THE GEORGIA ENERGY CODE:
2009 IECC + AMENDMENTS

For the Georgia Association of Home Inspectors
Bourke Reeve

ABOUT SOUTHFACE
EARTHCRAFT

Regional Green Building Program

HISTORY OF ENERGY CODES

- **MEC 1992, ’93, 95** – “Early” energy codes, complicated, DP windows required
- **IECC 98, 2000, ’03** – “Strengthening”, SHGC of 0.4 required where < 3500 HDD
- **IECC 2004, ’06** – “Simplification”, Fewer CZ’s, eliminate % glazing, certificate required
- **IECC 2009** – (GA Code) duct + envelope testing, efficient lighting required
- The code keeps pushing the bar! (’09 Code is ~15% more stringent than ’06 version)
IMPORTANCE OF ENERGY CODES

• **Saves energy** - Buildings consume 40% of energy in U.S.; energy codes reduce dependence on foreign energy sources
• **Saves money** - Energy costs continue to escalate and energy codes help keep money within local economy
• **Additional benefits:**
  - Increases comfort
  - Protects health
  - Enhances durability of homes
OVERVIEW OF RESIDENTIAL CODE REQUIREMENTS

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

Limited Heating, Air Conditioning, and Water Heating requirements
- Ducts
  - No cavities as ducts
  - Seal with mastic and insulate
  - Verify tight with duct pressurization test

Lighting equipment
- 50% of lamps to be high-efficacy lamps
- Lighting control options

No appliance requirements

GEORGIA AMENDMENTS

1. Improved Kneewalls
2. Consistent Windows
3. Air Sealing Graphics
4. Minimum Insulation Thresholds
5. Better Ducts - Require Mastic
6. No Electric Furnaces
7. No Powered Attic Ventilators (except solar powered)
8. Mandatory Blower Door and Duct Blaster test
9. Qualifications of Verifiers—(who can do testing)
STRUCTURE OF 2009 IECC

Ch. 1 - Administration
Ch. 2 - Definitions
Ch. 3 - Climate Zones
Ch. 4 - Residential Code
  • 401 General
  • 402 Building Thermal Envelope
  • 403 Fenestration
  • 404 Lighting
  • 405 Performance Alternative
Ch. 5 - Commercial Buildings
  (references ASHRAE 90.1)

ENERGY CODE COMPLIANCE PATHWAYS

Scope

Insulation & Window Requirements

Prescriptive Pathway

UA Trade-off Approach

Section 405 (annual simulation)

Mandatory Requirements
RESIDENTIAL BUILDINGS

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

Exempt Buildings
- No conditioning
- Historical
- Low peak energy for space conditioning
  - $< 3.4 \text{ Btu/hr/ft}^2$ of floor area
  - $< 1.0 \text{ W/ft}^2$ of floor area

ADDITIONS, ALTERATIONS, RENOVATIONS OR REPAIRS

101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portions thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone conforms or if the existing building and addition comply with this code as a single building.

Exemption: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing windows.
2. Glass only replacements in an existing wall and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction above the existing roof, wall or floor cavity is not exposed.
5. Replacing for each whose outer the sheathing nor the insulation is exposed. Each without insula-
tion in the cavity and where the sheathing or insulation is exposed during remodeling shall be insulated either above or below the sheathing.
CONDITIONED SPACE

Georgia clarification:
SPACE. An enclosed space within a building. The classifications of spaces are as follows for the purpose of determining building envelope requirements:
(a) Conditioned space: a cooled space, heated space, or indirectly conditioned space is defined as follows:
   (1) Cooled space: an enclosed space that is cooled by a cooling system whose sensible output capacity > 5 Btu/h∙ft² of floor area.
   (2) Heated space: an enclosed space that is heated by a heating system whose output capacity is > 5 Btu/h∙ft².
   (3) Indirectly conditioned space: an enclosed space within a building that is not a heated or cooled space, containing un-insulated ducts, or containing the heating equipment or which is heated or cooled indirectly by being connected to adjacent space(s), provided that air from heated or cooled spaces is transferred (naturally or mechanically) into the space. Unvented Attic Assemblies meeting the requirements of the IRC are an approved indirectly conditioned space.

2009 IECC CLIMATE ZONES: CHAPTER 3

Note: GA is in Climate Zone (CZ) 2, 3 and 4

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.
ENERGY CODE COMPLIANCE PATHWAYS

- Scope
- Insulation & Window Requirements
  - 2009 IECC (prescriptive chart)
  - UA Trade-off Approach
  - Section 405 (annual simulation)
- Mandatory Requirements
Building Thermal Envelope — The basement walls, exterior walls, floor, roof, and any other building element that encloses conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space — 2009 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.

