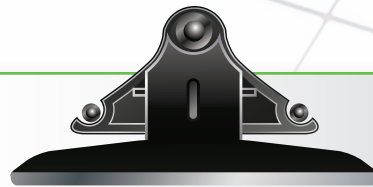




What's in it FOR ME?

RESIDENTIAL Compliance



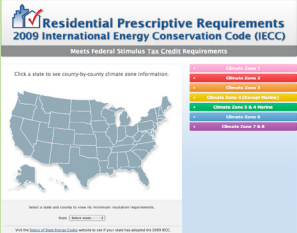

DOE's Building Energy Codes Program (www.energycodes.gov) and ICC (www.iccsafe.org) offer many resources for residential code officials. Examples in this section include:


- An introduction to residential compliance approaches and their corresponding tools
- Help with plan review:** DOE's Case Study and Quick Reference Guide with sample REScheck™ compliance certificate; *excerpts from ICC's 2009 IECC Plan Review Workbook, Commentary, and Study Companion*
- Help with inspections:** DOE's new 2009 IECC inspection checklist; an excerpt from *ICC's 2009 IECC Performing Residential Energy Inspections workbook*
- Residential Training and Support:** examples and where to go for more

RESIDENTIAL COMPLIANCE: Approaches and Tools

Residential buildings must demonstrate compliance with the the jurisdiction’s adopted residential energy code, which is often a close variation of the International Code Council’s (ICC’s) International Energy Conservation Code (IECC). The IECC is updated on a three year cycle (2006, 2009, 2012).

There are several ways to show compliance. Below are descriptions of the main three compliance approaches and their corresponding tools, followed by compliance approaches Q&A.

APPROACH	DESCRIPTION	COMPLIANCE TOOL(S)
<p>Prescriptive Packages Approach</p>	<p>A prescriptive packages approach lists the minimum R-value or maximum U-factor requirements for each building component such as windows, walls, and roofs. This approach is quick and easy to use, but many users find it somewhat restrictive because the requirements typically are based on worst-case assumptions, and all requirements must be met exactly as specified. By locating the correct climate zone and looking up the appropriate table of packages, you can verify that your project meets one of the packages listed for that climate zone.</p>	<p>The 2009 IECC itself contains tables that are used directly to demonstrate compliance with the prescriptive approach.</p> <p>For help, check out the requirements at http://energycode.pnl.gov/EnergyCodeReqs</p> <p>BECP’s interactive map tool makes the process easy: simply choose your state to see its climate zones and get the information you need.</p> 
<p>Trade-off Approach</p>	<p>A trade-off approach allows you to trade enhanced energy efficiency in one building component for decreased energy efficiency in another component. You can, for example, trade decreased wall efficiency (lower R-value) for increased window efficiency (lower U-factor), or increase the roof insulation and reduce or eliminate slab-edge insulation. Typically, this method is less restrictive than prescriptive approaches because components that exceed the requirements can compensate for those that do not meet the code.</p>	 <p>REScheck™ REScheck™, BECP’s free-of-charge compliance software, automates this approach. Through inputs of a building project’s features, a user can easily generate and print a compliance certificate. To download REScheck™ or begin using REScheck-Web™, please visit: www.energycodes.gov/software.stm</p>

APPROACH	DESCRIPTION	COMPLIANCE TOOL(S)
Performance Approach	<p>A performance approach (also known as a systems performance approach) allows you to compare your proposed design to a baseline or reference design and demonstrate that the proposed design is at least as efficient as the baseline in terms of annual energy use. This approach allows greater flexibility but requires considerably more effort. A performance approach is often necessary to obtain credit for special features, such as passive solar design, photovoltaic cells, thermal energy storage, and fuel cells. This approach requires an annual energy analysis for the proposed design and the reference design.</p>	<p>For a whole-building performance approach, DOE's Building Technologies Program maintains a list of building energy software tools. Residential tools such as Architectural Energy Corporation's <i>REM/Rate</i>[™] and <i>REM/Design</i>[™] help users show compliance by the performance approach. See these and nearly 400 other software tools through the Building Energy Software Tools Directory:</p> <p>http://apps1.eere.energy.gov/buildings/tools_directory/</p> <p> REScheck[™] REScheck[™] can be used to determine compliance based on a Simulated Performance Alternative method for high-efficiency equipment trade-off under the 2006 IECC and an orientation/Solar Heat Gain Coefficient trade-off under the 2009 IECC.</p>

Q: Which approach is the best for a particular building project?

A: Choosing the appropriate approach depends on the complexity and/or uniqueness of the building and the amount of time and money available for demonstrating compliance. The prescriptive approach allows quick review of the requirements. If these requirements are too restrictive, try a trade-off approach. For example, if the window area of the building exceeds that allowed by the prescriptive approach, a trade-off approach may be preferable. If nontraditional components are used or if energy use trade-off between building systems (e.g., envelope, mechanical) is desired, then use the performance approach.

- Additions may use the prescriptive or trade-off approach.
- An addition project that also includes alterations to the existing part of the building should show compliance separately for each part (the addition separately from alterations).
- For alterations, the prescriptive approach is preferable; otherwise the entire building should be brought up to code.

Q: Do the three approaches yield different results?

A: Yes, they can. Performance approaches require a higher degree of detail for an individual building to be designed to exactly meet the energy code requirements. Prescriptive approaches tend to be somewhat conservative and use worst-case default assumptions in order for the prescriptive packages to apply to all buildings. Although the prescriptive approach may result in a more energy-efficient building because of its conservative assumptions, this is not always the case. The prescriptive approach generally does not account for several features that affect energy use, such as the effect of window orientation and external shading on solar heat gain. Trade-off approaches fall somewhere between the prescriptive and performance approaches in both flexibility and complexity.

Q: Why are there so many compliance approaches?

A: Over the years, residential energy codes have grown to provide different approaches of varying simplicity and flexibility in order to meet user needs. The simpler approaches are less flexible but are generally easier to use. Some of the approaches have considerable overlap.

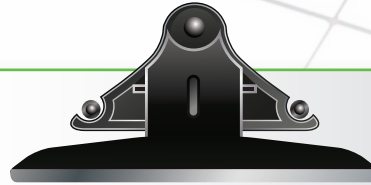
Q: Is it possible to any of these approaches and tools in my state?

A: It depends on the state, territory, or local jurisdiction. The IECC contains requirements for all three approaches, so if your jurisdiction has adopted a version of the IECC directly, buildings may demonstrate compliance using any of the three approaches.



What's in it FOR ME?

Residential Plan Review



In this section you'll find:

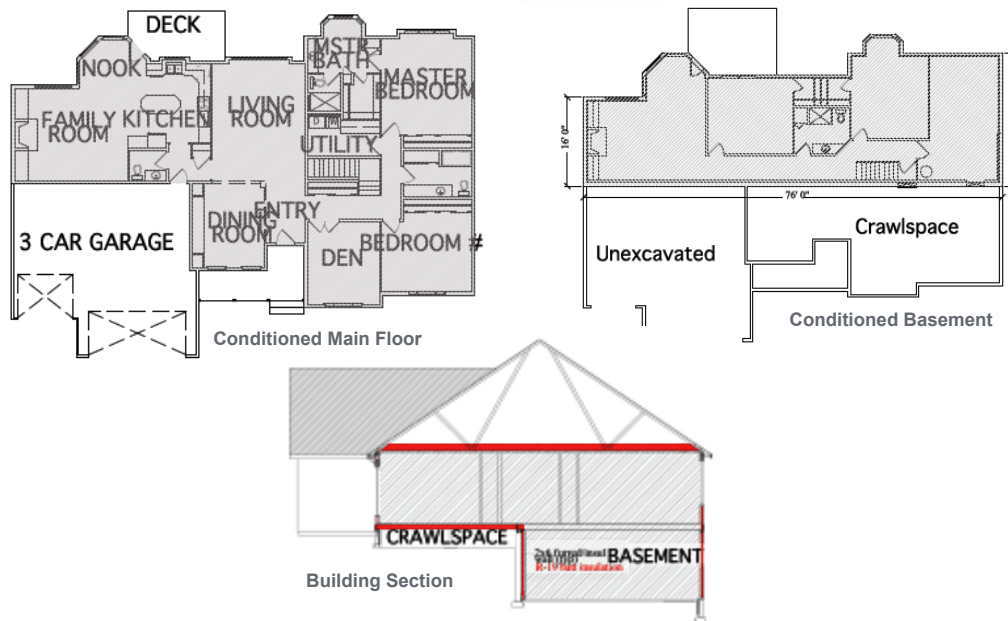
- Residential case study, complete with DOE's REScheck™ *Residential Plan Review Quick Reference Guide*
- Guidance on Additions, Alterations, and Sunrooms
- ICC excerpt:* *2009 IECC Performing Residential Energy Plan Reviews*
ICC excerpt: *2009 IECC Code and Commentary*
ICC excerpt: *2009 IECC Study Companion*



Jones Residence

This case study is based on a location where multiple building thermal envelope components are involved (basement, slab-on-grade, and vented crawl space). These slides correspond with DOE's Plan Review Quick Reference Guide and sample REScheck™ certificate, which immediately follow the presentation slides. This case study is available within Building Energy Codes University (www.energycodes.gov/becu)

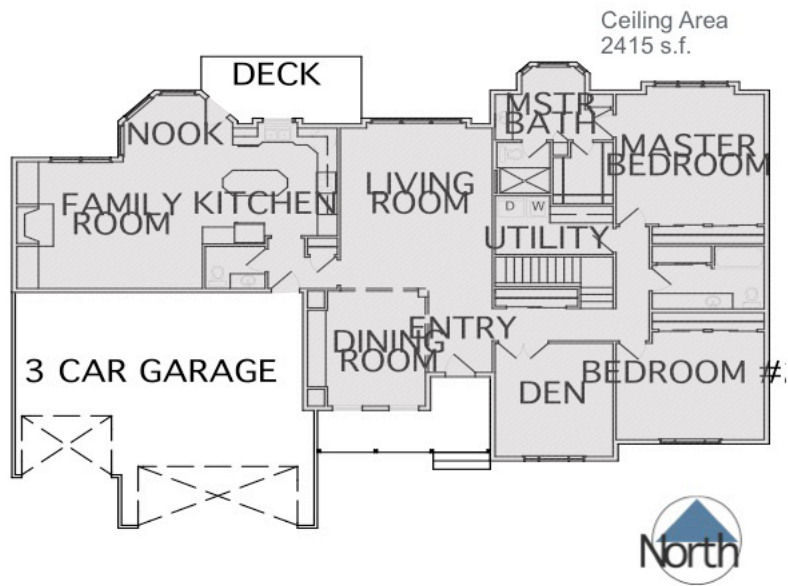
Building Envelope



The conditioned area or building thermal envelope is the first thing that needs to be defined for REScheck™ inputs.

The highlighted areas on the plans and building section show the areas of the house that are conditioned.

Ceiling Area



The ceiling area in this residence corresponds with the main floor area because the ceilings are flat. If this plan contained vaulted areas, the ceiling area would need to be adjusted for the larger ceiling area created by the vault.

Since insulation is placed at the ceiling, the ceiling area square footage would be calculated instead of at the roof deck.

Exterior Wall Areas

12' Exterior Walls - 689 s.f.

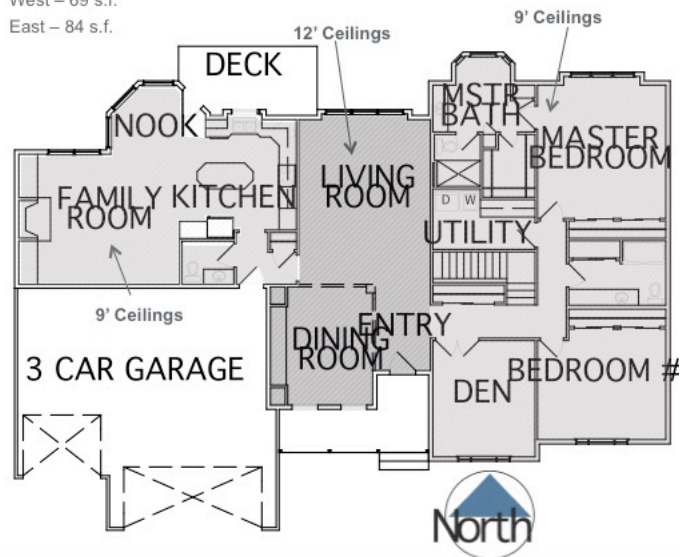
North – 221 s.f.
South – 234 s.f.
East – 52 s.f.
West – 182 s.f.

9' Exterior Walls - 2180 s.f.

North – 690 s.f.
South – 600 s.f.
East – 440 s.f.
West – 450 s.f.

3' knee walls (between 9'&12' sections) – 153 s.f.

West – 69 s.f.
East – 84 s.f.





Exterior Walls: The area of the exterior walls depend on the ceiling height of the space that the wall encloses. The highlighted sections on the main floor plan show the ceiling heights in various areas of the residence. The perimeter length of the exterior wall enclosing the space is multiplied by the wall height for the given area. This wall height includes the depth of the rim joist.

The knee walls between the 9' ceiling and 12' ceiling sections also enclose the conditioned space and are part of the building thermal envelope.

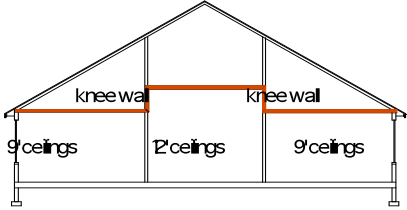
Knee Wall Insulation

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No, No... Never cut the batts too short



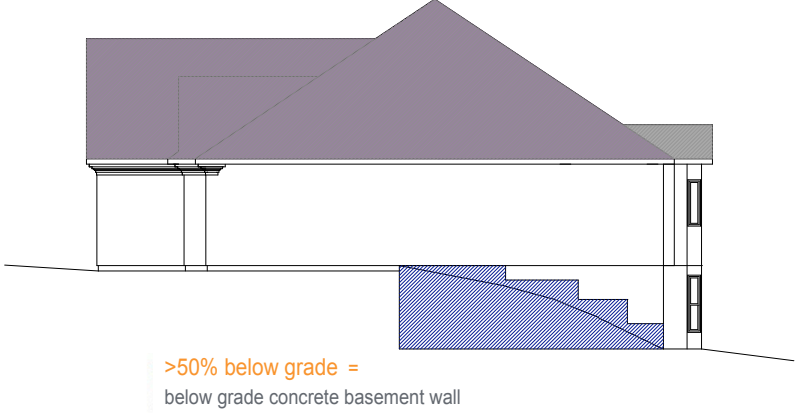
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The diagram is highlighting the ceiling area and knee wall insulation placement.

Basement Walls – Below Grade

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The “side” basement walls are assumed to be more than 50% below grade. Therefore, the entire wall is considered a “below grade” basement wall (solid masonry).

Defining Below-Grade Walls

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This diagram illustrates a typical walk out basement, where the back wall is fully below grade, side walls are >50% below grade and the front wall is fully above grade and the only wall that would be considered an above grade exterior wall.

Ways to Insulate Basement Walls

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Interior Studs w/batts

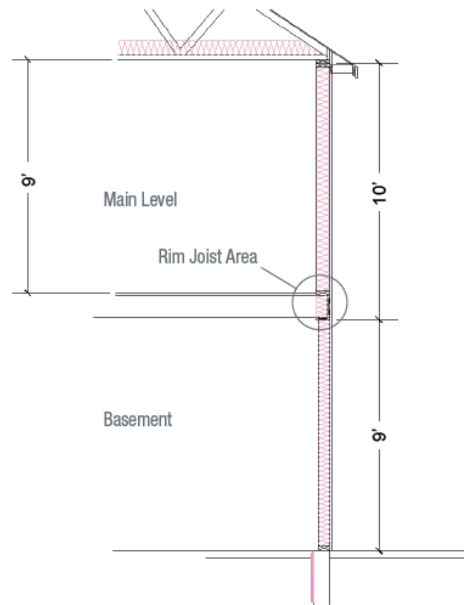
Exterior Rigid Foam

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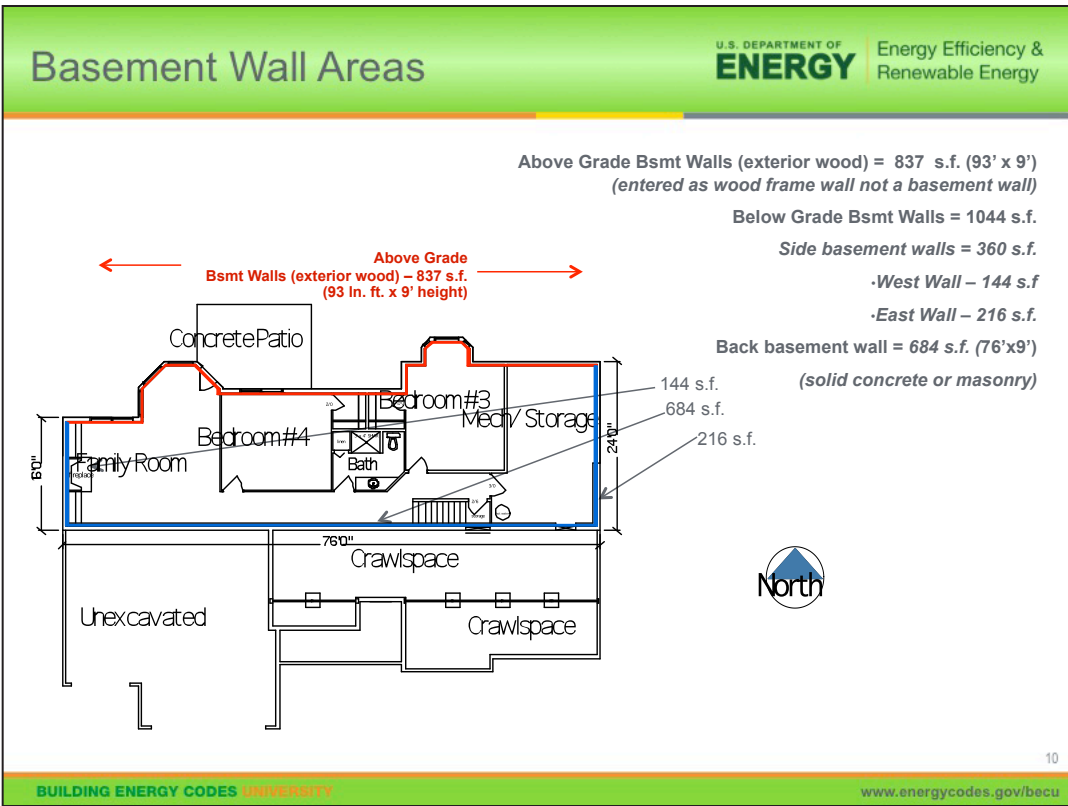
www.energycodes.gov/becu

Basement walls can either be insulated by furring out the interior and installing cavity insulation or insulating on the exterior with rigid foam board.

