

2018 International Energy Conservation Code

Residential Provisions



Why Energy Codes?

- Energy Codes set minimum efficiency requirements for new and renovated buildings, assuring reductions in energy use and emissions over the life of the building. Energy Codes are a subset of building codes, which establish baseline requirements and govern building construction.
 - Code compliant buildings are more comfortable and cost-effective to operate, assuring energy, economic and environmental benefits.
 - The relationship between the IRC and the IECC
 - IECC addresses only energy topics
 - IRC addresses all topics (structural, plumbing, etc.)
 - One book
 - Chapter 11 covers Energy requirements
 - IECC addresses both residential and commercial construction; IRC addresses all of the subsets of residential construction
 - Detached one- and two-family dwellings and townhomes 3 stories or less
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Structure of the 2018 IECC

Residential Section

- Ch. 1 Scope and Application/
Administration and Enforcement
- Ch. 2 Definitions
- Ch. 3 General Requirements
- Ch. 4 Residential Energy Efficiency
- Ch. 5 Existing Buildings
- Ch. 6 Referenced Standards

- Residential Buildings:
 - One- and two-family dwellings, townhouses of any size and R-2, R-3, R-4 \leq 3 stories
 - All buildings that are not “residential” by definition are “commercial”



Structure of the 2018 IECC

IECC Terminology

- Prescriptive
 - Required but can be modified or *eliminated* in trade for compensating improvements elsewhere
- Mandatory
 - Required and cannot be traded down, even in the simulated performance path and Energy Rating Index path

Climate Specific Requirements

- Roofs
- Above Grade Walls
- Foundations
 - Basements
 - Slabs
 - Crawlspace
 - Windows, Skylights, and Doors
 - Solar Heat Gain Coefficients

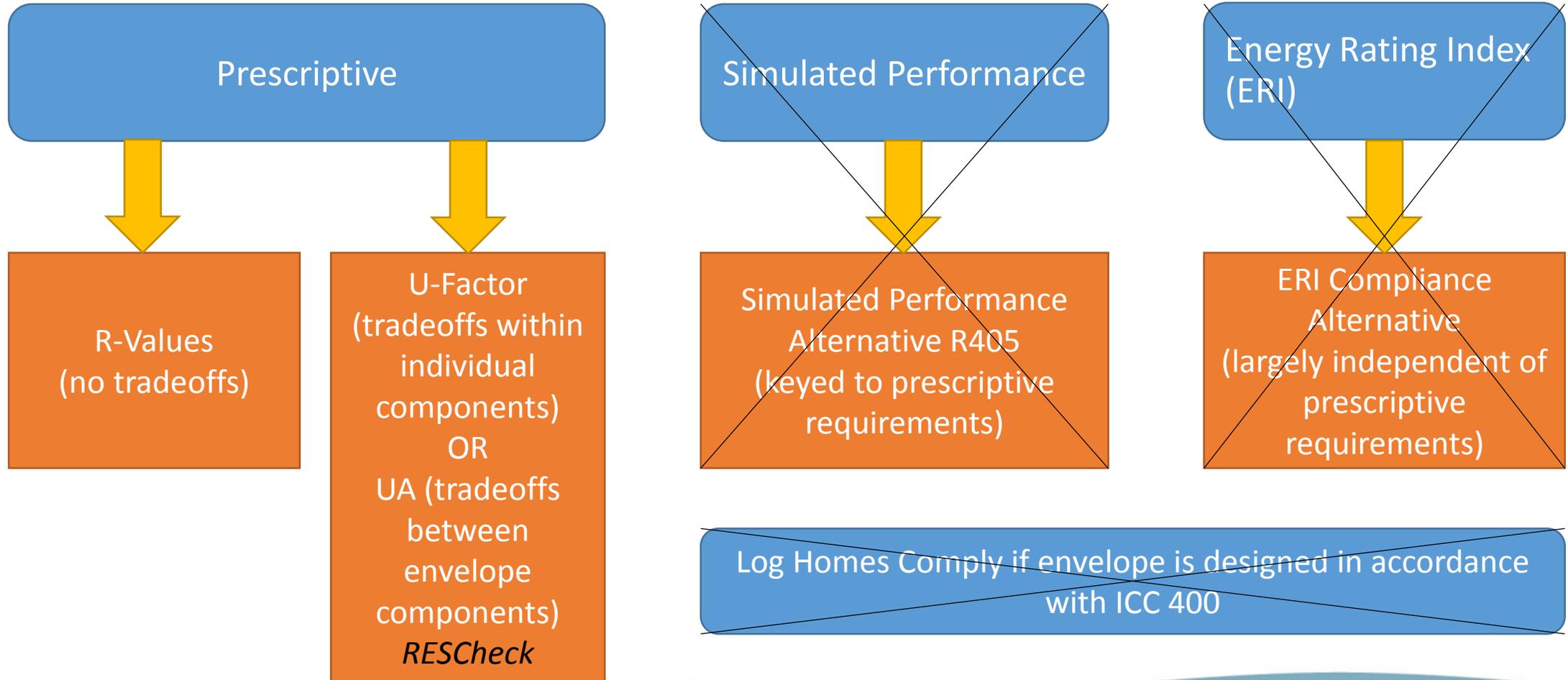
Mandatory Requirements (*apply everywhere*)

- Infiltration Control
- Duct Insulation, Sealing & Testing, No Use of Building Cavities
- HVAC Controls
- Piping Insulation & Circulating Service Hot Water Requirements
- Equipment Sizing
- Dampers
- Lighting

Some Elements Have “Hard Limits”

- AKA “Trade-Off Limits” or “Backstops”
- Prescriptive Requirements with hard limits can only be traded as far as the limit

