

ENERGY CODE COMPLIANCE: FROM ADOPTION TO IMPLEMENTATION

2019 ICAA CONFERENCE, PHOENIX AZ
10.09.2019

Southface

3:00 – 4:00 pm

Energy Code Compliance: From Adoption to Implementation

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Southface Energy Institute



Want to learn the latest updates to energy codes? Get a front seat to changes from previous editions of the IECC and ASHRAE 90.1 and how this can impact your business. Together, we will get into the nitty gritty of the codes in a way that is both detailed and understandable. At this session, you'll get the opportunity to understand permissible compliance paths in the codes.

Whether you're asking when the 2018 IECC is coming to your neighborhood, what was learned about insulation from the recent energy code compliance assessment, what HERS raters found in their insulation inspections, or anything else related to compliance such as why installers have to install a certain way, you're sure to benefit from this engaging session.

BPI CEU credits earned with this session!



CONTINUING
EDUCATION

1

About Southface



www.southface.org

<https://vimeo.com/169382048/c973625071>



2

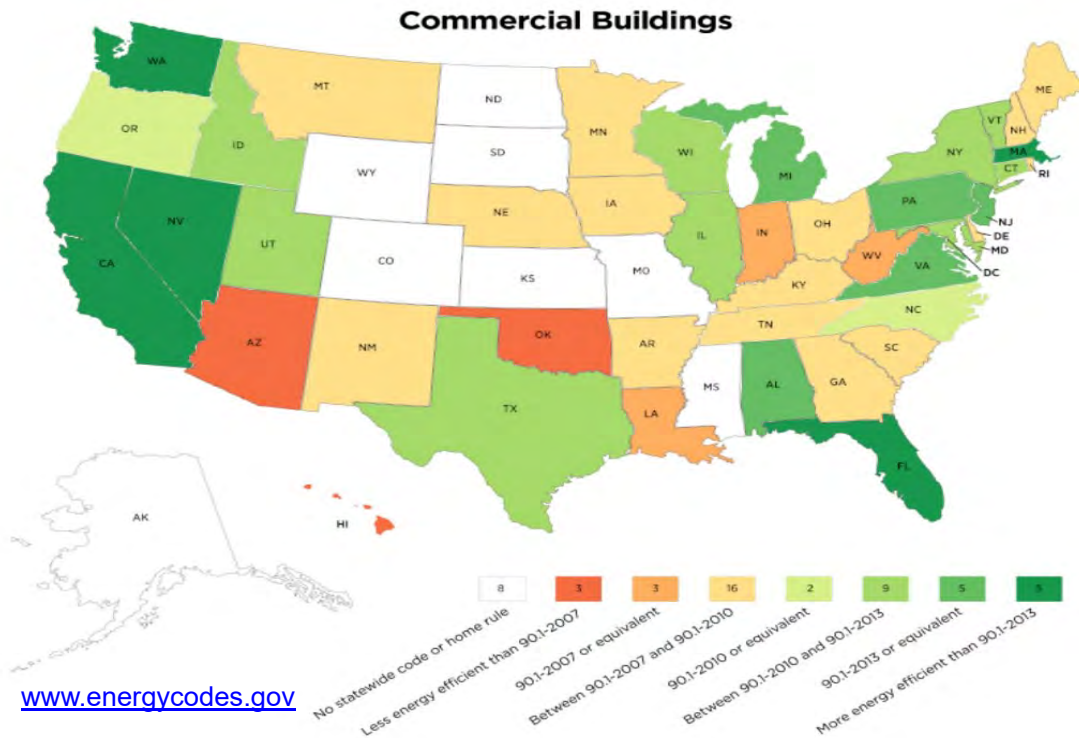
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LEARNING OBJECTIVES

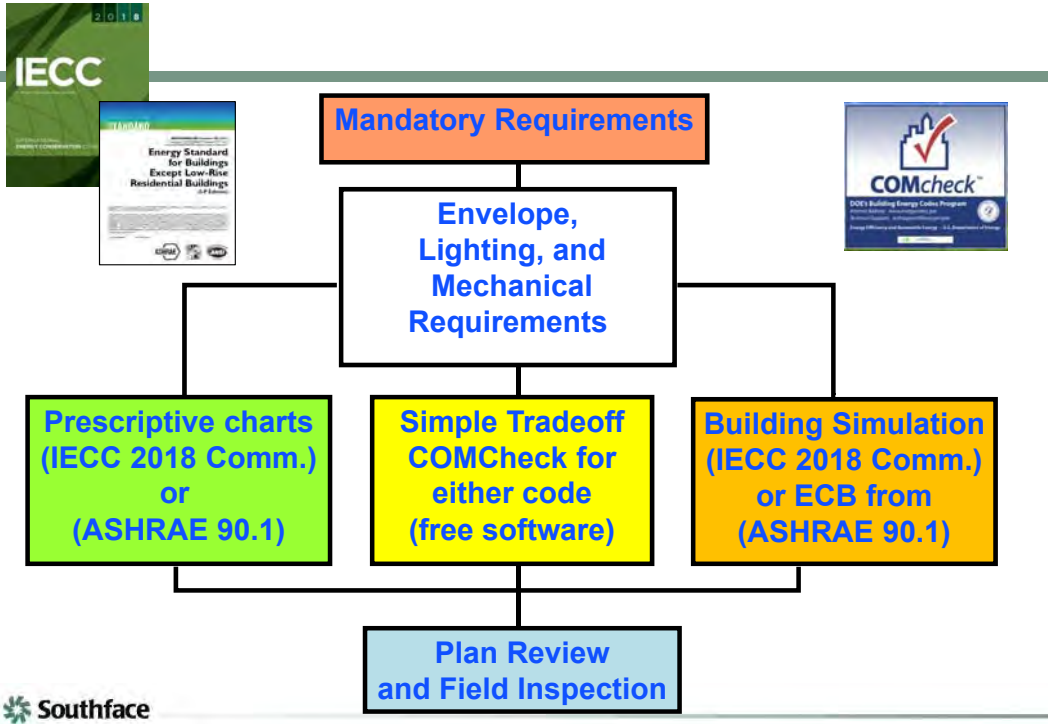
- Review latest 2018 IECC codes + ASHRAE 90.1, chap 3 vague
- Comprehend the Building Thermal Envelope
 - Understand energy code air barrier & insulation requirements
- Review RESNET grade I, reference ANSI 380
 - Learn the details of properly installed insulation – Grade I
 - Unfaced vs faced, side vs edge stapled
- Review Field Study results
 - Insulation Inspections are poor (tick the box)
- Case Study: What we did in GA:
 - Wrote a simple spec,
 - Created graphics in code appendix,
 - Inexpensive Pre-drywall inspection video,
 - Residential Field Guide – pictorial User’s Guide
- Three Take-aways:
 1. Videos that are custom, consider doing this - individual business, state or jurisdiction
 2. Industry - Create your own definition of good (RESNET is too complicated)
 3. Installers - Offer the whole airsealing + insulation package... (flash and batt/glass)



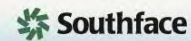
CURRENT COMMERCIAL ENERGY CODES



COMMERCIAL COMPLIANCE PATHWAYS



2018 IECC - Section C402.1



2018 INTERNATIONAL ENERGY CONSERVATION CODE®

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^a

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci
Metal buildings ^b	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, above grade																
Mass ^c	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20
Walls, below grade																
Below-grade wall ^d	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci
Floors																
Mass ^e	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-11.5ci	R-11.5ci	R-12.5ci	R-12.5ci	R-12.5ci	R-12.5ci	R-12.5ci
Joist framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30
Slab-on-grade floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below
Heated slabs ^f	R-7.5 for 12" below + R-5 full slab	R-7.5 for 12" below + R-5 full slab	R-7.5 for 12" below + R-5 full slab	R-7.5 for 12" below + R-5 full slab	R-10 for 24" below + R-5 full slab	R-10 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab
Opaque doors																
Nonswinging	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in 7.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches c/c with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h²-ft²-°F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. "Mass floors" shall be in accordance with Section C402.2.3.

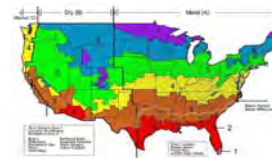
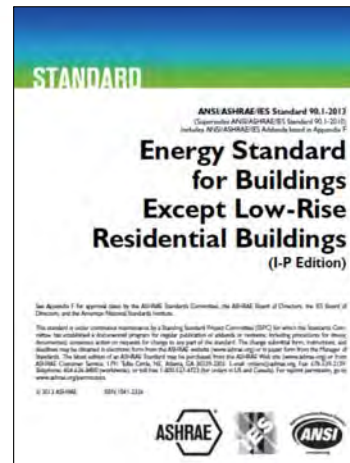
f. Steel floor joist systems shall be installed to R-33.



Table 5.5-3 Building Envelope Requirements for Climate Zone 3 (A,B,C)*

Opaque Elements	Nonresidential		Residential		Residential	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.039	R-25 c.i.	U-0.039	R-25 c.i.	U-0.119	R-7.6 c.i.
Metal Building ^a	U-0.041	R-10 + R-19 FC ^b	U-0.041	R-10 + R-19 FC ^b	U-0.096	R-16
Attic and Other	U-0.027	R-38	U-0.027	R-38	U-0.053	R-19
Walls, above Grade						
Mass	U-0.123	R-7.6 c.i.	U-0.104	R-9.5 c.i.	U-0.580	NR
Metal Building	U-0.094	R-0 + R-9.8 c.i.	U-0.072	R-0 + R-13 c.i.	U-0.162	R-13
Steel Framed	U-0.077	R-13 + R-5 c.i.	U-0.064	R-13 + R-7.5 c.i.	U-0.124	R-13
Wood Framed and Other	U-0.089	R-13	U-0.064	R-13 + R-3.8 c.i. or R-20	U-0.089	R-13
Wall, Below Grade						
Below Grade Wall	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.074	R-10 c.i.	U-0.074	R-10 c.i.	U-0.137	R-4.2 c.i.
Steel Joist	U-0.038	R-30	U-0.038	R-30	U-0.052	R-19
Wood Framed and Other	U-0.033	R-30	U-0.033	R-30	U-0.051	R-19
Sub-slab Floors						
Unheated	F-0.730	NR	F-0.540	R-10 for 24 in.	F-0.730	NR
Heated	F-0.860	R-15 for 24 in.	F-0.860	R-15 for 24 in.	F-1.020	R-7.5 for 12 in.
Opaque Doors						
Swinging	U-0.700		U-0.500		U-0.700	
Nonswinging	U-0.500		U-0.500		U-1.450	
 fenestration						
	Assembly Max. U	Assembly Min. SHGC	Assembly Min. VTSHGC	Assembly Max. U	Assembly Min. SHGC	Assembly Min. VTSHGC
Vertical Fenestration, 0% - 40% of Wall	(For all frame types)		(For all frame types)		(For all frame types)	
Nonmetal framing, all	U-0.35		U-0.35		U-0.87	
Metal framing, fixed	U-0.50		U-0.50		U-1.20	
Metal framing, operable	U-0.60	SHGC-0.25	1.10	SHGC-0.25	1.10	NR
Metal framing, entrance door	U-0.77		U-0.68		U-0.77	
Skylight, 0% - 7% of Roof						
All types	U-0.35	SHGC-0.35	NR	U-0.35	SHGC-0.35	NR

* The following definitions apply: c.i. = continuous insulation (see Section 5.5.2); FC = field cavity (see Section A2.3.2.2); L = linear system (see Section A2.3.2.4); NR = no (insulation) requirement.
^a When using the R-value compliance method for metal building roofs, a thermal spacer block is required (see Section A2.3.2.2).