Including Rim Joists in the Exterior Wall Area



The exterior wall height of the main floor walls includes the depth of the rim joist. The rim joist area is required to be insulated and should be included in your calculations as part of your above grade wall.



Basement Walls:

The “walkout” side of the basement is an exterior wood wall with windows and doors and is entered in REScheck™ as “wood frame wall – 16” o.c.”. The perimeter length of this wall is 93’. This length multiplied by the basement wall height of 9’ equals 837 square feet.

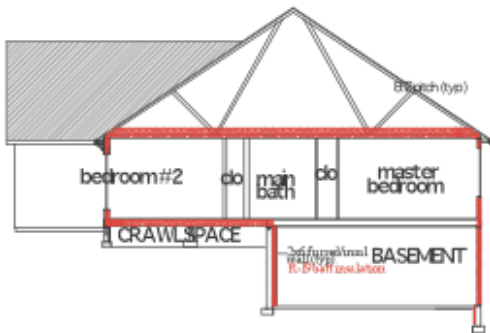
The “side” basement walls are >50% below grade and considered a “below grade basement wall (solid masonry)”. The perimeter length of these side walls equals 40 feet (360 s.f.).

The “back” basement wall is totally below grade and is considered a “below grade basement wall”. The length of the back wall is 76 feet (684 s.f.).

The area of all the below grade basement walls is 1044 square feet (116’ x 9’).

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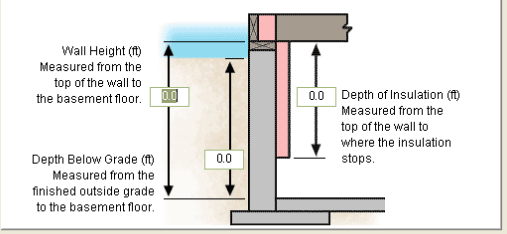
Basement Walls



“back” below grade basement wall
(entire back wall is adjacent to crawlspace)

Basement Walls

Enter the specified dimensions in feet (not inches) in the boxes provided.
A basement wall less than 50% below grade is considered an above-grade wall and must be entered using the Wall button.



Wall Height (ft)
Measured from the top of the wall to the basement floor. 0.0

Depth Below Grade (ft)
Measured from the finished outside grade to the basement floor. 0.0

Depth of Insulation (ft)
Measured from the top of the wall to where the insulation stops. 0.0

OK Cancel

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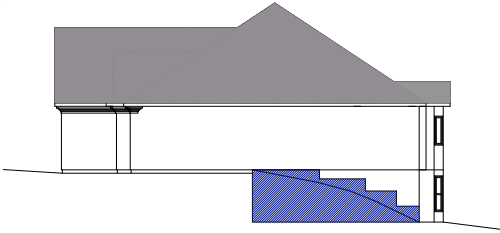
Screen shots of the below grade basement wall REScheck™ inputs are shown.

The back basement wall is assumed to have 7’ of the 9’ basement wall below grade (the 2’ above grade portion is the crawlspace section adjacent to the basement wall). The entire wall is assumed to be adjacent to the crawlspace for simplicity (this assumption is conservative). Users may wish to separate the “back” basement wall into two sections—one adjacent to the crawlspace and one adjacent to the garage (9’ below grade).

Basement Walls

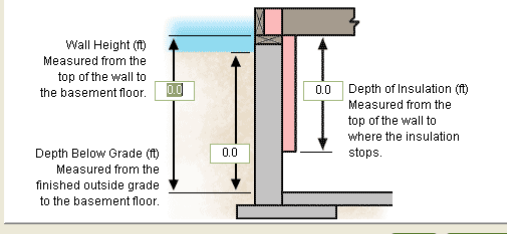
U.S. DEPARTMENT OF **ENERGY** Energy Efficiency & Renewable Energy

“side” below grade basement walls



Basement Walls

Enter the specified dimensions in feet (not inches) in the boxes provided. A basement wall less than 50% below grade is considered an above-grade wall and must be entered using the Wall button.



Wall Height (ft)
Measured from the top of the wall to the basement floor. 0.0

Depth Below Grade (ft)
Measured from the finished outside grade to the basement floor. 0.0

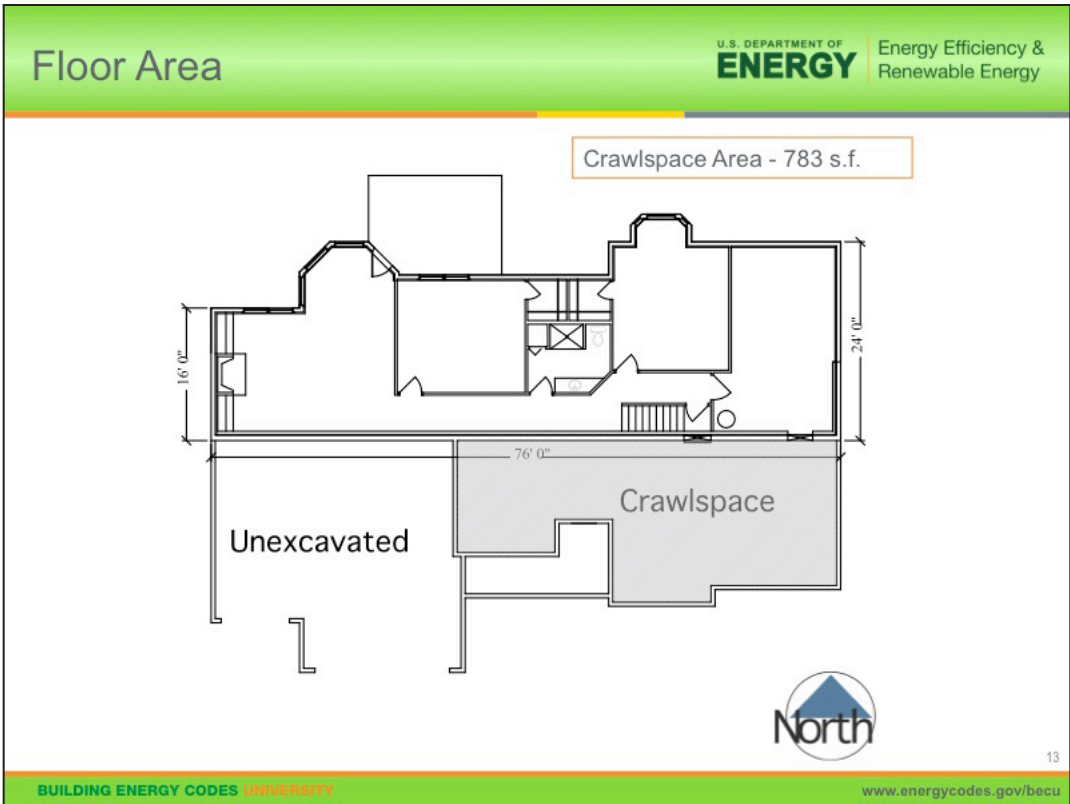
Depth of Insulation (ft)
Measured from the top of the wall to where the insulation stops. 0.0

OK Cancel

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Screen shots of the below grade basement wall REScheck™ inputs are shown.

The side basement walls are assumed to be 4.5' below grade. This assumption takes the average of the front of the wall that is totally above grade and the back section which is 9' below grade.

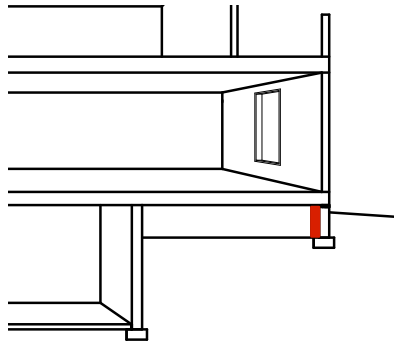


The area of the floor above the vented crawlspace is entered as a “floor” in REScheck™. The floor is insulated between the floor joists.

If the crawlspace wall had been insulated rather than the floor above the crawlspace, the perimeter length of the foundation stem wall would have been entered with the “crawlspace” tab in REScheck™.

Note: If the crawlspace is unvented, it would be required to be insulated and the stem walls shown in REScheck™ and the floor above the crawl would not be shown nor required to be insulated.

The area of the crawlspace is highlighted in the above floor plan (783 s.f.).



Example of an Insulated crawlspace wall =

- no foundation vents to the exterior
- + mechanically vented or conditioned

This case study does NOT have a conditioned crawlspace.



Installing insulation on the inside surface of the foundation stemwall is common practice in many cold locations in the country. This practice eliminates the need to install insulation in the raised floor over the crawlspace. There are a few criteria that must be met in order to use this insulation method:

- The crawlspace may not have ventilation openings that communicate directly with outside air
- The crawlspace must be mechanically ventilated or supplied with conditioned air
- The crawlspace floor must be covered with an approved vapor retarder material.

The IRC allows the construction of unventilated crawlspaces. To meet the requirements the crawlspace walls must be insulated to the R-value specified in the energy code. The crawlspace must either be provided with conditioned air or with mechanical ventilation. The code does not specify the quantity of conditioned air to supply the crawlspace.

If mechanical ventilation is selected, the crawlspace must be ventilated at 1 CFM per 50 square feet. The ground surface must also be covered with an approved vapor retarder material. To eliminate moisture from the crawlspace the sill plate and perimeter joist must be sealed. Also, while not a code requirement, all joints in the vapor retarder should be overlapped and taped. This includes the connection between the vapor retarder and crawlspace wall.

The code requires the crawl space wall insulation to extend from the top of the wall to the inside finished grade level and then vertically and/or horizontally for at least an additional 24 inches.

Crawlspace Walls in REScheck

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

Project		Envelope		Mechanical							
		Ceiling	Skylight	Wall	Window	Door	Basement	Floor	Crawl Wall		
Component	Assembly	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	UA	Wall Height (ft)	Depth Below Grade (ft)	Depth Below Inside Grade (ft)	Depth Insul. (ft)
Building											
1	Crawl 1	Solid Concrete or Masonry	0	ft2	0.0	0.0	0.0	0	0.0	0.0	0.0

Unventilated Crawl Space Walls

The crawl space wall option applies only to walls of unventilated crawl spaces. Enter the specified dimensions in feet (not inches) in the boxes provided.

Wall Height (ft) Measured from the top of the wall to top of the footing.

Depth Below Grade (ft) Measured from outside grade to the top of the footing.

Depth Below Inside Grade (ft) Measured from inside grade to the top of the footing.

Depth of Insulation (ft) Include the total vertical plus horizontal distance.

OK Cancel

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Screen shots of the crawl space wall REScheck™ inputs are shown. This case study does not have an unvented crawl space.

Slab Perimeter

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← Slab Perimeter - 93 linear feet →

Line represents the slab edge to be calculated in linear feet.

Unexcavated

Crawlspace

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The “front edge” of the basement exterior wall (above grade) is entered as a “slab on grade” in REScheck™. The perimeter edge measures 93 feet.

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Slabs in REScheck

Project			Envelope			Mechanical											
Ceiling			Skylight			Wall			Window			Door			Basement		
Component	Assembly		Gross Area														
Building																	
1	Floor 1	Click here to select Asse...	0		ft2												
		All-Wood Joist/Truss															
		Slab-On-Grade															
		Structural Insulated Panels															
		Other															

Help

- Depth of Insulation - Enter the depth (ft) of the insulation you intend to install as measured from the top of the slab to where the insulation stops. This distance should include the total vertical plus horizontal distance. Refer to the illustration below of acceptable configurations. If you enter a depth of 0, the program assumes no insulation is to be installed.

Slab-On-Grade Floors

Enter the depth of the insulation (ft.), including the total vertical and horizontal distance: ft.

Horizontal Insulation (A + B = Insulation Depth)

Vertical Insulation (A = Insulation Depth)

OK Cancel

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Screen shots of the slab on grade REScheck™ inputs are shown. Slab must be identified as either heated or unheated. Heated slabs are slabs that have hydronic or radiant heating systems installed within the slab floor. Depth of insulation (if applicable) must also be identified.

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Insulation Levels

Roof/Ceiling - R-49 batts

Wall - R-20 batts

Floor - R-30 batts

Slab - R-10 rigid (48" vertical)

TYP. EXTERIOR WALL:
 stucco
 Tyvek® infiltration barrier
 7/16" OSB sub sheathing
 2x6 @ 16" o.c. framing
 R-19 batt insulation
 1/2" gyp. wallboard (GWB)

TYP. FLOOR:
 1/2" part. board underlay
 3/4" T&G plywd. subfloor
 2x12 floor joists @ 16" o.c.
 R-19 batt insulation
 1/2" gypsum wall board ceiling

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Building Sections are used to clarify insulation locations and levels for REScheck™ inputs.

Window/Door Area

Glass Doors <50% glass - 40 s.f.; U-value = 0.50

North - 40 s.f.

Opaque Doors - 40 s.f.; U-value = 0.50

South - 40 s.f.

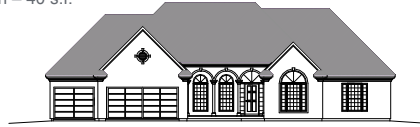
Window Area - 533 s.f.:

U-value = 0.35 & SHGC .40

North - 369 s.f.

South - 149 s.f.

West - 15 s.f.



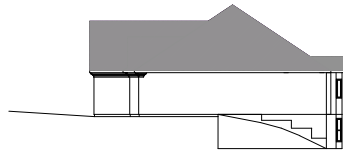
South



North



West



19

Window and door areas are listed to simplify REScheck™ inputs.

REScheckTM RESIDENTIAL PLAN REVIEW QUICK REFERENCE GUIDE



Plan review for energy code compliance can be conducted quickly and efficiently. The U.S. Department of Energy's REScheckTM Compliance Software is designed to create simplified compliance certificates that can be easily reviewed by enforcement personnel. The Quick Reference Guide identifies the objectives of plan review and code compliance responsibilities, and will take you step-by-step through a typical plan review of a REScheckTM submittal.

Plan Review Objectives: There are three objectives in conducting a building energy code plan review; verify:

- A. the documentation has been correctly prepared
- B. the levels of efficiency shown on the plans meet or exceed that shown in the documentation
- C. all information needed to conduct a field inspection is included in the plans or documentation for the inspector to use on site

Code Compliance Responsibilities: Successful compliance requires the cooperation of many individuals involved in a building project: designers, engineers, architects, builders, building owners, and others. Compliance also requires the efforts of certain individuals to whom the code gives specific responsibilities:

- Applicant
- Building official
- Plans examiner or special plans examiner
- Inspector or special inspector.

Role of the Applicant: The applicant is the person named on the building permit. The applicant is ultimately responsible for meeting all requirements specific in the code. The applicant may be the owner, architect, engineer, contractor or any other authorized agent for the project owner who applies for the building permit.

Role of the Building Official: The building official is typically responsible for enforcing all provisions of the code. To carry out code enforcement, the building official may appoint technical officers and inspectors.

Role of the Plans Examiner or Special Plans Examiner: Plans examiners or special plans examiners are typically responsible for verifying the plans for energy code compliance.

Role of the Inspector or Special Inspector: Inspectors and special Inspectors are responsible for conducting field inspections for energy code compliance.

REScheck™ Software Version 4.3.1 COMPLIANCE CERTIFICATE



Project Title: Jones Residence - Plan 3677
 Energy Code: **2009 IECC**
 Location: **Bloomington, Illinois**
 Construction Type: **Single Family**
 Building Orientation: **Bldg. faces 180 deg. from North**
 Glazing Area Percentage: **18%**
 Heating Degree Days: **6536**
 Climate Zone: **5**

Step 1: Verify the **Project Information** matches the building plans. The **Energy Code, Location, and Construction Type** will impact energy code compliance.

Construction Site:
Permit Date: March 15, 2010

Owner/Agent:
JJ Jones

Designer/Contractor:
Done Right Construction

Step 2: Verify **Compliance** (UA Trade-Off or Performance Alternative).

Step 3: Verify the building thermal envelope assemblies and **Gross Area or Perimeter** values are consistent with building plans. Verify the fenestration is calculated using the rough opening as shown on the plans. Walls that separate conditioned from unconditioned spaces such as a garage should be included in the wall area.

Step 4: Verify the insulation **R-values** shown on the building plans match or exceed the values in the **Cavity R-value and Continuous R-value** columns. Values should be for *insulation only*. Verify the insulation will fit uncompressed in the framing cavity. Continuous R-values should be for insulation installed over the face of framing or insulation installed with no thermal breaks.

Compliance: **Passes using UA trade-off**

Compliance: **2.1% Better Than Code**

Maximum UA: **582**

Your UA: **570**

The % Better or Worse Than Code index reflects how close compliance the house is based on code trade-off rules. It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: All-Wood Joist/Rafter/Truss	2415	49.0	0.0		63
Exterior Wall 1: Wood Frame, 16" o.c. Orientation: Front	911	20.0	0.0		30
Door 1: Opaque Orientation: Front	40			0.500	20
Window main: Vinyl Frame, Double Pane SHGC: 0.40 Orientation: Front	369			0.350	129
Exterior Wall 2 South: Wood Frame, 16" o.c. Orientation: Back	834	20.0	0.0		38

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Window 2: Vinyl Frame: Double Pane with Low-E SHGC: 0.40 Orientation: Back	149	0.350	52		
Door 2: Solid Orientation: Back	40			0.500	20
Exterior Wall 3 East: Wood Frame, 16" o.c. Orientation: Left Side	492	20.0	0.0		29
Exterior Wall 4 West: Wood Frame, 16" o.c. Orientation: Right Side	632	20.0	0.0		36
Window 3: Vinyl Frame: Double Pane with Low-E SHGC: 0.40 Orientation: Right Side	15			0.350	5
Knee Wall West: Wood Frame, 16" o.c. Orientation: Left Side	69	20.0	0.0		4
Knee Wall East: Wood Frame, 16" o.c. Orientation: Right Side	84	20.0	0.0		5

Step 5: Verify **Orientation** of each wall component and fenestration matches the building plans. Orientation is optional if showing compliance based on UA Trade Off.

Step 6: Verify the fenestration **U-Factors** and **SHGCs** match what is specified on building plans.

WARNING: "Other" Assembly(s) display only a **U-Factor** with no insulation values. Back-up documentation should be requested, if not provided, on the specifications for the overall U-Factor shown. No "other" assemblies are listed in this project.

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Basement Wall 2: Solid Concrete or Masonry Orientation: Left Side Wall height: 9.0' Depth below grade: 4.5' Insulation depth: 9.0'	144	20.0	0.0	7	
Basement Wall 1: Solid Concrete or Masonry Orientation: Right Side Wall height: 9.0' Depth below grade: 4.5' Insulation depth: 9.0'	216	20.0	0.0		11
Basement Wall 3: Solid Concrete or Masonry Orientation: Front Wall height: 9.0' Depth below grade: 7.0' Insulation depth: 9.0'	684	20.0	0.0		31
Floor 1: All-Wood Joist/Truss, Over Unconditioned Space	783	30.0	0.0		26
Floor 2: Slab-On-Grade:Unheated Insulation depth: 4.0'	93		10.0		64

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2009 IECC requirements in REScheck Version 4.3.1 and to comply with the mandatory requirements listed in the REScheck Inspection Checklist.

