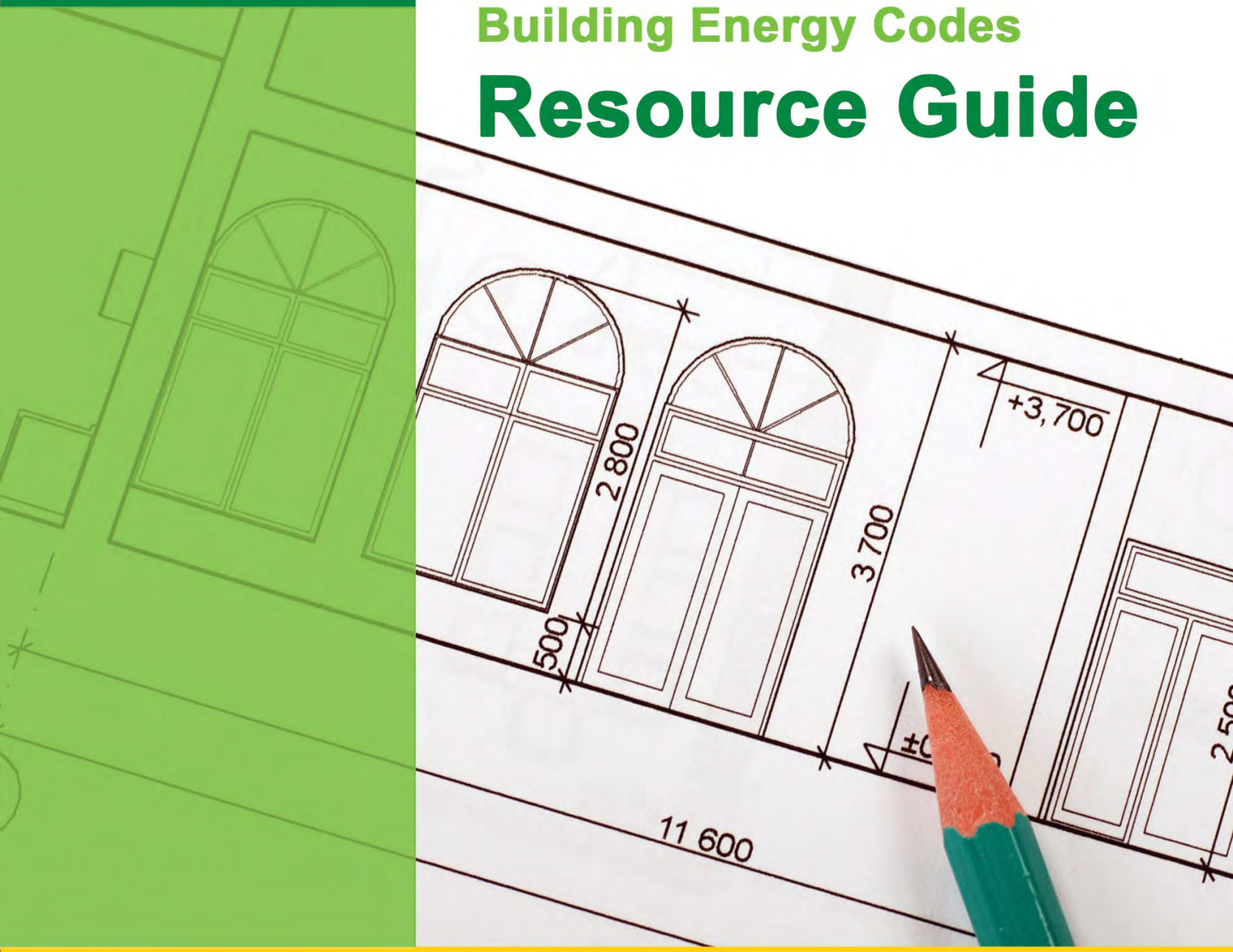
U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

Building Energy Codes
Resource Guide



Code Officials Edition

Building Energy Codes
U.S. Department of Energy

ICC
INTERNATIONAL
CODE COUNCIL®

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

Stay Up To Date!

**The world of energy codes is constantly progressing.
Please register your resource guide to receive updates.**

Simply visit:
www.energycodes.gov/publications/packetRegistration.php

Building Energy Codes

Department of Energy
Washington, DC 20585

September 22, 2010
To: ICC Chapter Presidents, BOD members and ICC Regional Staff
Subject: Support for Adoption of and Compliance with Building Energy Codes

I am writing on the behalf of the U.S. Department of Energy (DOE) to thank you, as well as your peers, for your efforts to adopt and seek compliance with building energy codes at the state and local levels. Buildings account for 40 percent of total U.S. energy consumption. While adopting building energy codes is important to reducing energy consumption, DOE realizes that compliance with those codes is what ensures energy savings, and ensuring compliance is the challenge the code enforcement community faces every day in the field.

We recognize that in most cases you and your peers are the last officials to see insulation and duct systems before they are covered, as well as many other building components and systems that, if not effectively installed, will never perform as intended. Inspecting energy efficiency items is important, just as inspecting critical safety items like structural components or fire suppression systems is important. When safety items fail, the causes and consequences of non-compliance are readily apparent. However, the causes and consequences of non-compliance with the energy code can be very difficult to observe after the building is finished.

We must all do our part to address energy challenges, and we very much appreciate your continuing attention to energy-related issues. As we all strive to do more with less, DOE wants you to know we continue to assist and support your efforts related to energy code compliance. The Building Energy Codes Program has considerable resources that are available, free of charge, to the building codes community at www.energycodes.gov. Downloadable copies of the resources in this "Building Energy Codes Resource Guide: Code Officials Edition" are also available at www.energycodes.gov/publications/resourceguides. We encourage you to review these materials and circulate electronic copies to your peers and others in your jurisdiction. Please also advise us how we might improve the website by contacting us at techsupport@becp.pnl.gov.

Again, thank you for all you do to protect the public and promote energy efficiency through building energy code adoption and compliance.

Sincerely,

Roland Risser

Roland Risser
Program Manager
Building Technologies Program
Energy Efficiency and Renewable Energy

International Code Council
500 New Jersey Avenue, NW
Sixth Floor
Washington, DC 20001
tel: 888.icc.safe (422.7233)
tel: 202.370.1800
fax: 202.783.2348
www.iccsafe.org

October 2010

To: ICC Chapter Presidents and ICC members
Subject: Building Energy Code Resources for Code Officials

On behalf of ICC, I am pleased to present to you this publication, which we developed jointly with the U.S. Department of Energy, in order to help you in understanding, and achieving compliance with, the 2009 International Energy Conservation Code.

Our relationship with DOE goes back over 30 years with the development of the IECC predecessor, the Model Code for Energy Conservation. This publication confirms that the relationship benefits both our members, by providing up-to-date tools, and the nation, by helping us reduce building energy use across the nation.

We recognize the important role that state and local code officials have played and continue to play in enhancing the performance of our built environment. Just as you have always had a key role in protecting the public safety and welfare in the built environment, the effort you devote to energy code compliance will result in a significant reduction in energy use and save consumers and businesses millions of dollars.

We know that you are being asked to do more with less lately, and we appreciate that challenge. The joint DOE/ICC resource guide is intended to be a useful reference that will assist you in continuing to improve your ability to explain, utilize and gain compliance with building energy code requirements. With your help we would like to further enhance this document and keep it updated as the IECC evolves. Consequently, we welcome any recommendations for its enhancement. Also we hope you will advise others to download the document at www.energycodes.gov. If you or your colleagues need additional copies of the IECC itself, a free download is available at www.iccsafe.org/freeIECC.

Thanks again for all you do every day to protect the public safety and welfare as well as our irreplaceable energy resources.

Sincerely,

Rick Weiland
Chief Executive Officer

THE GUIDE AT A GLANCE

Building Energy Codes

BUILDING ENERGY CODES
COMMERCIAL SUPPORT

COMMERCIAL COMPLIANCE TOOLS

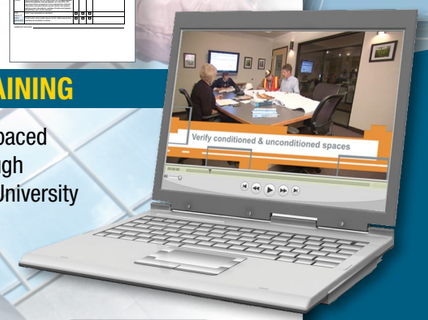
COMcheck™

COMcheck•Web™

Software, Web Tools, and Inspection Checklists

Software: www.energycodes.gov/software.stm

Checklists: www.energycodes.gov/arra/compliance_evaluation



COMMERCIAL TRAINING

Webcasts, Videos, Self-paced Courses and more through Building Energy Codes University

www.energycodes.gov/becu

COMMERCIAL SUPPORT

Publications, FAQ's, Resources, and Technical Assistance through the Solutions and Help Center

www.energycodes.gov/help

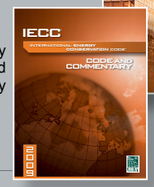
**

"Your blueprint of available resources to support compliance with ASHRAE Standard 90.1 and the IECC, the nation's main model energy codes"

INTERNATIONAL CODE COUNCIL®
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 IECC® ***Performing Residential Energy Inspections***-Training Workbook

2009 IECC® ***Performing Residential Energy Plan Reviews***-Training Workbook

RESIDENTIAL TRAINING

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

DOE's Building Energy Codes Program (BECP) Tools: A Matrix for Code Officials

BECP Product	Paper-based Tools	Software Tools			Trade-off Approach	(Simulated) Performance Approach	Prescriptive Packages Approach
		Desktop Tools		Web-based Tools			
		Windows	Mac				
RESIDENTIAL							
RES*check*™ Compliance Software		x	x	x	x	x	
RES*check*™ Technical Support Document & User's Guide	x				x	x	
2009 IECC Prescriptive Requirements Web Tool				x			x
RES*check*™ Prescriptive Package Generator (through 2006 IECC)				x			x
Plan Review Quick Reference Guide/ sample RES*check*™ case study	x*						
Inspection Checklists for the 2009 IECC	x*						
Residential Education & Training (www.energycodes.gov/becu)	x			x	x	x	x
COMMERCIAL							
COM*check*™ Compliance Software		x	x	x	x		
COM*check*™ Technical Support Document & User's Guide	x						
COM*check*™ Prescriptive Package Generator (through 90.1-2004)				x			x
Plan Review Quick Reference Guide/ sample COM*check*™ case study	x*						
Inspection Checklist: 2009 IECC Commercial Provisions	x*						
Inspection Checklist: Standard 90.1-2007	x*						
Commercial Education & Training (www.energycodes.gov/becu)	x			x	x		x

*Available within the Building Energy Codes Resource Guide: Code Officials Edition

International Code Council (ICC) Energy Training

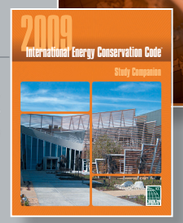
ICC Product	Architects/ Engineers	Building Inspectors	Building Officials	Commercial Energy Inspectors	Contractors/ Builders	Engineers	Plans Examiners	Residential Building Inspectors
2009 IECC Update	x	x	x	x	x	x	x	x
2009 IECC Fundamentals		x	x	x		x	x	x
2009 IECC Fundamentals residential provisions for builders					x			
2009 IECC Fundamentals residential provisions for designers	x							
2009 IECC Performing residential energy plan reviews							x	
2009 IECC performing residential energy inspections								x
2009 IECC Commercial Energy Plans Examiner CEP							x	
2009 IECC Residential Energy Inspector/Plans Examiner CEP							x	x
2009 IECC Commercial Energy Plans Examiner ORU							x	
2009 IECC Residential Energy Plans Examiner ORU							x	

INTERNATIONAL CODE COUNCIL®
COMMERCIAL 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

2009 International Energy Conservation Code® ***Study Companion***



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

COMMERCIAL TRAINING

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

Online Certification Practice Course
- 2009 IECC Commercial Energy Plan Examiner Certification Exam Practice Course

Online CEU
- 2009 IECC Commercial Energy Plans Examiner Online Renewal Update

Building Energy Codes

BUILDING ENERGY CODES
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RESIDENTIAL COMPLIANCE TOOLS

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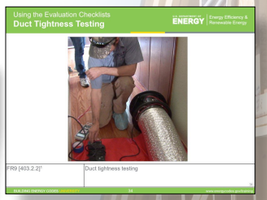

RESIDENTIAL TRAINING

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www.energycodes.gov/becu

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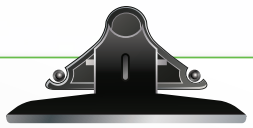
ASHRAE Standard 90.1-2007 cover image used with permission.
©American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., **www.ashrae.org**.

Check out **www.energycodes.gov** *for the U.S. Department of Energy's complete set of building energy codes resources, and* **www.iccsafe.org** *for the International Code Council's energy-related publications, training, and certification. To simplify the search,* **open this blueprint** *for a quick look at DOE's and ICC's specific offerings for code officials—many of which are included in this resource guide.*

Welcome!

The ***Building Energy Codes Resource Guide: Code Officials Edition*** was designed with you in mind.

The U.S. Department of Energy (DOE) and its Building Energy Codes Program (BECP) and the International Code Council (ICC) realize how busy code enforcement officials are as they do the vital work it takes to keep our buildings safe. As energy efficiency becomes increasingly emphasized to protect the nation's economic, environmental, and national security interests, building energy codes are probably becoming a larger part of your job. To make energy code compliance enforcement easier, BECP and ICC are bringing our most relevant resources to you. While the tools, training, information, and resources within are always available at **www.energycodes.gov** and at **www.iccsafe.org**, we've organized them here in a way that speaks to your profession.



☑ Watch for these **"What's in it for me?"** clipboards on the tabbed dividers for a quick look at the resources within each section—each item is included to make a code official's job easier.

Contents

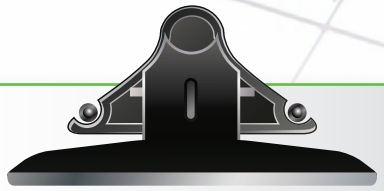
Don't forget to register your packet to receive the latest materials as they are updated:

www.energycodes.gov/publications/packetRegistration.php

* All ICC product excerpts (throughout) are included with permission. For full versions of these products visit **www.iccsafe.org**. ©International Code Council

ENERGY CODES

Background



To get a brief overview or train others on energy codes and the motivations behind them, find two new DOE resources in this section:

- ☑ *Top Ten Reasons for Energy Codes*
- ☑ *Energy Codes 101: An Introduction* (part of a series of "101" products available at **www.energycodes.gov/becu**)

What's in it FOR ME?

Top Ten Reasons for Building Energy Codes

Today's energy, economic, and environmental challenges—combined with the fact that buildings consume nearly 40% of the nation's energy—make energy codes a central part of a sustainable future. Here are ten key reasons why:

Energy codes lead to energy savings—which bring about multiple benefits for individuals, the nation, and the planet.

10. Energy codes establish a common foundation for evaluating, regulating, and incentivizing building performance, technologies, design, and construction.

9. Energy codes support more widespread decisions and actions that lead to efficient buildings.

8. Energy codes help drive the development and deployment of new building technologies and design strategies.

7. Energy codes provide a cost-effective step toward mitigating problems associated with growing demand for energy and power resources.

6. Energy codes can lock in the use of energy efficient technologies that have been proven through incentive programs, freeing up resources to focus on additional technologies.

5. Energy codes provide a common basis upon which to educate the building design and construction community in energy efficiency.

4. Energy codes safeguard owners and tenants from long-term financial burdens that can result from short-term design and construction decisions.

3. Energy codes continue to progress in terms of stringency, scope, and enforcement emphasis—all of which provide new jobs or opportunities to enhance the skills of the current workforce.

2. Energy codes help protect the natural environment from unnecessary emissions.

1. Energy codes reduce the vast amount of energy that is needlessly consumed each year to heat, cool, light, ventilate, and provide hot water for newly constructed residential and commercial buildings that lack adequate energy efficiency features.

Building Energy Codes

Building Energy Codes Website:
www.energycodes.gov
Tech Support:
www.energycodes.gov/help

EERE Information Center
1-877-EERE-INF (1-877-337-3463)
eere.energy.gov/informationcenter

PNNL-SA-72994

Building Energy Codes 101 – An Introduction

Description

The Building Energy Codes 101 family of products provides a basic, free-of-charge introduction to the varied and complex issues associated with building energy codes. Available in the form of a book, presentation, and corresponding training manual, these products can be used for self study or to educate others in your area—download what you need, modify it as you need with state and local information, and raise awareness among those who have an impact on building energy use. These resources are available—with a host of other multi-media training materials—within Building Energy Codes University: **www.energycodes.gov/becu.**

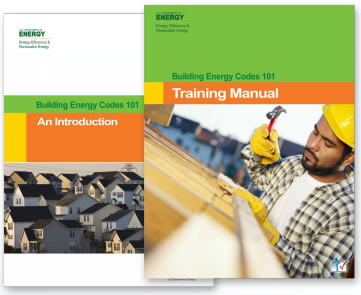


Table of Contents:

Originally published:

Spring 2010, by DOE's Building Energy Codes Program

Free Codes 101 Downloads Available:

Building Energy Codes 101 – An Introduction
(pdf presentation)

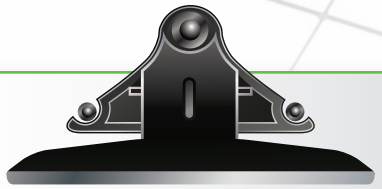
Building Energy Codes 101 – Slide Notes
(pdf presentation with notes showing)

Building Energy Codes 101 – An Introduction
(pdf booklet)

Building Energy Codes 101 – Training Manual *(pdf)*

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:

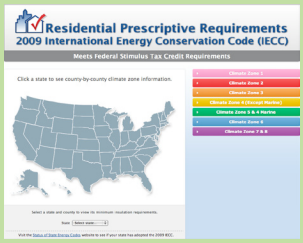
What's in it FOR ME?

- An introduction to residential compliance approaches and their corresponding tools
- **Help with plan review:** DOE's Case Study and Quick Reference Guide with sample RES*check*™ 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)
Prescriptive Packages Approach	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.	The 2009 IECC itself contains tables that are used directly to demonstrate compliance with the prescriptive approach. For help, check out the requirements at **http://energycode.pnl.gov/EnergyCodeReqs** BECP's interactive map tool makes the process easy: simply choose your state to see its climate zones and get the information you need. 
Trade-off Approach	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.	**RES*check*™**, 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 **RES*check*™** or begin using **RES*check-Web*™**, please visit: **www.energycodes.gov/software.stm**

APPROACH	DESCRIPTION	COMPLIANCE TOOL(S)
Performance Approach	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.	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 *REM/Rate*™ and *REM/Design*™ help users show compliance by the performance approach. See these and nearly 400 other software tools through the Building Energy Software Tools Directory: **http://apps1.eere.energy.gov/buildings/tools_directory/** REScheck™ **RES*check***™ 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.

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 buildiing 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.

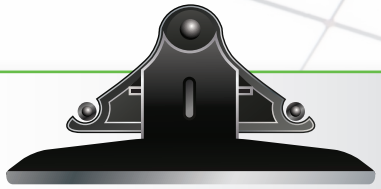
Q: Why are there so many compliance approaches?

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.

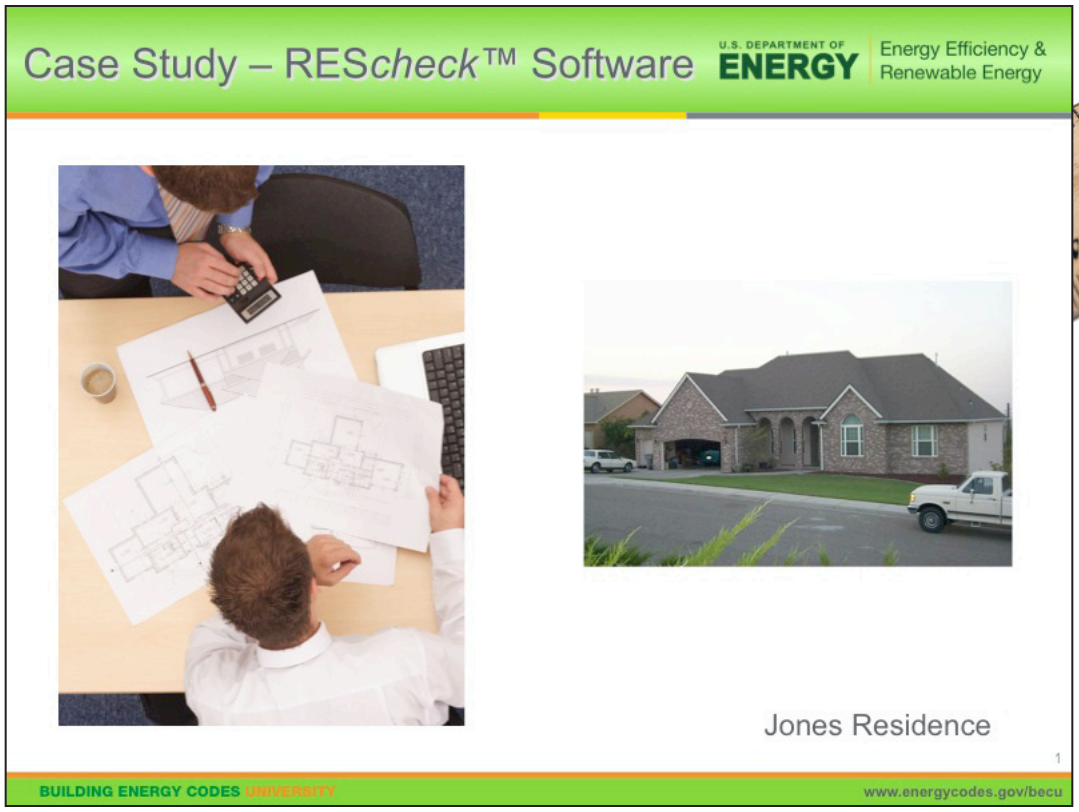
Residential
Plan Review



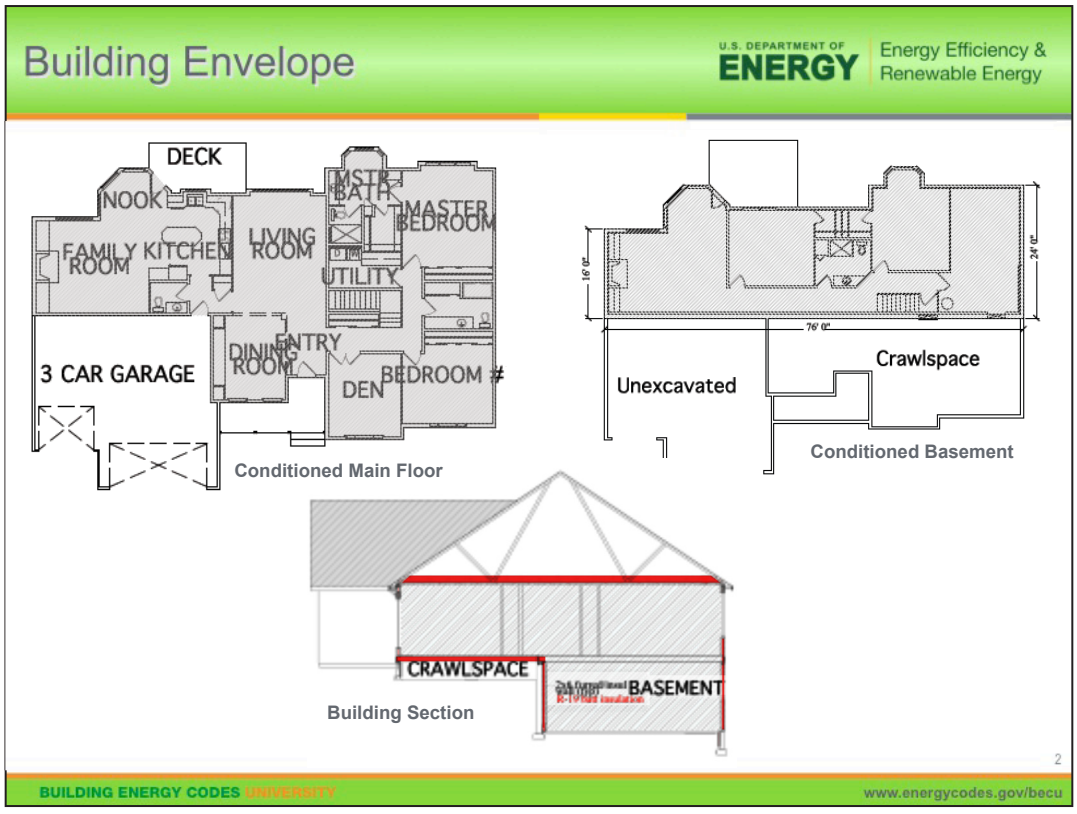
What's in it FOR ME?

In this section you'll find:

- ☑ Residential case study, complete with DOE's RES*check*™ *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*

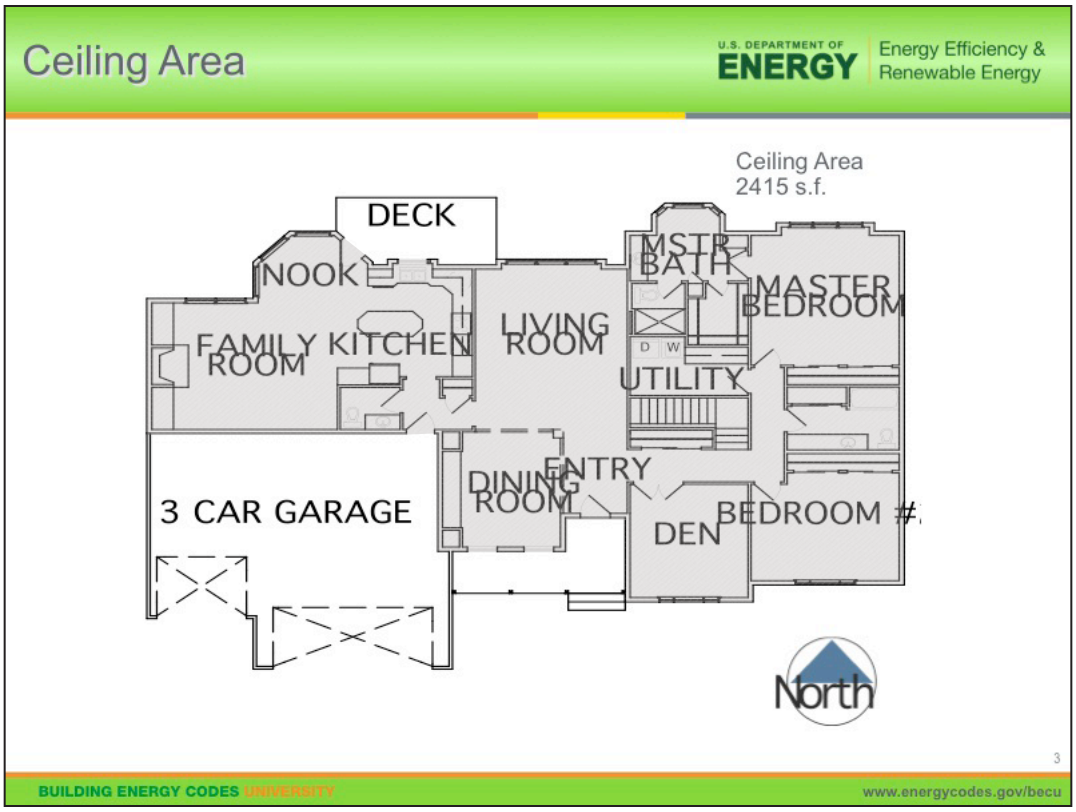


This case study is based on a location where multiple building thermal envelope components are involved (basement, slab-on-grade, and vented crawl space). These slides correspond with DOE's Plan Review Quick Reference Guide and sample RES*check*™ certificate, which immediately follow the presentation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



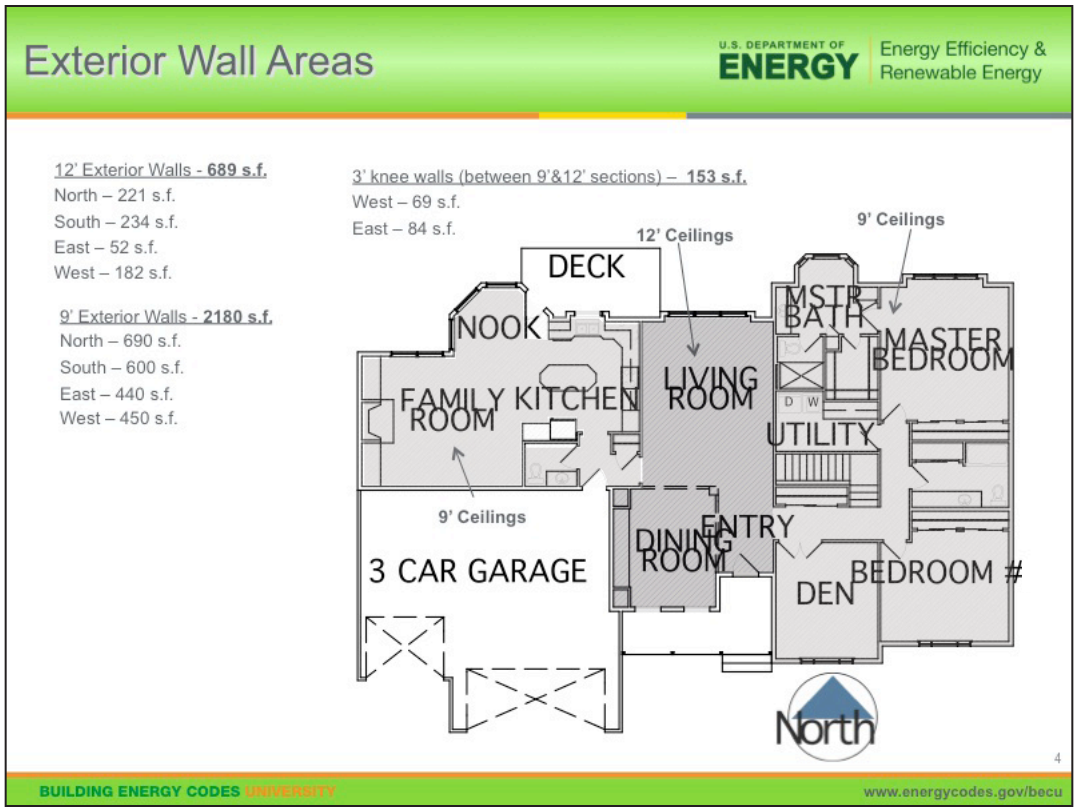
The conditioned area or building thermal envelope is the first thing that needs to be defined for RES*check*™ inputs.

