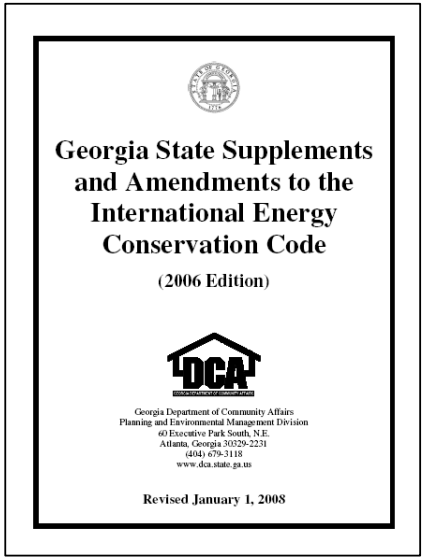
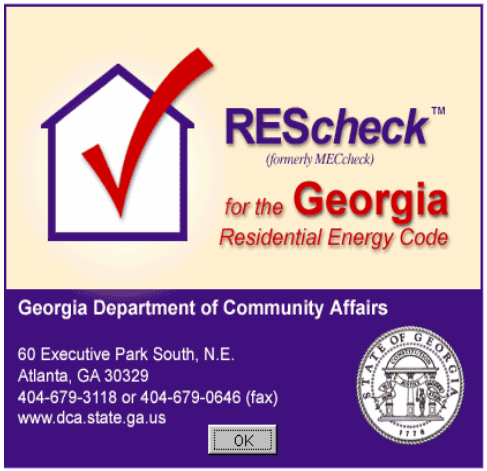
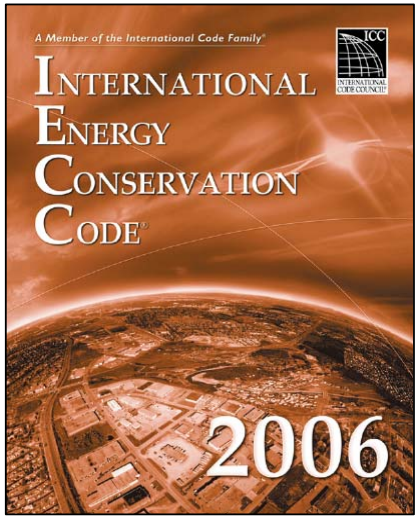
The New Georgia Energy Code: 2006 IECC







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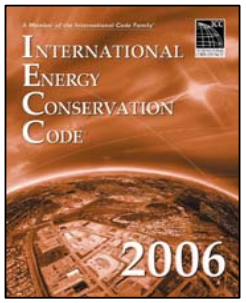
Sponsors and Resources



Georgia Department of Community Affairs

HBAG Home Builders Association of Georgia

AGL Resources

Georgia Environmental Facilities Authority

NAIMA North American Insulation Manufacturers Association

Georgia Power A Southern Company

EEBA Energy & Environmental Building Association

EarthCraft House

Greater Atlanta Home Builders Association

Construction Suppliers Association

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Building America

Pacific Northwest Laboratory: 1-800-270-CODE

www.dca.state.ga.us www.energycodes.gov

www.southface.org www.bcap-energy.org

About Southface

- Non-profit 501-C3 founded in 1978
- Pragmatic environmental organization with focus on the built environment

Mission: Southface promotes sustainable homes, workplaces and communities through education, research, advocacy and technical assistance

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Residential Green Building Services

- Training for residential stakeholders on green building issues from pre-design through construction
- Existing home services
- LEED for Homes Provider
- Energy performance modeling and building optimization
- Energy code training and compliance documentation
- Project energy design reviews
- Building energy assessments
- HERS Rater trainers and provider
- EarthCraft House program
- Community and Development planning & charrettes

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Southface Energy and Environmental Resource Center

- Demonstration facility built in 1996
- Reduces air and water pollution
- Conserves natural resources
- Provides a healthy indoor environment

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EarthCraft House

a Southface partnership with the Greater Atlanta HBA

- Healthy and quiet
- Low maintenance and durable
- Reduced energy and water bills
- Wise use of materials
- Added resale value
- Regional – GA, AL, TN, SC, NC, VA
- Single-family, Multifamily, Renovation, Communities, Light Commercial (pilot)

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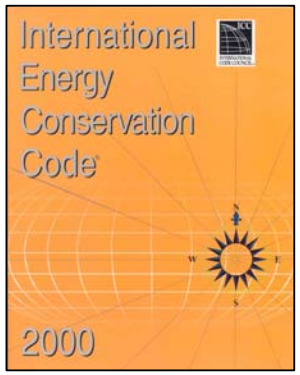
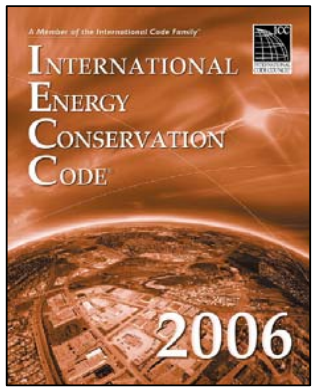
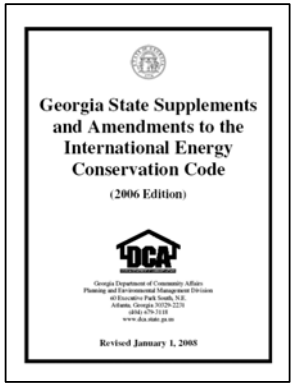
Structure: 2000 vs. 2006 IECC

- Ch. 1 - Administration and Enforcement
- Ch. 2 - Definitions
- Ch. 3 - Design Conditions
- *Ch. 4 - "Systems Analysis"*
- *Ch. 5 - "Component Performance"*
- *Ch. 6 - "Design by Acceptable Practice"*
- Ch. 7,8 - Design for non-Residential Buildings
  (Chapter 7 – ASHRAE 90.1)



- Ch. 1 - Administration
- Ch. 2 - Definitions
- Ch. 3 - Climate Zones
- *Ch. 4 - Residential Code*
  - *401 General*
  - *402 Building Thermal Envelope*
  - *403 Fenestration*
  - *404 Simulated Performance Alternative*
- Ch. 5 - Commercial Buildings
  (still references ASHRAE 90.1 – version 2004 is cited for GA)





What Residential Buildings Must Comply?

Chapter 1

- New construction
- 1 and 2 family
- Multi-family, 3 stories and less

CONDITIONED SPACE. An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent conditioned space.

Exempt Buildings

- No conditioning
- Historical
- Low peak energy for space conditioning
  - < 3.4 Btu/hr/ft^2 of floor area
  - < 1.0 W/ft^2 of floor area

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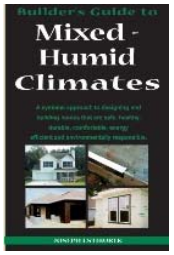
A few definitions…

Chapter 2



- Air Barrier
  - Any material that blocks air flow between a conditioned space and an unconditioned space, including necessary sealing to block excessive air flow at edges and seams. (Information on proper air sealing may be found in Appendix A, 'AIR SEALING KEY POINTS', on the U.S. Department of Energy's Building America website [www.eere.energy .gov/buildings/building_america], and in the Energy and Environmental Building Association's [EEBA's] Builders Guides [www.eeba.org]. These references include guidance on identifying and sealing air barriers.)
- Attic Kneewall
  - Any vertical or near-vertical wall in the building envelope that has conditioned space on one side and unconditioned attic space on the other side. If the envelope features the insulation installed along the sloped ceiling, the vertical wall is considered an interior wall and thus does not require insulation.
- R-value
  - …All R-values shall be stabilized (aged 2 minimum years) R-values.

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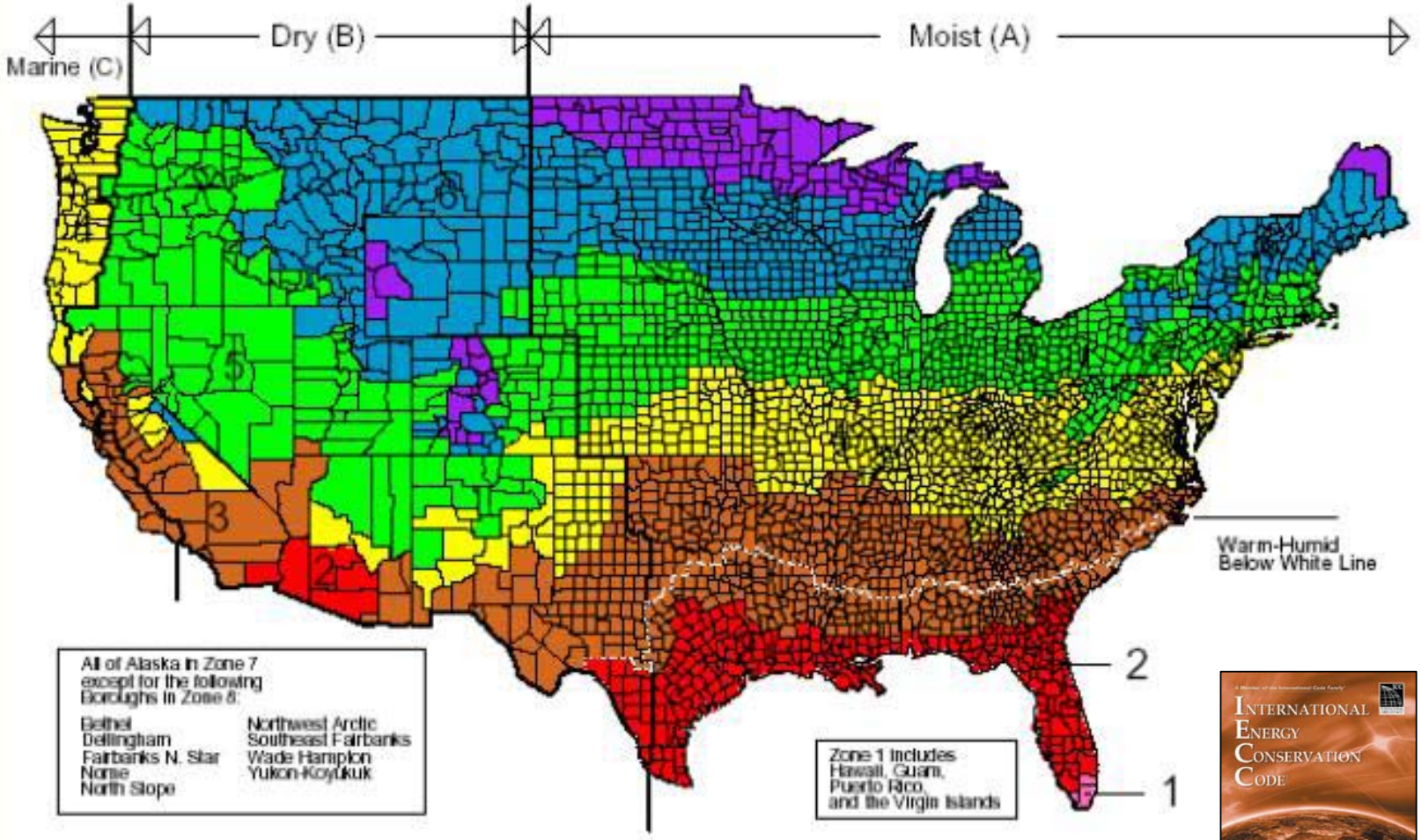
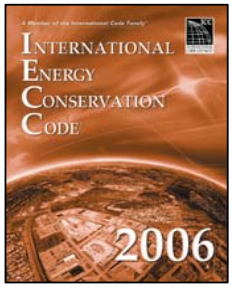
IECC 2006 Climate Zones Chapter 3





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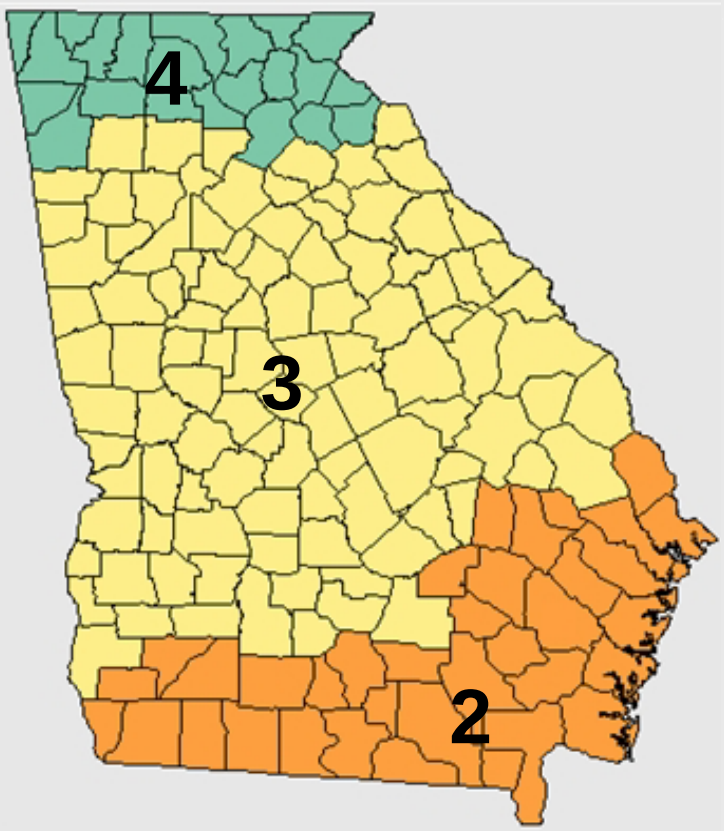
☞Note: All GA is CZ 2A, 3A, or 4A

GA Climate Zones



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IECC Climate Zone 4

Banks	Fannin	Habersham	Rabun	White
Catoosa	Floyd	Hall	Stephens	Whitfield
Chattooga	Franklin	Lumpkin	Towns	
Dade	Gilmer	Murray	Union	
Dawson	Gordon	Pickens	Walker	

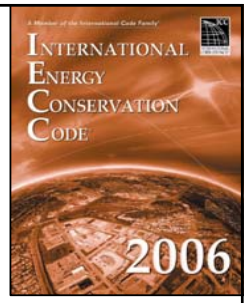
IECC Climate Zone 3

Baldwin	Crawford	Henry	Muscogee	Taylor
Barrow	Crisp	Houston	Newton	Telfair
Bartow	De Kalb	Irwin	Oconee	Terrell
Ben Hill	Dodge	Jackson	Oglethorpe	Tift
Bibb	Dooly	Jasper	Paulding	Treutlen
Bleckley	Dougherty	Jefferson	Peach	Troup
Bulloch	Douglas	Jenkins	Pike	Turner
Burke	Early	Johnson	Polk	Twiggs
Butts	Elbert	Jones	Pulaski	Upson
Calhoun	Emanuel	Lamar	Putnam	Walton
Candler	Fayette	Laurens	Quitman	Warren
Carroll	Forsyth	Lee	Randolph	Washington
Chattahoochee	Fulton	Lincoln	Richmond	Webster
Cherokee	Glascock	Macon	Rockdale	Wheeler
Clarke	Greene	Madison	Schley	Wilcox
Clay	Gwinnett	Marion	Screven	Wilkes
Clayton	Hancock	McDuffie	Spalding	Wilkinson
Cobb	Haralson	Meriwether	Stewart	Worth
Coffee	Harris	Monroe	Sumter	
Columbia	Hart	Montgomery	Talbot	
Coweta	Heard	Morgan	Taliaferro	

IECC Climate Zone 2

Appling	Bryan	Decatur	Lanier	Pierce
Atkinson	Camden	Echols	Liberty	Seminole
Bacon	Charlton	Effingham	Long	Tattnall
Baker	Chatham	Evans	Lowndes	Thomas
Berrien	Clinch	Glynn	McIntosh	Toombs
Brantley	Colquitt	Grady	Miller	Ware
Brooks	Cook	Jeff Davis	Mitchell	Wayne

IECC 2006 – Section 401



- Defines residential
  (lots of cross referencing to other I-codes)
  - R3 (1 and 2 family)
  - R2 and R4 (Multifamily 3 stories or less)
- Certificate on panel box shows major component R-values, U-factors, efficiencies, etc.

401.1 Scope. This chapter applies to residential buildings.

401.2 Compliance. Projects shall comply with Sections 401, 402.4, 402.5, 402.6 and 403 (referred to as the mandatory provisions) and either:

1. Sections 402.1 through 402.3 (prescriptive); or
2. Section 404 (performance).

401.3 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the type and efficiency of heating, cooling and service water heating equipment.

