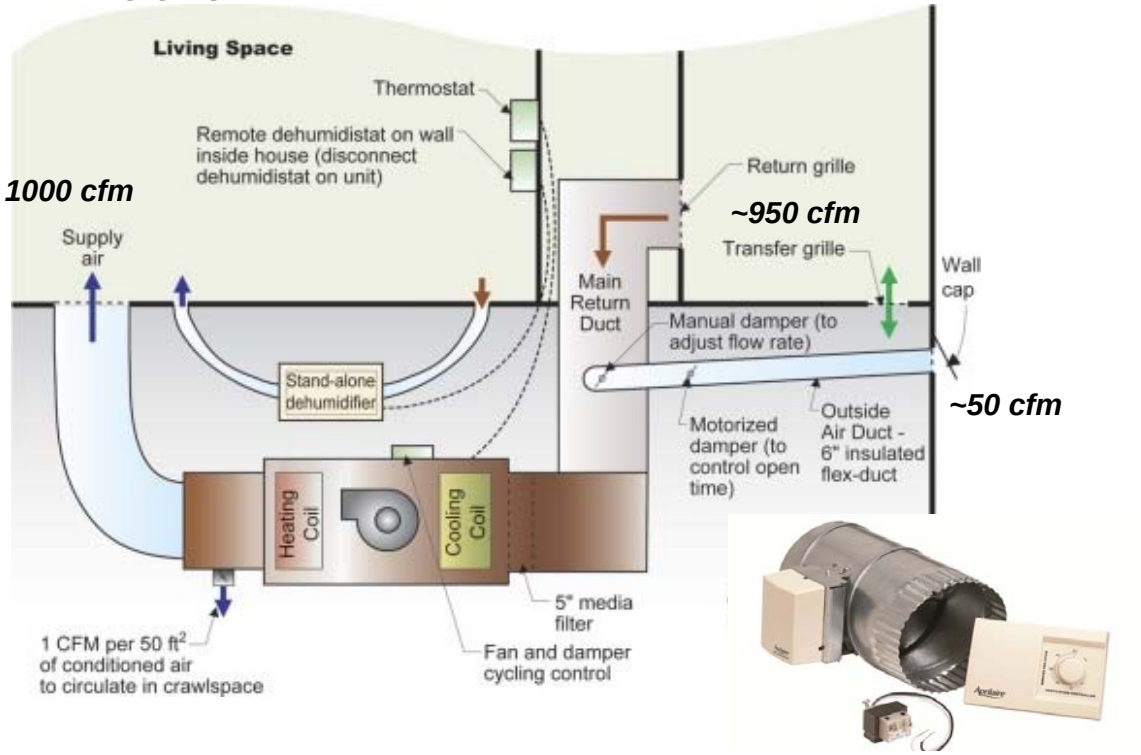
- Plus- Inexpensive to buy and operate, especially with DC motor; runs continuously
- Plus- If quiet, occupant might not unplug it
- Minus- Negative pressure pulls unconditioned air from largest, most available holes and leaks
- Minus- How will incoming air be filtered and conditioned?
- Minus- Potential combustion safety issues

Supply Only

- Vent from outside to house or return plenum
- Air needs to be filtered
- Need manual damper, motorized damper and controller/timer
- Insulate vent pipe



Supply - Positive Pressure Ventilation



Positive Ventilation Supplied via O.A. Ducted to Return

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Supply Only

- AirCycler FRV/VS
  - Around $75-250
  - Install $_____?
  - Controls AHU fan and motorized damper

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Supply Only

- Plus- If designed and installed correctly, this type should supply the intended ventilation cfm
- Plus- Air can be filtered and pre-conditioned
- Plus- Slight positive pressure inside house keeps pollutants at bay (good in humid climate zones)
- Plus- Ventilation air can be well mixed and distributed throughout house by duct system
- Plus- Minimizes combustion safety issues

Supply Only

Duct Diameter (in)	Maximum Capacity Flex (cfm)	Metal (cfm)
4	25	35
5	45	60
6	70	100
7	100	150
8	150	200