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



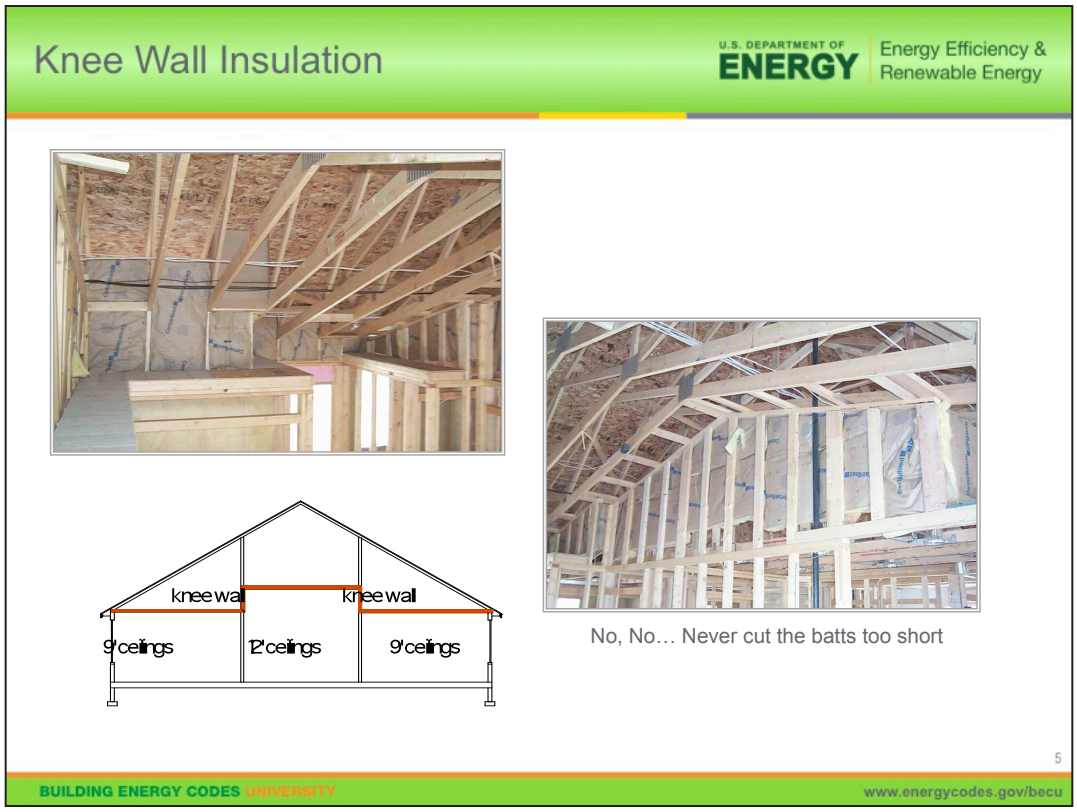
The ceiling area in this residence corresponds with the main floor area because the ceilings are flat. If this plan contained vaulted areas, the ceiling area would need to be adjusted for the larger ceiling area created by the vault.

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

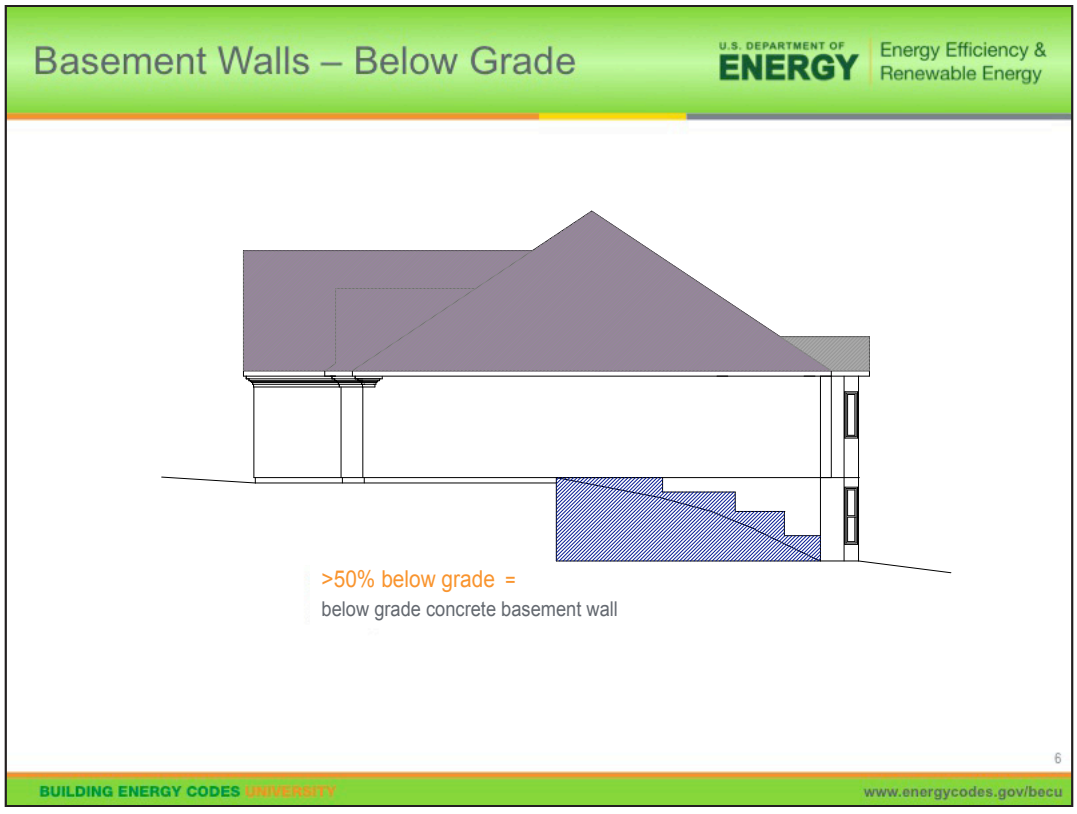


Exterior Walls: The area of the exterior walls depend on the ceiling height of the space that the wall encloses. The highlighted sections on the main floor plan show the ceiling heights in various areas of the residence. The perimeter length of the exterior wall enclosing the space is multiplied by the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

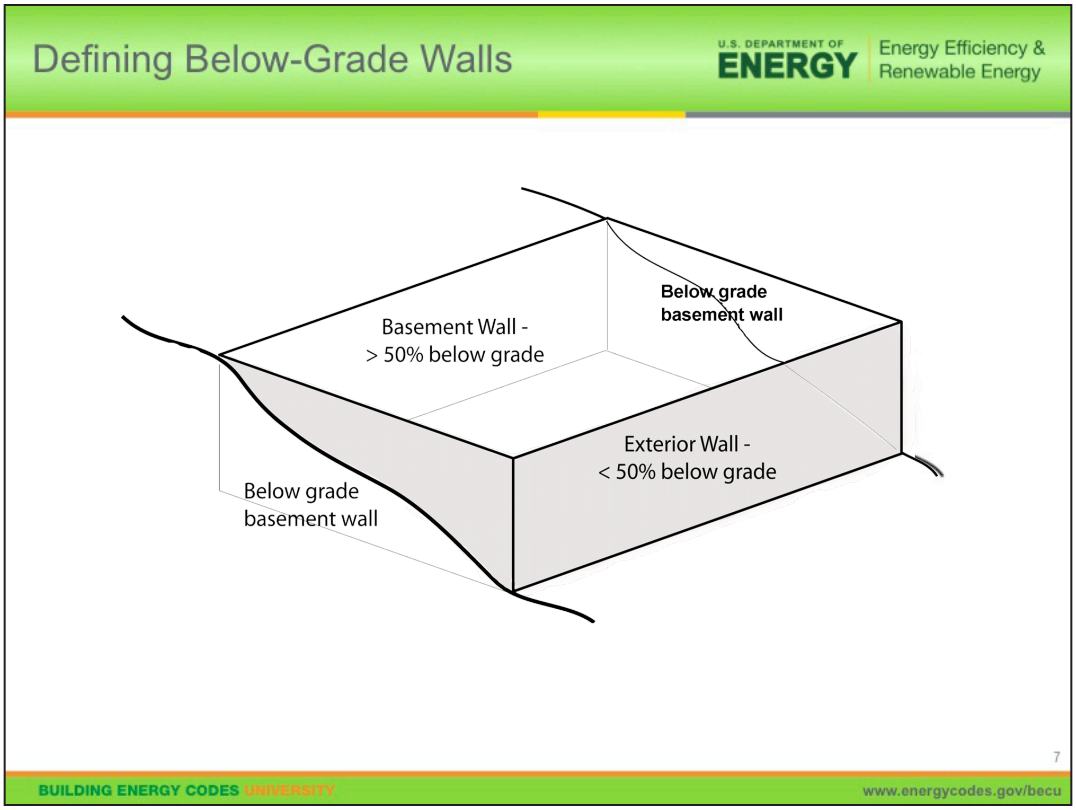
The knee walls between the 9’ ceiling and 12’ ceiling sections also enclose the conditioned space and are part of the building thermal envelope.



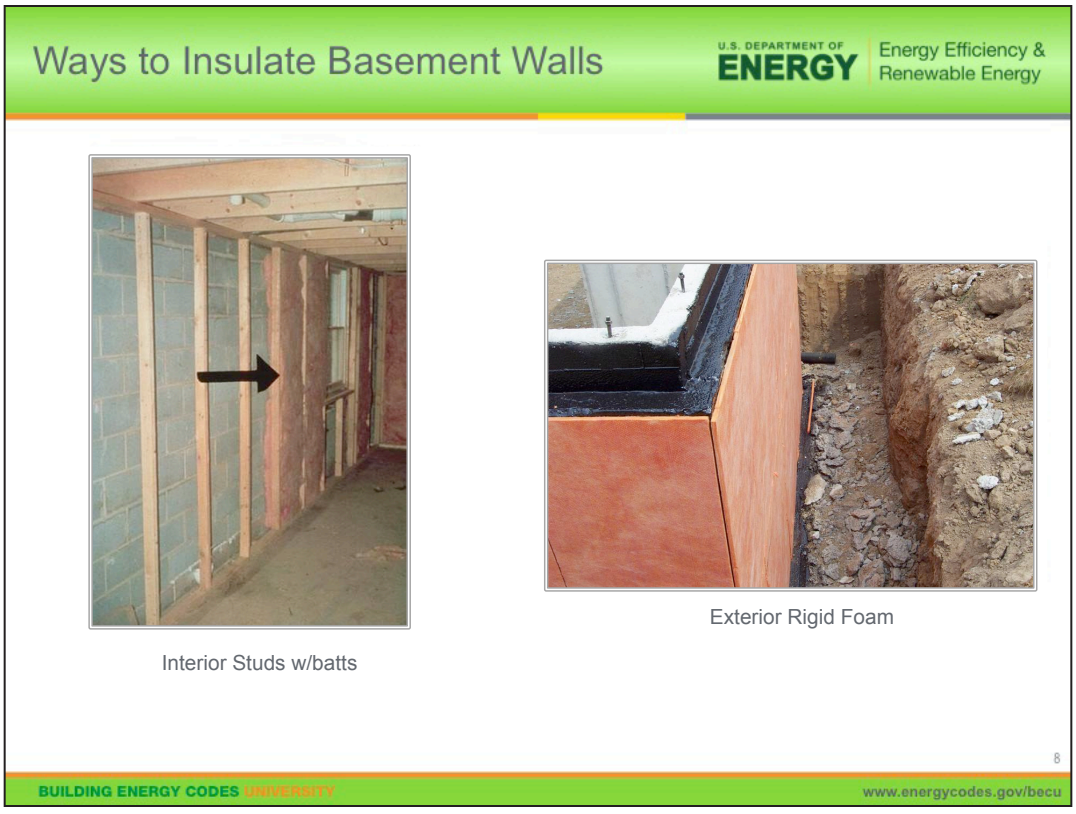
The diagram is highlighting the ceiling area and knee wall insulation placement.



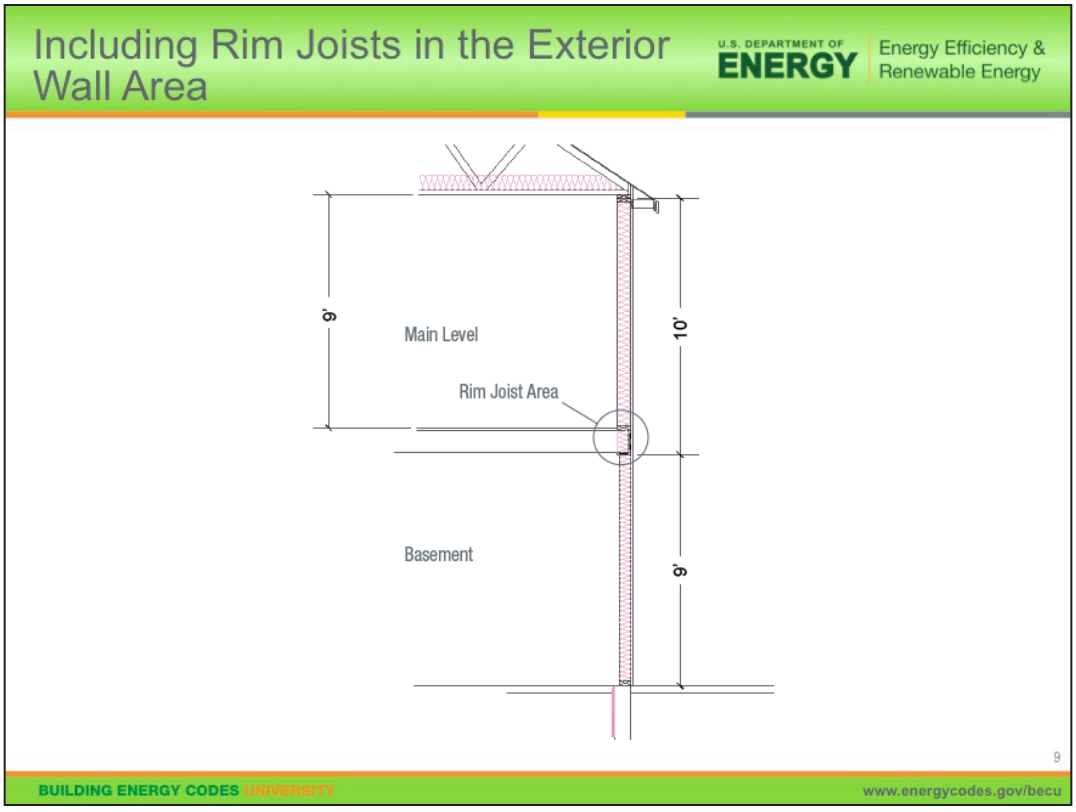
The “side” basement walls are assumed to be more than 50% below grade. Therefore, the entire wall is considered a “below grade” basement wall (solid masonry).



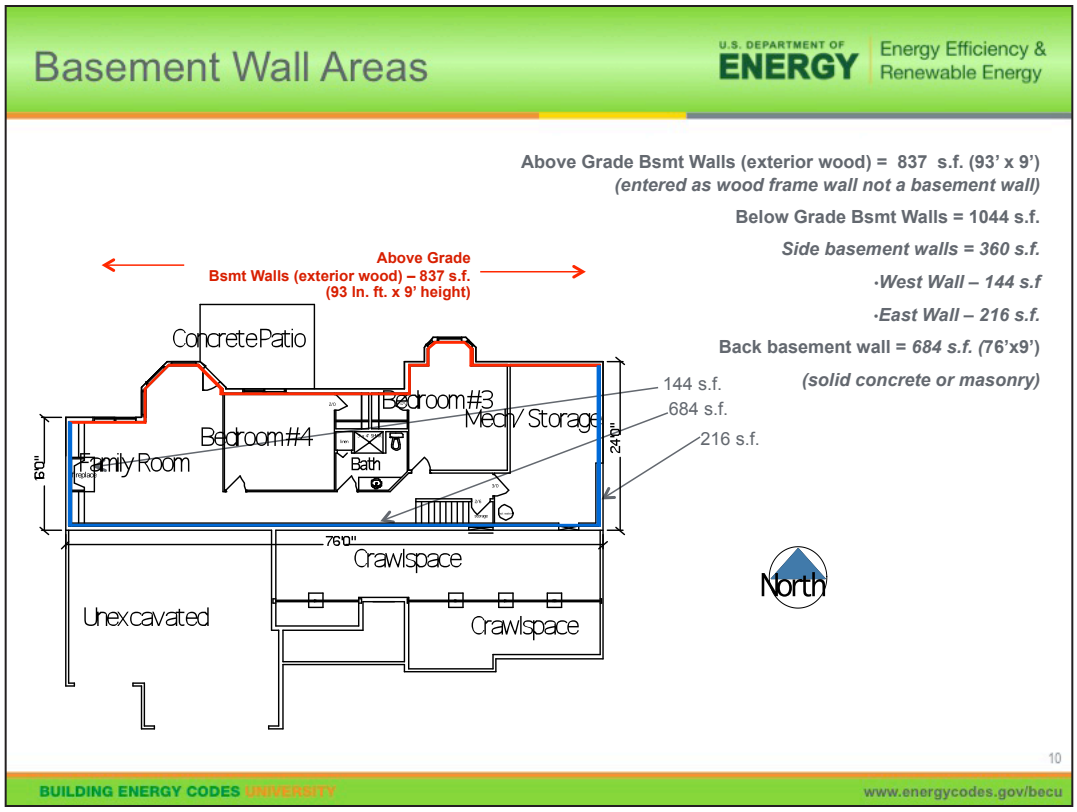
This diagram illustrates a typical walk out basement, where the back wall is fully below grade, side walls are >50% below grade and the front wall is fully above grade and the only wall that would be considered an above grade exterior wall.



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



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.

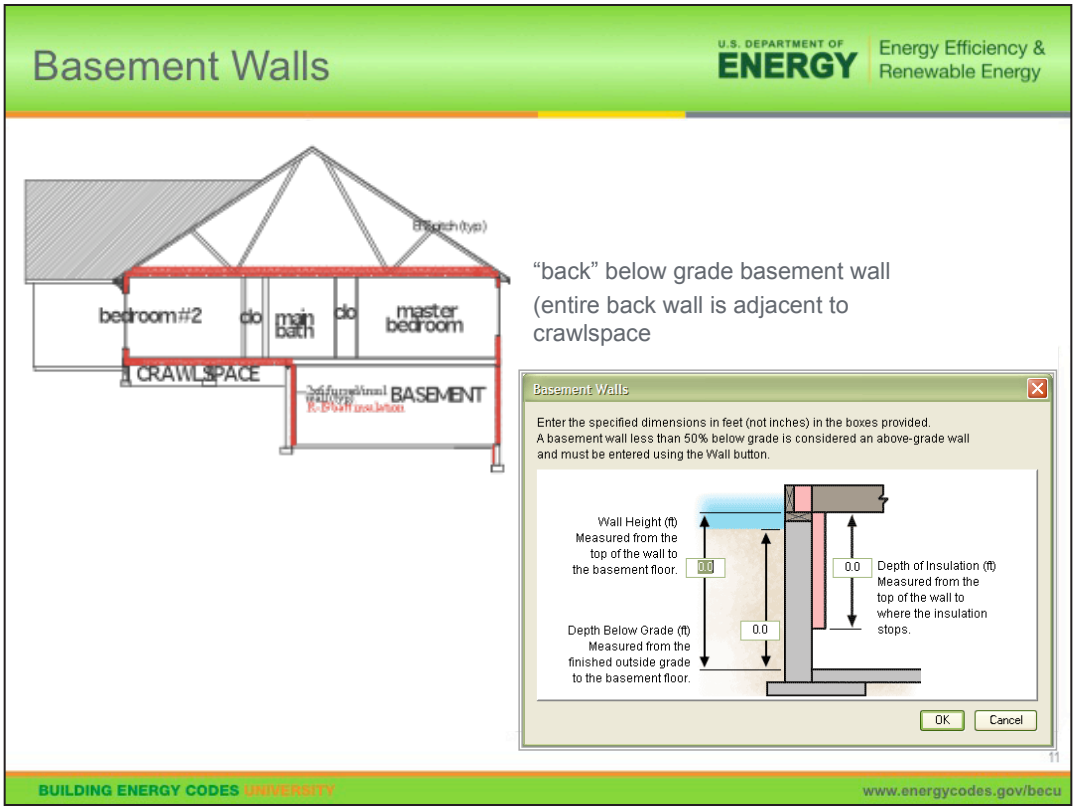


Basement Walls:
The "walkout" side of the basement is an exterior wood wall with windows and doors and is entered in RES*check*™ as "wood frame wall – 16" o.c.". The perimeter length of this wall is 93'. This length multiplied by the basement wall height of 9' equals 837 square feet.

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.).

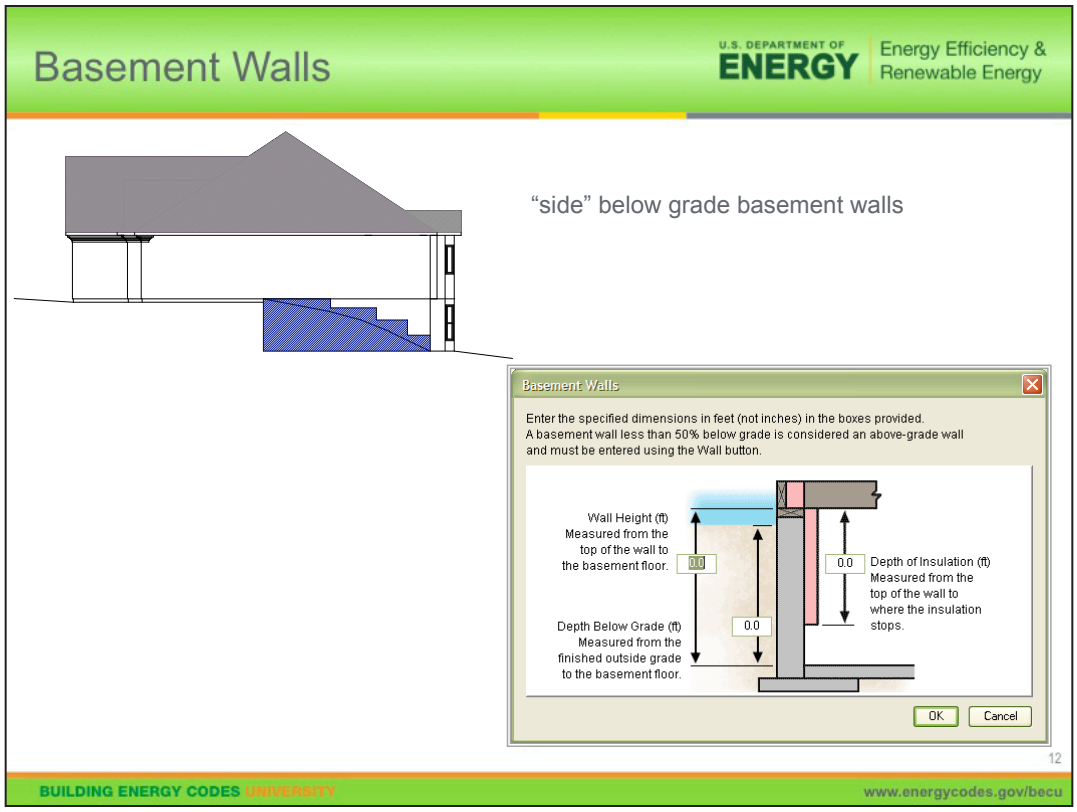
The "back" basement wall is totally below grade and is considered a "below grade basement wall". The length of the back wall is 76 feet (684 s.f.).

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



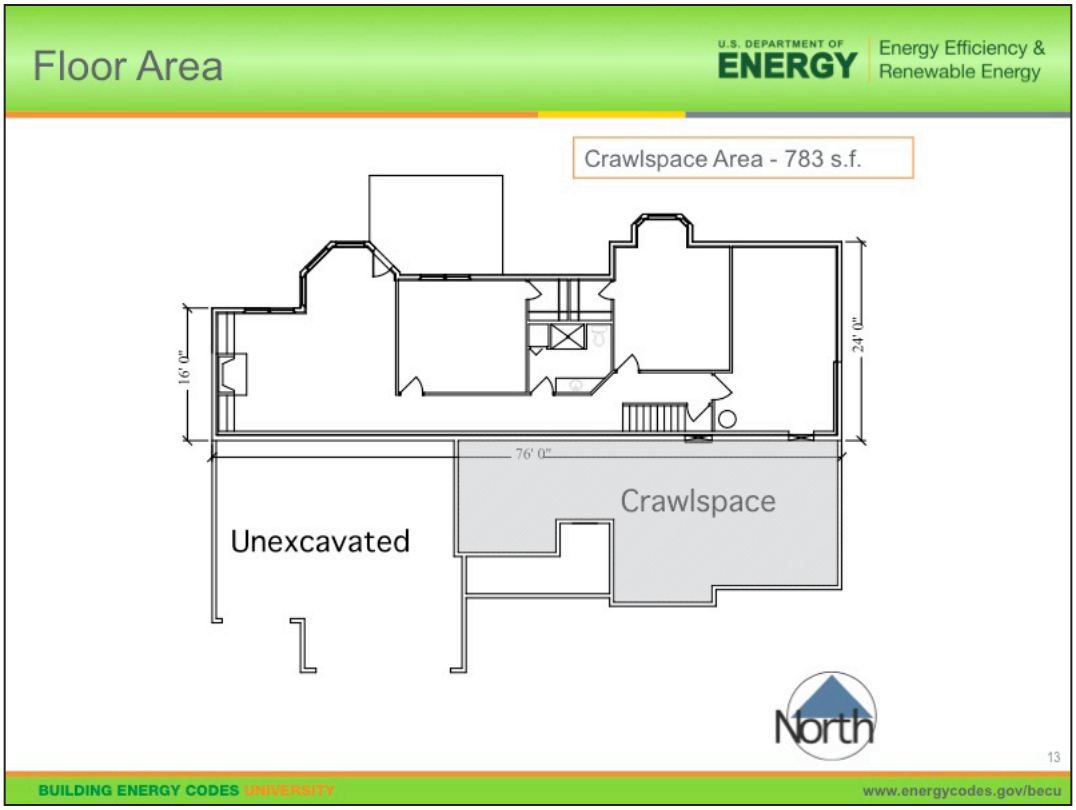
Screen shots of the below grade basement wall RES*check*™ inputs are shown.

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).



Screen shots of the below grade basement wall RES*check*™ 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.

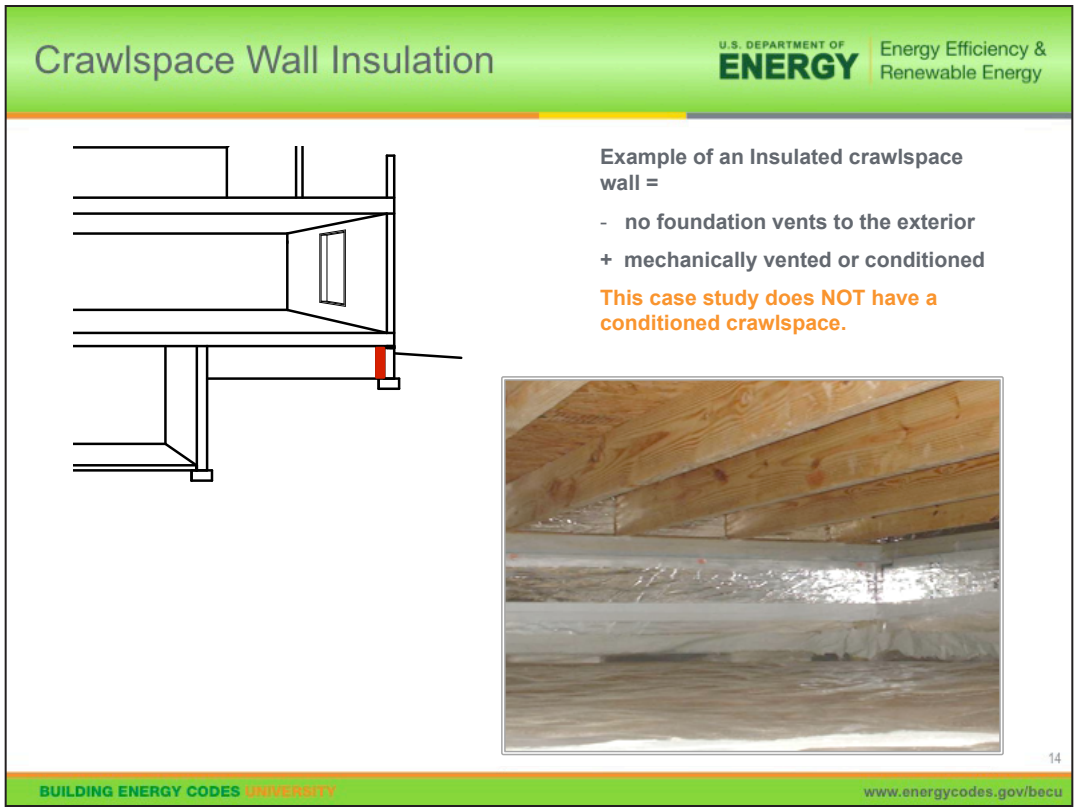


The area of the floor above the vented crawlspace is entered as a “floor” in RES*check*™. The floor is insulated between the floor joists.

