THE UTAH ENERGY CODE WEBINAR WILL BEGIN AT 11:00 AM

ENTER YOUR QUESTIONS IN THE CHAT WINDOW

IF YOU ARE REQUESTING DOPL CREDIT YOU MUST HAVE A WEBCAM TURNED ON AND BE VISIBLE TO THE INSTRUCTOR FOR THE ENTIRE WEBINAR

Dominion Energy ThermWise.com

ROCKY MOUNTAIN POWER
POWERING YOUR GREATNESS

UTAH GOVERNOR'S OFFICE OF ENERGY DEVELOPMENT

U.S. DEPARTMENT OF ENERGY

Salt Lake Community College
ENERGY INSTITUTE
INVESTING IN THE ENERGY WORKFORCE

THIS WEBINAR IS BEING RECORDED

1

9/9/2020

1

RESIDENTIAL IECC:

Improving Air Quality and Controlling Moisture with Ventilation and Local Exhaust

20 Nexant
Celebrating 20 years of innovation.

Brent Ursenbach, CBO, LEED AP
Energy/Mechanical Specialist
West Coast Code Consultants, Inc.
BrentU@WC-3.com
www.WC-3.com
O: (385) 237-3722
C: (801) 381-1449

2

9/9/2020

2

IECC RESOURCES

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building Energy Codes Program

https://www.energycode.gov

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building America Solution Center

https://basc.pnnl.gov

Resources from these websites were included in this presentation

3

9/9/2020

3

HIGH PERFORMANCE COOLERS

- Keep food and drinks cold 5 times longer than standard cheaper coolers
- Reduce the amount of heat transfer, either into or out of the cooler
- Increase insulation – R-value
  - Less conduction
- AIR SEALED – all have a gasket system and positive latching
  - Less convection
  - Fresh air not an issue inside

4

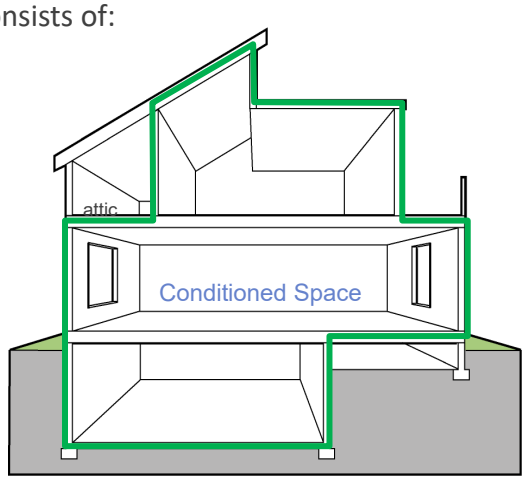
9/9/2020

4

A SIGNIFICANT PORTION OF THE RESIDENTIAL IECC FOCUSES ON THE BUILDING ENVELOPE SPECIFIC THERMAL REQUIREMENTS

Building Thermal Envelope consists of:

- ✓ Fenestration
- ✓ Ceilings
- ✓ Walls
  - Above grade
  - Below grade
  - Mass walls
- ✓ Floors
- ✓ Slabs
- ✓ Crawlspaces



