
Ameren
MISSOURI

St. Louis 2018 IECC:
Comprehensive Field Inspection Checklist

Mike Barcik, Southface Institute
Matt Belcher, MO Energy Code Consultant

Energy Code Resources

Technical assistance or training requests:

Matt Belcher, Energy Code Consultant
Matt@moenergycodesupport.org matt@verda-solutions.com
314.749.4189

Energy Code Resources

Missouri Residential Building Energy Code Construction Practices Study:
https://energy.mo.gov/energy-codes/missouri-residential-building-codes-study
For additional information on other DOE Field Studies and participating states, please visit https://www.energycodes.gov/compliance/energy-code-field-studies.
Additional education resources are available at www.southfaceonlinetraining.org.

www.southface.org
mikeb@southface.org

Special thanks to:
Andy Bell – Code Official, Opelika
abell@opelika-al.gov
Steve Johnson – Technical Principal, Southface
sjohnson1@southface.org

About Southface

www.southface.org

Building a Regenerative Economy,
Responsible Resource Use & Social Equity
Through a Healthy Built Environment for All

- Mike Barcik – Technical Principal
- mikeb@southface.org

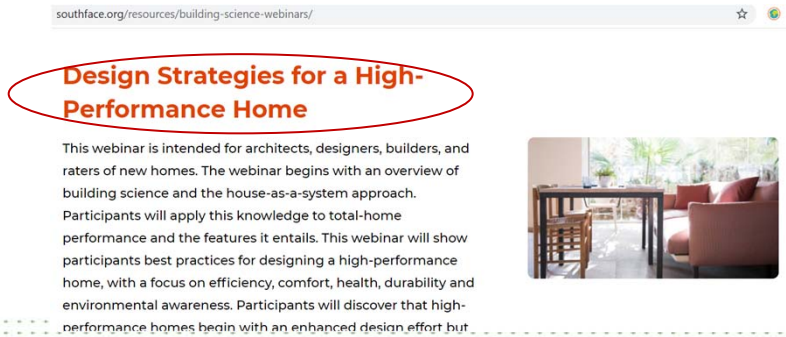
Learn More at www.southface.org

- Energy Code Resources
- 12 BS webinars
  - Heat Transfer
  - Air Movement
  - Moisture Flow
  - Insulation Installation
  - Ventilation – Concepts & Calcs
  - Ventilation – Strategies & Apps
  - Conditioned Crawlspaces
  - Ducted Mechanicals
  - Insulated Rooflines
  - Combustion Safety
  - HVAC Load Calcs
  - Design High Perf Homes

https://www.southface.org/insights/building-science-webinars/

Learn More at MEEA

https://www.mwalliance.org/ameren-missouri-residential-energy-code-support-program



Learning Objectives

- Quick review of prescriptive energy code requirements from 2018 IECC plus two St. Louis amendments
- Identify and reinforce code requirements
- Break down site inspections into up to 3 visits
  - Pre-insulation, pre-drywall
  - Post-insulation, pre-drywall
  - Final Inspection
- Learn the details and understand each inspection item
- See images and hear discussion of how to properly comply with energy code inspection items
- Value that if all items are properly addressed, the home should perform in an efficient manner

Design Approach for a High-Performance Home

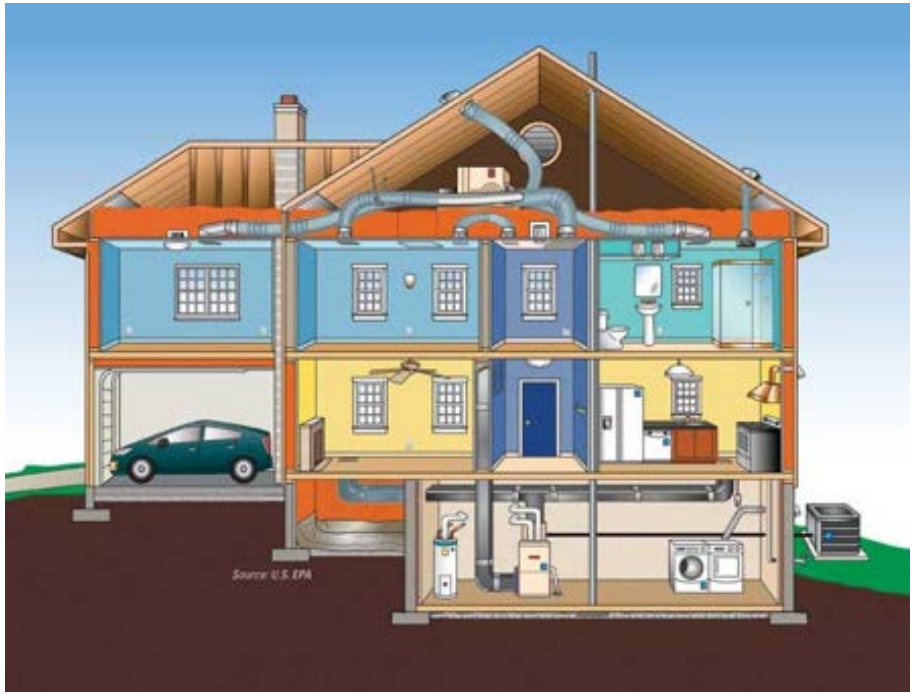
- **Building Science as guide**
  Understand physics of heat air and moisture flow
- **High Performance Enclosure**
  Sound structure, shell is tight, well-insulated and resilient
- **Air Distribution**
  Sealed & insulated ducts – located inside building envelope, intentional fresh air delivery
- **Reduced Equipment & Loads**
  Efficient Heating, Cooling, Hot Water, Lights, Appliances

The Key: It's not necessarily the stuff in the building — it's how it's all put together! (The house is a system)

Role of Building Science

A house is a system made up of interrelated parts:

- The *building thermal envelope**
- Systems
  - Heat and air conditioning
  - Ventilation
  - Water heating and distribution
- Lighting & appliances



IECC Definition:

**The basement walls, exterior walls, floor, roof and any other building elements that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.*

Part 2

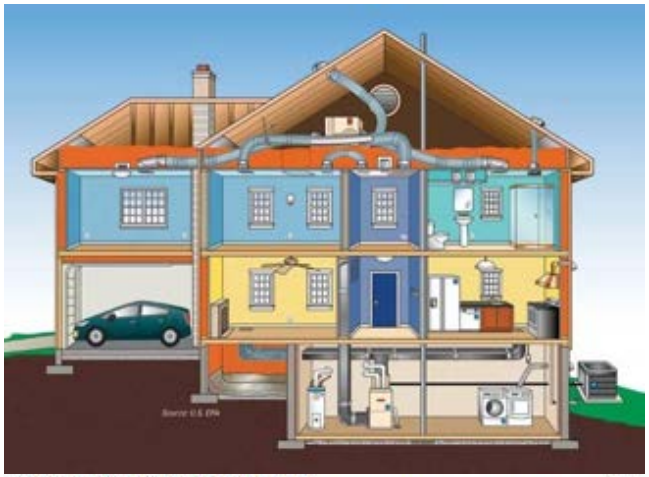
Energy Code: Residential Building

Applies to:

- New construction
- 1 and 2 family (R3)
- Multi-family, 3 stories and less (R2 and R4) – IECC 2009
- Additions, Alterations, Repairs

