2015 IECC Real World Applications - Residential

Colorado Code Consulting, LLC
For
Colorado Energy Office, 2016

Look how houses have changed

What do we know about the 100 year old house?

- Drafty, uncomfortable, yet very durable houses
  - Why?
- Expectation?

Building and Selling a House Today

What are our expectations today?

- What have we done to houses to meet expectations?
  - Thermal Insulation
  - Tighter Building Envelopes
  - Heating & Cooling Systems
- Yet some of our House are not
  - comfortable
  - Durable
  - Safe
  - Energy Efficient
  - Environmental
- How can we meet the Expectation?

The House as a System

(EEBA Builders Guide) www.eeba.org

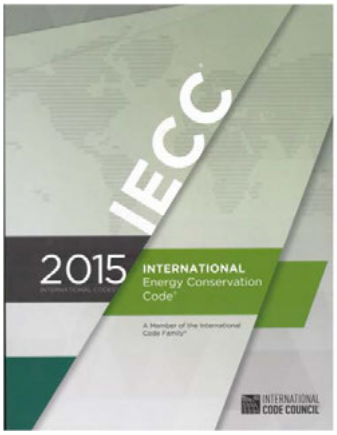
- "Residential Construction is a complex operation including thousands of processes by dozens of industries, bringing together hundreds of components and sub-systems into a house."

Systems Integration + Applied Building Science

Synergy

- **Two or more things working together to achieve something they could not achieve alone**
  - Envelope + Mechanical + Lighting
  - Touch one system, affect another System.

The look and layout of the 2015 IECC



- chapters C1-6
  Commercial (CE)

and

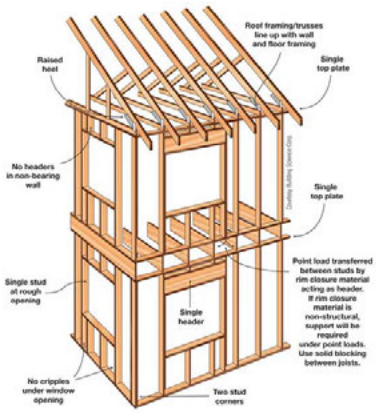
- **chapters R1-6 Residential (RE)**

2015 IECC – Intent

- This code shall regulate the design and construction of buildings for the effective use and conservation of energy **over the ~~useful~~ life of each building**.

2015 IECC – Intent

- This code is intended to **provide flexibility** to permit innovative approaches and techniques to achieve this objective.



2015 IECC – Intent

- The code is <u>not intended</u> to **abridge safety, health or environmental requirements** contained in other applicable codes or ordinances.

Residential VS Commercial

Definition of Residential per IECC is different than that found in the IRC and IBC:

RESIDENTIAL BUILDING. For this code, includes detached one and two family dwellings and multiple single family dwellings (townhouses) as well as R-2, R-3 and R-4 buildings three stories or less in height above grade plane.

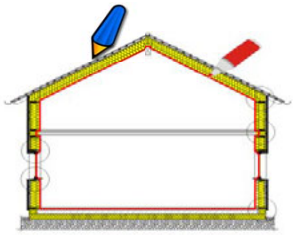
How is the code used in this building? 101.4.1

COMMERCIAL BUILDING. For this code, all buildings that are not included in the definition of "Residential buildings."

11

Construction Documentation R103

- **Submitted details must be able to show full compliance with each code requirement including:**
  - **Insulation types, locations and R-Values**
  - **Fenestration types, locations and U-Factors/SHGC**
  - **Mechanical and water heating size, type and efficiency**
  - **Equipment and system controls**
  - **Duct sealing and insulation locations**
  - **Air sealing details**
  - **DEPICTION OF THE THERMAL ENVELOPE (R103.2.1)**



R103.3: Code Official can hire someone else to do plan review as long as they were/are not affiliated with the design or construction of the building.

R202: CONDITIONED SPACE

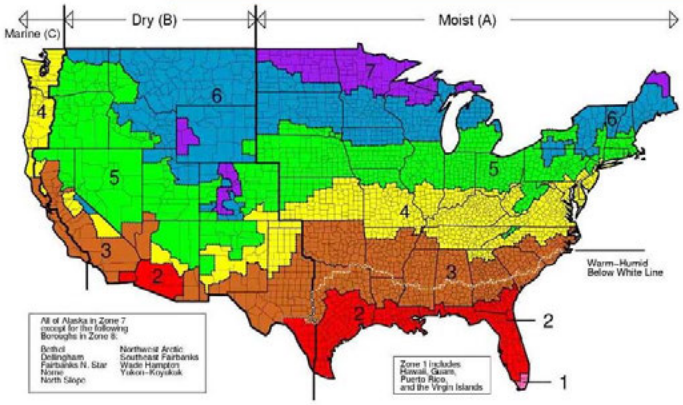
Area, room or space enclosed within thermal envelope

Directly or Indirectly heated or cooled

- communicates through openings with conditioned spaces
- separated from conditioned spaces by uninsulated walls, floors or ceilings
- contain uninsulated ducts, piping or other sources of heating or cooling

Climate Zones

2015 IECC - Chapter 3



New Tropical Climate Zone in IECC Includes: Hawaii, Puerto Rico, Guam, American Samoa, U.S. Virgin Islands, Commonwealth of Northern Mariana Islands and Islands in the area between the Tropic of Cancer and the Tropic of Capricorn.

Still listed as Zone 1A*. *-warm humid climate

Determining Your Climate Zone is one of the First Steps in the Process

IECC Residential Compliance Options

1 Prescriptive:

By the book approach

OR

2 Prescriptive Options

- **R402.1.4 U-factor Alternative**

OR

- **R402.1.5 Total UA alternative**

OR

3 Simulated Performance Approach

R405 – Building Performance based on Building Energy Cost.