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 RES*check*™.

Note: If the crawlspace is unvented, it would be required to be insulated and the stem walls shown in RES*check*™ 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.).



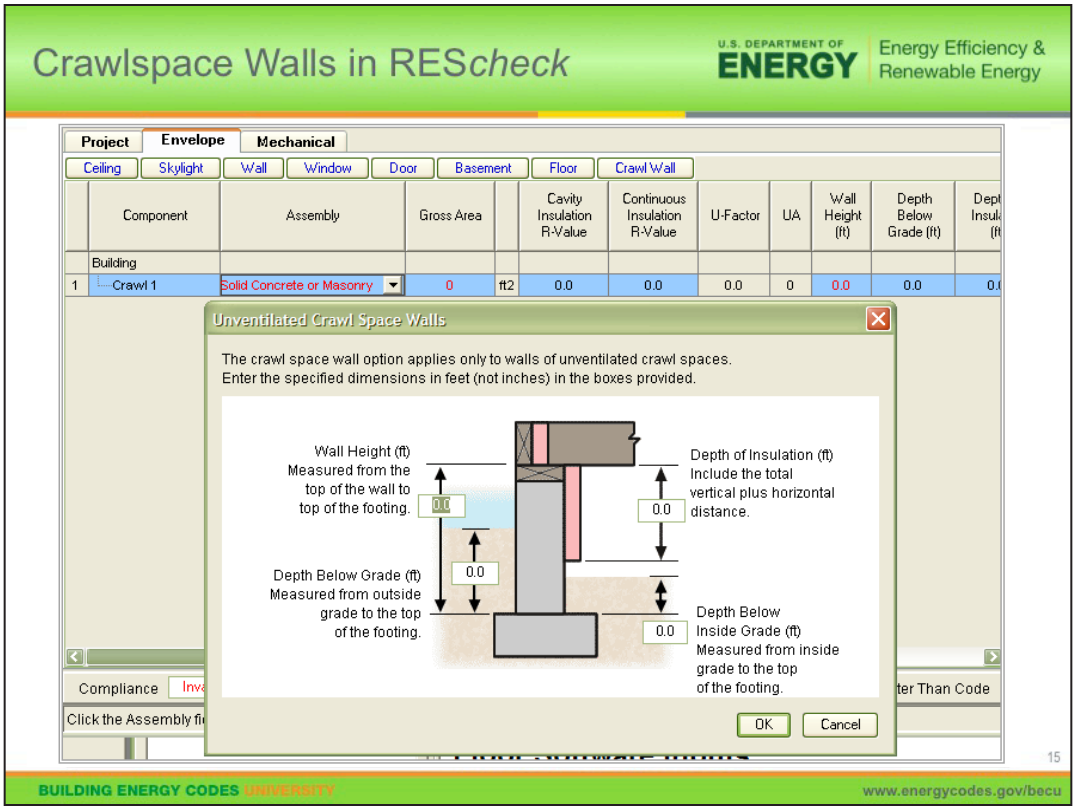
Installing insulation on the inside surface of the foundation stemwall is common practice in many cold locations in the country. This practice eliminates the need to install insulation in the raised floor over the crawlspace. There are a few criteria that must be met in order to use this insulation method:

- 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.

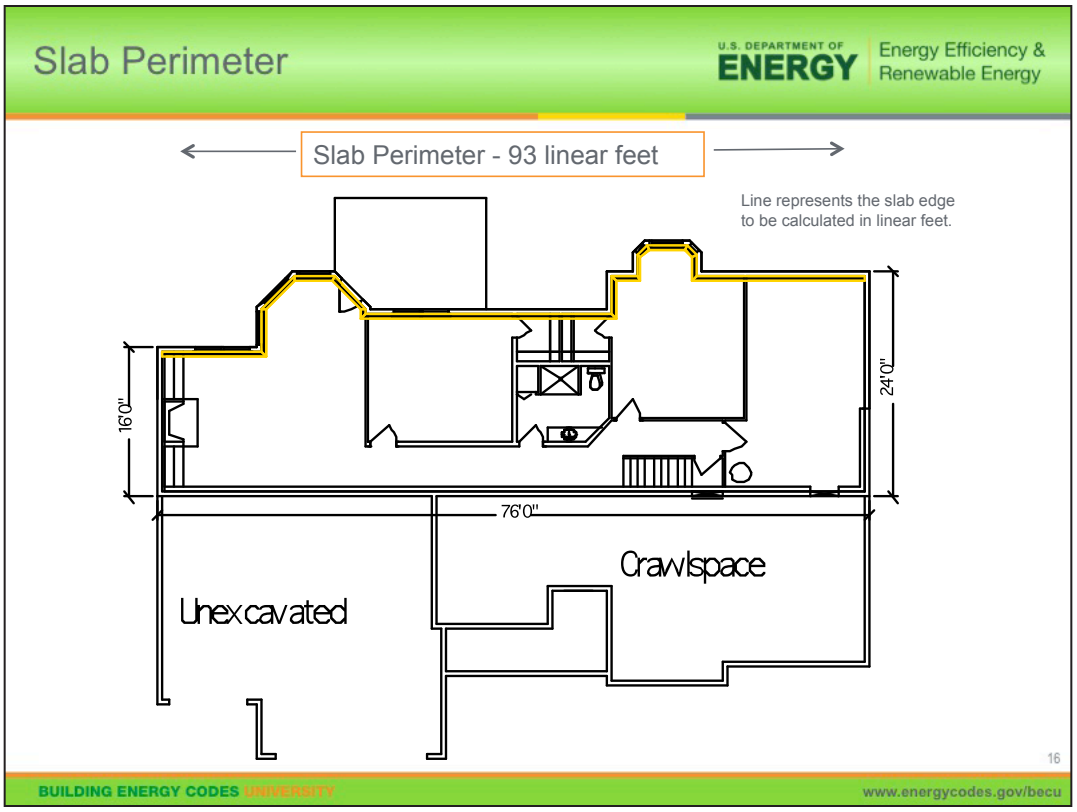
The IRC allows the construction of unventilated crawlspaces. To meet the requirements the crawlspace walls must be insulated to the R-value specified in the energy code. The crawlspace must either be provided with conditioned air or with mechanical ventilation. The code does not specify the quantity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

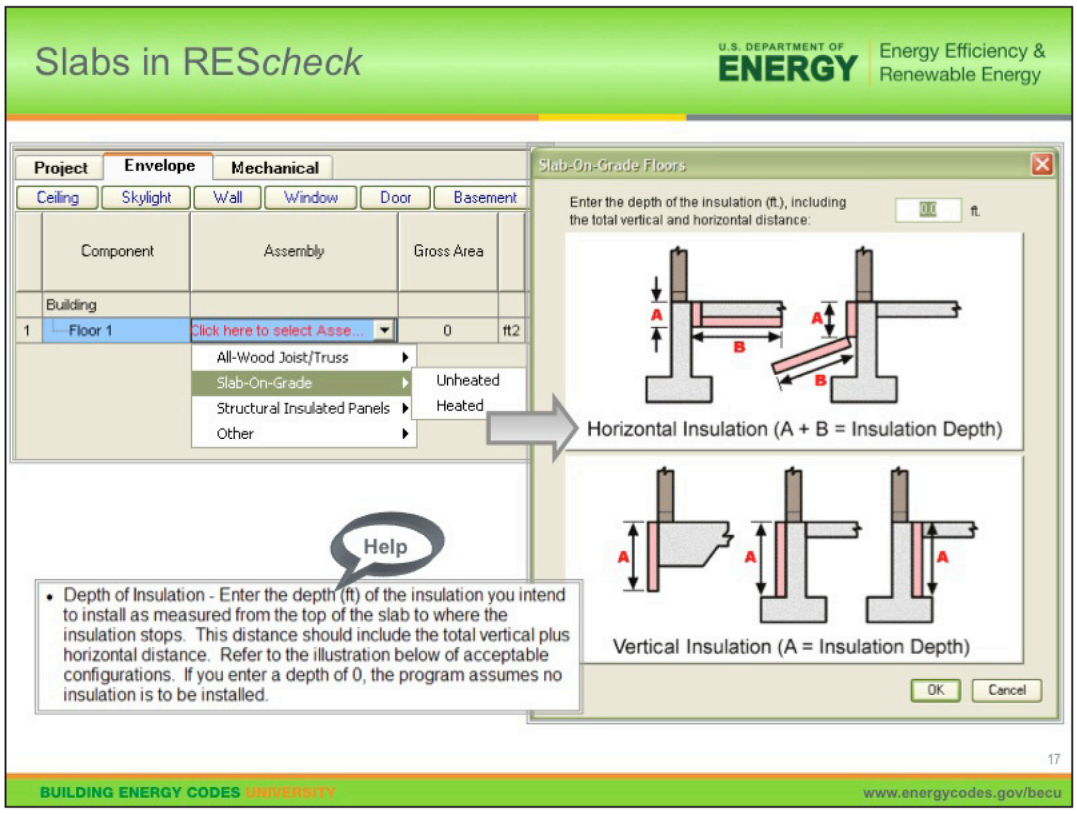
The code requires the crawl space wall insulation to extend from the top of the wall to the inside finished grade level and then vertically and/or horizontally for at least an additional 24 inches.



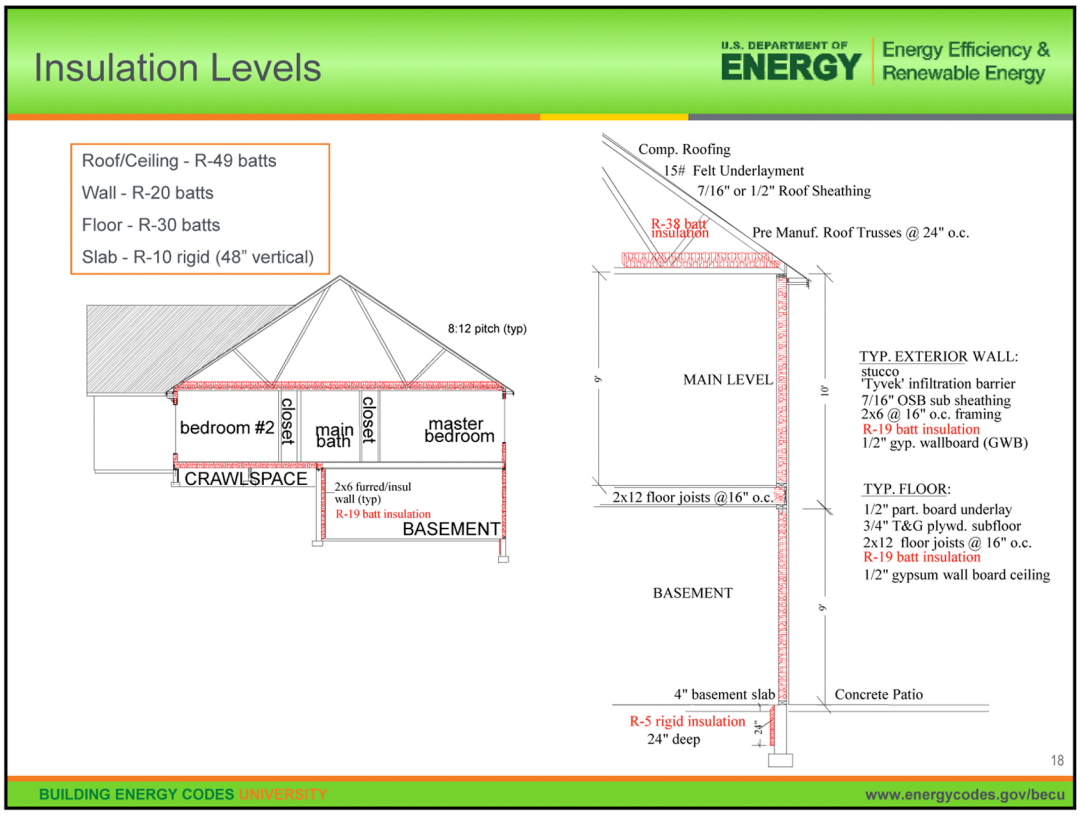
Screen shots of the crawl space wall RES*check*™ inputs are shown. This case study does not have an unvented crawl space.



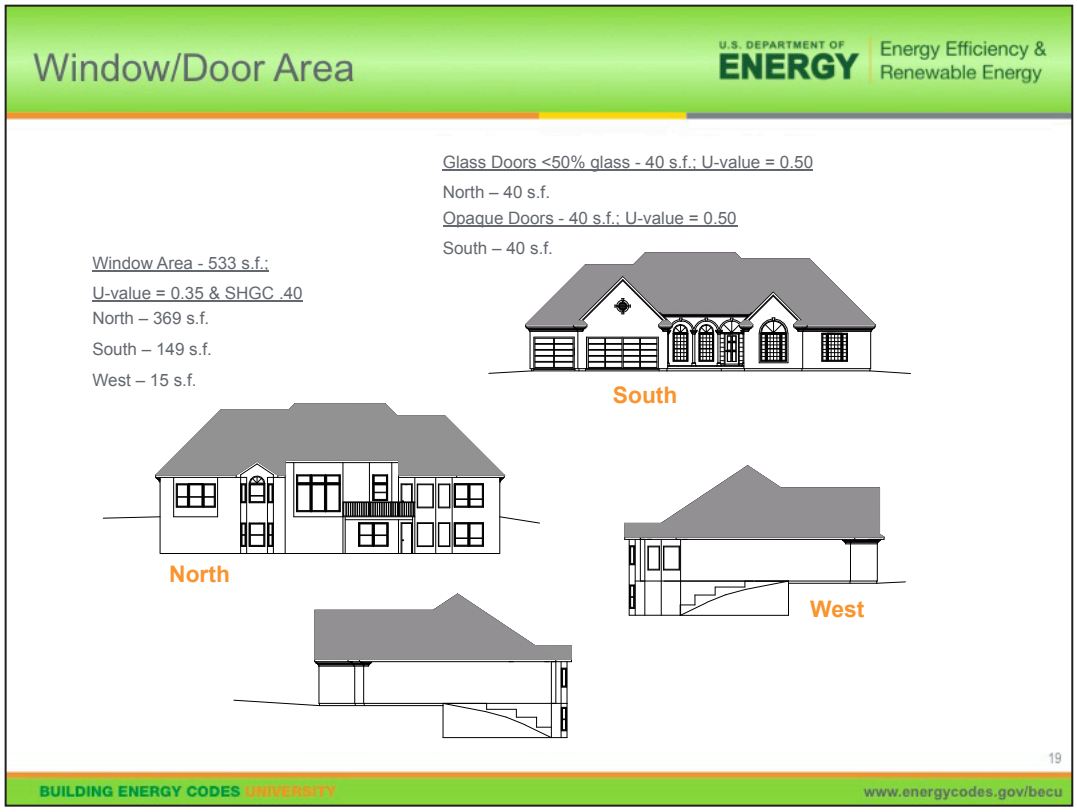
The “front edge” of the basement exterior wall (above grade) is entered as a “slab on grade” in RES*check*™. The perimeter edge measures 93 feet.



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



Building Sections are used to clarify insulation locations and levels for RES*check*™ inputs.



Window and door areas are listed to simplify RES*check*™ inputs.

RES*check*™ 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 RES*check*™ 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 RES*check*™ 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.

RES*check*™ Software Version 4.3.1
COMPLIANCE CERTIFICATE

REScheck

Project Title: Jones Residence - Plan 3677

Energy Code:	**2009 IECC**
Location:	**Bloomingdale, Illinois**
Construction Type:	**Single Family**
Building Orientation:	**Bldg. faces 180 deg. from North**
Glazing Area Percentage:	**18%**
Heating Degree Days:	**6536**
Climate Zone:	**5**

Step1: 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 to 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		40			0.500	20
Orientation: Back						
Exterior Wall 3 East: Wood Frame, 16" o.c.		492	20.0	0.0		29
Orientation: Left Side						
Exterior Wall 4 West: Wood Frame, 16" o.c.		632	20.0	0.0		36
Orientation: Right Side						
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.		69	20.0	0.0		4
Orientation: Left Side						
Knee Wall East: Wood Frame, 16" o.c.		84	20.0	0.0		5
Orientation: Right Side						

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 RES*check* Version 4.3.1 and to comply with the mandatory requirements listed in the RES*check* 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.

RES*check*™ 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.

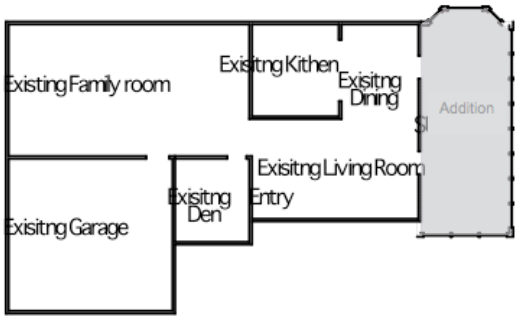
Additions Alterations Sunrooms 2009 IECC

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

1

BUILDING ENERGY CODES UNIVERSITY www.energycodes.gov/becu

New Addition Criteria

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

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

2

BUILDING ENERGY CODES UNIVERSITY www.energycodes.gov/becu

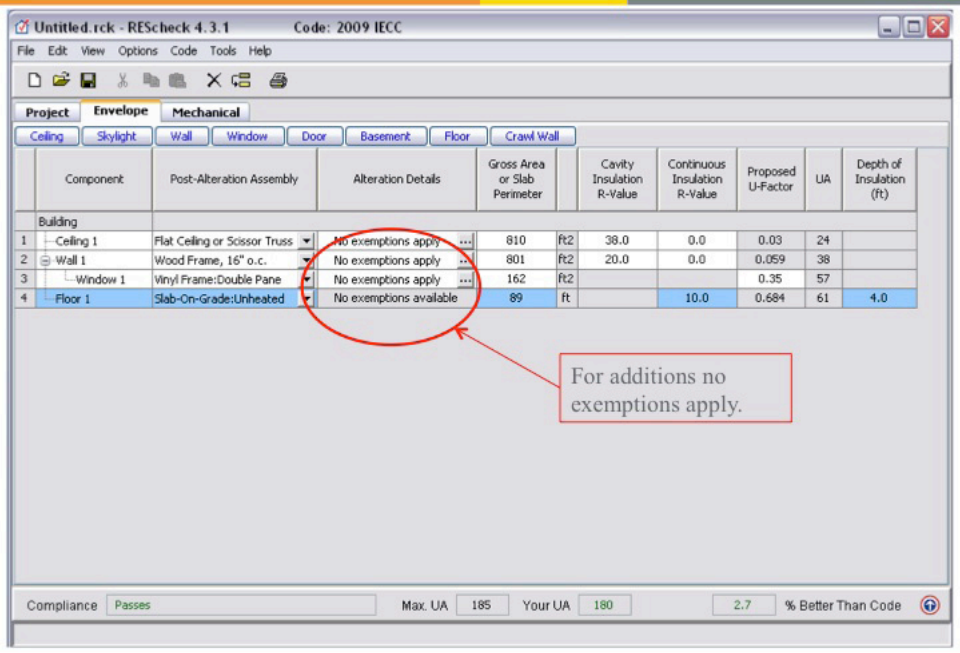
The following slides offer 2009 IECC compliance guidance for additions, alterations, and sunrooms—as well as some tips and screenshots on using RES*check*™ for these building projects.

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.

Additions in RES*check*™

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



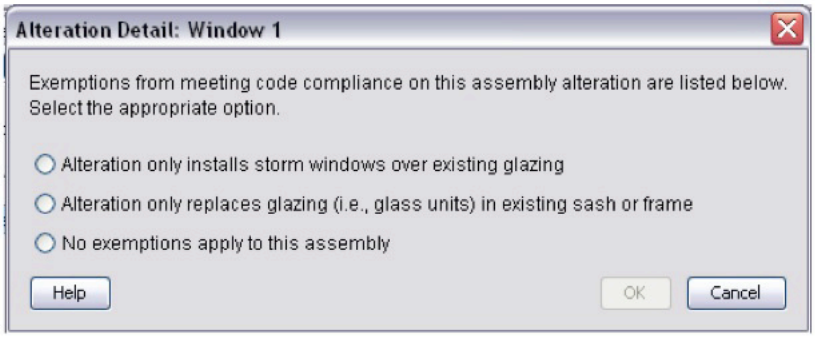
Alterations

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

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

Alterations – Window Replacement

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

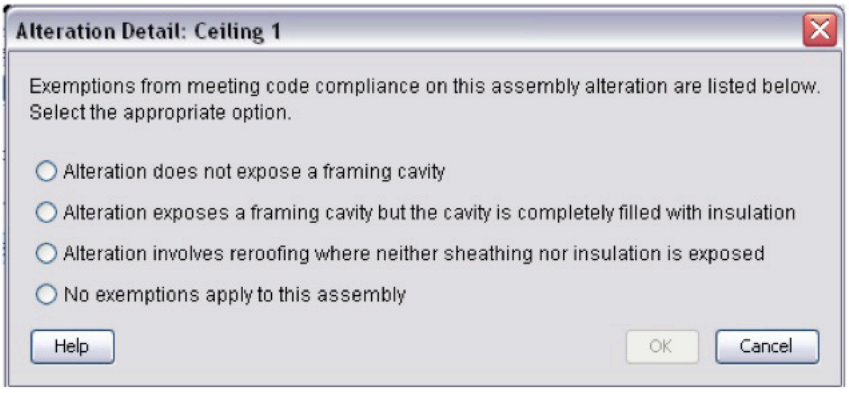


Choose the alteration exemption that applies, if any.

5

Alterations – Roof Replacement

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



Choose the roofing alteration exemption that applies, if any.

6

Special Rules for Sunrooms

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

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: RES*check*™ cannot be used for sunrooms

7

Sunroom Requirements/2009 IECC

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

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.

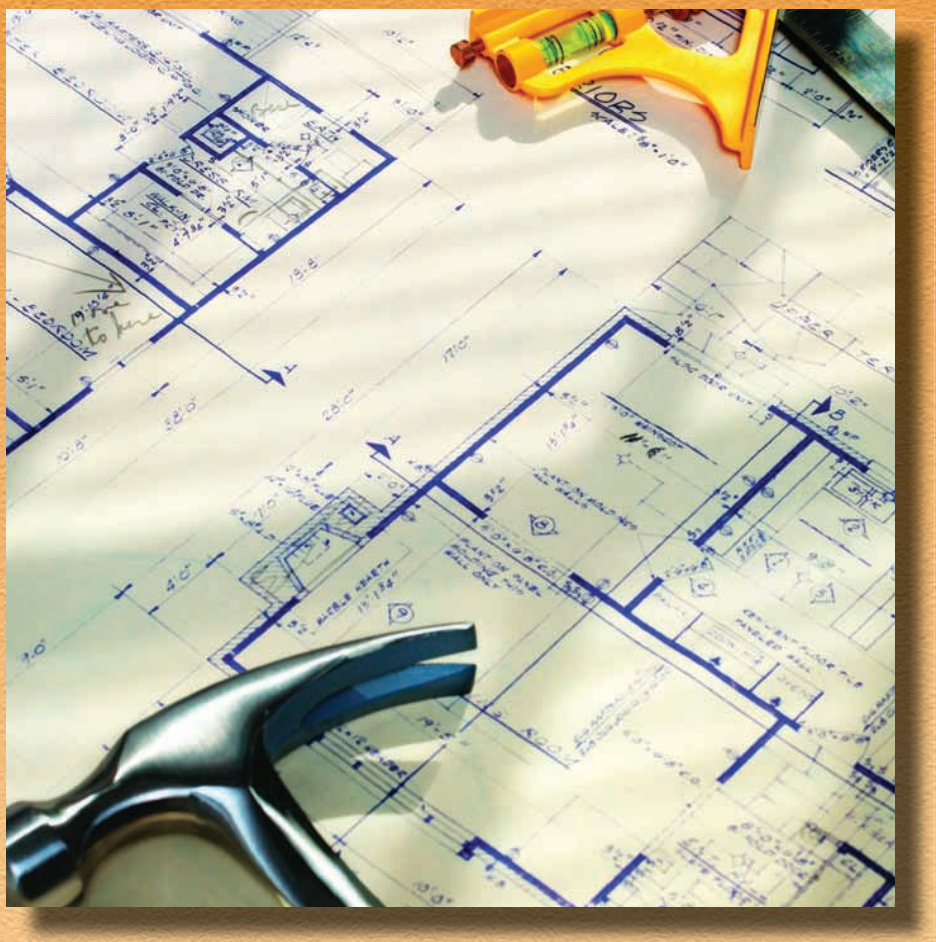
8

2009 Performing Series

Workbook Edition

2009 IECC® Performing Residential Energy Plan Reviews

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



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2009 IECC® Performing Residential Energy Plan Reviews

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2009 IECC Performing Residential Energy Plan Reviews

Third Printing: September 2010

PRINTED IN THE U.S.A.

Table of Contents

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

ICC
INTERNATIONAL CODE COUNCIL®

2009 International Energy Conservation Code®—Code and Commentary

First Printing: June 2010

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PRINTED IN THE U.S.A.

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.

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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 provided 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)].

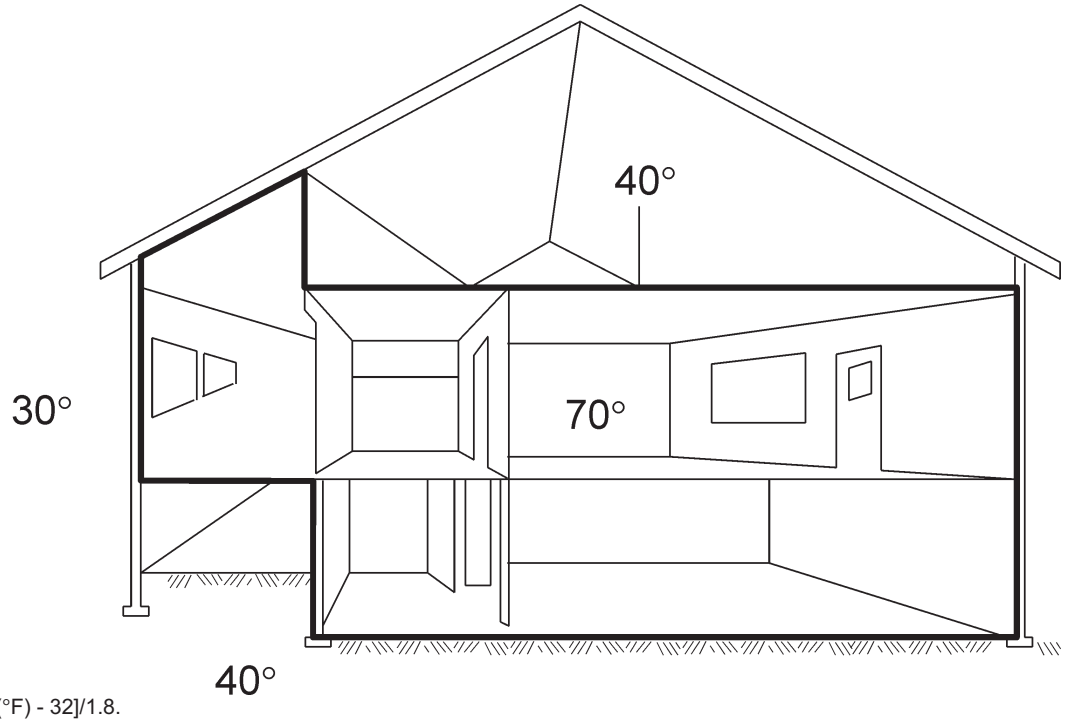
401.2 Compliance. Projects shall comply with Sections 401, 402.4, 402.5, and 403.1, 403.2.2, 403.2.3, and 403.3 through 403.9 (referred to as the mandatory provisions) and either:

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



For SI: °C = [(°F) - 32]/1.8.

Figure 401.1(1)
CONDITIONED ENVELOPE

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 effi-

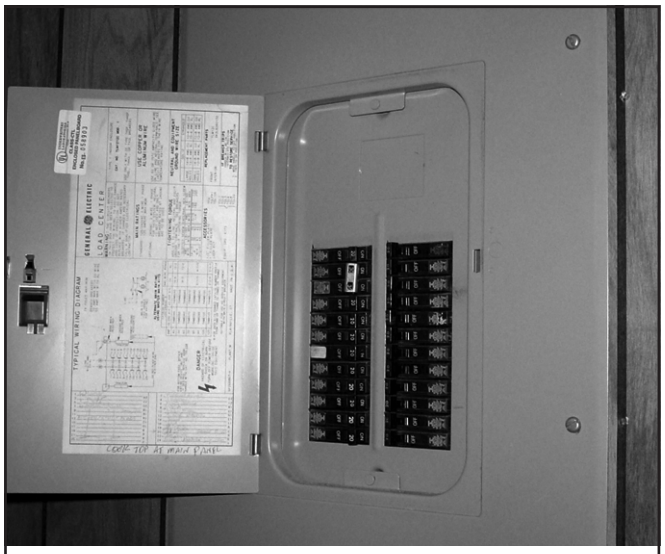


Figure 401.3
CERTIFICATE

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

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*.