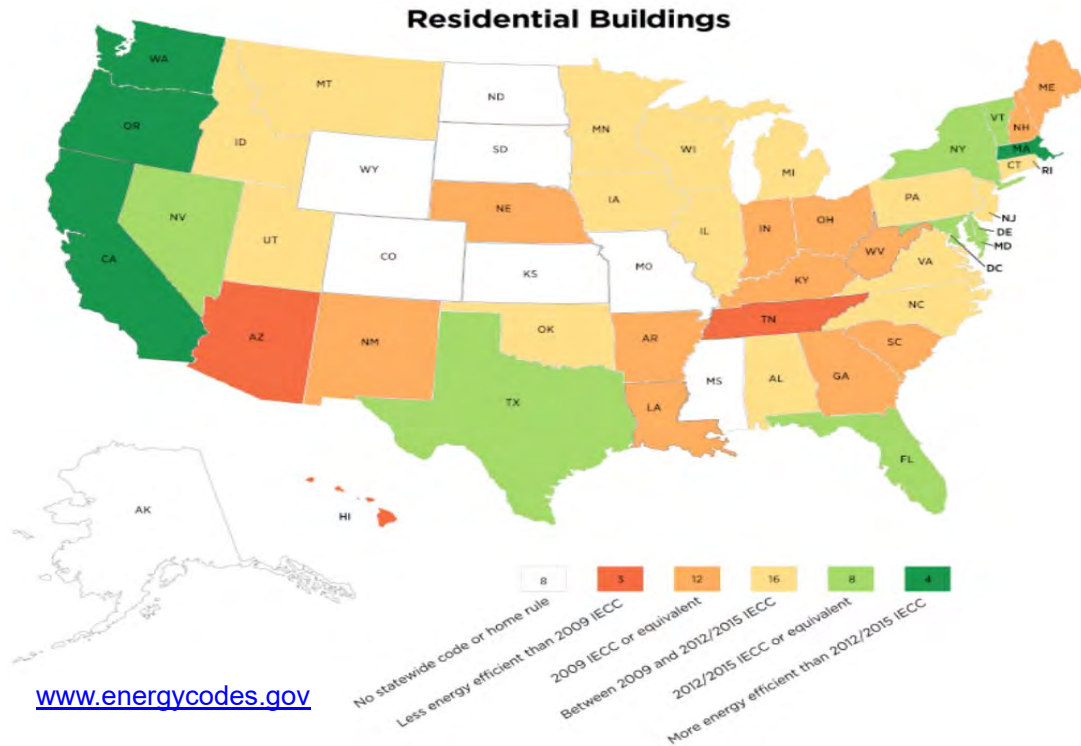


SCOPE OF RESIDENTIAL ENERGY CODE

- 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 tight envelope with blower door (or visual inspection)
- Ducts
 - No building cavities as ducts
 - Seal and insulate
 - Verify tight with duct pressurization test
- Lighting equipment
 - high-efficacy lamps required
- 3 alternatives to prescriptive compliance



CURRENT RESIDENTIAL ENERGY CODES



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RESIDENTIAL BUILDINGS

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

Exempt Buildings

- No conditioning
- Historical

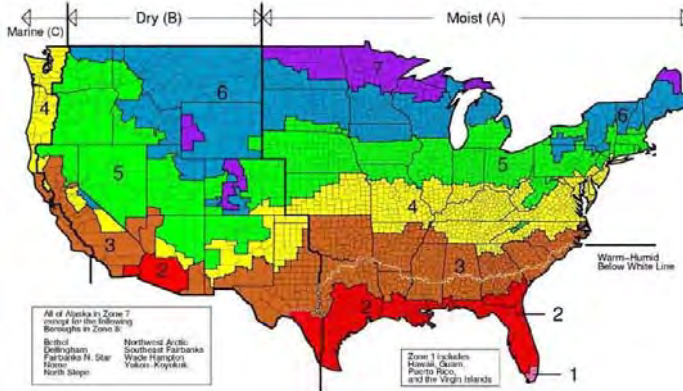


CONDITIONED SPACE. For energy purposes, space within a building that is provided with heating and/or cooling *equipment* or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) during the heating season and 85°F (29°C) during the cooling season, or communicates directly with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

2009 IECC- Section 402.1

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, c}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ^e	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^e WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65 ^j	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50 ^j	0.65	0.30	30	13	5/8	19	5/13 ^f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5 ^h	13/17	30 ^g	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5 ^h	15/19	30 ^g	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38 ^g	15/19	10, 4 ft	10/13

- For SI: 1 foot = 304.8 mm.
- R-values are minimums. U-factor more shall be marked with th
 - The fenestration U-factor col
 - "15/19" means R-15 continuc shall be permitted to be met wi home. "10/13" means R-10 co
 - R-5 shall be added to the req through 3 for heated slabs.
 - There are no SHGC require
 - Basement wall insulation is n
 - Or insulation sufficient to fill
 - "13+5" means R-13 cavity in required where structural shee lated sheathing of at least R-1
 - The second R-value applie v
 - For impact rated fenestration c maximum U-factor shall be 0



insulating sheathing is not supplemented with insu-

ational Building Code, the

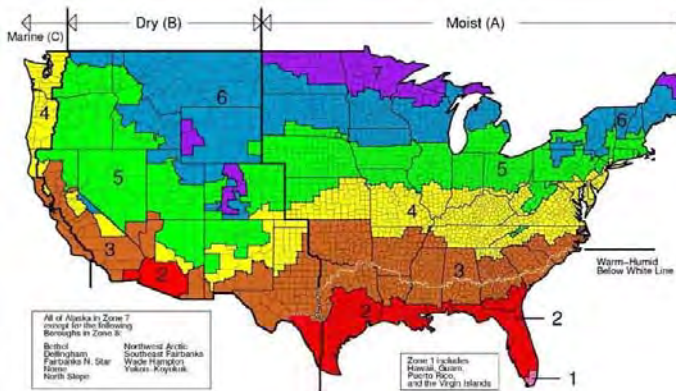
2018 IECC- Section R402.1

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT*

CLIMATE ZONE	FENESTRATION U-FACTOR ^a	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, c}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ^e	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^e 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	0.32	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	20 or 13+5 ^h	8/13	19	10/13	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
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

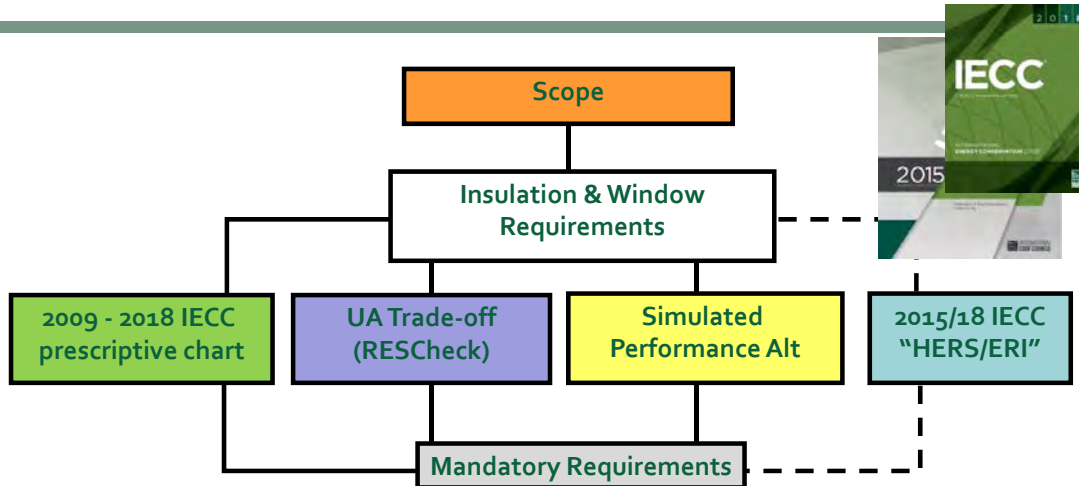
NR = Not Required.

- For SI: 1 foot = 304.8 mm.
- R-values are minimums. U insulation, the installed R-1
 - The fenestration U-factor c Exception: In Climate Zor for such skylights does not
 - "10/13" means R-10 contir "15/19" means R-15 contir compliance with "15/19" s home.
 - R-5 insulation shall be pro table. The slab edge insula
 - There are no SHGC requir
 - Basement wall insulation i
 - Alternatively, insulation su
 - The first value is cavity i continuous insulation.
 - Mass walls shall be in acco



cavity insulation plus R-5 ie interior of the mass wall.

COMPLIANCE PATHS FOR INSULATION & WINDOWS



- 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)

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GA LIMITS ON TRADEOFFS

- Home must meet mandatory requirements of R401.2 and R403.5.3
- The **building thermal envelope** shall be greater than or equal to levels of efficiency of the **GA 2011/2009 IECC**
- **Applies to all trade-off options**

Table applies to all Trade-off options:

- RESCheck
- UA Trade-off
- Simulated Perf
- Energy Rating Index (ERI)



Table R402.1.6
MINIMUM INSULATION R-VALUES FOR ENVELOPE COMPONENTS WHEN TRADE-OFFS ARE USED

Climate Zone	Wood Framed Walls ^a	Mass Wall ^{a, b}	Attic ^{a, c} Knee wall	Basement Wall ^a	Crawl Wall ^a	Floor Over Unheated Spaces	Ceilings with Attic Space	Vaulted ^{c, d} Unvented Attic Roofline Air-impermeable	Vaulted ^{c, d} Unvented Attic Roofline Air-permeable	Cathedralized ^{c, d} Vented Ceiling Roofline Air-permeable
2	13	4	18	0	0	13	30	20	20+5*	20
3	13	5	18	5	5	13	30	20	20+5*	20
4	13	5	18	5	5	13	30	20	20+15*	20

Window U-Factor 0.5 max with SHGC 0.30 max * Air-impermeable as per IRC 806.5

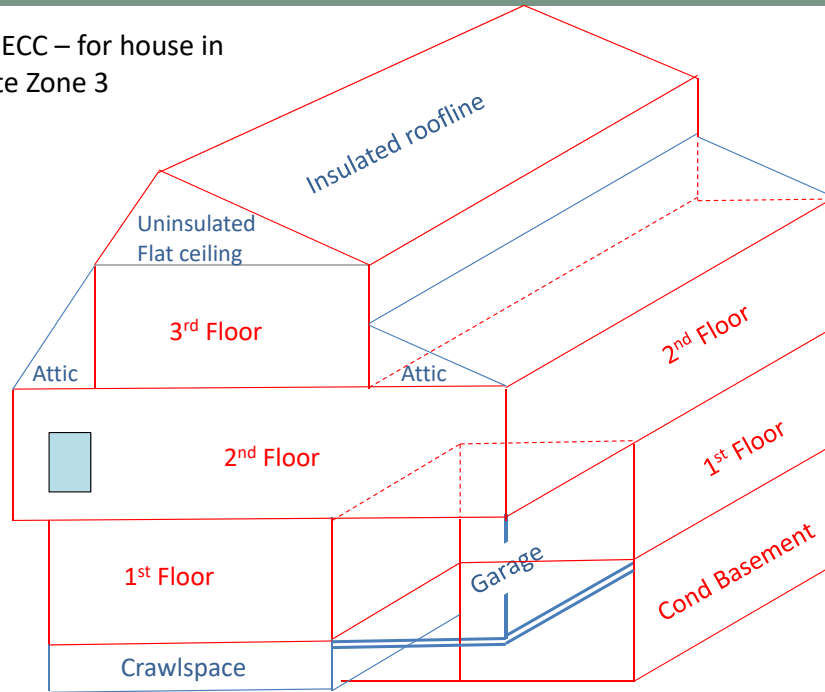
a: Weather-stripped hinged vertical doors (minimum R-5 insulation or maximum U-0.20), weather-stripped hatches/scuttle hole covers (minimum R-19 insulation or maximum U-0.05), or weather-stripped and disappearing/ pull-down stairs (minimum R-5 insulation or maximum U-0.20) shall be deemed to meet the minimum insulation R-values of the corresponding envelope element.
 b: Any mass wall (masonry, CMU, etc.)
 c: Attic kneewall for the purpose of this code is defined as any vertical or near vertical wall in the building envelope that has conditioned space on one side and attic space on the other side.
 Exception: When the building roofline is insulated, the former kneewall is classified as an interior wall.
 d: Examples of air-impermeable insulation include spray foam and rigid foam board. Examples of air-permeable insulation include fiberglass batts and cellulose. See 'Roofline Installed Insulation Options' in Appendix RA, of these Georgia State Supplements and Amendments for details.