- Minus- Energy penalty of using big fan to bring in a small amount of air (affects HERS Index)
- Minus- In MF, may yield inadequate air flow due to low pressure in HVAC closet – consider a shroud
- Minus- Potential moisture issue in HVAC closet
- Minus- Size of vent pipe contingent on run-time
- Minus- More pieces to design, install, operate
- Minus- More complex HERS modeling
- Minus- Exterior vent placement with cumbersome filtration

Supply Only With Controller

- Required in 62.2- 2010
- SWEET setup:
  - Outside air with manual damper (FanTech Iris), motorized damper and controller (Air Cycler VS)

Supply Only With In-Line Fan

- Around $300-400
- Labor $____?
- Use in-line fan instead of AH fan
- Manual and electric dampers
- Honeywell bath fan controller- fan and damper
- Relay to toggle off during AHU operation?

Supply Only With In-Line Fan

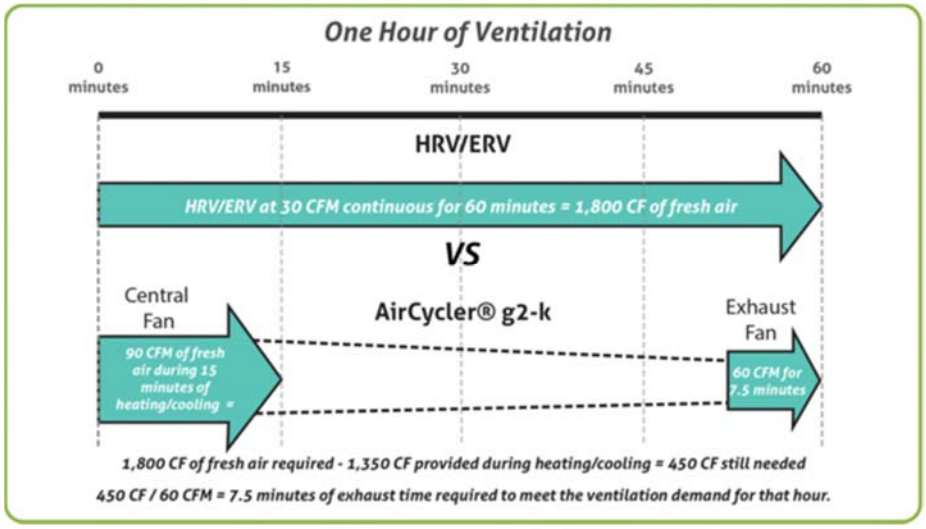
- Plus- Likely to have correct ventilation cfm
- Plus- Low initial and operating cost
- Minus- Potential moisture issues in HVAC closet

Balanced/Hybrid

- Uses exhaust fan with intake air controlled by electric damper
- Doesn't contribute to pressure imbalances inside house
- Air needs to be filtered
- Insulate vent pipe

Balanced/Hybrid

- AirCycler g2/g2-k
  - Around $250-350
  - Install $_____?



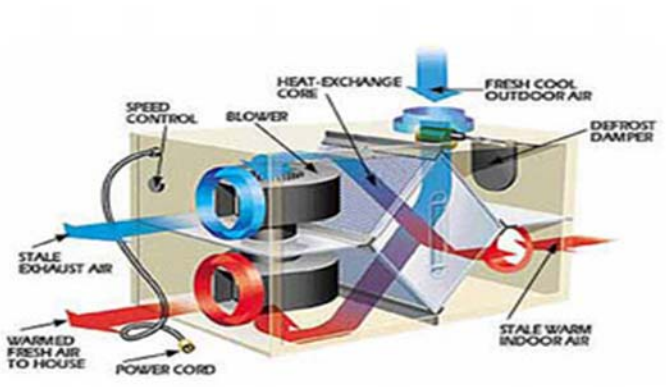
Balanced/Hybrid

- Plus- Doesn't contribute to pressure imbalances inside house
- Plus- Low energy use
- Plus- Low system cost
- Plus- Simple to install and operate
- Minus- Where is intake air coming from?
- Minus- Is intake air conditioned?
- Minus- Distribution?