About the International Code Council

The International Code Council® (ICC®) is a nonprofit membership association dedicated to protecting the health, safety and welfare of people by creating better buildings and safer communities. The mission of ICC is to provide the highest quality codes, standards, products and services for all concerned with the safety and performance of the built environment. ICC is the publisher of the family of International Codes® (I-Codes®), a single set of comprehensive and coordinated model codes. This unified approach to building codes enhances safety, efficiency and affordability in the construction of buildings. The Code Council is also dedicated to innovation, sustainability and energy efficiency. Code Council subsidiary ICC Evaluation Service issues Evaluation Reports for innovative products and reports of Sustainable Attributes Verification and Evaluation (SAVE).

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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:

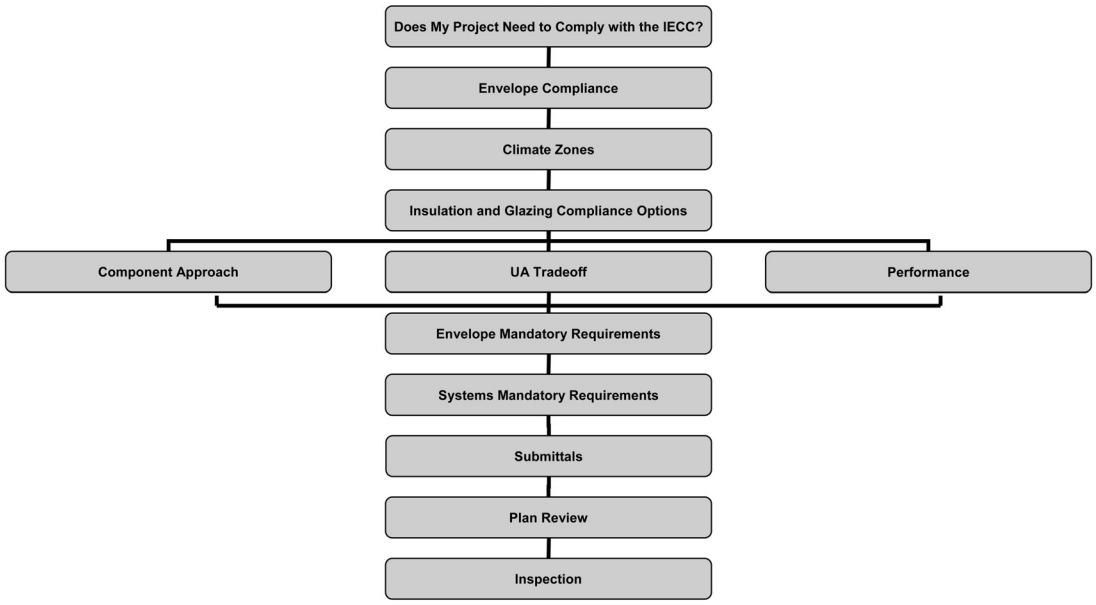
- Which options are available for demonstrating compliance with the Building Thermal Envelope requirements in the IECC for residential occupancies?
- What energy efficiency information must be included on the certificate that will be posted at each residence?
- What information is needed to use the "Insulation 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?

Topic: Compliance
Reference: IECC 401.2

Category: Residential Energy Efficiency
Subject: General Requirements

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 (ft^2) 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.



The Prescriptive approach is the easiest approach to use, but it is also the most restrictive. The UA alternative allows trade-offs between insulation levels and glazing efficiencies. The Simulated Performance Alternative offers the most flexibility.

Topic: Certificate | **Category:** Residential Energy Efficiency
Reference: IECC 401.3 | **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:

Feature	Efficiency level
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.

Topic: Prescriptive Approach
Reference: IECC 402.1.1, 402.1.2

Category: Residential Energy Efficiency
Subject: Building Thermal Envelope

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, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

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?

Topic: UA Alternative
Reference: IECC 402.1.3

Category: Residential Energy Efficiency
Subject: Building Thermal Envelope

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.

Topic: Total UA Alternative | **Category:** Residential Energy Efficiency
Reference: IECC 402.1.4 | **Subject:** Building Thermal Envelope

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-^{o}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

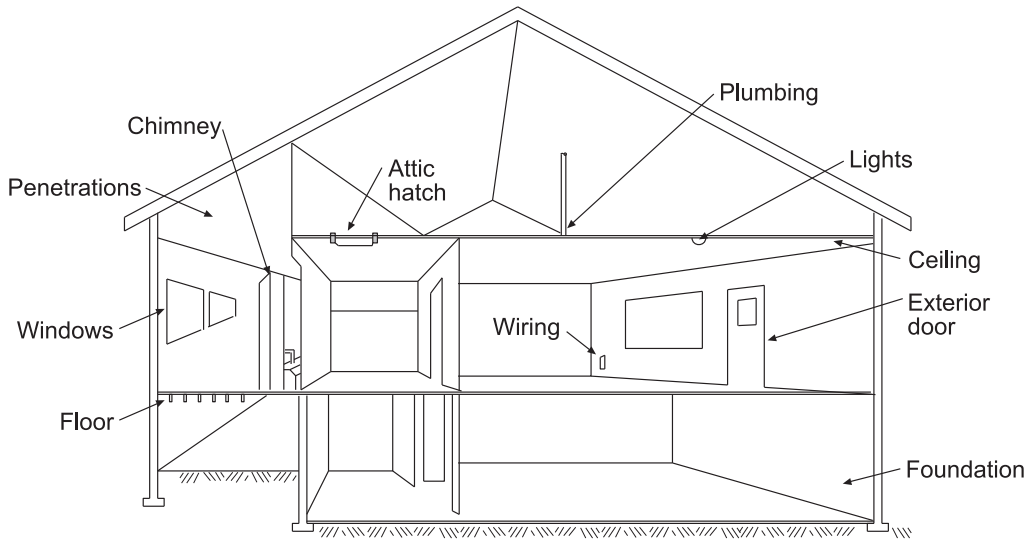
The *U*-factor of each proposed assembly is multiplied by the net area of each assembly (UA). Each assembly UA is then added to determine the total UA of the proposed building. The proposed UA is then compared with a *code building* UA generated by using the *U*-factors included in Table 402.1.3. If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

Topic: Air Leakage | **Category:** Residential Energy Efficiency
Reference: IECC 402.4.1 | **Subject:** Building Thermal Envelope

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.*

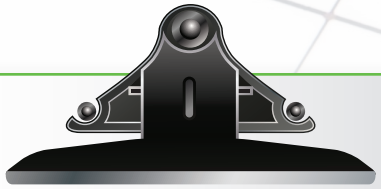
Discussion and Commentary: The goal of air leakage controls is to limit infiltration to reduce both heat and moisture flow. Infiltration is unwanted air leakage into or out of the building. A draft is an example of infiltration. Infiltration can be a major source of heat loss and increase the energy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



Typical sources of air leakage in the home

Infiltration will occur wherever there is a hole or penetration in the building envelope. The IECC is specific about the primary air leakage paths and ensuring that these are sealed.

Residential
Inspection



What's in it FOR ME?

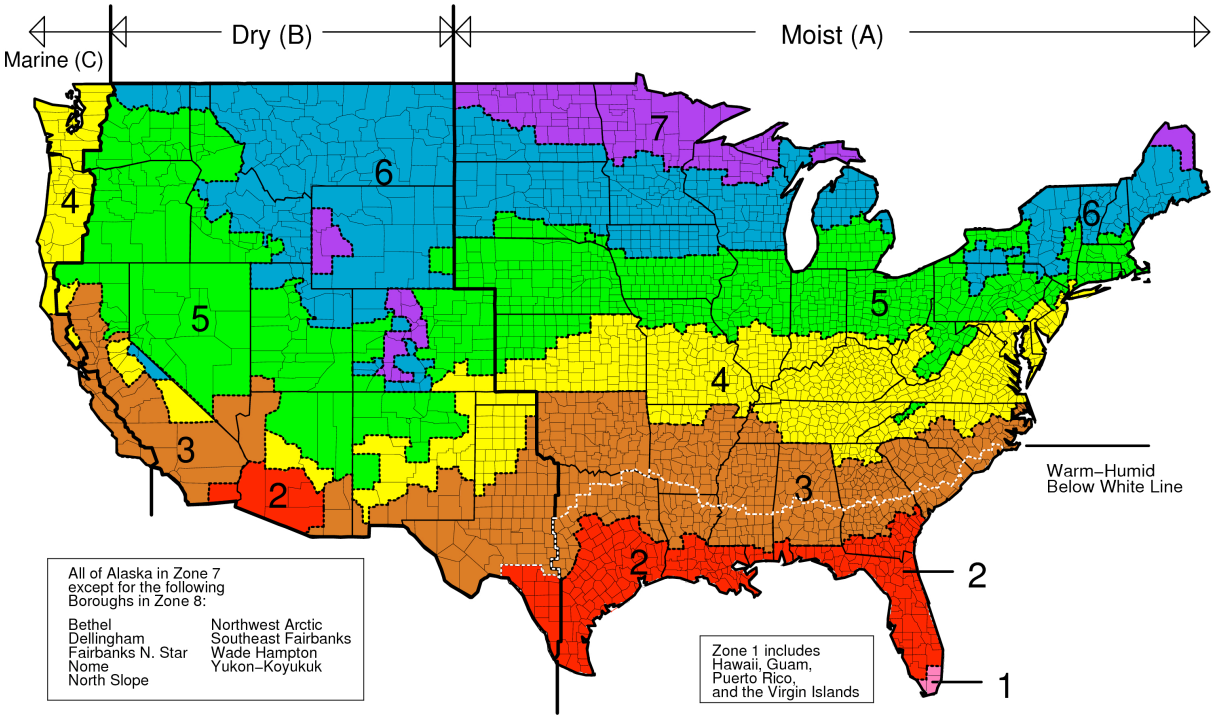
In this section you'll find:

- ☑ 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 RES*check*™ is used to show compliance, simply use the short inspection checklist that RES*check*™ 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 RES*check*™ 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 ft^2 of fenestration can be exempted from the prescriptive U-factor and SHGC requirements, and one side-hinged door up to 24 ft^2 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:_____ ft^2

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 Y	Complies N	Complies N/A	Comments/Assumptions[1]
103.2 [PR1][1]	Construction drawings and documentation available. Documentation sufficiently demonstrates energy code compliance.			☐	☐	☐	
403.6 [PR2][2]	HVAC loads calculations: Heating system size(s): Cooling system size(s):		kBtu: ____ kBtu: ____	☐	☐	☐	

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:_____ ft^2

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-_____ ☐ Unheated ☐ Heated	☐	☐	☐	
303.2, 402.2.8 [FO2][1]	Slab edge insulation Installed per manufacturer's instructions.			☐	☐	☐	
402.1.1 [FO3][1]	Slab edge insulation depth/length.	Heated: 2 ft.	_____ ft.	☐	☐	☐	
402.1.1 [FO4][1]	Basement wall exterior insulation R-value[2].	Continuous: R-10	R-_____	☐	☐	☐	
303.2 [FO5][1]	Basement wall exterior insulation installed per manufacturer's instructions.			☐	☐	☐	
402.2.7 [FO6][1]	Basement wall exterior insulation depth.	10 ft. or to basement floor	_____ ft.	☐	☐	☐	
402.2.9 [FO7][1]	Crawl space wall insulation R-value.	Continuous: R-10 Cavity: R-13	R-_____ R-_____	☐	☐	☐	
303.2 [FO8][1]	Crawl space wall insulation installed per manufacturer's instructions.			☐	☐	☐	
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.			☐	☐	☐	
303.2.1 [FO10][2]	Exposed foundation insulation protection.			☐	☐	☐	
403.8 [FO11][2]	Snow melt controls.			☐	☐	☐	

Additional Comments/Assumptions: _____

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

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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-____	☐	☐	☐	
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-____	☐	☐	☐	
402.1.1, 402.3.2, 402.3.3 [FR3][1]	Glazing SHGC value, including sunrooms (area-weighted average). [4]	N/A	SHGC: ____	☐	☐	☐	
303.1.3 [FR4][1]	Glazing labeled for U-factor (or default values used).			☐	☐	☐	
402.1.1, 402.3.3, 402.5 [FR5][1]	Skylight U-factor. [4]	U-0.6 (0.75 max)[5]	U-____	☐	☐	☐	
402.1.1, 402.3.3 [FR6][1]	Skylight SHGC value.[4]	N/A	SHGC: ____	☐	☐	☐	
303.1.3 [FR7][1]	Skylights labeled for U-factor (or default values used).			☐	☐	☐	
402.3.5 [FR8][1]	Sunroom glazing U-factor.	U-0.5	U-____	☐	☐	☐	
402.3.5 [FR9][1]	Sunroom skylight U-factor.	U-0.75	U-____	☐	☐	☐	
402.1.1 [FR10][1]	Mass wall exterior insulation R-value.	R-5[6]	R-____	☐	☐	☐	
303.2 [FR11][1]	Mass wall exterior insulation installed per manufacturer's instructions.			☐	☐	☐	
403.2.1 [FR12][1]	Duct insulation.	Attic Supply: R-8 Other: R-6	R-____ R-____	☐	☐	☐	
403.2.2 [FR13][1]	Duct sealing complies with listed sealing methods.			☐	☐	☐	
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	☐	☐	☐	
403.2.3 [FR15][1]	Building cavities NOT used for supply ducts.			☐	☐	☐	
402.4.5 [FR16][2]	IC-rated recessed lighting fixtures			☐	☐	☐	

[3] One side-hinged door up to 24 ft^2 can be exempted from the prescriptive door U-factor requirements.
[4] Up to 15 ft^2 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 ½ 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-____	☐	☐	☐	
403.4 [FR18][2]	Circulating hot-water piping insulation.	R-2	R-____	☐	☐	☐	
403.5 [FR19][2]	Dampers Installed on all outdoor Intake and exhaust openings.			☐	☐	☐	
402.4.4 [FR20][3]	Glazed fenestration air leakage.	0.3 cfm/ft^2	____ cfm/ ft^2	☐	☐	☐	
402.4.4 [FR21][3]	Swinging door air leakage.	0.5 cfm/ft^2	____ cfm/ ft^2	☐	☐	☐	
402.4.4 [FR22][3]	Fenestration and doors labeled for air leakage.			☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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-____ ☐ Wood ☐ Steel	☐	☐	☐	
303.2 [IN2][1]	Floor insulation installed per manufacturer's instructions, and in substantial contact with the subfloor.			☐	☐	☐	
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-____ ☐ Wood ☐ Mass ☐ Steel	☐	☐	☐	
303.2 [IN4][1]	Wall insulation installed per manufacturer's instructions.			☐	☐	☐	
402.1.1 [IN5][1]	Basement wall interior insulation R-value.	Continuous: R-10 Cavity: R-13	R-____ R-____	☐	☐	☐	
303.2 [IN6][1]	Basement wall interior insulation installed per manufacturer's Instructions.			☐	☐	☐	
402.2.7 [IN7][1]	Basement wall interior insulation depth.	10 ft or to basement floor	____ ft	☐	☐	☐	
402.2.11 [IN8][1]	Sunroom wall insulation R-value.	R-13	R-____	☐	☐	☐	
303.2 [IN9][1]	Sunroom wall insulation installed per manufacturer's Instructions.			☐	☐	☐	
402.2.11 [IN10][1]	Sunroom ceiling insulation R-value.	R-19	R-____	☐	☐	☐	
303.2 [IN11][1]	Sunroom ceiling insulation installed per manufacturer's instructions.			☐	☐	☐	
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 = ____	☐	☐	☐	
303.1 [IN13][2]	All installed insulation labeled or installed R-value provided.			☐	☐	☐	
402.4.1, 402.4.2 [IN14][3]	Air sealing of all openings and penetrations via visual inspection: • Site-built fenestration • Window/door openings • Utility penetrations • Attic access openings If applicable, verification via blower			☐	☐	☐	

[7] Floor steel frame equivalent: R-19+R-6 in 2x6 or R-19+R-12 in 2x8 or 2x10
[8] If more than ½ 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]	Air sealing of all envelope joints and seams via visual inspection: • Dropped ceilings • Knee walls • Assemblies separating garage • Tubs and showers • Common walls between units • Rim joist junctions If applicable, verification via blower door should be marked N/A.			☐	☐	☐	
402.4.1, 402.4.2 [IN16][3]	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.			☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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 [FI1][1]	Ceiling insulation R-value.	Wood: R-38[10] Steel Truss[11] Steel Joist: R-49	R-____ ☐ Wood ☐ Steel	☐	☐	☐	
303.1.1.1, 303.2 [FI2][1]	Ceiling insulation installed per manufacturer's instructions. Blown insulation marked every 300 ft^2.			☐	☐	☐	
402.2.3 [FI3][1]	Attic access hatch and door insulation.	R-38	R-____	☐	☐	☐	
403.2.2 [FI4][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	☐	☐	☐	
403.6 [FI5][1]	Heating and cooling equipment type and capacity as per plans.			☐	☐	☐	
404.1 [FI6][1]	Lighting - 50% of lamps are high efficacy.			☐	☐	☐	
401.3 [FI7][2]	Certificate posted.			☐	☐	☐	
402.4.3 [FI8][2]	Wood burning fireplace - gasketed doors and outdoor air for combustion.			☐	☐	☐	
403.1.1 [FI9][2]	Programmable thermostats installed on forced air furnaces.			☐	☐	☐	
403..1.2 [FI10][2]	Heat pump thermostat installed on heat pumps.			☐	☐	☐	
403.4 [FI11][2]	Circulating service hot water systems have automatic or accessible manual controls.			☐	☐	☐	
403.9 [FI12][2]	Pool heaters, covers, and automatic or accessible manual controls.			☐	☐	☐	

Additional Comments/Assumptions: _____

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

[10] R-30 if insulation is not compressed at eaves. R-30 may be used for 500 ft^2 or 20% (whichever is less) where sufficient space is not available.
[11] Steel truss equivalent: R-49; R-38+R-3.

2009 Performing Series

Workbook Edition

2009 IECC® Performing Residential Energy Inspections

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

ICC INTERNATIONAL CODE COUNCIL®

2009 IECC® Performing Residential Energy Inspections

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

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Fax: 562-692-3853

2009 IECC Performing Residential Energy Inspections

Second Printing: September 2010

PRINTED IN THE U.S.A.

Table of Contents

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.

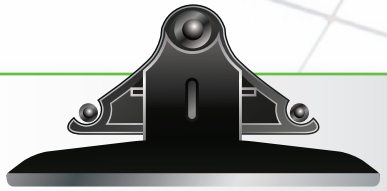
That is to say that the inspector's responsibility is to check for compliance with the approved drawings and specifications. Any variations from the drawings or specifications must be dealt with by the responsible design professional making appropriate changes and subsequent approval by the building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

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"

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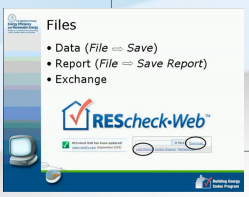
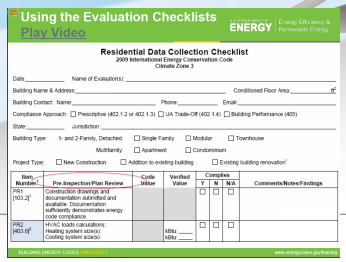
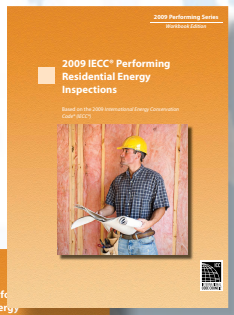




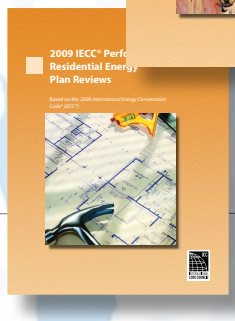
Find more at
www.energycodes.gov/becu

ICC INTERNATIONAL CODE COUNCIL® 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

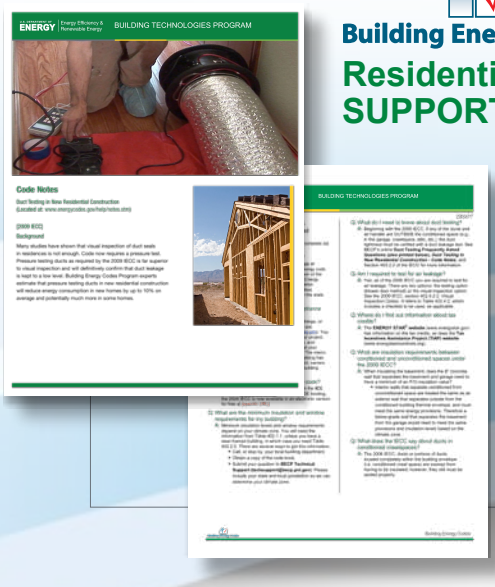
Online CEU

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.



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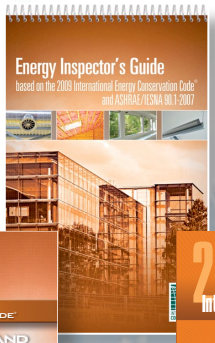
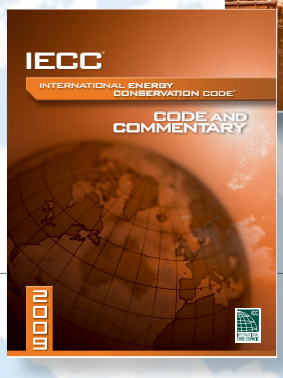
Find more at
www.energycodes.gov/help

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



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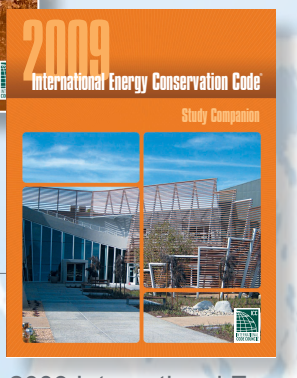


2009 International Energy Conservation Code® ***Study Companion***

DRAFT

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 RES*check*™ software** at no charge, or simply launch the RES*check*-*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.

RES*check*™-specific FAQs

Q: Can I use RES*check*™ in my state?

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

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

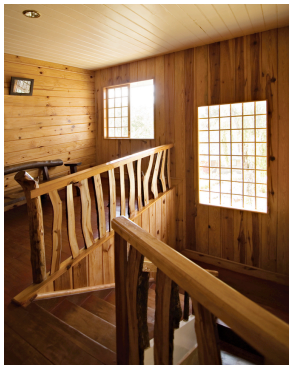
A: A trade-off approach allows you to trade enhanced energy efficiency in one component against decreased energy efficiency in another component. For example, under the 2006 IECC, you can trade off insulation and glazing efficiency against heating and cooling system efficiency. The 2009 IECC only allows 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 RES*check*™ 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 RES*check*™ 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 RES*check*™ software will include the DOE-2 energy analysis engine to perform the necessary calculations needed to determine compliance. For the 2009 IECC, RES*check*™ 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 RES*check*™, 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 (ft^2) and insulation R-value of new ceiling,
- Exterior walls – gross area (ft^2) 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 (ft^2) of windows and/or doors with U-factor from NFRC label or default table in the help section RES*check*™.
- Floor – gross area (ft^2) 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 ft² @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.

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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)

[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.

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

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/rlamps**).

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.

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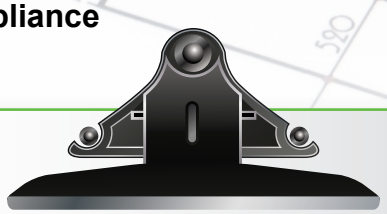
COMMERCIAL

Compliance



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

- An introduction to commercial compliance approaches and their corresponding tools
- **Help with plan review:** DOE's Case Study and Quick Reference Guide with sample COM*check*™ compliance certificates; excerpts from ICC's *2009 IECC Code and Commentary* and *2009 IECC Study Companion.*
- **Help with inspections:** DOE's new 2009 IECC and ASHRAE Standard 90.1-2007 commercial inspection checklists; ICC's *Energy Inspector's Guide*
- **Commercial Training and Support:** examples and where to go for more

What's in it FOR ME?

COMMERCIAL COMPLIANCE: Approaches and Tools

Commercial buildings must demonstrate compliance with the the jurisdiction's adopted commercial energy code, which is often a close variation of either the commercial chapter within the International Code Council's (ICC's) International Energy Conservation Code (IECC) or the ANSI/ASHRAE/IESNA[1] Standard 90.1 (Standard 90.1). The IECC is updated on a three year cycle (2006, 2009, 2012), as is Standard 90.1 (2004, 2007, 2010).

There are several ways to show compliance, but only one approach is necessary. Below are descriptions of the main three commercial compliance approaches and their corresponding tools, followed by compliance approaches Q&A.

APPROACH	DESCRIPTION	COMPLIANCE TOOL(S)
Prescriptive Packages Approach	For the building envelope, a prescriptive packages approach would list the minimum R-value or maximum U-factor requirements for each building component, such as windows, walls, and roofs. For lighting systems, a prescriptive approach would simply list the allowable watts per square foot for various building types. For mechanical systems and equipment, a prescriptive approach would list the minimum required equipment efficiencies. This approach is quick and easy to use, but some may find the approach somewhat restrictive because the requirements typically are based on worst-case assumptions, and all requirements must be met exactly as specified.	Standard 90.1-2007 and the 2009 IECC contain information tables that can be applied directly to demonstrate compliance with the prescriptive approach.
Trade-off Approach	A trade-off approach allows you to trade enhanced energy efficiency in one component against decreased energy efficiency in another component. These trade-offs typically occur within major building systems: envelope, lighting, or mechanical. 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. For lighting systems, the trade-off typically would occur between proposed lighting fixture wattages in various spaces within a building. The only trade-off allowed for mechanical systems and equipment is found in Chapter 8 of the IECC. You may trade off higher cooling equipment efficiency against a requirement for an economizer. The trade-off approach is less restrictive than the prescriptive approach because you describe the actual building design in the trade-off approach and may adjust individual component requirements.	COMcheck™ **COM*check*™**, 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 compliance certificates for each major building system. To download **COM*check*™** or begin using **COM*check-Web*™**, please visit: **www.energycodes.gov/software.stm**

[1] American National Standards Institute; American Society of Heating, Refrigerating and Air-Conditioning Engineers; Illuminating Engineering Society of North America

APPROACH	DESCRIPTION	COMPLIANCE TOOL(S)
Performance Approach	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.	DOE's Building Technologies Program maintains a list of building energy software tools. Commercial energy simulation software tools (e.g., EnergyPlus) help users show compliance by the performance approach. See EnergyPlus and nearly 400 other software tools through the Building Energy Software Tools Directory: **http://apps1.eere.energy.gov/buildings/tools_directory/**

Q: Which approach is the best for a specific building?

A: The choice of approach depends on the complexity 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 a building exceeds that allowed by the prescriptive approach, a trade-off approach may be preferable. If nontraditional components are involved or if energy use trade-off between building systems (e.g., envelope, mechanical) is desired, try the performance approach.

Of course, not all building projects are new construction. Beyond minor repairs, renovations must also comply with the energy code, and approaches may vary by project. For example:

- Additions may use the prescriptive or trade-off approach.
- For alterations, the prescriptive approach is preferable; otherwise the entire building should be brought up to code.
- When an alteration includes a change of occupancy or converts unconditioned space to conditioned space, treat the project as new construction, for which any of the three approaches can be used.

Q: Do the three approaches produce different results?

A: Yes, they can. Performance approaches require a higher degree of detail so that an individual building can be designed to exactly meet the IECC requirements. Prescriptive approaches tend to be somewhat conservative and use worst-case default assumptions so the prescriptive packages will 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 many of the features that affect energy use, such as the effect window orientation and external shading may have on solar heat gain. Trade-off approaches fall somewhere between the prescriptive and performance approaches in flexibility and complexity.

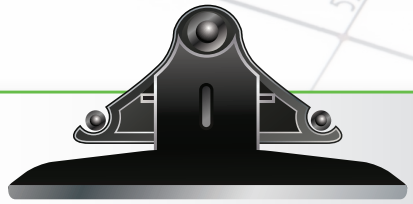
Q: Can I use both codes (the IECC and Standard 90.1) in one building?

A: No. If a building shows compliance with Standard 90.1-2007 in one building system (e.g., envelope, lighting, mechanical), then all systems must comply with 90.1-2007. The same rule applies with the IECC—mixing and matching provisions from the two commercial codes does not demonstrate a building's compliance.

Q: Is it possible to use all these approaches in my state?

A: The 1998, 2000, 2001, 2003, 2004, 2006, and 2009 IECC, and Standard 90.1-1989/1999/2001/2004/2007 contain requirements for all three approaches. If your state has adopted any of these codes directly, you may be allowed to use any of the three compliance approaches. However, if the code has been amended prior to adoption, there may be local variations in effect. It is always advisable for building owners and professionals to check which compliance approaches are available within their state or jurisdiction.

Commercial
Plan Review



What's in it FOR ME?