4 **Energy Rating Index (ERI)**

R406 – Building Performance based on HERS Index Score

2015 Prescriptive R-value Table Compliance Specification

Declare to the Code official that the pathway for compliance is the prescriptive path

Table R402.1.2

INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[a, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. First value is cavity insulation, second is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation *R*-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

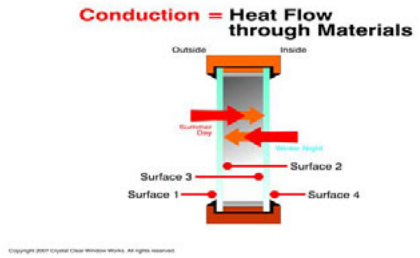
R402.1.4 U-factor Alternative

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U- FACTOR	FRAME WALL U- FACTOR	MASS WALL U-FACTORb	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U- FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.35	0.55	0.030	0.060	0.098	0.047	0.091c	0.136
4 except Marine	0.35	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.32	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.32	0.55	0.026	0.045	0.057	0.028	0.050	0.055

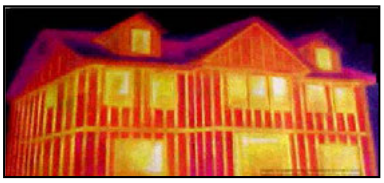
- **An assembly** with a U-factor equal to or less than that specified in Table R402.1.4 shall be permitted as an alternative to the R-value in Table R402.1.2
- Example: Climate zone 5 framed wall
  - U- .060 = R-16.67
  - R-value table requires cavity insulation at R20 or 13+5
  - 1/20 = U.05 Plus sheathing, air film, etc.

R402.1.5 Total UA alternative

- A method for performing conductive energy trade offs
  - Trading off the R-values and U-values of the thermal envelope
  - Mathematically making the R-value and U-value paths equal



- If the total building thermal envelope UA (sum of U-factor times assembly area) is less than or equal to the total UA resulting from using the U-factors in Table R402.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table R402.1.1. **The UA calculation shall include the thermal bridging effects of framing materials.**



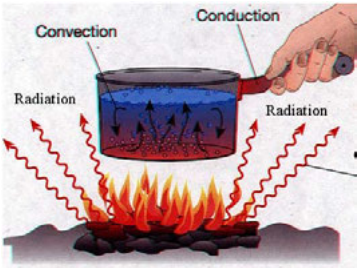
Simulated Performance Path

- Leverages the applied building science and systems thinking that is built into the code.
- Holistic approach rather than a component approach.
  - Air Flow
  - Thermal Flow
  - Moisture Flow

R405.3 Performance-based compliance

- Energy Analysis
  - A method for performing whole house performance energy trade offs
    - **Conduction** - Trading off R-values and U-values
    - Convection – Energy moving with air infiltration and exfiltration
    - **Radiation** – Trade offs created by energy moving form areas of high concentrations to low concentration through open space.

Energy moves from warm to cold



The Reference Home/Twin Home Concept Used by **modeling software for Code**

2015 reference design house
Built from table 405.5.2(1)

- The reference home is the **geometric twin** of the rated home ***configured to a standard set of thermal performance characteristics***:
- I.e. The 2015 IECC Prescriptive path

VS.

Rated Home: Builders desired house

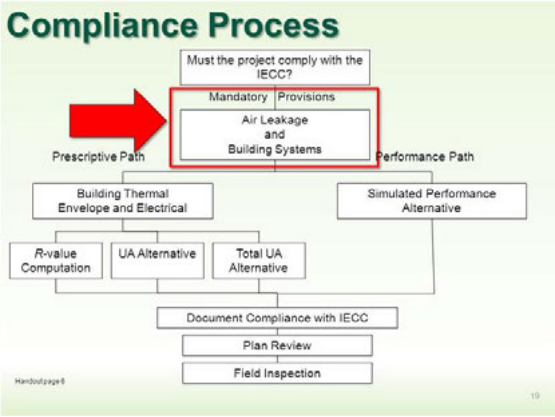
- The home you are building and evaluating, compared to the "Reference" home in order to quantify performance and demonstrate compliance with the Energy code.

Energy Costs?

- **405.3 Performance-based compliance.** Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an **annual energy cost** that is less than or equal to the annual energy cost of the standard reference design.

Simulated Performance Path

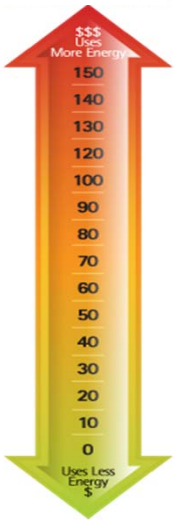
- R405.2 Mandatory Requirements
  - Compliance with this section requires that the mandatory provisions identified in section R401.2 be met.



Section R406 of the2015 IECC

Energy Rating Index Compliance Alternative

- What is an Energy Rating Index



Mandatory sections of the 2015 IECC

- R402.4 Air leakage (Mandatory)
  - Table R402.4.1.1
  - R402.4.1.2 Testing
    - Air leakage rate not exceeding 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8

R406.1 Mandatory Requirements

- The building thermal envelope shall be **greater than or equal** to levels of efficiency and Solar Heat Gain Coefficient in Table 402.1.1 or 402.1.3 of the **2009 *International Energy Conservation Code*.**

2009 IECC vs. 2015 IECC Prescriptive Table

Climate Zone	Window U-Factor	Window SHGC	Ceiling R-Value	Wood Framed Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value and Depth	Crawl Space Wall R-Value
1	1.2 NR	0.30 0.25	R-30	R-13	R-3/4	R-13	0	0	0
2	0.65 0.40	0.30 0.25	R- 30 38	R-13	R-4/6	R-13	0	0	0
3	0.35 0.35	0.30 0.25	R-30 38	R-13 20 or 13+5	R-5/8 8/13	R-19	R-5/13	0	R-5/13
4 except Marine	0.35 0.35	NR 0.40	R-38 49	R-13 20 or 13+5	R-5/10 8/13	R-19	R-10/13	R-10, 2ft	R-10/13
5 and Marine 4	0.35 0.32	NR	R-38 49	R-20 or 13+5	R-13/17	R-30	R-10/13 15/19	R-10, 2ft	R-10/13 15/19
Climate Zone 6	0.35 0.32	NR	R-49	R-20 or 13+5 20+5 or 13+10	R-15/20	R-30	R-15/19	R-10, 4ft	R-10/13 15/19
Climate Zone 7 & 8	0.35 0.32	NR	R-49	R-21 20+5 or 13+10	R-19/21	R-38	R-15/19	R-10, 4ft	R-10/13 15/19

Twin Houses

ERI reference design house

- Geometric Twin
- 2006 IECC prescriptive requirements

VS.