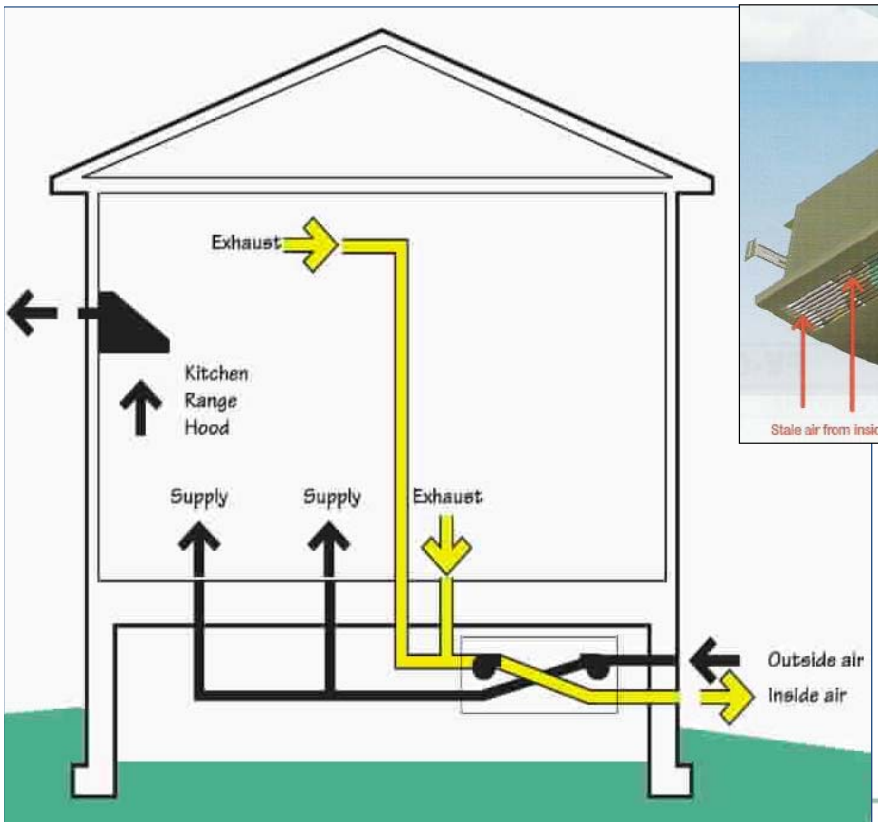
Balanced - ERV/HRV

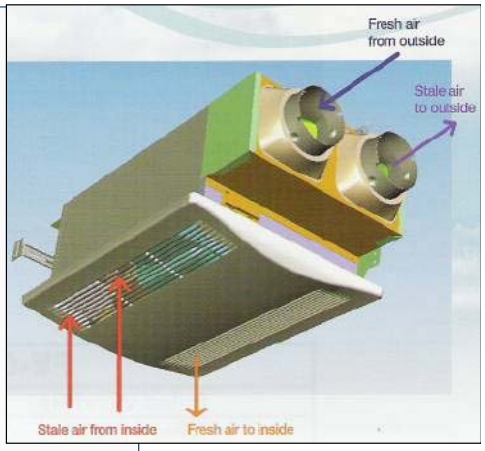
- Doesn't contribute to pressure imbalances inside house
- Can temper humidity and temperature of incoming air
- Can be controlled

  by T-stat



Balanced Ventilation





ERV -energy recovery ventilator

Balanced ERV-Spot Unit

- Panasonic WhisperComfort
  - Around $350 (internet)
  - Install $_____?
  - 20-40 cfm
  - 21-23 watts
  - Under 1 sone
  - Sensible Recovery
    Effectiveness 66%
  - Total Recovery
    Efficiency 36%

Balanced ERV-Spot Unit

- Plus- Doesn't contribute to pressure imbalances inside house
- Plus- Low energy use
- Plus- Relatively low cost
- Plus- Ease of set-up and operation
- Plus- 2 pipe design, lower install cost
- Minus- Low moisture transfer
- Minus- Distribution?