Name - Title

Signature

Date

Project Notes:

Jones Residence
1000 Maple Street
Circle Construction
Done Right Construction

Plan 3677

Step 7: Verify the correct **Floor assembly(s)** that define the building thermal envelope are shown. For example, a crawl space vented to the outside, the crawl walls would not be part of the building thermal envelope and should not be shown on the report, but the floor above the vented crawl space should be shown as part of the building thermal envelope. If a conditioned basement is fully below grade with a foundation that is > 12" below grade, a slab on grade assembly should not be shown on the report. If it is a walkout basement, slab on grade should be shown in linear feet of the slab on grade area that is exposed.

Step 8: Verify the dimensions of below grade walls (**basement walls**) and the specified insulation values. **Continuous insulation R-values** specified for basement walls would be considered insulation installed on the exterior side of the wall component.

Step 9: Verify the Compliance Statement has been signed. If the signature line does not appear, this means the building is not in compliance as entered.

REScheck™ Software Version 4.3.1 INSPECTION CHECKLIST

Step 10: Verify the R-values, U-factors, and SHGCs of all building thermal envelope components listed on the **Inspection Checklist** match the values listed in the preceding section. Include any comments to the inspectors in this section. Check the comments on each of the sections to ensure that they apply to the project.

Ceilings:

- Ceiling 1: All-Wood Joist/Rafter/Truss, R-49.0 cavity insulation
Comments: _____

Above-Grade Walls:

- Exterior Wall 1: Wood Frame, 16" o.c., R-20.0 cavity insulation
Comments: _____
- Exterior Wall 2 South: Wood Frame, 16" o.c., R-20.0 cavity insulation
Comments: _____
- Exterior Wall 3 East: Wood Frame, 16" o.c., R-20.0 cavity insulation
Comments: _____
- Exterior Wall 4 West: Wood Frame, 16" o.c., R-20.0 cavity insulation
Comments: _____
- Knee Wall West: Wood Frame, 16" o.c., R-20.0 cavity insulation
Comments: _____
- Knee Wall East: Wood Frame, 16" o.c., R-20.0 cavity insulation
Comments: _____

Basement Walls:

- Basement Wall 2: Solid Concrete or Masonry, 9.0' ht / 4.5' bg / 9.0' insul, R-20.0 cavity insulation
Comments: _____
- Basement Wall 1: Solid Concrete or Masonry, 9.0' ht / 4.5' bg / 9.0' insul, R-20.0 cavity insulation
Comments: _____
- Basement Wall 3: Solid Concrete or Masonry, 9.0' ht / 7.0' bg / 9.0' insul, R-20.0 cavity insulation
Comments: _____

Windows:

- Window main: Vinyl Frame, Double Pane, U-factor: 0.350
For windows without labeled U-factors, describe features:
#Panes _____ Frame Type _____ Thermal Break? Yes _____ No _____
Comments: _____
- Window 2: Vinyl Frame:Double Pane with Low-E, U-factor: 0.350
For windows without labeled U-factors, describe features:
#Panes _____ Frame Type _____ Thermal Break? Yes _____ No _____
Comments: _____
- Window 3: Vinyl Frame:Double Pane with Low-E, U-factor: 0.350
For windows without labeled U-factors, describe features:
#Panes _____ Frame Type _____ Thermal Break? Yes _____ No _____
Comments: _____

Doors:

- Door 1: Opaque, U-factor: 0.500
Comments: _____

This door is exempt from the U-factor requirement.

- Door 2: Solid, U-factor: 0.500
Comments: _____

Floors:

- Floor 1: All-Wood Joist/Truss, Over Unconditioned Space, R-30.0 cavity insulation
Comments: _____

Floor insulation is installed in permanent contact with the underside of the subfloor decking.

- Floor 2: Slab-On-Grade:Unheated, 4.0' insulation depth, R-10.0 continuous insulation

Comments: _____

Slab insulation extends down from the top of the slab to at least 4.0 ft. OR down to at least the bottom of the slab then horizontally for a total distance of 4.0 ft.

Air Leakage:

- Joints (including rim joist junctions), attic access openings, penetrations, and all other such openings in the building envelope that are sources of air leakage are sealed with caulk, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.
- Air barrier and sealing exists on common walls between dwelling units, on exterior walls behind tubs/showers, and in openings between window/door jambs and framing.
- Recessed lights in the building thermal envelope are 1) type IC rated and ASTM E283 labeled and 2) sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.
- Access doors separating conditioned from unconditioned space are weather-stripped and insulated (without insulation compression or damage) to at least the level of insulation on the surrounding surfaces. Where loose fill insulation exists, a baffle or retainer is installed to maintain insulation application.
- Wood-burning fireplaces have gasketed doors and outdoor combustion air.

Step 11: If Air Sealing and Insulation are not verified via testing, the items listed must be verified by **Visual Inspection**.

Air Sealing and Insulation:

- Building envelope air tightness and insulation installation complies by either 1) a post rough-in blower door test result of less than 7 ACH at 33.5 psf OR 2) the following items have been satisfied:

Air barriers and thermal barrier: Installed on outside of air-permeable insulation and breaks or joints in the air barrier are filled or repaired.

Ceiling/attic: Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed.

Above-grade walls: Insulation is installed in substantial contact and continuous alignment with the building envelope air barrier.

Floors: Air barrier is installed at any exposed edge of insulation.

Plumbing and wiring: Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.

Corners, headers, narrow framing cavities, and rim joists are insulated.

Shower/tub on exterior wall: Insulation exists between showers/tubs and exterior wall.

Sunrooms:

- For Zones 4 through 8, the maximum fenestration U-factor shall be 0.50 and the maximum skylight U-factor shall be 0.75. New windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements.

Materials Identification and Installation:

- Materials and equipment are installed in accordance with the manufacturer's installation instructions.
- Insulation is installed in substantial contact with the surface being insulated and in a manner that achieves the rated R-value.
- Materials and equipment are identified so that compliance can be determined.
- Manufacturer manuals for all installed heating and cooling equipment and service water heating equipment have been provided.
- Insulation R-values, glazing U-factors, and heating and cooling equipment efficiency are clearly marked on the building plans or specifications.

Duct Insulation:

- Supply ducts in attics are insulated to a minimum of R-8. All other ducts in unconditioned spaces or outside the building envelope are insulated to at least R-6.

Duct Construction and Testing:

- Building framing cavities are not used as supply ducts.
- All joints and seams of air ducts, air handlers, filter boxes, and building cavities used as return ducts are substantially airtight by means of tapes, mastics, liquid sealants, gasketing or other approved closure systems. Tapes, mastics, and fasteners are rated UL 181A or UL 181B and are labeled according to the duct construction. Metal duct connections with equipment and/or fittings are mechanically fastened. Crimp joints for round metal ducts have a contact lap of at least 1 1/2 inches and are fastened with a minimum of three equally spaced sheet-metal screws.

Exceptions:

Joint and seams covered with spray polyurethane foam.

Where a partially inaccessible duct connection exists, mechanical fasteners can be equally spaced on the exposed portion of the joint so as to prevent a hinge effect.

Continuously welded and locking-type longitudinal joints and seams on ducts operating at less than 2 in. w.g. (500 Pa).

Note: Duct tightness testing is a new requirement in the 2009 IECC. Duct tightness can be verified with a **Postconstruction Test** or a **Rough-In Test**.

- Duct tightness test has been performed and meets one of the following test criteria:
 - Postconstruction leakage to outdoors test:** Less than or equal to 323.8 cfm (8 cfm per 100 ft² of conditioned floor area).
 - Postconstruction total leakage test (including air handler enclosure): Less than or equal to 485.6 cfm (12 cfm per 100 ft² of conditioned floor area) pressure differential of 0.1 inches w.g.
 - Rough-in total leakage test with air handler installed:** Less than or equal to 242.8 cfm (6 cfm per 100 ft² of conditioned floor area) when tested at a pressure differential of 0.1 inches w.g.
 - Rough-in total leakage test without air handler installed: Less than or equal to 161.9 cfm (4 cfm per 100 ft² of conditioned floor area).

Temperature Controls:

- At least one programmable thermostat is installed to control the primary heating system and has set-points initialized at 70 degree F for the heating cycle and 78 degree F for the cooling cycle.

Heating and Cooling Equipment Sizing:

- Additional requirements for equipment sizing are included by an inspection for compliance with the International Residential Code.
- For systems serving multiple dwelling units documentation has been submitted demonstrating compliance with 2009 IECC Commercial Building Mechanical and/or Service Water Heating (Sections 503 and 504).

Circulating Service Hot Water Systems:

- Circulating service hot water pipes are insulated to R-2.
- Circulating service hot water systems include an automatic or accessible manual switch to turn off the circulating pump when the system is not in use.

Heating and Cooling Piping Insulation:

- HVAC piping conveying fluids above 105 degrees F or chilled fluids below 55 degrees F are insulated to R-3.

Swimming Pools:

- Heated swimming pools have an on/off heater switch.
- Pool heaters operating on natural gas or LPG have an electronic pilot light.
- Timer switches on pool heaters and pumps are present.

Exceptions:

Where public health standards require continuous pump operation.

Where pumps operate within solar- and/or waste-heat-recovery systems.

Heated swimming pools have a cover on or at the water surface. For pools heated over 90 degrees F (32 degrees C) the cover has a minimum insulation value of R-12.

Exceptions:

Covers are not required when 60% of the heating energy is from site-recovered energy or solar energy source.

Lighting Requirements:

- A minimum of 50 percent of the lamps in permanently installed lighting fixtures can be categorized as one of the following:
 - Compact fluorescent
 - T-8 or smaller diameter linear fluorescent
 - 40 lumens per watt for lamp wattage ≤ 15
 - 50 lumens per watt for lamp wattage > 15 and ≤ 40
 - 60 lumens per watt for lamp wattage > 40

Note: Lighting is a new requirement in the 2009 IECC.

Other Requirements:

Snow- and ice-melting systems with energy supplied from the service to a building shall include automatic controls capable of shutting off the system when a) the pavement temperature is above 50 degrees F, b) no precipitation is falling, and c) the outdoor temperature is above 40 degrees F (a manual shutoff control is also permitted to satisfy requirement 'c').

Certificate:

A permanent certificate is provided on or in the electrical distribution panel listing the predominant insulation R-values; window U-factors; type and efficiency of space-conditioning and water heating equipment. The certificate does not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels.

NOTES TO FIELD: (Building Department Use Only)

2009 IECC Energy Efficiency Certificate

Insulation Rating	R-Value	
Ceiling / Roof	49.00	
Wall	20.00	
Floor / Foundation	30.00	
Ductwork (unconditioned spaces):	_____	
Glass & Door Rating	U-Factor	SHGC
Window	0.35	0.40
Door	0.50	NA
Heating & Cooling Equipment	Efficiency	
Heating System: _____	_____	
Cooling System: _____	_____	
Water Heater: _____	_____	
Name: _____	Date: _____	
Comments: _____		

Step 12: Verify information matches compliance report. Additional information may need to be manually entered (water heater efficiency, duct insulation. The code requires that only the predominant values be listed. Where there is more than one value for each component the certificate should list the value covering the largest area.



Additions – Case Study

U.S. DEPARTMENT OF
ENERGY Energy Efficiency & Renewable Energy

Compliance options for additions:

- Treat the addition as a stand-alone building
- Bring the entire building into compliance

Wall Areas

- North – 162 ft²
- East – 45 ft²
- South – 189 ft²
- West – 405 ft²

Window Areas

- North – 30 ft²
- South – 42 ft²
- East – 90 ft²

Ceiling Area
810 ft²

Slab Perimeter
89 linear ft

BUILDING ENERGY CODES UNIVERSITY
www.energycodes.gov/becu

New Addition Criteria

U.S. DEPARTMENT OF
ENERGY Energy Efficiency & Renewable Energy

- REScheck™ determines pass or fail prescriptively for each component.
- When an addition creates a new common wall, the wall is not put into REScheck™.
- When adding a second story:
 - Additions over existing conditioned space create a common floor that is not entered in REScheck™
 - Additions over an uninsulated garage create additional floor area that must be insulated to code.

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The following slides offer 2009 IECC compliance guidance for additions, alterations, and sunrooms—as well as some tips and screenshots on using REScheck™ for these building projects.

For additions, there are two main compliance options:

1. Treat the addition as a stand-alone building and ignore the common walls between the existing building and the addition.
2. Combine the existing building with the addition and bring the whole building up to compliance. Compliance can be harder to achieve if the existing building is quite old.

Untitled.rck - REScheck 4.3.1 Code: 2009 IECC

File Edit View Options Code Tools Help

Project Envelope Mechanical

Ceiling Skylight Wall Window Door Basement Floor Crawl Wall

Component	Post-Alteration Assembly	Alteration Details	Gross Area or Slab Perimeter	Cavity Insulation R-Value	Continuous Insulation R-Value	Proposed U-Factor	UA	Depth of Insulation (ft)		
Building										
1	Ceiling 1	Flat Ceiling or Scissor Truss	No exemptions apply	810	ft2	39.0	0.0	0.03	24	
2	Wall 1	Wood Frame, 16" o.c.	No exemptions apply	801	ft2	20.0	0.0	0.059	38	
3	Window 1	Vinyl Frame:Double Pane	No exemptions apply	162	ft2			0.35	57	
4	Floor 1	Slab-On-Grade:Unheated	No exemptions available	89	ft			10.0	61	4.0

Compliance Passes Max. UA 185 Your UA 180 2.7 % Better Than Code

For additions no exemptions apply.

Alterations

- Each component that is being altered will be entered into REScheck™
- Common Alterations:
 - Window Replacement
 - Roof Replacement
 - Addition of Insulation

Alteration Detail: Window 1 ✕

Exemptions from meeting code compliance on this assembly alteration are listed below. Select the appropriate option.

- Alteration only installs storm windows over existing glazing
- Alteration only replaces glazing (i.e., glass units) in existing sash or frame
- No exemptions apply to this assembly

Choose the alteration exemption that applies, if any.

5

Alteration Detail: Ceiling 1 ✕

Exemptions from meeting code compliance on this assembly alteration are listed below. Select the appropriate option.

- Alteration does not expose a framing cavity
- Alteration exposes a framing cavity but the cavity is completely filled with insulation
- Alteration involves reroofing where neither sheathing nor insulation is exposed
- No exemptions apply to this assembly

Choose the roofing alteration exemption that applies, if any.

6

Sunroom addition defined:

- > 40% glazing of gross exterior wall and roof area
- Separate heating or cooling system or zone
- Must be thermally isolated and not used as a kitchen or sleeping quarters



Note: REScheck™ cannot be used for sunrooms

7

Minimum Insulation:

- ceiling: R-19 for climate zones 1-4
- ceiling: R-24 for climate zones 5-8
- walls: R-13 for all climate zones

A new wall (or walls) separating a sunroom from a conditioned space shall meet the building thermal envelope requirements.

Fenestration: 0.50 U-factor in climate zones 4-8 is a maximum

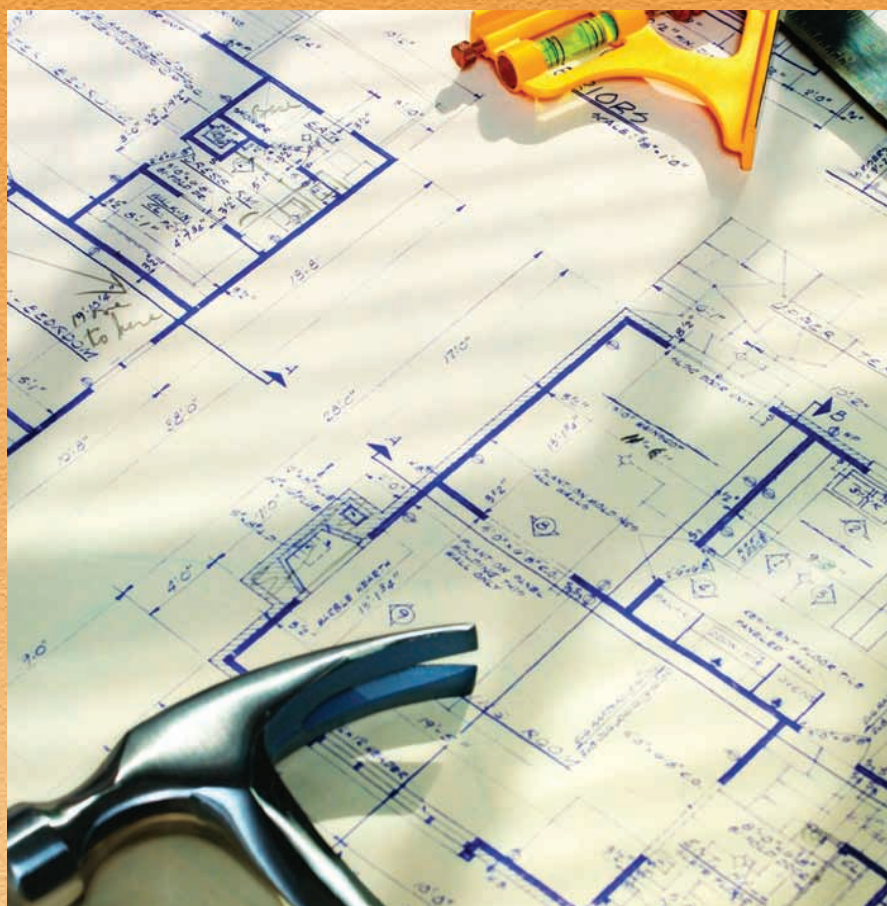
Skylights: 0.75 U-factor in all climate zones

Any new windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements.