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PRESCRIPTIVE RESIDENTIAL ENERGY CODE R-VALUES

2018 IECC – for house in Climate Zone 3



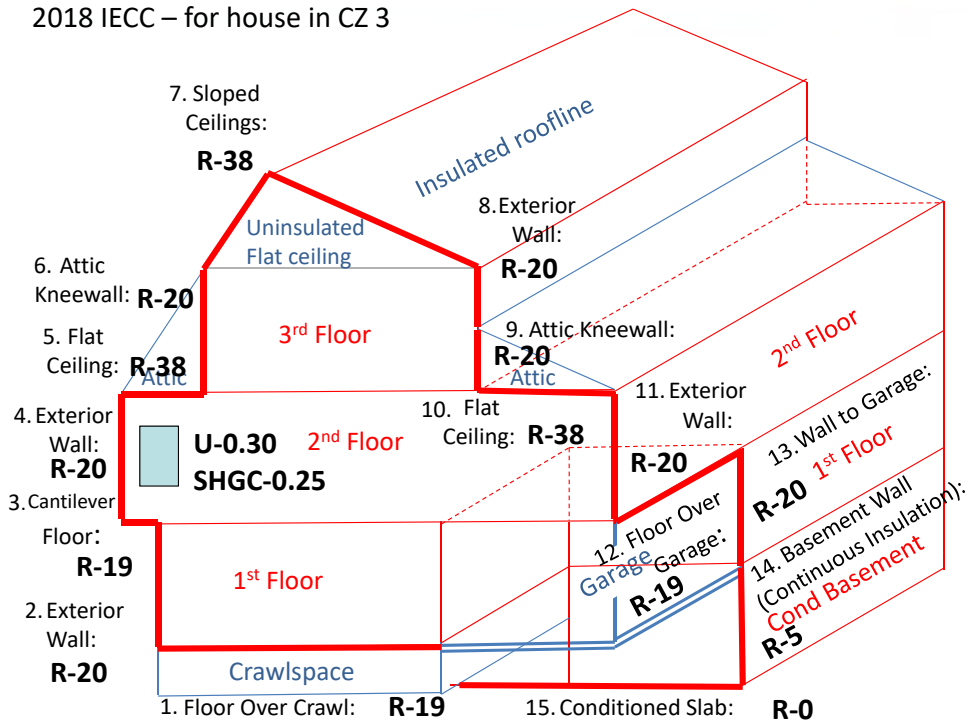
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15

Fill in the prescriptive code R-values



2018 IECC – for house in CZ 3



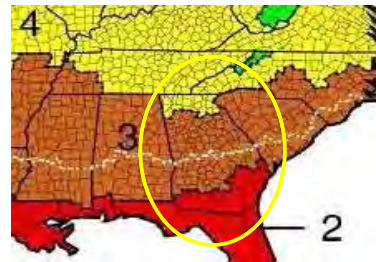
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2015 RESIDENTIAL ENERGY CODE FIELD STUDY – GEORGIA RESULTS

8 Key Items :

- High-efficiency lighting
- Envelope tightness (ACH50)
- Duct leakage
- Exterior wall insulation
- Ceiling insulation
- Foundation insulation (floor / basement wall / slab)
- Window U-factor
- Window SHGC



Minimum 63 observations of each key item



HIGH EFFICACY LAMPS (%)

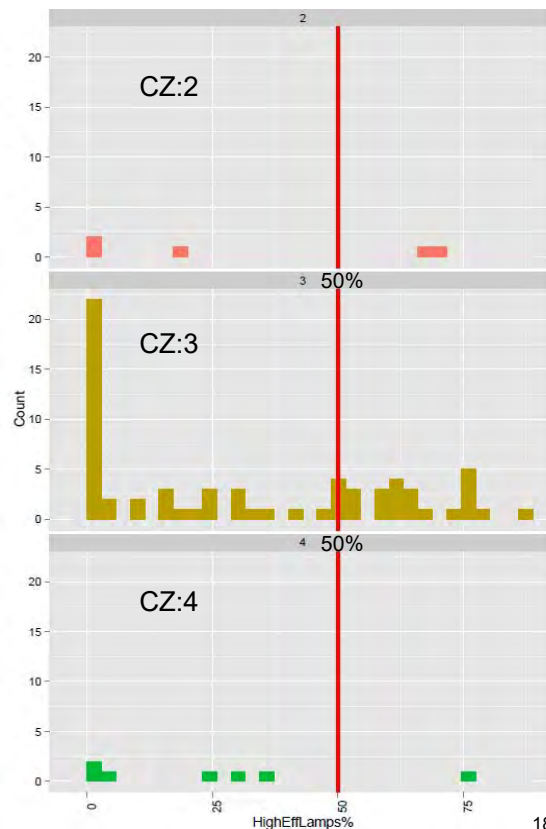
NO. OF OBSERVATIONS: 79

Vertical red line indicates the 2009 IECC prescriptive code requirement of 50% of all lamps

Key Takeaway:

Of 79 homes observed only 27 complied with the minimum Standard (~34% compliance)

Higher is Better!



ENVELOPE TIGHTNESS (ACH50)

NO. OF OBSERVATIONS: 73

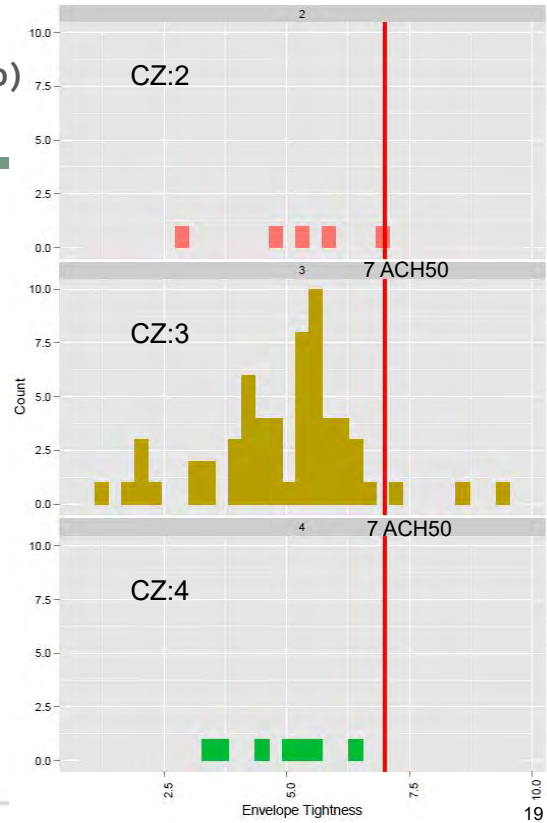
Vertical **red** line indicates the 2009 IECC prescriptive code requirement of **7 ACH50** (max.)

Key Takeaway:

Only 3 results worse than code of 73 tests conducted

The average ACH50 for all homes tested was **4.9**

Lower is Better!



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DUCT TIGHTNESS (CFM₂₅/100 FT² CFA)

NO. OF OBSERVATIONS: 70

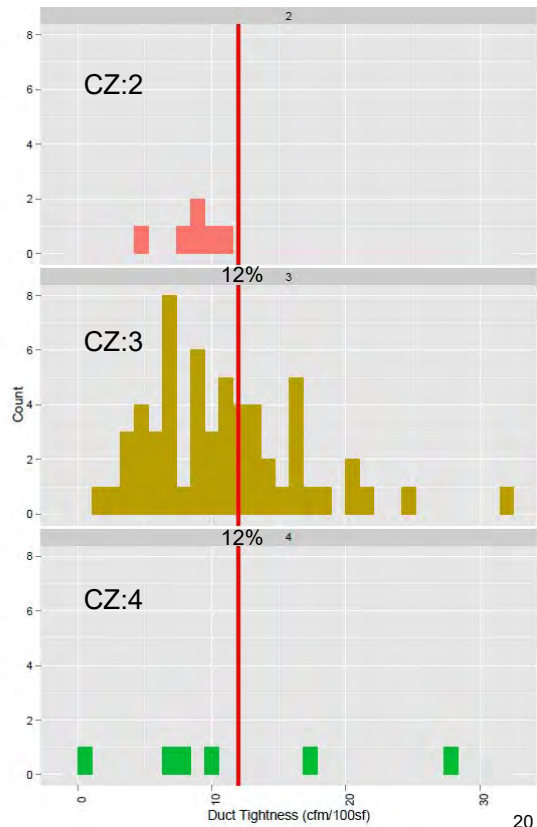
Vertical **red** line indicates the 2009 IECC prescriptive code requirement of maximum **12%** Total Leakage

Key Takeaways:

While many duct systems complied with the 2009 IECC, most would not comply with 2012/15/18 codes

Many duct systems located completely inside the thermal envelope tested much worse than 12% duct leakage

Lower is Better!



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CEILING R-VALUE

NO. OF OBSERVATIONS: 99

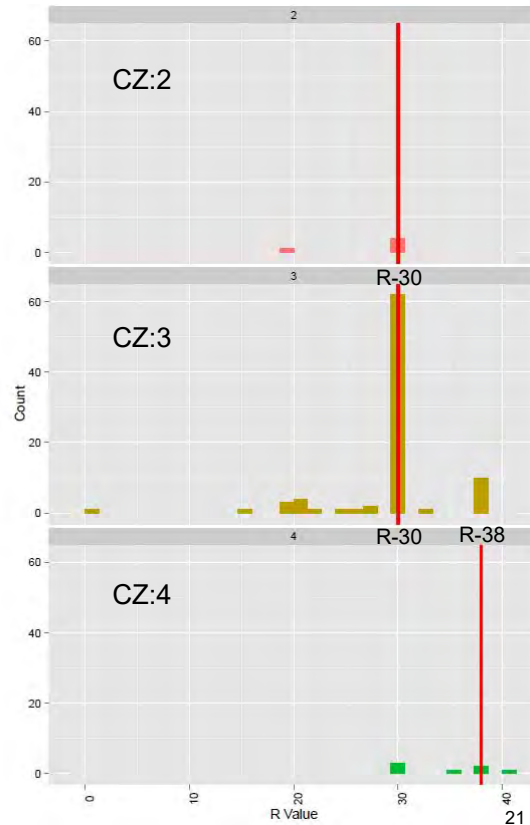
Vertical **red** line indicates the 2009 IECC prescriptive code requirement of R-30 in CZ's 2 & 3 and R-38 in CZ 4

GA Code allows ceiling insulation to be traded down to as low as R-19

Key Takeaway:

Quality of installation (Grade) was generally fair to poor

Higher is Better!