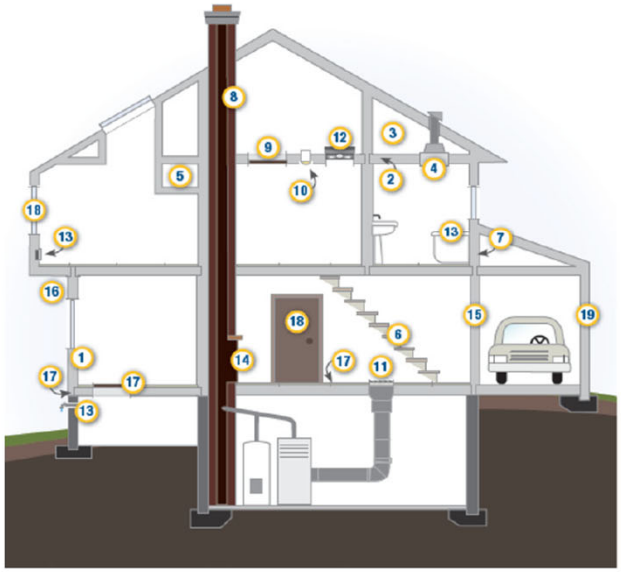
R-values and U-factors

5

9/9/2020

5

IECC ALSO INCLUDES A FOCUS ON AIR SEALING



Air Sealing Trouble Spots

1. Air Barrier and Thermal Barrier Alignment
2. Attic Air Sealing
3. Attic Kneewalls
4. Shaft for Piping or Ducts
5. Dropped Ceiling/Soffit
6. Staircase Framing at Exterior Wall
7. Porch Roof
8. Flue or Chimney Shaft
9. Attic Access
10. Recessed Lighting
11. Ducts
12. Whole-House Fan
13. Exterior Wall Penetrations
14. Fireplace Wall
15. Garage/Living Space Walls
16. Cantilevered Floor
17. Rim Joists, Sill Plate, Foundation, Floor
18. Windows & Doors
19. Common Walls Between Attached Dwelling Units

6

9/9/2020

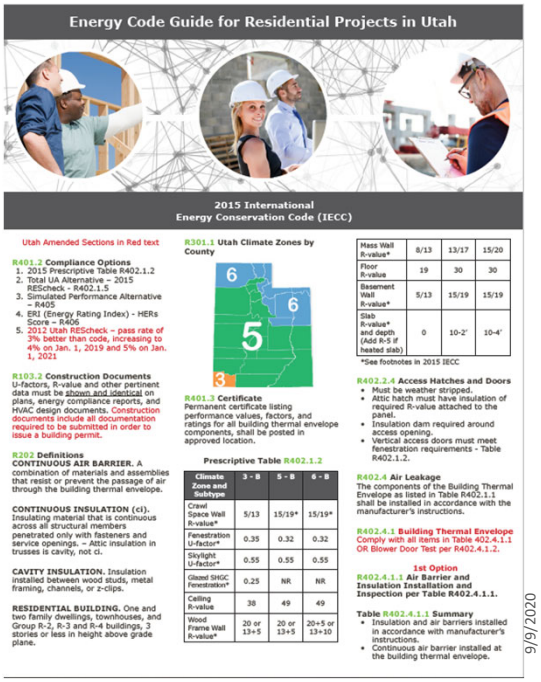
6

RESIDENTIAL IECC CODE GUIDE

- Code sections referenced are from the 2015 IECC Residential Provisions. Identical requirements are found in the 2015 IRC Chapter 11
- Example **IECC R403.3 Ducts** aligns with **IRC N1103.3**
- See the Energy Code Guide for Residential Projects in Utah with amendments
  - R403.6, backside of guide references Mechanical Ventilation

https://utahenergycode.com/wp-content/uploads/Residential_Energy_Code_QR_Guide-Updated-4-11-19.pdf

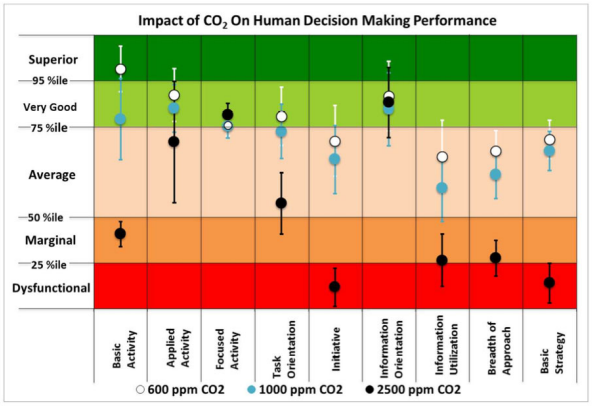
7



9/9/2020

7

CAN A HOME/BUILDING BE TOO TIGHT?