Exempt Buildings

- No conditioning
- Historical

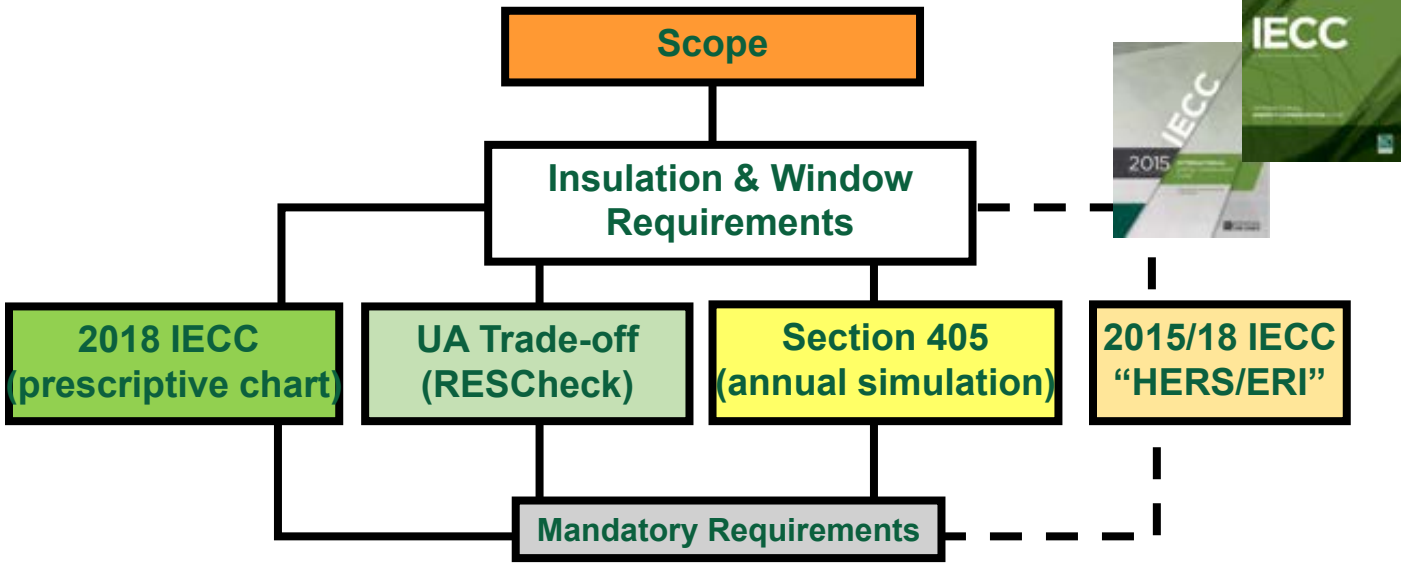


CONDITIONED SPACE. For energy purposes, space within a building that is provided with heating and/or cooling *equipment* or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) during the heating season and 85°F (29°C) during the cooling season, or communicates directly with a *conditioned space*. For mechanical purposes, an area, room or space being heated or cooled by any *equipment* or *appliance*.

Scope of Residential Energy Code

- Focus is on building envelope
  - Ceilings, walls, windows, floors, foundations
  - Sets insulation levels, window U-factors and SHGC
  - Infiltration control
    - Caulk and seal to prevent air leaks
    - Verify envelope tightness with blower door test (or visual inspection for 2009 code)
- Ducts
  - No building cavities as ducts (post-2009)
  - Seal properly and insulate
    even if all ductwork is in conditioned space
  - Verify tight with duct pressurization test
- Lighting equipment
  - High-efficacy bulbs required (50%, 75%, 90%)
- HVAC equipment efficiencies covered by different DOE standard
- No appliance requirements

Compliance Paths



- The new Energy Rating Index (ERI) path gives the most design flexibility (e.g., credit for mechanical equipment efficiency).
- It also credits items not covered by the code (e.g., appliance efficiencies).

Prescriptive R-values
2015 IECC vs. 2018 IECC

- One prescriptive "answer" for how to build per climate zone (CZ: 4 and 5)

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, 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
2015										
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
2018										
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49 R-38	20 or 13+5[h]	8/13	19	10 /13 R-0	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19

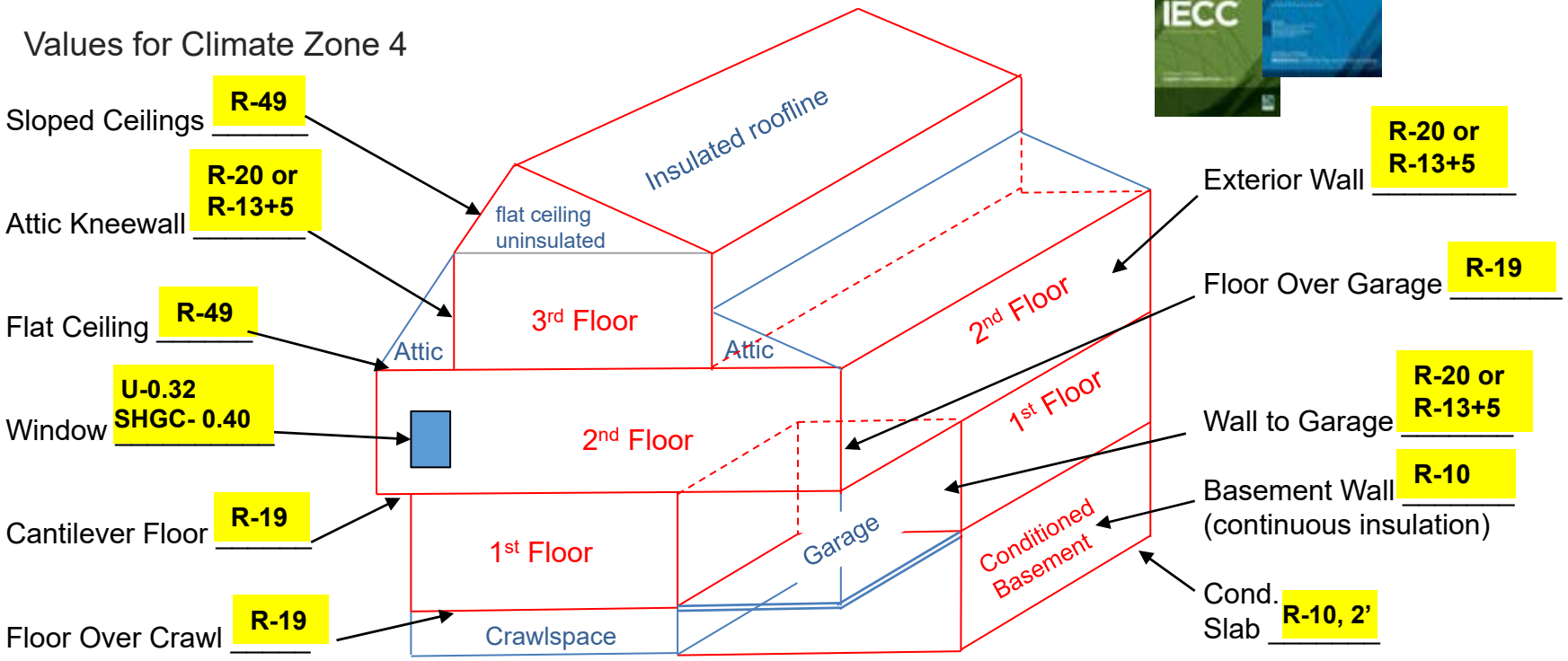
402.1.4 is similar table for U-factors

IECC Code Differences – ‘15 to ’18

- Window Ufactors dropped slightly from U35 to U32 & U30 (CZ’s 4-5)
- Exception for log homes built according to ICC 400
- ERV/HRV ducts exempt from leakage testing (if independently ducted).
- Ducts allowed to be buried in ceiling insulation
  - Ducts R-8
  - Minimum surrounding insulation R-19 (R-13 for CZ1-3A, ducts >3’)
  - Effective R-25 when modeling
- Ducts in conditioned space
  - Completely inside thermal envelope
  - Buried ducts with AHU inside envelope plus < 1.5% Total Leakage plus threshold of ceiling insulation
- 90% Efficient Lighting (LED’s)
- ERI relaxed targets
  - (62 for CZ4, 61 for CZ5, backstop penalty for renewables)