ENERGY CODE COMPLIANCE PATHWAYS

Scope

Insulation & Window Requirements

2009 IECC (prescriptive chart)

RESCheck (free software)

Section 405 (annual simulation)

Mandatory Requirements
One prescriptive “answer” for how to build in each climate zone (CZ: 2a, 3a and 4a)

Includes lots of footnotes

SECTION 402.1

Details for insulating various aspects of the building envelope

- Ceilings with Attic – 402.2.1
- Ceilings w/out Attic – 402.2.2
- Access hatches and doors – 402.2.3
- Mass Walls – 402.2.4
- Steel Framing – 402.2.5
- Floors – 402.2.6
- Basement Walls – 402.2.7
- Slab-on-grade – 402.2.8
- Crawlspace Walls – 402.2.9
- Masonry Veneer – 402.2.10
- Sunrooms – 402.2.11
402.2.1 - CEILINGS WITH ATTICS

- R-30 (CZ2 & 3) or R-38 (CZ4) are prescriptive requirements
- GA: R-19 acceptable under HVAC attic platforms (32 s.f./platform + 32” walkway)
- Rulers required every 300 s.f.

402.2.9 CRAWLSPACE WALLS - 3 OPTIONS

Standard vented crawlspace - underfloor insulation

Closed crawlspace with wall insulation

Closed crawlspace underfloor insulation

Note: all crawspaces must meet vapor retarder requirements, as per IRC
CLOSED CRAWLSPACES

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 (2006 IRC section R408.3)

**Venting Exceptions:**
- Continuous exhaust (radon)
- Direct condition crawlspace (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

CLOSED CRAWL SPACE STUDY

www.crawlspaces.org
www.crawlspaceproducts.com
402.2.9 – CRAWLSPACE WALLS

402.2.9 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 downgraded from the floor to within 9 inches (229 mm) of the finished interior grade adjacent to the foundation wall. A 3-inches (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 (229 mm) up the stem wall and shall be attached and sealed to the stem wall. (Effective January 1, 2011)

- Insulate band joist area
- 3-inch view strip (removable)
- Crawl space wall insulation to extend within 9 inches of finished interior grade
- Complete plastic sealed to walls at least 6 inches up the stem wall
REALITY OF UNDERFLOOR INSULATION

402.3 FENESTRATION REQUIREMENTS

Low-e effectively required!

Maximum fenestration

U-factor = 0.50 in CZ 2&3
= 0.35 in CZ4

• Area weighted average of fenestration

Maximum

SHGC = 0.30 for all glazing

• Area weighted average of fenestration
  1. Show compliance by having all glazing be < 0.30
  2. Perform REScheck weighted average trade-off

Southface
303.1.3 FENESTRATION

If not NFRC labeled, must use tables 302.1.3 to assign a default SHGC and U-Factor

Example: vinyl-clad wood window

If NFRC label present:
Values on label apply. (in this example: U-factor 0.30 SHGC 0.30)

If no NFRC label present:
Default U-factor: 0.55
Default SHGC: 0.70

402.3 FENESTRATION REQUIREMENTS

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
- GA Specific - exemption is not applicable to attic-access doors

Replacement fenestration – must meet code
402.1.4 – TOTAL UA ALTERNATIVE

Equivalency using UA approach
Allows for simple trade-offs with prescriptive chart

TABLE 402.1.1

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>INSULATION REQUIREMENTS</th>
<th>FENESTRATION REQUIREMENTS</th>
<th>SKYLIGHT REQUIREMENTS</th>
<th>GLAZED FENESTRATION REQUIREMENTS</th>
<th>CEILING REQUIREMENTS</th>
<th>WALL REQUIREMENTS</th>
<th>ATTIC REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.39</td>
<td>0.75</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
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<tr>
<td>3</td>
<td>0.39</td>
<td>0.65</td>
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<td>0.33</td>
<td>0.60</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
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</table>

* This requirement will take effect on July 1, 2011.
402.1.4 – GA: CANNOT TRADE TO ZERO