9/9/2020

8

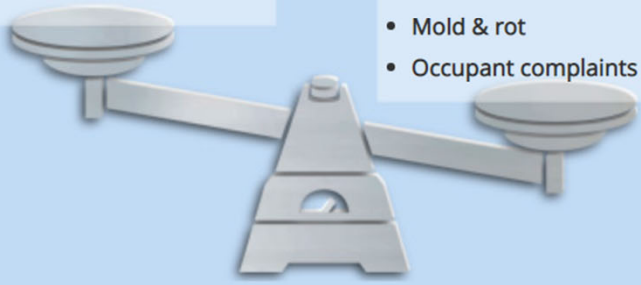
Hard Lessons from Tighter Building in the 1970s

Decreased

- Energy costs
- Air leakage

Increased

- Moisture problems
- Indoor pollutant levels
- Health risks
- Mold & rot
- Occupant complaints



9

Relied on Natural Ventilation, which did NOT work …… What are we doing today?

9/9/2020

9

Balancing Energy Efficiency with Indoor Air Quality

- Tight building
- Decreased energy use
- Well-designed ventilation system, properly installed and operated

- Acceptable indoor air quality
- Decreased health risks
- Reduced occupant complaints
- Reduced moisture levels in structure

10

Results in a must healthier building than a leaky building

9/9/2020

10

BUILD TIGHT – VENTILATE RIGHT

- AFTER source control (bath and kitchen) air changes, are the critical factors in decreasing pollutants
- Preventative measures to decrease pollutants include:
  - Decrease the use of products containing aldehydes such as formaldehyde
  - Open a window? Doesn't work – Does not uniformly exchange air throughout building
  - Test for and address radon gas
  - Ensure gas appliance are direct vent
- It's unreasonable to expect occupants to stop bathing, cooking, *breathing*, cleaning, washing, drying, hobbies, etc.
- The IECC beginning in 2012 requires mechanical ventilation in all homes built in Utah – state amendments allow exceptions

11

9/9/2020

11

VENTILATION SYSTEMS MEET TWO TASKS:

SPOT VENTILATION & WHOLE-BUILDING VENTILATION

- Spot Ventilation
  - Kitchen Exhaust
  - Bathroom Exhaust
- Whole-building ventilation
  - Provide overall healthy indoor environment – Includes:
    - VOCs in cabinetry, carpet, paints, furniture, paints and finishes
    - Airborne viruses and bacteria
  - **Control moisture** – see Construction Instruction.com for excellent discussions and videos on condensation and moisture control

Construction Instruction®
Building Science for Everyone, Everywhere

12

9/9/2020

12

WHAT HAPPENED IN THE 2012 IECC?

CONTINUES GENERALLY UNCHANGED IN THE 2015 IECC

Climate Zone	2009 IECC	2012 IECC
1 - 2	< 7 ACH	≤ 5 ACH @ 50 pascals
3 - 8	< 7 ACH @ 50 pascals	≤ 3 ACH @ 50 pascals

Table 1: 2009 vs. 2012 IECC Comparisons

Don't forget this number

R402.4 Air leakage (Mandatory)

*The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections **R402.4.1 through R402.4.4.***

Includes air barrier inspection check list, blower door testing

13

9/9/2020

State Amendment in later slides

13

TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between window/door jambs and framing, and skylights and framing shall be sealed.	
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors (including above garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members.

14

9/9/2020

Portion of Table

14

BU1

IECC, R403.5 MECHANICAL VENTILATION (MANDATORY)

Is *natural* ventilation ok in some conditions?

- *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.*

IRC, Section 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 ventilation in accordance with Section M1507.3.*
- *Similar text in IMC 401.2 for multi-family*

State Amendments in later slides

15

9/9/2020

15

IECC, SECTION R403.5.1 WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY

Mechanical ventilation system fans shall meet the efficacy requirements of Table 403.5.1.