SAMPLE CERTIFICATE

Georgia Energy Code Compliance Certificate*

Builder_____ Contact Information_____
Insulation Co._____ Contact Information_____
Heating & Air Co._____ Contact Information_____

Envelope Information
Flat Ceiling/Roof *R*-Value_____ Sloped/Vault Ceiling *R*-Value_____
Exterior Wall *R*-Value_____ (Note: *R*-13 + *R*-3 is *R*-13 Cavity and *R*-3 Sheathing)
Attic Kneewall Cavity *R*-Value_____ Attic Kneewall Sheathing *R*-Value_____
Basement Stud Wall *R*-Value_____ Basement Continuous *R*-Value_____
Crawlspace Stud Wall *R*-Value_____ Crawlspace Continuous *R*-Value_____
Foundation Slab Edge *R*-Value_____ Above Grade Mass Wall *R*-Value_____
Cantilevered Floor *R*-Value_____ Floor Over Unconditioned Space *R*-Value_____
Other Insulation *R*-Values_____
Window *U*-Factor_____ Window SHGC_____
Skylight *U*-Factor_____ Skylight SHGC_____
Glazed Door *U*-Factor_____ Opaque Doors (< 50% glazed) *U*-Factor_____

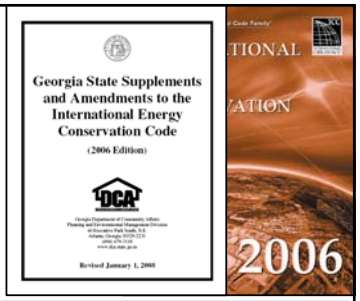
Mechanical Summary
Water Heater Installed By_____
Gas_____ Energy Factor_____ Electric_____ Energy Factor_____
Other (Explain)_____ Efficiency_____
Number of Heating & Cooling Systems: _____(# of Air Handlers)
Heating Gas_____ AFUE_____ Air Source Heat Pump_____ HSPF_____
Heat (Other)_____ Efficiency_____
Cooling System Type_____ (Direct Expansion, Heat Pump, Geothermal, Etc.) SEER___
Total House Heating Load_____ (Btu/h, Based on ACCA Manual J__or____)
Total House Cooling Load_____ (Btu/h, Based on ACCA Manual J__or____)
Cooling Sensible Load_____ (Btu/h) Cooling Latent Load_____(Btu/h)
Total Air Handler CFM _____ (Based on Design/Calculations)
Heating & Cooling Load Calculations Performed by (Name)_____

*Certificate shall be readily accessible and posted on the electrical distribution panel or air handler. List primary type when there is more than one value for each component (i.e. certificate shall list the value covering the largest area). The certificate shall be completed by the builder or registered design professional.

SAMPLE CERTIFICATE

IECC 2006 – Section 401

- See Appendix E for example certificate



- Amended language:
  - *"A permanent certificate shall be readily accessible and shall be posted on or near the electrical distribution panel or air handler.* The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant R-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; U-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the type and efficiency of heating, cooling and service water heating equipment. *The certificate shall also list the calculated heating load, sensible cooling load, latent cooling load and cfm for space conditioning."*

EXAMPLE OF COMPLETED SAMPLE CERTIFICATE

Georgia Energy Code Compliance Certificate*

Builder *A-1 Home Builder*	Contact Information *404-555-1122*
Insulation Co. *Super R*	Contact Information *404-555-2233*
Heating & Air Co. *Acme HVAC*	Contact Information *404-555-3344*

Envelope Information

Flat Ceiling/Roof *R*-Value *30*	Sloped/Vault Ceiling *R*-Value *N/A*
Exterior Wall *R*-Value *13 + 3*	(Note: *R*-13 + *R*-3 is *R*-13 Cavity and *R*-3 Sheathing)
Attic Kneewall Cavity *R*-Value *13*	Attic Kneewall Sheathing *R*-Value *5*
Basement Stud Wall *R*-Value *N/A*	Basement Continuous *R*-Value *N/A*
Crawlspace Stud Wall *R*-Value *0*	Crawlspace Continuous *R*-Value *5*
Foundation Slab Edge *R*-Value *0*	Above Grade Mass Wall *R*-Value *N/A*
Cantilevered Floor *R*-Value *N/A*	Floor Over Unconditioned Space *R*-Value *19*
Other Insulation *R*-Values *N/A*	
Window *U*-Factor *0.34*	Window SHGC *0.37*
Skylight *U*-Factor *N/A*	Skylight SHGC *N/A*
Glazed Door *U*-Factor *N/A*	Opaque Doors (< 50% glazed) *U*-Factor *0.35*

Mechanical Summary

Water Heater Installed By *Acme Plumbing*	
Gas *X* Energy Factor *0.61*	Electric ____ Energy Factor ____
Other (Explain) ____	Efficiency ____
Number of Heating & Cooling Systems:	*2* (# of Air Handlers)
Heating Gas *X* AFUE *80%*	Air Source Heat Pump ____ HSPF ____
Heat (Other) ____	Efficiency ____
Cooling System Type *DX Air Conditioner*	(Direct Expansion, Heat Pump, Geothermal, Etc.) SEER *13*
Total House Heating Load *57,144*	(Btu/h, Based on ACCA Manual J *X* or ____)
Total House Cooling Load *45,737*	(Btu/h, Based on ACCA Manual J *X* or ____)
Cooling Sensible Load *33,537*	(Btu/h) Cooling Latent Load *12,200* (Btu/h)
Total Air Handler CFM *1,526*	(Based on Design/Calculations)
Heating & Cooling Load Calculations Performed by (Name) *Jay Manuello, Acme HVAC*	

*Certificate shall be readily accessible and posted on the electrical distribution panel or air handler. List primary type when there is more than one value for each component (i.e. certificate shall list the value covering the largest area). The certificate shall be completed by the builder or registered design professional.

Building Science Fundamentals

- Heat
  - Conduction
  - Convection
  - Radiation
- Air
  - Wind
  - Stack Effect
  - Mechanical Fans
- Moisture
  - Bulk
  - Capillarity
  - Diffusion
  - Infiltration

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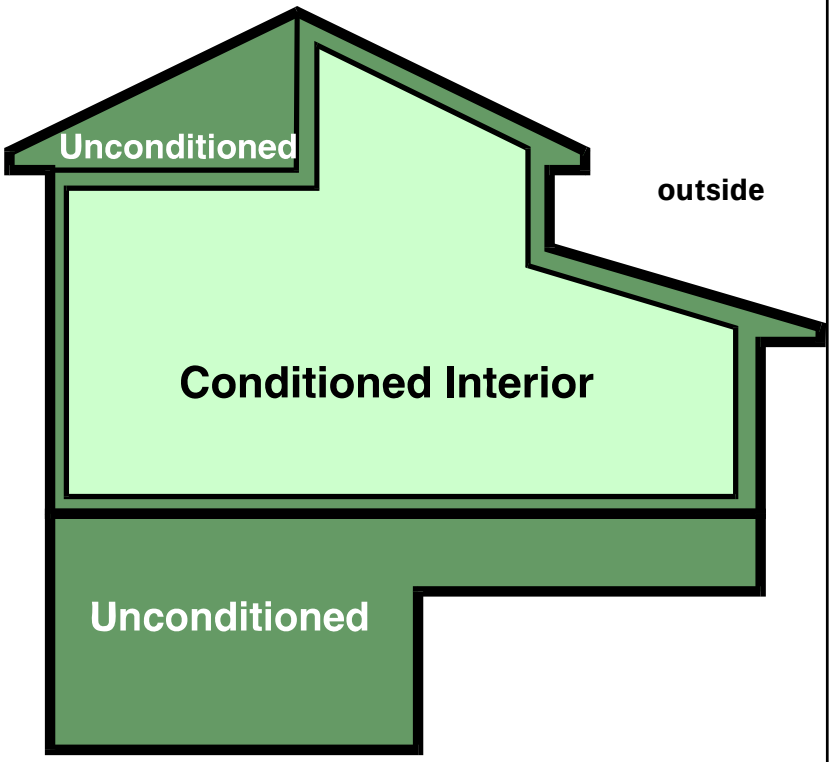
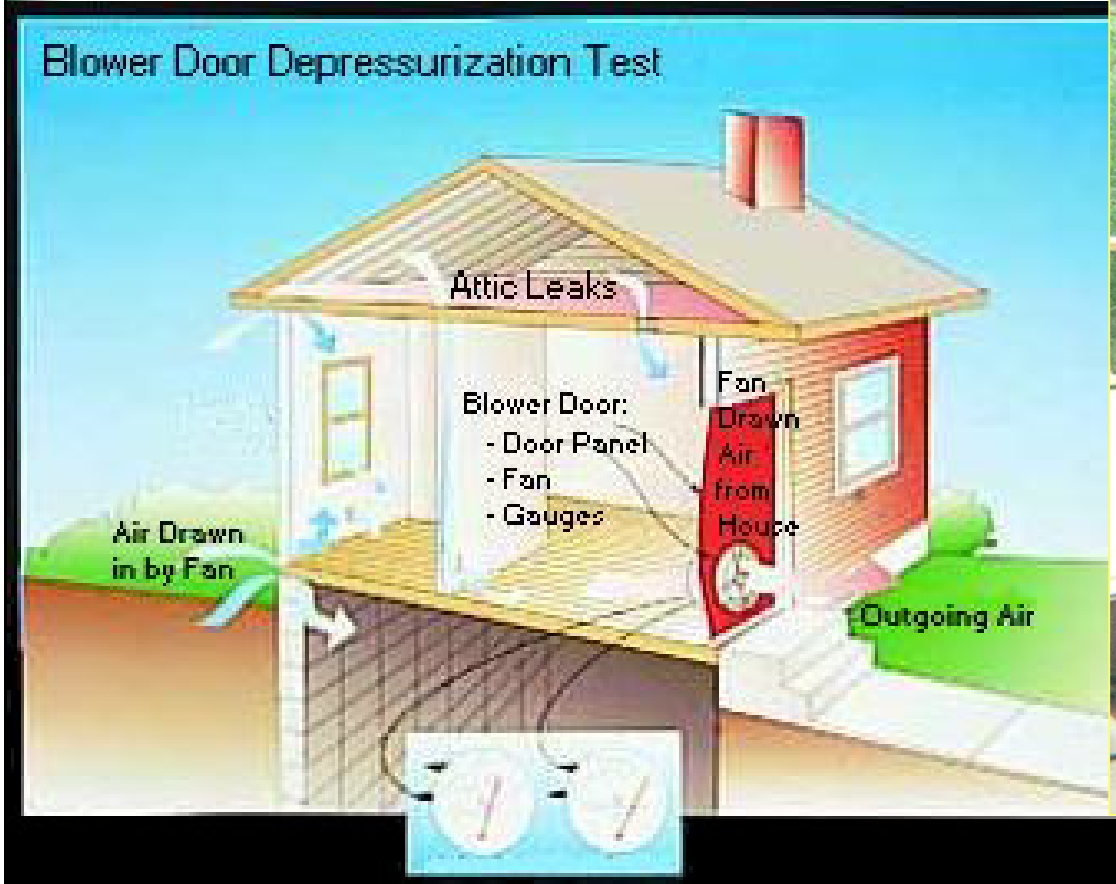
House as a System

- Building Envelope
  - Continuous air barrier
  - Complete insulation coverage
- Proper Heating and Cooling Systems
- Controlled Ventilation



The building envelope separates conditioned space from unconditioned (or outside) and consists of two elements: an air barrier & insulation that must be continuous and touching

Blower Door



Calculate Leakage from House Pressure and AirFlow Rate

Duct Blaster

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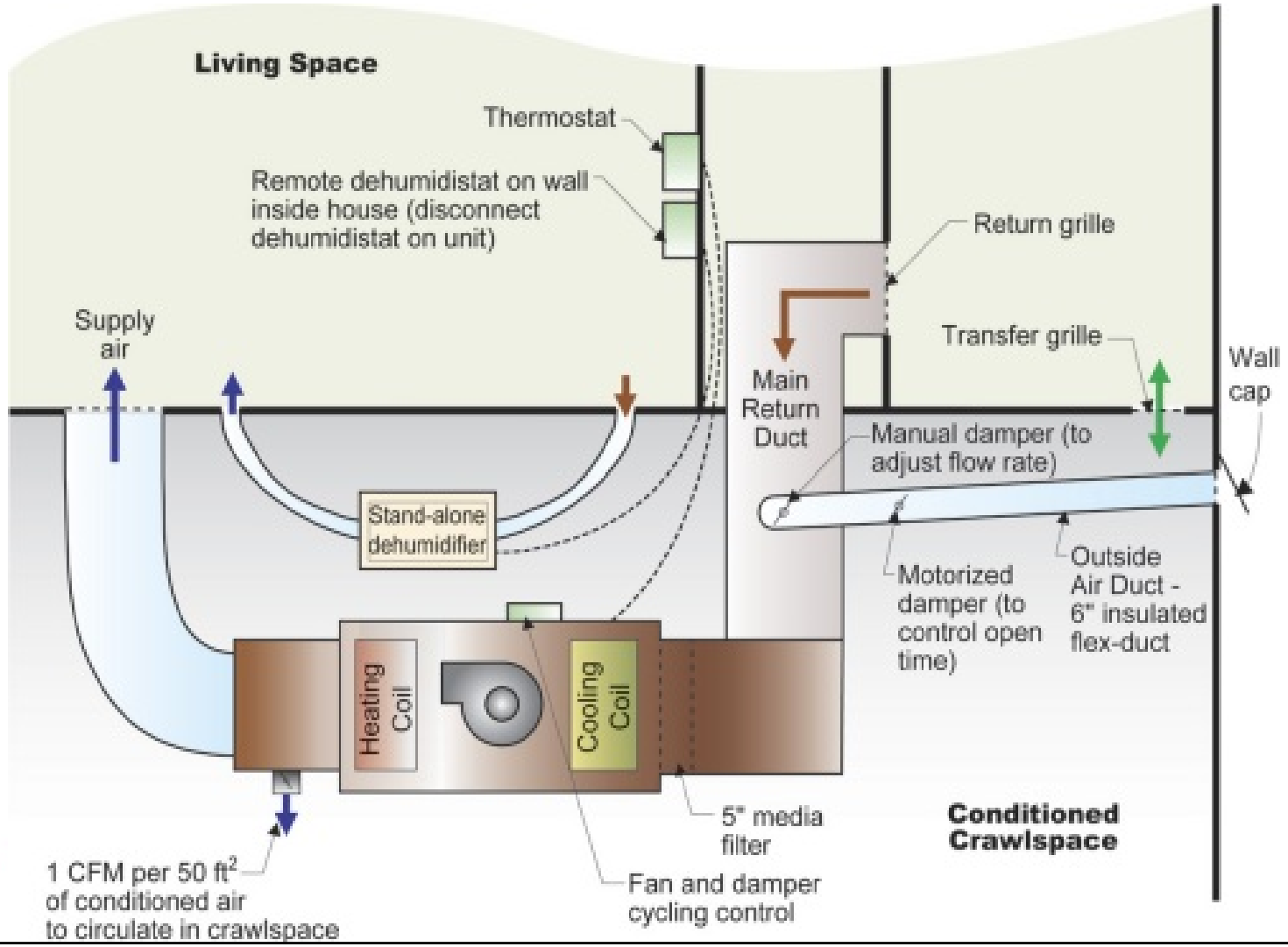
Positive Ventilation Supplied via O.A. Ducted to Return



Heat Flow

- **Conduction** is heat flowing through a *solid* material
- **Convection** is the transfer of heat by the movement of gases or liquids *(air)*
- **Radiation** is the movement of heat energy through space from a hot *surface* to a cold *surface*, and requires no transfer medium (air, water, etc.)

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Conduction

- **Conduction** is heat flowing through a solid material (insulation slows conduction)

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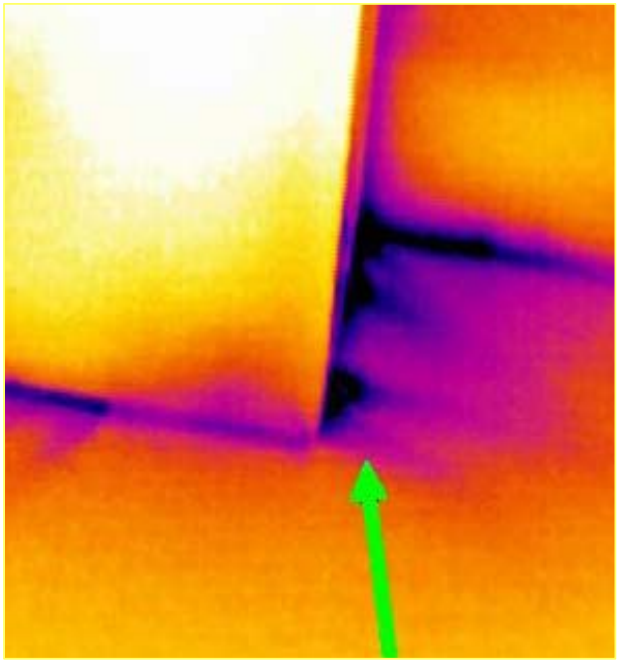
Convection

- **Convection** is the transfer of heat through air (air barriers slow convection)



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Radiation

Radiation is the movement of heat from a hot surface to a cold surface with nothing solid or opaque in between (low-emitting surfaces slow radiation)