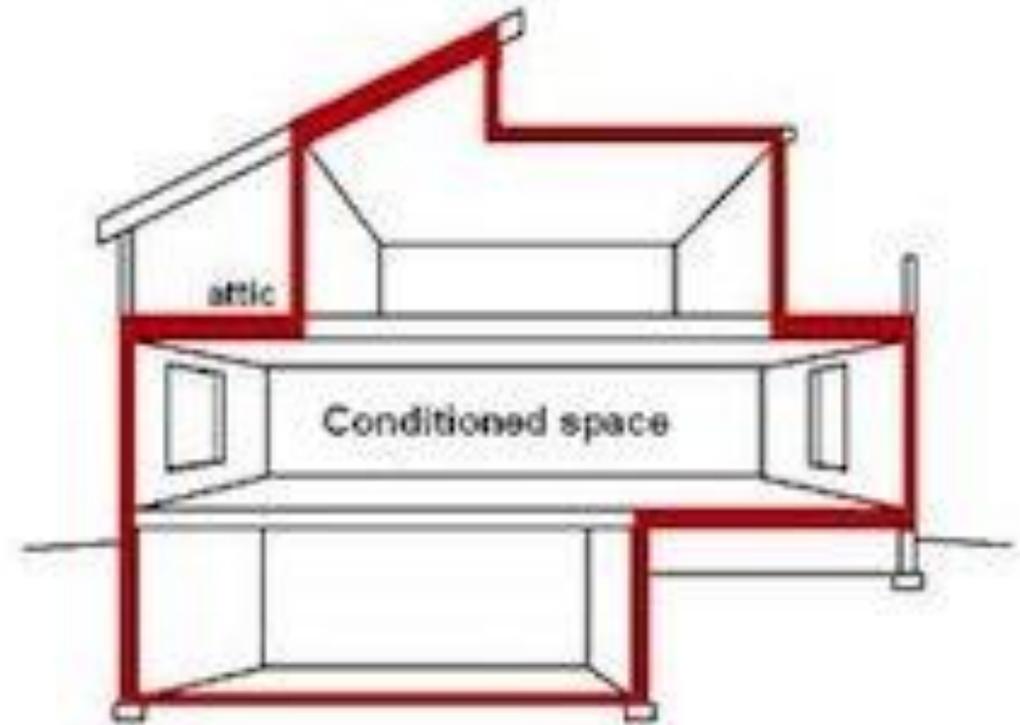
IECC Compliance Paths/Options



Building Envelope Requirements

The Building Thermal Envelope Consists of:

- Fenestrations (Doors & Windows)
- Ceilings
- Walls
 - Above Grade
 - Below Grade
 - Mass Walls
- Floors
- Slabs
- Basements and Crawlspaces



Insulation and Fenestration Requirements

	Residential Prescriptive Package Compliance Option									
	Windows			Insulation				Foundation		
	Fenestration U-Factor (b)	Skylight U-factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value (a)(f)	Mass Wall R-Value (g)	Floor R-Value (e)	Basement Wall R-Value (c)	Slab R-Value and Depth (d)	Crawl Space Wall R-Value
2009	0.35	0.60	NR	38	20 or 13+5	13/17	30	10/13	10, 2 ft	10/13
2018	0.30	0.55	NR	49	20 or 13+5	13/17	30	15/19	10, 2 ft	15/19

Table Notes:

- a. R-Values are minimums. U-Values and SHGC are maximums. **When insulation is installed in a cavity which is less than the labeled 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: In climate Zones 1 through 3, skylights may be permitted to be excluded from glazed fenestration.**
- c. **“15/19” for Basement Wall Insulation values 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. Alternatively, compliance with “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.**
- d. **R-5 insulation shall be provided under the full area of the heated slab in addition to the required slab edge insulation R-Value for slabs as indicated in the table. The slab edge insulation for heated slabs shall not be extended below the slab.**
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation is not required in warm-humid locations...
- g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of R-19.
- h. First value is cavity insulation, second is continuous insulation or insulated siding, so “13+5” for Wood Frame Wall Insulation values means R-13 cavity insulation plus R-5 continuous insulation or insulated siding.
- i. Mass walls shall be in accordance with R402.2.5. The second R-value applies when more than half of the insulation is on the interior of the mass wall.

Building Envelope Requirements

Fenestrations

Windows & Doors

- NFRC Rating or Default Table
- No Glass Area Limits
- Exemptions for meeting requirements
 - Not greater than 15 sq. ft. of glazing per dwelling unit
 - On side-hinged door assembly not greater than 24 sq. ft.

Skylights

- Must Meet U-factor and SHGC Requirements
 - Subject to Hard Limits in tradeoffs

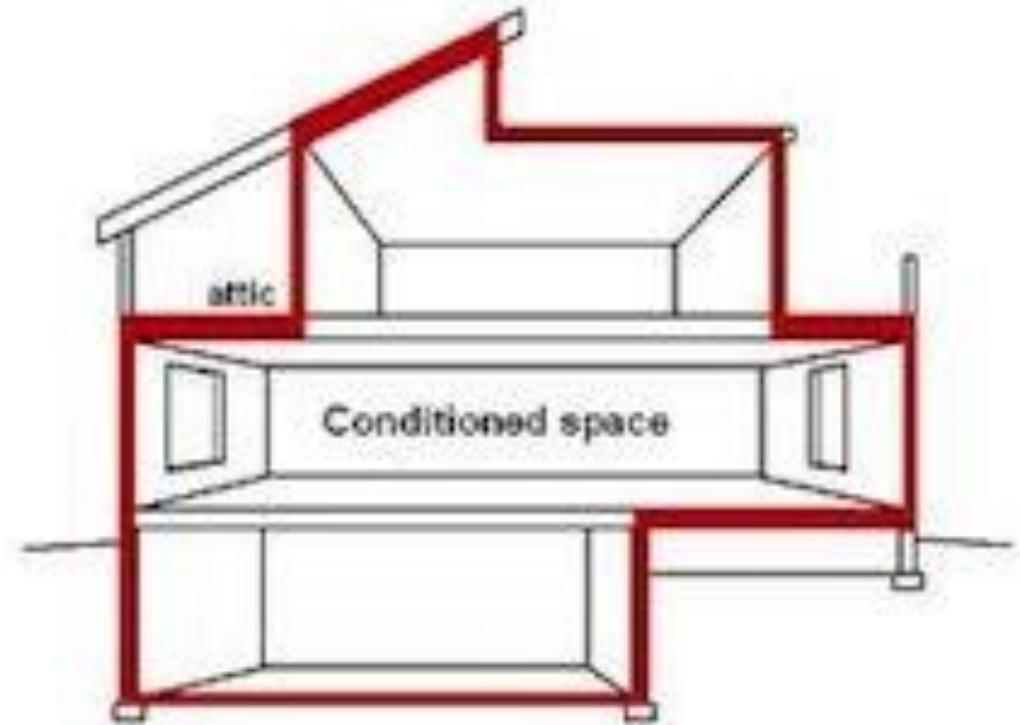
Windows			
	U-Factor (b)	Skylight U-factor	SHGC
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2018	0.30	0.55	NR