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

Fan Location	Air Flow Rate Minimum (CFM)	Minimum Efficacy (CFM/watt)	Air Flow Rate Maximum (CFM)
Range Hoods	Any	2.8	Any
In-line Fan	Any	2.8	Any
Bathroom, Utility Room	10	1.4	< 90
Bathroom, Utility Room	90	2.8	Any

State Amendment in later slides

16

9/9/2020

16

RESIDENTIAL - BUILDING THERMAL ENVELOPE

SECTION R402.4.1 – AIR LEAKAGE

IECC *without amendments* requires BOTH:

✓ Whole-house pressure test

Air Leakage Rate	Climate Zone	Test Pressure
≤ 5 ACH	1-2	50 Pascals
≤ 3 ACH	**3-8**	**50 Pascals**

- Testing may occur any time after creation of all building envelope penetrations

✓ Field verification of items listed in Table R402.4.1.1

- **State amendment continues to allow *either* the blower door test**

OR

- **the field verification of air barriers and proper insulation installation**

17

9/9/2020

17

BUILDING THERMAL ENVELOPE - *SECTION R402.4.1 – AIR LEAKAGE*

MANDATORY

Two options to demonstrate compliance (State Amendment)

✓ Whole-house pressure test

- By State Amendment, all climate zones test to 5 ACH @ 50 pa
  - January 1, 2019- 3.5 ACH @ 50 pa ***SFD***
  - January 1, 2019- **5** ACH @ 50 pa ***Townhouse and Multi-family ≤ 3 stories***
  - January 1, 2021- To be reviewed
- Testing may be by any *certified* tester- including contractors and sub contractors
- Testing may occur any time after creation of all building envelope penetrations

OR

✓ Field verification of items listed in Table R402.4.1.1

✓ ***Homes testing 3 ACH @ 50 pa require mechanical ventilation- IRC 303.4***

9/9/2020

18

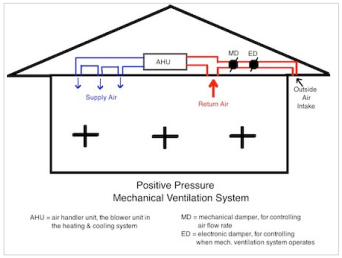
18

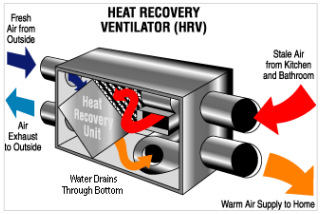
SECTION R403.6 - MECHANICAL VENTILATION

REQUIRED (IRC) IF TESTED TIGHTER THAN 3 ACH@50PA (STATE AMENDED FROM 5 ACH@50PA)

- ✓ Ventilation
  - Building to have ventilation meeting IRC or IMC or with other approved means (previously deleted by the 2012 amendments)
  - Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating
- ✓ Whole-house mechanical ventilation system fans to meet efficacy in Table R403.6.1
  - ✓ **Exception**
    - ✓ **When fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor**

M MANDATORY





19

9/9/2020

19

STATE AMENDMENT IN 2019

ADOPTED THIS 2018 TABLE FOR MECHANICAL VENTILATION SYSTEMS

TABLE R403.6.1
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
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.
a. When tested in accordance with HVI Standard 916.

2018 INTERNATIONAL ENERGY CONSERVATION CODE® **R-37**

9/9/2020

20

20

REVIEW

Without Amendments:

All homes in Utah must Blower Door test to ≤ 3 ACH @ 50pa

Any Home testing < 5 ACH @ 50pa must include mechanical ventilation

Ventilation fans must have a high efficacy fan motors

With Amendments:

Blower Door Testing is an Option – may complete the inspection check rather than test

If Blower Door testing, must test to ≤ 3.5 ACH @ 50 pa, ≤ 5 ACH in townhouse/multifamily

Any Home testing < 3 ACH @ 50pa must include mechanical ventilation

Consider the home that is not tested, but tighter than 3 or even 5 ACH?

Building Science experts all agree mechanical ventilation should occur at < than 5 ACH, with many suggesting 7 ACH is a safer number

21

9/9/2020

21

IRC CHAPTER 15 – WHOLE-HOUSE VENTILATION

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.