8

2009 IECC® Performing Residential Energy Plan Reviews

Based on the 2009 *International Energy Conservation Code*® (IECC®)



2009 IECC®

Performing Residential Energy Plan Reviews

Based on the 2009 *International Energy Conservation Code*® (IECC®)

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Table of Contents

Introduction.....	1
Module 1: Introduction to and Familiarization with the Codes.....	5
Working with the IECC.....	5
IECC's Relationship with ARRA.....	5
IECC's Role Within the I-Codes.....	6
IECC's Relationship with the IRC.....	7
Comparison of Similar Sections of the IRC and IECC.....	8
Other Areas Worth Mentioning.....	9
Partial List of IRC Items that Affect Implementation of the IECC.....	9
General Organization of the IECC.....	9
Staying Current with the IECC.....	10
Update the code book.....	11
Significant Changes to the 2009 IECC.....	12
The IECC Plan Review Process.....	14
The Inspection Process.....	15
Module 2: Chapters 1-3 of the IECC.....	17
IECC Chapter 1, Part 1: Scope and Application.....	17
IECC Chapter 1, Part 2: Administration and Enforcement.....	20
IECC Chapter 1 Review.....	22
IECC Chapter 2: Definitions.....	24
IECC Chapter 2 Review.....	28
IECC Chapter 3: General Requirements.....	29
IECC Chapter 3 Review.....	30
Module 3: Residential Energy Efficiency, Mandatory Provisions in Chapter 4.....	31
Key Concepts in the IECC.....	32
Compliance Process.....	33
A Sample Heat Loss Calculation.....	37
Module 4: Prescriptive Requirements.....	39
Compliance Process.....	39
Common Elements of the Prescriptive Path.....	40
Specific Insulation Requirements.....	41
Compliance Methods for Insulation and Fenestration.....	42
Plan Review.....	47
Compliance Process.....	48
R-value Computation.....	48
Plan Review.....	50
Compliance Process.....	51
U-factor Alternative.....	51
Weighted Average Worksheet for Residential Buildings.....	53
U-factor Alternative Plan Review.....	54
Compliance Process.....	55
What's the Difference Between UA and Total UA?.....	56

Table of Contents

Why Might Someone Want to Use Total UA?	56
Manually Calculate the Total UA	57
Using REScheck documents in residential plan reviews	58
REScheck Comparison	60
REScheck Exercise	61
Module 5: Performance Requirements for IECC Compliance	63
Compliance Process	63
Simulated Performance	63
Fuel Cost Exercise	65
A Simple Cost of Fuel Calculation	66
405.4 Documentation	67
Reading HERS reports.....	68
Module 6: Document Compliance and Knowledge Self-test	69
Compliance Process	69
Knowledge Self-test	70
Final Reflection.....	79
Answers to Activities.....	81
Activity—Pages 22-23	81
Activity—Page 28	82
Activity—Page 30	82
Activity—Page 32	83
Activity—Page 37	84
Activity—Page 47	85
Activity—Page 50	86
Activity—Page 53	89
Activity—Page 54	89
Activity—Page 57	91
Activity—Page 61	92
Activity—Page 65	97
Activity—Page 70	98
Appendix.....	101
Submittal Package.....	101
ES Report Activity	109
Example 1	118
Example 2	124
HERS Report.....	129

Introduction

This Course addresses the residential provisions of the 2009 *International Energy Conservation Code*[®] (IECC[®]). Although the *International Residential Code*[®] (IRC[®]) contains general energy provisions, the IECC provides a more specific and flexible framework for compliance. The IECC has been created to work within the Code Council family of codes, and should be utilized in conjunction with the IRC and other Code Council codes as applicable.

Seminar Goal

The goal of this seminar is for participants to apply the 2009 IECC to increase the efficient use of energy in the construction of new residential buildings and alterations to existing residential buildings. This will be accomplished through plan review to verify compliance with the code and approved design documents.

Description

The course involves exercises and practice on several energy plan reviews that are intended to help the energy plan reviewer to identify those areas to inspect in the structure after approval and to ensure compliance with the IECC.

Importance

There are many reasons that the IECC may be considered a good thing.

- For many, simple cost containment is an adequate argument for strong energy provisions. Buildings utilize approximately 70 percent of the fossil fuel in the United States, and most people don't know how much per unit (Btu/therm/cu ft, kwh) they're paying. But just about every one of them thinks they're paying too much.
- Even those who balk at additional regulation should realize that when a neighbor builds an energy hog, the infrastructure for generating and transmitting the energy is shared by all. Energy usage is not a personal matter; one person's usage affects the rates of all.
- For others, sustainability, limiting climate change, and reduction of the carbon footprint are important aspects. Proper application of the Energy Code helps towards all of those goals.
- Jobs and employment may be an additional consideration. The American Recovery and Reinvestment Act (ARRA) has specified compliance with the IECC as a condition for the receipt of federal grant money. This is not an unfunded mandate; funds for training, job retention and job creation are included.
- Regardless of the reasons above, it's the law.

Objectives

Upon completion of this seminar, participants will be better able to

- Describe the purpose, criteria and basis for the plan review and code compliance with the 2009 IECC, including
 - Plan review authorities and responsibilities
 - The collaborative nature of professional plan review
- Explain requirements for construction documents
- Meet plan review documentation and recordkeeping requirements
- Describe the basic terms related to performing an energy plan review
- Determine if the plan needs to comply with the IECC
- Determine if the plan needs to comply with residential or commercial provisions of the IECC
- Identify the compliance path for a given set of plans
 - *R*-value,
 - *U*-factor,
 - UA and
 - simulated performance.
- Identify and assess the design of building components for code compliance
- Evaluate those circumstances where requirements established in the IRC affect the IECC.

In short:

The objective is to make each of you **THE EXPERT** in your organization when it comes to residential energy plan review.

Having the capability to perform energy plan reviews will improve the resume and add value as a member of the plan review department. Each skill mastered will add value when it comes to employment and retention decisions.

IECC[®]

INTERNATIONAL ENERGY
CONSERVATION CODE[®]

CODE AND COMMENTARY

2009



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PREFACE

The principal purpose of the Commentary is to provide a basic volume of knowledge and facts relating to building construction as it pertains to the regulations set forth in the 2009 *International Energy Conservation Code*[®]. The person who is serious about effectively designing, constructing and regulating buildings and structures will find the Commentary to be a reliable data source and reference to almost all components of the built environment.

As a follow-up to the *International Energy Conservation Code*, we offer a companion document, the *International Energy Conservation Code Commentary*. The basic appeal of the Commentary is thus: it provides in a small package and at reasonable cost thorough coverage of many issues likely to be dealt with when using the *International Energy Conservation Code*—and then supplements that coverage with historical and technical background. Reference lists, information sources and bibliographies are also included.

Throughout all of this, strenuous effort has been made to keep the vast quantity of material accessible and its method of presentation useful. With a comprehensive yet concise summary of each section, the Commentary provides a convenient reference for regulations applicable to the construction of buildings and structures. In the chapters that follow, discussions focus on the full meaning and implications of the code text. Guidelines suggest the most effective method of application and the consequences of not adhering to the code text. Illustrations are provided to aid understanding; they do not necessarily illustrate the only methods of achieving code compliance.

The format of the Commentary includes the full text of each section, table and figure in the code, followed immediately by the commentary applicable to that text. At the time of printing, the Commentary reflects the most up-to-date text of the 2009 *International Energy Conservation Code*. Each section's narrative includes a statement of its objective and intent and usually includes a discussion about why the requirement commands the conditions set forth. Code text and commentary text are easily distinguished from each other. All code text is shown as it appears in the *International Energy Conservation Code*, and all commentary is indented below the code text and begins with the symbol ❖.

Readers should note that the Commentary is to be used in conjunction with the *International Energy Conservation Code* and not as a substitute for the code. **The Commentary is advisory only**; the code official alone possesses the authority and responsibility for interpreting the code.

Comments and recommendations are encouraged, for through your input, we can improve future editions. Please direct your comments to the Codes and Standards Development Department at the Chicago District Office.

TABLE OF CONTENTS

CHAPTER 1 ADMINISTRATION 1-1 — 1-30

CHAPTER 2 DEFINITIONS 2-1 — 2-18

CHAPTER 3 GENERAL REQUIREMENTS 3-1 — 3-28

**CHAPTER 4 RESIDENTIAL ENERGY
EFFICIENCY 4-1 — 4-40**

**CHAPTER 5 COMMERCIAL ENERGY
EFFICIENCY 5-1 — 5-108**

CHAPTER 6 REFERENCED STANDARDS..... 6-1 — 6-6

INDEX INDEX-1 — INDEX-6

Chapter 4: Residential Energy Efficiency

General Comments

Chapter 4 contains the energy-efficiency-related requirements for the design and construction of residential buildings regulated under the code. The applicable portions of the building must comply with the provisions within this chapter for energy efficiency.

Section 401 contains the scope and application of the chapter and also regulates a certificate that must be left with the building. Section 402 contains the insulation *R*-value requirements and the window *U*-factor requirements for the building envelope, which includes the roof/ceiling assembly, wall assembly and floor assembly as well as fenestration requirements. Section 403 contains the systems requirements for heating and cooling systems and includes requirements for equipment sizing, duct installation, piping insulation and the requirements for controls. Section 404 provides a performance option that will not only provide an additional means of

demonstrating compliance with the code, but also allows trade-offs between the various systems. Note that, for purposes of the code, a residential building is a building used for residential occupancies R-2, R-3, and R-4 that is less than four stories in height.

Purpose

This chapter defines requirements for the portions of the building and building systems that impact energy use in new residential construction and promotes the effective use of energy. The provisions within the chapter promote energy efficiency in the building envelope, the heating and cooling system and the service water heating system of the building. Compliance with this chapter will provide a minimum level of energy efficiency for new construction. Greater levels of efficiency can be installed to decrease the energy use of new construction.

SECTION 401 GENERAL

401.1 Scope. This chapter applies to residential buildings.

❖ This chapter covers the “residential” buildings as they are defined within Chapter 2. A review of the definition is important because it does not include all buildings that are classified as “residential” by the *International Building Code*® (IBC®). Hotels, motels and other transient occupancies that are classified as a Group R-1 occupancy by the IBC are not included within the definition of “Residential” and would therefore need to comply with the “commercial” provisions that are found in Chapter 5. Though not specifically mentioned within the definition, structures that are allowed to comply with the *International Residential Code*® (IRC®) would also be permitted to use Chapter 4 for compliance. The IRC contains provisions in Chapter 11 of that code that are virtually identical to those found within Chapter 4 of the code. The IRC, however, does not contain the performance option that is found within Section 405. Therefore, if a structure built under the IRC would want to use the code it would be appropriate to use the residential provisions of Chapter 4 and not the commercial requirements found within Chapter 5.

Chapter 4 applies to portions of the building thermal envelope that enclose conditioned space as shown in Figure 401.1(1). Conditioned space is the area pro-

vided with heating and/or cooling either directly through a positive heating/cooling supply system such as registers located in the space, or indirectly through an opening that allows heated or cooled air to communicate directly with the space. For example, a walk-in closet connected to a master bedroom suite may not contain a positive heating supply through a register, but it would be conditioned indirectly by the free passage of heated or cooled air into the space from the bedroom.

The code through Section 101.5.2 exempts areas that do not contain conditioned space and are separated from the conditioned spaces of the building by the building envelope from the building thermal envelope requirements. A good example of this would be an unconditioned garage or attic space. In the case of a garage, if the unconditioned garage area is separated from the conditioned portions of the residence by an assembly that meets the building thermal envelope criteria (meaning that the wall between them is insulated), the exterior walls of the garage would not need to be insulated to separate the garage from the exterior climate.

The building thermal envelope consists of the wall, roof/ceiling and floor assemblies that surround the conditioned space. Raised floors over a crawl space or garage or directly exposed to the outside air are considered to be part of the floor assembly. Walls sur-

rounding a conditioned basement (in addition to surrounding conditioned spaces above grade) are part of the building envelope. The code defines “Above grade walls” surrounding conditioned spaces as exterior walls. This definition includes walls between the conditioned space and unconditioned garage, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and basement walls with an average below grade area that is less than 50 percent of the total basement gross wall area. This definition would not include walls separating an unconditioned garage from the outdoors. The code’s definition of “Exterior walls” would also include basement walls. The roof/ceiling assembly is the surface where insulation will be installed, typically on top of the gypsum board [see Figure 401.1(2)].

401.2 Compliance. Projects shall comply with Sections 401, 402.4, 402.5, and 403.1, 403.2.2, 403.2.3, and 403.3 through 403.9 (referred to as the mandatory provisions) and either:

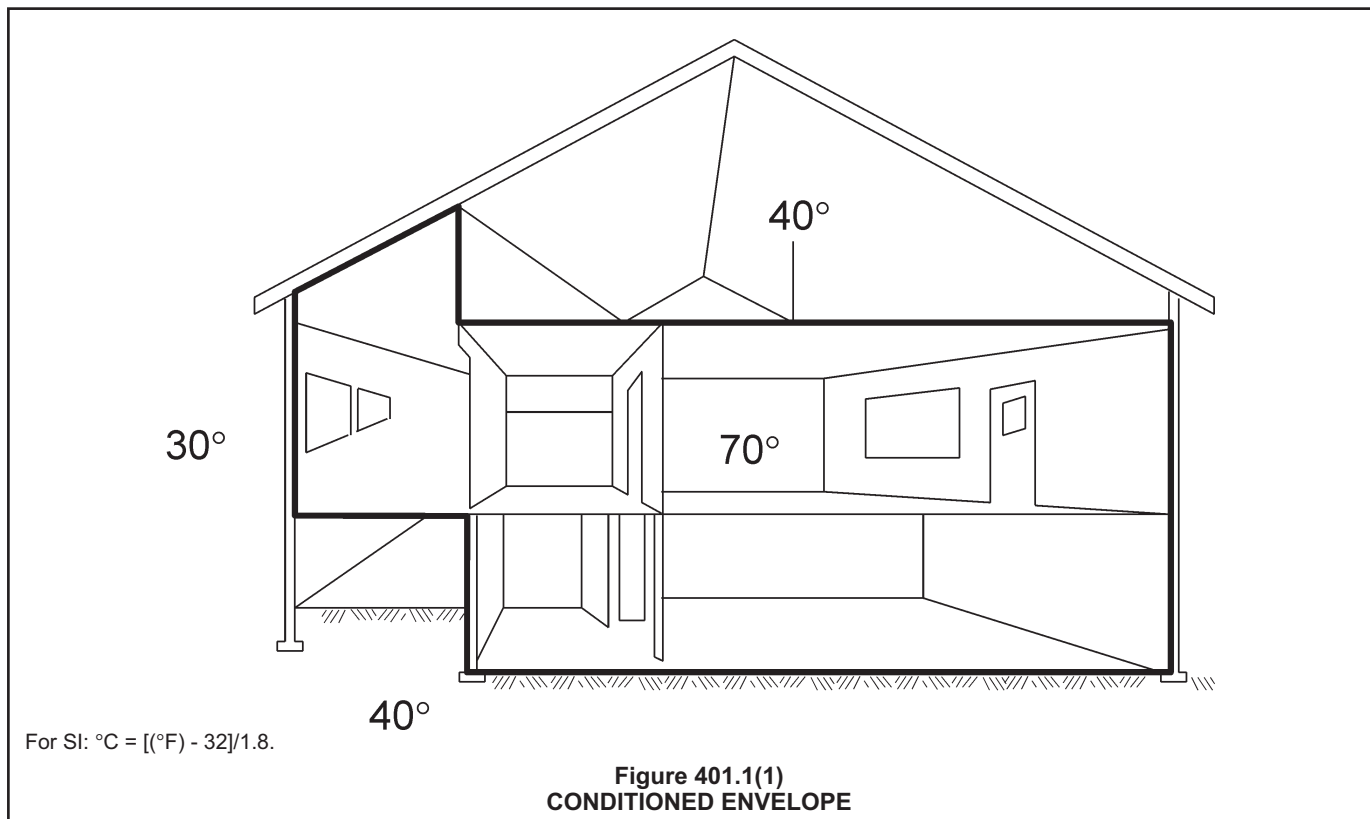
1. Sections 402.1 through 402.3, 403.2.1 and 404.1 (prescriptive); or
2. Section 405 (performance).

❖ This section allows residential buildings to comply with either the prescriptive building thermal envelope requirements of Sections 402.1 through 402.3, 403.2.1, and 404.1 or the performance options that are provided in Section 405. Under either option, the building must comply with the “mandatory” requirements that are found in Sections 401, 402.4, 402.5, 403.1, 403.2.2, 403.2.3 and 403.3. A code user may evaluate

both options and use the one that fits the project best, as these two differing methods can result in different requirements. Most requirements are given prescriptively. Two alternative tradeoffs are specified for many requirements, especially for the building thermal envelope requirements. For requirements specified by *U*-factors, an overall UA (*U*-factor times the area) can be used to show equivalence. A performance-based annual energy calculation can also be met by showing overall energy equivalence.

The majority of the requirements of this chapter are based upon the climate zone where the project is being built. The appropriate climate zone can be found in Chapter 3 of the code. Zones 1 through 7 apply to various parts of the continental United States and are defined by county lines. Zones 7 and 8 apply to various parts of Alaska, and Hawaii is classified as Zone 1. The climate zones have been divided into marine, dry and moist to deal with levels of humidity. For more details and background on the development of the new climate zones, see the commentary in Chapter 3.

401.3 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. 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 types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall list “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be *listed* for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.

❖ This section is intended to increase the consumer’s awareness of the energy-efficiency ratings for the various building elements in his or her home. The builder or registered design professional has to complete the certificate and place it on or inside the electrical panel (see Figure 401.3).

The certificate must disclose the building’s *R*-values, fenestration *U*-factors and fenestration solar heat gain coefficient (SHGC), heating, ventilating and air-conditioning (HVAC) equipment types and efficiencies. The energy efficiency of a building as a system is a function of many elements considered as separate parts of the whole. It is difficult to have a proper identification and analysis of a building’s energy efficiency once the building is completed because many of the elements may not be readily accessible.

This information is also valuable for existing structures undergoing alterations and additions to help determine the appropriate sizing for the mechanical systems.

This is meant to be a simple certificate that is easy to read. The certificate does not contain all the information required for compliance and cannot be substituted for information on the required construction documents. Instead, the certificate is meant to provide the housing owner, occupant or buyer with a simple-to-understand overview of the home’s energy efficiency.