Balanced ERV - Whole Unit

- Broan ERV70S
  - Around $675 ($475 internet)
  - Install $_____?
  - 35-70 cfm
  - 35-60 watts
  - low sones
  - Sensible Recovery Effectiveness 69%
  - Total Recovery Efficiency 50%

Balanced - ERV-Whole Unit

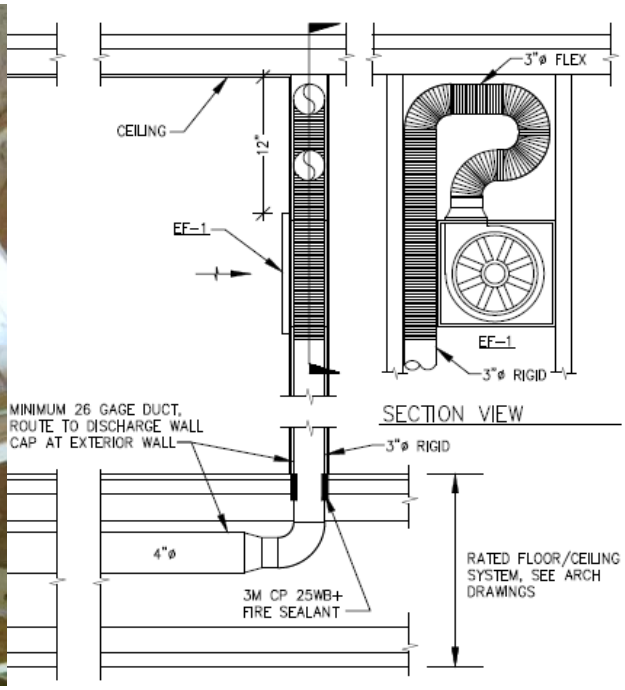
- Plus- Doesn't contribute to pressure imbalances inside house
- Plus- Low energy use
- Plus- Ease of set-up and operation
- Plus- Decent moisture transfer
- Plus- 4 pipe, can be tied into duct system
- Minus- Higher cost

Ventilation System Installation

- Always run to exterior vent cap
- Vent pipe sizing- continuous or intermittent
- As short and straight as possible
- Metal pipe best; pull tight if flex
- Turns as gradual as possible
- Insulate vent pipe
- Cover inlet w/ insect/bird screen
- Controls must be labeled

Ventilation System Installation

- Our “real world” concerns…

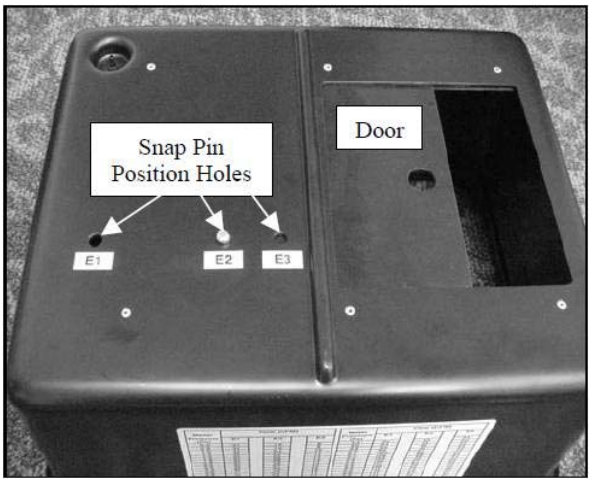


Proving Airflow

Testing ventilation airflow

- Exhaust Fan Flow Meter
- Flow hood/balometer
- Large vane anemometer
- Powered flow hood

TEC Exhaust Fan Flow Meter - $175



- E1: 44-124 cfm (Kitchen)
- E2: 21-59 cfm (Normal Bath)
- E3:10-28 cfm (Poor Bath)

Large Vane Anemometer- $300-700

- Accurate, easy to use
- Supply or return
- Measures temp and velocity
- Have to enter area of grill
- Use traverse to get average cfm

http://www.trutechtools.com/Airflow-Videos_c_1156.html

Flow Hood/Balometer- $1400-3000

- 10-500 cfm
- Measures supply and return
- Very accurate
- Easy to use

Powered Flow Hood- $3-4000

- <10-500 cfm
- Measures supply and return
- Most accurate
- Easy to use

Retrotec's FlowFinder®	The Energy Conservatory's Flow Blaster®
	

Ventilation - What could possibly go wrong…?