Builder's desired house

- Geometric Twin
- Mandatory 2009 IECC Envelope R-Values
- 2015 IECC Mandatory Requirements

The Builder's house must have the Energy Rating Index Required by code, or lower, to meet the intent of code

Table R406.4 Maximum Energy Rating Index

Climate Zone	Energy Rating Index
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

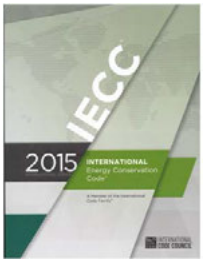
- Compliance based on an ERI analysis requires that the *rated design* be shown to have an ERI less than or equal to the appropriate value listed in Table R406.3, when compared to the *ERI reference design*

Features that Impact the ERI

(Lower the score)

- Mechanical equipment
  - High efficiency furnace
  - High efficiency AC
  - High efficiency water heater
- More R-value than required by the 2009 IECC
- House orientation with the ERI
- House tightness below 3 ACH50
- Duct leakage to the outside
- Duct location
- Whole house fan
- CFL or LED Lighting above 75%
- High efficiency appliances
- Solar

Mandatory Code Requirements



=

R402.4.1.2 Testing (Mandatory)

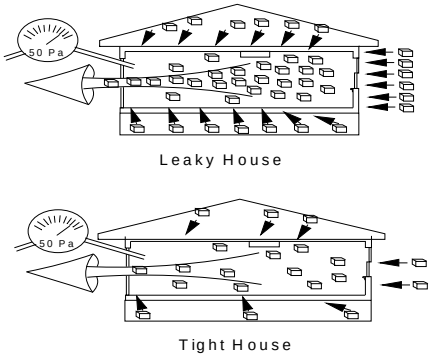
- The building or dwelling unit **shall be tested** and verified as having an air leakage rate not exceeding:
  - 5 ACH@50 in Climate Zones 1 and 2
  - **3 ACH@50 in Climate Zones 3 through 8**
- Testing shall be conducted by an approved third party
- Reporting

Air leakage Testing

Air out = Air in

The principle behind the blower door

Blower Door Depressurizing House
To 50 Pascals



402.4 Air Leakage and Air Barriers (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.
- The components of the building thermal envelope as listed in Table R402.4.1.1 shall be installed in **accordance with the manufacturer's instructions** and the criteria listed in Table R402.4.1.1

2012 IECC Table

TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	CRITERIA[a]
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. 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 sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.

2015 IECC Table

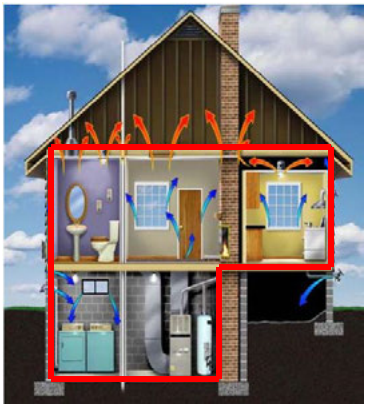
TABLE 402.4.1.1 (N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General Requirements	A continuous air barrier shall be installed in the building envelope. 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 sealed. Access openings, drop down stair 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.

Why Is Air Movement a Problem?

Air is an effective transport mechanism!

- Moisture / energy / pollutants
- Random leakage though random holes
- What kind of air is it? What is it carrying?
- What Problems can it create
- Control the air / control the house / gain predictability



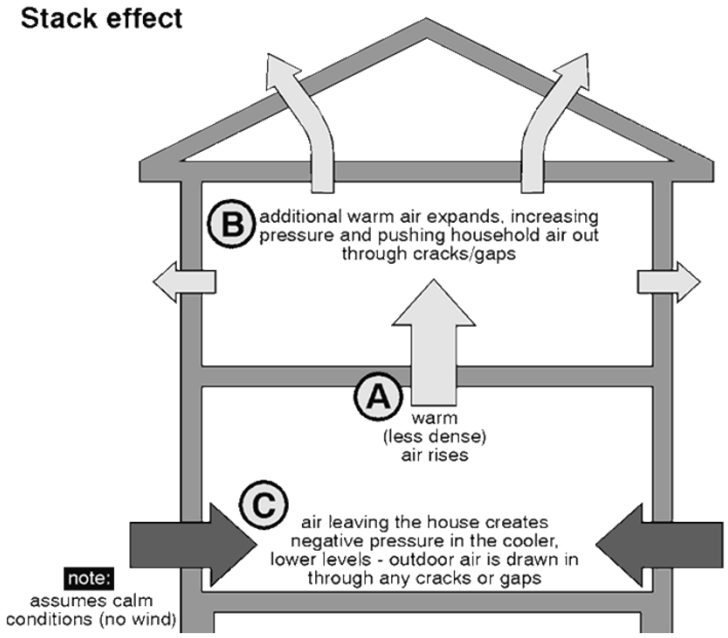
Air In = Air Out

Air Out = Air In

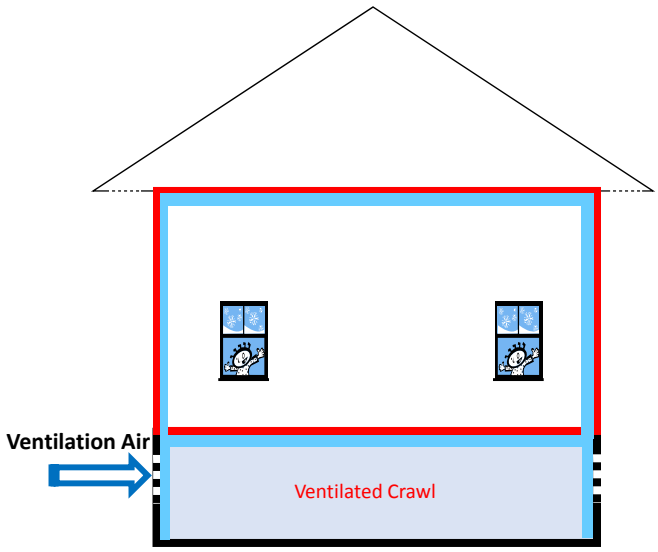
Transport Mechanism

Air flow basics

- Air is a fluid – like water
- Two requirements for air flow
  - Hole or path
  - Driving force = pressure difference