FRAME WALL R-VALUE (CAVITY)

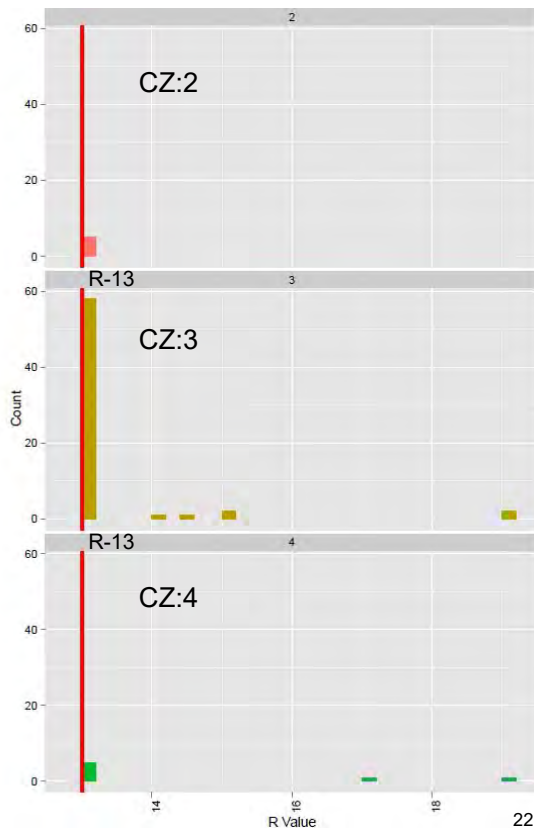
NO. OF OBSERVATIONS: 76

Vertical **red** line indicates the 2009 IECC prescriptive code requirement of R-13 for all CZ's

Key Takeaway:

Quality of installation (Grade) was generally poor

Higher is Better!





GEORGIA SAVINGS POTENTIAL

First-year savings if 100% compliance achieved

Electricity savings

- 11,148 MWh
- \$2.41 million

Total first-year savings:
\$3.1 million

Gas savings

- 547,700 therms
- \$0.78 million

Focus of new code:

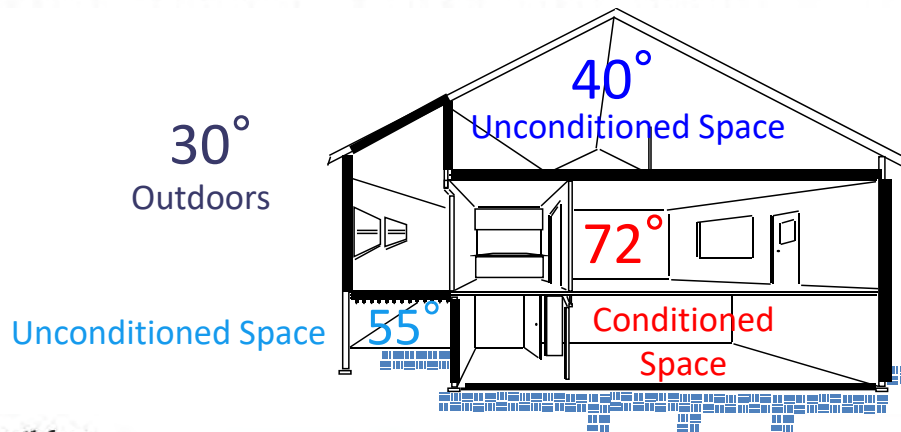
- LED lighting
- Tighter ducts & envelope
- Proper install of insulation



402—BUILDING THERMAL ENVELOPE

Building Thermal Envelope — The basement walls, exterior walls, floor, roof, and any other building element that enclose conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space.

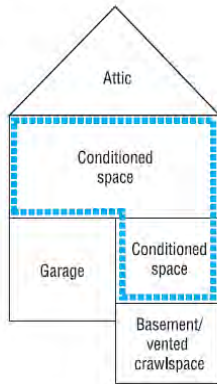
The *building thermal envelope* is the barrier that separates the conditioned space from the outside or unconditioned spaces. The building envelope consists of two parts - an air barrier and a thermal barrier that must be both continuous and contiguous (touching each other). In a typical residence, the building envelope consists of the roof, walls, windows, doors, and foundation. Examples of unconditioned spaces include attics, vented crawlspaces, garages, and basements with ceiling insulation and no HVAC supply registers.



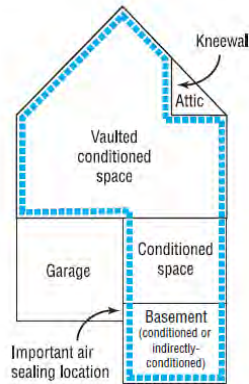
GA AMENDMENTS APPENDIX RA – BUILDING THERMAL ENVELOPE



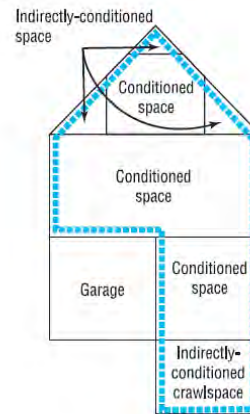
Example 1



Example 2



Example 3



- Although these three homes look identical from the outside, each has defined the building thermal envelope differently



R402.2: SPECIFIC INSULATION REQUIREMENTS



Prescriptive details for insulating portions 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**



402.2.1 - CEILINGS WITH ATTICS

- R-38 is prescriptive requirement CZ3
- Complete coverage of continuous R-30 is deemed to comply
- GA: R-19 is acceptable under HVAC attic platforms (32 s.f./platform + 32" walkway)
- Rulers (+card) required every 300 s.f. for blown attic insulation (R301.1.1)



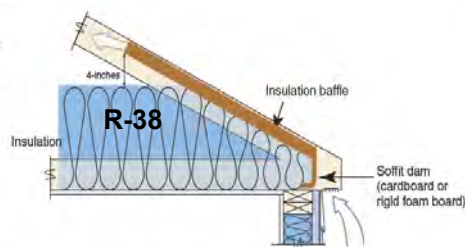
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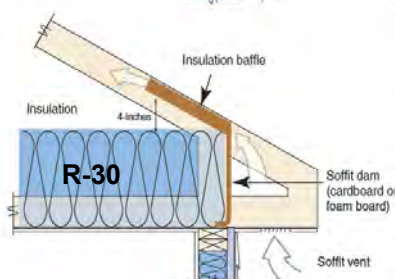
402.2.1 - CEILINGS WITH ATTICS



Standard Truss with tapered insulation depth



Energy Truss with full height insulation (recommended)



R402.2.1 Ceilings with attic spaces. Where Section R402.1.2 would require R-38 insulation in the ceiling, installing R-30 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly, where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the total UA alternative in Section R402.1.5.



28

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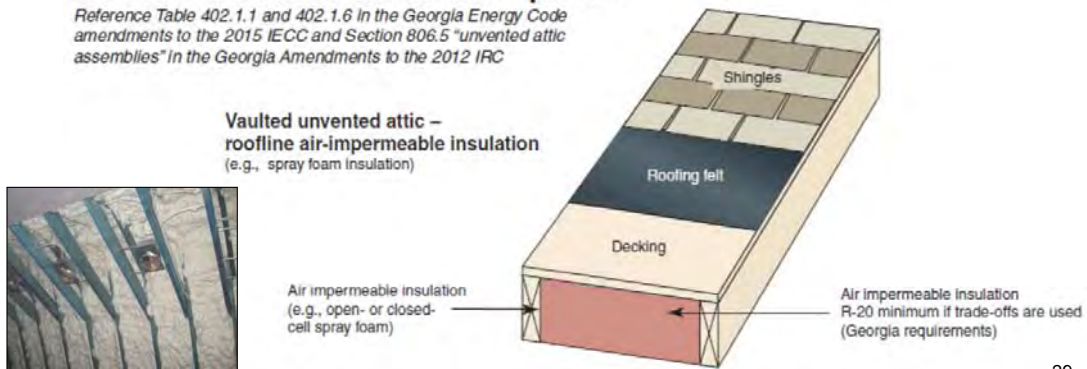
402.2.2 - CEILINGS WITHOUT ATTICS

- R-30 for 20% (up to 500 s.f.) acceptable for CZ3
- Vaulted ceilings and foam sprayed rooflines will need to perform an R-value trade-off
- GA specific: Can trade down to unvented R-20 if spray foam insulation is used (air impermeable insulation)



Roofline Installed Insulation Options

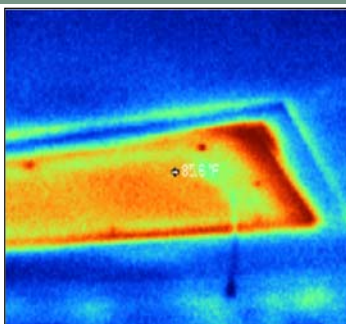
Reference Table 402.1.1 and 402.1.6 in the Georgia Energy Code amendments to the 2015 IECC and Section 806.5 "unvented attic assemblies" in the Georgia Amendments to the 2012 IRC



29

29

R402.2.4 ACCESS HATCHES & DOORS



- With 990 s.f. = R-38, and 10 s.f. = R-1, Effective R-value = R-29!

30

30

R402.2.4 ACCESS HATCHES & DOORS



Rough opening
must be air sealed



Attic zipper tent
with pocket for batt

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R402.2.8 FLOORS



R402.2.8 Floors. Floor framing-cavity insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

Exception: The 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 where combined with insulation that meets or exceeds the minimum wood frame wall *R*-value in Table 402.1.2 and that extends from the bottom to the top of all perimeter floor framing members.



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32

PROBLEMS WITH UNDERFLOOR INSULATION

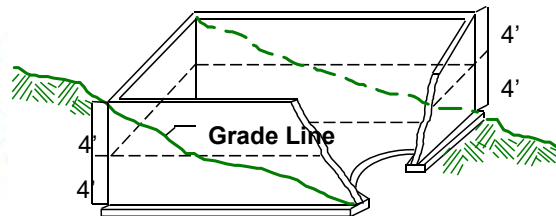


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R402.2.9 BASEMENT WALLS



R402.2.9 Basement walls. Walls associated with conditioned basements shall be insulated from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.