- Occupant doesn't run AC or dehumidifier
  - Use fans to move air
- Ventilation system is turned off
- Outside air not conditioned leading to moisture issues (mold/mildew)
- Lack of proper maintenance

HVAC and Moisture

- Don't expect HVAC to fix bad envelope moisture issues
- Remember Psychrometrics
  - "It ain't the heat, it's the humidity"
  - Southern weather example

- HVAC controls can help
  - Humidistat
  - Variable speed blower
  - Variable capacity equipment (staged compressors, staged burners)

HVAC and Moisture

Huntsville, AL

Bin Temperature	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	Total
# of Hours of Occurrence	1180	900	630	375	200	25	2	0	3312
	36%	27%	19%	11%	6%	1%	0%	0%	
	82%			**18%**					

Birmingham, AL

Bin Temperature	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	Total
# of Hours of Occurrence	1166	915	631	471	256	57	8	1	3505
	33%	26%	18%	13%	7%	2%	0%	0%	
	77%			**23%**					

Montgomery, AL

Bin Temperature	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	Total
# of Hours of Occurrence	1235	1121	751	500	322	89	7	0	4025
	31%	28%	19%	12%	8%	2%	0%	0%	
	77%			**23%**					

Mobile, AL

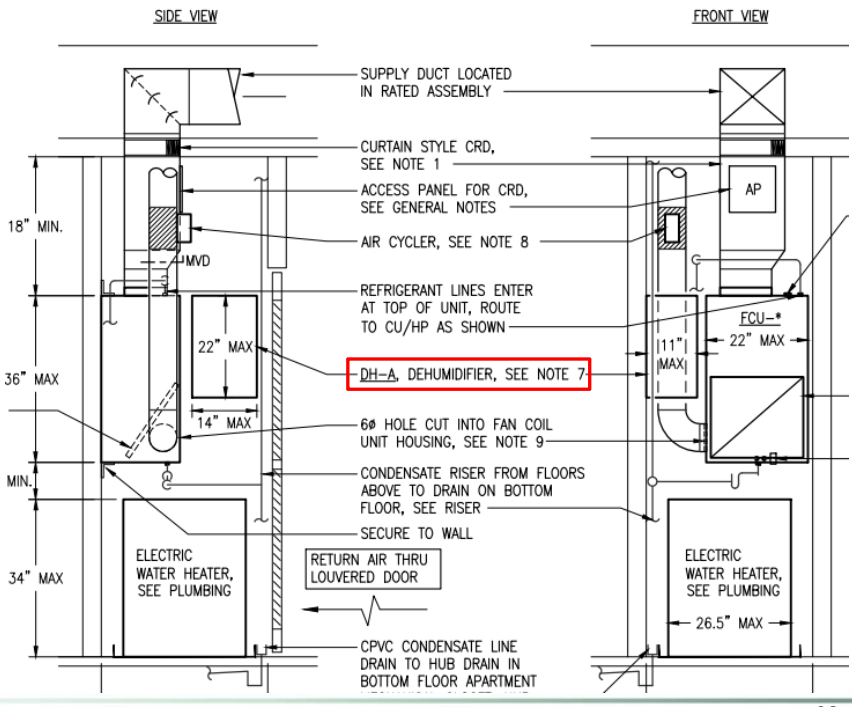
Bin Temperature	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	Total
# of Hours of Occurrence	1486	1338	785	523	220	38	2	0	4392
	34%	30%	18%	12%	5%	1%	0%	0%	
	82%			**18%**					

Dehumidifier/Ventilator

- Pulls air from house and from outside
- Filters & mixes two streams
- Dehumidifies as needed
  - Usually $1,000
  - Install $_____?
  - 70 to 100+ ppd
  - Ideal for better houses with lower sensible loads but similar latent loads

Supplemental Dehumidification

- Humidistat controlled
- Accessible controls?
- Install in HVAC closet
- Drain to condensate pipe

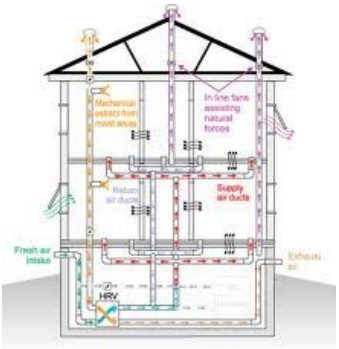


Supplemental Dehumidification

- Innovative Dehumidifier
  - In-wall
  - Tamper-resistant
  - 25 ppd
  - Around $650
- Stand-alone
  - 25-70 ppd
  - $150-400