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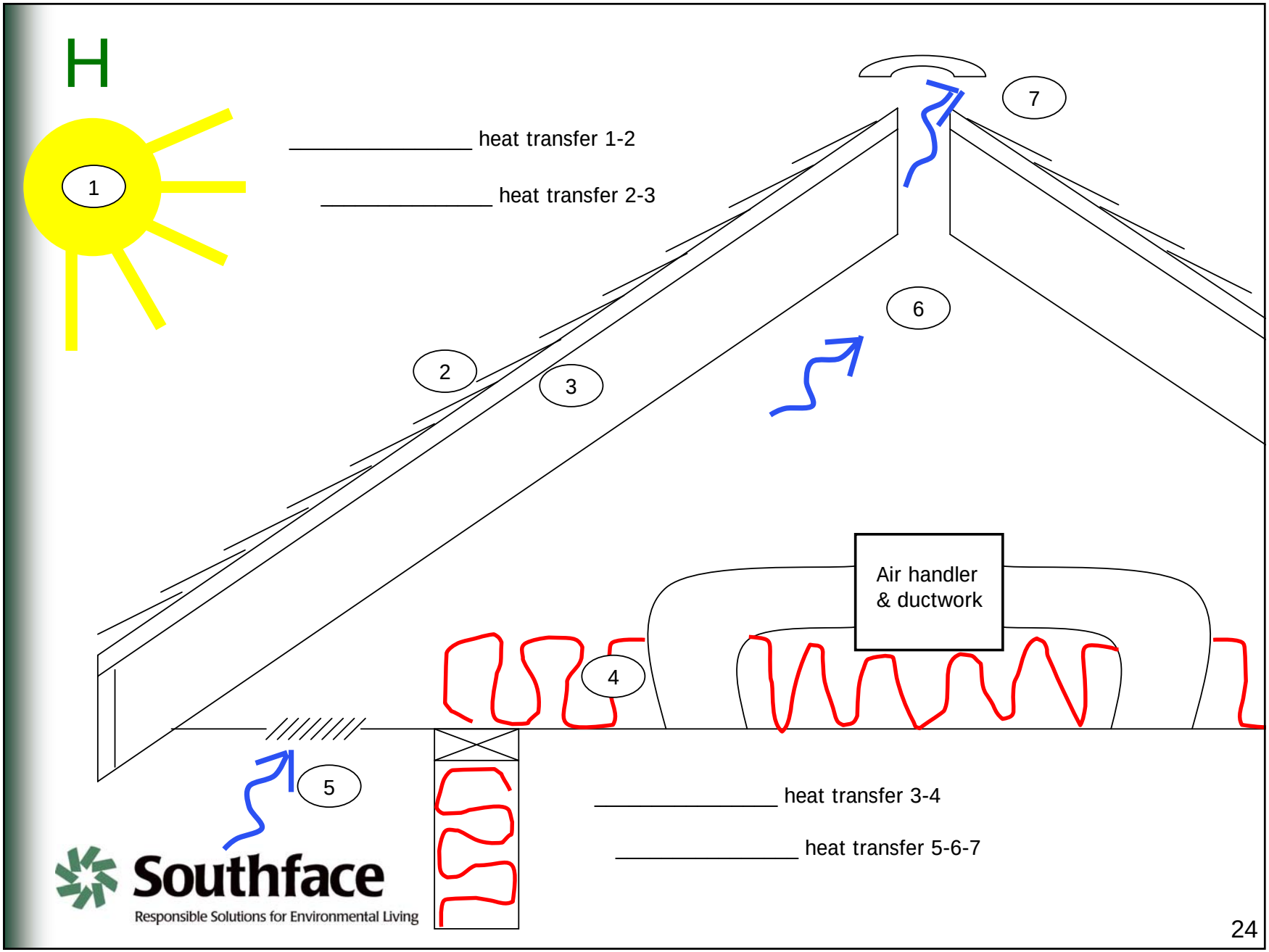
H
1
_____ heat transfer 1-2
_____ heat transfer 2-3
2
3
4
5
6
7
Air handler
& ductwork
_____ heat transfer 3-4
_____ heat transfer 5-6-7
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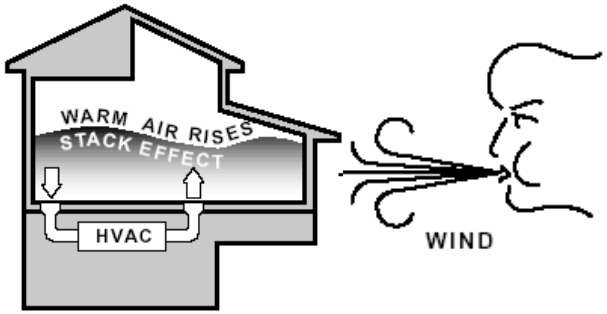
Air Leakage Requirements

Conditions for Air Infiltration

- Pressure difference (high to low)
- Penetrations in building envelope (holes)

Driving Forces

- Temperature difference (stack effect)
- Wind
- Mechanical systems



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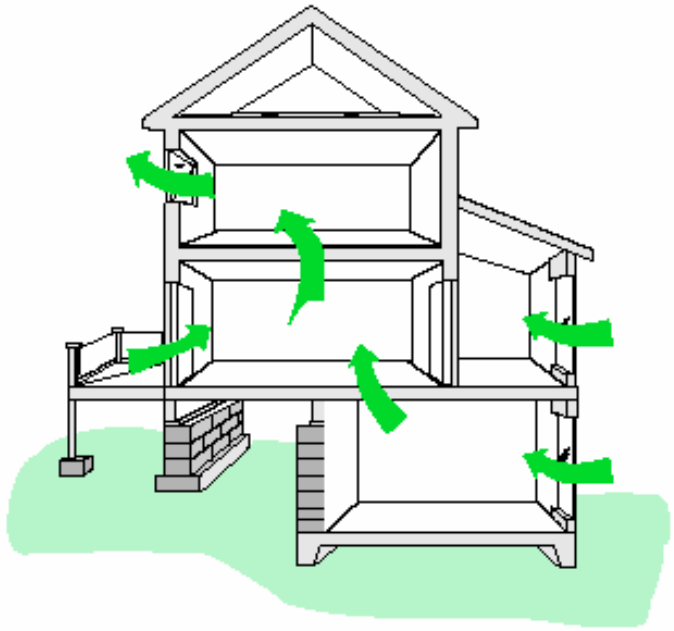
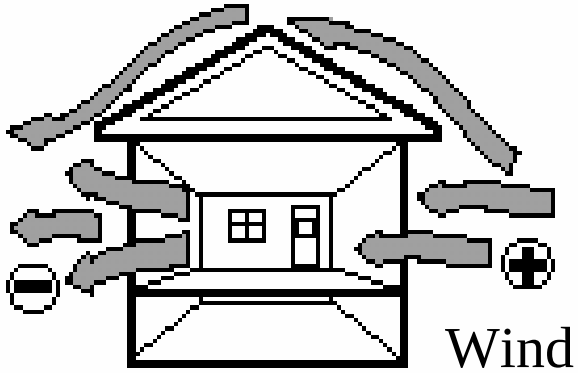
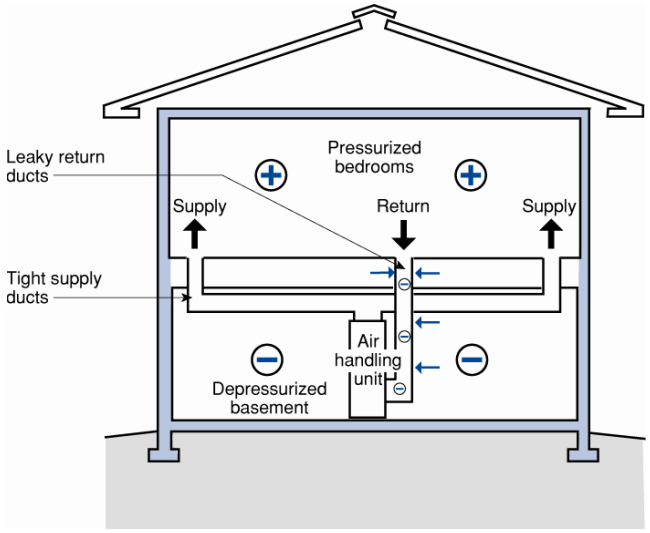
Driving Forces for Air Movement



Stack Effect



Wind



Mechanical Systems

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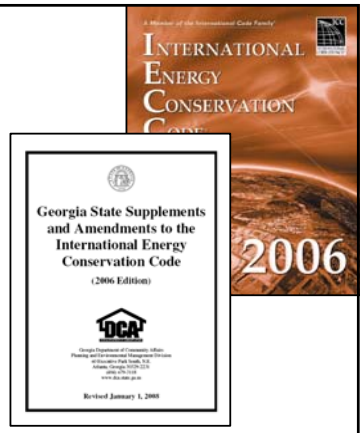
Energy Code Compliance Pathways



Basic Requirements

Insulation & Window Requirements

2006 IECC (prescriptive chart)

RESCheck (free software)

Section 404 (annual simulation)

Plan Review and Field Inspection

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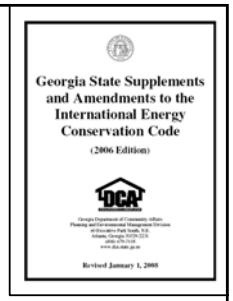
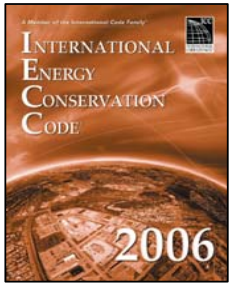
402-Building Thermal Envelope

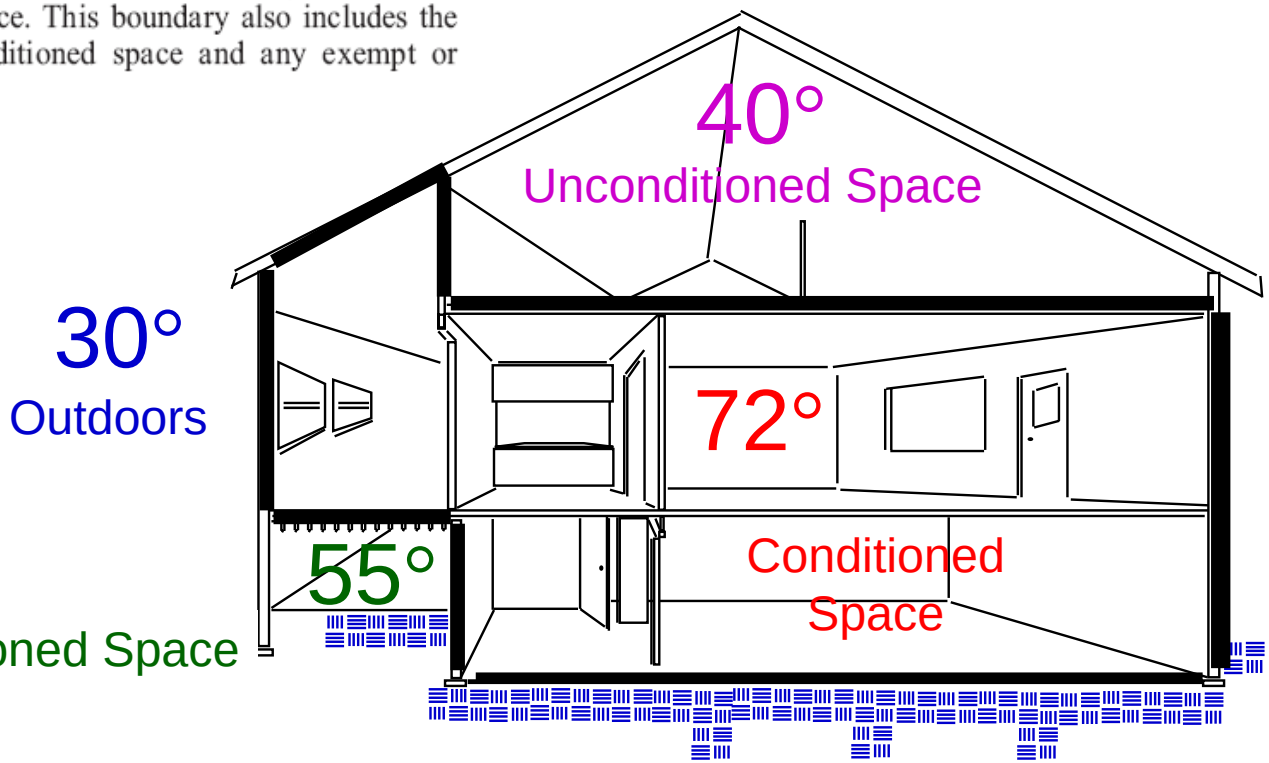


Building Thermal Envelope — The basement walls, exterior walls, floor, roof, and any other building element that encloses conditioned space. This perimeter also includes the boundary between conditioned space and any exempt or unconditioned space. —*2006 IECC*

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.

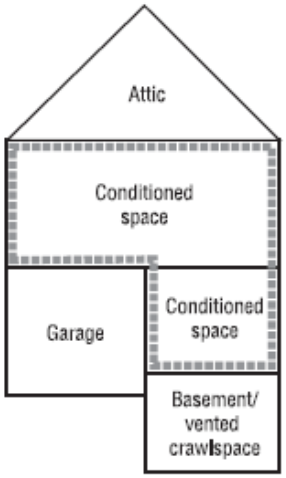
BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof, and any other building element that enclose conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space.





Building Envelope
- Appendix B

Example 1



This is a conventional approach that likely locates all ductwork in unconditioned spaces.

Example R-values

Flat ceiling: R-30

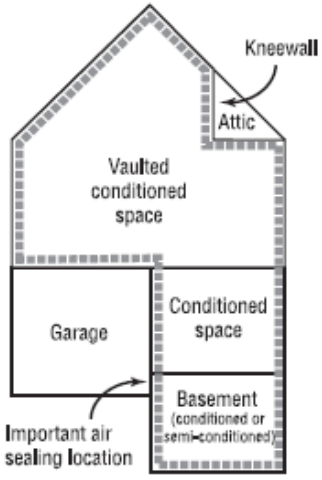
Exterior walls: R-13 + R-3 sheathing

Floor over garage and basement/crawl: R-19

Ductwork sealed with mastic and insulated to R-8

Garage[4], attic and basement/ crawl are unconditioned spaces

Example 2



If supply registers deliver conditioned air to basement, it is considered conditioned. With no supply air, it is considered a semi-conditioned space.

Example R-values

Flat ceiling: R-38

Kneewalls[1]: R-18 (required) (R-13+ R-5, R-15 + R-3, R-19 in 2x6)

Vaulted ceiling[2]: R-25

Exterior walls: R-13 + R-3 sheathing

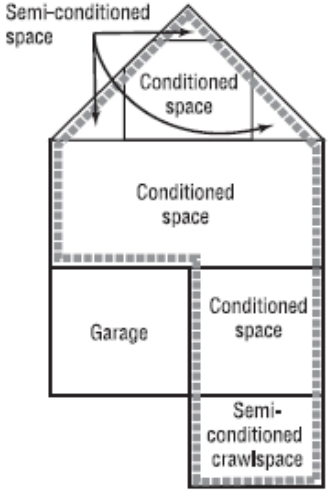
Basement masonry walls: R-5

Basement slab[3]: R-0

Ductwork sealed with mastic and insulated to R-8

Garage[4] and attic are unconditioned spaces

Example 3



The top conditioned floor functions as a vaulted ceiling with interior walls althought it appears to have kneewalls and a flat ceiling. An advantage of this approach is that all upstairs ductwork is located inside the building envelope.

The crawlspace walls are insulated and do not contain vents. The crawlspace ground is covered with concrete or 100% plastic to function as a "mini-basement."

Example R-values

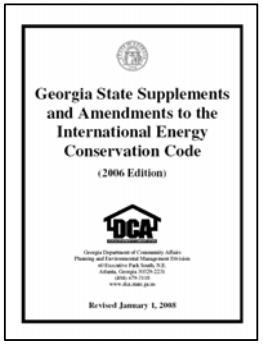
Vaulted ceiling[2]: R-19

Exterior walls: R-13 + R-3 sheathing

Crawlspace walls: R-5

Ductwork sealed with mastic and insulated to R-6

Garage[4] is unconditioned space

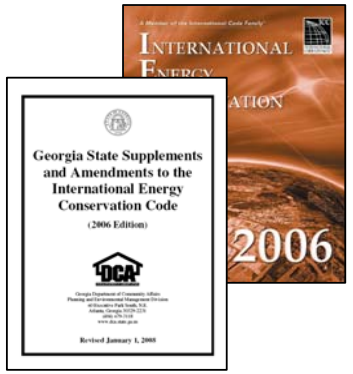

Georgia State Supplements and Amendments to the International Energy Conservation Code

(2006 Edition)

DCA

Revised January 1, 2008

Energy Code Compliance Pathways



Basic Requirements

Insulation & Window Requirements

2006 IECC (prescriptive chart)

RESCheck (free software)

Section 404 (annual simulation)

Plan Review and Field Inspection

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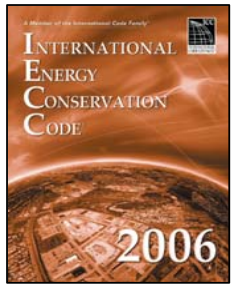
IECC 2006 - Section 402.1



- Biggest change is simplicity – one prescriptive "answer" for how to build in each climate zone
- Option for hourly energy simulation pathway (section 404)
- Mandatory provisions spelled out but similar (to IECC 2000)
- "Meat" of the code is only 4 pages (19-22)!

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	1.20	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5	19	0	0	5 / 13
4 except Marine	0.40	0.60	NR	38	13	5	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10 / 13	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10 / 13	10, 4 ft	10 / 13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2 × 6 cavity.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. The first *R*-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs.

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

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

g. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

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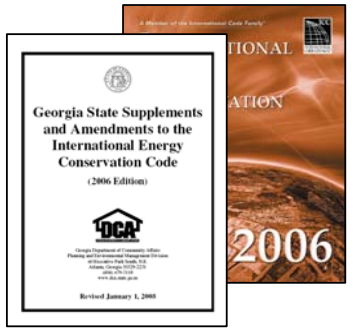
IECC 2006 - Section 402.1



- Revised table for GA – lots of footnotes

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT *U*-FACTOR[b]	GLAZED FENESTRATION SHGC[b]	CEILING *R*-VALUE[c]	WOOD FRAME WALL *R*-VALUE[d]	ATTIC KNEEWALL[e]
2	0.65	0.75	0.40	*R*-30 or *U*-0.030	*R*-13 or *U*-0.082	*R*-18 or *U*-0.065
3	0.65	0.65	0.40	*R*-30 or *U*-0.030	*R*-13 or *U*-0.082	*R*-18 or *U*-0.065
4	0.40	0.60	0.40	*R*-38 or *U*-0.025	*R*-13 or *U*-0.082	*R*-18 or *U*-0.065

CLIMATE ZONE	MASS WALL *R*-VALUE	FLOOR *R*-VALUE[f]	BASEMENT WALL *R*-VALUE[g,j]	SLAB *R*-VALUE AND DEPTH[h]	CRAWL SPACE WALL *R*-VALUE[i,j]
2	*R*-5 or *U*-0.141	*R*-13 or *U*-0.064	*R*-0 *U*-0.36	0	*R*-0 *U*-0.477
3	*R*-5 or *U*-0.141	*R*-19 or *U*-0.047	5/13 *U*-0.136	0	5/13 *U*-0.136
4	*R*-5 or *U*-0.141	*R*-19 or *U*-0.047	5/13 *U*-0.136	0	5/13 *U*-0.136

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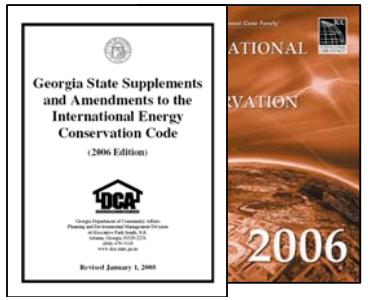
402.1 Footnotes



a. *R*-values are minimums. *U*-factors and SHGC are maximums. *R*-19 shall be permitted to be compressed into a 2 × 6 cavity. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration, including doors 50 percent or more glazed. One door or window (or up to 15 square feet [1.4 m^2] of glazed fenestration) may be exempt from meeting the *U*-factor and SHGC.

c. Ends and sides of ceiling joist cavity shall be blocked with an approved air barrier. Flat ceiling insulation shall be in contact with interior side of ceiling. Ceiling areas without attic space in Climate Zone 4 may be *R*-30 (maximum of 25 percent of ceiling area). For HVAC platform and floored access path areas, ceiling insulation may be reduced to *R*-19.

d. All vertical insulation shall be in substantial contact with an air barrier on all six (6) sides.