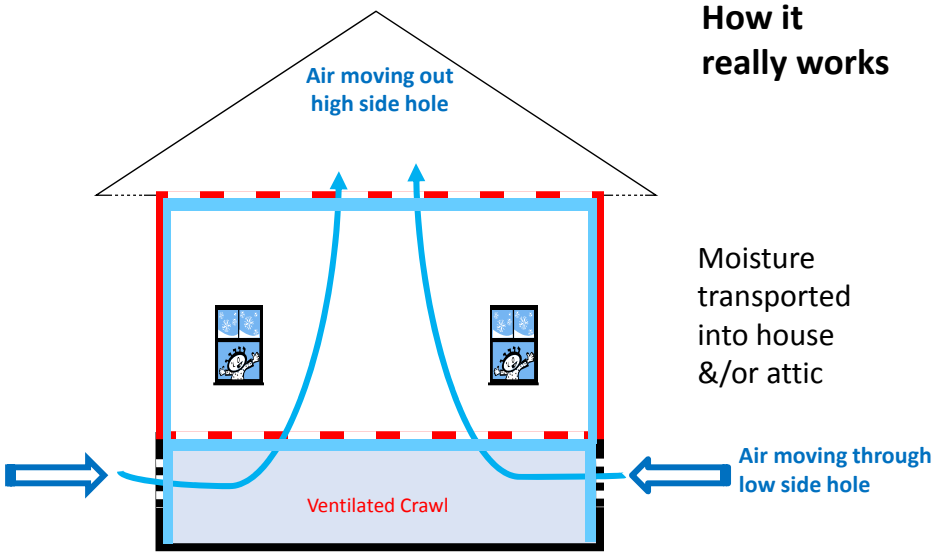
Vented Crawl Space



How we thought it worked

Moisture removed from house

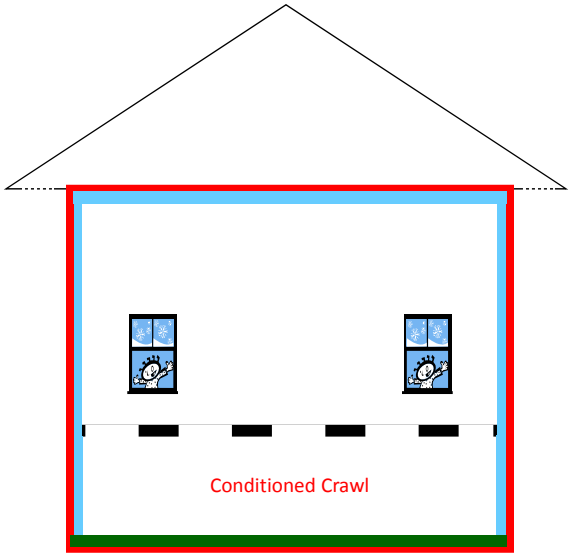
Vented Crawl Space



How it really works

Moisture transported into house &/or attic

Conditioned Crawl Space



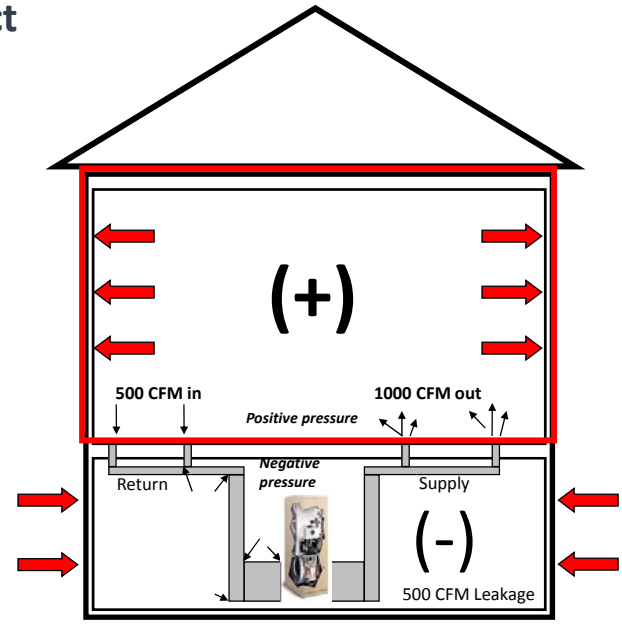
A building science solution

- Moisture controlled at sourced
- Thermal envelope defined
- Connection between crawl and house OK
- Short basement

System Effect

Having supply and return air not equal or dominant leakage on the ducts

Sends basement negative



Moisture

Moisture = #1 enemy of most building materials

Small amount of repeated wetting can lead to:

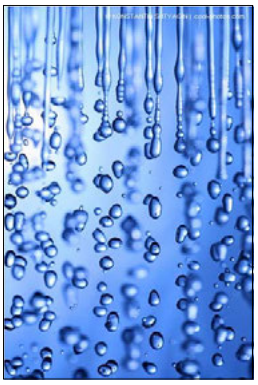
- Reduced R-value
- Mold, mildew
- Deterioration, rot

Moisture sources

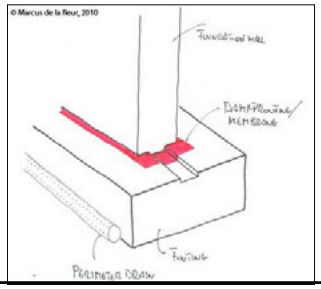
- Bulk water
- Vapor diffusion
- Air movement

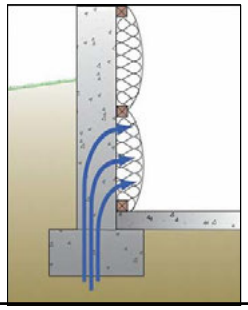
Courtesy of DOW Building Materials

Bulk Water



- Finds path of least resistance
- Generally follows gravity
- Can be drawn upward or sideways
  - Capillary action
  - Best practice