Building Envelope Requirements

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- Fenestrations (Doors & Windows)
- Ceilings – R-49
- Walls
 - Above Grade
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 - Mass Walls
- Floors
- Slabs
- Basements and Crawlspaces



Insulation and Fenestration Requirements

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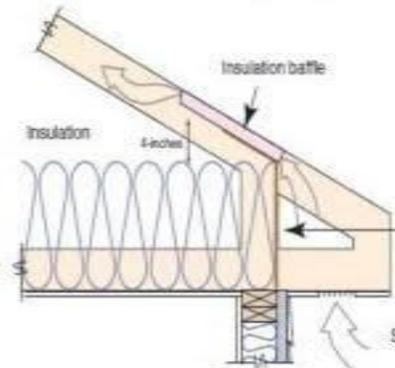
Building Envelope Requirements

- R-values are to be printed on batt insulation or rigid foam board
- Blown-in insulation must have insulation markers installed every 300 sq. ft., be marked with the minimum installed thickness and be affixed to the trusses or joists
- Insulation certificates should be installed in the attic and include:
 - R-value of installed thickness
 - Initial installed thickness
 - Installed density
 - Settled thickness/settled R-value
 - Coverage area
 - Number of bags installed
- Code requirements are based on ceiling/attic construction types:
 - Framed Assemblies
 - Continuous Insulation Options
 - Insulation installed between framing (cavity insulation)
- Ceiling insulation requirements in the R-value table assume standard truss/framing system
- R-value requirements for *steel-framed ceilings* are provided as an alternative:
 - R-49 equivalent is R-38 (cavity) + R-5 (cont.)

Building Envelope Requirements

- Prescriptive path R-value encourages raised heel trusses (*aka, energy trusses*)
 - If insulation is full height uncompressed over exterior wall top plate, covering 100% of the ceiling area
 - R-38 complies where R-49 is required
 - R-30 allowed for up to 500 sq. ft. or 20% total insulated ceiling, whichever is less
- For air permeable insulations in vented attics, a baffle shall be installed:
 - Adjacent to soffit and eave vents
 - To maintain an opening greater than or equal to the size of the vent
 - To extend over the top of attic insulation
 - May be of any solid material

Note: This reduction ONLY applies to the R-value prescriptive path, not the U-factor or Total UA alternatives.

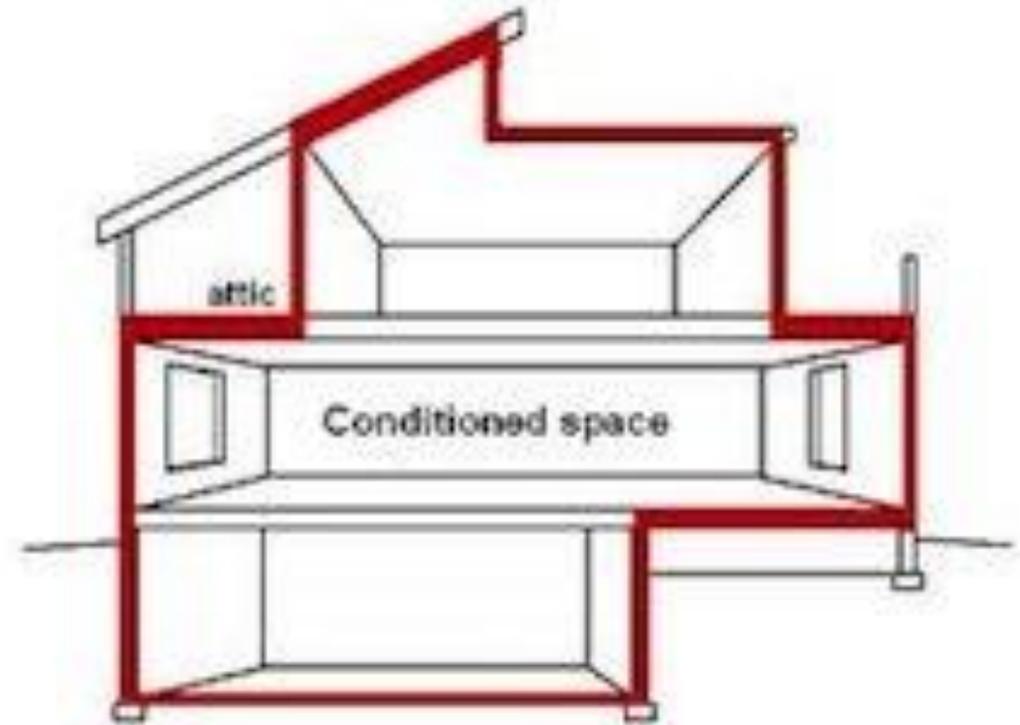


- Weatherstrip and insulate doors from conditioned spaces to unconditioned spaces (*eg. attics and crawl spaces*) to level equivalent to surrounding surfaces

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- Basements and Crawlspace



Insulation and Fenestration Requirements

	Residential Prescriptive Package Compliance Option									
	Windows			Insulation				Foundation		
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Building Envelope Requirements