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>Minimum R-value or Maximum U-factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls (Stud)</td>
<td>R-13</td>
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<tr>
<td>Mass Walls</td>
<td>Climate Zone: 2</td>
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<tr>
<td></td>
<td>R-4</td>
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<tr>
<td></td>
<td>Climate Zone: 3 &amp; 4</td>
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<td></td>
<td>R-5</td>
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<tr>
<td>Basement Walls</td>
<td>Climate Zone: 2</td>
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<td></td>
<td>R-0</td>
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<td></td>
<td>Climate Zone: 3 &amp; 4</td>
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<td></td>
<td>R-5</td>
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<tr>
<td>Attic Knee Walls</td>
<td>R-18</td>
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<tr>
<td>Ceilings with Attic Spaces</td>
<td>R-50</td>
</tr>
<tr>
<td>Air-permeable Roofline Installed Insulation</td>
<td>Climate Zone: 2 &amp; 3</td>
</tr>
<tr>
<td></td>
<td>R-19 air-permeable</td>
</tr>
<tr>
<td></td>
<td>+R-5 air-impermeable</td>
</tr>
<tr>
<td>Air-impermeable Roofline Installed Insulation</td>
<td>Climate Zone: 4</td>
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<td></td>
<td>R-19 air-impermeable</td>
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<tr>
<td></td>
<td>+R-15 air-impermeable</td>
</tr>
<tr>
<td>Floor over unheated spaces</td>
<td>R-13</td>
</tr>
<tr>
<td>Windows</td>
<td>U-: 0.50 with max. SHGC 0.30</td>
</tr>
</tbody>
</table>

RESCHECK™ SOFTWARE

www.energycodes.gov
Software evaluates specific designs quickly
Demonstrates SHGC compliance
Allows trade-offs
- Building envelope components
- No longer for heating & cooling equipment efficiencies
GA specific version (coming soon)
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
Total annual energy costs, duct insulation, window U-factor and SHGC, envelope and duct testing compared between 2009 IECC and home.

**ENERGY CODE COMPLIANCE PATHWAYS**

- **Scope**
  - Insulation & Window Requirements
    - 2009 IECC (prescriptive chart)
    - UA Trade-off Approach
    - Section 405 (annual simulation)
  - Mandatory Requirements
Mandatory Requirement:
- Certificate on panel box or air handler shows
- Major Component R-values
- U-factor, SHGC of Windows
- Equipment Efficiencies
- GA Specific: Load Calculations
- GA Specific: Envelope and Duct Testing Results

Go to southface.org to download fillable pdf of this form!
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Blower Door Results go here:

Load Calc Results go here:

Duct testing Results go here:

402.4 AIR LEAKAGE

Mandatory Requirement:
Air Sealing
• Detailed list
• Fenestration
• Fireplaces
• Recessed light fixtures: airtight, IC-rated

Details on techniques for air sealing – in flip book format
402.4.3 WOOD BURNING FIREPLACES

New *wood-burning fireplaces shall have gasketed doors and outdoor combustion air

402.4.5 RECESSED LIGHTS

| Standard Can Light | Air-tight and IC Rated |

402.4.5 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psf (75 Pa) pressure differential with no more than 2.0 cfm (0.044 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.
402.4.2 AIR BARRIER AND INSULATION INSPECTION

<table>
<thead>
<tr>
<th>BARRIERS</th>
<th>COMPONENT</th>
<th>CRITERIA</th>
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<tbody>
<tr>
<td>1</td>
<td>Air barrier and thermal barrier</td>
<td>No leaks, blisters, or thermal breakdown. Air barriers are properly installed and insulated.</td>
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<td>Air barrier and thermal barrier</td>
<td>Air barriers are properly installed and insulated.</td>
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</tr>
</tbody>
</table>

NO BIG HOLES!

Cover with sheet material and seal
APPENDIX A - AIR SEALING BLOCKING & SHEATHING

Solid sheet behind tubs & showers on insulated walls

APPENDIX A - AIR SEALING WINDOWS (P. 20)

402.4.4 - Windows, skylights and doors ≤ 0.3 cfm/s.f.,
Swinging doors ≤ 0.5 cfm/s.f.
Exception: site built
402.4.3: New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.
APPENDIX A - AIR SEALING ATTIC ACCESS (P. 23)

402.4.2.1 ENVELOPE TIGHTNESS

REQUIRED Blower Door test by certified Duct and Envelope Tightness (DET) verifier

- Test out at less than $7 \text{ACH}_{50}$

Exceptions
- Low-rise multifamily (R2 only) – 2 options
  1. Test 1 in 4 units or follow RESNET testing protocol
  2. Third-party ICC certified residential energy inspector or equivalent as approved by code official must visually inspect all units for air-sealing criteria

- Renovations that do not touch entire building envelope

\[
\text{ACH}_{50} = \frac{\text{CFM}_{50} \times 60}{\text{Volume}}
\]
403.2.2. DUCT TIGHTNESS TESTING

Duct Tightness Testing REQUIRED by DET Verifier

• When tested at rough-in
  • Maximum 6% leakage with AHU installed

• When tested at final
  • Maximum 8% – Leakage to Outside
  • Maximum 12% – Total Leakage

**Important:** Blower Door and Duct Leakage test results

• MUST be displayed on Certificate!