Critical needs…

- Occupant education
  - Explain why ventilation is important
  - What can happen if system not operated properly
- Better ventilation controls
  - Simple and robust
  - Easy to understand and operate
- Tying ventilation into whole house design
  - Regional standards
  - Takes energy use and humidity control into account



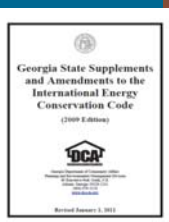
V is for Ventilation

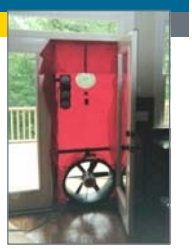
- Coming Soon - Get used to it!
- Spot Ventilation – (spec ENERGY STAR)
  - Kitchens (100 cfm)
  - Bathrooms (50 cfm)
- Whole House Mechanical Ventilation
  - Outside Air ducted to Return (with controller + motorized damper)
  - Energy Recovery Ventilator (ERV)
  - Ventilation Dehumidifier
- Amount: Use chart – IRC (based on 62.2 formula)
- Amount: (#BR+1) x 7.5 + 1 cfm / 100 s.f.
  [example: 3 BR, 2400 s.f. house = 30+24 = 54 cfm]

Current GA Energy Code

2009 IECC with 2011 GA Supplements

ASHRAE 62.2 & IRC 2012 Ventilation





<u>Must Prove Airsealing</u>:

1. Testing SF house leakage
   - For CZ's 2,3, & 4 the blower door result **< 7 ACH_{50}**
2. Visual Inspection for low-rise MF
   - Checklist option only for MF
   - Or, may sample blower door test 1 in 4 units per floor

$$ACH_{50} = \frac{CFM50 \times 60}{Volume}$$

NUMBER	COMPONENT	CRITERIA
1	Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air-permeable insulation is not used as a sealing material. Air-permeable insulation is inside of an air barrier.
2	Ceiling/attic	Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
3	Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
4	Windows and doors	Space between window/door jambs and framing is sealed.
5	Rim joists	Rim joists are insulated and include an air barrier.
6	Floors (including above-garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.
7	Crawl space walls	Insulation is permanently attached to walls. Exposed earth in unvented crawl spaces is covered with Class I vapor retarder with overlapping joints taped.
8	Shafts, penetrations	Duct shafts, utility penetrations, knee walls and flue shafts opening to exterior or unconditioned space are sealed.
9	Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by sprayed/blown insulation.
10	Garage separation	Air sealing is provided between the garage and conditioned spaces.
11	Recessed lighting	Recessed light fixtures are air tight, IC rated, and sealed to drywall. Exception—fixtures in conditioned space.
12	Plumbing and wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
13	Shower/tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
14	Electrical/phone box on exterior walls	Air barrier extends behind boxes or air sealed-type boxes are installed.
15	Common wall	Air barrier is installed in common wall between dwelling units.
16	HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
17	Fireplace	Fireplace walls include an air barrier.

What's different about 2012 IECC?

2012 IECC 402.4.2.1 Envelope Tightness

ASHRAE 62.2 & IRC 2012 Ventilation

$$ACH_{50} = \frac{CFM50 \times 60}{Volume}$$

Two Requirements:

1. Testing of house leakage
   - CZ's 3-8, blower door result < 3 ACH_{50}
   - CZ's 1-2, blower door result < 5 ACH_{50}
2. Visual Inspection
   - Slightly different Air Sealing and Insulation Checklist
   - MF common wall - gone
   - Fireplace doors - back

NUMBER	COMPONENT	CRITERIA
1	Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air-permeable insulation is not used as a sealing material. Air-permeable insulation is inside of an air barrier.
2	Ceiling/attic	Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
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4	Windows and doors	Space between window/door jambs and framing is sealed.
5	Rim joists	Rim joists are insulated and include an air barrier.
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16	HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
17	Fireplace	Fireplace walls include an air barrier.

What's different about 2012 IECC?

2012 IECC 403.5 Mechanical Ventilation

ASHRAE 62.2 & IRC 2012 Ventilation

Links Ventilation back to Mechanical code:

1. Dampers required
2. Efficient fans required

R403.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of the *International Residential Code* or *International Mechanical Code*, as applicable, or with other approved means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

R403.5.1 Whole-house mechanical ventilation system fan efficacy. Mechanical ventilation system fans shall meet the efficacy requirements of Table R403.5.1.