- Walls
 - Exterior above-grade walls
 - R-20 or 13+5
 - Attic kneewalls
 - R-20 or 13+5
 - Skylight shaft walls
 - R-20 or 13+5
 - Perimeter joists
 - R-20 or 13+5
 - Basement walls
 - **15/19 (continuous/cavity)**
 - Garage walls (*shared with conditioned space*)
 - R-20 or 13+5
- R-value requirements for ***steel-framed walls*** are provided as an alternative:
 - @ 16" on center
 - R-0+14.0, R-13+8.9, R-15+8.5, R-19+7.8, R-19+6.2 or R-21+10.9
 - @24" on center
 - R-0+14.0, R-13+7.7, R-15+7.1, R-19+6.3, or R-21+5.9
- Mass walls (above grade)
 - Concrete block, concrete, ICF, masonry cavity, brick (*other than veneer*) and solid timber/logs
 - **13/17** (the second R-value applies where more than ½ of the insulation is on the interior of the home)

Building Envelope Requirements

- Floors – R-30

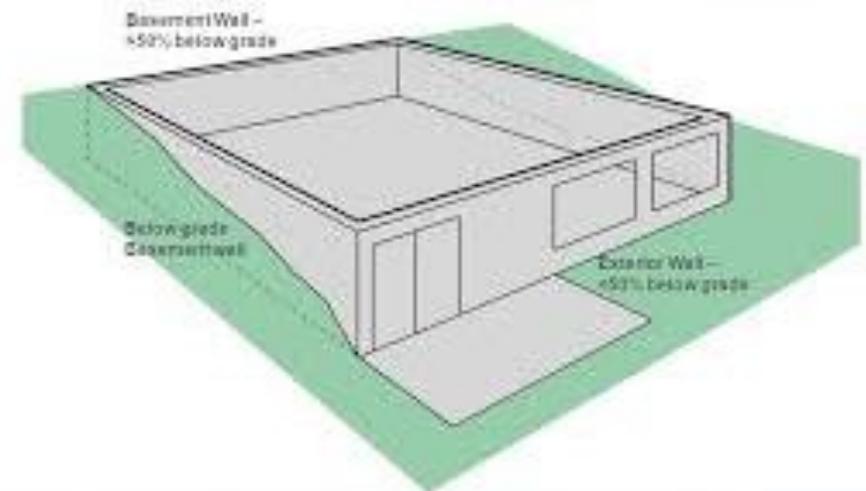
- If framing members are too small to accommodate R-30, insulation that fills the framing cavity, not less than R-19, complies
- Insulation must maintain permanent contact with the underside of the subfloor



Photo credit to QualiSTAT

- Basement Walls – **R-15** (*cont.*) or **R-19** (*cavity*)

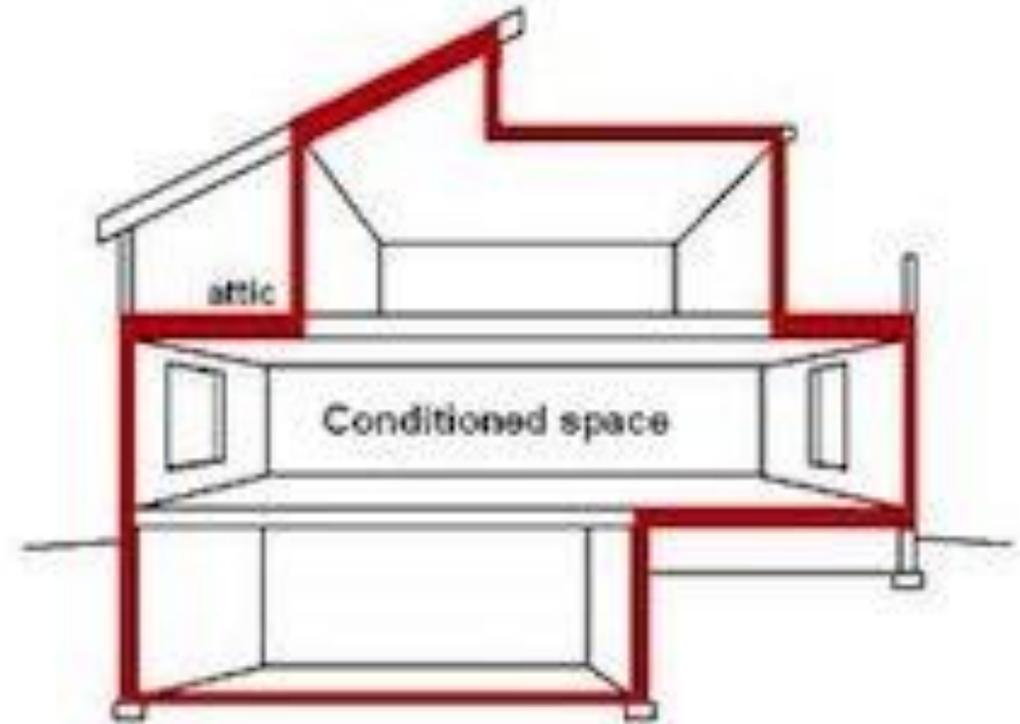
- Greater than 50% below grade
- Otherwise treat as above-grade wall
- Insulated from the top of basement wall down to 10 ft. below grade or basement floor, whichever is less