Basement Wall – Average gross wall must be > 50% below grade and enclose conditioned space

CZ4: R-10 continuous or R-13 cavity

CZ3: R-5 continuous or R-13 cavity

CZ2: No insulation required

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R402.2.9 BASEMENT WALLS



Insulation strategies:

Cellulose batt



Fiberglass batt w/
vinyl backing



Rigid foam board



35

35

R402.2.9 BASEMENT WALLS



Insulation strategies:

Rigid
foam board



Fiberglass batt in
AGW, foam board
on concrete



Spray
Polyurethane
Foam



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R402.2.9 BASEMENT WALLS



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R402.2.9 BASEMENT WALLS



Blanket basement
insulation options



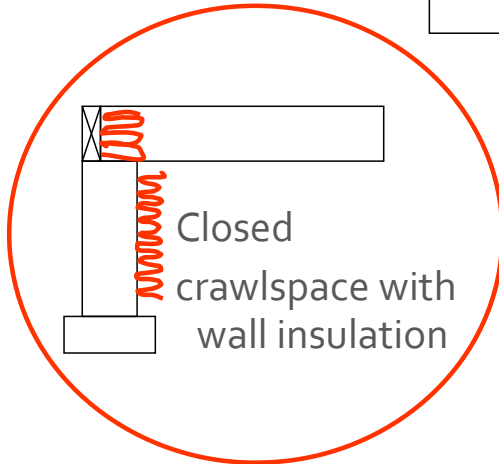
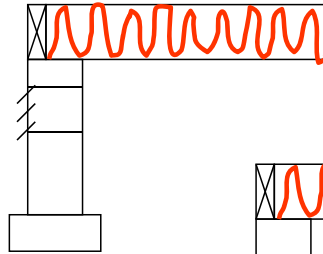
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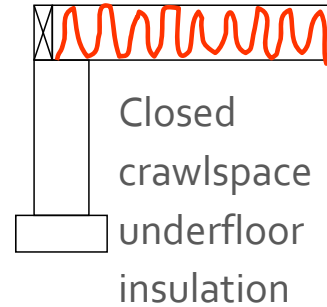
R402.2.11 CRAWLSPACE WALLS



Standard vented
crawlspace -
underfloor insulation



Closed
crawlspace with
wall insulation



Closed
crawlspace
underfloor
insulation

- **Note:** all crawlspaces must meet vapor retarder requirements, as per IRC (exception for open crawlspaces)

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R402.2.11 CRAWLSPACE WALLS



Seal ground with plastic (6" up walls, 6" overlaps)

Insulate interior of walls to satisfy code
(R-10 in CZ4, R-5 in CZ3, R-0 in CZ2)

Eliminate all vents and leaks (access doors)

Satisfy IRC exception to vent requirement (IRC section R408.3)

Venting Exceptions:

- Continuous exhaust (radon)
- Direct condition crawl space (supply)
- Direct condition (dehumidifier)



Critical Details:

- No drainage problems
- Use a sealed combustion / direct vent furnace or install a Heat Pump
- Pest Control and Code Official awareness

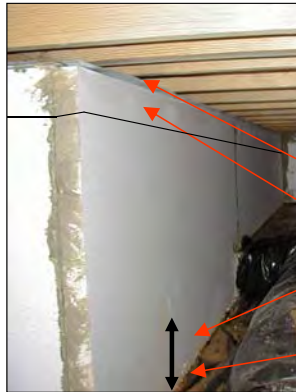
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R402.2.11 CRAWLSPACE WALLS



R402.2.11 Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to within 9 inches (229 mm) of the finished interior grade adjacent to the foundation wall. A 3-inch (76 mm) inspection/view strip immediately below the floor joists shall be provided to permit inspections for termites. Exposed earth in unvented crawl space foundations shall be covered with a continuous Class 1 vapor retarder in accordance with the *International Building Code*. All joints of the vapor retarder shall overlap by 6 inches (152 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (152 mm) up the stem wall and shall be attached and sealed to the stem wall. (Effective January 1, 2020)



www.crawlspace.org

- Air seal & insulate band area
- 3-inch view strip (removable is option)
- Crawl space wall insulation to extend to within 0-9" of finished interior grade
- Complete plastic sealed to walls at least 6 inches up the stem wall



41

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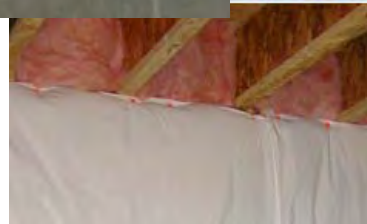
INSULATION TECHNIQUES – BAND AREA



Open/
Closed
Cell Foam

- Pest Control industry struggles with band area fully filled with SPF
- SPF that fills band blocks inspection for pest control
- Air seal and then insulate with movable insulation product (batts, pillows, rigid board, etc.)

Caulk and
Fiberglass
Batt



- Must air seal and insulate rim/band area in basements & crawlspaces

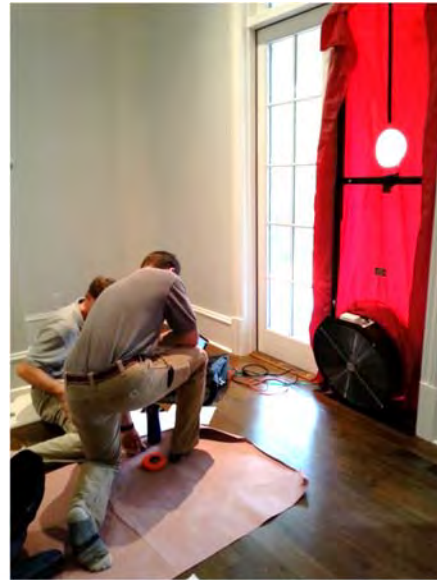


The band-joint area can be a challenge to insulate correctly, with some contractors opting for fiberglass batt rather than the complications of spray foam. For installers working with blown fiberglass or cellulose, National Fiber offers another option. Its Insul-Cube is a fire-rated bag can be filled with blown insulation on-site, then friction-fit between the joists. The amount of insulation used will vary according to the size of the space, and the cubes can be filled-in-place behind pipes or wires. National Fiber |

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BLOWER DOOR ENVELOPE TESTING

- Required in 2012
(2009 IECC option < 7 ACH₅₀)
(‘12-‘18 IECC < 3 ACH₅₀ *)
(* < 5 ACH₅₀ for CZ 1-2)
- Quantifies the Amount of Leakage Across the Home’s Thermal Boundary
- Administered by a Certified Professional (DET Verifier)
- Reported to Builder and Code Official with results on Certificate



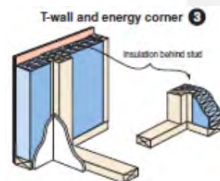
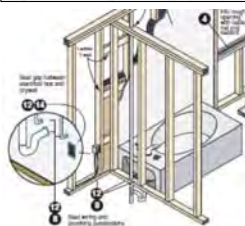
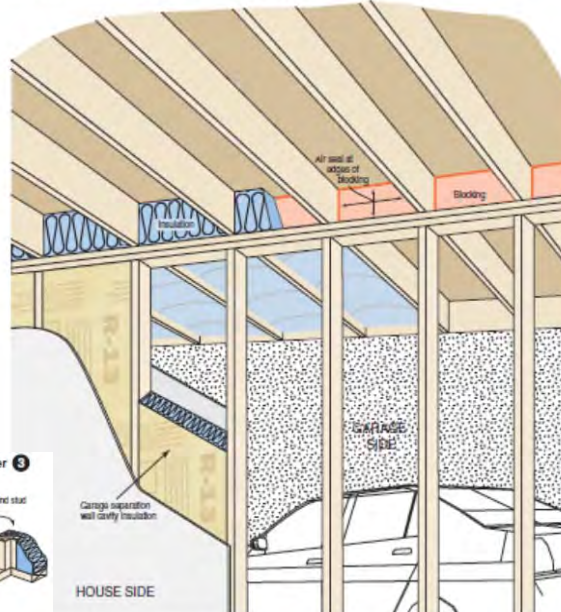
GA APPENDIX RA - GRAPHICS ILLUSTRATE TABLE 402.4.1.1 AIR SEALING & INSULATION



Component	Key Sealing/Insulation	Insulation/Sealing Details
1. Ceiling/ceilingline	Seal ceilingline to exterior wall and roofline. Seal ceilingline to exterior wall and roofline. Seal ceilingline to exterior wall and roofline.	Seal ceilingline to exterior wall and roofline.
2. Windows	Seal window frame to exterior wall. Seal window frame to exterior wall. Seal window frame to exterior wall.	Seal window frame to exterior wall.
3. Doors	Seal door frame to exterior wall. Seal door frame to exterior wall. Seal door frame to exterior wall.	Seal door frame to exterior wall.
4. Attic	Seal attic floor to exterior wall. Seal attic floor to exterior wall. Seal attic floor to exterior wall.	Seal attic floor to exterior wall.
5. Garage	Seal garage floor to exterior wall. Seal garage floor to exterior wall. Seal garage floor to exterior wall.	Seal garage floor to exterior wall.
6. Garage separation wall	Seal garage separation wall to exterior wall. Seal garage separation wall to exterior wall. Seal garage separation wall to exterior wall.	Seal garage separation wall to exterior wall.
7. Wall/ceilingline	Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall.	Seal wall/ceilingline to exterior wall.
8. Wall/door	Seal wall/door to exterior wall. Seal wall/door to exterior wall. Seal wall/door to exterior wall.	Seal wall/door to exterior wall.
9. Wall/window	Seal wall/window to exterior wall. Seal wall/window to exterior wall. Seal wall/window to exterior wall.	Seal wall/window to exterior wall.
10. Wall/ceilingline	Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall.	Seal wall/ceilingline to exterior wall.
11. Wall/door	Seal wall/door to exterior wall. Seal wall/door to exterior wall. Seal wall/door to exterior wall.	Seal wall/door to exterior wall.
12. Wall/window	Seal wall/window to exterior wall. Seal wall/window to exterior wall. Seal wall/window to exterior wall.	Seal wall/window to exterior wall.
13. Wall/ceilingline	Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall.	Seal wall/ceilingline to exterior wall.
14. Wall/door	Seal wall/door to exterior wall. Seal wall/door to exterior wall. Seal wall/door to exterior wall.	Seal wall/door to exterior wall.
15. Wall/window	Seal wall/window to exterior wall. Seal wall/window to exterior wall. Seal wall/window to exterior wall.	Seal wall/window to exterior wall.
16. Wall/ceilingline	Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall.	Seal wall/ceilingline to exterior wall.
17. Wall/door	Seal wall/door to exterior wall. Seal wall/door to exterior wall. Seal wall/door to exterior wall.	Seal wall/door to exterior wall.
18. Wall/window	Seal wall/window to exterior wall. Seal wall/window to exterior wall. Seal wall/window to exterior wall.	Seal wall/window to exterior wall.
19. Wall/ceilingline	Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall.	Seal wall/ceilingline to exterior wall.
20. Wall/door	Seal wall/door to exterior wall. Seal wall/door to exterior wall. Seal wall/door to exterior wall.	Seal wall/door to exterior wall.
21. Wall/window	Seal wall/window to exterior wall. Seal wall/window to exterior wall. Seal wall/window to exterior wall.	Seal wall/window to exterior wall.
22. Wall/ceilingline	Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall.	Seal wall/ceilingline to exterior wall.
23. Wall/door	Seal wall/door to exterior wall. Seal wall/door to exterior wall. Seal wall/door to exterior wall.	Seal wall/door to exterior wall.
24. Wall/window	Seal wall/window to exterior wall. Seal wall/window to exterior wall. Seal wall/window to exterior wall.	Seal wall/window to exterior wall.
25. Wall/ceilingline	Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall.	Seal wall/ceilingline to exterior wall.
26. Wall/door	Seal wall/door to exterior wall. Seal wall/door to exterior wall. Seal wall/door to exterior wall.	Seal wall/door to exterior wall.
27. Wall/window	Seal wall/window to exterior wall. Seal wall/window to exterior wall. Seal wall/window to exterior wall.	Seal wall/window to exterior wall.
28. Wall/ceilingline	Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall. Seal wall/ceilingline to exterior wall.	Seal wall/ceilingline to exterior wall.
29. Wall/door	Seal wall/door to exterior wall. Seal wall/door to exterior wall. Seal wall/door to exterior wall.	Seal wall/door to exterior wall.
30. Wall/window	Seal wall/window to exterior wall. Seal wall/window to exterior wall. Seal wall/window to exterior wall.	Seal wall/window to exterior wall.