Exception: Where mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

TABLE R403.5.1
MECHANICAL VENTILATION SYSTEM FAN EFFICACY

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any

For SI: 1 cfm = 28.3 L/min.

2012 IRC – The code in GA 1/1/14

ASHRAE 62.2 & IRC 2012 Ventilation

- Ventilation is REQUIRED
  - Any home tighter than **5 ACH_{50}**
- Between '12 IECC and '12 IRC, whole house mechanical ventilation is now mandated!

R303.4 Mechanical ventilation. Where the air infiltration rate of a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section N1102.4.1.2, the dwelling unit shall be provided with whole-house mechanical ventilation in accordance with Section M1507.3.

R303.5 Opening location. Outdoor intake and exhaust openings shall be located in accordance with Sections R303.5.1 and R303.5.2.

R303.5.1 Intake openings. Mechanical and gravity outdoor air intake openings shall be located a minimum of 10 feet (3048 mm) from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks, except as otherwise specified in this code. Where a source of contaminant is located within 10 feet (3048 mm) of an intake opening, such opening shall be located a minimum of 3 feet (914 mm) below the contaminant source.

For the purpose of this section, the exhaust from *dwelling* unit toilet rooms, bathrooms and kitchens shall not be considered as hazardous or noxious.

R303.5.2 Exhaust openings. Exhaust air shall not be directed onto walkways.

IRC Ventilation (based on ASHRAE 62.2-2010 table)

TABLE M1507.3.3(1) CONTINUOUS WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM AIRFLOW RATE REQUIREME

DWELLING UNIT FLOOR AREA (square feet)	NUMBER OF BEDROOMS				
	0 – 1	2 – 3	4 – 5	6 – 7	> 7
	Airflow in CFM				
< 1,500	30	45	60	75	90
1,501 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 6,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

Note:

IRC 2012 does ***not*** include ASHRAE 62.2 details & formula:

(#BR+1) x 7.5 cfm
+ 1 cfm / 100 s.f.

(Suggest state amendment with 62.2 as alternative approach)

For SI: 1 square foot = 0.0929 m^2, 1 cubic foot per minute = 0.0004719 m^3/s.

TABLE M1507.3.3(2) INTERMITTENT WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS[a, b]

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor[a]	4	3	2	1.5	1.3	1.0

a. For ventilation system run time values between those given, the factors are permitted to be determined by interpolation.
b. Extrapolation beyond the table is prohibited.

2012 IRC

ASHRAE 62.2 & IRC 2012 Ventilation

- Basically, takes the 62.2-2010 table (but not the formula)

TABLE M1507.3.3(1)
CONTINUOUS WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM AIRFLOW RATE REQUIREMENTS

DWELLING UNIT FLOOR AREA (square feet)	NUMBER OF BEDROOMS				
	0 – 1	2 – 3	4 – 5	6 – 7	> 7
	Airflow in CFM				
< 1,500	30	45	60	75	90
1,501 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 6,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

For SI: 1 square foot = 0.0929 m^2, 1 cubic foot per minute = 0.0004719 m^3/s.

TABLE M1507.3.3(2)
INTERMITTENT WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS[a, b]

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor[a]	4	3	2	1.5	1.3	1.0

a. For ventilation system run time values between those given, the factors are permitted to be determined by interpolation.
b. Extrapolation beyond the table is prohibited.

2012 INTERNATIONAL RESIDENTIAL CODE® 509

2012 IRC

ASHRAE 62.2 & IRC 2012 Ventilation

- CFM's are based on design and not on verified flow measurements

SECTION M1507
MECHANICAL VENTILATION

M1507.1 General. Where local exhaust or whole-house mechanical ventilation is provided, the equipment shall be designed in accordance with this section.

2012 INTERNATIONAL RESIDENTIAL CODE®

M1507.4 Local exhaust rates. *Local exhaust* systems shall be designed to have the capacity to exhaust the minimum air flow rate determined in accordance with Table M1507.4.