In this section you'll find:

- ☑ Commercial Case Study, complete with DOE's COM*check*™ *Commercial Plan Review Quick Reference Guide*
- ☑ ICC excerpt: *2009 IECC Code and Commentary*
- ICC excerpt: *2009 IECC Study Companion*

Commercial Case Study

This case study is of a three-story commercial building. These slides correspond to DOE's *Plan Review Quick Reference Guide* and sample COM*check*™ certificates, which immediately follow the presentation slides.
This case study is available within Building Energy Codes University (**www.energycodes.gov/becu**)

Envelope – Typical Wall Section

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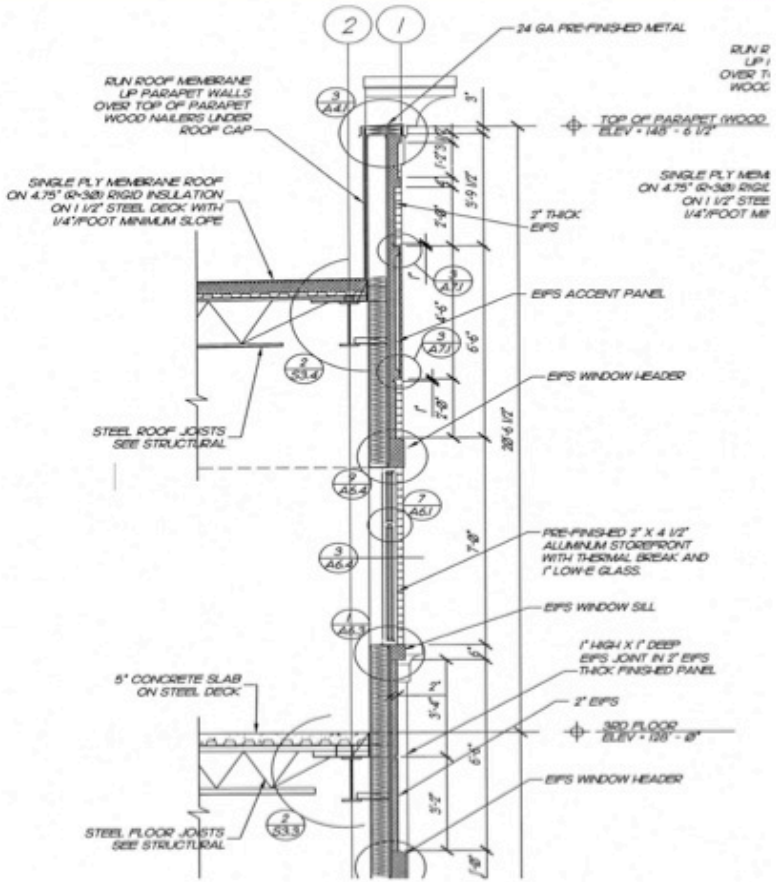

Identifies assembly type and insulation R-value

Wall and roof sections from the plans help identify the assembly type and proposed insulation value for the assembly. For example, the proposed wall type for this building is Steel frame, 16 o.c. with R21 cavity insulation. The roof is a single membrane roof with R-30 continuous insulation.

Envelope – COM*check*™ Exterior Wall Component Inputs

Define Assembly, Construction Details, Gross Area and insulation R-value

Case Study.cck - COMcheck 3.8.0 Code: 2009 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical

Roof | Skylight | Ext. Wall | Window | Door | Basement | Floor

	Component	Assembly	Construction Details	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value
	Building						
1	Roof 1	Insulation Entirely Above...		11570	ft2		30.0
2	Front Exterior Wall	Steel-Framed, 16" o.c.		6075	ft2	21.0	0.0
3	Window 1	Metal Frame with Therma...	Glazing: Ti...	2185	ft2		
4	Storefront Window	Metal Frame:Double Pan...	Glazing: Ti...	46	ft2		
5	Entrance Door	Glass (> 50% glazing):M...	Type: Entr...	47	ft2		
6	Back Exterior Wall	Steel-Framed, 16" o.c.		6075	ft2	21.0	0.0
7	Window 1	Metal Frame with Therma...	Glazing: Ti...	2183	ft2		
8	Storefront Window	Metal Frame:Double Pan...	Glazing: Ti...	27	ft2		
9	Entrance Door	Glass (> 50% glazing):M...	Type: Entr...	47	ft2		

Envelope – Window Schedule

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WINDOW SCHEDULE

WINDOW TYPE	DIMENSIONS			DETAILS			GLAZING	REMARKS (P) FLOAT GLASS (T) TEMPERED GLASS (S) SPANDREL GLASS (A) FLOAT GLASS WITH INSERT
	WIDTH	HEIGHT	THICK'	HEAD	JAMB	SILL		
(A)	9'-5 1/2"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(B)	9'-0"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(C)	15'-0"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(D)	17'-10"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(E)	16-8"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(F)	9'-5 1/2"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(G)	9'-0"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(H)	15'-0"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(J)	12'-2"	8'-6"	4 1/2"	10/A6.4	4/A6.4	1/A6.4	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(K)	17'-10"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(L)	16'-8"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(M)	9'-5 1/2"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(N)	9'-0"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(P)	15'-0"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(Q)	12'-2"	6'-0"	4 1/2"	10/A6.4	7/A6.4	2/A6.4	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(R)	17'-10"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(S)	16'-8"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
( )								
( )								
( )								

Window schedule provides the type of windows (aluminum, thermal break with low e) and dimensions. Assembly type and total square footage (rough opening) are required inputs in COM*check*™. Window schedule can also provide fenestration values (U-factor and SHGC).

Envelope – COM*check*™ Window and Door Input

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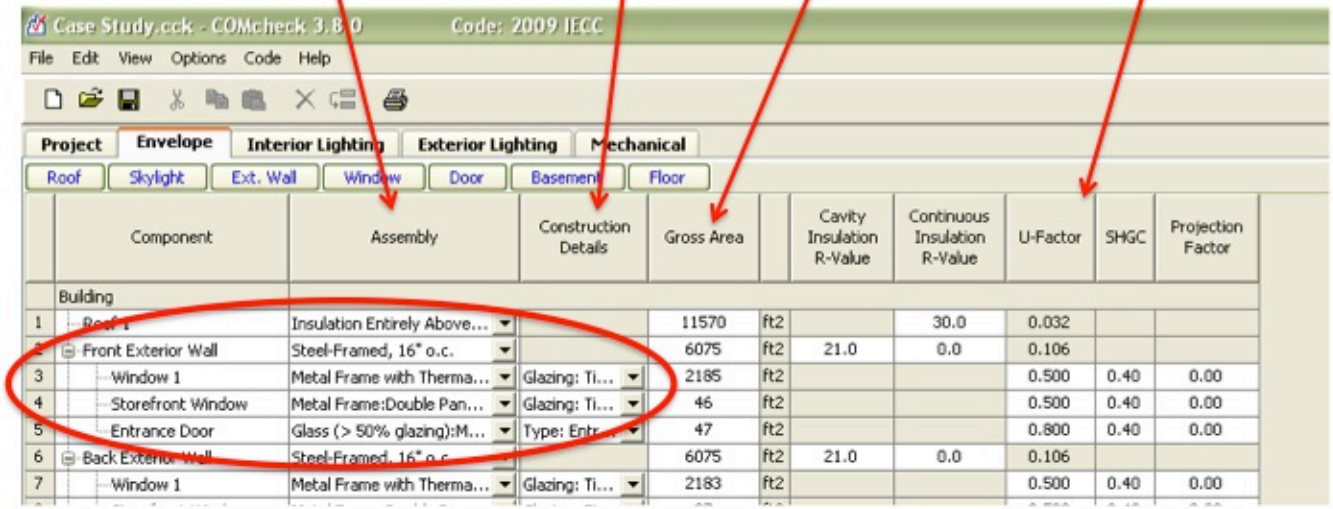
Define Assembly, Construction Details, Gross Area, U-factor and SHGC



	Component	Assembly	Construction Details	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	SHGC	Projection Factor
	Building									
1	Roof 1	Insulation Entirely Above...		11570	ft2		30.0	0.032		
2	Front Exterior Wall	Steel-Framed, 16" o.c.		6075	ft2	21.0	0.0	0.106		
3	Window 1	Metal Frame with Therma...	Glazing: Ti...	2185	ft2			0.500	0.40	0.00
4	Storefront Window	Metal Frame:Double Pan...	Glazing: Ti...	46	ft2			0.500	0.40	0.00
5	Entrance Door	Glass (> 50% glazing):M...	Type: Entr...	47	ft2			0.800	0.40	0.00
6	Back Exterior Wall	Steel-Framed, 16" o.c.		6075	ft2	21.0	0.0	0.106		
7	Window 1	Metal Frame with Therma...	Glazing: Ti...	2183	ft2			0.500	0.40	0.00

Envelope – COM*check*™ summary

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

BUILDING ENVELOPE SUMMARY			
Total Building Area	34,710 ft²		
Number of Floors	3		
Total Finished Out Area	2,014 ft²		
Assembly Type	**Description**	**Area**	**R-value**
Roof	Single Ply Membrane Roof on 4.75" Rigid Insulation on 1 ½" Steel Deck	11,570 ft²	R-30
Exterior Walls	6" Steel Studs @ 16" O.C. w/R-19 unfaced Batts	19,152 ft² (Gross)	R-19
Floor	Slab-on-grade – R-5 perimeter insulation down 2 ft.	447 Linear feet	R-5
Glazing	Storefront Window Metal Frame with Thermal Break, Double Glazed Low E	6,436 ft²	U-0.50 SHGC – 0.40
	Storefront Window Metal Frame with Thermal Break, Double Glazed Low E	294 ft²	U-0.50 SHGC – 0.40
Exterior Doors	All Glass Metal Frame Entrance Doors	188 ft²	U-0.80 SHGC – 0.40

This table provides the overall summary of building thermal envelope take offs that would be entered into COM*check*™ for compliance.

Mechanical – Rooftop Cooling Units

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

Packaged Rooftop Unit Schedule

RTU-1

DESCRIPTION:	PACKAGED ROOFTOP MOUNTED VARIABLE AIR VOLUME AIR CONDITIONING UNIT COMPLETE WITH: INDOOR BLOWER WITH VARIABLE FREQUENCY DRIVE; 100% EXHAUST BLOWER WITH ADJUSTABLE V-BELT DRIVE; HIGH EFFICIENCY VFD COMPATIBLE MOTORS; INSULATED CABINET; PACKAGED DX REFRIGERATION COILS AND COMPRESSORS WITH MULTIPLE STEP LOADING / UNLOADING AND LOW AMBIENT OPERATION CAPABILITY; VAV CONTROLS; FILTER RACKS WITH FILTERS; FULL ECONOMIZER CAPABILITY WITH FIXED MINIMUM POSITION OUTSIDE AIR DAMPER; FACTORY ROOF MOUNTING CURB/FRAME. APPROX. OPERATING WEIGHT: 10,500 LB.
COOLING:	55.0 NOM. TONS. 721.4 MBH TOTAL COOLING CAPACITY; 586.1 GROSS SENSIBLE AT OUTPUT AT 80.0 DEG. F. ENT. D.B., 64 DEG. F. ENT. W.B., 91 DEG. F. AMB., 22,000 CFM AT 55.4 DEG. F. LDB; 53.6 DEG. F. LWB. ALL AT 4400 FT. ELEVATION. THREE 15 TON AND ONE 10 TON COMPRESSORS. 9.7 EER.
SUPPLY BLOWER:	22,000 CFM S.A., 2200 CFM MIN. O.A. AT 1.75 IN. WG. EXTERNAL, 3.6 IN. WG TOTAL STATIC. 1130 RPM VARIABLE SPEED BLOWER, 24.9 BHP, ALL AT 4400 FT. ELEV. 25.0 HP 460 V 3PH VFD COMPATIBLE BLOWER MOTOR.
EXHAUST BLOWER:	20,000 CFM EXHAUST AIR AT 0.75 IN. WG. EXTERNAL, 0.8 IN. WG TOTAL STATIC. 784 RPM BELT DRIVE BLOWER, 9.0 BHP, ALL AT 4400 FT. ELEV. 10.0 HP 460 V 3PH SINGLE SPEED BLOWER MOTOR.
UNIT WIRING:	396.6 MCA, 450 A. MINIMUM RECOMMENDED RDE FUSE AT 208 VOLTS, 3 PHASE
FILTERS:	20 - 20" X 25" X 2" DISPOSABLE PLEATED GLASS MEDIA FILTERS IN FRAME.
MANUFACTURER:	TRANE CO. MODEL SXHFC554 OR ENGINEER APPROVED EQUAL.

Packaged Rooftop Unit Schedule

RTU-2

DESCRIPTION:	PACKAGED ROOFTOP MOUNTED VARIABLE AIR VOLUME AIR CONDITIONING UNIT COMPLETE WITH: INDOOR BLOWER WITH VARIABLE FREQUENCY DRIVE; 100% EXHAUST BLOWER WITH ADJUSTABLE V-BELT DRIVE; HIGH EFFICIENCY VFD COMPATIBLE MOTORS; INSULATED CABINET; PACKAGED DX REFRIGERATION COILS AND COMPRESSORS WITH MULTIPLE STEP LOADING / UNLOADING AND LOW AMBIENT OPERATION CAPABILITY; VAV CONTROLS; FILTER RACKS WITH FILTERS; FULL ECONOMIZER CAPABILITY WITH FIXED MINIMUM POSITION OUTSIDE AIR DAMPER; FACTORY ROOF MOUNTING CURB/FRAME. APPROX. OPERATING WEIGHT: 6,190 LB.
COOLING:	30.0 NOM. TONS. 363.5 MBH TOTAL COOLING CAPACITY; 304.5 GROSS SENSIBLE AT OUTPUT AT 80.0 DEG. F. ENT. D.B., 64 DEG. F. ENT. W.B., 91 DEG. F. AMB., 12,000 CFM AT 56.1 DEG. F. LDB; 54.5 DEG. F. LWB. ALL AT 4400 FT. ELEVATION. TWO 15 TON COMPRESSORS. 9.8 EER.
SUPPLY BLOWER:	12,000 CFM S.A., 1500 CFM MIN. O.A. AT 1.75 IN. WG. EXTERNAL, 3.7 IN. WG TOTAL STATIC. 1230 RPM VARIABLE SPEED BLOWER, 13.5 BHP, ALL AT 4400 FT. ELEV. 15.0 HP 460 V 3PH VFD COMPATIBLE BLOWER MOTOR.
EXHAUST BLOWER:	11,000 CFM EXHAUST AIR AT 0.75 IN. WG. EXTERNAL, 0.8 IN. WG TOTAL STATIC. 845 RPM BELT DRIVE BLOWER, 3.8 BHP; ALL AT 4400 FT. ELEV. 5.0 HP 460 V 3PH SINGLE SPEED BLOWER MOTOR.
UNIT WIRING:	214.2 MCA, 250.0 A. MINIMUM RECOMMENDED RDE FUSE AT 208 VOLTS, 3 PHASE
FILTERS:	16 - 20" X 20" X 2" DISPOSABLE PLEATED GLASS MEDIA FILTERS IN FRAME.
MANUFACTURER:	TRANE CO. MODEL SXHFC304 OR ENGINEER APPROVED EQUAL.

COM*check*™ provides a mechanism to enter all HVAC, plant, and service water heating systems. The program does not calculate a pass or fail but provides a customized list of requirements based on the system(s) shown. The packaged rooftop unit (RTU) schedule will provide system type, capacity, and efficiency. In this example the RTU shown on the plans is a packaged variable air volume system.

Mechanical – VAV Terminal Unit

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

VAV Terminal Unit Schedule

UNIT TAG	TRANE CO. MODEL NO.	INLET DIA (IN.)	DSGN CLG FLOW (CFM)	MIN CLG FLOW (CFM)	MIN HTG FLOW (CFM)	PD @DESIGN CLG FLOW (IN.WG)	PRIM HTG FLOW (CFM)	UNIT HTG FLOW (CFM)	FAN FLOW (CFM)	FAN SPEED	FAN MOTOR POWER (HP)	COIL HEAT (MBH)[1]	WATER FLOW (GPM)	COIL WPD (FT)	B&G CIRC. SET.
V-101	VPWF-12035Q	12	1600	240	240	0.01	240	800	560	VAR	1/3 HP	36.05	2.88	2.55	1/2"
V-102	VPWF-10035Q	10	1200	180	180	0.03	180	600	420	VAR	1/3 HP	18.34	1.47	0.51	1/2"
V-103	VPWF-08025Q	8	800	120	120	0.14	120	500	380	VAR	1/8 HP	16.53	1.32	1.26	1/2"

NOTES:
1. FAN MOTORS FOR VAV BOXES SHALL BE 115 V. SINGLE PHASE
2. COIL HEAT CAPACITIES FOR FAN POWERED UNITS ARE BASED ON 175 DEG. EWT, 65 DEG. EAT. 105 DEG. LAT, APPROX 30 DEG. WTD. ALL COILS SHALL BE HIGH CAP.
3. COIL HEAT CAPACITIES FOR RE-HEAT UNITS ARE BASED ON 175 DEG. EWT, 55 DEG. EAT.
4. ALL CAPACITIES SHOWN ARE BASED ON ACTUAL AIR, DERATED FOR ALTITUDE

This is the schedule for the Variable Terminal Units proposed for the building. Hot water reheat is proposed for this building for the VAV boxes. A plan note will need to be included that describes when the reheat will be allowed to be used based on the IECC.

Mechanical – Heating Water Boiler Schedule

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

Heating Water Boiler Schedule

PACKAGED ATMOSPHERIC PRESSURE, NATURAL GAS FIRED WATER TUBE STYLE HEATING WATER BOILER COMPLETE WITH: OPERATING CONTROLS; ATMOSPHERIC BURNERS; MAIN AND PILOT GAS COCKS; GAS PRESSURE REGULATOR(S); BAROMETRIC DAMPER; LOW WATER CUT-OFF; 60 LB. ASME RELIEF VALVE; HIGH LIMIT CONTROL; PRESSURE AND TEMPERATURE GAUGE.

1,250 MBH INPUT, 1,037.5 MBH OUTPUT AT SEA LEVEL, 850 MBH OUTPUT AT 4500 FT. ELEVATION. 73 GAL CAPACITY; 161 SQ.FT. HEATING SURFACE; RATED AT UP TO 2,075 GPH AT 60 DEG. F. TEMP RISE. 1-16" DIA. VENT COLLAR. APPROX. 3,510 LBS OPERATING WEIGHT.

120 VOLT CONTROL CIRCUIT.

AJAX CO. MODEL WRN-1250 OR ENGINEER APPROVED EQUAL.

The building will utilize hot water from a boiler for reheat in the VAV system. Boiler efficiency will need to be verified in addition to checking to see that the boiler either has temperature reset or multiple-staged pumps to increase the efficiency of the system for part load.

Lighting Schedule

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

LIGHT FIXTURE SCHEDULE				
TYPE	MANUFACTURER	CATALOG NUMBER	LAMPING	DESCRIPTION
A	DAY-BRITE LIGHTING	2LP3GS33236ALUNV-1/3-EB	(3) 32W T8	FLUORESCENT 2'X4' LAY-IN 18 CELL PARABOLIC LOUEVER
A-EM	DAY-BRITE LIGHTING	2LP3GS33236ALUNV-1/3-EB	(3) 32W T8	SAME AS A BUT WITH ONE LAMP ON EMERGENCY BATTERY PACK
B	CAPRI LIGHTING	CM6-FV26/32/42U-V65	(1) 26W CFM	COMPACT FLUORESCENT RECESSED DOWNLIGHT
B-EM	CAPRI LIGHTING	CM6-FV26/32/42UER-V65	(1) 26W CFM	SAME AS B BUT WITH AN EMERGENCY BATTERY PACK
C	DAY-BRITE LIGHTING	CAN32UNV-1/2-EB	(2) 32W T8	NARROW FLUORESCENT WRAPAROUND
D	T.B.D.	T.B.D.	T.B.D.	BATHROOM VANINTY LIGHT ($200.00 ALLOWANCE)
E	T.B.D.	T.B.D.	T.B.D. MIN EFFICACY: 60 LUMENS/WATT	CONTEMPORARY WALL SCONCE ($200.00 ALLOWANCE)
E-EM	T.B.D.	T.B.D.	T.B.D.	SAME AS E BUT WITH AN EMERGENCY BATTERY PACK
F	US ARCHITECTURAL LIGHTING	DSSHR-111250MH120XPDDBM	250W MH	PARKING AREA LIGHTS MOUNTED ON 20'-0" POLE
G	T.B.D.	T.B.D.	T.B.D.	LOBBY CEILING CHANDELIER ($300.00 ALLOWANCE)
EX1	DAY-BRITE LIGHTING	VEGWEM	LED	GREEN LED EMERGENCY EXIT LIGHT
EX2	DAY-BRITE LIGHTING	VEGWEM	LED	DOUBLE SIDED GREEN LED EMERGENCY EXIT LIGHT
EX3	DAY-BRITE LIGHTING	CCTXL1GWLH	LED	GREEN LED EMERGENCY EXIT LIGHT WITH EMERGENCY BUG LIGHTS

Lighting fixture schedule provides the type of lamps, number of fixtures, and fixture wattage. Interior lighting is calculated based on whole-building or space-by-space type total allowed wattage (watts/sq. ft.) based on the projects proposed wattage (watts/sq. ft.). Allowances and exemptions can also be identified using COM*check*™.

Lighting – Com*check*™ Interior Lighting Inputs

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

Case Study.cck - COMcheck 3.8.0 Code: 2009 IECC

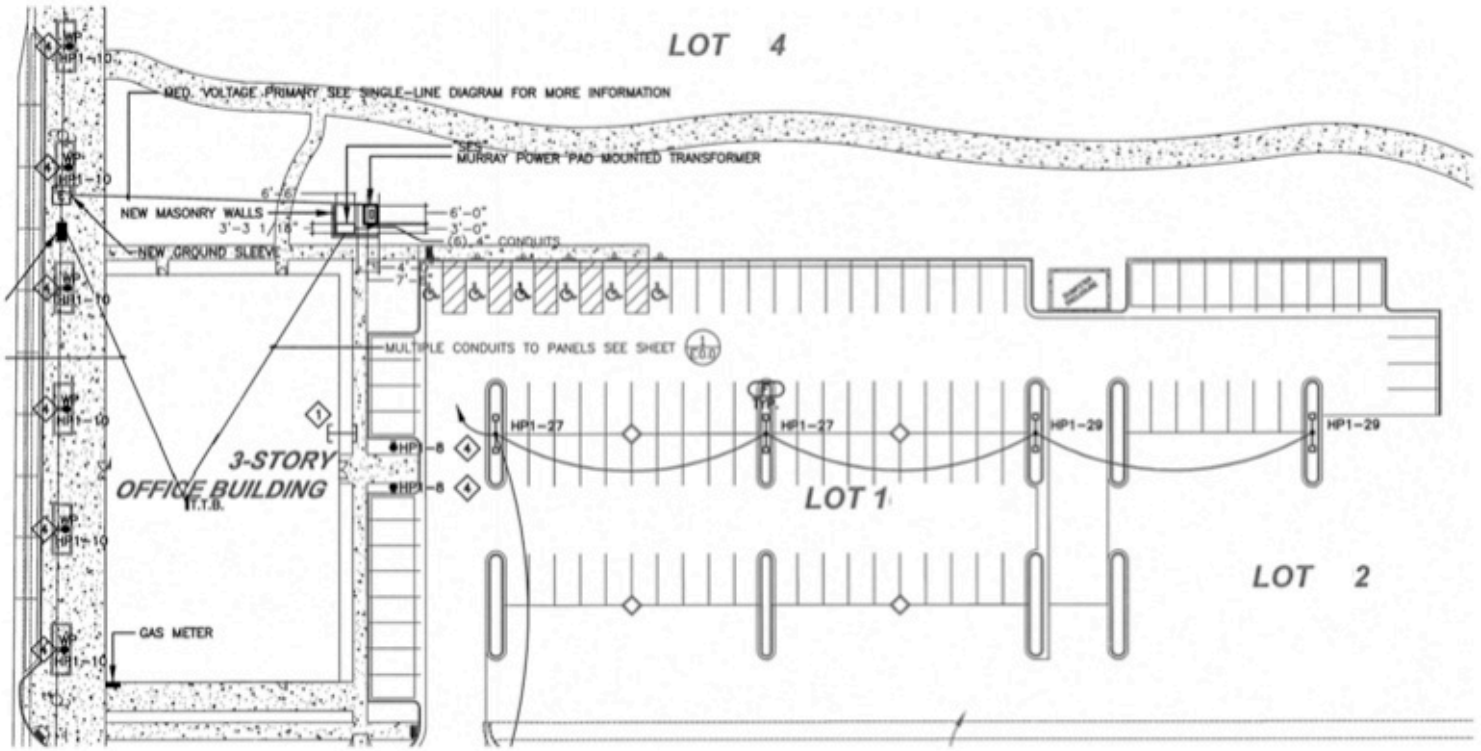
File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical

Linear Fluorescent | Compact Fluorescent | HID | Incandescent | Halogen | Track Lighting

	Component	Fixture ID	Fixture Description	Lamp Description/ Wattage Per Lamp	Ballast	Lamps Per Fixture	Number of Fixtures	Fixture Wattage	Track Lighting Wattage
	Building	Allowed wattage = 2014 Proposed wattage = 1765							
1	Office (2014 sq.ft.)	Allowed wattage = 2014 Proposed wattage = 1765							
2	Linear Fluorescent 2	Type A	32 W T8	48" T8 32W	Electronic	3	10	95	
3	Compact Fluorescent 1	Type B	CFL	Triple 4-pin 26W	Electronic	1	10	29	
4	Linear Fluorescent 1	Type C	32 W T8	48" T8 32W	Electronic	2	5	65	
5	Incandescent 1	Type D	Bathroom Fan Lighting	Incandescent 100W		1	2	100	

Lighting – Parking Lot



The exterior plans designate exterior lights that will need to be documented to determine compliance with the exterior lighting requirements. The light standards that are designated on the plans include a designation that links back to the light schedule. Lighting on the exterior of the building designated on the interior lighting plans will also need to be accounted for in the energy code documentation.

Exterior Lighting Applications

Description	Area
Uncovered Parking Areas - Parking Lots and Drives	40,360 ft^2
Building Grounds - Walkways (<10 ft wide)	355 ft
Building Grounds - Walkways (≥ 10 ft wide)	4,320 ft^2
Building Entrances - Main Entries	12 ft
Building Entrances – Other Doors	12 ft

Exterior lighting compliance is based on the application. The table summarized the exterior lighting applications for this case study.

Lighting – COM*check*™ Exterior Lighting Inputs

Case Study.cck - COMcheck 3.8.0 Code: 2009 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | **Exterior Lighting** | Mechanical

Linear Fluorescent | Compact Fluorescent | HID | Incandescent | Halogen

	Component	Fixture ID	Fixture Description	Lamp Description/ Wattage Per Lamp	Ballast	Lamps Per Fixture	Number of Fixtures	Fixture Wattage
	Exterior Lighting Areas:	Tradable Wattage: Allowed = 3754 Proposed = 3480 Supplemental wattage: 600 (see Help for details)						
1	Parking area (40360 ft2)	Tradable Wattage: Allowed = 2421 Proposed = 2040						
2	HID 1			Metal Halide 250W	Pulse start	1	8	255
3	Walkway < 10 feet wide (355 ft of wa	Tradable Wattage: Allowed = 248 Proposed = 320						
4	HID 2			Metal Halide 75W	Pulse start	1	4	80
5	Walkway >= 10 feet wide (4320 ft2)	Tradable Wattage: Allowed = 604 Proposed = 800						
6	HID 2 copy 1			Metal Halide 75W	Pulse start	1	10	80
7	Main entry (12 ft of door width)	Tradable Wattage: Allowed = 240 Proposed = 160						
8	HID 2 copy 2			Metal Halide 75W	Pulse start	1	2	80
9	Other door (not main entry) (12 ft of	Tradable Wattage: Allowed = 240 Proposed = 160						
10	HID 2 copy 3			Metal Halide 75W	Pulse start	1	2	80

COM*check*™ COMMERCIAL PLAN REVIEW *QUICK REFERENCE GUIDE*

Plan review for energy code compliance can be conducted quickly and efficiently. The U.S. Department of Energy's COM*check*™ 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 COM*check*™ 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, building owners, etc. 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.

COM*check* Software Version 3.8.0

Envelope Compliance Certificate

Step 1: Verify the **Project Information** matches the information on the building plans. The code, location, and project type will impact compliance.

2009 IECC

Section 1: Project Information

Project Type: **New Construction**
Project Title : Sample Office Building

Construction Site:
2222 Redwood Road
Salt Lake City, UT 22262
Permit No. 10-463
Permit Date: August 19, 2010

Owner/Agent:
ABC Property Company
1677 2nd Street
Salt Lake City, UT 22311

Designer/Contractor:
Designs Are Us
1453 McMinnion Street
Park City, UT 99422

Step 2: Verify the **Building Type** or **Activity Type(s)** and **Floor Area** match the project type. Verify the floor area does not exceed the project floor area shown on the building plans. Single occupancy buildings should always use Whole Building Method unless each **Activity Type** within the building is identified separately.

Section 2: General Information

Building Location (for weather data):	**Salt Lake City, Utah**
Climate Zone:	**5b**
Vertical Glazing / Wall Area Pct.:	**26%**

Activity Type(s)	Floor Area
Office	2014

Step 3: Verify the exterior building thermal envelope complies with the code by +0% or greater.

Step 4: Verify the construction assemblies listed under **Component Name/Description** match the construction assemblies shown on the plans.

Step 5: Verify the **Gross Area** or **Perimeter** values represent the proposed project. Verify the fenestration is calculated correctly (rough opening).