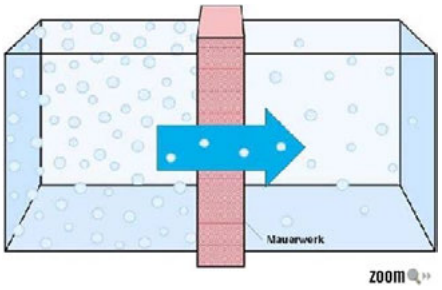




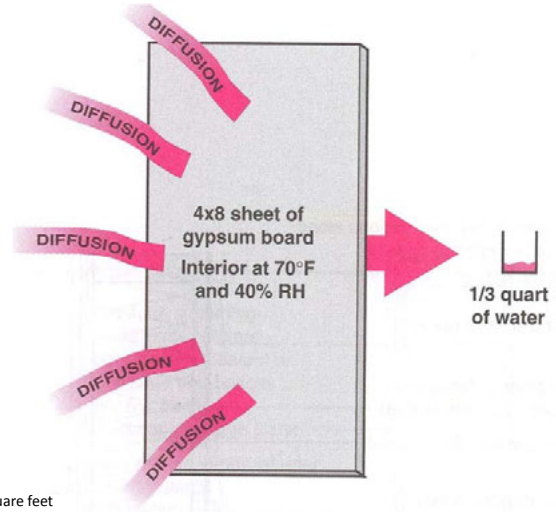
Vapor Diffusion

- Moisture moving directly through a material
  - From More to Less
  - Vapor pressure pushes water at a microscopic level through a material

- Function of
  - Temperature
  - Relative humidity



Vapor Diffusion a Slow Small Process

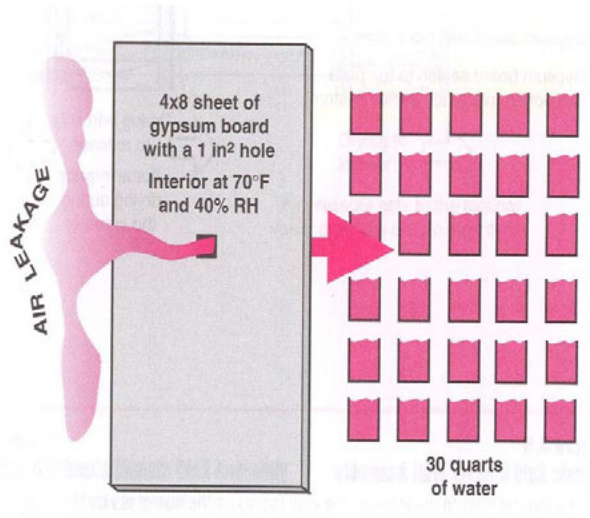


From EEBA Builder's Guide to Cold Climates by Joseph Lstiburek

46

The Problem with Air - the 4 M's

- Much
- More
- Moisture
- Movement



32 Square feet

From EEBA Builder's Guide to Cold Climates by Joseph Lstiburek

Table 402.4.1.1

Component – General Air barrier/Thermal barrier

Air Barrier Criteria	Insulation Installation Criteria
• A continuous air barrier shall be installed in the building envelope • 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

Insulation

Insulation traps pockets of air

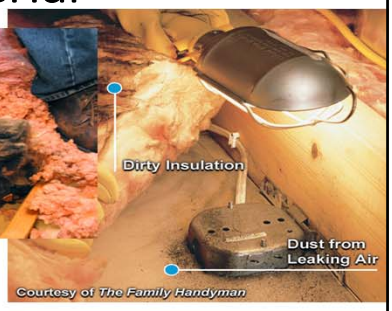
Stagnate Air Pockets create the R-value

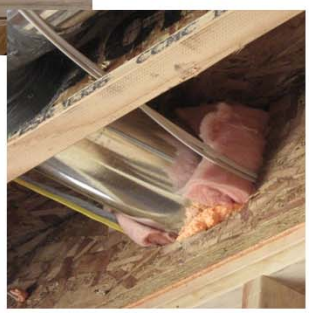
Air Barrier

Stopping the movement of air from scrubbing away the stagnate air pocket

Now it works

Air-permeable insulation shall not be used as a sealing material





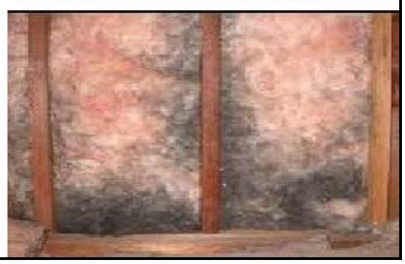
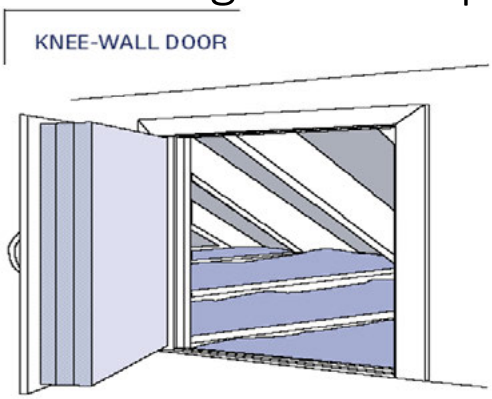


Table 402.4.1.1

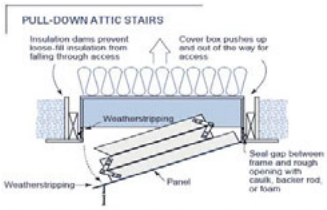
Component – Ceiling / Attic

Air Barrier Criteria	Insulation Installation Criteria
• The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed • Access openings, drop down stair 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

Ceiling Access Openings



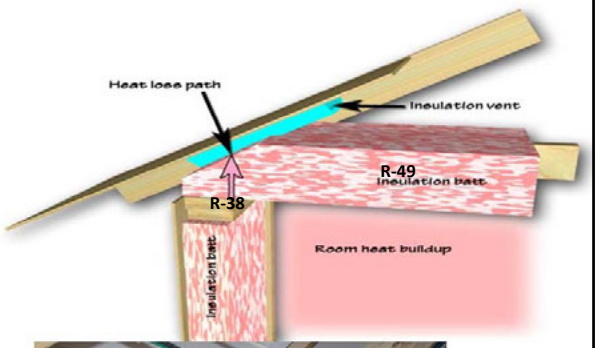
Add R-value to a knee-wall door by adhering rigid insulation boards (sandwiched together with construction adhesive and screws) to the back of the door. Pay special attention to the clearance between the insulation and the door frame and air sealing details.