22

9/9/2020

22

MECHANICAL VENTILATION METHODS

SUPPLY-ONLY VENTILATION

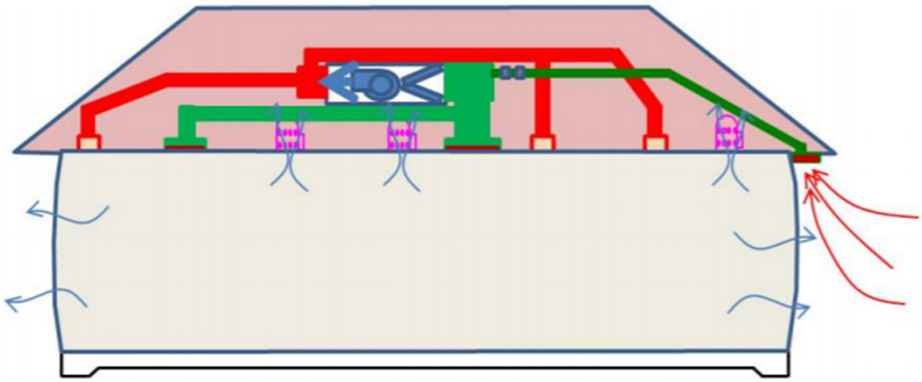


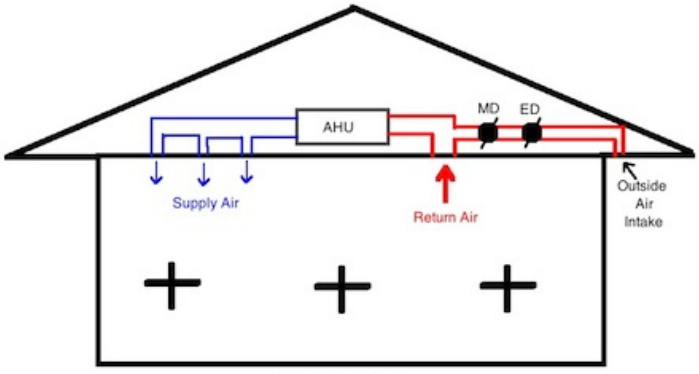
Figure 1 - With supply-only ventilation, the building is under positive pressure.

23

9/9/2020

23

POSITIVE PRESSURE VENTILATION



- Continuous or 1 hour every 4 hours
- If intermittent, must close damper when not in operation
- Furnace Air/handler must have ECM motor
- Path to outside envelope leakage

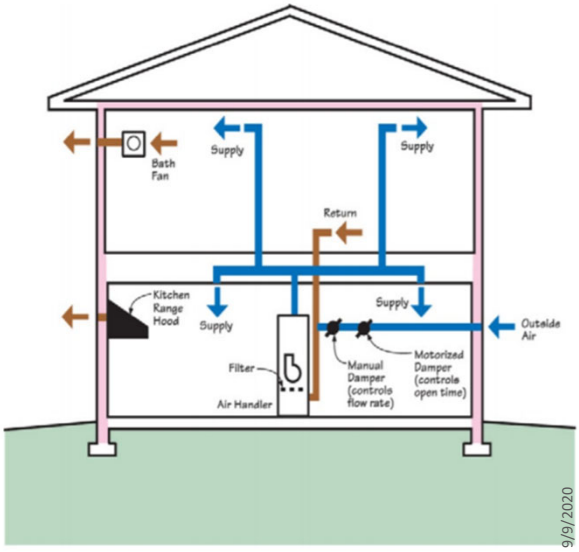
24

9/9/2020

24

CENTRAL FAN INTEGRATED SUPPLY VENTILATION - DETAILS

- Heating, cooling or fan-only must be energized
- Must use ECM fan motors
- Continuous fan operation tends to over-ventilate; inefficient
  - In humid climates, may result in excessive latent loads
  - Extremely tight construction make humidity control simpler
- Code requires minimum 1-hour operation each 4-hours
- May be filtered with better filters
- IECC includes direction from ASHRAE 62.2



25

9/9/2020

25

EXHAUST-ONLY VENTILATION

- Relies on air leakage to replace exhausted air
- Ventilation air not filtered
- Very quiet efficient fans available
- Fan efficacy requirements
- Affordable – great starting point