Section 3: Requirements Checklist

Envelope PASSES: Design 0.4% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor(a)
Roof 1: Insulation Entirely Above Deck	11570	---	30.0	0.032	0.048
Front Exterior Wall: Steel-Framed, 16" o.c.	6075	21.0	0.0	0.106	0.064
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, Tinted, SHGC 0.40	2185	---	---	0.500	0.550
Storefront Window: Metal Frame:Double Pane with Low-E, Tinted, SHGC 0.40	46	---	---	0.500	0.550
Entrance Door: Glass (> 50% glazing):Metal Frame, Entrance Door, SHGC 0.40	47	---	---	0.800	0.800
Back Exterior Wall: Steel-Framed, 16" o.c.	6075	21.0	0.0	0.106	0.064
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, Tinted, SHGC 0.40	2183	---	---	0.500	0.550
Storefront Window: Metal Frame:Double Pane with Low-E, Tinted, SHGC 0.40	27	---	---	0.500	0.550
Entrance Door: Glass (> 50% glazing):Metal Frame, Entrance Door, SHGC 0.40	47	---	---	0.800	0.800
Left Exterior Wall: Steel-Framed, 16" o.c.	3501	21.0	0.0	0.106	0.064
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, Tinted, SHGC 0.40	46	---	---	0.500	0.550
Storefront Window: Metal Frame:Double Pane with Low-E, Tinted, SHGC 0.40	88	---	---	0.500	0.550
Entrance Door: Glass (> 50% glazing):Metal Frame, Entrance Door, SHGC 0.40	47	---	---	0.800	0.800
Right Exterior Wall: Steel-Framed, 16" o.c.	3501	21.0	0.0	0.106	0.064
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, Tinted, SHGC 0.40	46	---	---	0.500	0.550
Storefront Window: Metal Frame:Double Pane with Low-E, Tinted, SHGC 0.40	133	---	---	0.500	0.550
Entrance Door: Glass (> 50% glazing):Metal Frame, Entrance Door, SHGC 0.40	47	---	---	0.800	0.800
Floor 1: Slab-On-Grade:Unheated, Vertical 2 ft.	447	---	5.0	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Step 6: Verify the insulation R-values shown on the building plans meet or exceed the values in the **Cavity R-Value** and **Continuous R-Value** section. Verify the insulation will fit uncompressed in the framing cavity. Continuous R-values are for insulation installed over the face of framing; insulation installed with no thermal breaks.

Step 7: Verify the fenestration and door **U-Factors** shown meet or exceed what is provided on the building plans. If shown, **SHGC** and **Projection Factor (PF)** should also be verified.

WARNING: "Other" Assembly Components display only a **U-Factor** with no insulation values. Back-up documentation should be requested or provided on the specifications for the overall U-Factor shown. *No "other" assemblies are listed in this project.*

Air Leakage, Component Certification, and Vapor Retarder Requirements:

☐ 1. All joints and penetrations are caulked, gasketed or covered with a moisture vapor-permeable wrapping material installed in accordance with the manufacturer's installation instructions.

☐ 2. Windows, doors, and skylights certified as meeting leakage requirements.

☐ 3. Component R-values & U-factors labeled as certified.

☐ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.

☐ 5. 'Other' components have supporting documentation for proposed U-Factors.

☐ 6. Insulation installed according to manufacturer's instructions, in substantial contact with the surface being insulated, and in a manner that achieves the rated R-value without compressing the insulation.

☐ 7. Stair, elevator shaft vents, and other outdoor air intake and exhaust openings in the building envelope are equipped with motorized dampers.

☐ 8. Cargo doors and loading dock doors are weather sealed.

☐ 9. Recessed lighting fixtures installed in the building envelope are Type IC rated as meeting ASTM E283, are sealed with gasket or caulk.

☐ 10. Building entrance doors have a vestibule equipped with closing devices.

Exceptions:

Building entrances with revolving doors.

Doors that open directly from a space less than 3000 sq. ft. in area.

Section 4: Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed envelope system has been designed to meet the 2009 IECC requirements in COM*check* Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title | Signature | Date

Project Notes:

Core and Shell Example. Energy Code Compliance is for the building envelope, mechanical system and lighting for the Floor 1 finished out core area.

Step 8: Checklist items: **Insulation, Fenestration and Doors, and Air Leakage and Component Certification** should be reviewed to ensure these mandatory requirements will be met or are exempt (not applicable). For example, review documentation as to whether a vestibule is required.

COM*check* Software Version 3.8.0

Interior Lighting Compliance Certificate

Step 1: Verify the **Project Information** matches the information on the building plans. The code, location, and project type will impact compliance.

2009 IECC

Section 1: Project Information

Project Type: **New Construction**
Project Title : Sample Office Building

Construction Site:
2222 Redwood Road
Salt Lake City, UT 22262
Permit No. 10-463
Permit Date: August 19, 2010

Owner/Agent:
ABC Property Company
1677 2nd Street
Salt Lake City, UT 22311

Designer/Contractor:
Designs Are Us
1453 McMinnion Street
Park City, UT 99422

Step 2: Verify the **Building Type** or **Area Category(s)** and **Floor Area** match the project type. Verify the floor area does not exceed the project floor area shown on the building plans. Single occupancy buildings should always use Whole Building Method unless each **Area Category** within the building is identified separately.

Section 2: Interior Lighting and Power Calculation

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B x C)
Office	2014	1	2014
Total Allowed Watts =			2014

Step 3: Verify the **Lighting Power Calculation** is consistent with the lighting plans.

Step 4: Verify the **Fixture Description, Lamps per Fixture, Ballast Type**, and **Number of Fixtures** shown in the documentation is consistent with the lighting plans/fixture schedule.

Step 5: Verify the **Fixture Wattage** is accurate. Default values can be used in COM*check* or from the manufacture literature. However, careful attention to overall wattage installed against the proposed should be reviewed.

Section 3: Interior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Office (2014 sq.ft.)				
Linear Fluorescent 2: Type A: 32 W T8 / 48" T8 32W / Electronic	3	10	95	950
Compact Fluorescent 1: Type B: CFL / Triple 4-pin 26W / Electronic	1	10	29	290
Linear Fluorescent 1: Type C: 32 W T8 / 48" T8 32W / Electronic	2	5	65	325
Incandescent 1: Type D: Bathroom Fan Lighting / Incandescent 100W	1	2	100	200
Total Proposed Watts =				1765

Step 6: Verify the **Proposed Wattage** is less than or equal to the **Allowed Wattage**.

Section 4: Requirements Checklist

Lighting Wattage:

☐ 1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
2014	1765	YES

Step 7: Verify all mandatory requirements have been met. For example, verify switching for each interior space is shown on the lighting plans and is applicable to the space type.

Controls, Switching, and Wiring:

☐ 2. Daylight zones under skylights more than 15 feet from the perimeter have lighting controls separate from daylight zones adjacent to vertical fenestration.

☐ 3. Daylight zones have individual lighting controls independent from that of the general area lighting.

Exceptions:
Contiguous daylight zones spanning no more than two orientations are allowed to be controlled by a single controlling device.
Daylight spaces enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.

☐ 4. Independent controls for each space (switch/occupancy sensor).

Exceptions:
Areas designated as security or emergency areas that must be continuously illuminated.
Lighting in stairways or corridors that are elements of the means of egress.

☐ 5. Master switch at entry to hotel/motel guest room.

☐ 6. Individual dwelling units separately metered.

☐ 7. Medical task lighting or art/history display lighting claimed to be exempt from compliance has a control device independent of the control of the nonexempt lighting.

☐ 8. Each space required to have a manual control also allows for reducing the connected lighting load by at least 50 percent by either controlling all luminaires, dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps, switching the middle lamp luminaires independently of other lamps, or switching each luminaire or each lamp.

Exceptions:
Only one luminaire in space.
An occupant-sensing device controls the area.
The area is a corridor, storeroom, restroom, public lobby or sleeping unit.
Areas that use less than 0.6 Watts/sq.ft.

☐ 9. Automatic lighting shutoff control in buildings larger than 5,000 sq.ft.

Exceptions:
Sleeping units, patient care areas; and spaces where automatic shutoff would endanger safety or security.

☐ 10. Photocell/astronomical time switch on exterior lights.

Exceptions:
Lighting intended for 24 hour use.

☐ 11. Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).

Exceptions:
Electronic high-frequency ballasts; Luminaires on emergency circuits or with no available pair.

Interior Lighting PASSES: Design 12% better than code.

Section 5: Compliance Statement

Compliance Statement: The proposed lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2009 IECC requirements in COM*check* Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title | Signature | Date

Step 8: Verify the **Interior Lighting** complies with the code by +0% or greater.

COM*check* Software Version 3.8.0

Exterior Lighting Compliance Certificate

2009 IECC

Step 1: Verify the **Project Information** matches the information on the building plans. The code, location, and project type will impact compliance.

Section 1: Project Information

Project Type: **New Construction**
Project Title : Sample Office Building
Exterior Lighting Zone: **2 (Neighborhood business district)**

Construction Site:
2222 Redwood Road
Salt Lake City, UT 22262
Permit No. 10-463
Permit Date: August 19, 2010

Owner/Agent:
ABC Property Company
1677 2nd Street
Salt Lake City, UT 22311

Designer/Contractor:
Designs Are Us
1453 McMinnion Street
Park City, UT 99422

Step 2: Verify the lighting application(s) (**Exterior Area/Surface), Quantity**, and **Totals** match lighting specifications.

Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (B x C)	F Proposed Watts
Parking area	40360 ft2	0.06	Yes	2422	2040
Walkway < 10 feet wide	355 ft of walkway length	0.7	Yes	248	320
Walkway >= 10 feet wide	4320 ft2	0.14	Yes	605	800
Main entry	12 ft of door width	20	Yes	240	160
Other door (not main entry)	12 ft of door width	20	Yes	240	160
Total Tradable Watts* =				3755	3480
Total Allowed Watts =				3755	
Total Allowed Supplemental Watts** =				600	

* Wattage tradeoffs are only allowed between tradable areas/surfaces.
** A supplemental allowance equal to 600 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Step 3: Verify the **Fixture Description, Lamps per Fixture, Ballast Type**, and **Number of Fixtures** shown in the documentation is consistent with the lighting plans/fixture schedule.

Step 4: Verify the **Fixture Wattage** is accurate. Default values can be from COM*check* or from manufacture literature. However, careful attention to overall wattage installed against the proposed should be reviewed.

Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Parking area (40360 ft2): Tradable Wattage				
HID 1: Metal Halide 250W / Pulse start	1	8	255	2040
Walkway < 10 feet wide (355 ft of walkway length): Tradable Wattage				
HID 2: Metal Halide 75W / Pulse start	1	4	80	320
Walkway >= 10 feet wide (4320 ft2): Tradable Wattage				
HID 2 copy 1: Metal Halide 75W / Pulse start	1	10	80	800
Main entry (12 ft of door width): Tradable Wattage				
HID 2 copy 2: Metal Halide 75W / Pulse start	1	2	80	160
Other door (not main entry) (12 ft of door width): Tradable Wattage				
HID 2 copy 3: Metal Halide 75W / Pulse start	1	2	80	160
Total Tradable Proposed Watts =				3480

Step 5: Verify all mandatory requirements have been met.

Section 4: Requirements Checklist

Lighting Wattage:

☐ 1. Within each non-tradable area/surface, total proposed watts must be less than or equal to total allowed watts. Across all tradable areas/surfaces, total proposed watts must be less than or equal to total allowed watts.

Compliance: Passes.

Controls, Switching, and Wiring:

☐ 2. All exemption claims are associated with fixtures that have a control device independent of the control of the nonexempt lighting.

☐ 3. Lighting not designated for dusk-to-dawn operation is controlled by either a a photosensor (with time switch), or an astronomical time switch.

☐ 4. Lighting designated for dusk-to-dawn operation is controlled by an astronomical time switch or photosensor.

☐ 5. All time switches are capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.

Exterior Lighting Efficacy:

☐ 6. All exterior building grounds luminaires that operate at greater than 100W have minimum efficacy of 60 lumen/watt.

Exceptions:

Lighting that has been claimed as exempt and is identified as such in Section 3 table above.
Lighting that is specifically designated as required by a health or life safety statue, ordinance, or regulation.
Emergency lighting that is automatically off during normal building operation.
Lighting that is controlled by motion sensor.

Exterior Lighting PASSES: Design 20% better than code.

Section 5: Compliance Statement

Compliance Statement: The proposed exterior lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2009 IECC requirements in COM*check* Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title | Signature | Date

Step 6: Verify the **Exterior Lighting** complies with the code by +0% or greater.

COM*check* Software Version 3.8.0

Mechanical Compliance Certificate

2009 IECC

Step 1: Verify the **Project Information** matches the information on the building plans. The code, location, and project type will impact compliance.

Section 1: Project Information

Project Type: **New Construction**
Project Title : Sample Office Building

Construction Site:
2222 Redwood Road
Salt Lake City, UT 22262
Permit No. 10-463
Permit Date: August 19, 2010

Owner/Agent:
ABC Property Company
1677 2nd Street
Salt Lake City, UT 22311

Designer/Contractor:
Designs Are Us
1453 McMinnion Street
Park City, UT 99422

Section 2: General Information

Building Location (for weather data): **Salt Lake City, Utah**
Climate Zone: **5b**

Step 2: Verify the Mechanical System(s) specified in Section 3 matches what is called out on the mechanical plans/specifications and the quantity and type of each unit are correct.

Section 3: Mechanical Systems List

Quantity	System Type & Description
1	HVAC System 1: Cooling: Cooling equipment (Rooftop Package Unit), Capacity Unknown, Efficiency: 12.10 , Evaporatively Cooled Condenser / Multiple-Zone
1	HVAC System 3: Cooling: Cooling equipment (Rooftop Package Unit), Capacity Unknown, Evaporatively Cooled Condenser / Multiple-Zone
1	Plant 1: Heating: Hot Water Boiler, Capacity 1038 kBtu/h, Gas, Efficiency: 75.00 % Et

Section 4: Requirements Checklist

Requirements Specific To: HVAC System 1 :

☐ 1. Equipment minimum efficiency: Rooftop Package Unit: 12.1 EER
☐ 2. Minimum one temperature control device per zone
☐ 3. Leak testing > 3 per in. static pressure - report submitted showing CL < 6.0
☐ 4. Balancing and pressure test connections on all hydronic terminal devices
☐ 5. Systems serving more than one zone must be VAV systems
Exception: Where pressure relationships must be maintained
Exception: Zones or supply air systems with at least 75% of reheating/recooling energy site recovered or site solar
Exception: Zones with humidity requirements for special processes
Exception: Zones with cfm <300 and flow rate <10% of total design flow rate
Exception: Outside air needed to meet IMC Chapter 4

☐ 6. Single-duct VAV terminals reduce primary air before reheating

☐ 7. Controls capable of resetting supply air temp (SAT) by 25% of SAT-room temp difference
Exception: Systems that prevent reheating, recooling or mixing of heated and cooled supply air
Exception: Seventy five percent of the energy for reheating is from site-recovered or site solar energy sources.
Exception: Zones with peak supply air quantities of 300 cfm (142 L/s) or less.

Requirements Specific To: HVAC System 3 :

☐ 1. Equipment minimum efficiency: Rooftop Package Unit: 12.1 EER

☐ 2. Minimum one temperature control device per zone

☐ 3. Leak testing > 3 per in. static pressure - report submitted showing CL < 6.0

☐ 4. Balancing and pressure test connections on all hydronic terminal devices

☐ 5. Systems serving more than one zone must be VAV systems
Exception: Where pressure relationships must be maintained
Exception: Zones or supply air systems with at least 75% of reheating/recooling energy site recovered or site solar
Exception: Zones with humidity requirements for special processes
Exception: Zones with cfm <300 and flow rate <10% of total design flow rate
Exception: Outside air needed to meet IMC Chapter 4

☐ 6. Single-duct VAV terminals reduce primary air before reheating

☐ 7. Controls capable of resetting supply air temp (SAT) by 25% of SAT-room temp difference
Exception: Systems that prevent reheating, recooling or mixing of heated and cooled supply air
Exception: Seventy five percent of the energy for reheating is from site-recovered or site solar energy sources.
Exception: Zones with peak supply air quantities of 300 cfm (142 L/s) or less.

Requirements Specific To: Plant 1 :

☐ 1. Equipment minimum efficiency: Boiler Thermal Efficiency 75% Et 80% Ec

☐ 2. Two-pipe changeover heating/cooling controls must have:
a) 15 degrees F deadband where boiler and chiller can not operate,
b) allow operation in either heating or cooling for at least 4 hrs. and
c) prevent difference between heating and cooling set points greater than 30 degrees F

☐ 3. Newly purchased heating equipment meets the efficiency requirements
- used equipment must meet 80% Et @ maximum capacity

☐ 4. Systems with multiple boilers have automatic controls capable of sequencing boiler operation

☐ 5. Hydronic heating systems comprised of a single boiler and >500 kBtu/h input design capacity
include either a multistaged or modulating burner

Generic Requirements: Must be met by all systems to which the requirement is applicable:

☐ 1. Plant equipment and system capacity no greater than needed to meet loads
Exception: Standby equipment automatically off when primary system is operating
Exception: Multiple units controlled to sequence operation as a function of load

☐ 2. Minimum one temperature control device per system

☐ 3. Minimum one humidity control device per installed humidification/dehumidification system

☐ 4. Load calculations per ASHRAE/ACCA Standard 183

☐ 5. Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock,
2-hour occupant override, 10-hour backup
Exception: Continuously operating zones
Exception: 2 kW demand or less, submit calculations

☐ 6. Outside-air source for ventilation; system capable of reducing OSA to required minimum

☐ 7. R-5 supply and return air duct insulation in unconditioned spaces
R-8 supply and return air duct insulation outside the building
R-8 insulation between ducts and the building exterior when ducts are part of a building assembly
Exception: Ducts located within equipment
Exception: Ducts with interior and exterior temperature difference not exceeding 15°F.

☐ 8. Mechanical fasteners and sealants used to connect ducts and air distribution equipment

☐ 9. Ducts sealed - longitudinal seams on rigid ducts; transverse seams on all ducts;
UL 181A or 181B tapes and mastics

☐ 10. Hot water pipe insulation: 1 in. for pipes <=1.5 in. and 2 in. for pipes >1.5 in.
Chilled water/refrigerant/brine pipe insulation: 1 in. for pipes <=1.5 in. and 1.5 in. for pipes >1.5 in.
Steam pipe insulation: 1.5 in. for pipes <=1.5 in. and 3 in. for pipes >1.5 in.
Exception: Piping within HVAC equipment.
Exception: Fluid temperatures between 55 and 105°F.
Exception: Fluid not heated or cooled with renewable energy.
Exception: Piping within room fan-coil (with AHRI440 rating) and unit ventilators (with AHRI840 rating).
Exception: Runouts <4 ft in length.

☐ 11. Operation and maintenance manual provided to building owner

☐ 12. Hot water distribution systems >=300 kBtu/h must have one of the following:
a) controls that reset supply water temperature by 25% of supply/return delta T
b) mechanical or electrical adjustable-speed pump drive(s)
c) two-way valves at all heating coils
d) multiple-stage pumps
e) other system controls that reduce pump flow by at least 50% based on load
- calculations required

Exception: Where the supply temperature reset controls cannot be implemented without causing improper operation of heating, cooling, humidification, or dehumidification systems.
Exception: Hydronic systems that use variable flow to reduce pumping energy.

☐ 13. Balancing devices provided in accordance with IMC (2006) 603.17

☐ 14. Demand control ventilation (DCV) present for high design occupancy areas (>40 person/1000 ft2 in spaces >500 ft2) and served by systems with any one of 1) an air-side economizer, 2) automatic modulating control of the outdoor air damper, or 3) a design outdoor airflow greater than 3000 cfm.

Exception: Systems with heat recovery.
Exception: Multiple-zone systems without DDC of individual zones communicating with a central control panel.
Exception: Systems with a design outdoor airflow less than 1200 cfm.
Exception: Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1200 cfm.

☐ 15. Motorized, automatic shutoff dampers required on exhaust and outdoor air supply openings

Exception: Gravity dampers acceptable in buildings <3 stories
Exception: Gravity dampers acceptable in systems with outside or exhaust air flow rates less than 300 cfm where dampers are interlocked with fan

☐ 16. Automatic controls for freeze protection systems present

☐ 17. Three-pipe systems not used

☐ 18. Exhaust air heat recovery included for systems 5,000 cfm or greater with more than 70% outside air fraction or specifically exempted

Exception: Hazardous exhaust systems, commercial kitchen and clothes dryer exhaust systems that the International Mechanical Code prohibits the use of energy recovery systems.
Exception: Systems serving spaces that are heated and not cooled to less than 60°F.
Exception: Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
Exception: Heating systems in climates with less than 3600 HDD.
Exception: Cooling systems in climates with a 1 percent cooling design wet-bulb temperature less than 64°F.
Exception: Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
Exception: Laboratory fume hood exhaust systems that have either a variable air volume system capable of reducing exhaust and makeup air volume to 50 percent or less of design values or, a separate make up air supply meeting the following makeup air requirements: a) at least 75 percent of exhaust flow rate, b) heated to no more than 2°F below room setpoint temperature, c) cooled to no lower than 3°F above room setpoint temperature, d) no humidification added, e) no simultaneous heating and cooling.

Section 5: Compliance Statement

Compliance Statement: The proposed mechanical design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2009 IECC requirements in COM*check* Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title	Signature	Date

COM*check* Software Version 3.8.0

Mechanical Requirements Description

2009 IECC

The following list provides more detailed descriptions of the requirements in Section 4 of the Mechanical Compliance Certificate.

Requirements Specific To: HVAC System 1 :

1.The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Rooftop Package Unit: 12.1 EER

2.Each zone of a multiple-zone system must have its own temperature control device.

3.The specified distribution system is designed to operate at static pressure over 3 in. water column. The system must be leak tested in accordance with SMACNA standards. The contractor or engineer must submit a report to the enforcing jurisdiction documenting that a minimum of 25% of all duct surfaces have been tested and that tested ducts have a SMACNA rated air leakage class of under 6.0.

4.Hydronic heating and cooling coils must be equipped with a way to pressure test connections and measure and balance water flow and pressure.

5.Systems serving multiple thermostatic control zones must be variable-flow systems. Zone terminal controls must reduce the flow of primary supply air before reheating, recooling, or mixing air streams to one of the following:
a) 30% of the maximum supply air to each zone,
b) 300 cfm or less where the maximum flow rate is less than 10% of the total fan system supply airflow rate, or
c) minimum ventilation requirements of Chapter 4 of the International Mechanical Code.

Exception: VAV controls are not required for zones with special pressurization or cross-contamination requirements. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones or supply air systems where at least 75% of the reheating and recooling energy is made available through the use of site-recovered or site solar energy. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones with special humidity control requirements for specialized processes. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones that require less than 300 cfm of supply air provided the total airflow to these zones does not exceed 10% of the total design flow rate for the system.
Exception: VAV controls are not required where constant volume supply air is necessary to meet the minimum outside air requirements of Chapter 4 of the International Mechanical Code. These zones must be called out in the construction documents for easy identification during field inspection.

6.The specified multiple-zone system is equipped with single-duct VAV terminals. These terminals must be equipped with dampers, air valves, or other means to reduce the supply of primary supply air to a minimum prior to reheating.

7.Automatic controls capable of resetting supply-air temperature (within a range of 25 percent of the difference between supply-air and design air temperature) in response to building loads or outdoor air temperature exist on systems serving multiple zones.

Exception: Systems that prevent reheating, recooling or mixing of heated and cooled supply air
Exception: Seventy five percent of the energy for reheating is from site-recovered or site solar energy sources.
Exception: Zones with peak supply air quantities of 300 cfm (142 L/s) or less.

Requirements Specific To: HVAC System 3 :

1.The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Rooftop Package Unit: 12.1 EER

2.Each zone of a multiple-zone system must have its own temperature control device.

3.The specified distribution system is designed to operate at static pressure over 3 in. water column. The system must be leak tested in accordance with SMACNA standards. The contractor or engineer must submit a report to the enforcing jurisdiction documenting that a minimum of 25% of all duct surfaces have been tested and that tested ducts have a SMACNA rated air leakage class of under 6.0.

4.Hydronic heating and cooling coils must be equipped with a way to pressure test connections and measure and balance

water flow and pressure.

5.Systems serving multiple thermostatic control zones must be variable-flow systems. Zone terminal controls must reduce the flow of primary supply air before reheating, recooling, or mixing air streams to one of the following:
a) 30% of the maximum supply air to each zone,
b) 300 cfm or less where the maximum flow rate is less than 10% of the total fan system supply airflow rate, or
c) minimum ventilation requirements of Chapter 4 of the International Mechanical Code.

Exception: VAV controls are not required for zones with special pressurization or cross-contamination requirements. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones or supply air systems where at least 75% of the reheating and recooling energy is made available through the use of site-recovered or site solar energy. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones with special humidity control requirements for specialized processes. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones that require less than 300 cfm of supply air provided the total airflow to these zones does not exceed 10% of the total design flow rate for the system.
Exception: VAV controls are not required where constant volume supply air is necessary to meet the minimum outside air requirements of Chapter 4 of the International Mechanical Code. These zones must be called out in the construction documents for easy identification during field inspection.

6.The specified multiple-zone system is equipped with single-duct VAV terminals. These terminals must be equipped with dampers, air valves, or other means to reduce the supply of primary supply air to a minimum prior to reheating.

7.Automatic controls capable of resetting supply-air temperature (within a range of 25 percent of the difference between supply-air and design air temperature) in response to building loads or outdoor air temperature exist on systems serving multiple zones.

Exception: Systems that prevent reheating, recooling or mixing of heated and cooled supply air
Exception: Seventy five percent of the energy for reheating is from site-recovered or site solar energy sources.
Exception: Zones with peak supply air quantities of 300 cfm (142 L/s) or less.

Requirements Specific To: Plant 1 :

1.The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Boiler Thermal Efficiency 75% Et 80% Ec

2.Two-pipe changeover heating/cooling controls must:
a) allow a deadband between changeover from one mode (heating/cooling) to the other of at least 15 degrees F outside temperatures
b) allow operation in one mode (heating/cooling) for at least 4 hours before changing over to the other mode
c) allow heating and cooling supply temperatures at the changeover point to be no more than 30 degrees F apart.

3.The specified heating equipment is covered by Federal minimum efficiency requirements. New equipment of this type can be assumed to meet or exceed ASHRAE 90.1 Code requirements for equipment efficiency. Used equipment must meet 80% Et @ maximum capacity.

4.Systems with multiple boilers have automatic controls capable of sequencing the operation of the boilers.

5.Hydronic heating systems comprised of a single boiler and >500 kBtu/h input design capacity include either a multistaged or modulating burner.

Generic Requirements: Must be met by all systems to which the requirement is applicable:

1.All equipment and systems must be sized to be no greater than needed to meet calculated loads. A single piece of equipment providing both heating and cooling must satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

Exception: The equipment and/or system capacity may be greater than calculated loads for standby purposes. Standby equipment must be automatically controlled to be off when the primary equipment and/or system is operating.
Exception: Multiple units of the same equipment type whose combined capacities exceed the calculated load are allowed if they are provided with controls to sequence operation of the units as the load increases or decreases.

2.Each heating or cooling system serving a single zone must have its own temperature control device.

3.Each humidification system must have its own humidity control device.

4.Design heating and cooling loads for the building must be determined using procedures in the ASHRAE Handbook of Fundamentals or an approved equivalent calculation procedure.

5.The system or zone control must be a programmable thermostat or other automatic control meeting the following criteria:
a) capable of setting back temperature to 55°F during heating and setting up to 85°F during cooling,
b) capable of automatically setting back or shutting down systems during unoccupied hours using 7 different day schedules,
c) have an accessible 2-hour occupant override,
d) have a battery back-up capable of maintaining programmed settings for at least 10 hours without power.

Exception: A setback or shutoff control is not required on thermostats that control systems serving areas that operate continuously.
Exception: A setback or shutoff control is not required on systems with total energy demand of 2 kW (6,826 Btu/h) or less.

6.The system must supply outside ventilation air as required by Chapter 4 of the International Mechanical Code. If the ventilation system is designed to supply outdoor-air quantities exceeding minimum required levels, the system must be

capable of reducing outdoor-air flow to the minimum required levels.

7.Air ducts must be insulated to the following levels:
a) Supply and return air ducts for conditioned air located in unconditioned spaces (spaces neither heated nor cooled) must be insulated with a minimum of R-5. Unconditioned spaces include attics, crawl spaces, unheated basements, and unheated garages.
b) Supply and return air ducts and plenums must be insulated to a minimum of R-8 when located outside the building.
c) When ducts are located within exterior components (e.g., floors or roofs), minimum R-8 insulation is required only between the duct and the building exterior.

Exception: Duct insulation is not required on ducts located within equipment.
Exception: Duct insulation is not required when the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F.

8.Mechanical fasteners and seals, mastics, or gaskets must be used when connecting ducts to fans and other air distribution equipment, including multiple-zone terminal units.

9.All joints, longitudinal and transverse seams, and connections in ductwork must be securely sealed using weldments; mechanical fasteners with seals, gaskets, or mastics; mesh and mastic sealing systems; or tapes.
Tapes and mastics must be listed and labeled in accordance with UL 181A and shall be marked '181A-P' for pressure sensitive tape,
'181A-M' for mastic or '181A-H' for heat-sensitive tape. Tapes and mastics used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked '181B-FX' for pressure-sensitive tape or '181B-M' for mastic. Unlisted duct tape is not permitted as a sealant on any metal ducts.

10.All pipes serving space-conditioning systems must be insulated as follows:

Hot water piping for heating systems:
1 1/2 in. for pipes <=1 1/2-in. nominal diameter,
2 in. for pipes >1 1/2-in. nominal diameter.

Chilled water, refrigerant, and brine piping systems:
1 1/2 in. insulation for pipes <=1 1/2-in. nominal diameter,
1 1/2 in. insulation for pipes >1 1/2-in. nominal diameter.

Steam piping:
1 1/2 in. insulation for pipes <=1 1/2-in. nominal diameter,
3 in. insulation for pipes >1 1/2-in. nominal diameter.