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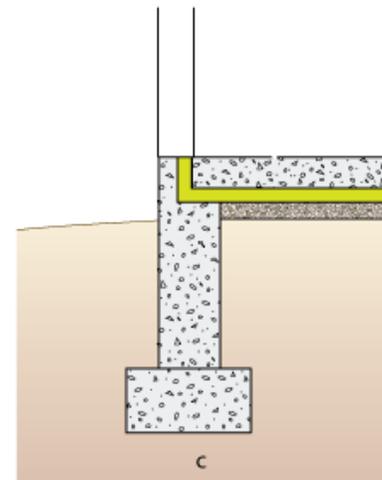
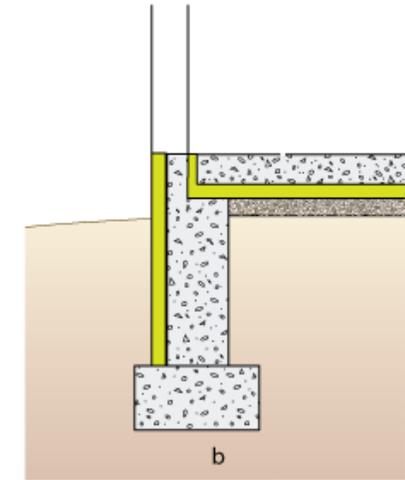
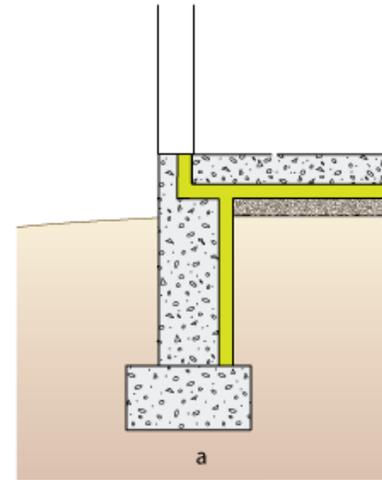
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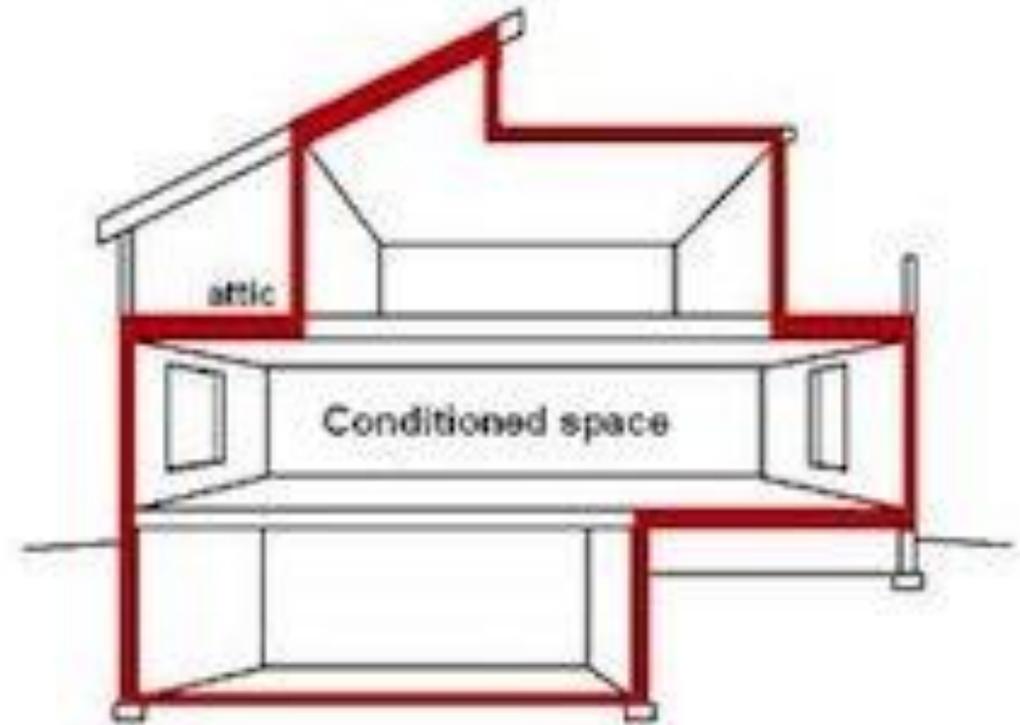
- Slabs – R-10, 2 ft.
 - Insulation can be vertical or extended horizontally under slab or out of the building under 10” of soil or pavement
 - R-5 is required under the full slab area of a heated slab in addition to the required slab edge insulation
 - Must be installed to provide a complete thermal break
 - The top edge of insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45° angle



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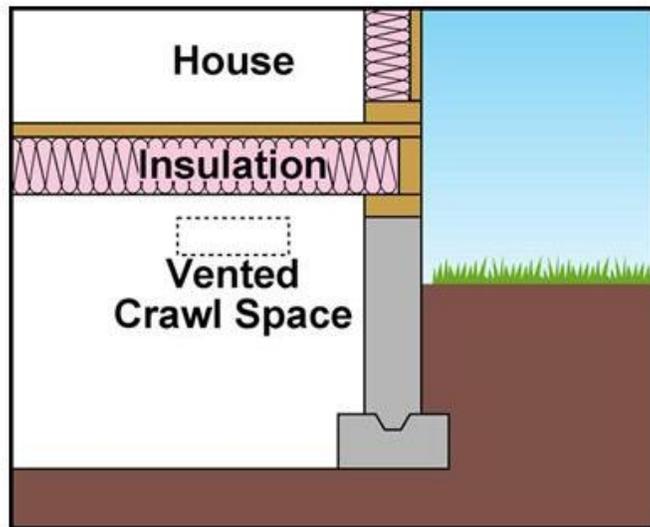
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Building Envelope Requirements

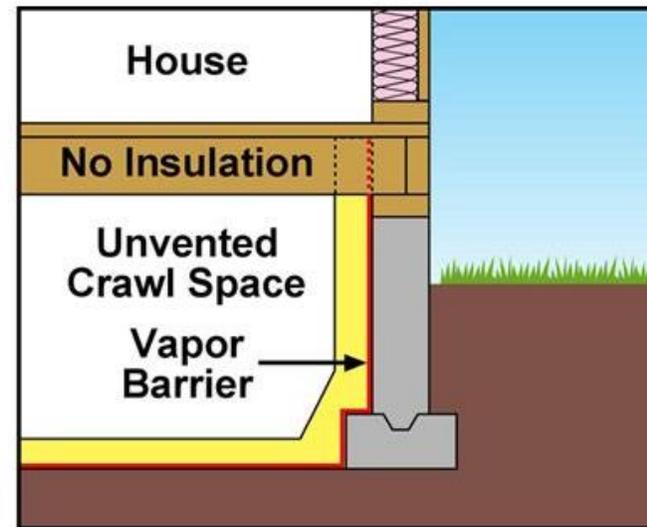
- Vented Crawl Space

- The raised floor is insulated
- Ventilation openings are required
- Ducts in crawlspace must be sealed and be insulated to an R-6



- Unvented Crawl Space

- Crawlspace walls are insulated
- Insulation extends from the top of the wall to the inside finished grade and then 24" vertically or horizontally
- Must be mechanically ventilated or conditioned as part of the building envelope



Question Break!