Exceptions:

1. Unfinished basements (insulation shall be restrained to stay in place).
2. On interior side of wall in Climate Zones 2 and 3 behind tubs, showers and fireplaces (insulation shall be restrained to stay in place).

e. *R*-13 + *R*-5, *R*-15 + *R*-3, or *R*-19 compressed into a 2 × 6 cavity is deemed to meet *R*-18 minimum requirement. Attic side shall have a sealed air barrier.

f. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking, and insulation ends shall be blocked. Cantilevered floors shall be *R*-30 and band area above exterior wall shall be blocked.

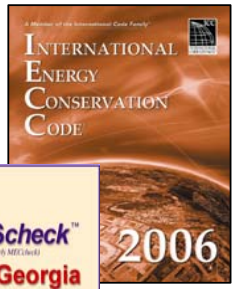
g. *R*-5 is mass and *R*-13 is cavity and band. For basements with no direct conditioning, either the floor or all of the basement walls shall be insulated. For basements with direct conditioning, all of the basement walls shall be insulated.

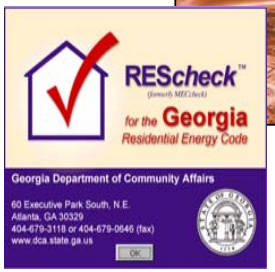
h. Unheated slabs. Heated slabs shall have exterior edge insulated to *R*-5 to a depth of 2 feet (610 mm). Insulation located below grade shall be in compliance with Section 402.2.7.

i. See Section 402.2.8 of these Georgia State Supplements and Amendments.

j. Consideration should be given for mold, moisture, and for termite inspection and treatment.

IECC 2006 – Section 402.1.4





- Equivalency using UA approach (REScheck)

402.1.4 Total UA alternative. If the total building thermal envelope UA (sum of *U*-factor times assembly area) is less than or equal to the total UA resulting from using the *U*-factors in Table 402.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table 402.1.1. The UA calculation shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance.

TABLE 402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	1.2	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.06	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.059	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

South GA
Middle GA
North GA

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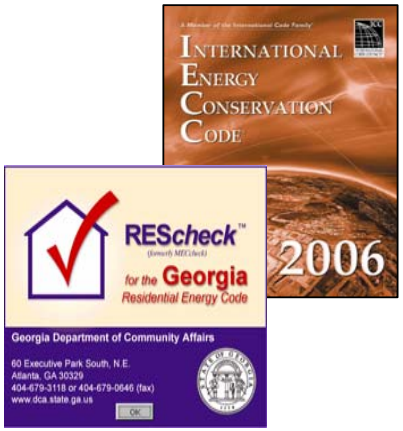
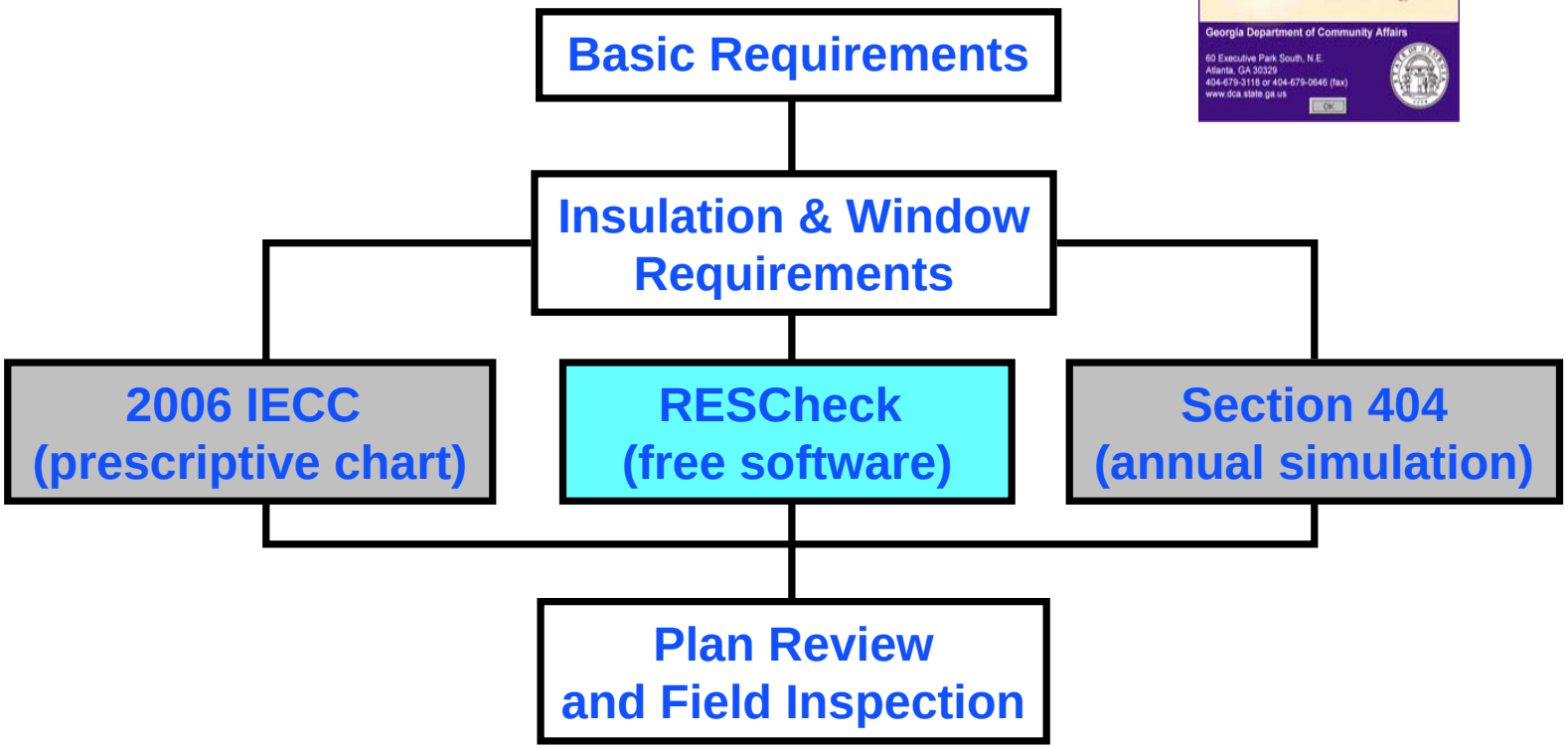
Compliance Paths for Insulation and Windows





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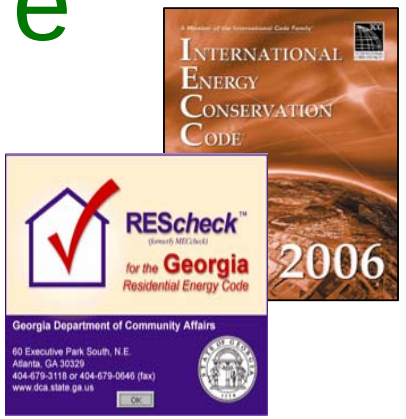
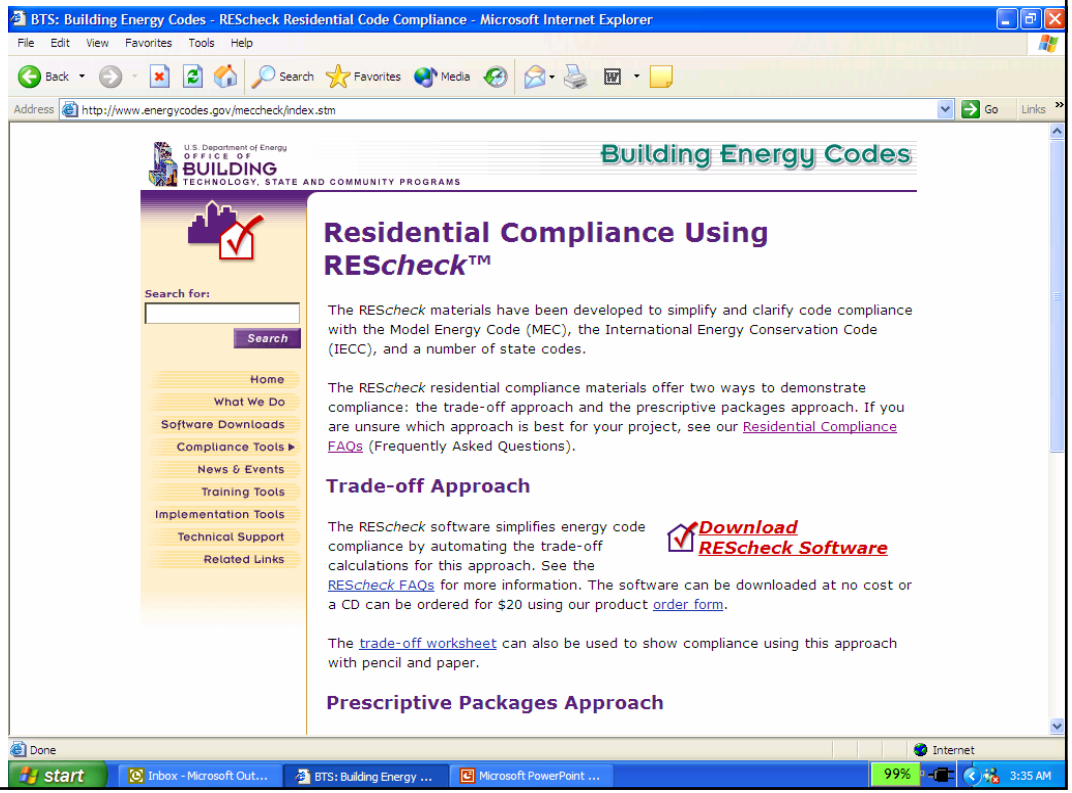
RES*check*™ Software

www.energycodes.gov



- Software evaluates specific designs quickly
- Demonstrates SHGC compliance
- Allows trade-offs
  - Building envelope components
  - Heating and cooling equipment efficiencies



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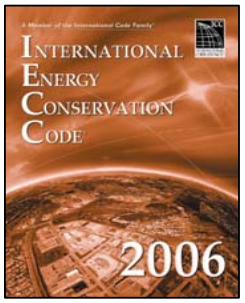
Section 402.2 Specific Insulation Requirements



- Details for insulating various aspects of the building envelope
  - Ceilings with Attic – 402.2.1
  - Ceilings without Attic – 402.2.2
  - Mass Walls – 402.2.3
  - Steel Framing – 402.2.4
  - Floors – 402.2.5
  - Basement Walls – 402.2.6
  - Slab-on-grade – 402.2.7
  - Crawlspace Walls – 402.2.8
  - Masonry Veneer – 402.2.9
  - Sunrooms – 402.2.10

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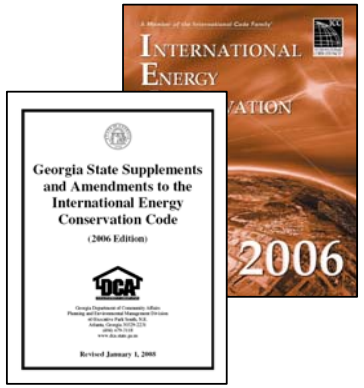
402.2.1 - Ceilings with Attics

- In CZ4, the R-38 may be reduced to R-30 if full-height over the top plate

402.2.2 - Ceilings without Attics

- In CZ4, the R-38 may be reduced to R-30 if there is not sufficient room for R-38 (up ~~to 500 s~~.f. 25% of the ceiling area may be exempt)



☞Vaulted ceilings and foam sprayed rooflines would need to perform an R-value trade-off

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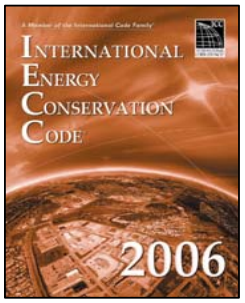
402.2.3 – Mass Walls



- Mass walls (concrete block, concrete, insulated concrete forms, masonry cavity, brick (other than veneer), earth (adobe, compressed block, rammed earth) and solid timber/logs
- R-value must be either exterior or integral and meet requirements of table (adding R-6 in CZ2 or R-8 in CZ3) or else meet frame wall requirements

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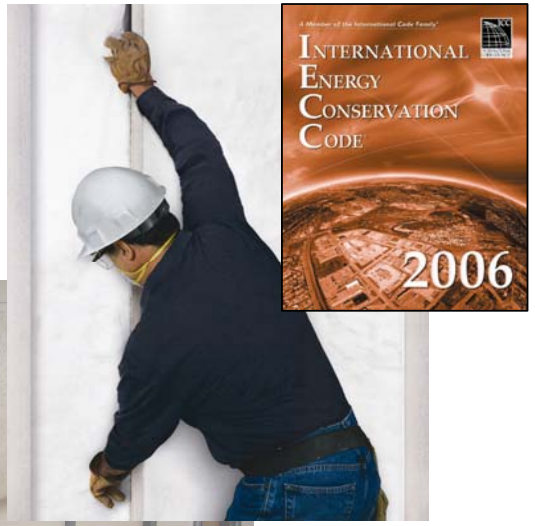
402.2.4 – Steel Framing

- Steel framing – equivalency charts adjust for thermal bridging (see Table 402.2.4)



402.2.5 – Floors

- Floors – insulation must be permanently installed against subfloor

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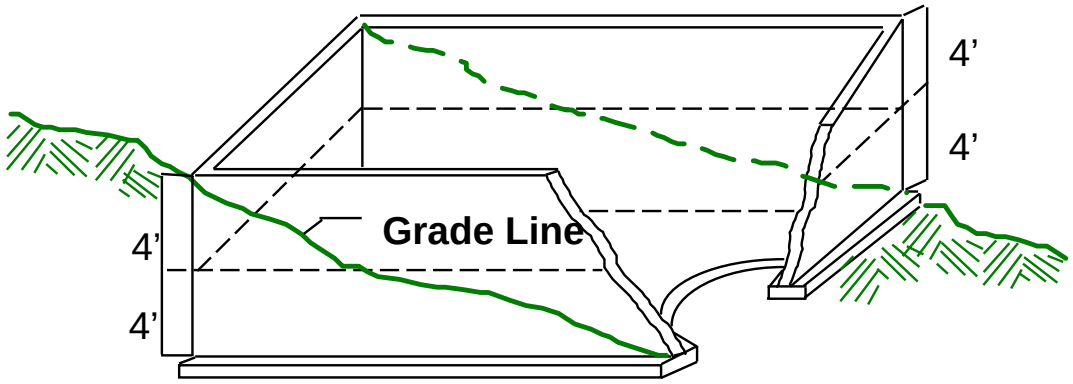
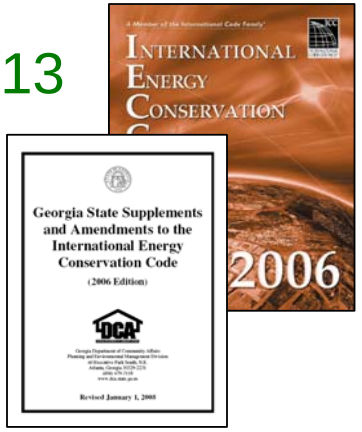
402.2.6 Basement Walls Min. R-5/13





- Basement Wall – Average gross wall must be at least 50% below grade and enclose conditioned space
- CZ 3 & 4 requires R-5 continuous or R-13 in cavity

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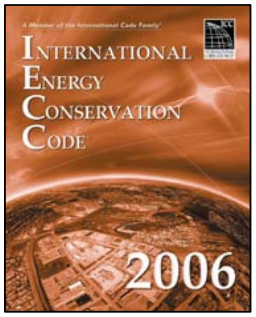
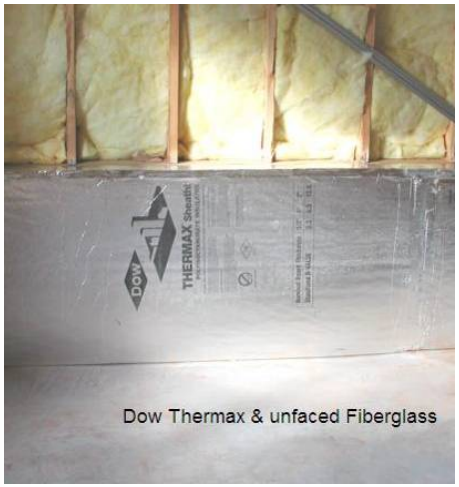
402.2.6 – Basement Walls