2018 IECC/IRC Prescriptive Code R-Values

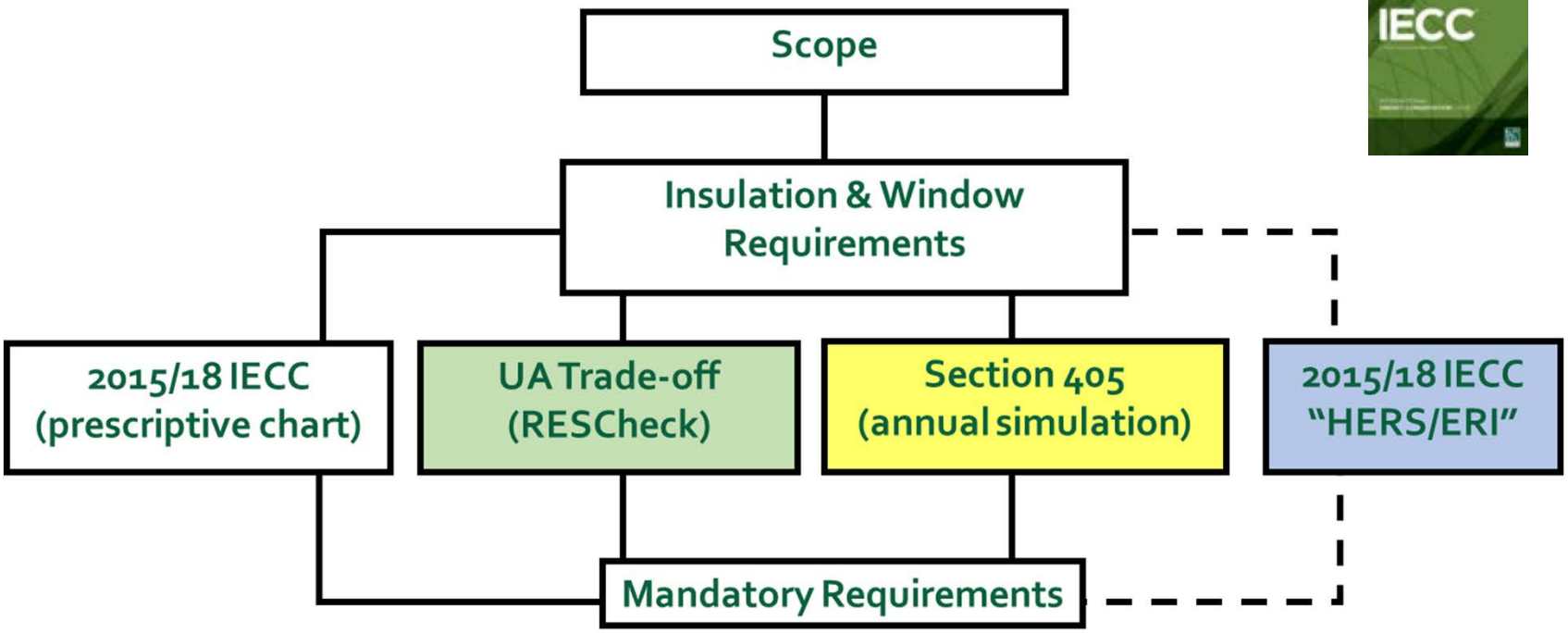
Values for Climate Zone 4



Section 402.2: Insulation Requirements

- Details for insulating various aspects of the building envelope:
  - **Ceilings with Attic – 402.2.1**
  - **Ceilings w/out Attic – 402.2.2**
  - **Eave baffles – 402.2.3**
  - **Access hatches and doors– 402.2.4**
  - Mass Walls – 402.2.5
  - Steel Framing – 402.2.6
  - Partial Structural sheathed walls – 402.2.7
  - **Floors – 402.2.8**
  - **Basement Walls – 402.2.9**
  - Slab-on-grade – 402.2.10
  - **Crawlspace Walls – 402.2.11**
  - Masonry Veneer – 402.2.12
  - Sunrooms – 402.2.13

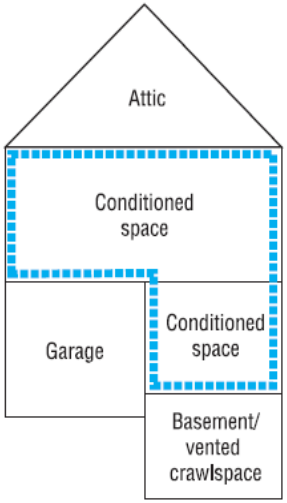
Envelope Tradeoff Options



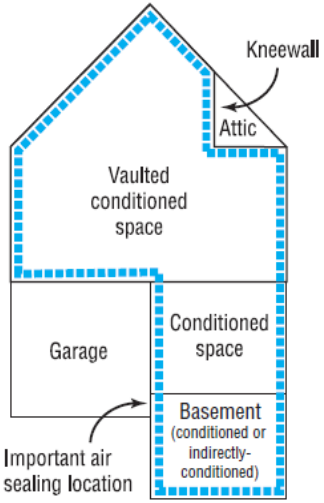
Building Thermal Envelope

- Options for defining the building thermal envelope

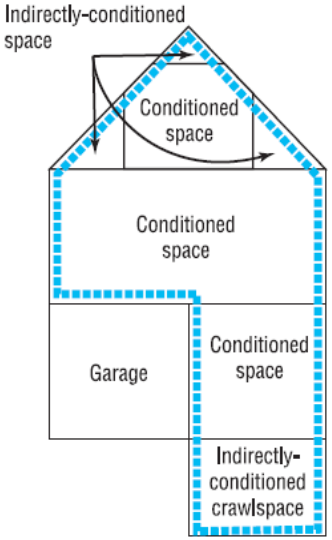
Example 1



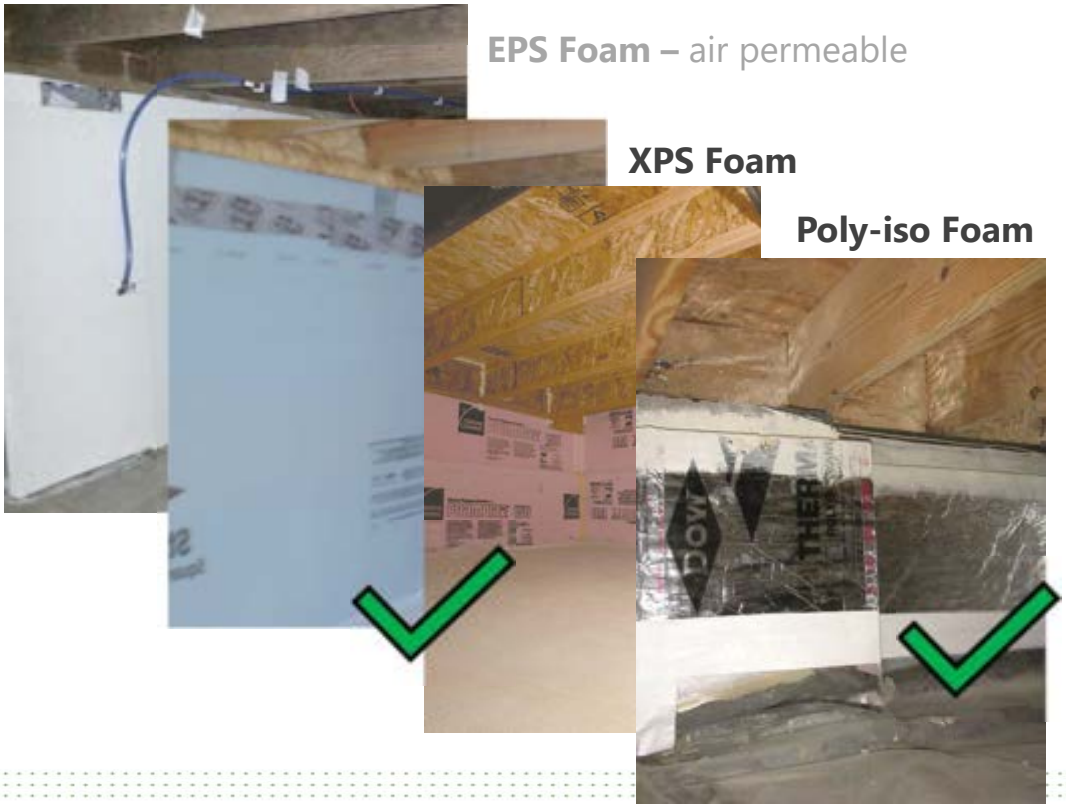
Example 2



Example 3



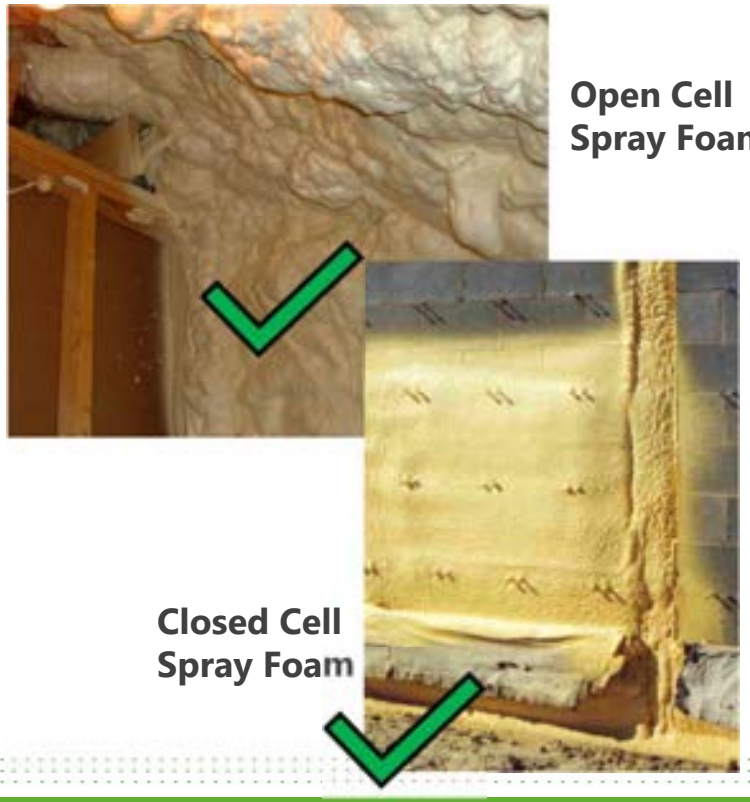
Air permeable vs. air impermeable insulation



EPS Foam – air permeable

XPS Foam

Poly-iso Foam



Open Cell Spray Foam

Closed Cell Spray Foam

St. Louis 2018 IECC Energy Code - Comprehensive Field Inspection Checklist
(Southface version 10-5-21)

Instructions/Overview
The purpose of this checklist is to assist in field Inspection primarily for air sealing and insulation details of the 2018 IECC St. Louis Energy Code. While not every detail is included, the list below contains the majority of critical inspected items. It is likely that certain items are not applicable to all houses.
Note: St Louis amended to R-38 ceilings and R-0 basements.