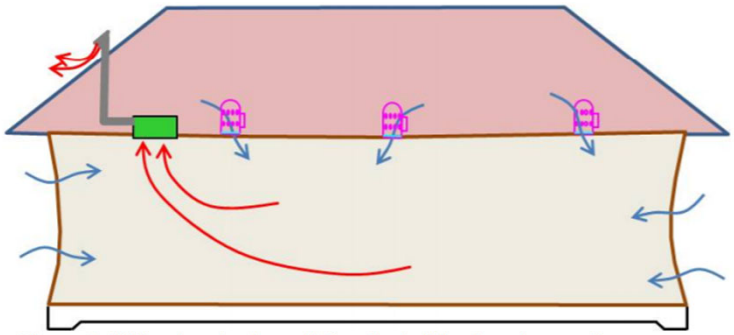


Figure 3 - With exhaust-only ventilation, the building is under negative pressure.

26

9/9/2020

26

EXHAUST ONLY- NEGATIVE PRESSURE

- Continuous Operation or 1 hr. every 4 hrs. @ 4 time the CFM
- Backdraft damper
- Set at minimum CFM
- Jump to higher speed
  - Occupancy sensor
  - Humidity sensor
  - Manual switch
- Leaks replacement air into the house
- No filtering

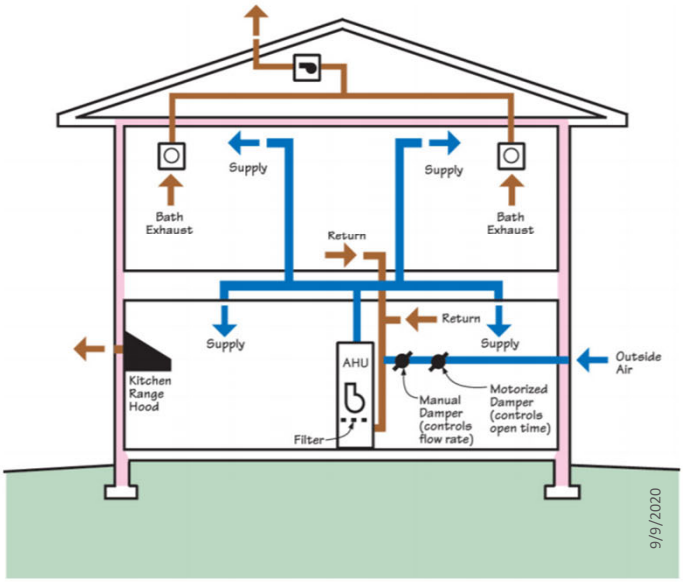
27

9/9/2020

27

INTERMITTENTLY BALANCED

- Combined supply and exhaust without HRV or ERV
- Bath and Kitchen exhaust coupled with furnace or AC air handler
- Controls may be complex
- Imbalance typical
- Challenge in meeting continuous or 1 hour each 4 hours