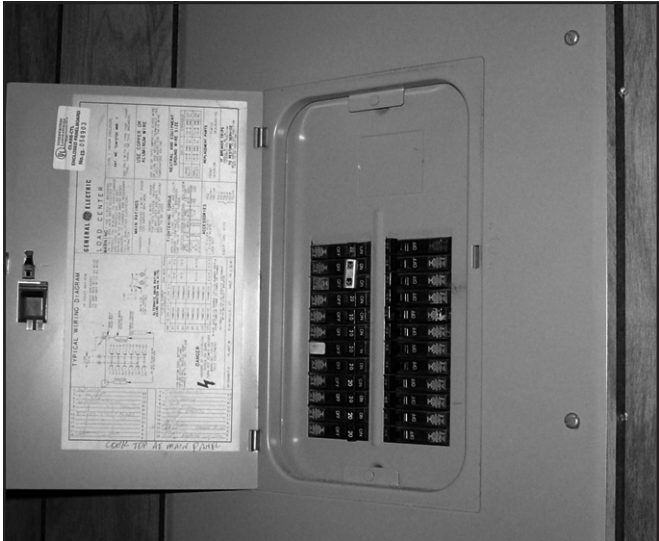


Figure 401.3
CERTIFICATE

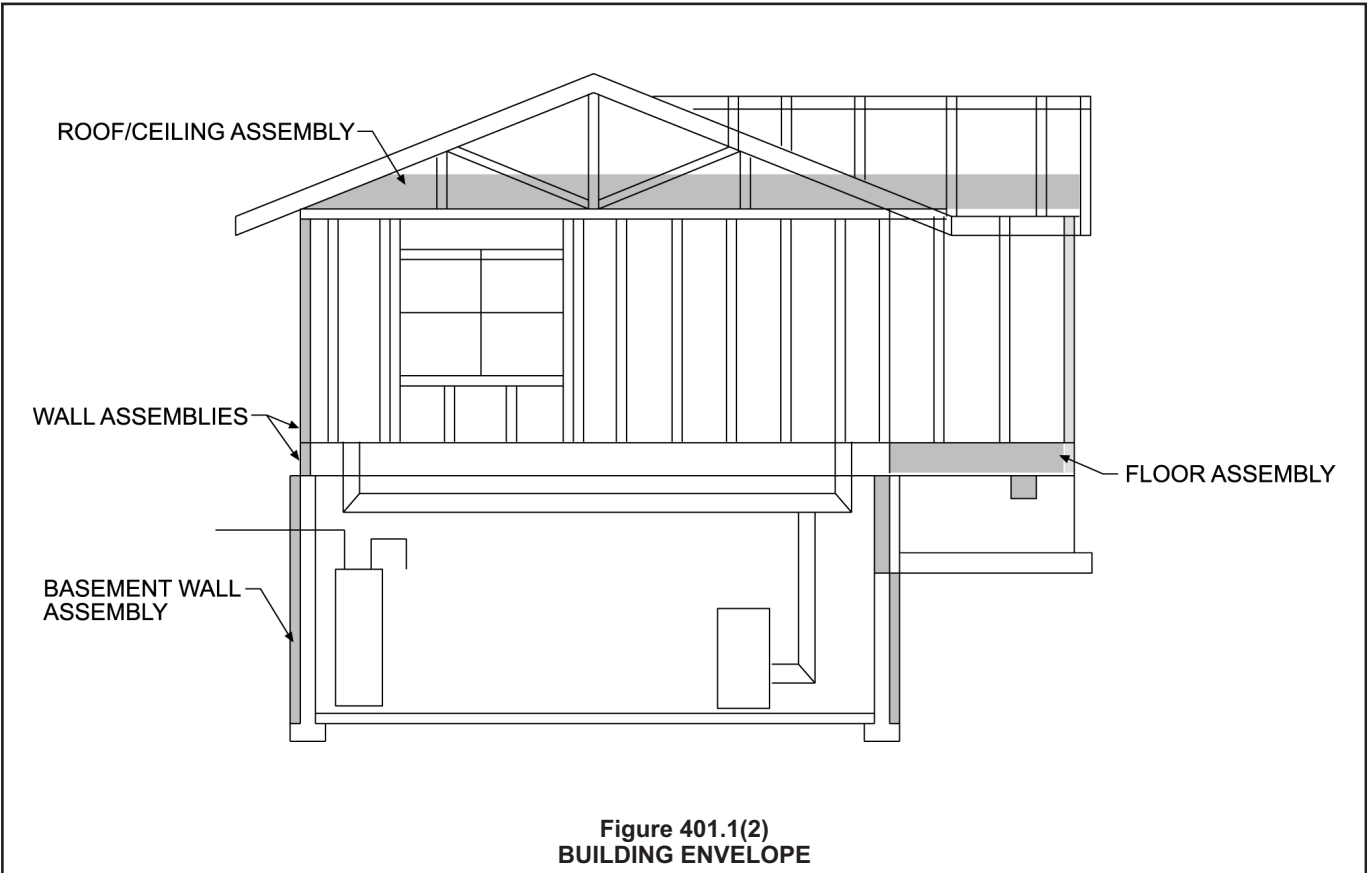


Figure 401.1(2)
BUILDING ENVELOPE

ciency. Where there is a mixture of insulation and/or fenestration values, the value applying to the largest area is specified. For example, if most of the wall insulation was R-19, but a limited area bordering the garage was R-13, the certificate would specify R-19 for the walls. (In contrast, plans and overall compliance would need to account for both *R*-values.)

The code specifies the minimum information on the certificate, but does not prohibit additional information being added so long as the required information is clearly visible. For example, a builder might choose to list energy-efficiency features beyond those required by the code.

SECTION 402 BUILDING THERMAL ENVELOPE

402.1 General (Prescriptive).

❖ The provisions of Section 402 are the detailed requirements of the levels of insulation, the performance of openings (fenestrations) and air-leakage and moisture-control provisions that serve to establish the building's energy efficiency. When combined with the "systems" requirements (Section 403), these two sections will provide the total package of energy conservation that the code requires.

The term "building thermal envelope" is defined in Chapter 2 as being "the basement walls, exterior walls, floor, roof and any other building elements that enclose conditioned spaces." Therefore, when combined with the definition of "Conditioned space," the code has defined the boundaries of the building that will be regulated by this section. The building thermal envelope is a key term and resounding theme used throughout the energy requirements. It defines what portions of the building structure bound conditioned space and are thereby covered by the insulation and infiltration (air leakage) requirements of the code. The building thermal envelope includes all building components separating conditioned spaces (see commentary, "Conditioned space") from unconditioned spaces or outside ambient conditions and through which heat is transferred. For example, the walls and doors separating an unheated garage (unconditioned space) from a living area (conditioned space) are part of the building envelope. The walls and doors separating an unheated garage from the outdoors are not part of the building thermal envelope. Walls, floors and other building components separating two conditioned spaces are not part of the building envelope. For example, interior partition walls, the common or party walls separating dwelling units in multiple-family buildings and the wall between a new conditioned addition and the existing conditioned space are not considered part of the building envelope.

Unconditioned spaces (areas having no heating or cooling sources) are considered outside the building thermal envelope and are exempt from these requirements (see Section 101.5.2). A space is conditioned if

it is heated or cooled directly; communicates directly with a conditioned space; or where a space is indirectly supplied with heating, cooling or both through uninsulated walls, floors or uninsulated ducts or HVAC piping. Boundaries that define the building envelope include the following:

- Building assemblies separating a conditioned space from outdoor ambient weather conditions.
- Building assemblies separating a conditioned space from the ground under or around that space, such as the ground around the perimeter of a slab or the soil at the exterior of a conditioned basement wall. Note that the code does not specify requirements for insulating basement floors or underneath slab floors (except at the perimeter edges).
- Building assemblies separating a conditioned space from an unconditioned garage, unconditioned sunroom or similar unheated/cooled area.

The code specifies requirements for ceiling, wall, floor, basement wall, slab-edge and crawl space wall components of the building envelope. In some cases, it may be unclear how to classify a particular part of a building. For example, skylight shafts have properties of a wall assembly but are located in the ceiling assembly. In these situations, a determination needs to be made and approved by the code official prior to construction so that the proper level of insulation can be installed to complete the building thermal envelope. Generally, skylight shafts and other items that are vertical or at an angle of greater than 60 degrees (1.1 rad) from the horizontal would typically use the wall insulation value.

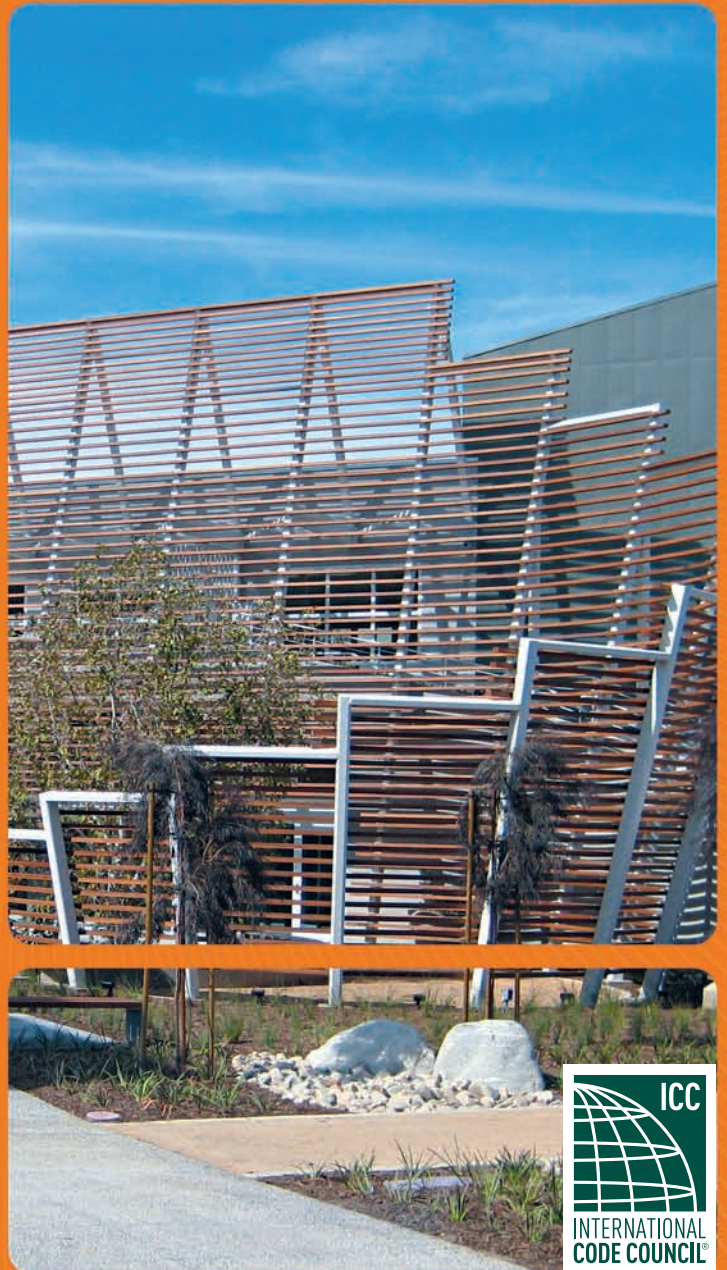
402.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Table 402.1.1 based on the climate *zone* specified in Chapter 3.

❖ This section serves as the basis for the code's general insulation and fenestration requirements. Therefore, this is the first place to determine what the requirements for the building thermal envelope will be. There are specific requirements for certain assemblies and locations that are addressed in Sections 402.2 and 402.3. Those requirements should be checked and would be considered the applicable requirements for those items based on the normal code application that the specific requirement shall be applicable. This section begins by establishing the requirements for the building thermal envelope by requiring compliance with the proper component insulation and fenestration requirements of Table 402.1.1. However, once that general requirement is established, Sections 402.1.2, 402.1.3 and 402.1.4 will provide three possible means of showing that the building thermal envelope will comply. Any of the three methods may be used at the discretion of the designer. The three options and their advantages are discussed in the commentary with the subsections. In general, the later subsections will pro-

2009

International Energy Conservation Code[®]

Study Companion



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TABLE OF CONTENTS

Study Session 1:

2009 IECC Chapter 1—Administration and Enforcement	1
Quiz	12

Study Session 2:

2009 IECC Chapters 2 and 3—Definitions and Climate Zones	19
Quiz	34

Study Session 3:

2009 IECC Sections 401 and 402 (partial)—Residential Energy Efficiency—Part I	39
Quiz	55

Study Session 4:

2009 IECC Sections 402 (partial) and 403—Residential Energy Efficiency—Part II	61
Quiz	75

Study Session 5:

2009 IECC Sections 404 and 405—Residential Energy Efficiency—Part III	81
Quiz	90

Study Session 6:

2009 IECC Sections 501 and 502 (partial)—Commercial Energy Efficiency—Part I	95
Quiz	105

Study Session 7:

2009 IECC Sections 502 (partial) and 503 (partial)—Commercial Energy Efficiency—Part II	111
Quiz	124

Study Session 8:

2009 IECC Sections 503 (partial) and 504—Commercial Energy Efficiency—Part III	129
Quiz	140

Study Session 9:

2009 IECC Section 505 (partial)—Commercial Energy Efficiency—Part IV	147
Quiz	158

Study Session 10:

2009 IECC Sections 505 (partial) and 506—Commercial Energy Efficiency —Part V 165
Quiz 173

Answer Keys 179

INTRODUCTION

This study companion provides practical learning assignments for independent study of the provisions of the 2009 *International Energy Conservation Code*[®] (IECC[®]). The independent study format affords a method for the student to complete the study program in an unregulated time period. Progressing through the workbook, the learner can measure his or her level of knowledge by using the exercises and quizzes provided for each study session.

The workbook is also valuable for instructor-led programs. In jurisdictional training sessions, community college classes, vocational training programs and other structured educational offerings, the study guide and the IECC can be the basis for code instruction.

All study sessions begin with a general learning objective, the specific sections or chapters of the code under consideration, and a list of questions summarizing the key points of study. Each session addresses selected topics from the IECC and includes code text, a commentary on the code provisions, and illustrations representing the provisions under discussion. Quizzes are provided at the end of each study session. Before beginning the quizzes, the student should thoroughly review the referenced IECC provisions—particularly the key points.

The workbook is structured so that after every question the student has an opportunity to record his or her response and the corresponding code reference. The correct answers are located in the back of the workbook in the answer key.

This study companion was developed by the Britt/Makela Group, Inc. Eric Makela has provided energy code and conservation support for the building, design and enforcement community since 1986. He has trained or presented on energy codes in over 22 states with sessions focused on residential and commercial building energy codes. Eric holds ICC certifications for both Commercial and Residential Energy Codes Plans Examination.

Questions or comments concerning this workbook are encouraged. Please direct your comments to ICC at studycompanion@iccsafe.org.

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Study Session

3

2009 IECC Sections 401 and 402 (partial) Residential Energy Efficiency—Part I

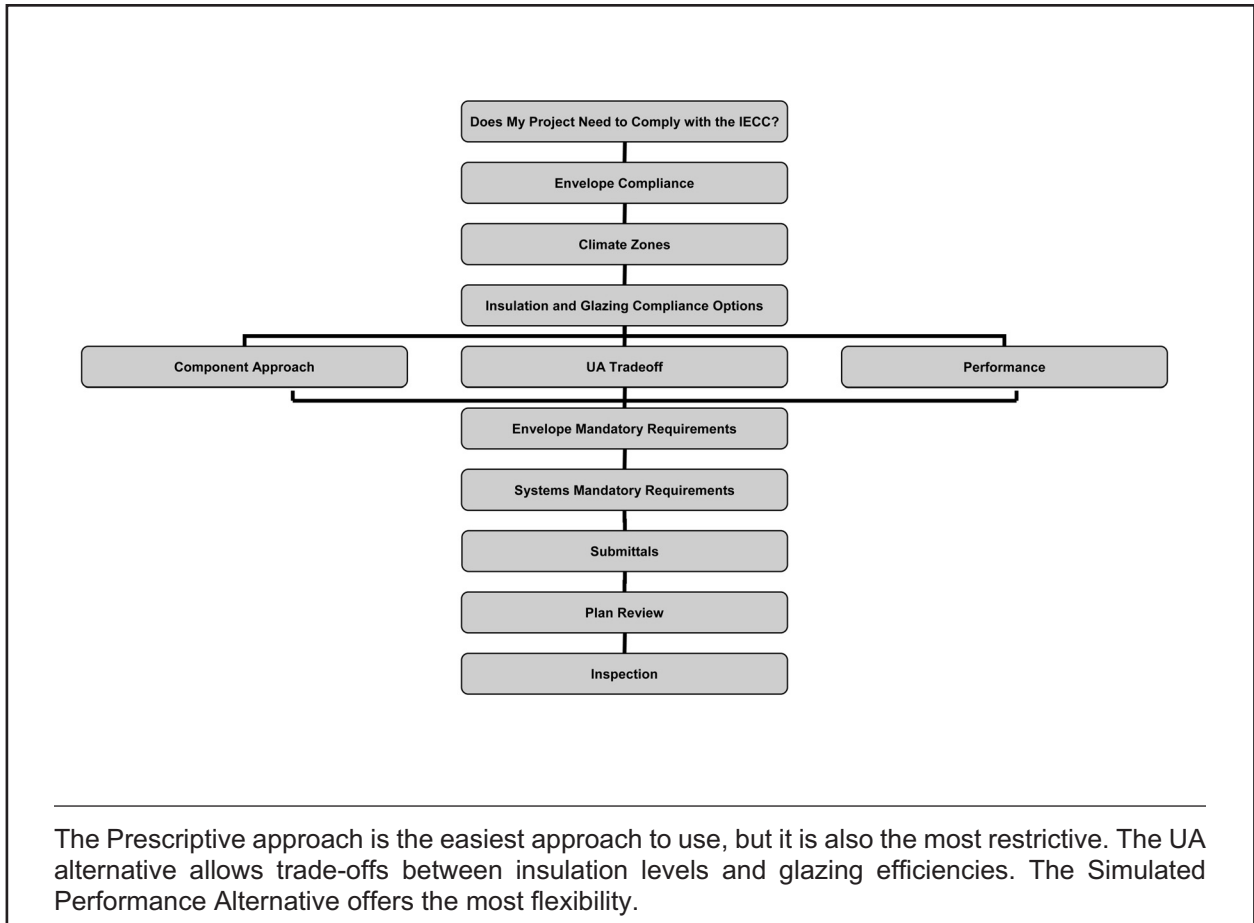
OBJECTIVE: To obtain an understanding of the residential building thermal envelope prescriptive insulation requirements.

REFERENCE: Sections 401 and 402 (partial), 2009 *International Energy Conservation Code*

- KEY POINTS:**
- Which options are available for demonstrating compliance with the Building Thermal Envelope requirements in the IECC for residential occupancies?
 - What energy efficiency information must be included on the certificate that will be posted at each residence?
 - What information is needed to use the “Insulation and Fenestration Requirements by Component” table (Table 402.1.1)? Where is this information located?
 - Can the *R*-value for ceiling assemblies be reduced when the roof framing allows the insulation to be installed full height? What is the requirement for vaulted ceilings without an attic space?
 - Do mass walls require the same insulation levels as framed wall systems? Does insulation placement affect the *R*-value requirement?
 - What is the insulation requirement for steel-framed construction?
 - What is a basement wall? How are walkout basements addressed?
 - If insulation is placed on all of the crawl space walls, may the crawl space be exposed to outside air? What are the requirements for crawl spaces and crawl space wall insulation?
 - Must all of the fenestration meet or exceed the *U*-factor requirements? May any fenestration be exempted?
 - Must all of the fenestration meet or exceed the solar heat gain coefficient requirement? May any fenestration be exempted?

Code Text: *Projects shall comply with Sections 401, 402.4, 402.5, and 403.1, 403.2.2, 403.2.3, and 403.3 through 403.9 (referred to as the mandatory provisions) and either: 1) Sections 402.1 through 402.3, 403.2.1 and 404.1(prescriptive); or 2) Section 405 (performance).*

Discussion and Commentary: Chapter 4 provides three methods for demonstrating compliance with the insulation and glazing requirements of the code. Section 402.1 contains two prescriptive methods of compliance. The code user can choose to comply with the insulation *R*-value requirements, glazing *U*-factor requirements and SHGC requirements by using Table 402.1.1. The code user can also choose to perform a prescriptive trade-off approach by calculating the *U*-factor of each assembly (e.g., wall assembly, floor assembly, etc.) and multiplying this by the area (ft²) of the assembly to determine a UA. Table 402.1.3 is provided for this approach. In addition, the code user can use the Simulated Performance Alternative (Performance) approach to demonstrate compliance with the IECC. Computer modeling is used to determine the cost of energy to operate a residence annually. Mandatory requirements must be met as well, which include air sealing, vapor retarders, duct insulation and duct sealing.