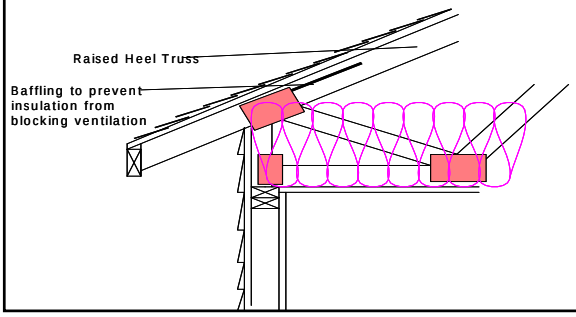


An attic stair cover box is made from rigid insulation. It drops down from the attic side to seal and insulate the pull-down stairs.

R402.2.1 Ceilings with attic spaces

- R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.





R402.2.3 Eave baffle

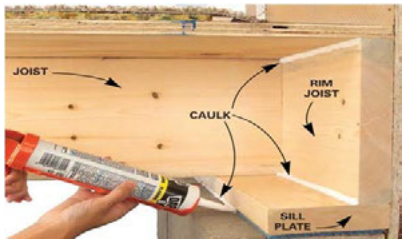
- For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents
- Baffles shall maintain an opening equal or greater than the size of the vent
- The baffle shall extend over the top of the attic insulation

Table 402.4.1.1

Component – Walls

Air Barrier Criteria	Insulation Installation Criteria
• The junction of the foundation and sill plate shall be sealed • The junction of the top plate and 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 R3 per inch minimum • Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier

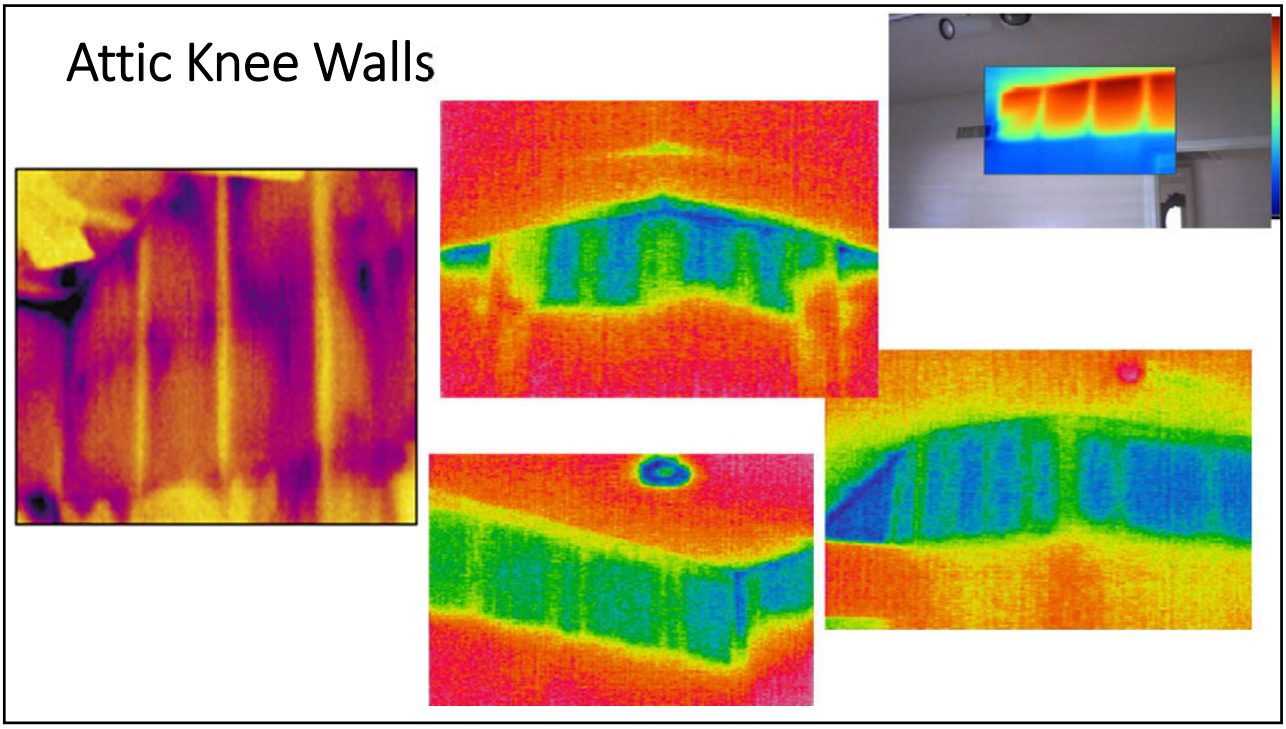
Junction of foundation and sill plate is sealed



The junction of the top plate and top of exterior walls shall be sealed

Attic Knee Walls

Attic Knee Walls



Corners and Headers shall be Insulated

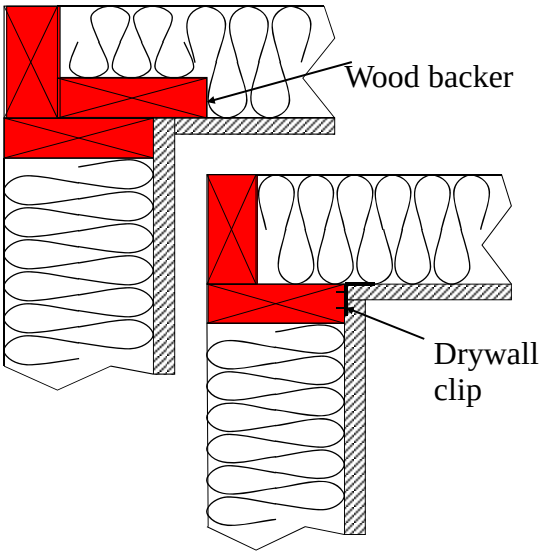


Table 402.4.1.1

Component – Windows, Skylights, and Doors

Air Barrier Criteria	Insulation Installation Criteria
• The space between window/door jambs and framing and skylights and framing shall be sealed	

Openings between window/door jambs sealed

Table 402.4.1.1

Component – Rim Joists

Air Barrier Criteria

- Rim joists shall include the air barrier

Insulation Installation Criteria

- Rim joists shall be insulated

Rim Joist

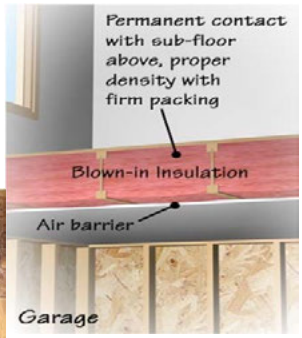
Box Sill

Table 402.4.1.1

Component – Floors (including above garage &cantilever floors)