Garage blocking and sealing key points

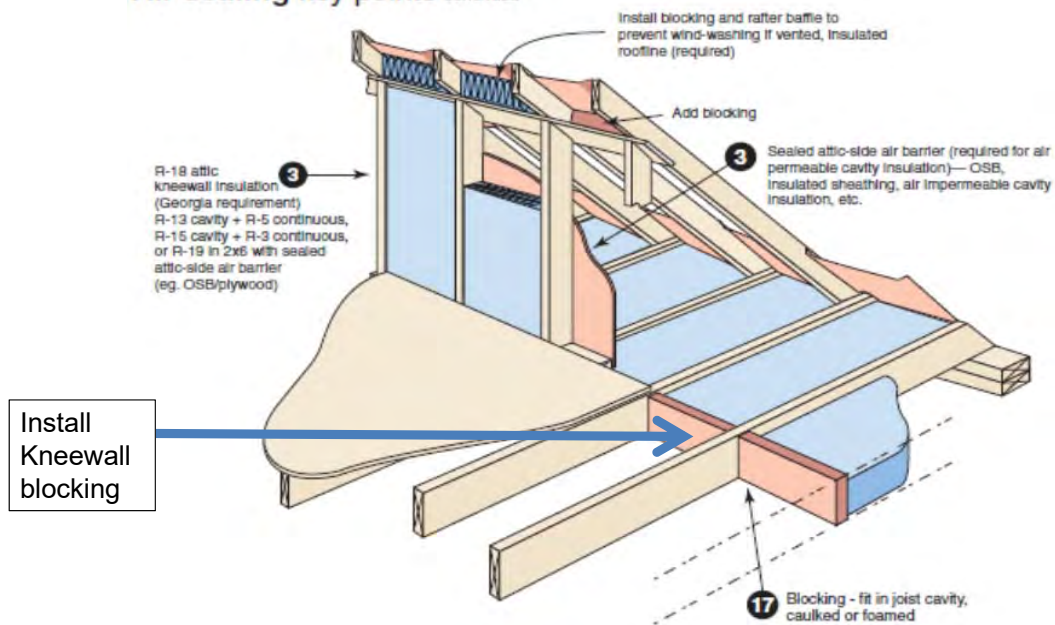
Blocking, air sealing and insulation required above garage separation wall



GA APPENDIX RA - GRAPHICS ILLUSTRATE CORRECT PRACTICE – ATTIC KNEEWALLS



Air sealing key points *continued*



45

45

INSTALLING INSULATION

- Voids/gaps
- Compression/ incomplete fill



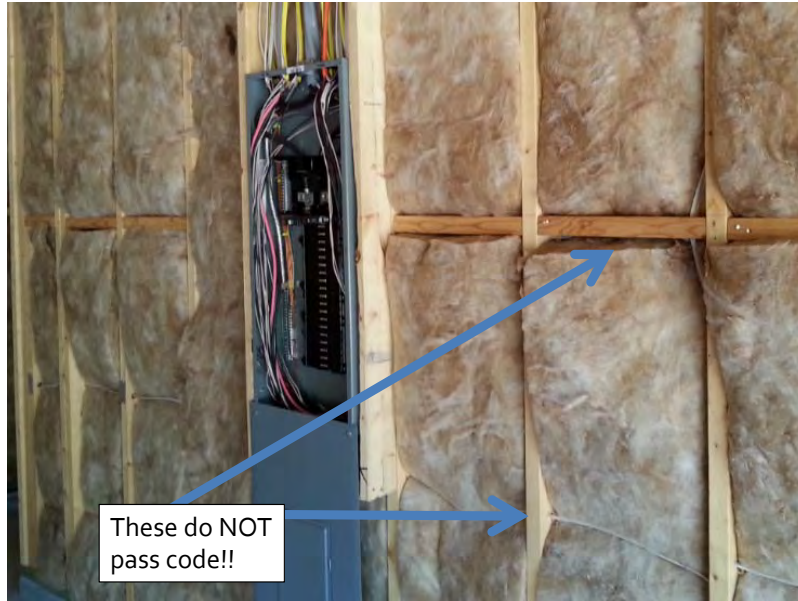
These do NOT pass code!!

46

46

INSTALLING INSULATION

- Voids/gaps
- Compression/incomplete fill



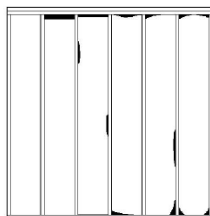
INSULATION INSTALLATION: GRADE I, II, OR III

Unless verified, assume Grade III (worst) – see RESNET Mortgage Standard Appendix A11-16

Installation shall be *at least* this good to be labeled as "Grade III".



"Grade II":

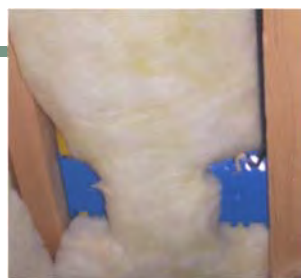


No more than 2% of surface area of insulation missing is acceptable for "Grade II"

"Grade I":

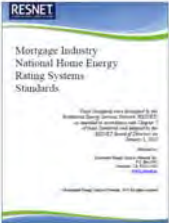


Occasional very small gaps are acceptable for "Grade I".

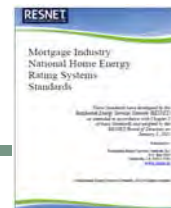


INSULATION INSTALLATION: RESNET APPENDIX A

- Voids / Gaps
- Compression / Incomplete fill

Building Element: Walls (continued)		
Rated Feature	Task	On-Site Inspection Protocol
 <p>Mortgage Industry National Home Energy Rating Systems Standards</p>	Determine cavity insulation installation characteristics	<p>When it is possible to inspect insulation as installed (i.e., new construction), inspectors shall rate the installation as "Grade I, II, or III" according to the following guidelines, regardless of insulation material or installation process. Note that all insulation installation techniques require proper care to ensure they are completed correctly, if they are not, thermal performance can suffer dramatically. These guidelines apply to cavity fill insulation, continuous rigid insulation, and any other field-installed insulation products.</p> <p>1. "Grade I" shall be used to describe insulation that is generally installed according to manufacturers instructions and/or industry standards. A "Grade I" installation requires that the insulation material uniformly fills each cavity side-to-side and top-to-bottom, without substantial gaps or voids around obstructions (such as blocking or bridging), and is split, installed, and/or fitted tightly around wiring and other services in the cavity. To inspect, probe in, around, or through the insulation and/or vapor retarder in several places to see whether these requirements are met. Replace or repair the vapor retarder and insulation as necessary. During inspection (typically before drywall is installed), if the exterior sheathing is visible from the building interior through gaps in the cavity insulation material, it is not considered a "Grade I" installation.</p> <p>To attain a rating of "Grade I", wall insulation shall be enclosed on all six sides, and shall be in substantial contact with the sheathing material on at least one side (interior or exterior) of the cavity. Exception: the interior sheathing/enclosure material is optional in climate zones 1-3, provided insulation is adequately supported and meets all other requirements.</p> <p>For rim or band joist insulation, use the inspection guidelines under "Walls—Insulation value" to assess "Grade I", "Grade II", or "Grade III" installation. Exception: the interior sheathing/enclosure material is optional in all climate zones, provided insulation is adequately supported and meets all other requirements.</p>

INSULATION INSTALLATION: GRADE I



For exterior applications of rigid insulation, insulation shall be in firm contact with the structural sheathing materials, and tightly fitted at joints to be considered a "Grade I" installation.

For faced batt insulation, Grade I can be designated for side-stapled tabs, provided the tabs are stapled neatly (no buckling), and provided the batt is only compressed at the edges of each cavity, to the depth of the tab itself, and provided it meets the other requirements of Grade I.

For sprayed or blown-in products, density shall be sufficient that the fill material springs back when compressed slightly with a hand or finger, and provided it meets the other requirements of Grade

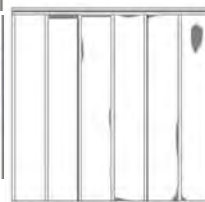
Interpretation:

The following illustrations represent the boundary conditions between Grade I and Grade II, that is, the installation shall be at least this good to be labeled as "Grade I":

The following standards may be applied as a reference: NAIMA, Recommendations for Installation in Residential and Other Light-Frame Construction—Fiber Glass Home Insulation (PUB # BI402), Recommendations for Installation in Residential and Other Light-Frame Construction—Fiber Glass Loose Fill Insulation (PUB # BI403), CIMA, Technical Bulletin #2 -- Standard Practice for Installing Cellulose Building Insulation, Technical Bulletin #3-- Standard Practice for Installation of Sprayed Cellulosic Wall Cavity Insulation. For other products and materials, manufacturer's installation instructions will apply.

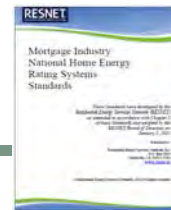


Occasional very small gaps are acceptable for "Grade I"



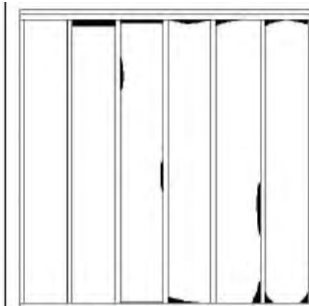
Compression or incomplete fill amounting to 2% or less, if the empty spaces are less than 30% of the intended fill thickness, are acceptable for "Grade I".

INSULATION INSTALLATION: GRADE II

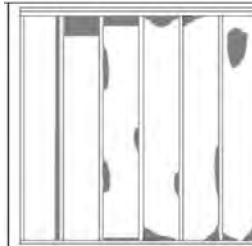


2. "Grade II" shall be used to describe an installation with moderate to frequent installation defects: gaps around wiring, electrical outlets, plumbing and other intrusions; rounded edges or "shoulders"; or incomplete fill amounting to less than 10% of the area with 70% or more of the intended thickness (i.e., 30% compressed); or gaps and spaces running clear through the insulation amounting to no more than 2% of the total surface area covered by the insulation. To attain a rating of "Grade II", wall insulation shall be enclosed on all six sides, and shall be in substantial contact with the sheathing material on at least one side (interior or exterior) of the cavity.