Exception: Pipe insulation is not required for factory-installed piping within HVAC equipment.
Exception: Pipe insulation is not required for piping that conveys fluids having a design operating temperature range between 55°F and 105°F.
Exception: Pipe insulation is not required for piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
Exception: Piping within room fan-coil (with AHRI440 rating) and unit ventilators (with AHRI840 rating).
Exception: Pipe insulation is not required for runout piping not exceeding 4 ft in length and 1 in. in diameter between the control valve and HVAC coil.

11.Operation and maintenance documentation must be provided to the owner that includes at least the following information:
a) equipment capacity (input and output) and required maintenance actions
b) equipment operation and maintenance manuals
c) HVAC system control maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions; desired or field-determined set points must be permanently recorded on control drawings, at control devices, or, for digital control systems, in programming comments
d) complete narrative of how each system is intended to operate.

12.Hot water space-heating systems with a capacity exceeding 300 kBtu/h supplying heated water to comfort conditioning systems must include controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outside air temperature.

Exception: Where the supply temperature reset controls cannot be implemented without causing improper operation of heating, cooling, humidification, or dehumidification systems.
Exception: Hydronic systems that use variable flow to reduce pumping energy.

13.Balancing devices provided in accordance with IMC (2006) 603.17.

14.Demand control ventilation (DCV) required for high design occupancy areas (>40 person/1000 ft2 in spaces >500 ft2) and served by systems with any one of 1) an air-side economizer, 2) automatic modulating control of the outdoor air damper, or 3) a design outdoor airflow greater than 3000 cfm.

Exception: Systems with heat recovery.
Exception: Multiple-zone systems without DDC of individual zones communicating with a central control panel.
Exception: Systems with a design outdoor airflow less than 1200 cfm.
Exception: Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1200 cfm.

15.Outdoor air supply and exhaust systems must have motorized dampers that automatically shut when the systems or spaces served are not in use. Dampers must be capable of automatically shutting off during preoccupancy building warm-up, cool-down, and setback, except when ventilation reduces energy costs (e.g., night purge) or when ventilation must be supplied to meet code requirements.
Both outdoor air supply and exhaust air dampers must have a maximum leakage rate of 3 cfm/ft2 at 1.0 in w.g. when tested in accordance with AMCA Standard 500.

Exception: Gravity (non-motorized) dampers are acceptable in buildings less than three stories in height.
Exception: Systems with a design outside air intake or exhaust capacity of 300 cfm (140 L/s) or less that are equipped with motor operated dampers that open and close when the unit is energized and de-energized, respectively.

16.All freeze protection systems, including self-regulating heat tracing, must include automatic controls capable of shutting off the systems when outside air temperatures are above 40°F or when the conditions of the protected fluid will prevent freezing. Snow- and ice-melting systems must include automatic controls capable of shutting off the systems when the pavement temperature is above 50°F and no precipitation is falling, and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F.

17.Hydronic systems that use a common return system for both hot water and chilled water must not be used.

18.Individual fan systems with a design supply air capacity of 5000 cfm or greater and minimum outside air supply of 70 percent or greater of the supply air capacity must have an energy recovery system with at least a 50 percent effectiveness. Where cooling with outdoor air is required there is a means to bypass or control the energy recovery system to permit cooling with outdoor air.

Exception: Hazardous exhaust systems, commercial kitchen and clothes dryer exhaust systems that the International Mechanical Code prohibits the use of energy recovery systems.
Exception: Systems serving spaces that are heated and not cooled to less than 60°F.
Exception: Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
Exception: Heating systems in climates with less than 3600 HDD.
Exception: Cooling systems in climates with a 1 percent cooling design wet-bulb temperature less than 64°F.
Exception: Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
Exception: Laboratory fume hood exhaust systems that have either a variable air volume system capable of reducing exhaust and makeup air volume to 50 percent or less of design values or, a separate make up air supply meeting the following makeup air requirements: a) at least 75 percent of exhaust flow rate, b) heated to no more than 2°F below room setpoint temperature, c) cooled to no lower than 3°F above room setpoint temperature, d) no humidification added, e) no simultaneous heating and cooling.

IECC®

INTERNATIONAL ENERGY CONSERVATION CODE®

CODE AND COMMENTARY

2009

ICC
INTERNATIONAL CODE COUNCIL®

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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 5:
Commercial Energy Efficiency

General Comments

Chapter 5 can be used to demonstrate compliance for the design and construction of most types of commercial buildings and residential buildings greater than three stories in height above grade [see Table 5(1)]. Residential buildings, townhouses and garden apartments three stories or less in height are covered in Chapter 4.

The thermal envelope requirements of this code do not apply to (see commentary, Section 101.5.2):

1. Very low energy use buildings (less than 3.4 Btu per hour per square foot or 1 watt per square foot of floor area); and
2. Buildings or portions of buildings that are neither heated nor cooled.

While the code will also exempt the applicability of some or all provisions of the code (see Section 101.4) to:

- Continued use of existing buildings;
- Historic buildings; and
- Additions, alterations, renovations or repairs.

A building designed and constructed to meet the requirements of this chapter generally meets or exceeds the energy-efficiency level of a similar building constructed to meet ASHRAE/IES 90.1-2004 requirements.

The provisions of Chapter 5 simplify and clarify energy code requirements specific to commercial buildings. Chapter 5 is presented in a different format than ASHRAE 90.1. Redundant provisions and those having no impact on overall energy performance have been removed for the utility of the user.

Purpose

Chapter 5 contains several options to address the energy efficiency of commercial buildings. The options are most clearly shown in Section 501.1 where compliance with either ASHRAE/IESNA 90.1 or the remaining provi-

Table 5(1)
EXAMPLES OF BUILDING TYPES COVERED BY CHAPTER 5

Airports	Indoor sporting facilities
Apartment buildings and condominiums ≥ four stories	Industrial work buildings
Assembly and conference areas	Laboratories
Banks	Libraries
Barber shops and beauty parlors	Museums and galleries
Bowling alleys	Nursing homes
Churches, synagogues and chapels	Offices
Commercial or industrial warehouses	Police and fire houses
Convention centers	Restaurants
Dormitories (more than three stories)	Retail, grocery and wholesale stores
Exhibit halls	Schools
Gymnasiums	Shopping malls
Health clubs	Shops (nonindustrial)
High-rise residential (over three stories)	Sporting arenas
Hospitals	Theaters and auditoriums
Hotels and motels	Warehouses and storage facilities

Note: This table includes only examples of building types covered by the code. It is not intended to be an exhaustive list. Other building types may be covered, even though they are not listed.

sions of Chapter 5.

ASHRAE 90.1 is intended to promote the application of cost-effective design practices and technologies that minmize energy consumption without sacrificing either the comfort or productivity of the occupants. The 2006 edition of the code adopts ASHRAE 90.1 by reference in Chapter 5 as an alternative to the remaining portions of Chapter 5.

The Energy Policy Act of 1992 (EPAct 92) requires state and local governments to update their commercial building energy-efficiency codes to be at least as stringent as the ASHRAE 90.1 or successor. Unlike residential codes, states do not have the option of determining whether it is appropriate to update the energy-efficiency provisions of their commercial building code. To meet this requirement, many states are expected to adopt the code as the principal benchmark of energy policy for commercial buildings or to have otherwise developed unique state codes that meet or exceed the level of stringency in ASHRAE 90.1. The U.S. Department of Energy (DOE) provides incentive funding and technical assistance to states to update and implement their building energy codes to meet or exceed the model codes determined to improve energy efficiency.

Besides adopting the ASHRAE 90.1 standard by reference, Chapter 5 contains a set of requirements for the energy-efficient design of commercial buildings that are easier to use and that provide an alternative way to show compliance for structures or systems based on ASHRAE 90.1 (see commentary, Section 501.1). The options outlined in Sections 502 through 506 are reasonably equivalent to ASHRAE 90.1. The principal difference is that the code has removed redundant requirements and those having no impact in overall energy performance. Moreover, those portions of Chapter 5 are written in code language. The advice and recommendations contained in ASHRAE 90.1 are eliminated.

The alternative methodology and prescriptive requirements in Chapter 5 were initially approved by the IECC Code Development Committee during the 1997 code development cycle to meet the needs of designers, builders and regulatory officials involved in the construction of commercial buildings who had requested a more easily understandable, usable and enforceable commercial energy conservation code.

This chapter was developed by Pacific Northwest National Laboratory (PNNL) on behalf of the U.S. DOE and is intended to promote the application of cost-effective design practices and technologies that minimize energy consumption without sacrificing either the comfort or productivity of the occupants. The EPAct 92 requires state and local governments to update their commercial building energy-efficiency codes to be at least equivalent to ASHRAE 90.1-1989 or successor. To meet this requirement, many states are expected to adopt the simplified and usable provisions of the 2006 code instead of the more complex and technically sophisticated provisions of ASHRAE 90.1. In reality, adopting the code does meet the requirements of EPAct 92 because the code does include ASHRAE 90.1 by reference.

SECTION 501
GENERAL

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet either the requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or the requirements contained in this chapter.

❖ In Chapter 5, the requirements address the design of all building systems that affect the visual and thermal comfort of the occupants, including:

- Wall, roof and floor insulation;
- Windows and skylights;
- Cooling equipment (air conditioners, chillers and cooling towers);
- Heating equipment (boilers, furnaces and heat pumps);
- Pumps, piping and liquid circulation systems;
- Heat rejection equipment (fan cooling towers, air cooled condensers);
- Service water heating (kitchens, lavatories and pools); and
- Electrical power and lighting systems (lighting types, densities, zones and controls).

Chapter 5 applies to new commercial and high-rise residential buildings and also additions, repairs and alterations to existing buildings. “High rise” in this context is defined to include buildings four or more stories in height. Chapter 5 does not apply to low-rise residential buildings such as single-family homes, duplexes and garden apartments three stories or less in height. However, these building types are covered by comparable provisions in Chapter 4.

Just as the code does not regulate or control the energy used by things such as office equipment and computers, the code does not limit or regulate the energy use intended primarily for manufacturing, commercial or industrial processing. Although the energy for the manufacturing and processing is excluded, the building’s envelope, mechanical systems, service water heating, and electrical power and lighting systems are regulated. Chapter 5 includes a total building performance evaluation as a compliance option. This option includes a requirement for documentation, and a listing of software tools to determine the total building performance.

501.2 Application. The *commercial building* project shall comply with the requirements in Sections 502 (Building envelope requirements), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Electrical power and lighting

systems) in its entirety. As an alternative the *commercial building* project shall comply with the requirements of ASHRAE/IESNA 90.1 in its entirety.

Exception: Buildings conforming to Section 506, provided Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.

❖ Because Chapter 5 applies to such a wide variety of buildings in various climate zones (see Tables 502.1.2 and 502.2(1), there must be flexibility in its application. The goal is to achieve energy-efficient building performance. When possible, this goal is achieved without requiring specific measures or products. Flexibility is offered at the prescriptive and systems' levels, and at the whole building level based on total building performance (see Figure 501.2). The building designer must select which commercial building compliance path he or she is going to use to design the entire building—Chapter 5 of the code or ASHRAE Standard 90.1.

Flexibility is achieved at the prescriptive level by specifying criteria in terms of component performance. The criterion for the roof component, for instance, is stated in terms of the *R*-value. Any construction assembly or method may be used as long as its *R*-value meets this criterion. For the overall building envelope, however, no flexibility is offered through an area-weighted average as allowed in Section 402.1.4 or the fenestration provisions of Section 402.3.1. For example, each portion of the building envelope must meet or exceed the criteria requirement on its own without the benefit of area-weighted averages.

Lighting control requirements can be satisfied with multiple switches, occupant sensors, time clocks or dimmers but must be satisfied on a space-by-space basis. Lighting power requirements can be satisfied by any combination of equipment as long as the total connected interior lighting power is less than the total permitted lighting power from Section 505.5.2. The total exterior lighting power allowance for all exterior building applications is determined using the lighting zones information in Table 505.6.2(1) and the lighting power allowances in Table 505.6.2(2). HVAC equipment and water heaters can be manufactured in a variety of ways as long as each piece of equipment meets the applicable overall criterion of energy efficiency: the energy efficiency ratio (EER). Averaging equipment efficiencies is not acceptable.

For the building envelope, Chapter 5 has prescriptive tables that give wall, floor and roof *R*-values, window *U*-factors, solar heat gain coefficient (SHGC), opaque doors, etc. that satisfy the requirements for the specific climate zone. This is the easiest approach to meet the building envelope criteria. Where the prescriptive tables do not offer enough flexibility, an alternative method approved by the code official may be used. Generally, such approved alternatives allow consideration of window area and orientation; thermal mass; insulation position (on the inside or outside of

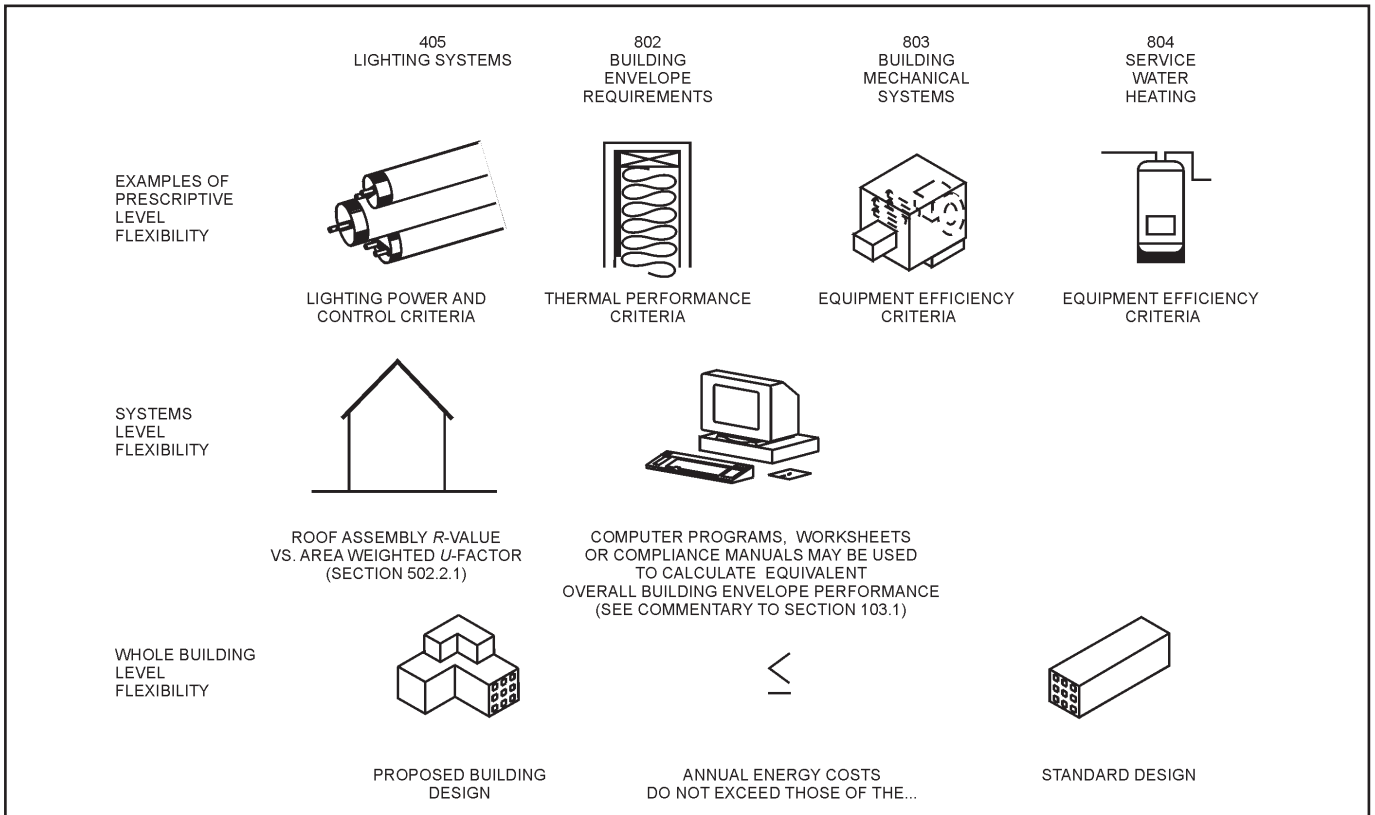

Figure 501.2
DESIGN FLEXIBILITY PROVIDED BY CHAPTER 5

the wall); daylighting; and internal gains from lights, equipment and people. Evaluation of such alternatives can be obtained by using a calculation software tool as listed in Section 506.6, worksheets and/or compliance manuals where approved by the authority having jurisdiction (see commentary, Sections 101.3 and 101.5 or 103.1).

The greatest flexibility is achieved at the whole building level under the ASHRAE Standard 90.1 or Section 506 as referenced by the exception. Section 506 permits the comparative evaluation of annual energy costs to assess total building performance compliance. As long as the estimated annual energy cost of the proposed design is less than or equal to the estimated annual energy cost of the standard design, the proposed design meets the code. More information to determine the total building performance is in the commentary for Section 506. When this evaluation is complete, the compliance calculations must be certified by a registered architect and/or licensed professional engineer.

SECTION 502
BUILDING ENVELOPE REQUIREMENTS

502.1 General (Prescriptive).

❖ This section of the code references acceptable methods and procedures for compliance evaluation for the insulation *R*-value of building envelope components and the fenestration *U*-factors for doors, windows and skylights [see Figure 502.1(1)].

The building envelope is important to building energy efficiency. When it is cold outside, heat loss and air leakages through the building envelope add to the heating load. On hot days, solar gains through windows contribute to the air-conditioning (cooling) load. The building envelope requirements of Section 502 are intended to reduce heat gains and losses through the building envelope.

Determining the right amount and type of fenestration and optimizing the levels of insulation is a detailed process that depends on climate, occupancy, schedules of operation, internal gains and other factors. The code sets minimum levels of thermal performance for all components of the building envelope and limits fenestration solar gain. While these limits ensure a minimum level of performance, they do not necessarily result in an optimum design. The designer is encouraged to use the code as a starting point; minimum compliance may not be the optimum solution.

The prescriptive building envelope requirements apply only to buildings where the window and glazed door area is not greater than 40 percent of the gross above-grade wall area and the building is conditioned (heating or cooling). Understanding the occupancy requirements for the commercial building is necessary in using the correct values for the *U*-factor, *C*-factor or *F*-factor of the building envelope requirements listed in Tables 502.1.2 and 502.2(1). The definition of "Conditioned space" is important (see Section 101.5.1, Item 2 and definition in Chapter 2). Notice that based on Section 101.5.2, Item 1, any building or portion of a building that uses more than 3.4 Btu/h · ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) for "space conditioning purposes" would be required to comply with the building envelope requirements.

Because the thermal envelope requirements do not apply to buildings that are neither heated nor cooled (Section 101.5.2), shell buildings present a special problem. Shell buildings are built before it is known how they will be used or even whether they will be heated or cooled. Although the code official has discretion in dealing with shell buildings, a common approach is to postpone compliance until a permit application is filed for a heating or cooling system. At that time, the permit applicant documents compliance with the building envelope requirements as well as the HVAC requirements. It may be necessary to upgrade the building envelope for those areas that are heated or cooled; for example, by installing additional insulation. In colder climates, however, some code officials may want to assume that heating will always be installed for freeze protection and, therefore, require insulation during the initial construction of shell buildings. This most often applies to ceiling insulation based on the rationale that it is more costly to add insulation after the roof is finished.

Even with shell buildings, the designer should consider the requirements of the code to avoid problems at the time of future tenant improvements. It would be best to assume that the entire building will be heated or cooled, and to establish a plan for upgrading the building envelope in the event that it is. While it may be easy to insulate the inside of tilt-up concrete walls at a later time, windows should be carefully sized and selected [*U*-factor, projection factor (PF) and solar heat gain coefficient (SHGC)] to reasonably achieve compliance.

502.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Tables 502.2(1) and 502.3 based on the climate *zone* specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table 502.2(1). Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table 502.2(1). Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table 502.3 shall comply with the building envelope provisions of ASHRAE/IESNA 90.1.

❖ This section provides the initial references to the prescriptive envelope requirements. The opaque portions of the envelope (walls, roofs, floors and opaque doors) must comply with the requirements of Table 502.2(1) while the fenestration (windows, glazed wall systems and skylights) must comply with Table 502.3. Commercial buildings or portions thereof enclosing Group R occupancies shall use the *R*-values from the "Group

R "column. Otherwise the "All other" column shall be used for the *R*-values to determine the correct building thermal envelope. According to the *International Building Code*® (IBC®) the Residential Group R includes the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the *International Residential Code*® (IRC®). Group R includes the use of a building or structure, or a portion thereof, including R-1, R-2, R-3 and R-4 as defined in the IBC.

Some of the envelope requirements are based on surface area. For instance, glazing area is limited to a percentage of the gross exterior wall area above grade and skylight area is limited to a percentage of the gross roof area. The rules for measuring surface areas are summarized in Figure 502.1.1.

The fenestration area is the entire window and glazed door area including the frame. For premanufactured windows and doors, this area must be considered as the rough frame opening.

Windows located in interior walls adjacent to unconditioned space would need to be included when determining the percentage of fenestration. Although these openings do not have a solar heat gain coefficient (SHGC) concern, they would still need to comply with the appropriate *U*-factor from Table 502.3 and would represent a reduction from the wall insulation levels required in Table 502.2(1). Therefore, it is appropriate that their size be included in the 40-percent limit on the amount of fenestration openings.

502.1.2 *U*-factor alternative. An assembly with a *U*-factor, *C*-factor, or *F*-factor equal or less than that specified in Table 502.1.2 shall be permitted as an alternative to the *R*-value in Table 502.2(1). Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-factor, *C*-factor, or *F*-factor from the "Group R" column of Table 502.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall

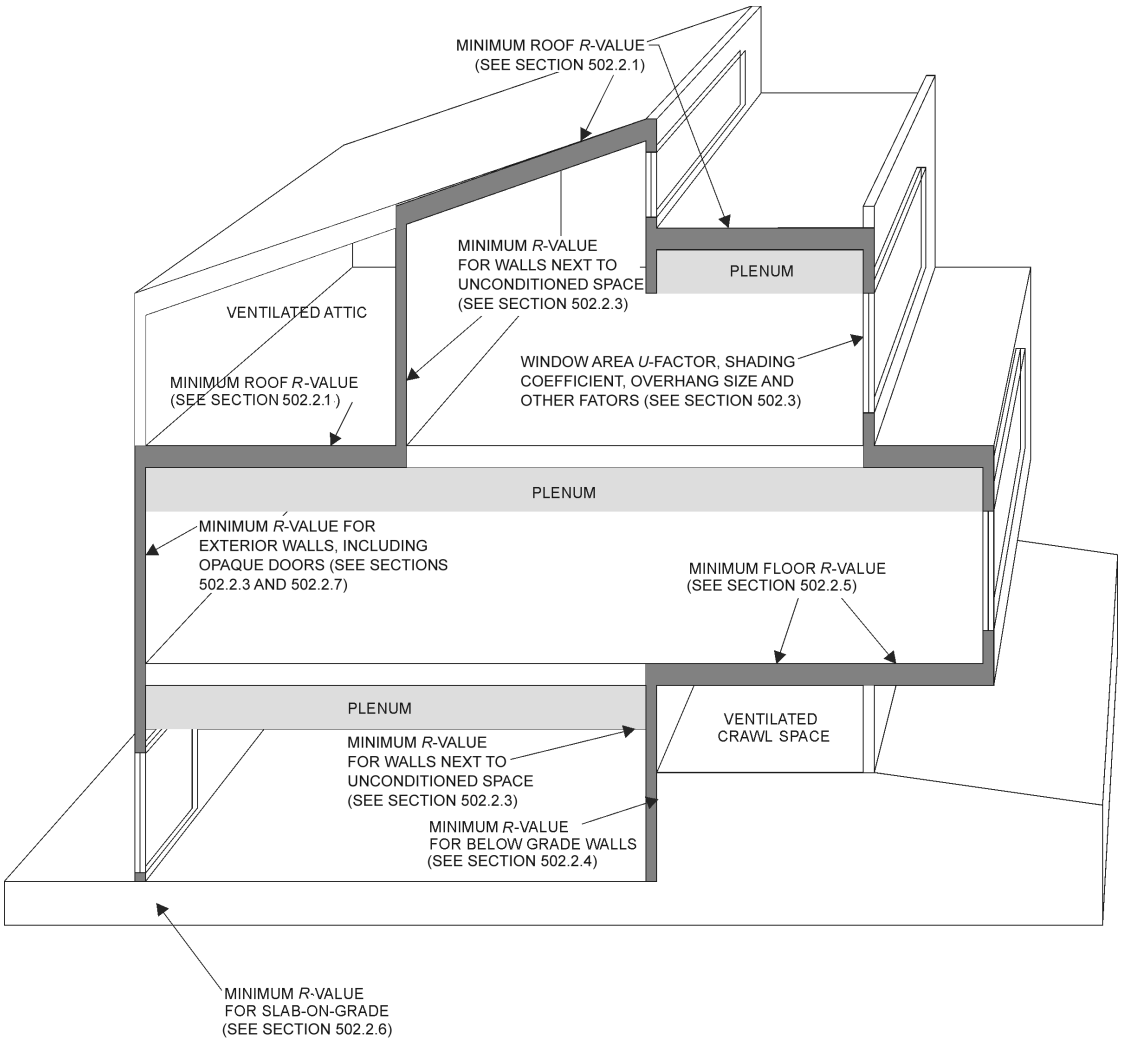

Figure 502.1(1)
GRAPHIC SUMMARY OF ENVELOPE REQUIREMENTS
(Courtesy of U.S. Department of Energy, Office of Building Technology State and Community Programs, www.energycodes.org)

2009 International Energy Conservation Code®

Study Companion

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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

6

2009 IECC Sections 501 and 502 (partial)

Commercial Energy Efficiency—Part I

OBJECTIVE: To obtain an understanding of the building envelope requirements for the opaque envelope contained in Chapter 5, Commercial Energy Efficiency.

REFERENCE: Chapter 5, Sections 501 and 502 (partial), 2009 *International Energy Conservation Code*

KEY POINTS:

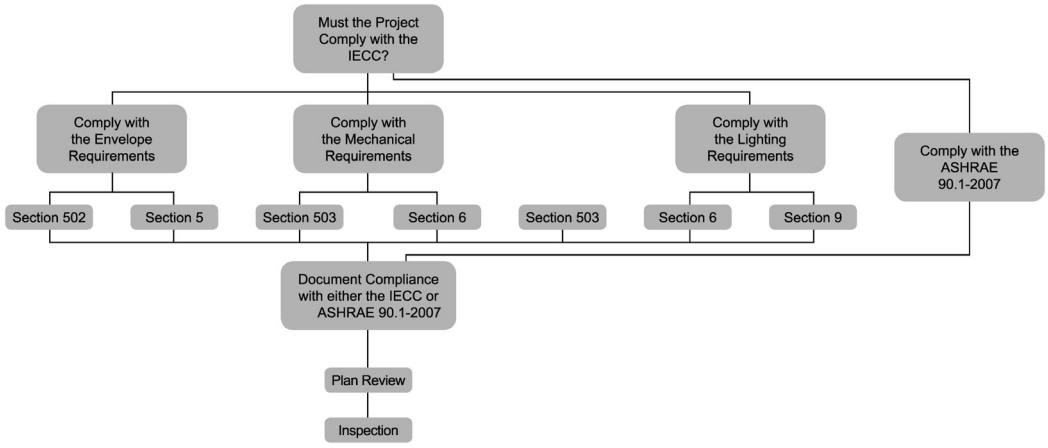
- Which compliance options are available for demonstrating compliance with the IECC for commercial buildings? When should one be utilized instead of the other for the building envelope?
- Which parts of the building envelope are covered under Chapter 5?
- What two parameters must be determined before the thermal requirements for the building envelope can be selected?
- What are the different wall types addressed in Chapter 5?
- Where can roof insulation be installed to meet the envelope requirements? What are the requirements for metal roof systems?
- How does the IECC apply to metal wall systems?
- Which options are available for insulated framed wall systems? Which options are available for insulated concrete or concrete masonry unit wall systems?
- Which options are available when the design includes more than 3 percent of the roof area in skylights?
- How should slab edge insulation be installed to meet the code requirements? Below grade walls?

Topic: Application
Reference: IECC 501.2

Category: Commercial Energy Efficiency
Subject: General

Code Text: *The commercial building project shall comply with the requirements in Sections 502 (Building envelope requirements), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Electrical power and lighting systems) in its entirety.* See exception for those buildings that conform to Section 506 (total building performance method), where Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied. *As an alternative, the commercial building project shall comply with the requirements of ASHRAE/IESNA 90.1 in its entirety.*

Discussion and Commentary: Compliance for a commercial building can be demonstrated by using Chapter 5 to individually evaluate the building envelope, mechanical, service water heating and lighting systems. As an alternative, ASHRAE/IESNA Standard 90.1-2007 can be used to demonstrate compliance with the IECC. ASHRAE 90.1 is also to be used when the building system is not covered under Chapter 5.



Chapter 5 is prescriptive in nature. Because of this, there are no trade-offs between the envelope, lighting, service water and mechanical systems. The project may be made to comply by using either IECC Chapter 5 or ASHRAE 90.1, but not a combination of both. Typically, compliance with ASHRAE 90.1 will be selected because the proposed system falls out of the scope of IECC Chapter 5. IECC Section 506 allows trade-offs between levels of efficiency in the building envelope, mechanical and lighting systems.

Topic: General | **Category:** Commercial Energy Efficiency
Reference: IECC 502.1.1 | **Subject:** Building Envelope Compliance

Code Text: *The building thermal envelope shall meet the requirements of Tables 502.2(1) and 502.3 based on the climate zone specified in Chapter 3. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table 502.3 shall comply with the building envelope provisions of ASHRAE/IESNA 90.1.*

Discussion and Commentary: The opaque envelope provisions contain specific requirements addressing two types of buildings: 1) those Group R buildings defined as commercial buildings by Chapter 2, and (2) all other commercial buildings. Typically, the insulation requirements for Group R occupancies defined as *commercial* are more stringent than for other commercial buildings so as to be more consistent with the insulation requirements for Group R buildings defined as *residential*.