Air Barrier Criteria

- The air barrier shall be installed at any exposed edge of insulation

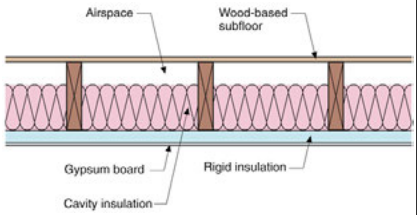


Insulation Installation Criteria

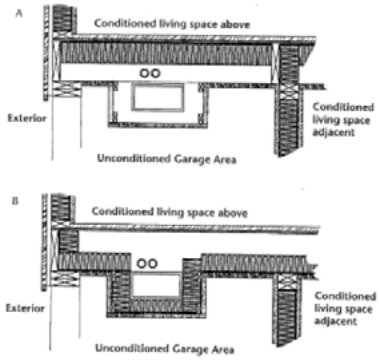
- Floor framing cavity insulation shall be installed to maintain permanent contact with underside of subfloor decking
- 2015 IECC introduction
  - or floor framing cavity insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing and extends from the bottom to the top of all perimeter floor framing members.

Floors
Section R402.2.8

Floor framing cavity insulation must be installed to maintain permanent contact with underside of subfloor decking or structural slabs



NEW Exceptions: Floor framing cavity insulation is permitted to be in contact with top side of sheathing or ci installed on the bottom side of floor where combined with insulation that meets or exceeds R-value in Table R402.1.2 for "Wood framed Walls" and extends from the bottom to the top of all perimeter floor framing or floor assembly members



Details: Cantilever Floor

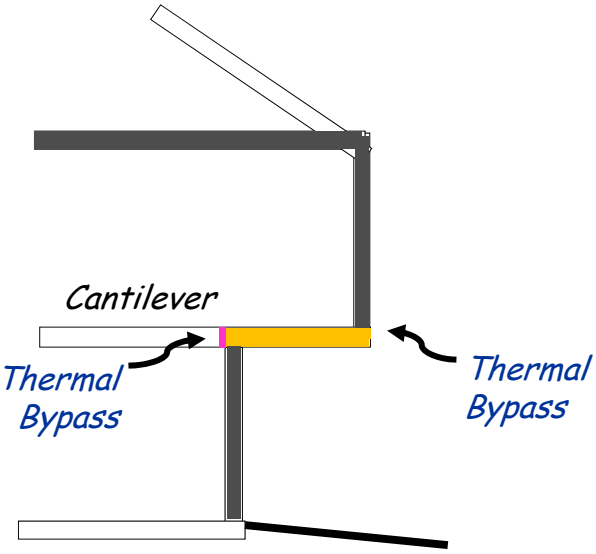
Bad Cantilevers

Poor detailing

CANTILEVERED FLOOR

Solution:

- *align insulation*
- *add air barriers*



Cantilevers

Effective detailing

Table 402.4.1.1

Component – Crawl Space Walls

Air Barrier Criteria	Insulation Installation Criteria
• Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped	• Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawlspace walls

2015 IECC table 402.4.1.1

Crawl – Insulation is permanently attached to walls, earth covered and sealed with Class 1 vapor barrier

Table 402.4.1.1

Component – Shafts, Penetrations

Air Barrier Criteria

- Duct shafts, utility penetrations, fireplace chases and flue shafts opening to exterior or unconditioned space shall be sealed

Insulation Installation Criteria

- In the 2015 IECC the Fireplace section was consolidated into this section

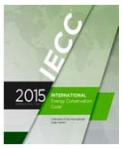
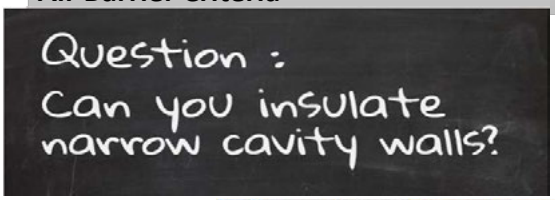
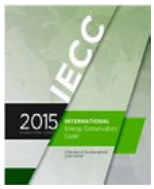


Table 402.4.1.1
Component – Narrow Cavities

Air Barrier Criteria





Insulation Installation Criteria

- Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space. Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space

Table 402.4.1.1
Component – Garage Separation

Air Barrier Criteria

- Air sealing shall be provided between the garage and conditioned spaces

Insulation Installation Criteria

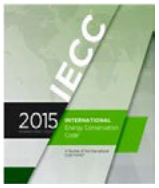


Table 402.4.1.1

Component – Recessed lighting

Air Barrier Criteria

- Recessed light fixtures installed in the building thermal envelope shall be sealed to the drywall

Insulation Installation Criteria

- Recessed light fixtures installed in the building thermal envelope shall be air tight, IC rated

Table 402.4.1.1

Component – Plumbing and Wiring

Air Barrier Criteria

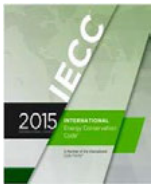
Insulation Installation Criteria

- Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring

Table 402.4.1.1

Component – Shower/tub on exterior wall

Air Barrier Criteria	Insulation Installation Criteria
• The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs	• Exterior walls adjacent to showers and tubs shall be insulated



Tubs and Showers

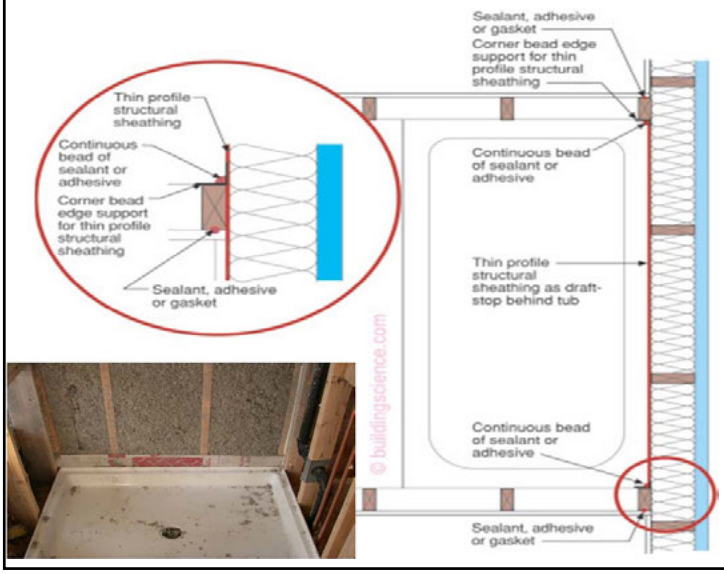


Table 402.4.1.1

Component – Electrical/phone box on exterior walls

Air Barrier Criteria

- The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed

Insulation Installation Criteria

Electrical/phone box on exterior walls

Table 402.4.1.1

Component – HVAC Register boots

Air Barrier Criteria

- HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall

Insulation Installation Criteria

Table 402.4.1.1

Component – Fireplace

Air Barrier Criteria

- This section was moved in the 2015 IECC
- An air barrier shall be installed on fireplace walls
- Fireplaces shall have gasketed doors