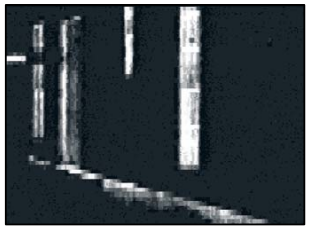


- Basement walls – top ten feet insulated, CZ3 & 4



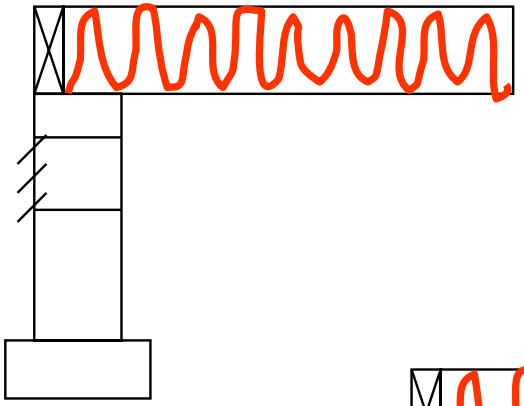
402.2.7 – Slab-on-grade

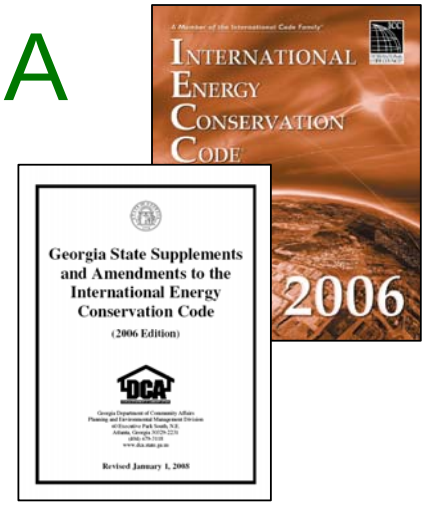
- Slabs – only CZ4 required insulation, but termite exemption includes all of GA
- R-5 added to R-value for heated slab

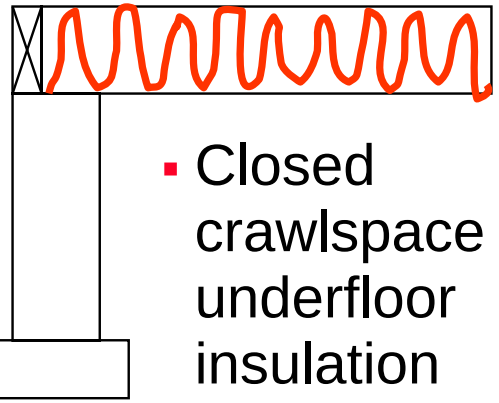


3 Crawlspace Options in GA

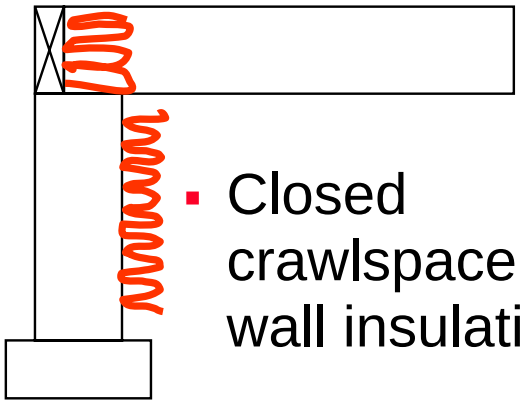
- Standard vented crawlspace - underfloor insulation







- Closed crawlspace - underfloor insulation



- Closed crawlspace with wall insulation

- **Note**: all crawspaces must meet vapor retarder requirements, as per IRC

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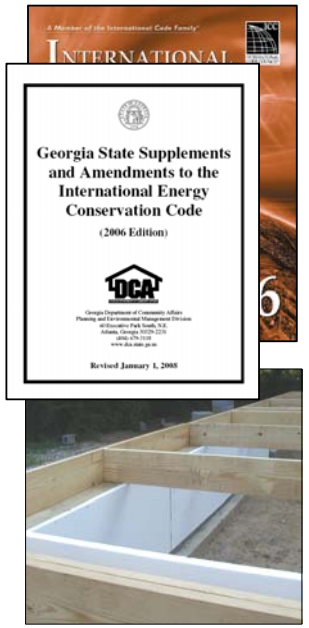
IECC 2006 – Section 402.2.8

- Crawlspace Walls



402.2.8 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 vapor retarder (minimum 6-mil [0.15 mm]). 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.

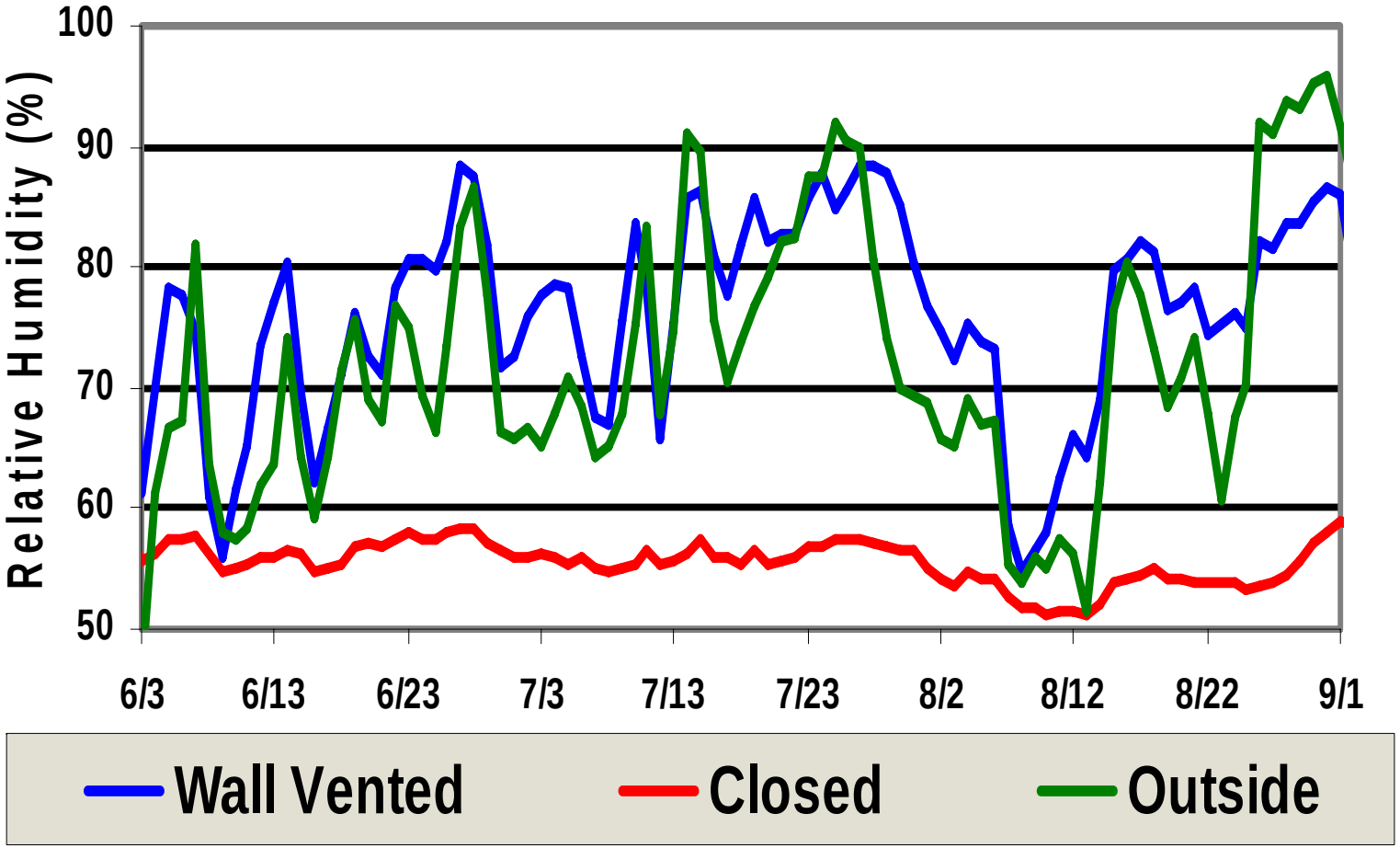
- 3” inspection view strip

(optional removable insulation “plugs”, with approval)

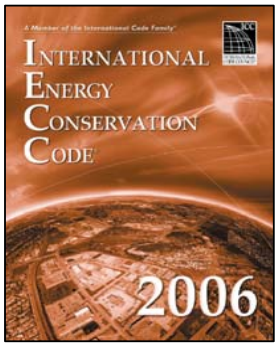
- Complete plastic sealed to walls
- 9” to finished grade

Crawlspace Moisture Levels

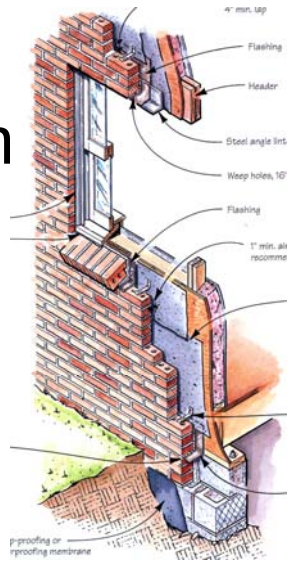
Summer 2002



IECC 2006 – Section 402.2.9



- Masonry veneer – horizontal insulation not required (insulation exception for brick ledge)



Section 402.2.10

- Sunrooms (thermally isolated insulation) - details

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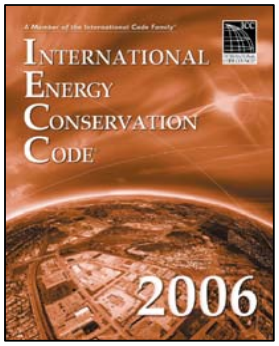
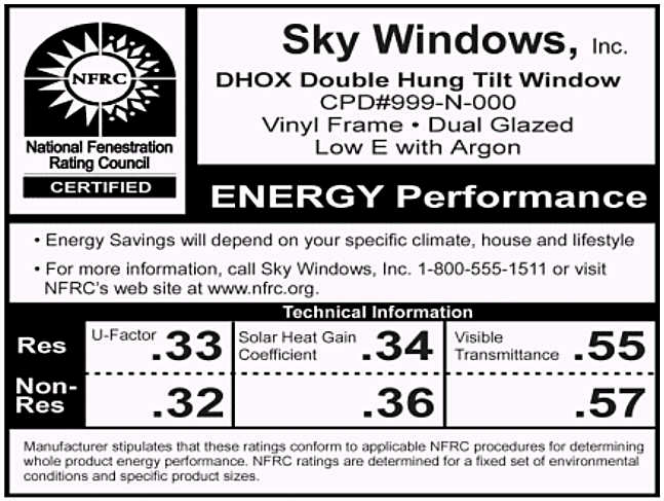
IECC 2006 – Sections 402.3



- Fenestration (windows and doors)
  - U-factors and SHGC from table – low-e effectively required
  - Exempt - 15 sq. feet from U & SHGC plus one opaque door
  - 402.6 - Area weighted average SHGC is 0.5 when modeling (Section 404)
  - Replacement glazing must comply



<<Sample Window Label of DEFAULT Energy Performance Values>>

DEFAULT Window Label	**Manufacturer/Assembler Certifying to Default U-factor and Default SHGC: XYZ Supply Co.**
Key Features:	Double Pane
	Operable
	Wood frame
	Bronze Tint
U-FACTOR	**SHGC**
Default U-factor (from Table 102.5.2(1)):	**Default SHGC (from Table 102.5.2(3)):**
0.55	**0.46**

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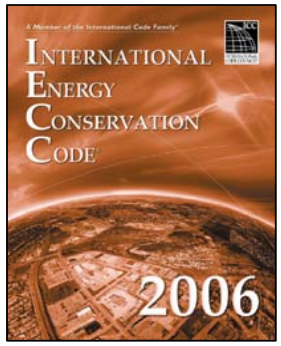
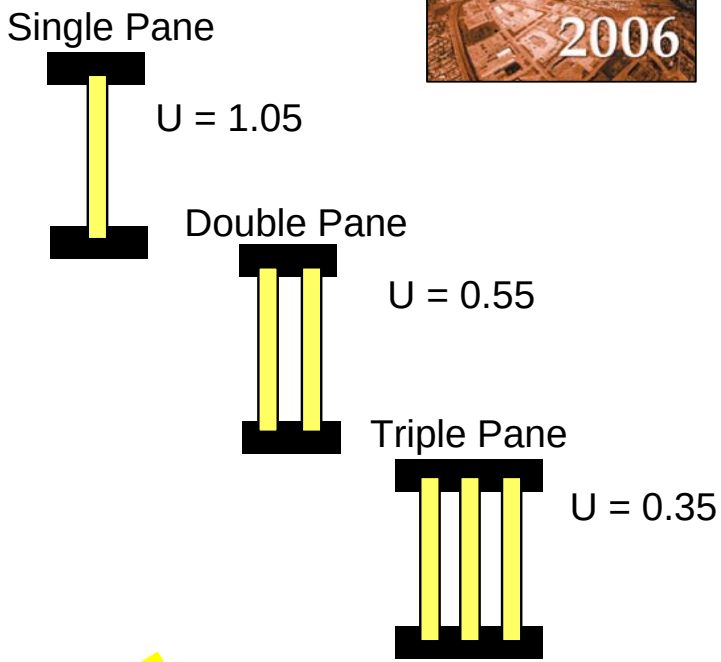
Fenestration U-factors



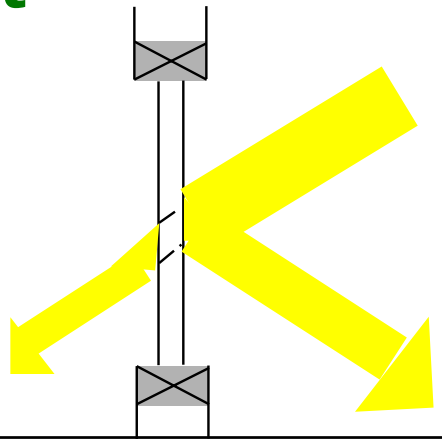
- Lower U-factor means better insulated (U = 1/R)
- U-factor applies to

  windows, skylights, doors



Solar Heat Gain Coefficient

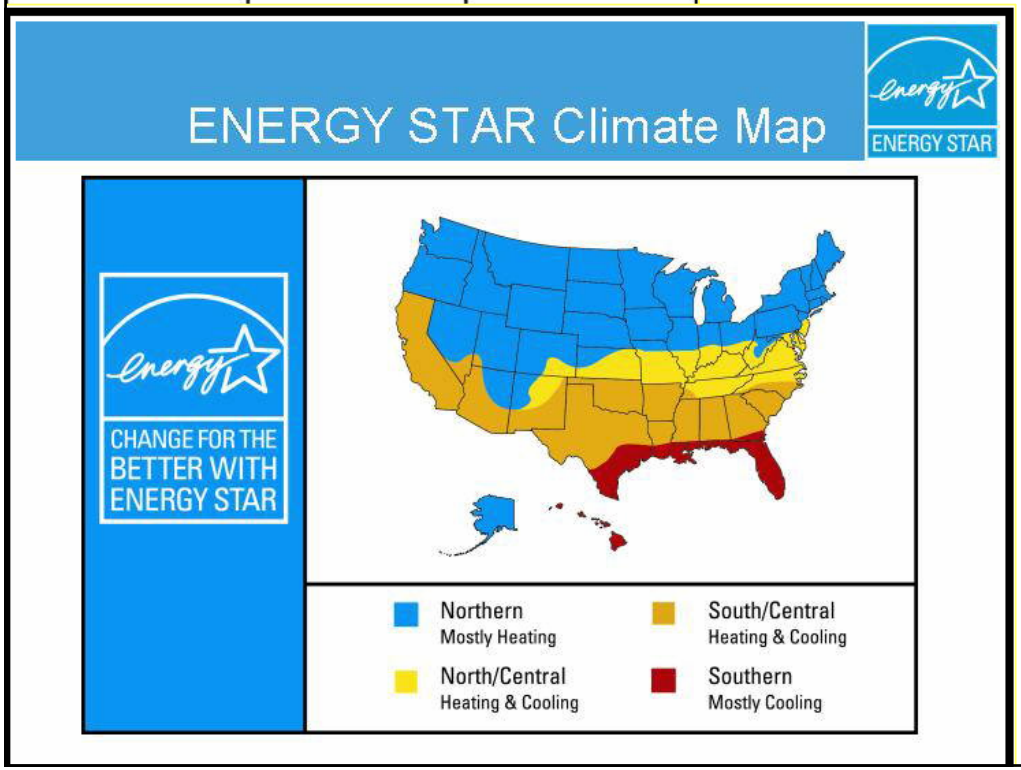
- DP clear glass
  SHGC: ~ 0.6
- DP low-e
  (low solar gain)
  SHGC: < 0.4



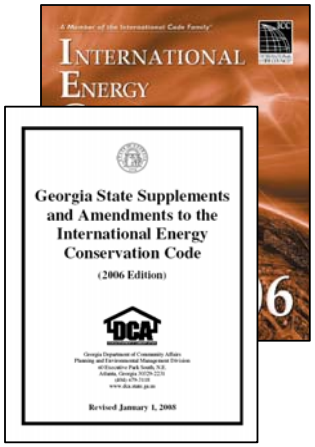
ENERGY STAR Criteria

ENERGY STAR® Qualification Criteria WINDOWS AND DOORS		
Zone	U-factor	SHGC
Northern	≤ 0.35	Any
North/Central	≤ 0.40	≤ 0.55
South/Central	≤ 0.40	≤ 0.40
Southern	≤ 0.65	≤ 0.40