403.2.2. DUCT TESTING EXCEPTIONS

• If all ductwork and air handler is inside the building envelope
• If less than 50% of duct system is replaced
• If Air handler, furnace or coil is replaced
  • Must seal all joints, seams and connections from equipment to plenum and from plenum to duct system with mastic
  • Must be verified via visual inspection by a state licensed conditioned air contractor or a Georgia DET verifier
403.2 - DUCTS

Mandatory Requirement:

Insulation:

• R-8 Insulation in Attic
• R-6 Insulation other unconditioned space
• No Insulation required when inside envelope

Sealing with Mastic required – “thick as a nickel” (GA specific)

May not use building cavities as supply or return (GA specific)

IRC REFERENCE – DUCT SEALING

M1603.3 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 tape, metal, gasketing or other approved closure systems. Closure systems used with rigid fiberglass should comply with M161, B1A, and shall be marked “HBA-P” for pressure-sensitive tape; “HBA-M” for manual; or “HBA-B” for heat-sensitive tape. Closure systems used with flexible air ducts shall comply with UL 181, UL 191, and shall be marked “HBB-PX” for pressure-sensitive tape or “HBB-MC” for manual. Duct connections to flanges of auxiliary systems, equipment, or sheet metal flanges shall be mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181. UL 191, and shall be marked “181B-C.” Crimp joints for round metal ducts shall have a contact lap of at least 1/2 inches (13 mm) and shall be mechanically fastened by means of at least three sheet metal screws or rivets equally spaced around the joint.
**DUCT AND ENVELOPE TIGHTNESS (DET) VERIFIER**

Certified Verifier can either Be Certified

- DET Verifier
- HERS Rater
- BPI Analyst
- Home Performance with ENERGY STAR contractor

Pass a DET Verifier Course

- Explain calculations for ACH50 and % duct leakage
- Discuss testing protocol (setup, safety, and accuracy)
- Field exam on tools (use blower door and duct tester)
- Pass Written Exam – 25 Questions (1 hour)

CERTIFIED DUCT AND ENVELOPE TIGHTNESS (DET) VERIFIER. A certified DET verifier shall be a certified Home Energy Rating System (HERS) rater, or be a certified Home Performance with ENERGY STAR contractor, or be a Building Performance Institute (BPI) Analyst, or successfully complete a certified DET verifier course that is approved by the Georgia Department of Community Affairs. (Effective January 1, 2011)

**SECTION 403 - SYSTEMS**

All Mandatory Requirements

Load Calculations

- Heating and Cooling Efficiency
- Duct Testing, Installation and Insulation
- Temperature & Humidity Controls
- Pipe Insulation
SECTION 403.1 - HVAC CONTROLS

Mandatory Requirement:
• **Programmable** thermostat required for furnace
• Heat Pump requires smart thermostat or lockout feature to prevent unnecessary strip heat

403.3&4 PIPES, 403.5 VENTS

Pipe Insulation
• R-3: mechanical systems – fluids > 105 F or < 55 F
• R-2: for plumbing circulating systems (plus controls)

Mechanical Vents
• Require dampers
403.6.1-HEAT SOURCE, 403.10 POWER ATTIC VENTS

- GA Specific - New or replacement central HVAC systems shall not use electric-resistance heat as primary heat source for home

- GA Specific – No grid-tied power attic ventilators allowed (exception for solar powered)

403.6 SIZING

Load Calcs & Sizing
- Per Mechanical section of IRC
- ACCA Manual J or approved equivalent, i.e., ASHRAE Fundamentals

- 302.1: Interior design temp (72°F heating, 75°F cooling)
- MUST BE ACCURATE
2009 IECC - SECTION 401.3

Mandatory Requirement:
• Certificate on panel box or air handler shows
• Major Component R-values
• U-factor, SHGC of Windows
• Equipment Efficiencies
• GA Specific: Load Calculations
• GA Specific: Envelope and Duct Testing Results

404 - LIGHTING

A minimum of 50 percent of bulbs in permanent fixtures must be high-efficacy or on occupancy / vacancy sensor (GA specific)
High efficacy =
+ CFL,
+ T8 or T5 fluorescent bulb or,
+ Meet certain lumen/W requirements (good LEDs)
• NOT incandescent/ halogen bulbs
• NOT T12 fluorescent bulbs
GEORGIA COMMERCIAL ENERGY CODE

WRAP UP AND Q&A

Thank you!

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breeve@southface.org