Interpretation:
The following illustrations represent the boundary conditions between Grade II and Grade III, that is, the installation shall be at least this good to be labeled as "Grade II":

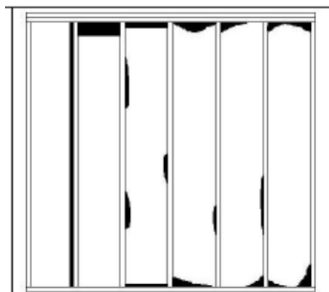
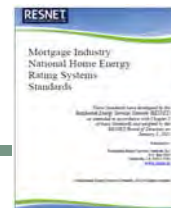


No more than 2% of surface area of insulation missing is acceptable for "Grade II"



No more than 10% of surface area of insulation compressed or incomplete fill, by up to 30% (70% or more of intended thickness) is acceptable for "Grade II"

INSULATION INSTALLATION: GRADE III



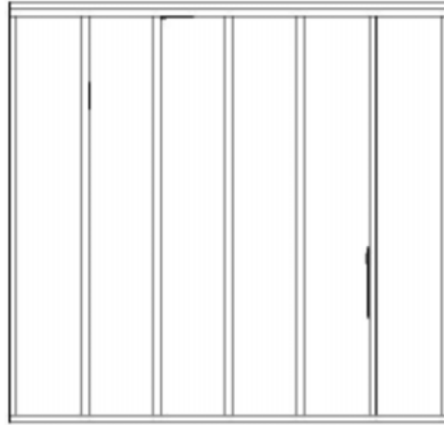
3. "Grade III" shall be used to describe an installation with substantial gaps and voids, with missing insulation amounting to greater than 2% of the area, but less than 5% of the surface area is intended to occupy. More than 5% missing insulation shall be measured and modeled as separate, uninsulated surfaces according to 3.B.5.p. This designation shall include wall insulation that is not in substantial contact with the sheathing on at least one side of the cavity, or wall insulation in a wall that is open (unsheathed) on one side and exposed to the exterior, ambient conditions or a vented attic or crawlspace. The presence of an air-impermeable barrier such as housewrap will be considered to enclose the building cavities.

Interpretation:
The following illustration represents the boundary conditions between Grade III and the situation whereby one must measure the uninsulated areas; that is, the installation shall be at least this good to be labeled as "Grade III":

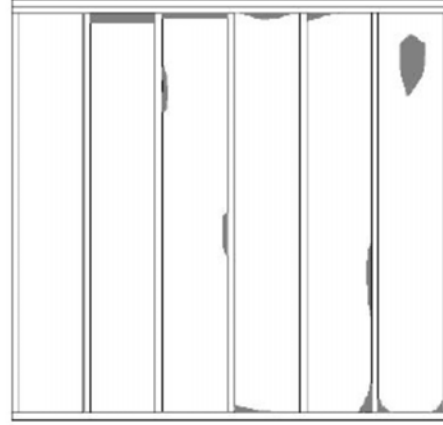
GRADE I

Appendix A-11 - A-13

- occasional very small gaps
- less than 2% compression/incomplete fill (which may not be more than 30% compressed)



Gaps

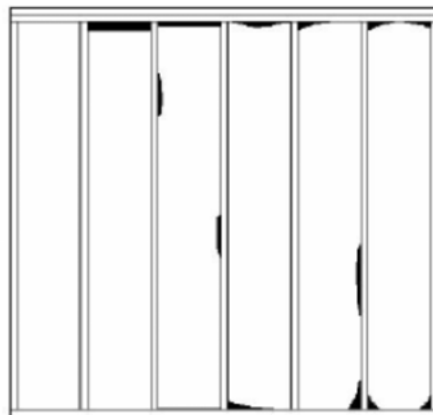


Compression

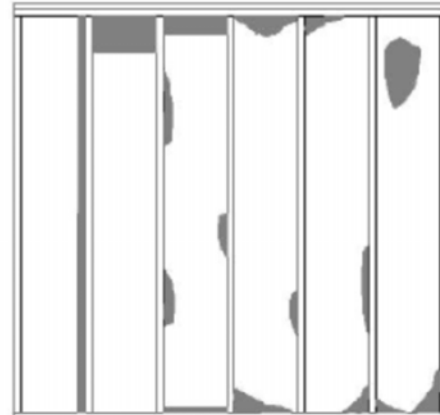
GRADE II

Appendix A-13 - A-15

- <2% gaps
- <10% compression/incomplete fill (which may not be more than 30% compressed in depth)



Gaps

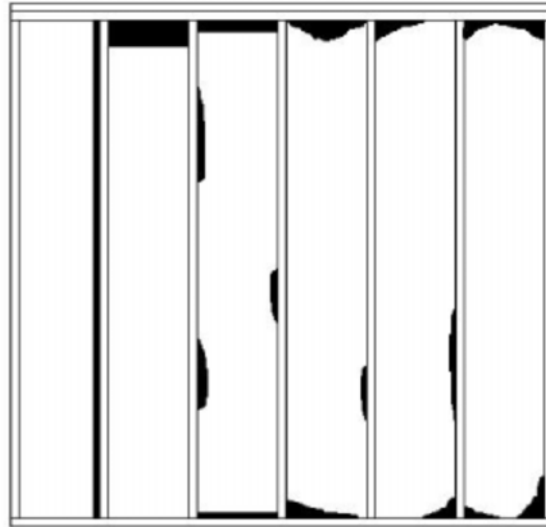


Compression

GRADE III

Appendix A-15 - A-16

- > 2% and < 5% gaps
- (greater than 5% = downgraded R-value)

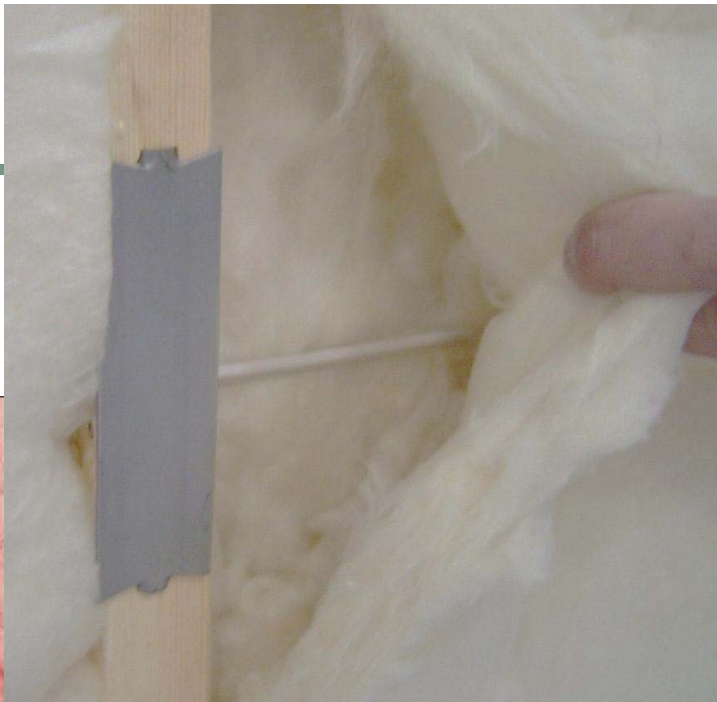


Gaps

WHAT GRADE?



WHAT GRADE?



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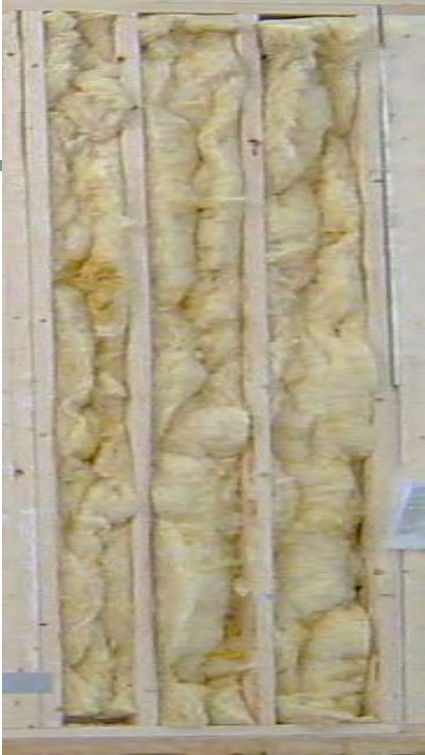
WHAT GRADE?



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WHAT GRADE?



WHAT GRADE?



WHAT GRADE?



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61

WHAT GRADE?




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62

62

WHAT GRADE?



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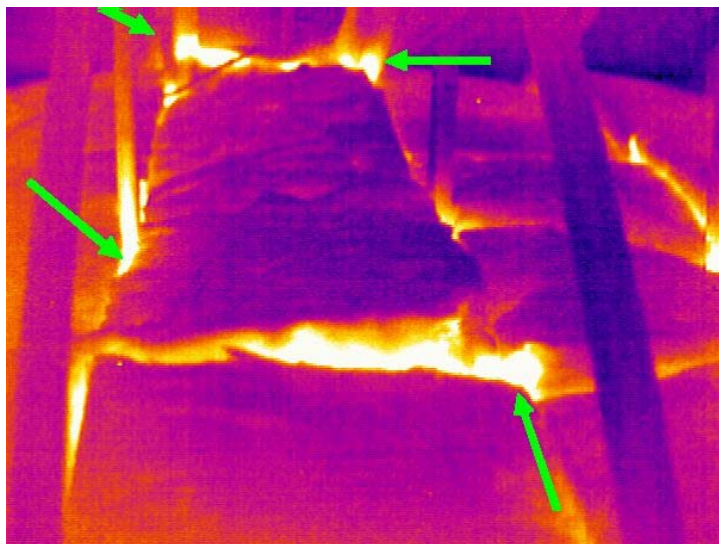
63

63

CONTINUOUS INSULATION & AIR BARRIER

Building Thermal Envelope

(air barrier and insulation must be in complete contact)



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CEILING INSULATION FAIL



INSTALLING INSULATION

- Voids / Gaps
- Compression / Incomplete Fill



Georgia Insulation Installation – Passing Grade Details

Wall and ceiling insulation that makes up portions of the building thermal envelope in Georgia residences shall be installed to Passing Grade quality.

Two criteria affect installed insulation grading: **voids/gaps** (in which no insulation is present in a portion of the overall insulated surface) and **compression/incomplete fill** (in which the insulation does not fully fill out or extend to the desired depth).

Voids/Gaps

- o Voids or gaps in the insulation are **< 1%** of overall component surface area (only occasional and very small gaps allowed for Passing Grade)

Compression/Incomplete Fill

- o Compression/Incomplete Fill for both **air permeable insulation** (e.g., fiberglass, cellulose) and **air impermeable insulation** (e.g., spray polyurethane foam) must be less than 1 inch in depth, less than 30% of the intended depth, whichever is more stringent. The allowable area of compression/incomplete fill must be **less than 2%** of the overall insulated surface to achieve a Passing Grade.
- o Any compression/incomplete fill with a **depth** greater than the above specifications (up to 1" or 30% of the intended depth, whichever is more stringent) shall not achieve a Passing Grade.

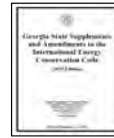
Additional Wall Insulation Requirements

- o All vertical air permeable insulation shall be installed in substantial contact with an air barrier on all six (6) sides.
Exception: Unfinished basements, rim/band joist cavity insulation and fireplaces (insulation shall be restrained to stay in place).
For unfinished basements, air permeable insulation and associated framing in a framed cavity wall shall be installed less than 1/4" from the basement wall surface.
- o Attic kneewall details – Attic kneewalls shall be insulated to a total R-value of at least R-18 through any combination of cavity and continuous insulation. Air permeable insulation shall be installed with a fully sealed attic-side air barrier (e.g., OSB with seams caulked, rigid insulation with joints taped, etc.). Attic kneewalls with air impermeable insulation shall not require an additional attic-side air barrier.