Building Envelope Requirements

- Alternative Compliance Options
 - U-factor Alternative
 - Similar to Prescriptive R-value but uses U-factors
 - Allows for innovative or less common construction techniques such as SIPs or advanced framing
 - Allows no trade-offs between building components
 - Total UA Alternative – RESCheck
 - Allows trade-offs across all building envelope components
 - Simulated Performance Alternative
 - Proposed building design simulations that are shown to have an annual energy cost that is less than or equal to the annual energy cost of the reference standard
 - Energy Rating Index
 - Completed by an approved third party and documentation including compliance reports must be reviewed by the code official – **Zone 5 ERI 61**

Building Envelope **Mandatory** Requirements

Air Leakage – Building Thermal Envelope

- Whole-house pressure tests
 - Zone 5 - ≤ 3 Air Changes per Hour (ACH)
- Field verification of air sealing

Can Lights

- Shall be IC-rated and labeled as with an air leakage rate (as per ASTM E283) not greater than 2.0 cfm

Fireplaces

- New wood-burning fireplaces shall have tight-fitting flue dampers or doors, and outdoor combustion air. Factory-built fireplaces shall be listed and labeled in accordance with UL 127.

Fenestration Air Leakage

- Windows, glass doors & skylights
 - ≤ 0.3 cfm/ft²
- Swinging Doors
 - ≤ 0.5 cfm/ft²

Hard Limits

- Window U-factor Maximum – 0.48
- Skylight U-factor Maximum – 0.75
 - U-factors of individual windows or skylights can be higher if area-weighted average is below these limits

Sunrooms

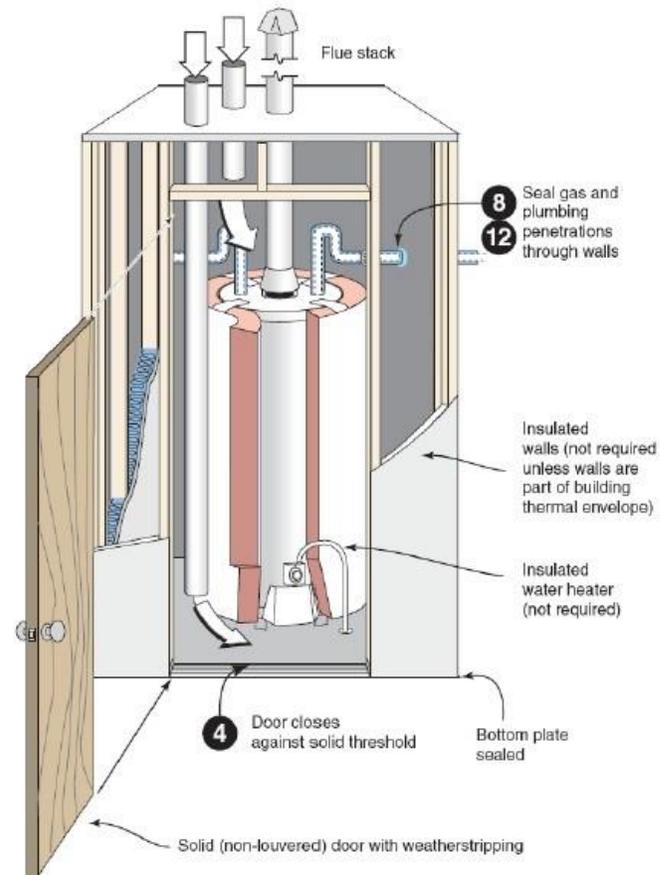
- Ceiling Insulation
 - R-24
- Wall Insulation
 - R-13
- Fenestration U-factor
 - U-0.45
- Skylight U-factor
 - U-0.70



Building Envelope **Mandatory** Requirements

Rooms Containing Fuel-Burning Appliances

- New in 2018
 - Where open combustion air ducts provide combustion air to open fuel burning appliances, the appliances and combustion air opening shall be located outside the building thermal envelope or enclosed in a room that is **isolated** from inside the thermal envelope.



Mechanical Requirements

HVAC Controls

- No Change
 - Programmable Thermostats
 - Mandatory Heat Pump Supplementary Heat Requirements
- New in 2018
 - Hot water boiler outdoor temperature setback.
 - Hot water boilers that supply heat to the building through one- or two-pipe heating systems shall have an outdoor setback control that decreases the boiler water temperature based on the outdoor temperature.

Duct Insulation

- In 2009
 - Supply ducts *in attics* shall be insulated to a minimum R-8. All other ducts shall be insulated to a minimum R-6.
- In 2018
 - Supply and return ducts *in attics* shall be insulated to a minimum of:
 - R-8 for ducts 3" in diameter and larger, and
 - R-6 for ducts less than 3" in diameter.

Mechanical Requirements

Duct Sealing

- In 2009
 - All ducts, air handlers, filter boxes and ***building cavities used as ducts*** shall be sealed.
 - Allowed building framing cavities to be used as return ducting.
- In 2018
 - Ducts, air handlers and filter boxes shall be sealed.
 - Building framing cavities ***shall not*** be used as ducts or plenums.