TABLE M1507.4
MINIMUM REQUIRED LOCAL EXHAUST RATES FOR ONE- AND TWO-FAMILY DWELLINGS

AREA TO BE EXHAUSTED	EXHAUST RATES
Kitchens	100 cfm intermittent or 25 cfm continuous
Bathrooms-Toilet Rooms	Mechanical exhaust capacity of 50 cfm intermittent or 20 cfm continuous

For SI: 1 cubic foot per minute = 0.0004719 m^3/s.

M1507.3 Whole-house mechanical ventilation system. Whole-house mechanical ventilation systems shall be designed in accordance with Sections M1507.3.1 through M1507.3.3.

M1507.3.1 System design. The whole-house ventilation system shall consist of one or more supply or exhaust fans, or a combination of such, and associated ducts and controls. Local exhaust or supply fans are permitted to serve as such a system. Outdoor air ducts connected to the return side of an air handler shall be considered to provide supply ventilation.

M1507.3.2 System controls. The whole-house mechanical ventilation system shall be provided with controls that enable manual override.

M1507.3.3 Mechanical ventilation rate. The whole-house mechanical ventilation system shall provide outdoor air at a continuous rate of not less than that determined in accordance with Table M1507.3.3(1).

Exception: 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 prescribed in Table M1507.3.3(1) is multiplied by the factor determined in accordance with Table M1507.3.3(2).

www.southface.org

A New Approach…

ASHRAE 62.2 & IRC 2012 Ventilation

- Frustrated with the energy implications of where 62.2-2013 is going, BSC Standard 01-2013 has emerged – new homes only!
- Based on 62.2-2010, the new standard requires upsizing the exhaust ducts by 1”
- CFM measured or based on HVI rated airflow at 0.25” w.c.

Ventilation for New Low-Rise Residential Buildings

August 7, 2013

BSC Standard 01 – 2013

Building Science Corporation
30 Forest Street
Somerville, MA, 02143
www.buildingscience.com

4.1 Ventilation Flow Rate

Outdoor air shall be mechanically supplied to each dwelling unit using a ventilation system providing no less than the rate specified in Equations 4.1a and 4.1b. The whole-building ventilation system may be balanced, intermittently balanced, or unbalanced.

$Q_v = 0.01\ A_{floor} + 7.5(N_{br} + 1)$ (4.1a)

$Q_{fan} = Q_v C_s$ (4.2)

where

Q_{fan} = fan flow rate (cfm)

C_s is the system coefficient from Table 4.1

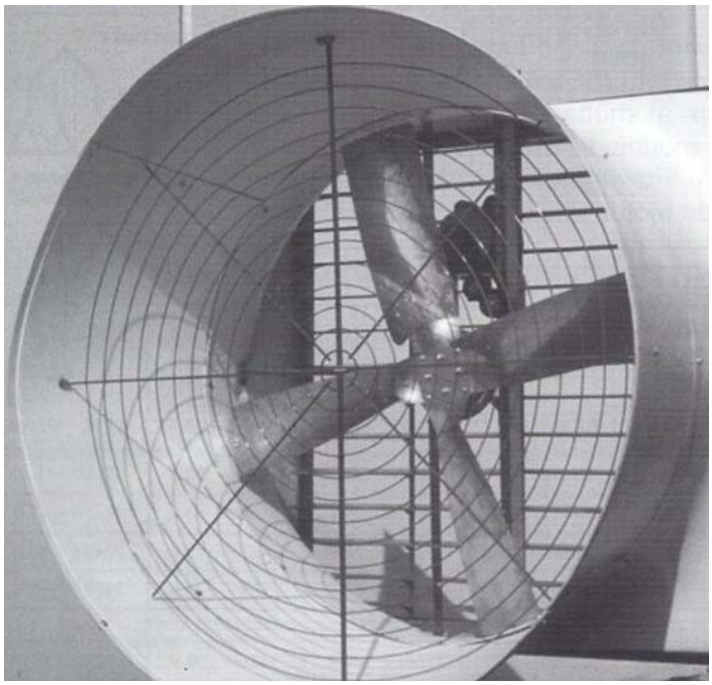
Table 4.1

System Coefficient based on system type[1]

System Type	Distributed	Not Distributed
Balanced	1.0	1.25
Not Balanced	1.25	1.5

[1] Where there is whole-building air mixing of at least 70% recirculation turnover each hour, the system coefficient may be reduced by 0.25.

Thank You…!!!



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