The checklist has been separated into three sections, corresponding to three different stages of construction. If an item does not comply and must be remedied, or if it cannot be confirmed at this stage of construction, that item should be verified at a later inspection or, at their discretion, by photographic documentation provided to the code official. An item that is not present shall be marked "N/A".

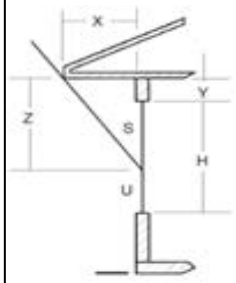
Permit
Air barrier and insulation details are located on plans (as applicable).

Pre-insulation, pre-drywall

Pre-insulation, pre-Drywall

- May coincide with framing, rough-in inspection

Yes	No	N/A	**Pre-insulation, pre-drywall list:** (Framing rough inspection)
☐	☐	☐	1. Bottom Plate sealed to slab or subfloor – gasket or sealant on inside edge
☐	☐	☐	2. Bottom Plate penetrations sealed – (electrical, plumbing knockout, etc.)
☐	☐	☐	3. Top Plate penetrations sealed – (electrical, plumbing knockout, etc.)
☐	☐	☐	4. Exterior wall sheathing seams are sealed OR completely sealed housewrap installed on exterior (housewrap edges all sealed and housewrap penetrations sealed/repaired)
☐	☐	☐	5. Cavities within headers, corners and intersecting T-walls are fully insulated
☐	☐	☐	6. Attic kneewalls have blocking installed at ceiling joist intersection
☐	☐	☐	7. Rim and band areas have air sealing performed
☐	☐	☐	8. Windows and doors sealed into rough opening (fiberglass chinking not permissible)
☐	☐	☐	9. Window spot check: U-factor and SHGC are reasonable and expected for DP low-e wood/vinyl frame. Weighted average U-factor ≤ 0.32, SHGC ≤ 0.40 (Climate Zone 4)
☐	☐	☐	10. Cantilevered Floor joists have blocking (and air sealing) installed above supporting walls
☐	☐	☐	11. Rafters have sufficient depth provided for insulation in vaulted ceilings.
☐	☐	☐	12. Chases (e.g., to attic) are capped and sealed (chase walls have interior air barrier at insulated wall)
☐	☐	☐	13. Tubs and Showers against exterior walls have insulation and sealed air barrier on interior.
☐	☐	☐	14. *Plumbing* penetrations sealed: through envelope floors (e.g., tub drains, supply lines, vent stacks), walls (e.g., kneewalls, crawlspaces, wall plates) and ceilings (e.g., chases and soffits) -Hot water piping buried in slabs is insulated to R-3
☐	☐	☐	15. *Electrical* penetrations sealed: Similar to plumbing, includes main service line entry (Best practice: locate panel box in non-insulated wall)
☐	☐	☐	16. *HVAC* penetrations sealed – Fuel lines and penetrations through chases sealed.
☐	☐	☐	17. Platforms in attics for HVAC & appliances are elevated for sufficient depth of insulation
☐	☐	☐	18. Fireplace inserts – -Sheathing in chase is sealed (or exterior housewrap sealed) before insulation installed -Insulation coverage is complete (walls, top and bottom) and aligns with air barrier -Fire-rated caulk sealed at flue to cap transition (and flue includes damper) -Outside/combustion air duct installed and sealed (and includes shut off damper) -Fuel gas penetrations are sealed. (Best practice: fully air-seal and insulate before setting insert)

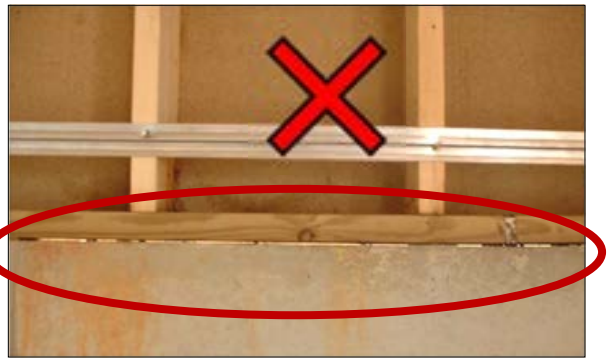


Pre-insulation, pre-Drywall

1. Bottom plate sealed to slab or subfloor

Yes No N/A

1. Bottom Plate sealed to slab or subfloor – gasket or sealant on inside edge

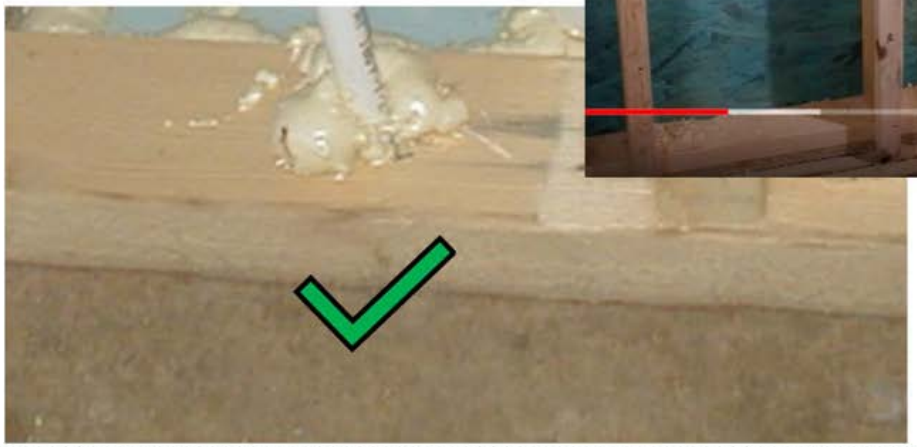


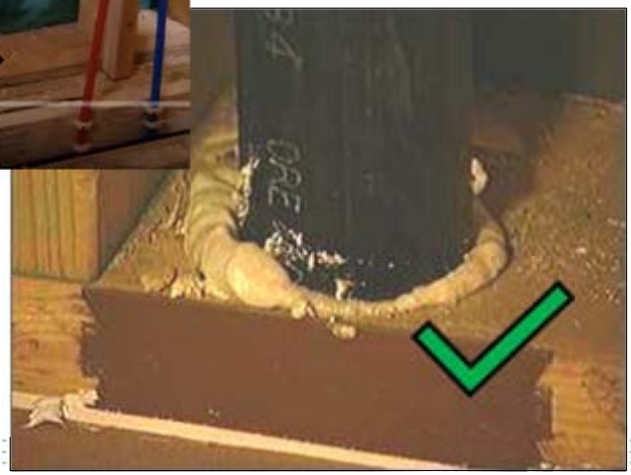
Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 2. Bottom Plate penetrations sealed – (electrical, plumbing knockout, etc.)

2. Bottom plate penetrations sealed



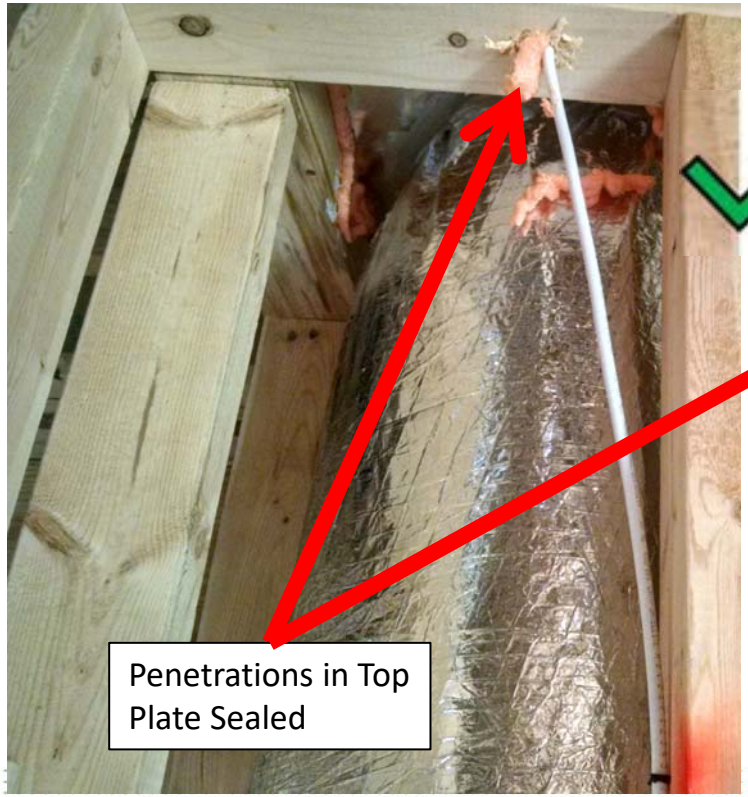


Pre-insulation, pre-Drywall

3. Top plate penetrations sealed

Yes No N/A

☐☐☐ 3. Top Plate penetrations sealed – (electrical, plumbing knockout, etc.)