28

9/9/2020

28

BALANCED VENTILATION

HRV OR ERV

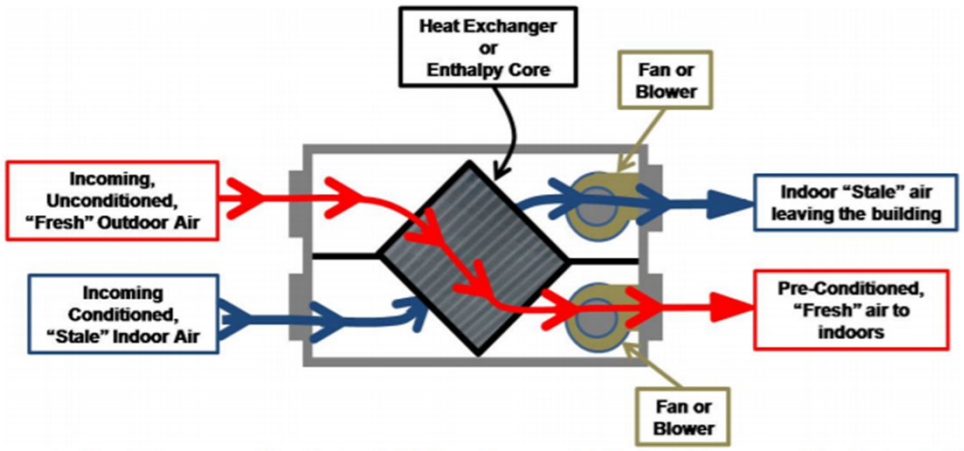


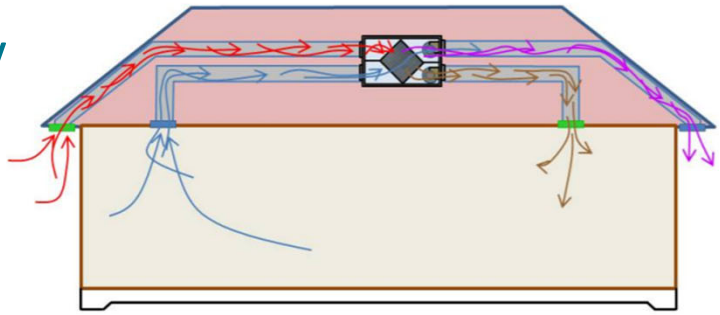
Figure 4 - Heat Recovery Ventilator (HRV) or Energy (Enthalpy) Recovery Ventilator (ERV).

29

9/9/2020

29

HRV - ERV



- Same volume of air provided from outside as exhausted from inside
- ERV - the heat exchanger transfers water vapor along with heat energy
- HRV only transfers heat
- 70-80% energy recovery
- Ventilation Air is filtered

30

9/9/2020

30

HEAT RECOVERY/ENERGY RECOVERY VENTILATORS – BALANCED VENTILATION

HRV or ERV?

- If you live in a colder climate with a longer heating season such as Canada or the northern US, the HRV will provide the most comfort and efficiency.
- In the Midwest and southern states, where humidity removal is needed for the incoming air, an ERV provides year-round efficiency.

HRV/ERV is now in the IECC for some commercial applications requiring large quantities of ventilation air

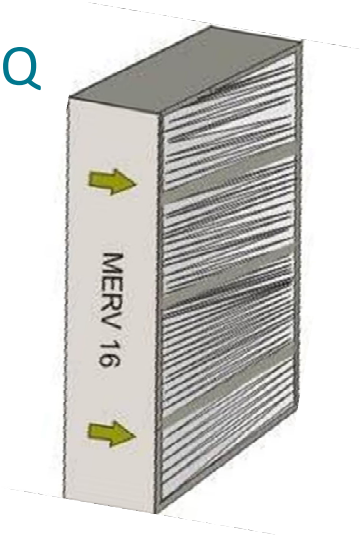
31

9/9/2020

31

AIR FILTERS CAN IMPROVE IAQ

- Air filter efficiency is defined in MERVs, or "Minimum Efficiency Reporting Value
- MERV 4 traps dust, fibers, some pollen
- MERV 8 fine powders, mold, animal dander
- MERV 13 some viruses and bacteria
- MERV 17-20 very effective on viruses and bacteria
- **Filter higher than MERV 8 must be used with caution! Restricts airflow**
- **DO NOT use those 1" thick high efficiency filters during AC unless approved by competent HVAC professional**
- **Thicker (4"+) filters are less restrictive**



32

9/9/2020

32

UV LIGHT TREATMENT SYSTEMS

- Reduce airborne bacteria and virus
- Typically installed at evaporator coils to address mold and bacteria growing on wet coils
- Requires time, not considered effective on air moving through the duct
- May damage some plastics such as flex duct liners

33

9/9/2020

33

QUESTIONS OR COMMENTS?

THANK YOU FOR YOUR PARTICIPATION!

BE SAFE - STAY HEALTHY

Brent Ursenbach, CBO, LEED® AP
West Coast Code Consultants, Inc.
Mechanical & Energy Specialist
801.381.1449
brentu@wc-3.com
bursenbach@gmail.com

34

9/9/2020

34