Topic: Certificate
Reference: IECC 401.3

Category: Residential Energy Efficiency
Subject: General Requirements

Code Text: *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.*

Discussion and Commentary: A certificate is required to be posted on or in the electrical panel box that list the levels of efficiency installed. The label will provide the inspector with the information needed to determine if the home complies with the IECC and will also provide the homeowner with information on the levels of efficiency installed in the home.

World's Greatest Energy Company

The following energy efficiency features have been installed in this house:

<u>Feature</u>	<u>Efficiency level</u>
Floor insulation	R-19
Wall insulation	R-21
Attic/ceiling insulation	R-44
Windows efficiency	U-0.35
Window SHGC	SHGC-0.35
Duct insulation	R-8
Heating system type	Forced air, electric
Heating system efficiency	90% AFUE
Cooling system type	Air cooled condenser
Cooling system efficiency	13 SEER

Example of energy efficiency certificate

If the residence contains a gas-fired unvented room heater, electric furnace and/or baseboard electric heater, such information shall be posted on the certificate; however, an efficiency rating shall not be listed for such equipment.

Code Text: *The building thermal envelope shall meet the requirements of Table 402.1.1 based on the climate zone specified in Chapter 3. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. The manufacturer’s settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.*

Discussion and Commentary: Table 402.1.1 provides an easy-to-use prescriptive approach that eliminates the need to determine glass and skylight area. To apply the table, the code user must first determine the climate zone for the proposed residential occupancy. After the climate zone is determined, the user can then determine the R-values of the insulation that is required to be installed for each assembly type. For example, a residence proposed in Climate Zone 3 would need a minimum wall insulation of R-13 to comply. A minimum insulation R-value of R-30 is required at the ceiling.

**TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a**

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, g}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^e WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^c WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65 ^j	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50 ^j	0.65	0.30	30	13	5/8	19	5/13 ^f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5 ^h	13/17	30 ^e	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5 ^h	15/19	30 ^e	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38 ^e	15/19	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 batts compressed into a nominal 2 × 6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
- c. “15/19” means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. “15/19” shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. “10/13” means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
- d. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.
- g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
- h. “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.
- i. The second R-value applies when more than half the insulation is on the interior of the mass wall.
- j. For impact rated fenestration complying with Section R301.2.1.2 of the *International Residential Code* or Section 1608.1.2 of the *International Building Code*, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

R-values are for insulation only. Insulation R-values can be added to determine the total R-value for the assembly. For example, a wall system with R-13 installed between studs, and R-5 rigid board insulation installed over the face of the studs would have a total R-value of R-18.

Study Session

4

2009 IECC Sections 402 (partial) and 403 Residential Energy Efficiency—Part II

OBJECTIVE: To obtain an understanding of the Mandatory Requirements that apply to all residential buildings covered under Chapter 4 of the IECC applicable to the building envelope, mechanical and service water heating system.

REFERENCE: Sections 402 (partial) and 403, 2009 *International Energy Conservation Code*

- KEY POINTS:**
- Can higher levels of efficiency be traded off from one part of the building for lower levels in another part of the building?
 - Why is air leakage important in residential construction? How does the IECC address air sealing? What areas of the structure should be sealed to minimize air leakage?
 - Which types of sealants should be used to effectively seal the structure?
 - What are the requirements for recessed lighting? What are the options for the types that can be installed?
 - How many temperature controls are needed if the building has one heating and cooling system? What are the requirements for temperature controls for heat pumps?
 - What are the minimum duct insulation requirements for ducts in unconditioned space? What is the minimum duct insulation requirement for ducts located in floor joists?
 - What are the duct sealant requirements for all duct systems? Is duct tape approved as a duct sealant?
 - What are the requirements for circulation systems for water heating systems?

Code Text: *An assembly with a U-factor equal to or less than that specified in Table 402.1.3 shall be permitted as an alternative to the R-value in Table 402.1.1.*

Discussion and Commentary: As an alternative to evaluating the building thermal envelope using the insulation *R*-values of the components, a building assembly can also be recognized for prescriptive compliance by considering the *U*-factor of the assembly. The proposed assembly *U*-value must be calculated using a method consistent with the ASHRAE *Handbook of Fundamentals* and must include the thermal bridging effects of framing materials. The proposed *U*-factor is then compared with the Equivalent *U*-factor listed in IECC Table 402.1.3 based on the assembly type and climate zone.

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 ^b	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR ^d	CRAWL SPACE WALL U-FACTOR ^c
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091 ^c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	0.050	0.065

- a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, and the same as the frame wall *U*-factor in Marine Zone 4 and Zones 5 through 8.
- c. Basement wall *U*-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.
- d. Foundation *U*-factor requirements shown in Table 402.1.3 include wall construction and interior air films but exclude soil conductivity and exterior air films. *U*-factors for determining code compliance in accordance with Section 402.1.4 (total UA alternative) of Section 405 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air films.

As an example, if a frame wall assembly had a calculated *U*-factor of 0.054 for a proposed building located in Climate Zone 5, it would still comply with the IECC, even if the proposed insulation *R*-value was slightly less than that required in Table 402.1.1. The *U*-factor alternative allows the code user to take advantage of the additional insulating qualities of materials, e.g., gypsum board and structural wall sheathing that are not counted in the *R*-value Prescriptive Compliance approach.

Code Text: *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.*

Discussion and Commentary: The total UA Alternative is used to provide trade-offs between components of the building that do not comply with the *R*-values listed in Table 402.1.1 or the *U*-factors listed in Table 402.1.3 with those are more stringent than required. For example, installed ceiling insulation that surpasses the code can be traded for a less efficient wall system or a lack of slab-edge insulation. This approach allows the user to install any level of efficiency that can be demonstrated to comply, providing more flexibility than the *R*-value computation approach. To use this approach, a UA budget must be established, using the areas of the building assemblies for the proposed house and the *U*-factor values for each of the assemblies from Table 402.1.3. The proposed house budget is then calculated using the *U*-factors of the proposed assemblies. The building complies if the proposed house UA is less than or equal to the code house UA.

Example (for calculating UA budget and proposed house budget)

$$UA = (U_w \times A_w) + (U_g \times A_g) + (U_d \times A_d) + (U_r \times A_r) + (U_f \times A_f)$$

Where:

UA = Total heat loss through the building envelope (Btu/h-°F)

U_w = *U*-factor of opaque wall

A_w = Area of opaque wall

U_g = *U*-factor of glazing

A_g = Area of glazing

U_d = *U*-factor of door

A_d = Area of door

U_r = *U*-factor of roof

A_r = Area of roof

U_f = *U*-factor of floor

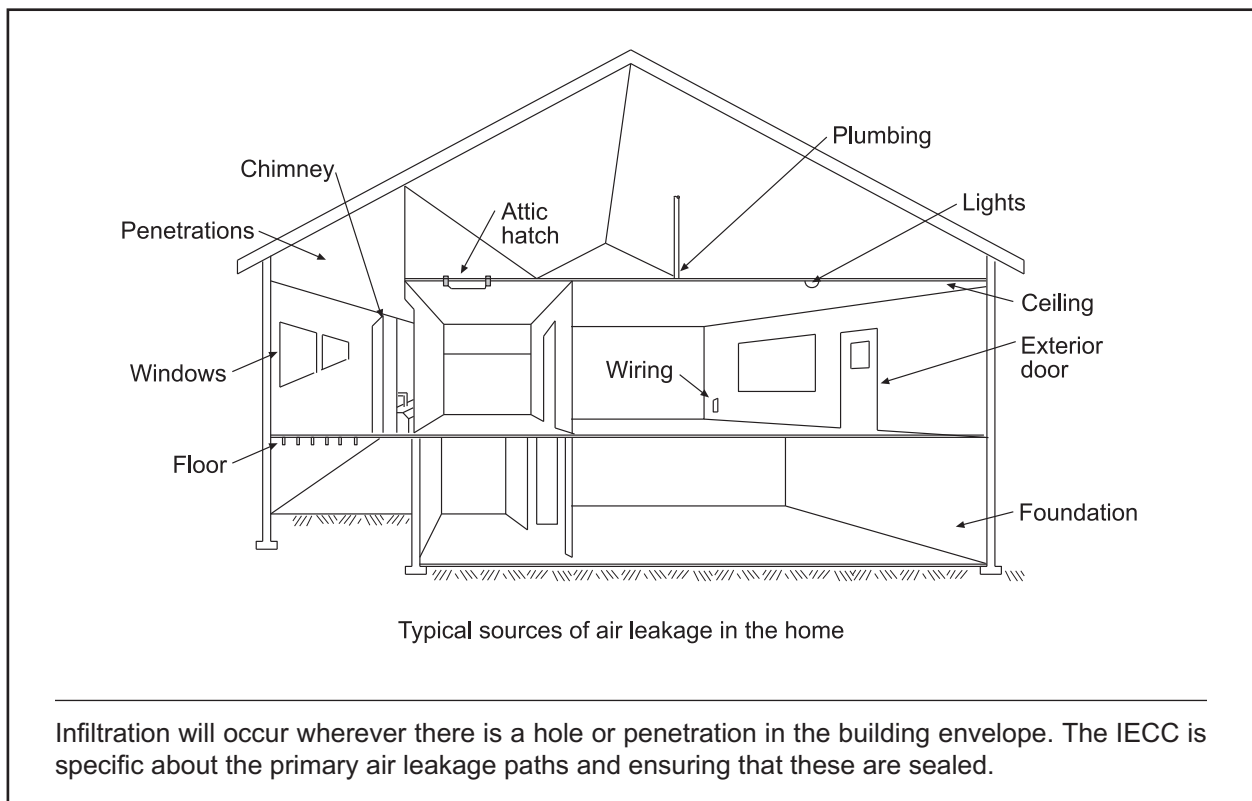
A_f = Area of floor

The *U*-factor of each proposed assembly is multiplied by the net area of each assembly (UA). Each assembly UA is then added to determine the total UA of the proposed building. The proposed UA is then compared with a *code building* UA generated by using the *U*-factors included in Table 402.1.3. If the proposed UA is less than or equal to the code building UA, the building complies with the IECC.

Code Text: *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. Attic access openings.
11. Rim joist junction.
12. Other sources of infiltration.

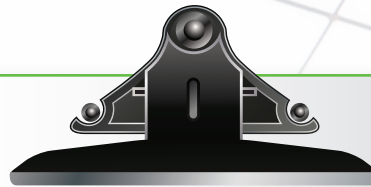
Discussion and Commentary: The goal of air leakage controls is to limit infiltration to reduce both heat and moisture flow. Infiltration is unwanted air leakage into or out of the building. A draft is an example of infiltration. Infiltration can be a major source of heat loss and increase the energy use in the building.





What's in it FOR ME?

Residential Inspection



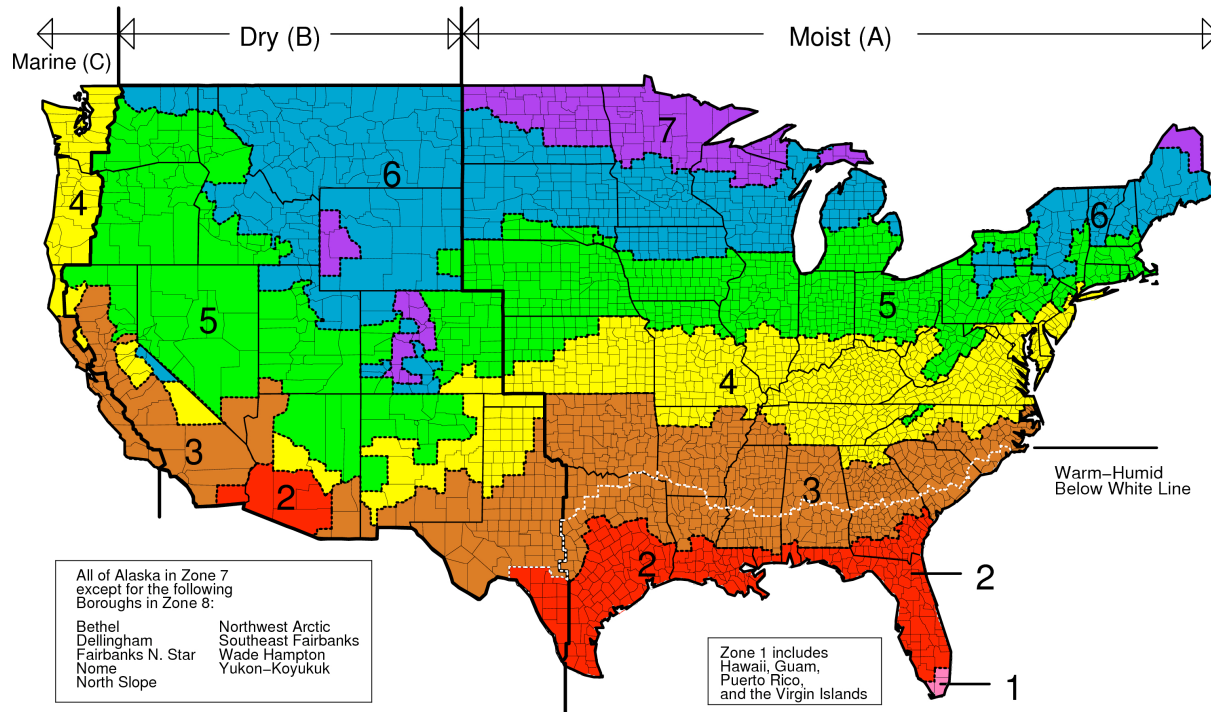
In this section you'll find:

- Guidance on how to use DOE's new residential inspection checklists for the 2009 IECC
- DOE's 2009 IECC residential checklist (example: climate zone 4)
- ICC excerpt: *2009 IECC Performing Residential Inspections*

Instructions for the Residential Building Data Collection Checklist 2009 International Energy Conservation Code

Please Note: If REScheck™ is used to show compliance, simply use the short inspection checklist that REScheck™ generates as part of the compliance report (see the checklist in the previous “Jones” case study section). This checklist includes all of the mandatory requirements. If REScheck™ is not used, please use the checklist shown in this section (download the up-to-date version for your climate zone by clicking the compliance checklists link at www.energycodes.gov/arra/compliance_evaluation.stm).

Find your jurisdiction’s climate zone on the map below, and download the inspection checklist that applies in your area.



Use of these instructions with the residential checklists assumes a general understanding of the provisions of the International Energy Conservation Code (2009 IECC) and key concepts and definitions applicable to those provisions. Consult the 2009 IECC when in doubt about a particular item in the checklist. Each checklist item contains the corresponding 2009 IECC code section(s) for quick reference. While most of the code provisions are included in the checklists, there are a few requirements that are deemed administrative and/or without significant impact, and these are not included. The checklists were originally developed for use in addressing Recovery Act and State Energy Program requirements, both of which are focused on saving energy. However, these can be useful inspection tools for all code officials in jurisdictions that have adopted the 2009 IECC, noting that slight modifications may be necessary in jurisdictions that amended the code prior to adoption.

The checklists are divided into stages corresponding to traditional building inspection stages. A building may require more than one field visit to gather compliance data during each stage of construction. Multiple buildings can be used to derive a single building evaluation. This may occur where multiple buildings are being simultaneously constructed, with construction in varying stages occurring at the same time (e.g., a housing subdivision, condominium or apartment complex, or commercial office park). In these cases, the same building must be used for at least one complete inspection stage (i.e., plan review, foundation, framing, insulation, or final inspection). Additionally, the buildings must be of the same building type.

Completing the General Information Section. All inputs at the top of the first page of the checklist should be completed. Some of these inputs are repeated on the beginning of each construction stage. Where a single building is being evaluated for each stage of construction, the duplicate inputs can be ignored. Where different buildings are used for completing different stages of construction, the top portion of each checklist stage must be completed for each different building evaluated.

- **Compliance Approach:** Compliance with the energy code can be demonstrated by the prescriptive, trade-off, or performance approach. In evaluating building compliance, the prescriptive approach should be assumed unless documentation is obtained from the building department or responsible authority demonstrating compliance with either the trade-off or performance approach. The *Code Value* column on the checklist contains the prescriptive requirement which must be met under the prescriptive approach. If a trade-off or performance approach is used to demonstrate compliance, the buildings may NOT comply with these prescriptive values and yet may still be deemed to comply with the code (and therefore should be marked as compliant for the given checklist item) on the basis that some other aspect of the building exceeds the code. For example, assume a trade-off approach was used and a valid worksheet or software report was submitted showing a compliant building in Climate Zone 3 with R-3 basement insulation. In Climate Zone 3, the code's prescriptive insulation R-value requirement for a basement wall is listed as R-5. In this example, the basement insulation should be marked as compliant even though it does not meet the prescriptive requirement given on the checklist. If the trade-off submission is valid, there will be some other building component that exceeds code requirements and offsets the non-compliant basement wall.

Complies Column. Each checklist item must be selected as compliant (Y), not compliant (N), or not applicable (N/A). Some examples of where a checklist item might be considered N/A include pool requirements for buildings that do not have a pool, basement requirements for a building that has a slab-on-grade foundation, or sunroom requirements for buildings that do not have a sunroom. When evaluating a renovation or addition, it is also appropriate to select N/A for code provisions that do not apply. N/A should **not** be selected for cases where the code provision cannot be inspected because it has been covered or can't be observed. If necessary, a different building of the same type but in a different stage of construction would have to be used to complete a checklist stage in order to inspect these items.

It should be noted that state or local government may amend the IECC and/or enforcing authorities (code officials and inspectors) may have developed localized interpretations of the code that might result in minor modifications to code requirements where energy usage is not negatively impacted. As an example, the requirement that a certificate identifying the energy-related features of the building be placed in the electrical box might be modified to allow its placement elsewhere in the building. In cases where these minor alterations are deemed by the evaluator to still meet the intent of the code, the checklist item can be marked as compliant with a corresponding comment from the evaluator.

Verified Values Column. The checklists are used to collect information about the building as well as to determine compliance. Provide the observed value (R-value, U-factor, depth of insulation, etc) in the *Verified Value* column. In many cases, you may observe more than one value, in which case all values observed should be recorded. For example, windows in the building may have a different U-factor than sliding glass doors. How compliance is determined when multiple values are found may vary depending on the compliance approach:

- Prescriptive Approach – Insulation R-values: All insulation R-values must be equal to or greater than the prescriptive code value. Enter all observed R-values into the *Verified Value* column. If any are less than the prescriptive code value, this checklist item is deemed to fail.
- Prescriptive Approach – Fenestration U-factors and SHGC: Enter all observed U-factors into the *Verified Value* column. If all values are less than or equal to the code value, the checklist item is deemed to pass. Alternatively, if the area-weighted average glazing U-factor is less than or equal to the prescriptive code value, then the checklist item is deemed to pass. Where multiple U-factors are observed, and some are above and some below the code value, it may be necessary to check the area-weighted average, which will require glazing areas. The areas, U-factors, and calculations can be provided in the *Additional Comments* area of the checklist or on a separate worksheet. A similar approach should be taken for fenestration SHGC. Note that up to 15 ft² of fenestration can be exempted from the prescriptive U-factor and SHGC requirements, and one side-hinged door up to 24 ft² can be exempted from the prescriptive door U-factor requirements.
- Trade-Off and Performance Approaches: Under alternative approaches, the values and areas to be verified are those on the compliance documentation. Where multiple values are observed, enter the observed R-values, U-factors, and their corresponding areas into the *Verified Value* column if space permits. Where space does not allow this, use the *Additional Comments* area of the checklist or a separate worksheet.