- Almost all windows sold in GA meet ENERGY STAR

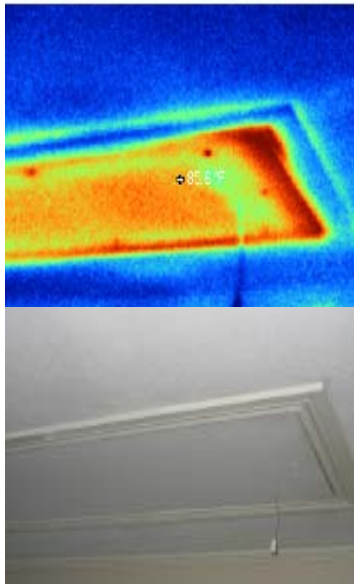


402.3 Fenestration Requirements



- Maximum fenestration U-factor = 0.65
  - Area weighted average of fenestration
- Maximum SHGC = 0.40 for all *glazing*
  - 1. Show compliance by having all glazing be <= 0.40
  - 2. Perform REScheck weighted average trade-off
  - 3. Use REScheck to take credit for large overhangs and/or solar shade screens with clear glazing
- 15 square feet exemption for decorative glazing
  - Permits modest amount of stained glass, transom windows, etc.
- Opaque door exemption
  - One opaque door is exempt from U-factor requirements
- Sunrooms
- Replacement fenestration –must meet code
- Weather-stripped access doors –includes hatches/scuttle hole covers

Attic Hatch



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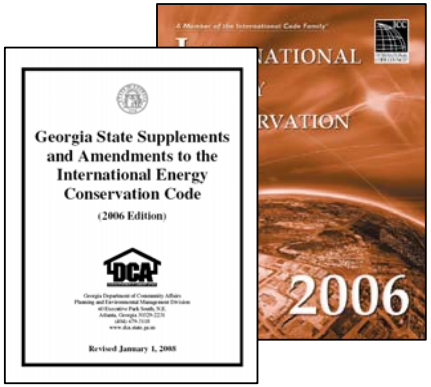
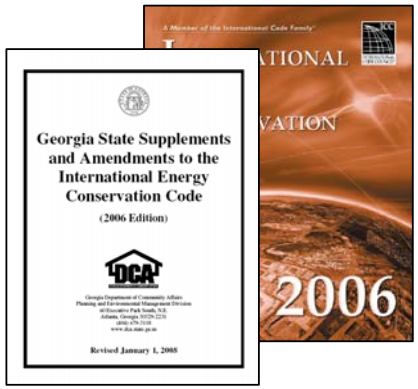
Access to Attics

- Weather-stripped access doors –includes kneewall doors, pull-down stairs, and hatches/scuttle hole covers
- R-values for hatches R-19
- Kneewall doors R-3
- Pull-down stairs R-3



Responsible Solutions for Environmental Living

IECC 2006 – Section 402.4



- Air Sealing
  - Detailed list
  - Fenestration
  - IC-rated fixtures (option 3 is eliminated)
  - Air barrier leakage criteria in Section 402.4.4
- Appendix A for details on techniques for air sealing –now in flip book format

402.4 Air leakage. (Mandatory).

402.4.1 Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Other sources of infiltration.

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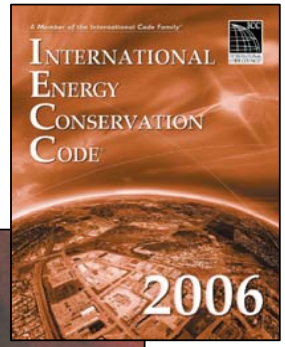
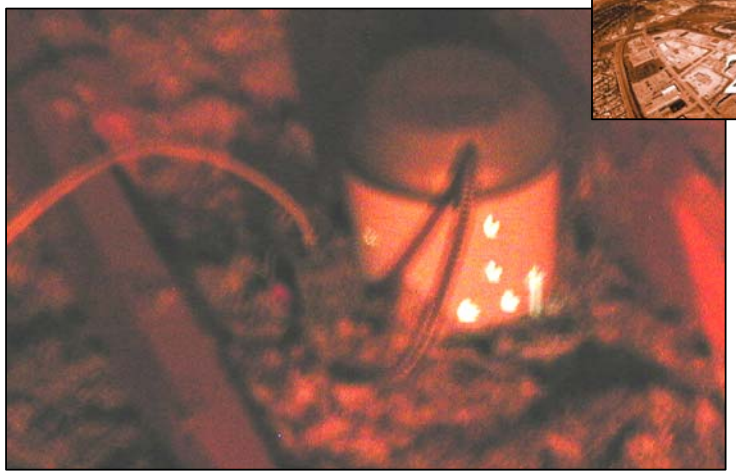
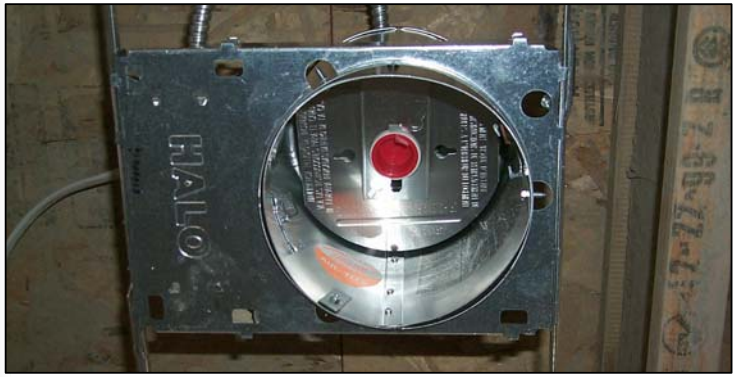
402.4.1 Recessed Lights

Option 1 & 2 only: Must be airtight, IC-rated





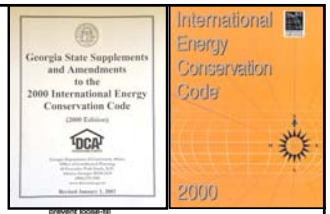
Standard Can Light



Airtight, IC-rated

After drywall

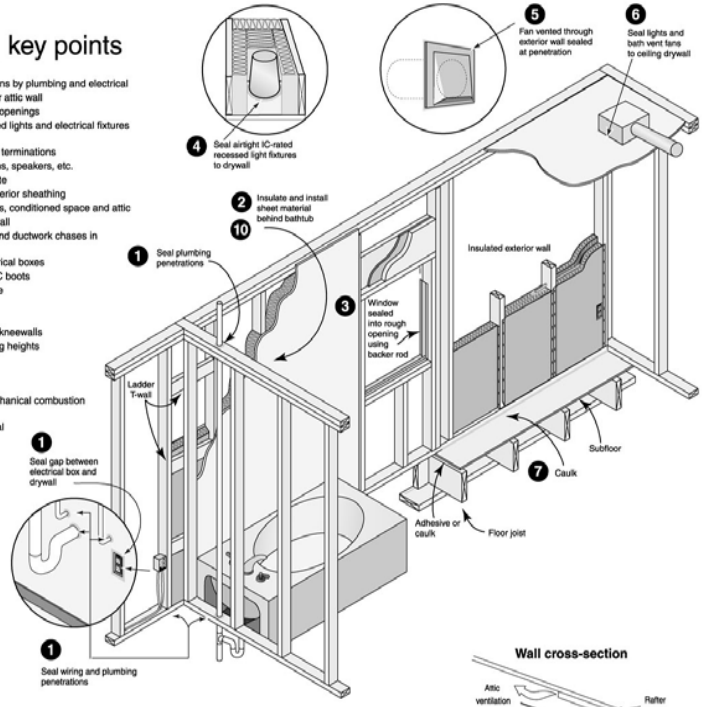
Old Code – Appendix B

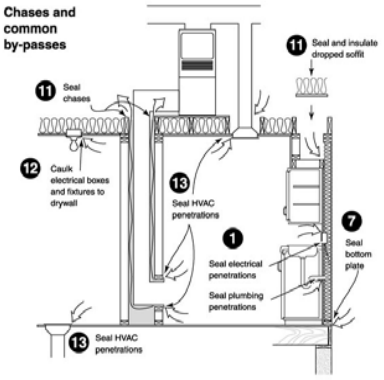


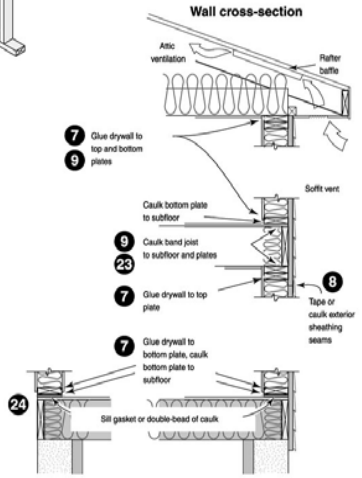
Appendix

Air sealing key points

1. Plate and wall penetrations by plumbing and electrical
2. Tub/shower on outside or attic wall
3. Window and door rough openings
4. Airtight, IC-rated recessed lights and electrical fixtures exposed to attic
5. Exterior wall exhaust fan terminations
6. Ceiling mounted bath fans, speakers, etc.
7. Bottom plate and top plate
8. Seams between rigid exterior sheathing
9. Band area between floors, conditioned space and attic
10. Garden tub on exterior wall
11. Mechanical equipment and ductwork chases in attics, crawlspaces
12. Ceiling/crawlspace electrical boxes
13. Ceiling/crawlspace HVAC boots
14. Shower and tub drain line
15. Fireplace inserts
16. Attic kneewall doors
17. Joist cavities under attic kneewalls
18. Transition between ceiling heights (e.g., 10' to 8')
19. Attic scuttle hole
20. Attic pull-down stairs
21. Wall penetrations of mechanical combustion closets
22. Thresholds at mechanical combustion closet doors
23. Band joist exposed to exterior
24. Band area exposed to unconditioned space (such as basement or garage)
25. Exterior wall penetrations for refrigeration lines, condensate line, etc.

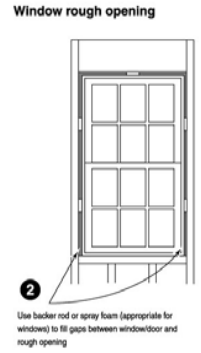


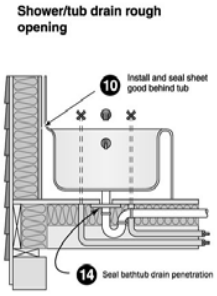


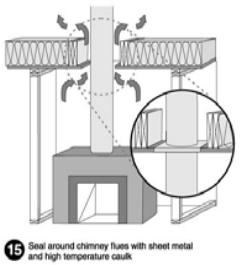


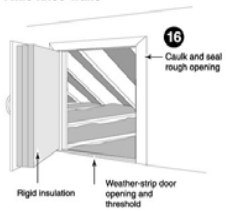
Appendix

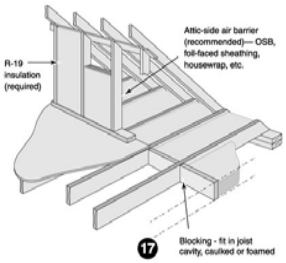
Air sealing key points *continued*

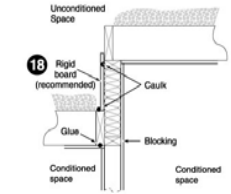




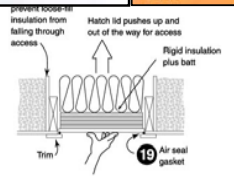


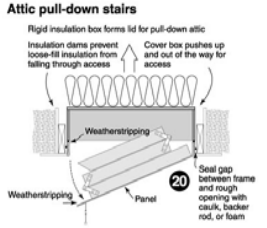


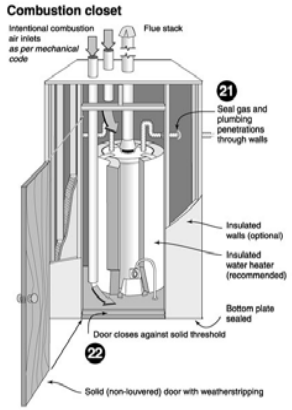


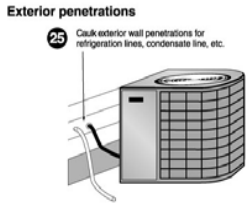


Disclaimer:
This document is intended solely to help graphically demonstrate the air leakage provisions of section 502.1.4 of the 2000 IECC. It does not cover all airsealing locations or techniques. Other code provisions may be applicable as well.

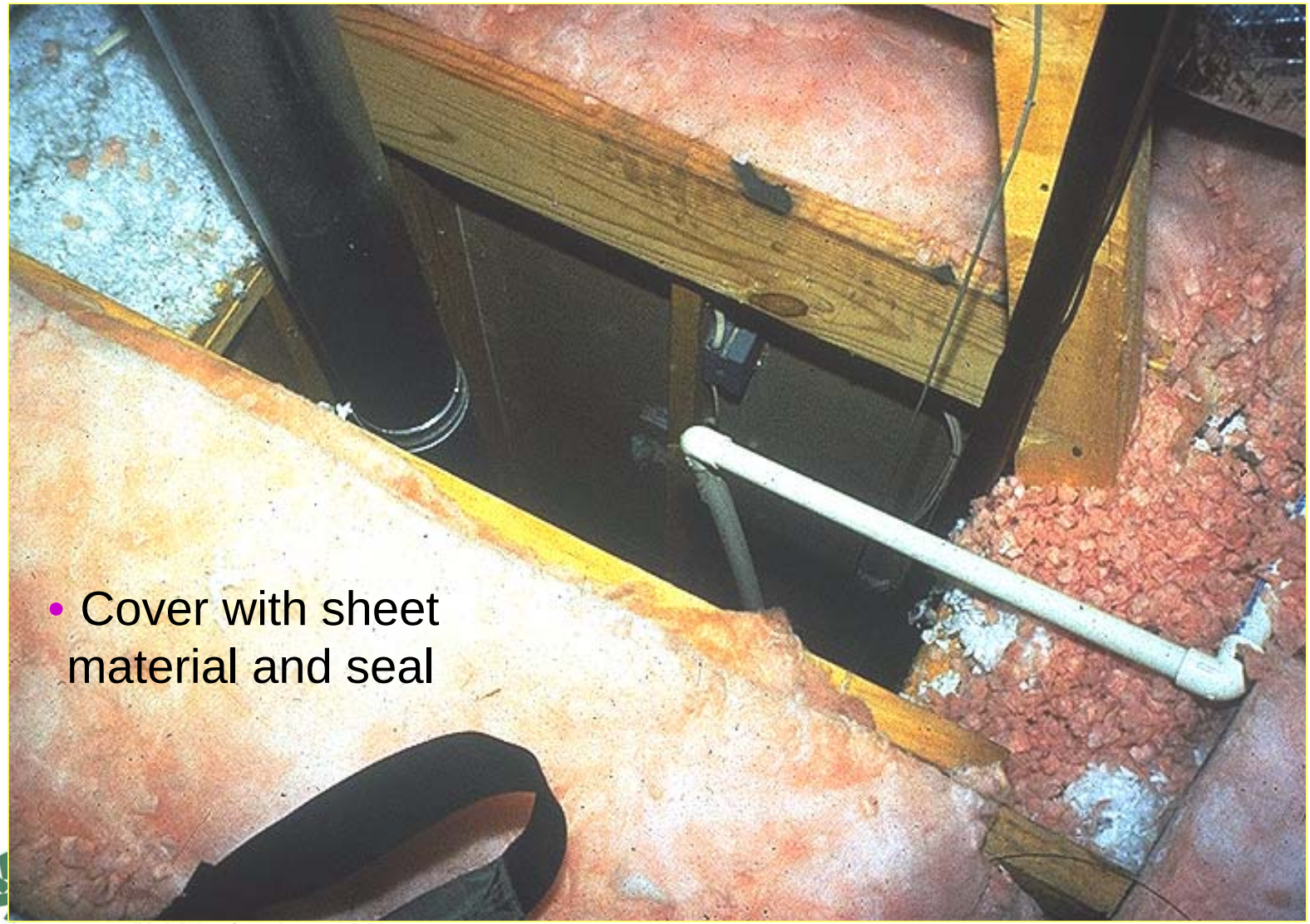








No BIG Holes!