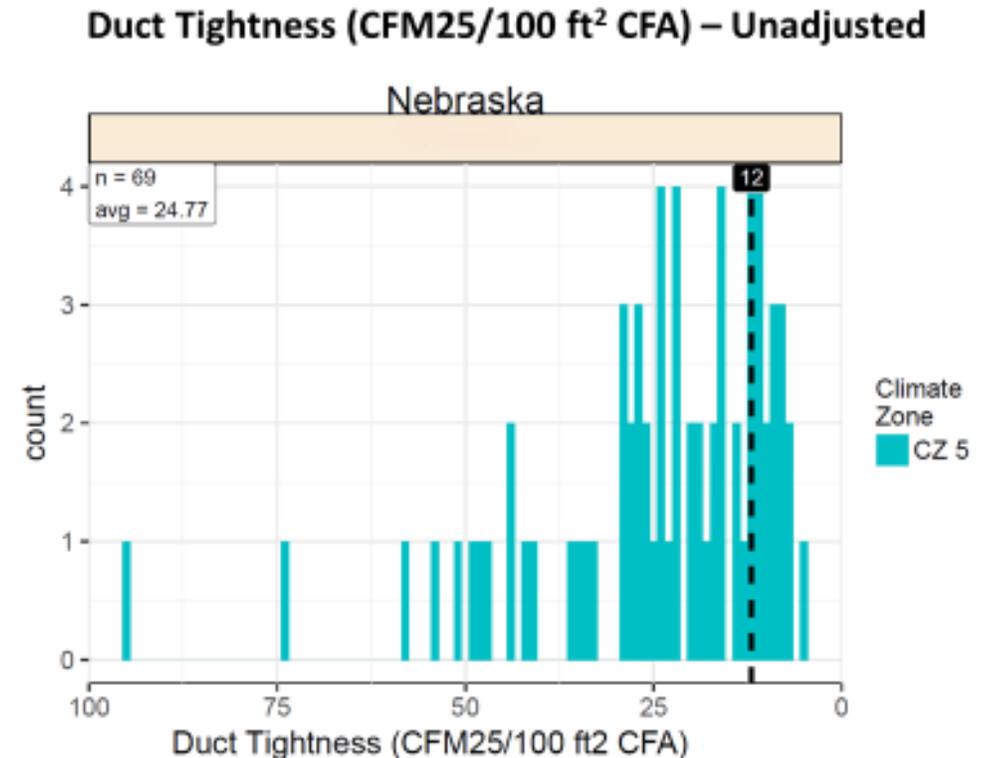
Mechanical Requirements

Duct Tightness Testing

- Required in both 2009 and **2018** if any ducts are located ***outside of the building envelope***.
- 2009 Testing Requirements
 - Post-construction testing requirements:
 - Leakage to outdoors **8** cfm per 100 ft² of conditioned area
 - Total leakage **12** cfm per 100 ft² of conditioned area
 - Rough-in testing requirement:
 - Total leakage **6** cfm per 100 ft² of conditioned area
 - If the air handler is not installed at the time of the test, total leakage **4** cfm per 100 ft² of conditioned area
- 2018 Testing Requirements
 - Post-construction testing requirement:
 - Total leakage **4** cfm per 100 ft² of conditioned area
 - Rough-in testing requirement:
 - Total leakage **4** cfm per 100 ft² of conditioned area
 - If the air handler is not installed at the time of the test, total leakage **3** cfm per 100 ft² of conditioned area
- Easiest Solution – ***Keep Ductwork inside the building envelope***

Residential Energy Code Compliance Evaluation

- In 2017 NDEE completed building envelope tightness and duct tightness pressure testing (blower door and duct blaster testing) on 63 homes that were “substantially” complete but not yet occupied. At the same time, heating and cooling equipment information was collected when available.
- Duct Pressure Testing –
 - Although not specifically a requirement of the 2009 IECC unless ductwork goes “outside” of the building thermal envelope
 - If tested, the code allows no more than 12 CFM/100 ft²



Residential Energy Code Compliance Evaluation

- Practices encountered that seriously impact duct tightness and the appropriate delivery of air
 - Not ensuring that the “duct system” provides air into the room and not the “floor system”, make an additional efforts to seal the boot to the floor prior to the installation of the finished floor. *A ¼” gap around a 2x10 floor grille can account for 32 CFM²⁵ of duct leakage*
- Verify that ducts intended to provide conditioned air through the toe kick of a cabinet are **actually** ducted to the grill. Situations such as those shown in the photos below include the cabinet area into the “duct system” and obviously cannot appropriately provide conditioned air to the intended space.

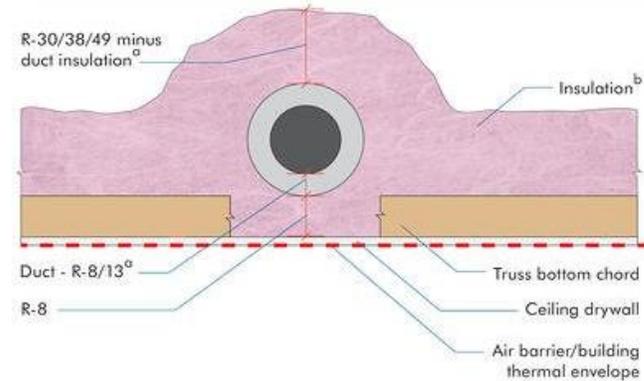


Mechanical Requirements

Duct Buried in Ceiling Insulation

- New In 2018

- Supply and return ducts shall have an insulation R-value not less than R-8
- At all points along each duct, the sum of the ceiling insulation R-value against and above the top of duct, and against and below the bottom of the duct shall not be less than R-19, excluding the R-value of the duct insulation.



Notes:

- a. Dependent on Climate Zone.
- b. Minimum prescriptive ceiling insulation



Mechanical Requirements

Service hot water system requirements have been added:

- Heated water circulation and temperature maintenance systems
 - Must be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosiphon systems are prohibited.
- Demand recirculation water systems
 - Control requirements are established.

Hot water pipe insulation

- R-3 for:
 - $\frac{3}{4}$ " and larger diameter
 - serving more than 1 dwelling
 - outside of the conditioned space
 - from water heater to distribution manifold
 - under floor slab
 - buried
 - supply and return in recirculation systems other than demand recirculation systems
- Drain water heat recovery units
 - Shall comply with CSA B55.2