WALL INSULATION – VOIDS / GAPS

< 1% of insulated area

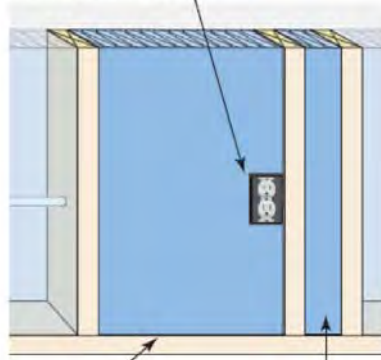


Wall Insulation key points

Voids / Gaps

Passing Grade

Insulation is notched and completely surrounds electrical box



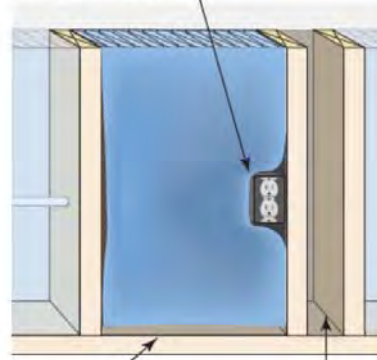
Insulation fully fills cavity at top and bottom

Narrow cavity fully insulated

Good!!!

Unacceptable Installation

Incomplete insulation coverage around electrical box



Insulation does not extend to bottom of cavity

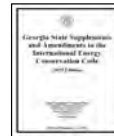
Narrow cavity not insulated

Bad!!!



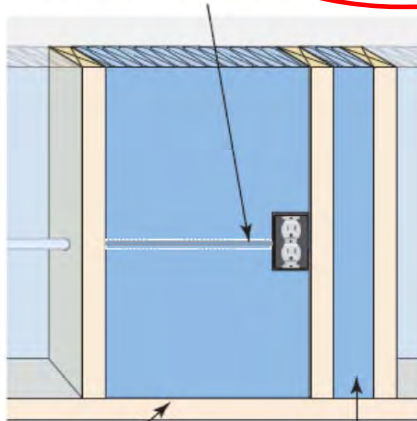
WALL INSULATION – COMPRESSION / INCOMPLETE FILL

< 2% of insulated area AND < 1" of depth



Passing Grade

Insulation is slit around electrical wire



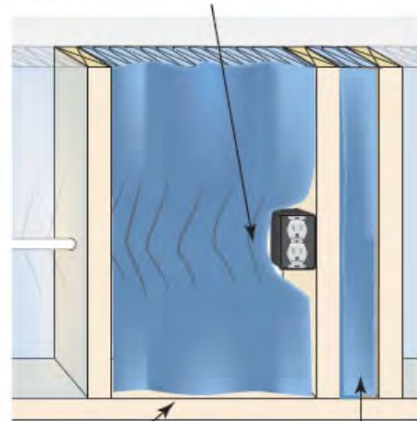
Insulation extends from front to back and fully fills entire cavity

Proper width insulation fully fills narrow cavity

Good!!!

Unacceptable Installation

Insulation is compressed behind electrical wire



Insulation does not fully fill entire cavity

Improper width insulation is compressed into narrow cavity

Bad!!!



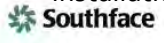
INSULATION: INSTALLATION VS. VAPOR RETARDER



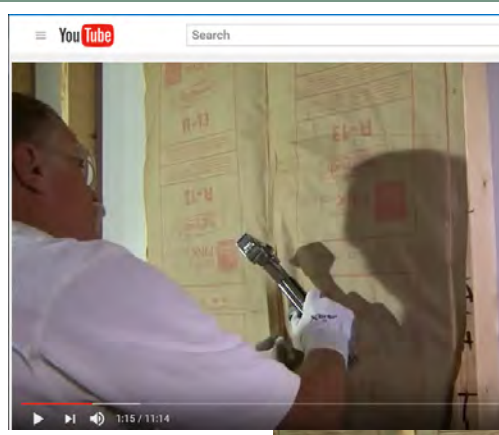
R402.1.1 Vapor retarder. Wall assemblies in the *building thermal envelope* shall comply with the vapor retarding requirements of Section R702.7 of the *International Residential Code* or Section 1405.3 of the *International Building Code*, as applicable.




- Wall and ceiling vapor retarders are not required in Climate Zones 1-4
- Often, kraft paper-facing on batts adversely impacts installation



VIDEOS OF INSULATION INSTALLATION



VIDEOS OF INSULATION INSTALLATION



YouTube Search

1:26 / 11:14

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VIDEOS OF INSULATION INSTALLATION



YouTube Search

Keys to Proper Batt Installation

- #1 - Fill the cavity top-to-bottom, side-to-side and back-to-front
- #2 - Leave no gaps between insulation and framing members - studs and top & bottom plates
- #3 - Split around wiring
- #4 - Insulate behind electrical boxes and other voids created by cavity obstructions

3:27 / 11:14

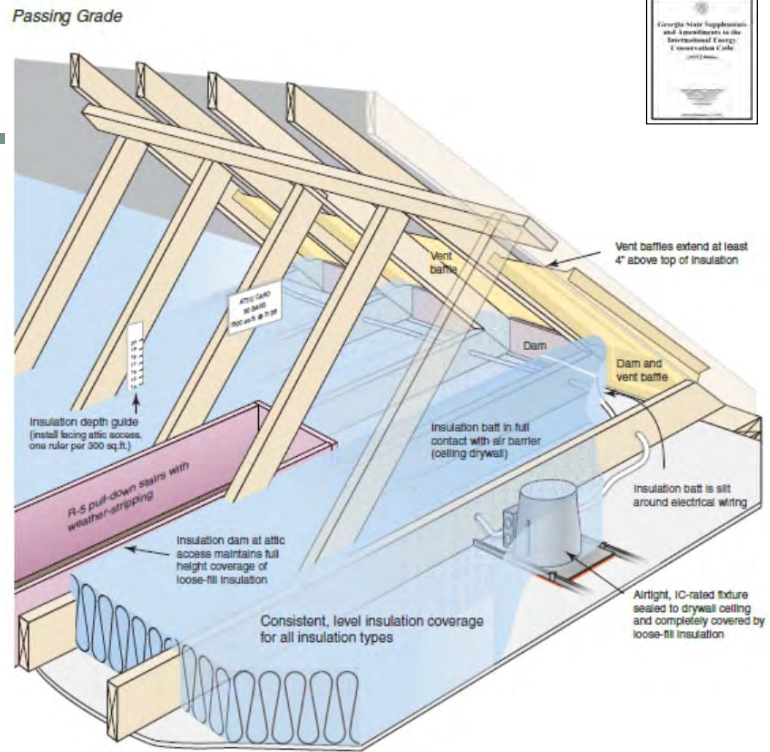
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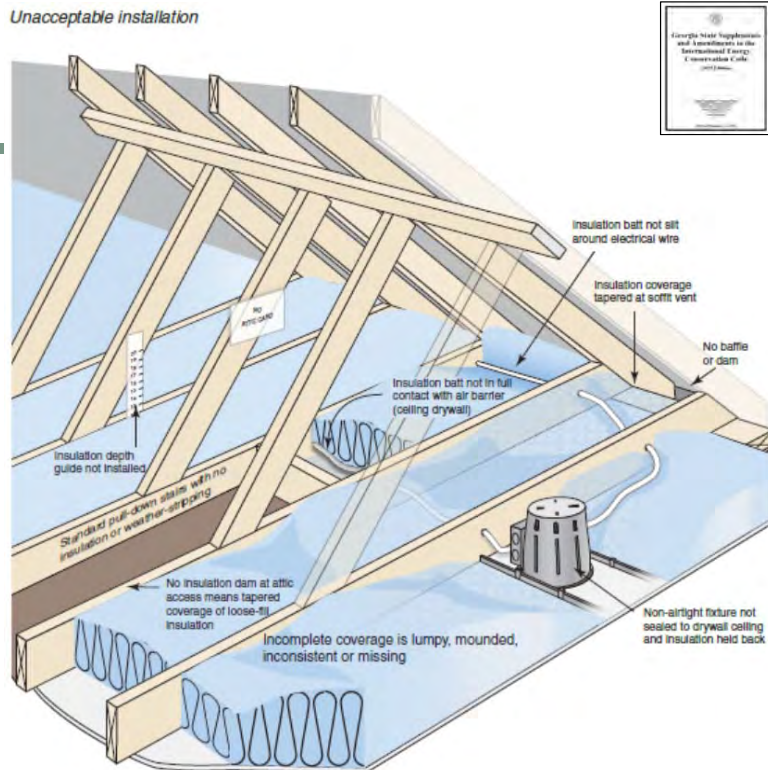
CEILING INSULATION

Good!!!



CEILING INSULATION

Bad!!!



UGLY CEILING INSULATION



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FLOOR INSULATION



Underfloor insulation that makes up portions of the building thermal envelope in Georgia residences shall be installed to Passing Grade quality.

Two criteria affect installed insulation grading: **voids/ gaps** (in which no insulation is present in a portion of the overall insulated surface) and **compression/incomplete fill** (in which the insulation does not fully fill out or extend to the desired depth).

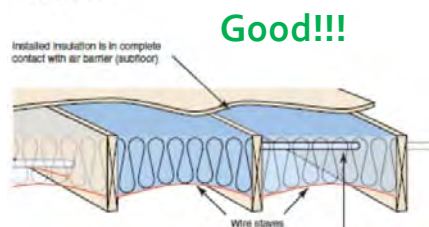
Voids/Gaps

- o Voids or gaps in the insulation are minimal for Passing Grade (< 2% of overall component surface area)

Compression/Incomplete Fill

- o Compression/Incomplete Fill for both *air permeable insulation* (e.g., fiberglass, cellulose) and *air impermeable insulation* (e.g., spray polyurethane foam) must be less than 1 inch in depth or less than 30% of the intended depth, whichever is more stringent. The allowable area of compression/incomplete fill must be less than 10% of the overall insulated surface to achieve a Passing Grade.
- o Any compression/incomplete fill with a **depth** greater than the above specifications (up to 1" or 30% of the intended depth, whichever is more stringent) shall not achieve a Passing Grade.
- o Air-permeable underfloor insulation shall be permanently installed against the subfloor decking. Adequate insulation supports (e.g., wire staves) for air permeable insulation shall be installed at least every 18-24".
Exception: The 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 where combined with insulation that meets or exceeds the minimum wood frame wall R-value and that extends from the bottom to the top of all perimeter floor framing members

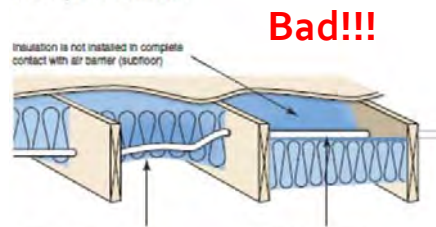
Passing Grade



Insulation coverage is complete

Insulation is all around plumbing and wiring and securely fastened with minimal compression

Unacceptable Installation



Insulation coverage is incomplete due to obstructions (plumbing, electrical, ductwork, etc.)

Insulation is compressed around plumbing and wiring and is not securely fastened

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WRAP UP AND ENERGY CODE RESOURCES

mikeb@southface.org

Online educational resources are available by visiting:
www.southfaceonlinetraining.org

Technical assistance or training requests can be submitted to
Energy Code Hotline at: energycodes@southface.org or
404-604-3598

Additional Resources

DOE Field Study: For additional information on other DOE Field Studies
and participating states, visit the Building Energy Codes website here:
<https://www.energycodes.gov/compliance/energy-code-field-studies>



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