- Cover with sheet material and seal

New Code – Appendix A

(page 1)

Air sealing key points

1. Building envelope plate and wall plumbing and electrical penetrations
2. Tub/shower on outside or attic wall
3. Window and door rough openings
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6. Ceiling mounted bath fans, speakers, etc.
7. Bottom plate and top plate
8. Seams between rigid exterior sheathing
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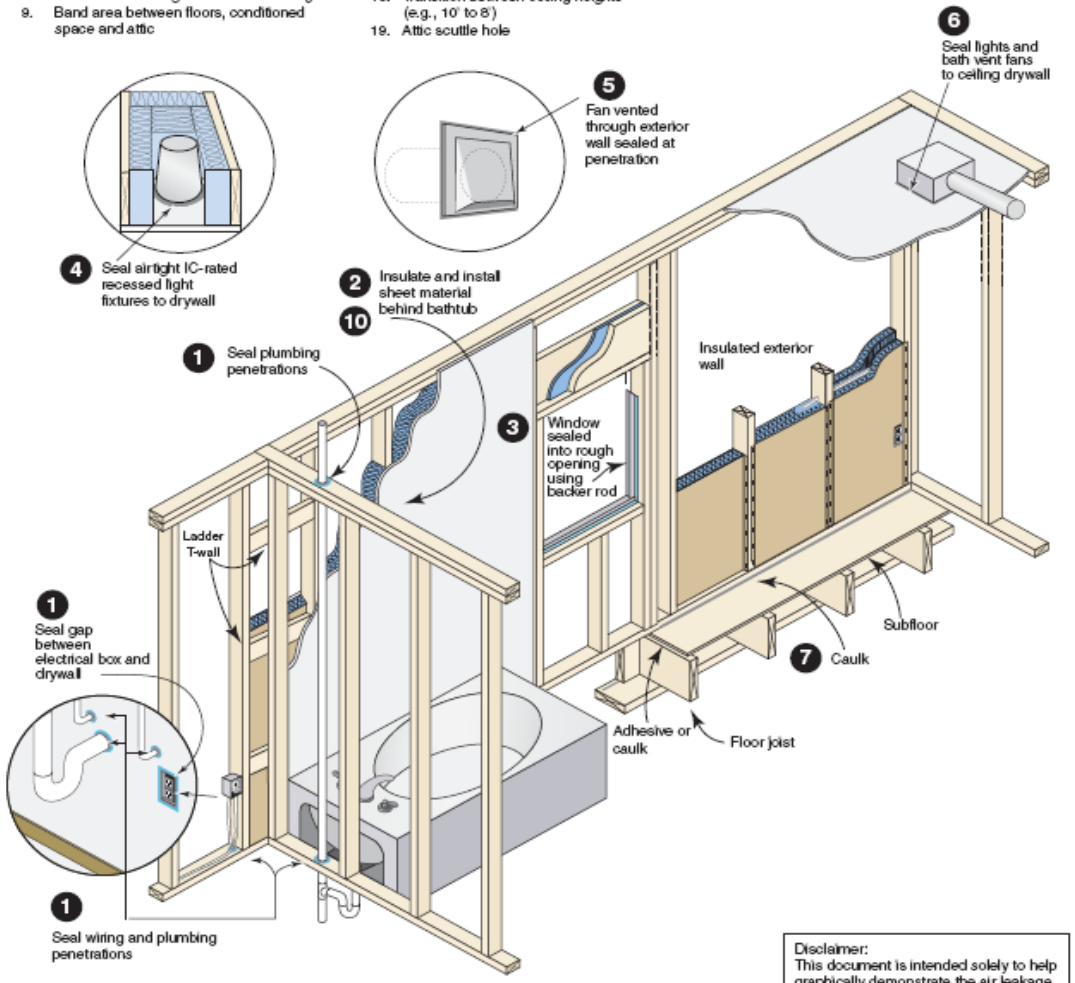

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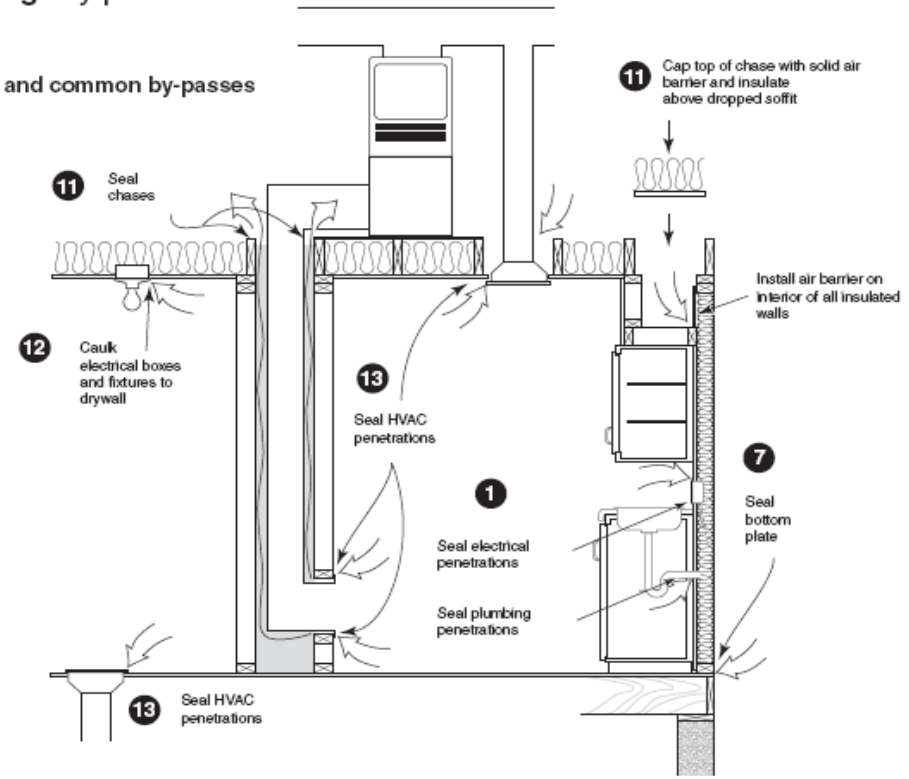
New Code – Appendix A

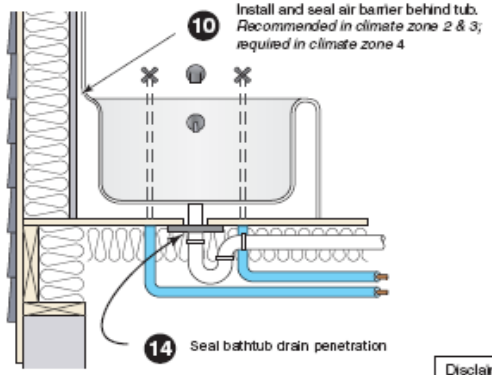
(page 2)

Air sealing key points *continued*

Chases and common by-passes



Shower/tub drain rough opening



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Air Sealing Blocking & Sheathing

Solid sheet behind tubs & showers on insulated walls

•*Callback waiting to occur*

•*Call back prevention*

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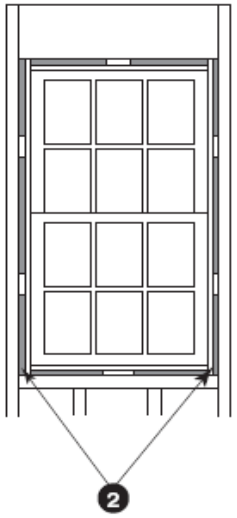
Responsible Solutions for Environmental Living

New Code – Appendix A

(page 3)

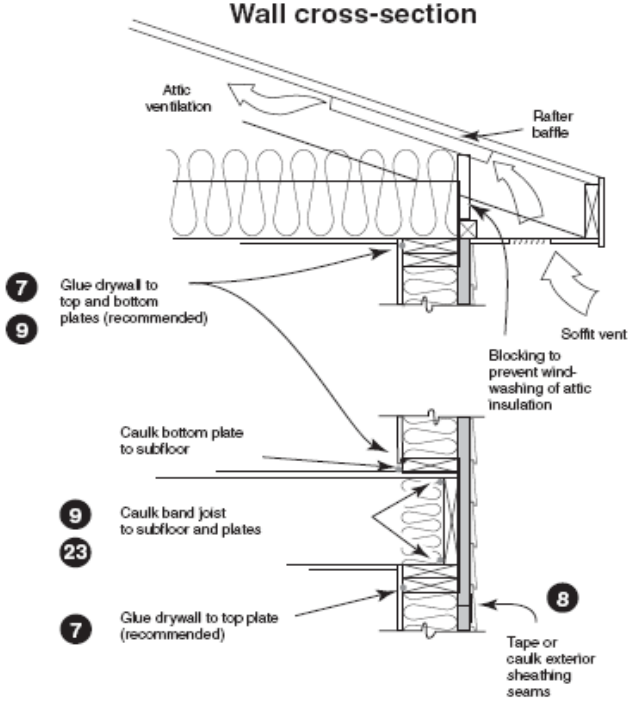
Air sealing key points *continued*

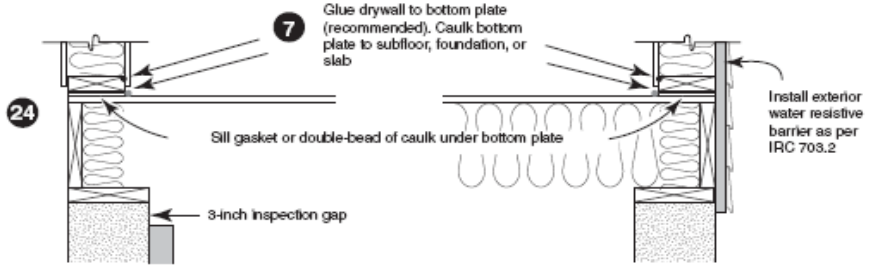
Window rough opening



Use backer rod or spray foam (appropriate for windows) to fill gaps between window/door and rough opening

Wall cross-section





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for Environmental Living

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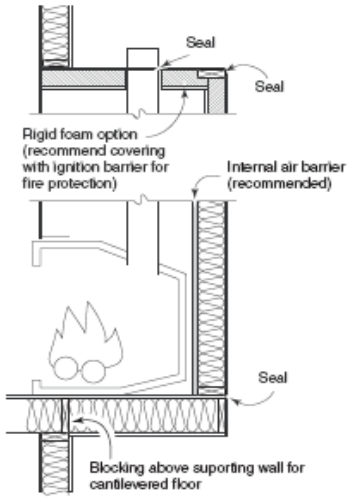
New Code – Appendix A

(page 4)

Air sealing key points *continued*

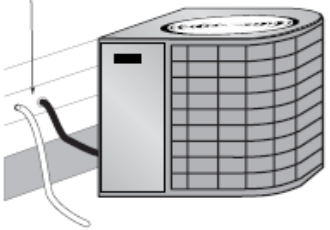
Combustion chase penetrations



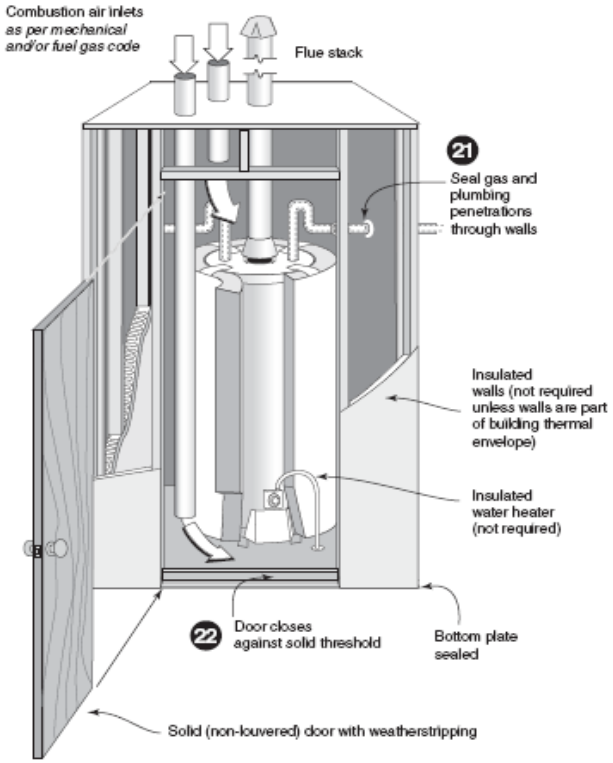
15 Seal around chimney flues with sheet metal cap

Exterior penetrations

25 Caulk exterior wall penetrations for refrigeration lines, condensate line, etc.



Combustion closet



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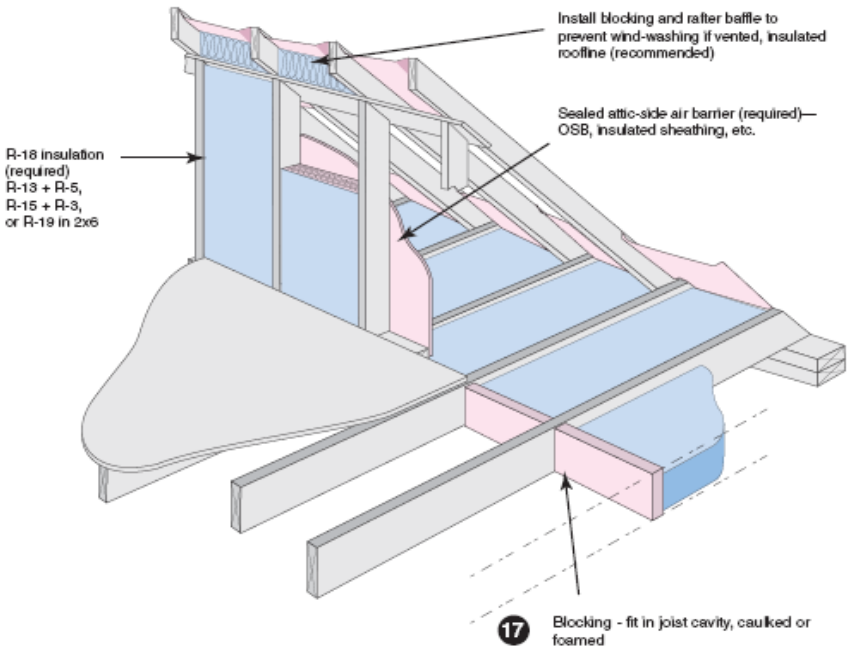
New Code – Appendix A

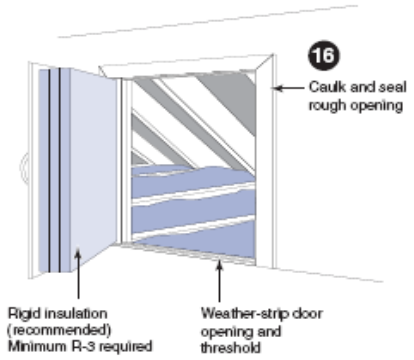
(page 5)

Attic Kneewalls
(min. R-18 with attic-side air barrier required)

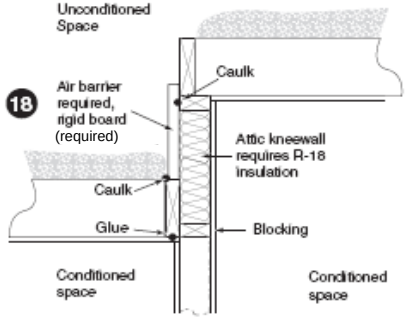
Air sealing key points *continued*



Attic knee-walls



Two-level attic



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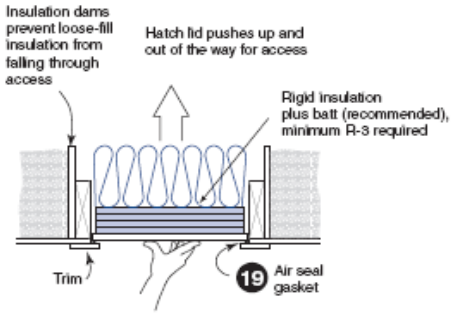
New Code – Appendix A

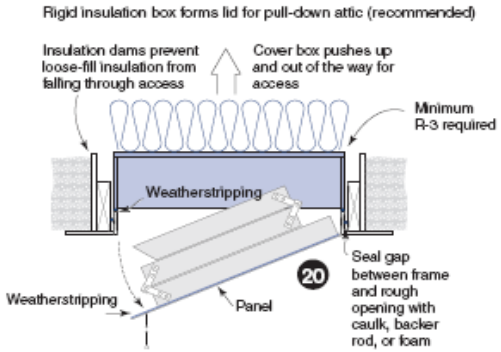
(page 6)

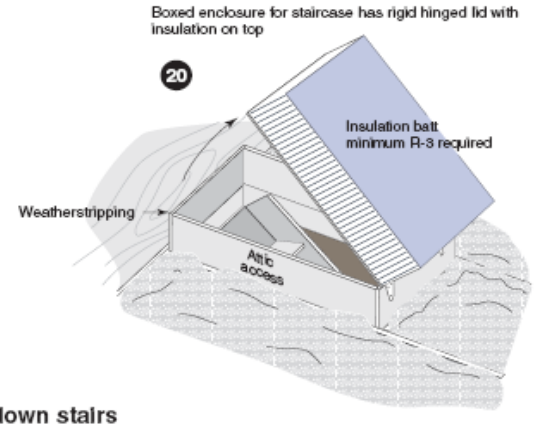
Air sealing key points *continued*

Attic scuttle

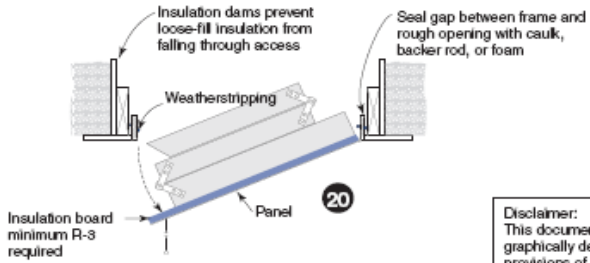


Attic pull-down stairs





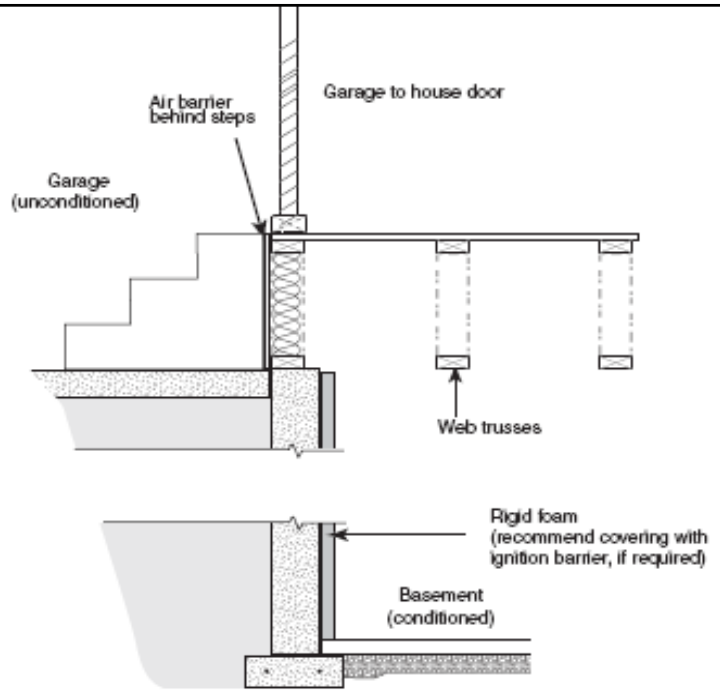
Attic pull-down stairs

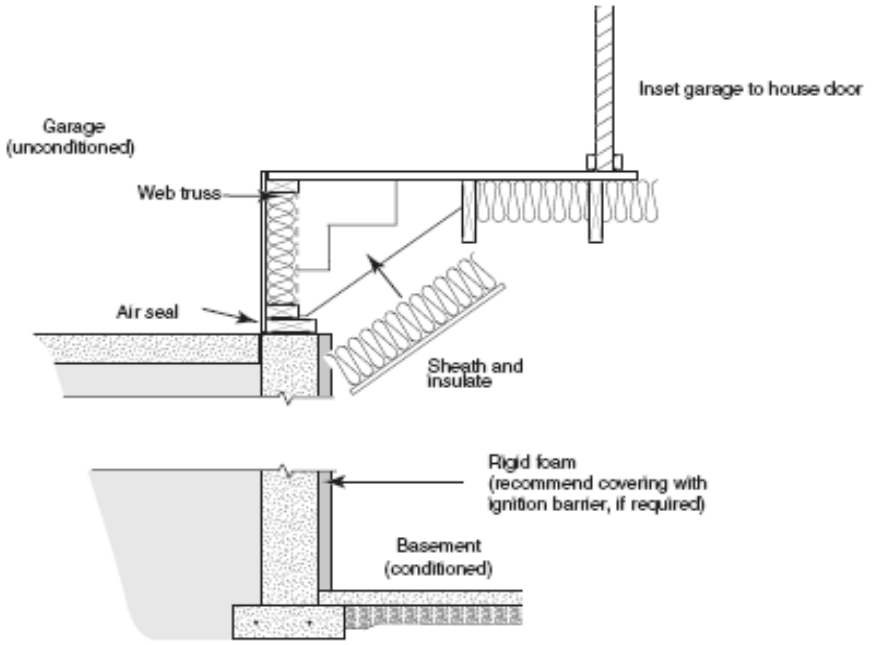


Disclaimer:
This document is intended solely to help graphically demonstrate the air leakage provisions of section 402.4 of the 2006 IECC. It does not cover all airsealing locations or techniques. Other code provisions may be applicable as well.