Pre-insulation, pre-Drywall

Ameren MISSOURI

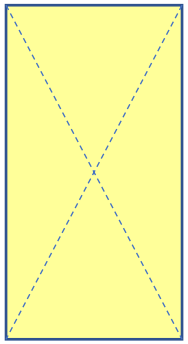
Yes No N/A

☐☐☐ 4. Exterior wall sheathing seams are sealed OR completely sealed housewrap installed on exterior (housewrap edges all sealed and housewrap penetrations sealed/repaired)

4. Exterior Wall Sheathing seams are sealed OR completely sealed housewrap installed on exterior

Pre-insulation, pre-Drywall

4. Sealed housewrap installed on exterior



Yes No N/A

☐☐☐ 4. Exterior wall sheathing seams are sealed OR completely sealed housewrap installed on exterior (housewrap edges all sealed and housewrap penetrations sealed/repaired)

Top Sash after trim removed

Rotten Header

Windows (incorrectly) have flange over housewrap

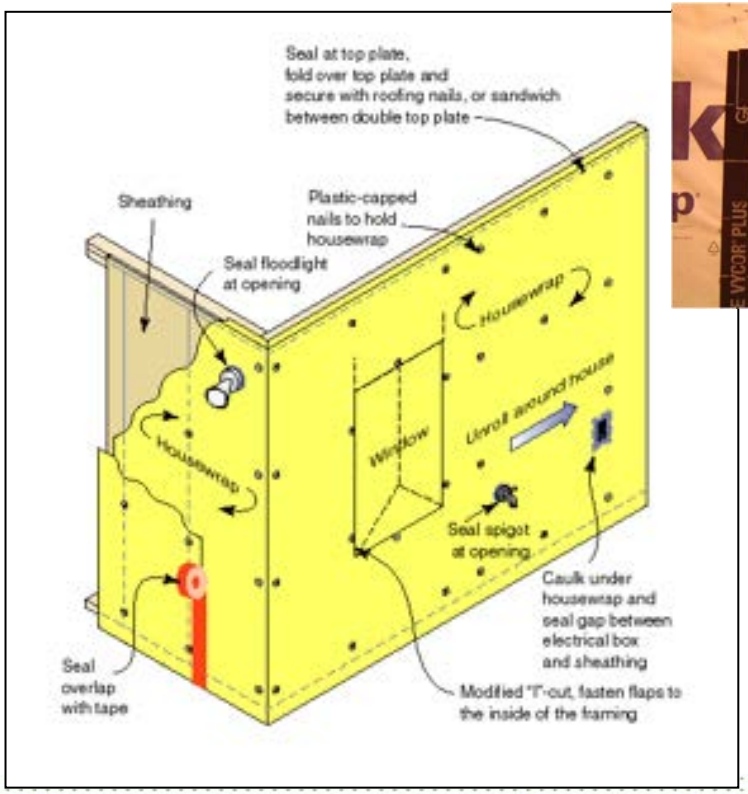
See WRB factsheet for more details

"The bitterness of poor quality remains long after the sweetness of low price is forgotten" -Benjamin Franklin

Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 4. Exterior wall sheathing seams are sealed OR completely sealed housewrap installed on exterior (housewrap edges all sealed and housewrap penetrations sealed/repaired)



Technology Fact Sheet

WEATHER-RESISTIVE BARRIERS

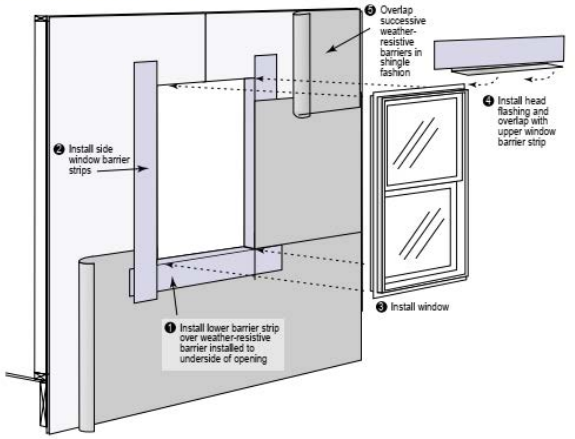
How to select and install housewrap and other types of weather-resistive barriers

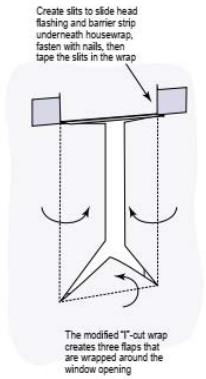
INTRODUCTION

Weather-resistive barriers are a part of exterior

WHEN AND HOW TO USE WEATHER-RESISTIVE BARRIERS

FLASHING WINDOW OPENINGS



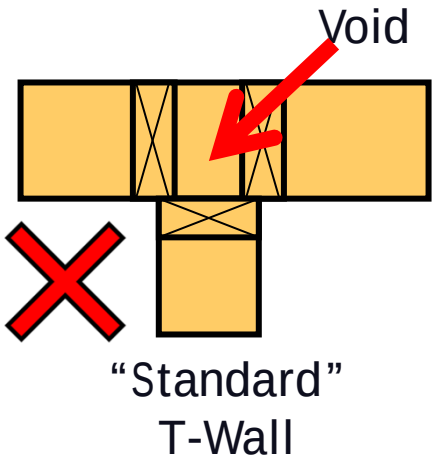


Pre-insulation, pre-Drywall

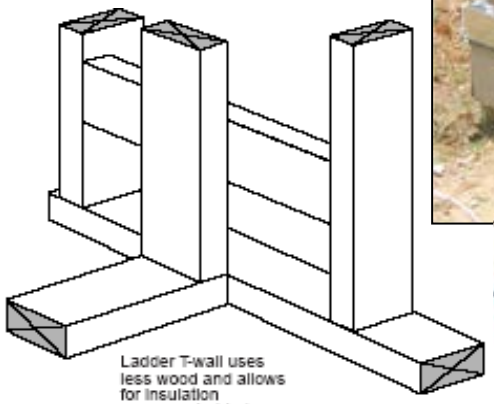
Yes No N/A

☐☐☐ 5. Cavities within headers, corners and intersecting T-walls are fully insulated

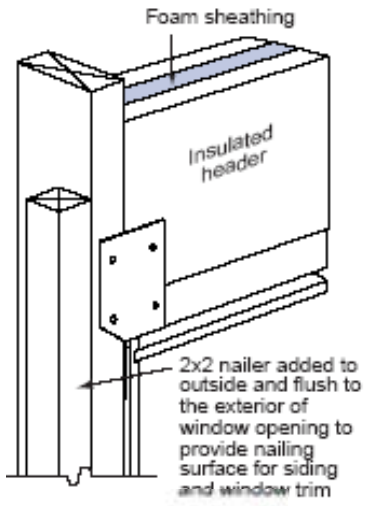
5. Cavities within headers, corners & intersecting T-walls are fully insulated



"Standard" T-Wall



Ladder T-wall uses less wood and allows for insulation coverage behind partition walls



Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 5. Cavities within headers, corners and intersecting T-walls are fully insulated

5. Cavities within headers, corners & intersecting T-walls are fully insulated

"Standard" 3-Stud Corner

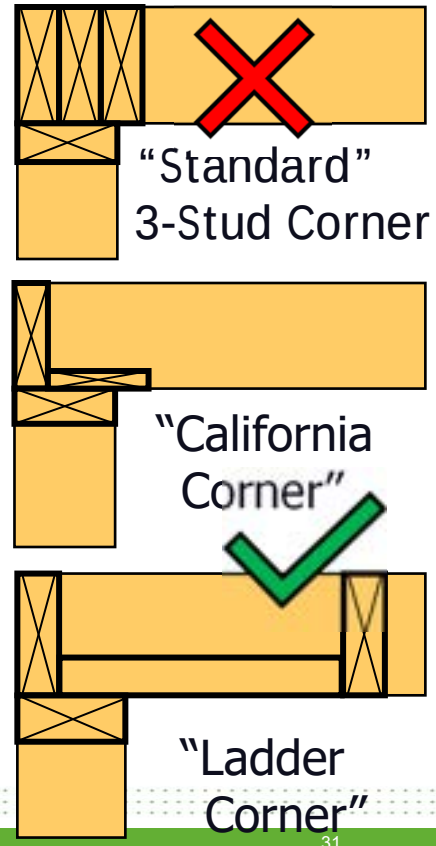
Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 5. Cavities within headers, corners and intersecting T-walls are fully insulated