Insulation Installation Criteria

Sequencing is the Issue

air barrier 1st then over framing

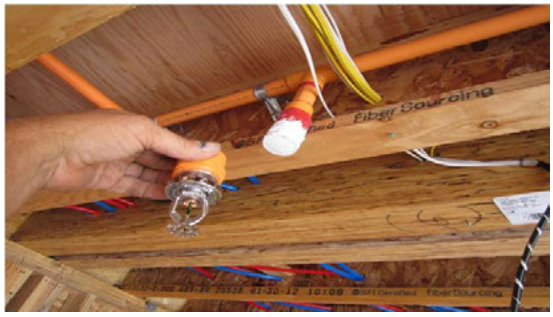
Table 402.4.1.1

Component – Concealed Sprinklers

Air Barrier Criteria

- When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings

Insulation Installation Criteria



Rooms Containing Fuel-burning Appliances
Section R402.4.4

NEW

- Appliances and combustion air openings to be located outside the building thermal envelope or enclosed in a room isolated from inside the thermal envelope in Climate Zones 3-8
- Where open combustion air ducts provide combustion air to open combustion space conditioning fuel-burning appliances
- Rooms to be sealed and insulated per envelope requirements
- Doors into the rooms fully gasketed
- Water lines and ducts insulated
- Combustion air ducts that pass through conditioned space, insulated to ≥ R-8

Exceptions:

- Direct vent appliances with both intake and exhaust pipes installed continuous to the outside
- Fireplaces and stoves complying with 901-905 IMC and Section 2111.13 IBC

R403.6 Mechanical ventilation (Mandatory)

- The building shall be provided with ventilation that meets the requirements of the International Residential Code or International Mechanical Code
- 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. (**Efficient fans needed**)
- Exception: Where mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an **electronically commutated motor**

M1507.3 Whole-house mechanical ventilation system

- **M1507.3.1 System design:** The whole-house ventilation system shall consist of: Supply Side, Exhaust Side, Balanced systems, or combination there of
- **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:**
  - **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 is multiplied by the factor determined in accordance with Table M1507.3.3(2).

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

- Simulated Performance and ASHRAE 62.2 Formula:
- Ventilation can't be greater than what is calculated by formula

Fan flow (CFM) = 0.01 CFM x your floor area + 7.5 x (your number of bedrooms + 1)

- For a 1,510 square foot 4-bedroom home,

(0.01 X 1510) + (7.5 times 5)

Formula Result: 52.5 CFM

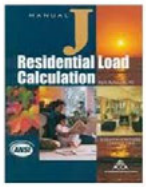
Chart Result: 75 CFM

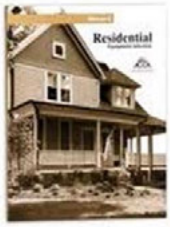
R403.3 Ducts

- Insulation (Prescriptive):Attics get R-8 or R-6, elsewhere it's R-6 and R4.2 (dependent on duct size)
- Sealing (Mandatory): new exceptions brought in if using spray foam products or if there is a static pressure less than 2" w.c. with welded joints and seams or certain locking-type joints and seams.
- Testing (Mandatory): You must test either at rough-in or final and a report provided to the code official, **but…**
- Duct Leakage (Prescriptive): The amount of leakage can now be traded off.

R403.7 Equipment Sizing

- Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation technologies.

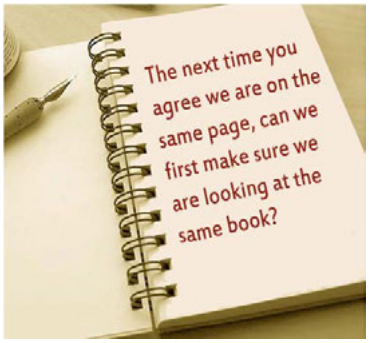




Building/Fire Code and Energy Code

Not on the same page

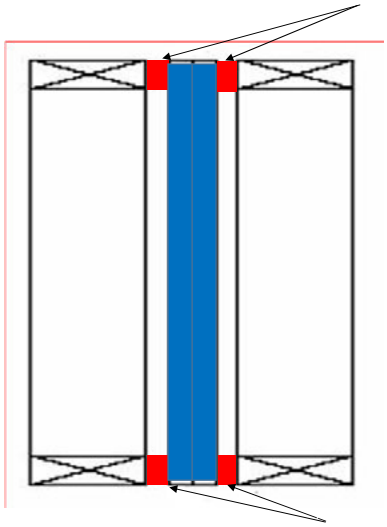
- 2009 IECC
  - Common wall: Air barrier is installed in common wall between dwelling units
- 2012 and 2015 IECC
  - Not mentioned in the table



The Problem

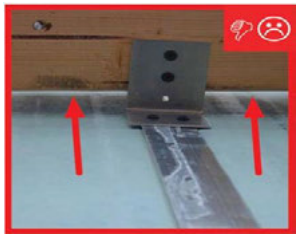
Common wall between Dwelling Units taken out of the code table

- Energy Code and Building/Fire Code are not in alignment
- Potential swapping of like materials
  - Fire rated foam for rock wool fire stop
  - Blown fiberglass for fiberglass batt



What constitutes the assembly?

Fill the gap



- **Treat Common / Party Walls Like Exterior Walls and require all air sealing and air barriers adjacent to the assembly**

QUESTIONS?

Thank You!!!

Shaunna Mozingo
Colorado Code Consulting
Smozingo@coloradocode.net

COLORADO CODE
CONSULTING
LLC