Mechanical Requirements

Snow and Ice Melt Systems (Mandatory) both 2009 & 2018

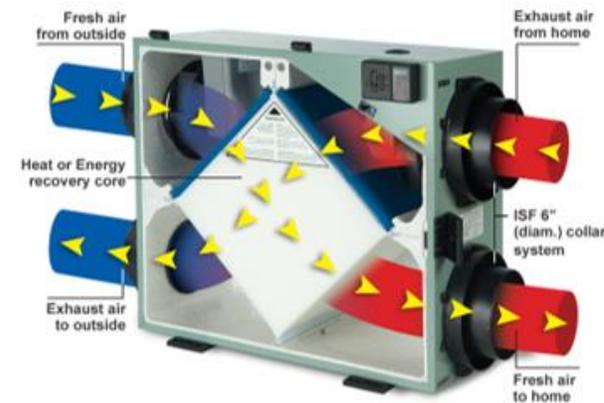
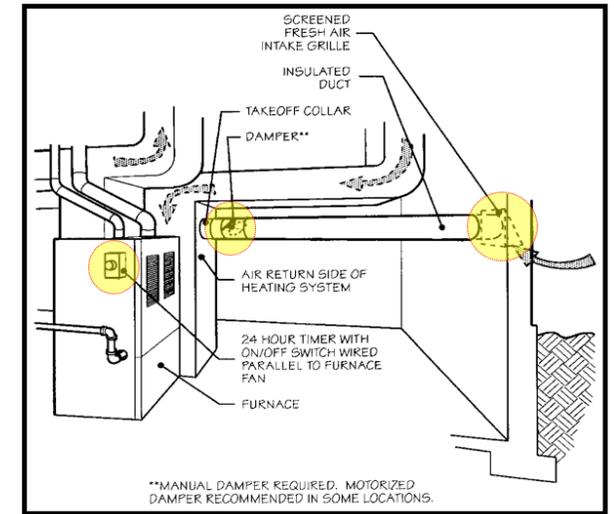
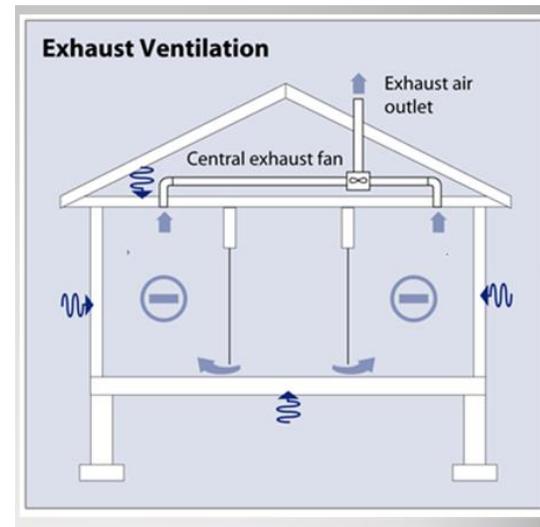
- shall include automatic controls that shut off the system when the pavement temperature is above 50°F, and no temperature is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F.



Mechanical Requirements

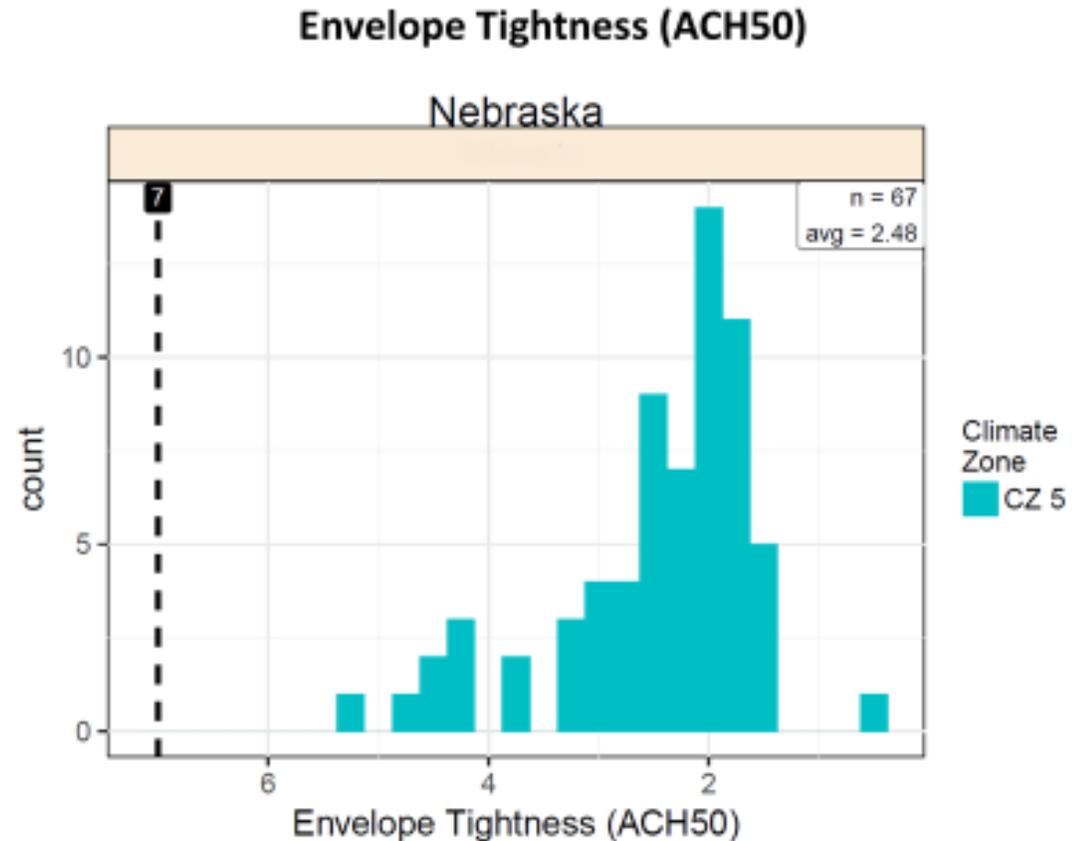
Air Sealing and Blower Door Testing

- New in 2018
 - All new homes to be air sealed and blower door tested.
 - Homes must not exceed 3 air changes per hour but the IMC requires that homes “tighter than 3 air changes per hour” meet the requirements of ASHRAE 62.2.
 - Pretty much requiring all new homes to have continuous ventilation.



2017 Residential Energy Code Compliance Evaluation

- Blower Door Testing –
 - Not specifically a requirement for the 2009 IECC – visual inspection by code officials is allowed
 - If tested, the code allows no more than 7 ACH
 - The 2012 - 2018 IECC versions allow no more than 3 ACH



Lighting Requirements

High Efficiency Lighting

- In 2009 – 50%
- In 2018 – 90%



More Information can be found at:

www.iccsafe.org

- click on ‘Online Building Codes’ and select the code you wish to view.”

Questions

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