5. Cavities within headers, corners & intersecting T-walls are fully insulated

Energy Corner

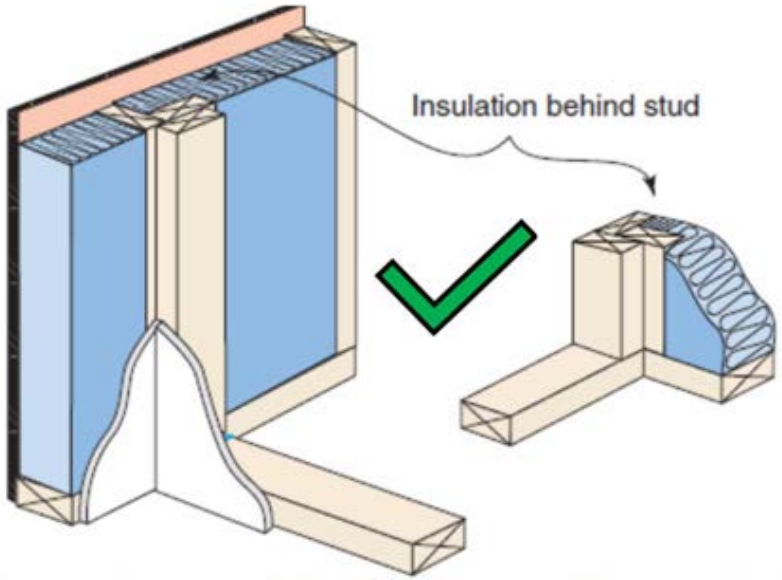


Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 5. Cavities within headers, corners and intersecting T-walls are fully insulated

5. Cavities within headers, corners & intersecting T-walls are fully insulated

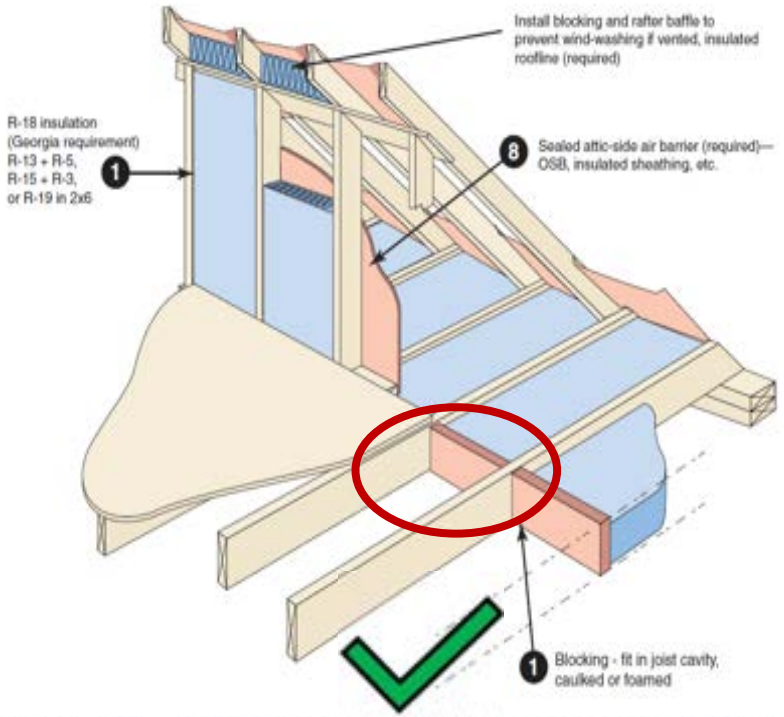


Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 6. Attic kneewalls have blocking installed at ceiling joist intersection

6. Attic kneewalls have blocking installed at ceiling joist intersection



ATTIC KNEEWALL – PICS SHOWS NEED FOR BLOCKING & SHEATHING

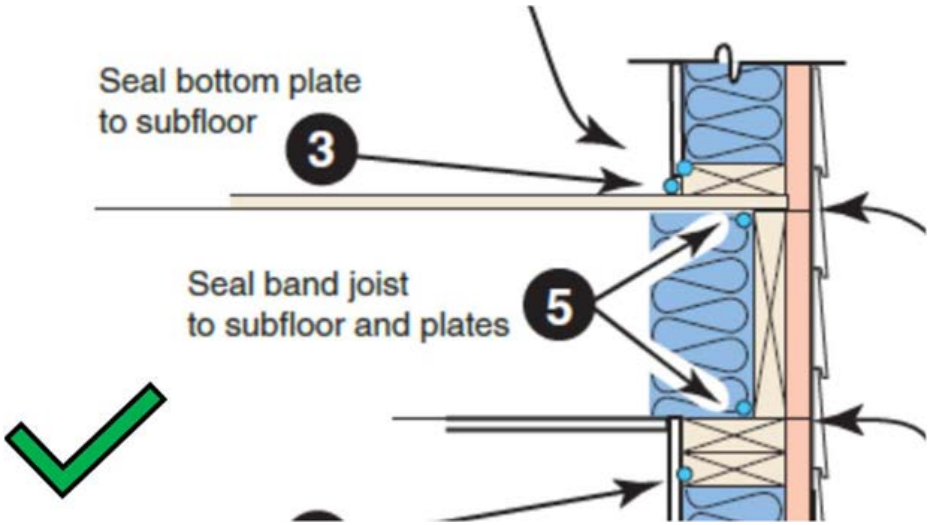
PROPER BLOCKING UNDER ATTIC KNEEWALLS

Pre-insulation, pre-Drywall

7. Rim and band joist areas are air sealed

Yes No N/A

☐☐☐ 7. Rim and band areas have air sealing performed

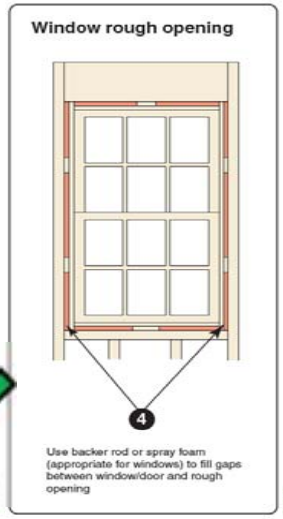


Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 8. Windows and doors sealed into rough opening (fiberglass chinking not permissible)

8. Windows and doors sealed into rough opening (no fiberglass chinking)



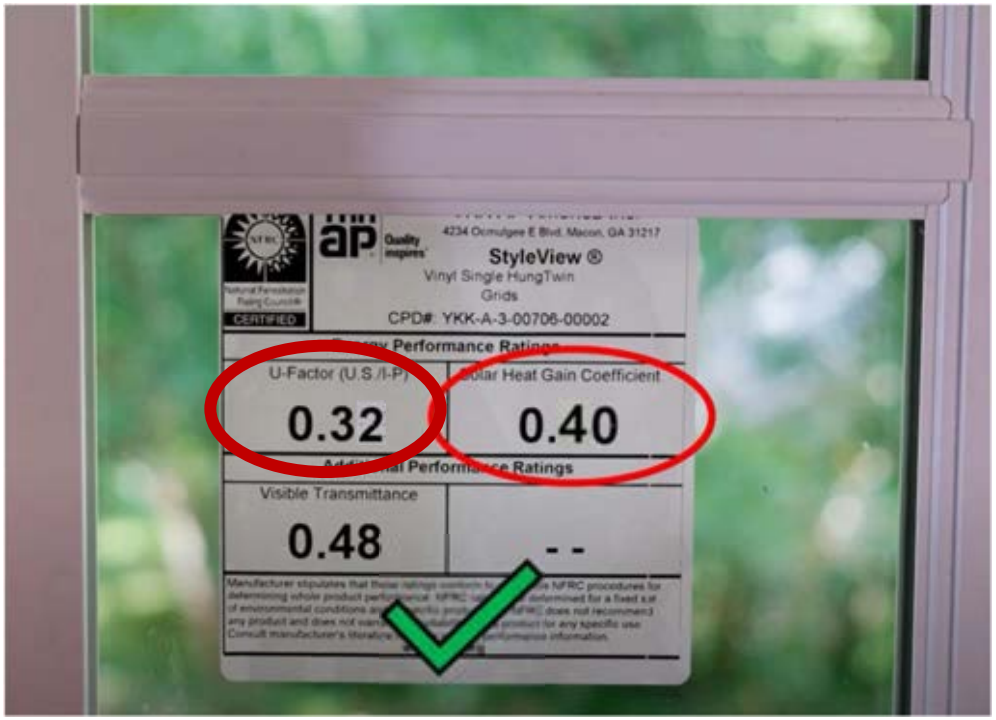
Seal rough openings with caulk, backer rod or special foam