Residential Data Collection Checklist*

2009 International Energy Conservation Code
Climate Zone 4 Except Marine

KEY ¹ High Impact (Tier 1) ² Medium Impact (Tier 2) ³ Low Impact (Tier 3)

Building ID: _____ Date: _____ Name of Evaluator(s): _____

Building Contact: Name: _____ Phone: _____ Email: _____

Building Name & Address: _____

Subdivision: _____ Lot #: _____ Conditioned Floor Area: _____ ft²

State: _____ County: _____ Jurisdiction: _____

Compliance Approach (check all that apply): Prescriptive Trade-Off Performance

Compliance Software Used: _____ Green Building/Above-Code Program? Yes No

Building Type: 1- and 2-Family, Detached: Single Family Modular Townhouse

Multifamily: Apartment Condominium

Project Type: New Building Existing Building Addition Existing Building Renovation

IECC Section #	Pre-Inspection/Plan Review	Code Value	Verified Value	Complies			Comments/Assumptions ¹
				Y	N	N/A	
103.2 [PR1] ¹	Construction drawings and documentation available. Documentation sufficiently demonstrates energy code compliance.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.6 [PR2] ²	HVAC loads calculations: Heating system size(s): Cooling system size(s):		kBtu: _____ kBtu: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Additional Comments/Assumptions: _____

*This example checklist is still being refined through pilot studies in several states. Make sure to get the latest checklist for your climate zone at www.energycodes.gov/arra/compliance_evaluation.stm

¹ Use Comments/Assumptions to document code requirements that pass due to exceptions, and specify the exception. Also use Comments/Assumptions to document multiple values observed for a given code requirement, such as multiple equipment efficiencies.

General building information only required if different than above

Building ID: _____

Date: _____ Name of Evaluator(s): _____

Building Name & Address: _____ Conditioned Floor Area: _____ ft²

Building Contact: Name: _____ Phone: _____ Email: _____

Compliance Approach (check all that apply): Prescriptive Trade-Off Performance

Compliance Software Used: _____ Green Building/Above-Code Program? Yes No

IECC Section #	Foundation Inspection	Code Value	Verified Value	Complies			Comments/Assumptions
				Y	N	N/A	
402.1.1 [FO1] ¹	Slab edge insulation R-value.	Unheated: R-10 Heated: R-15	R-____ <input type="checkbox"/> Unheated <input type="checkbox"/> Heated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2, 402.2.8 [FO2] ¹	Slab edge insulation Installed per manufacturer's instructions.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.1.1 [FO3] ¹	Slab edge insulation depth/length.	Heated: 2 ft.	____ ft.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.1.1 [FO4] ¹	Basement wall exterior insulation R-value ² .	Continuous: R-10	R-____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2 [FO5] ¹	Basement wall exterior insulation installed per manufacturer's instructions.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.2.7 [FO6] ¹	Basement wall exterior insulation depth.	10 ft. or to basement floor	____ ft.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.2.9 [FO7] ¹	Crawl space wall insulation R-value.	Continuous: R-10 Cavity: R-13	R-____ R-____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2 [FO8] ¹	Crawl space wall insulation installed per manufacturer's instructions.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.2.9 [FO9] ¹	Crawl space continuous vapor retarder installed with joints overlapped by 6 inches and sealed, and extending at least 6" up the stem wall.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2.1 [FO10] ²	Exposed foundation insulation protection.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.8 [FO11] ²	Snow melt controls.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Additional Comments/Assumptions: _____

² Basement insulation is not required in warm-humid locations.

Date: _____ Name of Evaluator(s): _____

Building Name & Address: _____ Conditioned Floor Area: _____ ft²

Building Contact: Name: _____ Phone: _____ Email: _____

Compliance Approach (check all that apply): Prescriptive Trade-Off Performance

Compliance Software Used: _____ Green Building/Above-Code Program? Yes No

IECC Section #	Framing / Rough-In Inspection	Code Value	Verified Value	Complies			Comments/Assumptions
				Y	N	N/A	
402.1.1, 402.3.4 [FR1] ¹	Door U-factor. ³	U-0.35	U-_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.1.1, 402.3.1, 402.3.3, 402.5 [FR2] ¹	Glazing U-factor (area-weighted average). ⁴	U-0.35 (0.48 max) ⁵	U-_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.1.1, 402.3.2, 402.3.3 [FR3] ¹	Glazing SHGC value, including sunrooms (area-weighted average). ⁴	N/A	SHGC: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.1.3 [FR4] ¹	Glazing labeled for U-factor (or default values used).			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.1.1, 402.3.3, 402.5 [FR5] ¹	Skylight U-factor. ⁴	U-0.6 (0.75 max) ⁵	U-_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.1.1, 402.3.3 [FR6] ¹	Skylight SHGC value. ⁴	N/A	SHGC: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.1.3 [FR7] ¹	Skylights labeled for U-factor (or default values used).			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.3.5 [FR8] ¹	Sunroom glazing U-factor.	U-0.5	U-_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.3.5 [FR9] ¹	Sunroom skylight U-factor.	U-0.75	U-_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.1.1 [FR10] ¹	Mass wall exterior insulation R-value.	R-5 ⁶	R-_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2 [FR11] ¹	Mass wall exterior insulation installed per manufacturer's instructions.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.2.1 [FR12] ¹	Duct insulation.	Attic Supply: R-8 Other: R-6	R-_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.2.2 [FR13] ¹	Duct sealing complies with listed sealing methods.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.2.2 [FR14] ¹	Duct tightness via rough-in test. If applicable, verification via post-construction test should be marked N/A.	Across System: 6 cfm No Air Handler: 4 cfm	_____ cfm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.2.3 [FR15] ¹	Building cavities NOT used for supply ducts.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.4.5 [FR16] ²	IC-rated recessed lighting fixtures			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

³ One side-hinged door up to 24 ft² can be exempted from the prescriptive door U-factor requirements.

⁴ Up to 15 ft² of glazed fenestration, including skylights, may be exempted from U-factor and SHGC requirements under the prescriptive approach.

⁵ U-factor mandatory maximum using trade-offs.

⁶ If more than 1/2 the insulation is on the interior, mass wall interior insulation requirement applies (R-10).

	meet infiltration criteria.						
403.3 [FR17] ²	HVAC piping insulation.	R-3	R-____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.4 [FR18] ²	Circulating hot-water piping insulation.	R-2	R-____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.5 [FR19] ²	Dampers Installed on all outdoor Intake and exhaust openings.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.4.4 [FR20] ³	Glazed fenestration air leakage.	0.3 cfm/ft ²	____ cfm/ ft ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.4.4 [FR21] ³	Swinging door air leakage.	0.5 cfm/ft ²	____ cfm/ ft ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.4.4 [FR22] ³	Fenestration and doors labeled for air leakage.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Additional Comments/Assumptions: _____

DRAFT

Date: _____ Name of Evaluator(s): _____

Building Name & Address: _____ Conditioned Floor Area: _____ ft²

Building Contact: Name: _____ Phone: _____ Email: _____

Compliance Approach (check all that apply): Prescriptive Trade-Off Performance

Compliance Software Used: _____ Green Building/Above-Code Program? Yes No

IECC Section #	Insulation Inspection	Code Value	Verified Value	Complies			Comments/Assumptions
				Y	N	N/A	
402.1.1, 402.2.5, 402.2.6 [[IN1] ¹	Floor insulation R-value.	Wood: R-19 Steel: ⁷ See footnote	R-____ <input type="checkbox"/> Wood <input type="checkbox"/> Steel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2 [[IN2] ¹	Floor insulation installed per manufacturer's instructions, and in substantial contact with the subfloor.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.1.1 402.2.5 402.2.4 [[IN3] ¹	Wall insulation R-value.	Wood: R-13 Mass: ⁸ R-10 Steel: ⁹ See footnote	R-____ <input type="checkbox"/> Wood <input type="checkbox"/> Mass <input type="checkbox"/> Steel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2 [[IN4] ¹	Wall insulation installed per manufacturer's instructions.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.1.1 [[IN5] ¹	Basement wall interior insulation R-value.	Continuous: R-10 Cavity: R-13	R-____ R-____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2 [[IN6] ¹	Basement wall interior insulation installed per manufacturer's Instructions.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.2.7 [[IN7] ¹	Basement wall interior insulation depth.	10 ft or to basement floor	____ ft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.2.11 [[IN8] ¹	Sunroom wall insulation R-value.	R-13	R-____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2 [[IN9] ¹	Sunroom wall insulation installed per manufacturer's Instructions.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.2.11 [[IN10] ¹	Sunroom ceiling insulation R-value.	R-19	R-____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.2 [[IN11] ¹	Sunroom ceiling insulation installed per manufacturer's instructions.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.4.2, 402.4.2.1 [[IN12] ¹	Air sealing complies with sealing requirements via blower door test. If applicable, verification via visual inspection should be marked N/A.	ACH 50 ≤ 7	ACH 50 = ____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.1 [[IN13] ²	All installed insulation labeled or installed R-value provided.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.4.1, 402.4.2 [[IN14] ³	Air sealing of all openings and penetrations via visual inspection: <ul style="list-style-type: none"> • Site-built fenestration • Window/door openings • Utility penetrations • Attic access openings If applicable, verification via blower			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

⁷ Floor steel frame equivalent: R-19+R-6 in 2x6 or R-19+R-12 in 2x8 or 2x10

⁸ If more than 1/2 the insulation is on the exterior, mass wall exterior insulation requirement applies (R-5).

⁹ Wall steel frame equivalent: R-13+R-5; R-15+R-4; R-21+R-3; R-0+R-10

	door should be marked N/A.						
402.4.1, 402.4.2 [IN15] ³	<p>Air sealing of all envelope joints and seams via visual inspection:</p> <ul style="list-style-type: none"> • Dropped ceilings • Knee walls • Assemblies separating garage • Tubs and showers • Common walls between units • Rim joist junctions <p>If applicable, verification via blower door should be marked N/A.</p>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.4.1, 402.4.2 [IN16] ³	<p>Air sealing of all other sources of infiltration, including air barrier, via visual inspection. If applicable, verification via blower door should be marked N/A.</p>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Additional Comments/Assumptions: _____

DRAFT

Date: _____ Name of Evaluator(s): _____

Building Name & Address: _____ Conditioned Floor Area: _____ ft²

Building Contact: Name: _____ Phone: _____ Email: _____

Compliance Approach (check all that apply): Prescriptive Trade-Off Performance

Compliance Software Used: _____ Green Building/Above-Code Program? Yes No

IECC Section #	Final Inspection Provisions	Code Value	Verified Value	Complied			Comments/Assumptions
				Y	N	N/A	
402.1.1, 402.2.1, 402.2.2 [F11] ¹	Ceiling insulation R-value.	Wood: R-38 ¹⁰ Steel Truss ¹¹ Steel Joist: R-49	R-____ <input type="checkbox"/> Wood <input type="checkbox"/> Steel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
303.1.1.1, 303.2 [F12] ¹	Ceiling insulation installed per manufacturer's instructions. Blown insulation marked every 300 ft ² .			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.2.3 [F13] ¹	Attic access hatch and door insulation.	R-38	R-____	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
403.2.2 [F14] ¹	Duct tightness via post-construction test. If applicable, verification via rough-in test should be marked N/A.	To Outdoors: 8 cfm Across System: 12 cfm	____ cfm	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
403.6 [F15] ¹	Heating and cooling equipment type and capacity as per plans.			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
404.1 [F16] ¹	Lighting - 50% of lamps are high efficacy.			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
401.3 [F17] ²	Certificate posted.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
402.4.3 [F18] ²	Wood burning fireplace - gasketed doors and outdoor air for combustion.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.1.1 [F19] ²	Programmable thermostats installed on forced air furnaces.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.1.2 [F110] ²	Heat pump thermostat installed on heat pumps.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.4 [F111] ²	Circulating service hot water systems have automatic or accessible manual controls.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
403.9 [F112] ²	Pool heaters, covers, and automatic or accessible manual controls.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Additional Comments/Assumptions: _____

KEY	¹ High Impact (Tier 1)	² Medium Impact (Tier 2)	³ Low Impact (Tier 3)
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¹⁰ R-30 if insulation is not compressed at eaves. R-30 may be used for 500 ft² or 20% (whichever is less) where sufficient space is not available.

¹¹ Steel truss equivalent: R-49; R-38+R-3.

2009 IECC® Performing Residential Energy Inspections

Based on the 2009 *International Energy Conservation Code® (IECC®)*



2009 IECC[®]

Performing Residential Energy Inspections

Based on the 2009 *International Energy Conservation Code*[®] (IECC[®])

International Code Council

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2009 IECC Performing Residential Energy Inspections

Second Printing: September 2010

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Table of Contents

Introduction	1
Module 1: IECC’s relationship with the 2009 IRC	5
IBC/IRC 101.3 Intent	5
2009 IRC and IECC	6
About “Smart” Vapor Retarders	9
Comparison of Similar Sections of the IRC and IECC	10
Code Compliance Process	13
The Inspection Process	14
How the inspection process fits with residential construction:	15
Module 2: Chapters Chapter 1-3 of the IECC	17
IECC Chapter 1 Administration	17
Section 101 Scope and General Requirements	17
Items to include on the Field correction notice	22
Write a Field Correction Notice	23
Q&A	26
IECC Chapter 2 Definitions	28
The Building Thermal Envelope	29
IECC Chapter 3 General Requirements	30
Q&A	31
Module 3: Foundation Inspection	33
Foundation Inspection	33
Inspection Specific Definitions:	34
Inspection Specific Information	37
Inspection Steps	38
Foundation Inspection Checklist	43
Case Study Activity	45
Module 4: Rough Inspection	51
Rough Inspection	51
Inspection Specific Definitions	52
Inspection steps	52
Blower Door Video	54
Case Study Activity	55
Duct Test Video	65
Rough Inspection	67
Case Study Activity	70
Module 5: Final Inspection	79
Final Inspection	80
Inspection Specific Definitions	80
Inspection Steps	81
Final Inspection Checklist	90
Case Study Activity	95

Table of Contents

Final Reflection..... 100

Answers to Activities 101

Introduction

This course addresses numerous provisions in the 2009 *International Energy Conservation Code*[®] (IECC[®]) where the code contains requirements applicable to construction and inspection of residential construction, but that are not regulated specifically by the *International Residential Code*[®] (IRC[®]). The course is intended to help the building inspector or builder identify those areas to inspect on the site that were approved in the review and ensure compliance with the IECC.

Upon completion of the course, students will be able to apply provisions of the 2009 IECC specifically related to the proper construction and inspection of residential construction.

Seminar Goal

The goal of this seminar is for participants to apply the 2009 IECC to increase the efficient use of energy in the construction of new residential buildings and alterations to existing residential buildings. This will be accomplished through field inspection of the approved design to verify compliance with the code and approved design documents.

Description

This course provides an outline of basic requirements related to residential construction, in order that the building official understands the fundamentals for the IECC. However, the fundamental rule that should never be forgotten is:

Code compliance for field inspection equals compliance with the approved drawings and specifications.

That is to say that the inspector's responsibility is to check for compliance with the approved drawings and specifications. Any variations from the drawings or specifications must be dealt with by the responsible design professional making appropriate changes and subsequent approval by the building official.

Objectives

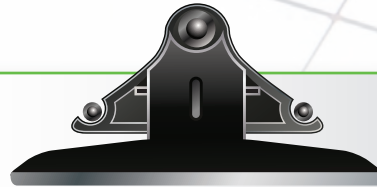
Upon completion of this seminar, participants will be better able to:

- Explain authorities and responsibilities of the building official regarding an energy inspection.
- Describe the purpose, criteria and basis for the inspection and code compliance with the 2009 IECC.
- Describe the basic terms related to performing an energy inspection.
- Determine code compliance by using a plan review record to verify construction is executed according to approved plans.
- Locate general topics in the 2009 IECC.
- Locate applicable tables in the 2009 IECC for specific situations.
- Utilize the completed plan review record for the project to perform field inspections.
- Determine if the constructed building complies with the approved design documents and the code.
- Identify borderline scenarios as compliant or noncompliant.
- Identify essential code components of energy-efficient building thermal envelopes, energy-efficient mechanical design principles and electrical power and lighting system in the field.



What's in it FOR ME?

Residential Training and Support



In this section you'll find:

- Examples of training for residential code officials, and where to find more
- Where to go for energy codes solutions and technical support
- Residential energy codes FAQ
- Two examples of DOE's "Code Notes"

TRAINING FOR CODE OFFICIALS through Building Energy Codes University



Press “play” on the codes training you need most: find webcasts, videos, self-paced training courses, and more resources for residential code officials on www.energycodes.gov/becu



**Building Energy Codes
Residential
TRAINING**

**REScheck™ Basics
Residential Requirements of
the 2009 IECC
and much more...**



Using the Evaluation Checklists
Play Video

ENERGY Energy Efficiency & Renewable Energy

Residential Data Collection Checklist
2009 International Energy Conservation Code Chapter 602.5

Date: _____ Name of Evaluator(s): _____
 Building Name & Address: _____ Conditioned Floor Area: _____ ft²
 Building Contact: Name: _____ Phone: _____ Email: _____
 Compliance Approach: Prescriptive (602.1.1 or 602.1.3) UA Trade-Off (602.1.4) Building Performance (602.1.5)
 State: _____ Jurisdiction: _____
 Building Type: 1- and 2-Family, Detached Single Family Mobile Townhouse
 Multifamily Apartment Condominium Other _____
 Project Type: New Construction Addition to existing building Existing building renovation?

Item #	Description	Code Value	Verified Value	Complete	Comments/Notes/Findings
602.1.1	602.1.2	602.1.3	602.1.4	602.1.5	
1001	The Inspection Plan Review (Construction drawings, 3rd party inspection identified and available, Documentation and/or energy code compliance)			<input type="checkbox"/>	
1002	Final Code Compliance (Heating system ready, Cooling system ready)			<input type="checkbox"/>	

For more information visit www.energycodes.gov

Files

- Data (File → Save)
- Report (File → Save Report)
- Exchange

REScheck-Web™



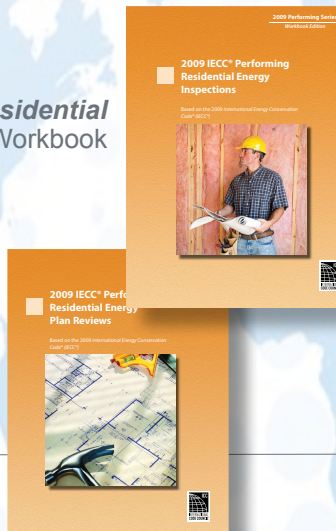
Find more at www.energycodes.gov/becu



Residential TRAINING

2009 IECC® Performing Residential Energy Inspections-Training Workbook

2009 IECC® Performing Residential Energy Plan Reviews-Training Workbook



Training Seminars

2009 IECC Update

“This seminar introduces participants to the major changes from the 2006 IECC to the 2009 IECC. Participants will discuss the changes, reasons for the changes, and take part in knowledge review activities. Information presented will allow participants to apply these new code requirements to design, plan review, and/or inspection. This seminar emphasizes the increase in energy efficiency improvements.”