New Code – Appendix A

(page 7)





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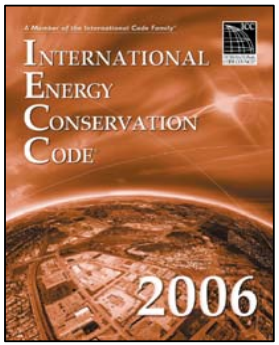
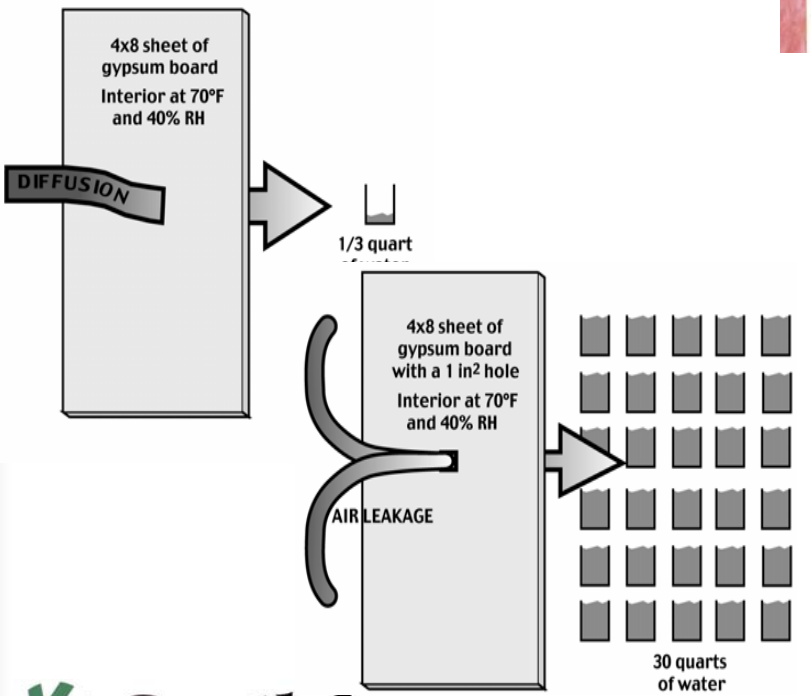
Disclaimer:
This document is intended solely to help graphically demonstrate the air leakage provisions of section 402.4 of the 2006 IECC. It does not cover all airsealing locations or techniques. Other code provisions may be applicable as well.

IECC 2006 – Section 402.5

- Moisture Control
  - No wall or ceiling Vapor Diffusion Retarder required in GA
  - Crawlspace floor requires 100% plastic sealed to walls and with seams sealed (IRC)





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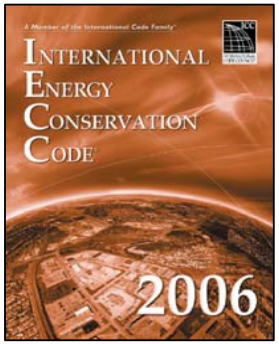
IECC 2006 – Section 402.6



- Fenestration U-factor and SHGC
  - Maximum values permitted based on trade-off approach

IECC 2006 – Section 402.7

- Minimum R-values for trade-offs with REScheck

TABLE 402.7.1
SUMMARY OF MINIMUM INSULATION *R*-VALUES
AND MAXIMUM *U*-FACTORS FOR ENVELOPE COMPONENTS

ELEMENT[1]	MODE	MINIMUM *R*-VALUE OR MAXIMUM *U*-FACTOR
Walls Stud	Heating or Cooling	*R*-13
Walls Masonry/CMU[2]	Heating or Cooling	*R*-5
Attic Kneewalls[3]	Heating or Cooling	*R*-18
Roof/Ceiling	Heating or Cooling	*R*-19
Floor Over Unheated Spaces	Heating or Cooling	*R*-13
Windows[4]	Heating or Cooling	*U*-0.65 with Maximum 0.40 SHGC

1. Weather-stripped access doors (maximum *U*-0.35), weather-stripped hatches/scuttle hole covers (minimum *R*-19 insulation or maximum *U*-0.05), or weather-stripped disappearing/pull-down stairs (maximum *U*-0.35) shall be deemed to meet the minimum insulation *R*-values of any element.
2. Any mass wall above or below grade.
   Exception: Climate Zone 2.
3. See definition of 'ATTIC KNEEWALL' in these Georgia State Supplements and Amendments.
4. Maximum window *U*-factor shall be 0.65 and maximum SHGC shall be 0.40.

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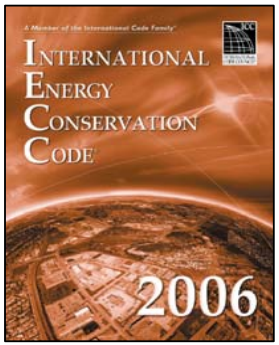
Section 403 - Systems



Load Calculations

Ductwork

Heating and Cooling Efficiency

Duct Installation and Insulation

FURNACE

A/C UNIT

Temperature & Humidity Controls

Pipe Insulation

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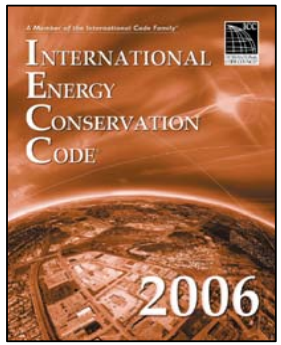
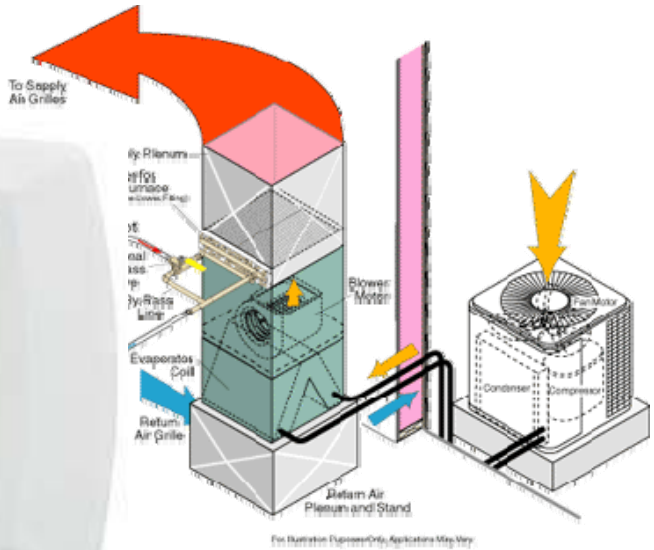
IECC 2006 – Section 403.1



- HVAC Controls
  - Thermostat required
  - Heat Pump requires smart thermostat to prevent unnecessary strip heat



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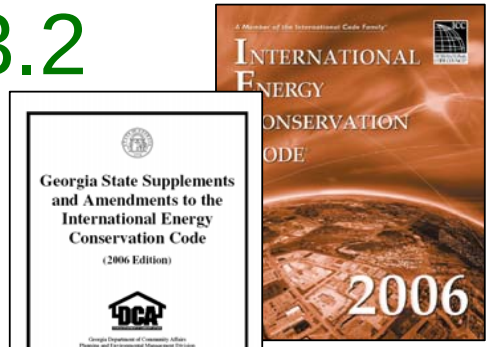
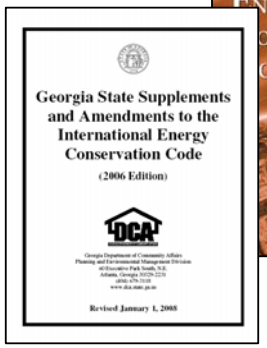
IECC 2006 – Section 403.2

- Ducts
  - R-8 Insulation (R-6 ducts in floor trusses)
  - No Insulation required when inside envelope
  - Sealing required as per IRC Mech section (UL 181 approved sealants)
  - Allowed to used building cavities for returns

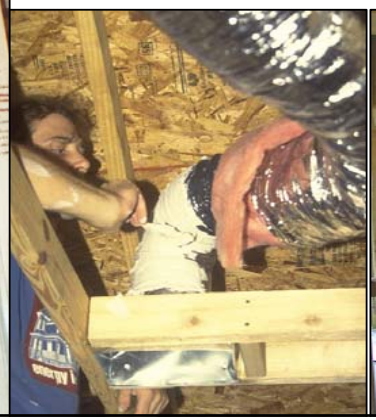




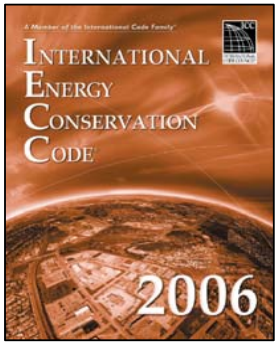
403.2.1 Insulation. Supply and return ducts in unconditioned attics and exterior locations shall be insulated to a minimum of *R*-8. All other ducts located outside the building thermal envelope shall be insulated to a minimum of *R*-6.

Exception: Ducts or portions thereof located completely inside the building thermal envelope.

403.2.2 Sealing. All ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3.1 of the *International Residential Code*. Air handlers with a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested at an air pressure of 1-inch water gauge when all air inlets, air outlets, and condensate drain port(s) are sealed shall be deemed sealed. Air handlers with filter boxes shall be tested with the filter box in place.



IECC 2006 – Section 403.3



- Pipe Insulation – Min. R-2
  - mechanical systems - fluids > 105 F or < 55 F
  - for plumbing circulating systems (plus controls)
- Mechanical Vents
  - require dampers
- Load Calcs & Sizing
  - as per Mechanical section of IRC (ACCA Manual J or approved equivalent, i.e., ASHRAE Fundamentals)
  - summary info required on certificate

Right-Suite Residential J8 - [Lanigan-Cape-Cod.rsp: Loads Worksheet]

File Edit View Show Drawing Options Window Help

Right-J8 Worksheet

<< < prev zone next zone > >>

ACCA MANUAL J8

1	Room name					Entire House				Basement z			
2	Exposed wall					172.0 ft				172.0 ft			
3	Ceiling height					10.0	d			10.0	p		
4	Room dimensions												
5	Room area					1741.6 ft²				1741.6 ft²			
	Ty	Construction number (Select any cell then click here)	U-value	Or	HTM (Btuh/ft²)		Area (ft²) or perimeter (ft)		Load (Btuh)		Area (ft²) or perimeter (ft)		Load (Btuh)	
					Heat	Cool	Gross	N/P/S	Heat	Cool	Gross	N/P/S	Heat	Cool
6	W	12C-6bw	0.060	ne	2.820	0.759	0	0	0	0	0	0	0	0
.	W	15B-0c-6	0.488	ne	13.07	2.996	523	523	6834	1567	523	523	6834	658
.	W	12C-6bw	0.060	se	2.820	0.759	0	0	0	0	0	0	0	0
.	W	15B-0c-8	0.488	se	8.986	1.498	333	333	2992	499	333	333	2992	343
11	W	12C-6bw	0.060	sw	2.820	0.759	0	0	0	0	0	0	0	0
	W	15B-0c-6	0.488	sw	13.07	2.996	523	523	6834	1567	523	523	6834	1332
	W	12C-6bw	0.060	nw	2.820	0.759	333	209	588	158	333	209	588	132
	G	1D-c2ow	0.550	nw	25.85	34.40	83	0	2157	2871	83	0	2157	6231
	G	10B-w	0.600	nw	28.20	18.13	41	0	1156	743	41	0	1156	1482
	C	16B-28md	0.034	-	1.590	1.770	0	0	0	0	0	0	0	0
	F	22A-vpm	1.180	-	55.46	0.000	330	55	3050	0	330	55	3050	0
	F	21A-28t	0.022	-	1.034	0.000	1411	116	1459	0	1411	116	1459	0

IRC references

M1601.3 Installation. Duct installation shall comply with Sections M1601.3.1 through M1601.3.6.

M1601.3.1 Joints and seams. Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gasketing or other approved closure systems. Closure systems used with rigid fibrous glass ducts shall comply with UL 181A and shall be marked "181A-P" for pressure-sensitive tape, "181 A-M" for mastic or "181 A-H" for heat-sensitive tape. Closure systems used with flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic. Duct connections to flanges of air distribution system equipment or sheet metal fittings shall be mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked 181B-C. Crimp joints for round metal ducts shall have a contact lap of at least $1^1/_2$ inches (38 mm) and shall be mechanically fastened by means of at least three sheet-metal screws or rivets equally spaced around the joint.

SECTION M1401
GENERAL

M1401.1 Installation. Heating and cooling equipment and appliances shall be installed in accordance with the manufacturer's installation instructions and the requirements of this code.

M1401.2 Access. Heating and cooling equipment shall be located with respect to building construction and other equipment to permit maintenance, servicing and replacement. Clearances shall be maintained to permit cleaning of heating and cooling surfaces; replacement of filters, blowers, motors, controls and vent connections; lubrication of moving parts; and adjustments.

M1401.3 Sizing. Heating and cooling equipment shall be sized based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.

M1401.4 Exterior installations. Equipment installed outdoors shall be listed and labeled for outdoor installation. Supports and foundations shall prevent excessive vibration, settlement or movement of the equipment. Supports and foun-

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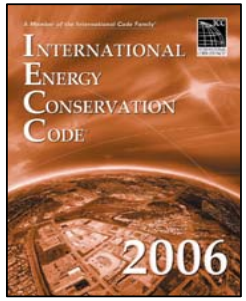
Compliance Paths for Insulation and Windows



Basic Requirements

Insulation & Window Requirements

2006 IECC (prescriptive chart)

RESCheck (free software)

Section 404 (annual simulation)

Plan Review and Field Inspection

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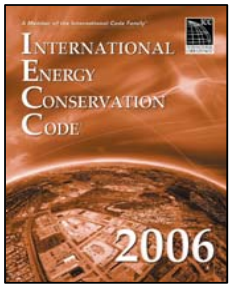
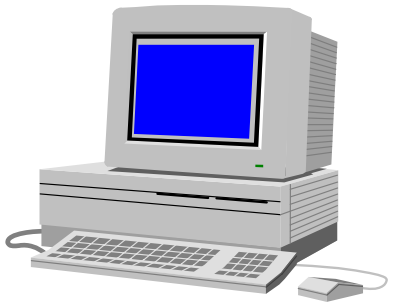
IECC 2006 – Section 404
Simulated Performance Alternative



- Annual energy usage simulation demonstrates that the proposed building's *energy costs* are ≤ "standard code" building
- Likely to involve a HERS rater
- REMrate & Energy Gauge are acceptable

www.resnet.us



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Energy Code “on a Stick”

- Revised table for GA – lots of footnotes
- Created by RECA

		WINDOWS AND INSULATION								FOUNDATION TYPE			
	Package	Window U-factor	Skylight U-Factor	Window and Skylight SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Attic & Knee Wall R-Value	Mass Wall R-Value	Duct R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value and Depth	Crawl Space Wall R-Value
South GA	Climate Zone 2	0.65	0.75	0.40	R-30	R-13	R-18	R-5	R-6/8	R-13	R-0	R-0	R-0
Middle GA	Climate Zone 3	0.65	0.65	0.40	R-30	R-13	R-18	R-5	R-6/8	R-19	R-5/13	R-0	R-5/13
North GA	Climate Zone 4	0.40	0.60	0.40	R-38	R-13	R-18	R-5	R-6/8	R-19	R-5/13	R-0	R-5/13

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