Pre-insulation, pre-Drywall

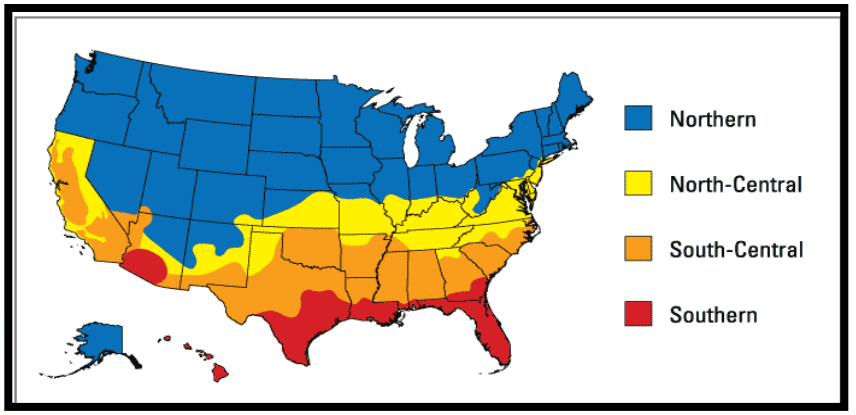
9. Windows spot check on U-factor & SHGC (U≤0.32, SHGC ≤ 0.40)

Yes No N/A

☐☐☐ 9. Window spot check: U-factor and SHGC are reasonable and expected for DP low-e wood/vinyl frame. Weighted average U-factor < 0.32, SHGC < 0.40 (Climate Zone 4)



ENERGY STAR Windows



Climate Zone	U-Factor[1]	SHGC[2]	
Northern*	≤ 0.27	Any	Prescriptive
	= 0.28	≥ 0.32	Equivalent Energy Performance
	= 0.29	≥ 0.37	
	= 0.30	≥ 0.42	
North-Central	≤ 0.30	≤ 0.40	
South-Central	≤ 0.30	≤ 0.25	
Southern	≤ 0.40	≤ 0.25	

Skylights

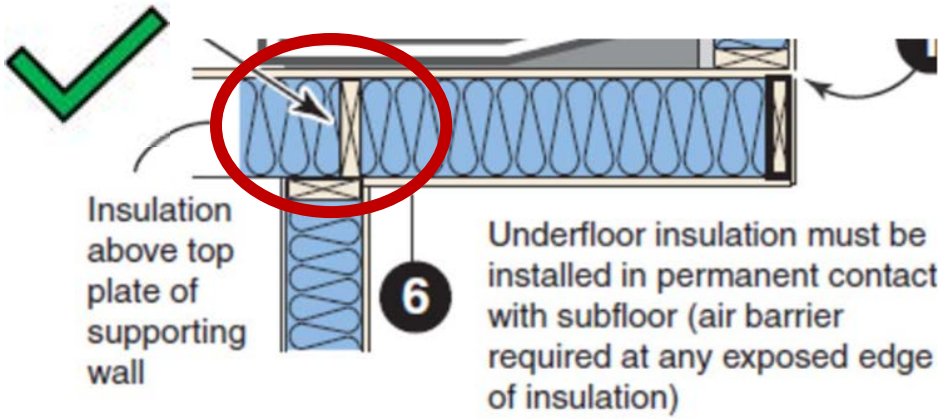
Climate Zone	U-Factor[1]	SHGC[2]
Northern	≤ 0.50	Any
North-Central	≤ 0.53	≤ 0.35
South-Central	≤ 0.53	≤ 0.28
Southern	≤ 0.60	≤ 0.28

Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 10. Cantilevered Floor joists have blocking (and air sealing) installed above supporting walls

10. Cantilevered floor joists have sealed blocking at junction with supporting wall

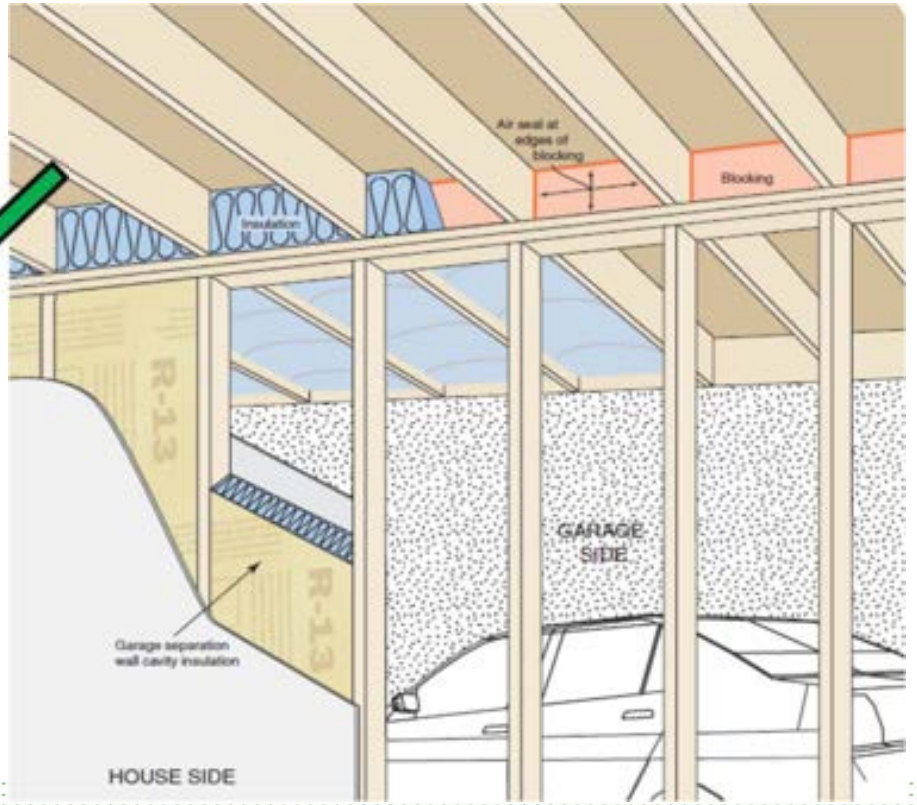


Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 10. Cantilevered Floor joists have blocking (and air sealing) installed above supporting walls

10. Cantilevered floor joists have sealed blocking at junction with supporting wall



Pre-insulation, pre-Drywall

Yes No N/A

10. Cantilevered Floor joists have blocking (and air sealing) installed above supporting walls

10. Cantilevered floor joists have sealed blocking at junction with supporting wall

Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 10. Cantilevered Floor joists have blocking (and air sealing) installed above supporting walls

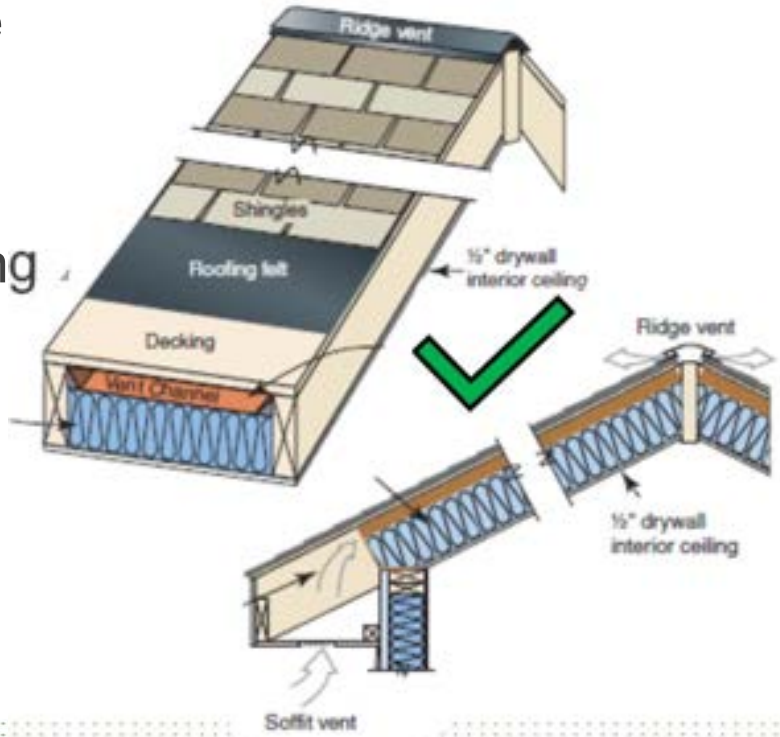
10. Cantilevered floor joists have sealed blocking at junction with supporting wall

Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 11. Rafters have sufficient depth provided for insulation in vaulted ceilings

11. Rafters have sufficient insulation depth for vaulted ceiling



Pre-insulation, pre-Drywall

12. Chases are capped and sealed

Yes No N/A

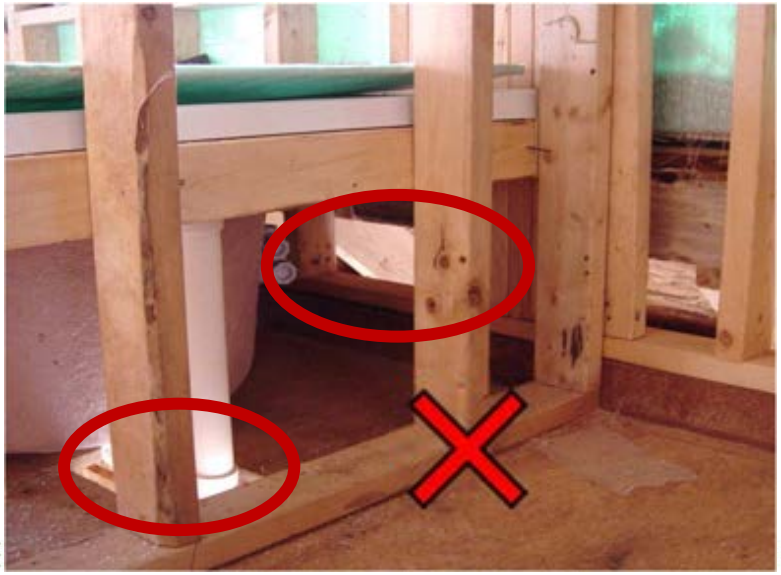
☐☐☐ 12. Chases (e.g., to attic) are capped and sealed
(chase walls have interior air barrier at insulated wall)

Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 13. Tubs and Showers against exterior walls have insulation and sealed air barrier on interior

13. Tubs & Showers against thermal envelope walls have insulation and sealed air barrier on interior side



Pre-insulation, pre-Drywall

13. Tubs & Showers against thermal envelope walls have insulation and sealed air barrier on interior side

Yes No N/A

☐☐☐ 13. Tubs and Showers against exterior walls have insulation and sealed air barrier on interior

Pre-insulation, pre-Drywall

14. Plumbing penetrations; R-3 hot water piping (in slabs, etc.)

Yes No N/A

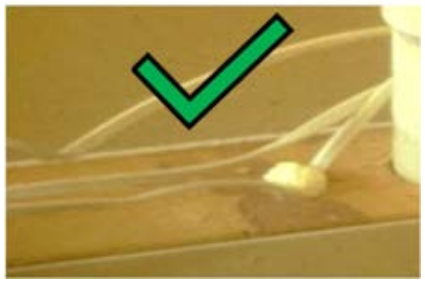
☐☐☐ 14. *Plumbing* penetrations sealed: through envelope floors (e.g., tub drains, supply lines, vent stacks), walls (e.g., kneewalls, crawlspaces, wall plates) and ceilings (e.g., chases and soffits)
-Hot water piping buried in slabs is insulated to R-3

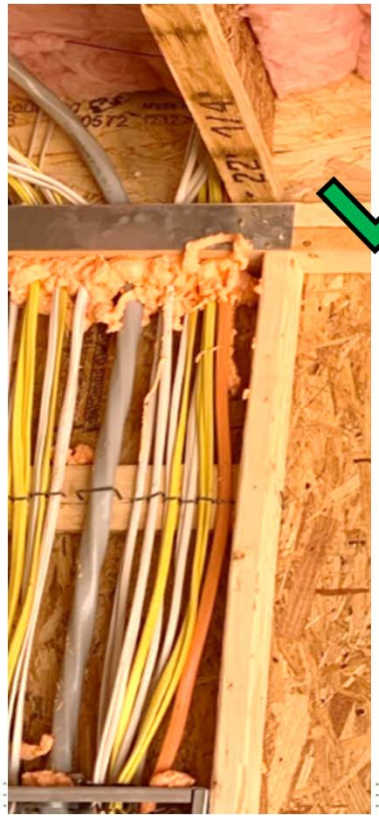
Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 15. *Electrical* penetrations sealed: Similar to plumbing, includes main service line entry (Best practice: locate panel box in non-insulated wall)

15. Electrical penetrations





Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 16. *HVAC* penetrations sealed – Fuel lines and penetrations through chases sealed

16. HVAC penetrations

Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 16. *HVAC* penetrations sealed – Fuel lines and penetrations through chases sealed

16. HVAC penetrations

Pre-insulation, pre-Drywall

Yes No N/A

☐☐☐ 17. Platforms in attics for HVAC & appliances are elevated for sufficient depth of insulation

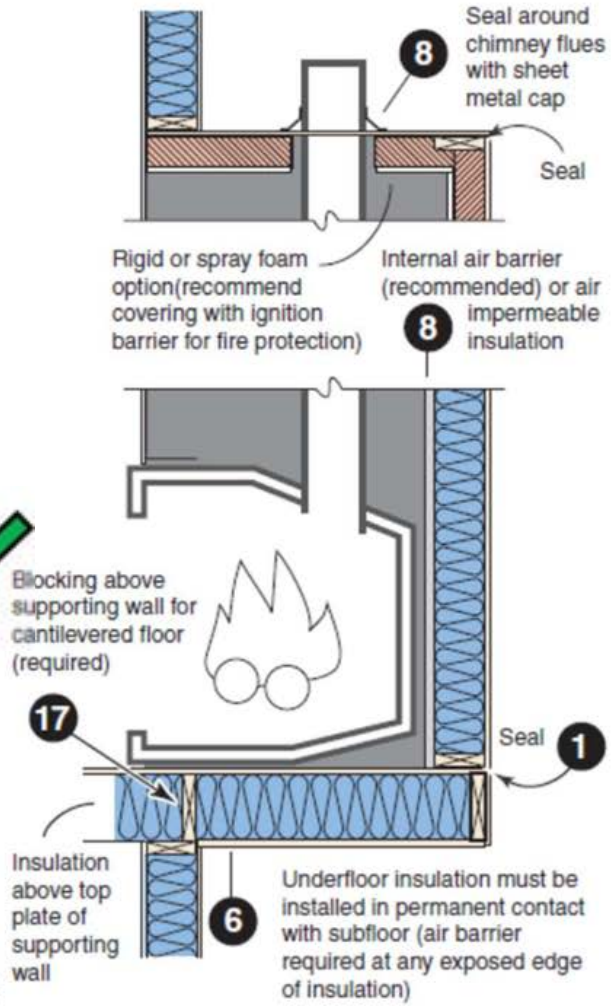
17. Platforms in attics elevated to allow room for insulation

Pre-insulation, pre-Drywall

18. Fireplaces

Yes No N/A

☐☐☐ 18. Fireplace inserts –
-Sheathing in chase is sealed (or exterior housewrap sealed) before insulation installed
-Insulation coverage is complete (walls, top and bottom) and aligns with air barrier
-Fire-rated caulk sealed at flue to cap transition (and flue includes damper)
-Outside/combustion air duct installed and sealed (and includes shut off damper)
-Fuel gas penetrations are sealed.
(Best practice: fully air-seal and insulate before setting insert)



Pre-insulation, pre-Drywall

18. Fireplaces

Yes No N/A

☐☐☐

18. Fireplace inserts –
-Sheathing in chase is sealed (or exterior housewrap sealed) before insulation installed
-Insulation coverage is complete (walls, top and bottom) and aligns with air barrier
-Fire-rated caulk sealed at flue to cap transition (and flue includes damper)
-Outside/combustion air duct installed and sealed (and includes shut off damper)
-Fuel gas penetrations are sealed.
(Best practice: fully air-seal and insulate before setting insert)

Pre-insulation, pre-Drywall

18. Fireplaces

Yes	No	N/A
☐	☐	☐

18. Fireplace inserts –
-Sheathing in chase is sealed (or exterior housewrap sealed) before insulation installed
-Insulation coverage is complete (walls, top and bottom) and aligns with air barrier
-Fire-rated caulk sealed at flue to cap transition (and flue includes damper)
-Outside/combustion air duct installed and sealed (and includes shut off damper)
-Fuel gas penetrations are sealed.
(Best practice: fully air-seal and insulate before setting insert)