2009 IECC Fundamentals

Residential Provisions for Builders
Residential Provisions for Designers

2009 IECC Performing

Residential Energy Plan Reviews
Residential Energy Inspections

Online Certification Practice Course

2009 IECC Residential Energy Inspector/Plan Examiner Certification Exam Practice Course

Online CEU

2009 IECC Residential Energy Plans Examiner Online Renewal Update

Find more at www.iccsafe.org or 1-800-786-4452

SUPPORT FOR CODE OFFICIALS

Whether you're looking for published resources, frequently asked questions, or technical support, **BECP's Solutions and Help Center** will point you in the right direction.



Building Energy Codes Residential SUPPORT



Find more at www.energycodes.gov/help

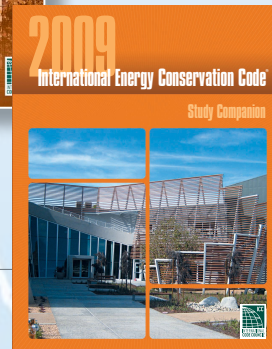
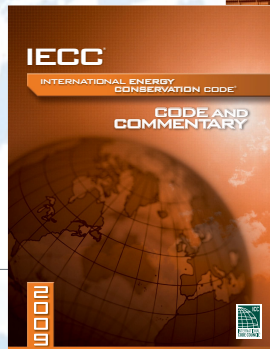
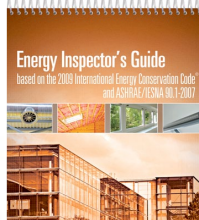


Residential SUPPORT

Energy Inspector's Guide: Easy to use pocket guide based on the 2009 International Energy Conservation Code® and ASHRAE/IESNA 90.1-2007

2009 International Energy Conservation Code® and Commentary

Find more at www.iccsafe.org or 1-800-786-4452



2009 International Energy Conservation Code® *Study Companion*

RESIDENTIAL CODES

Examples of Frequently Asked Questions (FAQs).

See www.energycodes.gov/help/faqs.stm for the complete list.

Q: What code do I need to comply with?

A: Visit the **BECP Status of State Codes** page at www.energycodes.gov to find out which energy code your state has adopted, most often a version of the International Code Council's International Energy Conservation Code (IECC) or a close variation. However, local jurisdictions and municipalities sometimes have codes in place other than the state adopted code.

Q: How do I create an energy code compliance report to get my building permit?

A: Download **REScheck™** software at no charge, or simply launch the **REScheck-Web™** (both are available at www.energycodes.gov/software.stm). You will fill out forms with information about your project, such as square footage of the floors, walls, and ceilings, insulation levels, information about your windows and heating and cooling system. The menu-driven software will show you when the building has complied with the energy code. At that point, owners can print out the reports to submit for the building permit.

Q: Where can I get a copy of the energy code?

A: Copies of the IECC can be purchased from the **ICC website** (www.iccsafe.org). With new DOE funding, the 2009 IECC is now available in an electronic version for free at <http://www.iccsafe.org/store/pages/doeregistration.aspx>.

Q: What are the minimum insulation and window requirements for my building?

A: Minimum insulation levels and window requirements depend on your climate zone. You will need the information from Table 402.1.1, unless you have a steel framed building, in which case you need Table 402.2.5. There are several ways to get this information:

- Call, or stop by, your local building department.
- Obtain a copy of the code book.
- Submit your question to **BECP Technical Support** (techsupport@becp.pnl.gov). Please include your state and local jurisdiction so we can determine your climate zone.

Q: What do I need to know about duct testing?

A: Beginning with the 2009 IECC, if any of the ducts and air handler are OUTSIDE the conditioned space (e.g., in the garage, crawlspace, attic, etc.), the duct tightness must be verified with a duct leakage test. See BECP's online **Duct Testing Frequently Asked Questions (also printed below)**, **Duct Testing in New Residential Construction - Code Notes**, and Section 403.2.2 of the IECC for more information.

Q: Am I required to test for air leakage?

A: Yes, as of the 2009 IECC you are required to test for air leakage. There are two options: the testing option (blower door method) or the visual inspection option. See the 2009 IECC, section 402.4.2.2. Visual Inspection Option. It refers to Table 402.4.2, which includes a checklist to be used, as applicable.

Q: Where do I find out information about tax credits?

A: The **ENERGY STAR® website** (www.energystar.gov) has information on the tax credits, as does the **Tax Incentives Assistance Project (TIAP) website** (www.energytaxincentives.org).

Q: What are insulation requirements between conditioned and unconditioned spaces under the 2009 IECC?

A: When insulating the basement, does the 8" concrete wall that separates the basement and garage need to have a minimum of an R10 insulation value?

- Interior walls that separate conditioned from unconditioned space are treated the same as an exterior wall that separates outside from the conditioned building thermal envelope, and must meet the same energy provisions. Therefore a below-grade wall that separates the basement from the garage would need to meet the same provisions and insulation levels based on the climate zone.

Q: What does the IECC say about ducts in conditioned crawlspaces?

A: The 2006 IECC: ducts or portions of ducts located completely within the building envelope (i.e. conditioned crawl space) are exempt from having to be insulated; however, they still must be sealed properly.

 REScheck™-specific FAQs

Q: Can I use REScheck™ in my state?

A: REScheck™ can be used in most states and local jurisdictions. Please see the **States that can use REScheck™ for Compliance** page on www.energycodes.gov.

Q: What is a trade-off approach, and can I still use it with the 2009 IECC?

A: A trade-off approach allows you to trade enhanced energy efficiency in one component against decreased energy efficiency in another component. For example, under the 2006 IECC, you can trade off insulation and glazing efficiency against heating and cooling system efficiency. The 2009 IECC only allows you to trade off levels of insulation and glazing efficiency. For example, trade decreased wall efficiency (lower R-value) for increased window efficiency (lower U-factor), or increase the roof insulation and reduce or eliminate slab-edge insulation. Typically, this method is less restrictive than prescriptive approaches because components that exceed the requirements can compensate for those that do not meet the code.

Q: How do I show compliance for mass walls?

A: You can use REScheck™ software, specifying the type of wall. Performance software may best reflect the thermal heat capacities of mass walls (see *What is a performance approach?*).

Q: How do I show compliance for log walls?

A: You can use REScheck™ software, specifying the type of wall. Performance software may best reflect the thermal heat capacities of mass walls (see *What is a performance approach?*).



*Performance software may best reflect the thermal heat capacities of mass walls (see *What is a performance approach?*).*

Q: What is a performance approach?

A: A performance approach (also known as a systems performance approach) allows you to compare your proposed design to a baseline or reference design and demonstrate that the proposed design is at least as efficient as the baseline in terms of annual energy use. This approach allows greater flexibility but requires considerably more effort. A performance approach is often necessary to obtain credit for special features, such as passive solar design, photovoltaic cells, thermal energy storage, and fuel cells. This approach requires an annual energy analysis for the proposed design and the reference design. We do not offer residential software products at this time to comply using this approach, but future versions of the REScheck™ software will include the DOE-2 energy analysis engine to perform the necessary calculations needed to determine compliance. For the 2009 IECC, REScheck™ does allow for a *simulated* performance approach—please see the software for more details. Samples of software available for the performance approach are listed in the **Building Energy Software Tools Directory** on the **Building Technologies Program** website (www.eere.energy.gov/buildings).

Q: How do I show compliance with additions or alterations?

A: One of the keys to showing compliance for additions and alterations is to remember that you are only considering the new space, or the new walls, etc. You have the option of showing compliance for the entire space, but this is not necessary or typical. Using REScheck™, you will indicate “addition” or “alteration” on the project information tab, and need to enter the following information, as it applies to your project:

- Ceiling – gross area (ft²) and insulation R-value of new ceiling,
- Exterior walls – gross area (ft²) of new exterior walls and insulation R-value (the existing exterior wall(s) that will become interior wall(s) once the addition is built are to be considered interior walls and should not be entered as part of the addition wall area).
- Windows/Doors – gross area (ft²) of windows and/or doors with U-factor from NFRC label or default table in the help section REScheck™.
- Floor – gross area (ft²) of addition and insulation R-value. If the floor is a slab, the length of the exterior slab edge should be entered in linear feet.

Q: How do I show compliance for my basement?

A: I have a solid concrete wall as the exterior basement wall that goes up from the footing to midway up the first floor. I have a 2x6 stud wall framed on the inside of this wall with insulation. How do I report this on the software?

- Enter your basement wall as solid concrete, square footage, height, height below grade, depth of insulation. Then enter your insulation R-value as cavity. The software will calculate the wall according to the amount of cavity insulation is shown and consider it as a furred out wall.

Duct Testing Frequently Asked Questions

Q: How do I test for duct leakage?

A: The most common method for testing ducts for air leakage is to use a fan to pressurize the duct system and measure leakage. This is commonly referred to as the duct blaster method. Additional methods include the blower door subtraction method and DeltaQ testing.

Duct blaster method – A duct blaster combines a small calibrated fan and a pressure gauge to pressurize a house's duct system and measure air leakage from the ductwork. The fan is directly connected to the duct system, usually at a central return or at the air handler cabinet. The rest of the registers and grills are temporarily taped off and duct air tightness is measured by either pressurizing or depressurizing the duct system and measuring the fan flow at specific duct pressure levels. The duct blaster can quickly and accurately measure duct leakage rates of between about 20 and 1500 CFM.

Duct blaster tests can be performed on new homes before drywall is installed, making duct sealing easier. The drawback of this method is that it only measures total duct leakage and cannot separate leaks to the outside of the building from less wasteful (though still undesirable) leaks to inside the building conditioned spaces.

For step-by-step breakdowns of various testing options, see California's duct testing procedures at www.energy.ca.gov/title24/2005standards/residential_acm/2005_RES_ACM_APP_RC.PDF.

Blower door subtraction method – The "blower door" test is a pressurization test similar to the duct blaster, but it tests the entire building envelope rather than just the duct system. The fan equipment is typically installed in a door opening in the building, which explains the name "blower door." This test should only

be done after the entire house construction is completed. The blower door test is valuable as it measures all leakage out of a building, including ceilings, walls, windows, and foundations in addition to leaks from ducts.

The blower door can be used to estimate leakage from just the ducts by what is known as the subtraction method. First, the total leakage out the house (which includes leaks in the ducts) is measured at a certain air pressure. Then the same test is performed with all the ducts' registers sealed off so the leakage out the house excludes the duct system. Subtracting the leakage of the second test from the first test gives an estimate of the leakage to the outside of the building from the ducts only.

See Southface's factsheet at www.southface.org/web/resources&services/publications/factsheets/22blowdoor.pdf for more information on blower door and duct blaster testing.

DeltaQ testing –The Delta Q test is a recently developed test that also utilizes the blower door to measure duct leaks to the outdoors, but with a more sophisticated set of tests with the air handler fan on and off. The Delta Q test is capable of measuring duct leaks at the actual system operating pressure and measuring leaks from supply ducts and return ducts separately. One additional advantage of the Delta Q test is that registers do not need to be sealed.

Another great resource on the Web is Washington State University Extension Energy Program's video on duct sealing: <http://vimeo.com/8129040>.

Q: Who can do the testing?

A: For the most common methods, a variety of people can conduct the testing, including the building's HVAC subcontractor, the primary builder, or a third-party. The tester should have experience or training in operating the pressure testing equipment and performing the test. Testing immediately after the ducts are put in while the installers are still at the site has the advantage of allowing leaks to be sealed right then if the leakage rate exceeds the code limit.



Code Notes

Duct Testing in New Residential Construction
(Located at: www.energycodes.gov/help/notes.stm)

[2009 IECC]

Background

Many studies have shown that visual inspection of duct seals in residences is not enough. Code now requires a pressure test. Pressure testing ducts as required by the 2009 IECC is far superior to visual inspection and will definitively confirm that duct leakage is kept to a low level. Building Energy Codes Program experts estimate that pressure testing ducts in new residential construction will reduce energy consumption in new homes by up to 10% on average and potentially much more in some homes.

Please note: If all ductwork is located within conditioned space, duct testing is not required.



Requirements

Section 403.2.2 of the 2009 IECC states that the sealing of ducts must be verified by a duct pressure test. This test involves using a fan to force air into the duct system and measuring how much air leaks out through cracks and holes (the registers are taped closed for the test). A duct pressure test is not required if the air handler and all ducts are located inside the building thermal envelope. The requirements for how to seal ducts are given in Section M1601.3 of the International Residential Code, and apply regardless of the location of the ducts.

The code allows considerable flexibility in the required test. It can be conducted by anyone, including the installer or a third party. It can be done either after rough-in of the ducts or at the completion of construction (i.e., after drywall has been installed and finished). There are separate requirements for testing at rough-in, depending on whether the air handler has been installed at the time of the test. The post-construction test can measure either the “total leakage” of the ducts or the “leakage to outdoors” (the fraction of the total that leaks outside the conditioned space).

The allowable leakage rates are expressed in terms of airflow (cubic feet per minute or CFM) per 100 ft² of conditioned floor area, when duct registers or boots are taped/sealed and the duct system is pressurized to 25 Pascals (0.1 inches w.c.). Maximum leakage rates for the various testing options are as follows:

Testing Option	Maximum CFM per 100 ft ² @25 Pascals
At rough-in, air handler not installed	4
At rough-in, air handler installed	6
Post-construction, leakage to outdoors	8
Post-construction, total leakage	12

The drawbacks of rough-in testing include less accuracy as leaks in the boot assembly cannot be fully measured because drywall is not yet installed. Also, it is only possible to measure total leakage whereas leakage specifically to the outdoors can be measured when the house is completed.

Plan Review

No action is required at plan review.

Field Inspection

The builder shall provide data confirming that leakage rates are equal to or less than the rates specified in Section 403.2.2 of the IECC 2009.

Testing is not required if all ducts and the air handler are inside the building thermal envelope. Code officials shall perform a visual inspection of ducts to confirm proper sealing in all buildings.

Code Citations*

IECC 2009, 403.2.2 Sealing

Requires that all ducts, air handlers, filter boxes, and building cavities used as ducts be sealed. Joints and seams shall comply with Section M1601.4.1 of the International Residential Code. Duct tightness shall be verified by either a post-construction test or rough-in test.

For More Information

For more information, please see the Duct Testing Frequently Asked Questions (resourcecenter.pnl.gov/cocoon/morf/ResourceCenter/article/1696) article.

For information on why duct testing is important, see PG&E’s Tech Brief at www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/rebatesincentives/duct_testing.pdf.

For information on efficient duct systems see the ENERGY STAR® write up at www.energystar.gov/ia/new_homes/features/DuctSystems_062906.pdf.



Energy Efficiency & Renewable Energy

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 1-877-EERE-INFO (1-877-337-3463)
eere.energy.gov/informationcenter



Building Energy Codes
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Code Notes

High-efficacy lighting in new homes

(Located at: <http://resourcecenter.pnl.gov/cocoon/morf/ResourceCenter/article//1695>)



Lighting consumes more than 10% of electric energy used in homes, presenting a substantial opportunity for lowering residential energy consumption.

[2009 IECC and 2009 IRC]

Background

Lighting consumes more than 10% of electric energy used in homes, presenting a substantial opportunity for lowering residential energy consumption. The International Code Council (ICC) recently passed a code change that will appear in the 2009 International Energy Conservation Code (IECC) and the International Residential Code (IRC) requiring that half of the permanent lighting in a new home have high-efficacy lamps.



Requirements

Section 404.1 of the 2009 IECC and Section N1104.1 of the 2009 IRC state that a minimum of 50 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps. ICC defines high efficacy as: 60 lumens/W for lamps over 40W; 50 lumens/W for lamps over 15W to 40W; 40 lumens/W for lamps 15W or less.

High-Efficacy Lamps

Lamp	Efficiency
≤15W	40 lumens/W
>15W-40W	50 lumens/W
>40W	60 lumens/W

These efficacy minimums are above the level of current incandescent products. However, many compact fluorescent lamps, all T-8 or smaller diameter linear fluorescent lamps, and most metal halide lamps meet these requirements. A “lamp” is simply the light bulb or tube itself; it is not the fixture. So a chandelier is one fixture but may have many lamps.


The count is based on the number of lamps and includes both pin-based fixtures (fluorescent tubes and pin-based compacts) and standard screw-base fixtures. The provision applies to indoor spaces and outdoor facades of all residential buildings, including accessory structures and garages. The code permits up to 50% of the lamps to be of a standard efficacy, providing flexibility to allow lighting for certain applications that cannot be met with high-efficacy lamps.

Benefits

Compact fluorescent lamps (CFLs) have become more available and have dropped in price. A 60-watt replacement CFL can be purchased for about \$1.50 per lamp. CFLs use about 80% less energy than standard incandescent

lighting and last 6 to 10 times longer. At \$1.50 per lamp with electricity at 9 cents per kwh, the payback time is less than two years, assuming that each light is on a half hour each day.

CFLs offer versatile lighting solutions

CFLs are available in a variety of shapes and sizes so they can be used in most areas of the home where standard incandescent lamps would be used. Their longer life makes them ideal for high ceilings and other hard-to-reach spots. Reflector CFLs are now available for recessed downlighting; the best models have passed Elevated Temperature Life Testing, lasting over 6,000 hours without failure (see www.pnl.gov/rflamps .

Energy-efficient chandeliers

While incandescent lamps have traditionally been used in chandeliers because of their ability to dim and their small size possibilities, dimmable high-efficacy CFLs designed for candelabra-sized sockets and other specialty applications are also readily available.

For more information on lighting, see the ENERGY STAR  web page.

Plan Review

Verify that 50% of all lamps will be high-efficacy according to the count of lamps as shown on the plans. Confirm each lamp type’s efficacy by requiring manufacturer’s or independent test data for each lamp type indicating its efficacy rating. If the manufacturer or product packaging has only separate ratings for lumen output and wattage, simply divide the lumen rating by the wattage to get lumens per watt.

Code Citations*

IECC 2009, Section 404.1 Lighting equipment

A minimum of 50 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

IECC 2009, Section 202 General Definitions High-Efficacy Lamps sets the criteria.

IRC 2009, Section N1104.1 Lighting Equipment

A minimum of 50 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

IRC 2009, Section R202 General Definitions High-Efficacy Lamps sets the criteria.

Field Inspection

Inspect representative CFL lamps, linear fluorescents, and other lamps to ensure that at least 50% of all lamps are high-efficacy by comparing the installed lamp make/model number to the ones on the approved plans. Non-specified lamps should have efficacy rating information supplied at inspection.

U.S. DEPARTMENT OF
ENERGY

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