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES

	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
CLIMATE ZONE	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	R-15ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci
Metal buildings (with R-5 thermal blocks[a, b])	R-19	R-19	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-19	R-19	R-13 + R-19	R-19 + R-10	R-11 + R-19	R-19 + R-10
Attic and other	R-30	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R- 38	R-38	R-38	R-38	R-38	R-38	R-49	R-49
Walls, Above Grade																
Mass	NR	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3 ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building[b]	R-16	R-16	R-16	R-16	R-19	R-19	R-19	R-19	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci
Metal framed	R-13	R-13	R-13	R-13+ 7.5ci	R-13 + R-3.8ci	R-13 + R-7.5ci	R-13 + R-7.5	R-13 + R-7.5ci	R-13 + R-7.5 ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5 ci	R-13 + R-18.8ci
Wood framed and other	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13+ R-3.8ci	R-13 + R-3.8ci	R-13 + R-3.8	R-13 + R-7.5	R-13 + R-7.5	R-13+ R-7.5ci	R-13 +7.5ci	R-13 + R-15.6ci	R-13 + 15.6ci

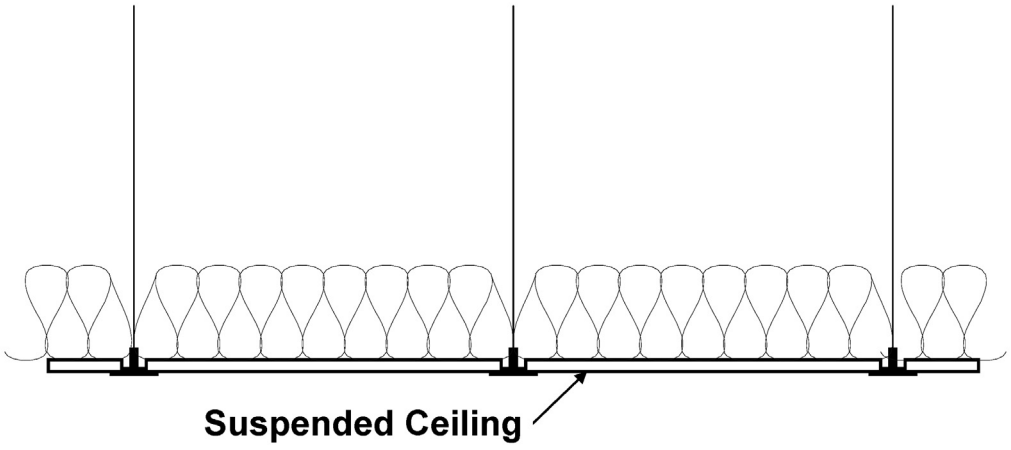
(continued)

Typically, insulation requirements for metal-framed walls are more stringent than for wood-framed wall systems because of the increased heat transfer in metal. For example, in Climate Zone 3, metal wall systems must be provided with continuous insulation in addition to the required insulation installed between the framing members. A wood-framed wall in the same Climate Zone is only required to have insulation installed between the framing members.

Topic: Roof Assembly	**Category:** Commercial Energy Efficiency
Reference: IECC 502.2.1	**Subject:** Building Envelope Compliance

Code Text: *The minimum thermal resistance (*R-*value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table 502.2(1), based on construction materials used in the roof assembly.* See exception for continuously insulated roof assemblies where the insulation thickness varies by no more than 1 inch and the area-weighted *U*-factor is equivalent to the same assembly, with the *R*-value specified in Table 502.2(1). *Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.*

Discussion and Commentary: The insulation requirements for a roof/ceiling assembly will vary depending on how the roof is constructed and where the insulation is placed. Three different roof assemblies are listed. Based on the roof type, insulation is required to be placed between framing or be continuous (ci). For example, in most Climate Zones a vented attic space will be required to have a minimum R-38 insulation installed between framing.



Insulation installed on top of a suspended ceiling system cannot contribute toward the ceiling insulation requirement. Insulation must be installed at the same location as the air barrier. A suspended ceiling cannot be considered an air barrier, unless each ceiling tile is individually sealed.

Study Session

7

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

OBJECTIVE: To obtain an understanding of Chapter 5, Commercial Energy Efficiency, requirements for fenestration, and Section 503, Building Mechanical Systems, mandatory requirements through the energy recovery ventilation systems.

REFERENCE: Sections 502 (partial) and 503 (partial), 2009 *International Energy Conservation Code*

KEY POINTS:

- What two requirements apply to vertical glazing? How can an overhang affect one of the requirements?
- When are vestibules required on commercial buildings?
- When does the code apply to HVAC systems? How does the code apply to systems installed to handle process loads?
- What types of HVAC systems fall under the simple system category? What system types are classified as complex systems?
- What are the requirements for sizing heating and cooling systems? When can systems be oversized?
- What are the minimum efficiency requirements for heating and cooling systems?
- What are the minimum capability requirements for thermostats? How many systems may a thermostat control?
- When is an energy recovery ventilation system required?

Topic: Fenestration
Reference: IECC 502.3.2
Category: Commercial Energy Efficiency
Subject: Building Envelope Compliance

Code Text: *For vertical fenestration, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, based on the window projection factor. For skylights, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.*

Discussion and Commentary: The *U*-factor is a measure of how well the assembly conducts heat. The lower the number, the better the assembly performs as an insulator. This information should be listed in the window schedule on the approved building plans, with the manufacturer's data on the window label or on the documentation. Glazing must be rated by the National Fenestration Rating Council (NFRC). The solar heat gain coefficient (SHGC) is a measure of how much solar radiation is transmitted through the window. The lower the number, the lower the amount of solar radiation that passes through the glazing, and the lower the solar heat gain. SHGC is part of a system for rating window performance used by the NFRC. The SHGC requirement is affected by the projection factor (PF) of qualifying overhangs. The projection factor is calculated by measuring the horizontal distance from the window surface to the farthermost edge of the overhang and dividing that by the vertical distance from the bottom of the window to the lowest point of the overhang.

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
***U*-factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC-all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

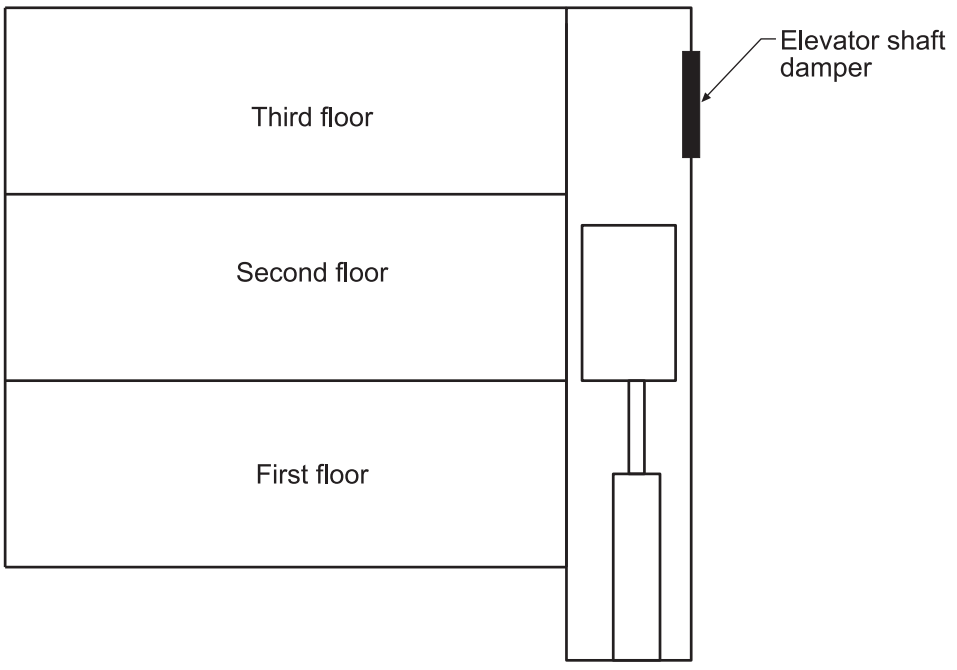
NR = No requirement.
PF = Projection factor (see Section 502.3.2).
a. All others includes operable windows, fixed windows and nonentrance doors.

The building design must have a SHGC that does not exceed that in the prescriptive package. The greater the projection factor, the better the window is shaded, and a window with a higher SHGC value can be used to comply with the IECC.

Topic: Outdoor Air Intake and Exhaust Openings **Category:** Commercial Energy Efficiency
Reference: IECC 502.4.5 **Subject:** Building Envelope Compliance

Code Text: *Stair and elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be equipped with not less than a Class I motorized, leakage-rated damper with a maximum leakage rate of 4 cfm per square foot (6.8 L/s•Cm^2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.* See exception for use of gravity (nonmotorized) dampers in one- and two-story buildings.

Discussion and Commentary: All vents installed in the building must be equipped with either a motorized damper or, for buildings less than three stories, a gravity damper.



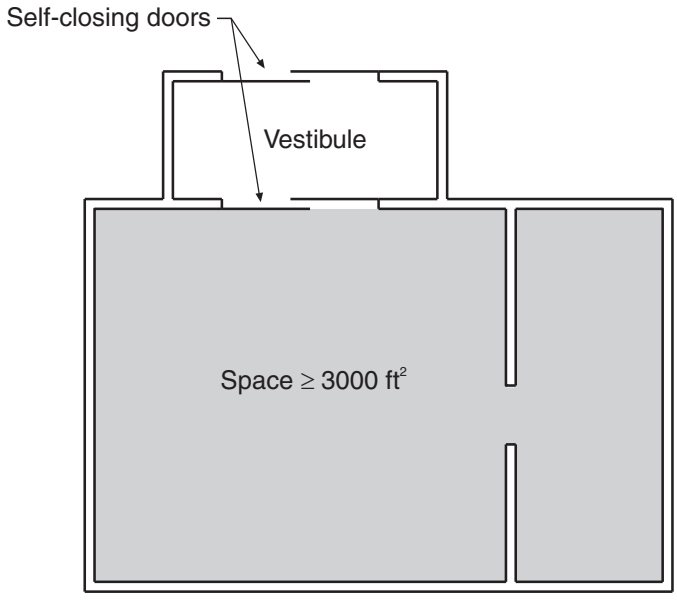
The use of a damper eliminates air infiltration into the building through the vent when the vent does not need to be open.

Topic: Vestibules
Reference: IECC 502.4.7

Category: Commercial Energy Efficiency
Subject: Building Envelope Compliance

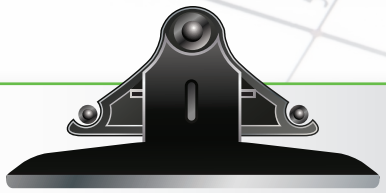
Code Text: *A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time.* See exceptions for (1) buildings in Climate Zones 1 and 2, (2) doors not intended to be used as a building entrance door, (3) doors opening directly from a sleeping unit or dwelling unit, (4) doors that open directly from a space less than 3,000 square feet in area, (5) revolving doors and (6) doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

Discussion and Commentary: Enclosed vestibules are often required to reduce air infiltration at doors that lead from the building to the outdoors. The provisions only apply to doors that are considered entrance doors to the building. The doors leading into and out of the vestibule must have self-closing devices. In addition, the doors must be designed so that it is not necessary to open the doors leading into and out of the vestibule simultaneously to enter and exit the space.



"Entrance doors" are defined in Chapter 2 as *fenestration products used for ingress, egress and access in nonresidential buildings, including, but not limited to, exterior entrances that utilize latching hardware and automatic closers and contain over 50-percent glass specifically designed to withstand heavy use and possibly abuse.*

Commercial
Inspection



What's in it FOR ME?

In this section you'll find:

- 2009 IECC commercial inspection checklist
- ASHRAE Standard 90.1-2007 inspection checklist
- *ICC Energy Inspector's Guide: Based on the 2009 International Energy Conservation Code® and ASHRAE/IESNA 90.1-2007 (cover and URL)*

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

Use of these instructions with the commercial checklist assumes a comprehensive understanding of the provisions of Chapter 5 of the 2009 International Energy Conservation Code (2009 IECC) and key concepts and definitions applicable to those provisions. Consult the 2009 IECC about particular items in the checklist, each of which contains the corresponding 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 checklist was developed specifically for use in addressing Recovery Act and State Energy Program requirements, both of which are focused on saving energy. However, it is a useful inspection tool for all code officials in jurisdictions that have adopted the commercial provisions in the 2009 IECC, noting that slight modifications may be necessary for 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, plumbing, mechanical, electrical, insulation, or final inspection). Additionally, the buildings must be of the same building type. Another approach may use a primary building for completing most of the evaluation, but separate buildings may be inspected for capturing compliance on checklist items that could not be evaluated for this primary building. A companion document, *Measuring Energy Code Compliance*[1], describes these approaches for using multiple buildings to derive a single evaluation.

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 2009 IECC contains the prescriptive requirements 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 3B with R-30 attic insulation. In Climate Zones 3A, B, and C, the prescriptive insulation R-value requirement for attics is listed as R-38 (Table 502.2(1) in 2009 IECC). In this example, the attic insulation should be marked as compliant even though it does not meet the prescriptive requirement. If the trade-off submission is valid, there will be some other building component that exceeds code requirements and offsets the non-compliant attic insulation.

[1] Pacific Northwest National Laboratory. 2010. *Measuring Energy Code Compliance*. PNNL-19281. http://www.energycodes.gov/arra/compliance_evaluation.stm

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 basement requirements for a building that has a slab-on-grade foundation. 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 2009 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.

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, equipment efficiency, 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. The *Comments/Notes/Findings* column may be used if additional space is needed. For example, windows in the building may have a different U-factor than sliding glass doors. In another case, the checklist asks for the efficiency of all HVAC equipment, which might require multiple entries with differing units of measurement. 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 *Comments/Notes/Findings* area of the checklist or on a separate worksheet. A similar approach should be taken for fenestration SHGC.

- 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 *Comments/Notes/Findings* area of the checklist or a separate worksheet.

Commercial Building Data Collection Checklist*

2009 International Energy Conservation Code

KEY	[1]	High Impact (Tier 1)	[2]	Medium Impact (Tier 2)	[3]	Low Impact (Tier 3)	C	Complex Mechanical

Building ID:_____ Climate Zone: _____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

State:_____ County:_____ Jurisdiction:_____

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

Building Use: ☐ Office ☐ Retail/Mercantile ☐ Warehouse/Storage ☐ Education/School ☐ Lodging/Hotel/Motel

☐ Restaurant/Dining/Fast Food ☐ Public Assembly/Religious ☐ Healthcare ☐ High-Rise Residential ☐ Other

Building Ownership: ☐ State-owned ☐ Local government-owned ☐ National account ☐ Speculative ☐ Private ☐ Other

Project Type: ☐ New Building ☐ Existing Building Addition ☐ Existing Building Renovation Valuation (If Renovation): $_____

2009 IECC Section #	Plan Review	Complies			Comments/Assumptions
		Y	N	N/A	
103.2 [PR1][1]	Plans and/or specifications provide all information with which compliance can be determined for the **building envelope** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
103.2 [PR2][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **mechanical systems and equipment** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
103.2 [PR3][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **service water heating systems and equipment** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
103.2 [PR4][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **lighting and electrical systems and equipment** and delineate and document where exceptions to the standard are claimed. Information provided should include interior and exterior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	☐	☐	☐	

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**

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Footing / Foundation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
502.2.4 [FO1][2]	Below-grade wall insulation R-value.	R-_____	☐	☐	☐	
303.2 [FO2][2]	Below-grade wall insulation installed per manufacturer's instructions.		☐	☐	☐	
502.2.6 [FO3][2]	Slab edge insulation R-value.	R-_____ ☐ Unheated ☐ Heated	☐	☐	☐	
303.2 [FO4][2]	Slab edge insulation installed per manufacturer's instructions.		☐	☐	☐	
502.2.6 [FO5][2]	Slab edge insulation depth/length.	_____ ft				
303.2.1 [FO6][1]	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities and should extend >=6 in. below grade.		☐	☐	☐	
503.2.7 [FO8][1]	Piping, ducts and plenum are insulated and sealed when installed in or under a slab.	R-_____	☐	☐	☐	
503.2.4.5 [FO9][3]	Freeze protection and snow/ice melting system sensors for future connection to controls.		☐	☐	☐	
504.5 [FO10][1]	Any recirculating SWH piping in or under slab is insulated.	R-_____	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Framing / Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
502.4.1, 502.4.2 [FR1][3]	Fenestration meets maximum air leakage requirements.	_____ cfm/ ft^2	☐	☐	☐	
502.4.1, 502.4.2 [FR2][3]	Doors meet maximum air leakage requirements.	_____ cfm/ ft^2	☐	☐	☐	
502.4.1, 502.4.2 [FR3][3]	Fenestration and doors labeled for air leakage.		☐	☐	☐	
502.4.7 [FR4][3]	Vestibules installed per approved plans.		☐	☐	☐	
502.2.1 [FR5][1]	Roof insulation R-value.	R-_____ ☐ Above deck ☐ Metal ☐ Attic	☐	☐	☐	
303.2 [FR6][1]	Roof insulation R-value installed per manufacturer's instructions.		☐	☐	☐	
502.3.1, 502.1.1 [FR7][1]	Performance compliance approach submitted for vertical fenestration area >40% or skylight area >3%.		☐	☐	☐	
502.3.2 [FR8][1]	Vertical fenestration U-Factor.	U-_____	☐	☐	☐	
502.3.2 [FR9][1]	Skylight fenestration U-Factor.	U-_____	☐	☐	☐	
502.3.2 [FR10][1]	Vertical fenestration SHGC value.	SHGC: _____	☐	☐	☐	
502.3.2 [FR11][1]	Skylight SHGC value.	SHGC: _____	☐	☐	☐	
303.1.3 [FR12][2]	Fenestration products rated in accordance with NFRC.		☐	☐	☐	
303.1.3 [FR13][1]	Fenestration products are certified as to performance. Labels or certificates provided.		☐	☐	☐	
502.3.2, 502.4.1, 502.4.2 [FI4][2]	U-factor of opaque doors associated with the building thermal envelope meets requirements.	U-_____ ☐ Swinging ☐ Nonswinging	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Plumbing Rough-In Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
504.5 [PL1][2]	Piping for recirculating and non-recirculating service hot-water systems insulated.	☐	☐	☐	
504.3 [PL2] [3]C	Temperature controls installed on service water heating systems <=110 ºF for intended use serving dwelling units and <=90 ºF serving other occupancies.	☐	☐	☐	
504.6 [PL3][1]	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	☐	☐	☐	
[504.4 [PL4][3]	Heat traps installed on non-circulating storage water tanks.	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
503.2.3 [ME1][2]	HVAC equipment efficiency verified.	Efficiency: _____	☐	☐	☐	
Table 503.2.3(3) [ME2][3]	PTAC and PTHP with sleeves 16 in by 42 in. labeled for replacement only.		☐	☐	☐	
502.4.5 [ME3][3]	Stair and elevator shaft vents have motorized dampers that automatically close.		☐	☐	☐	
502.4.5, 503.2.4.4 [ME4][3]	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.		☐	☐	☐	
503.2.5.1 [ME6][1]	Demand control ventilation provided for spaces >500 ft^2 and >40 people/1000 ft^2 occupant density and served by systems with air side economizer, auto modulating outside air damper control or design airflow >3,000 cfm.		☐	☐	☐	
503.2.7 [ME8][2]	HVAC ducts and plenums insulated.	R-_____	☐	☐	☐	
503.2.8 [ME9][2]	HVAC piping insulation thickness.	_____ in.	☐	☐	☐	
503.2.7.1 [ME10][2]	Ducts and plenums sealed based on static pressure and location.		☐	☐	☐	
503.2.7.1.3 [ME11][3] C	Ductwork operating >3 in. water column is air leakage tested.		☐	☐	☐	
503.3.1, 503.4.1 [ME12][1]	Air economizers provided where required, meet the requirements for design capacity, control signal, and high-limit shut-off and integrated economizer control.		☐	☐	☐	
502.4.5, 503.2.4.4 [ME13][2]	Return air and outdoor air dampers meet minimum air leakage requirements.		☐	☐	☐	
503.3.1 [ME14][1]	Means provided to relieve excess outside air.		☐	☐	☐	
503.4.5 [ME17][1]	Zone controls can limit simultaneous heating and cooling and sequence heating and cooling to each zone.		☐	☐	☐	
503.4.3.3 [ME18][2] C	Hydronic heat pump systems connected to a common water loop meet heat rejection and heat addition requirements.		☐	☐	☐	

2009 IECC Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
503.2.9.1 [ME41iecc][3]	Air outlets and zone terminal devices have means for air balancing.		☐	☐	☐	
503.2.9.2 [ME42iecc][3]	HVAC hydronic heating and cooling coils have means to balance and have pressure test connections.		☐	☐	☐	
503.2.10.1 [ME40iecc][1]	HVAC fan systems >5 hp meet fan power limitation.		☐	☐	☐	
503.2.10.2 [ME21] [2]	HVAC fan motors not larger than the first available motor size greater than the bhp.	bhp: _____	☐	☐	☐	
503.4.2 [ME22] [2]C	VAV fan motors ≥10 hp to be driven by mechanical or electrical variable speed drive, or have a vane-axial fan with variable pitch blades, or have controls or devices to limit fan motor demand to ≤30% of design wattage at 50% design air volume at static pressure of 1/3 total rated static pressure of the fan.	☐ VSD ☐ Vane axial fan ☐ Other	☐	☐	☐	
503.4.2 [ME24] [2]C	Reset static pressure setpoint for DDC controlled VAV boxes reporting to central controller based on the zones requiring the most pressure.		☐	☐	☐	
503.4.3.5 [ME26] [3]C	Reduce flow in pumping systems of any size to multiple chillers or boilers when others are shut down.		☐	☐	☐	
503.4.3.4 [ME27] [3]C	Temperature reset by representative building loads in pumping systems >10 hp for chiller and boiler systems > 300,000 Btu/h.		☐	☐	☐	
503.4.3.3.3 [ME28] [3] C	Two-position automatic valve interlocked to shut off water flow when hydronic heat pump with pumping system >10 hp is off.		☐	☐	☐	
503.4.4 [ME29] [3]C	Fan systems with motors ≥7.5 hp associated with heat rejection equipment to have capability to operate at 2/3 of full-speed and auto speed controls to control the leaving fluid temp or condensing temp/pressure of heat rejection device.		☐	☐	☐	
503.2.6 [ME30][1]	Exhaust air energy recovery on systems ≥ 5,000 cfm and 70% of design supply air.		☐	☐	☐	
503.4.6 [ME31] [3]C	Condenser heat recovery system that can heat water to 85 ºF or provide 60% of peak heat rejection is installed for preheating of service hot water in 24/7 facility, water cooled systems reject >6 MMBtu, SHW load ≥1 MMBtu.		☐	☐	☐	
503.2.11 [ME34] [3]	Unenclosed spaces that are heated use only radiant heat.		☐	☐	☐	
502.4.4 [ME35][1] C	Hot gas bypass on cooling systems limited to: ≤240 kBtu/h – 50% >240 kBtu/h – 25%		☐	☐	☐	
504.2 [ME36][2]C	Service water heating equipment meets efficiency requirements.		☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Rough-In Electrical Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
505.2.2.2 [EL3] [2]	Automatic lighting control to shut off all building lighting installed in buildings >5,000 ft^2.	☐	☐	☐	
505.2.1 [EL4] [2]	Independent lighting control installed per approved lighting plans and all manual control readily accessible and visible to occupants.	☐	☐	☐	
505.2.4 [EL5] [2]	Automatic lighting controls for exterior lighting installed.	☐	☐	☐	
505.2.3 [EL6] [1]	Verify separate lighting control devices for specific uses installed per approved lighting plans.	☐	☐	☐	
505.3 [EL7] [3]	Ballasted one and three lamp fixtures with >30 W/lamp have two lamp tandem wired ballasts when ≥2 fixtures in same space on same control.	☐	☐	☐	
505.4 [EL8] [1]	Exit signs do not exceed 5 watts per face.	☐	☐	☐	
505.6.1 [EL9] [1]	Exterior grounds lighting over 100 W provides >60 lm/W unless on motion sensor or fixture is exempt from scope of code or from external LPD.	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Insulation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
502.4.3 [IN1][1]	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed, weather stripped or wrapped with moisture vapor-permeable wrapping material to minimize air leakage.		☐	☐	☐	
502.2.1 [IN2][1]	Roof insulation R-value.	R-_____	☐	☐	☐	
303.2 [IN3][1]	Roof insulation installed per manufacturer's instructions.		☐	☐	☐	
502.2.3 [IN6][1]	Above-grade wall insulation R-value.	R-_____ ☐ Mass ☐ Metal ☐ Steel ☐ Wood	☐	☐	☐	
303.2 [IN7][1]	Above-grade wall insulation installed per manufacturer's instructions.		☐	☐	☐	
502.2.5 [IN8][2]	Floor insulation R-value.	R-_____ ☐ Mass ☐ Steel ☐ Wood	☐	☐	☐	
303.2 [IN9][2]	Floor insulation installed per manufacturer's instructions.		☐	☐	☐	
303.1.1, 303.1.1.1 [IN10][2]	Building envelope insulation is labeled with R-value or insulation certificate providing R-value and other relevant data.		☐	☐	☐	
303.2.1 [IN14][2]	Exterior insulation is protected from damage with a protective material.		☐	☐	☐	
502.2.1 [IN17][3]	Insulation intended to meet the roof insulation requirements not installed on top of a suspended ceiling.		☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Final Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
502.4.6 [FI1] [1]	Weatherseals installed on all loading dock cargo doors in all zones.	☐	☐	☐	
503.2.4.1 [FI2] [2]	Heating and cooling to each zone is controlled by a thermostat control.	☐	☐	☐	
503.2.4.2, 503.2.4.3 [FI3] [2]	Temperature controls have the following features: dead band controls, setpoint overlap restrictions, off-hour controls, automatic shutdown, setback controls.	☐	☐	☐	
503.2.4.1.1 [FI5] [3]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐	☐	☐	
502.4.8 [FI20iecc] [3]	Recessed luminaires in thermal envelope to limit infiltration and be IC rated and labeled. Seal between interior finish and liminare housing.	☐	☐	☐	
503.2.2 [FI21iecc] [3]	HVAC systems and equipment capacity does not exceed calculated loads.	☐	☐	☐	
504.3 [FI11] [3]	Public lavatory faucet water temperature not greater than 110 °F.	☐	☐	☐	
504.5 [FI19iecc] [2]	Insulate automatic circulating hot water systems and 1st eight feet of non-circulating systems without integral heat traps.	☐	☐	☐	
504.7.1 [FI13] [3]C	Pool heaters are equipped with on/off switch and no continuous burning pilot light.	☐	☐	☐	
504.7.3 [FI4] [2]C	Pool covers are provided for heated pools and pools heated to >90˚F have a cover ≥R-12.	☐	☐	☐	
504.7.2 [FI15] [3]C	Time switches are installed on all pool heaters and pumps.	☐	☐	☐	
503.2.9.3 [FI17] [3]	Furnished O&M instructions for systems and equipment to the building owner or designated representative.	☐	☐	☐	
505.5, 505.6 [FI18] [1]	Installed lamps and fixtures are consistent with what is shown on the approved lighting plans.	☐	☐	☐	

Additional Comments: _____

KEY	[1]	High Impact (Tier 1)	[2]	Medium Impact (Tier 2)	[3]	Low Impact (Tier 3)	C	Complex Mechanical

Evaluator Assessment
Please provide a general description of what was discovered during the onsite evaluation, and a professional estimate of what you feel the compliance rating should be, regardless of the individual metrics scored above. Include your assessment of the most impactful energy requirements for this particular building.

Instructions for the Commercial Building Data Collection Checklist ANSI/ASHRAE/IESNA Standard 90.1-2007

Use of these instructions with the commercial checklist assumes a comprehensive understanding of the provisions of the ANSI/ASHRAE/IESNA Standard 90.1–2007 (90.1-2007) and key concepts and definitions applicable to those provisions. Consult 90.1-2007 about particular items in the checklist, each of which contains the corresponding 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 checklist was originally developed specifically for use in addressing Recovery Act and State Energy Program requirements, both of which are focused on saving energy. However, it is a useful inspection tool for all code officials in jurisdictions that have adopted 90.1-2007, noting that slight modifications may be necessary for use in jurisdictions that amended the standard 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, plumbing, mechanical, electrical, insulation, or final inspection). Additionally, the buildings must be of the same building type. Another approach may use a primary building for completing most of the evaluation, but separate buildings may be inspected for capturing compliance on checklist items that could not be evaluated for this primary building. A companion document, *Measuring Energy Code Compliance*[1], describes these approaches for using multiple buildings to derive a single evaluation.

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. 90.1-2007 contains the prescriptive requirements 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 3B with R-30 attic insulation. In Climate Zones 3A, B, and C, the prescriptive insulation R-value requirement for attics is listed as R-38 (Table 5.5-3 in 90.1-2007). In this example, the attic insulation should be marked as compliant even though it does not meet the prescriptive requirement. If the trade-off submission is valid, there will be some other building component that exceeds code requirements and offsets the non-compliant attic insulation.

[1] Pacific Northwest National Laboratory. 2010. *Measuring Energy Code Compliance*. PNNL-19281. http://www.energycodes.gov/arra/compliance_evaluation.stm

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 basement requirements for a building that has a slab-on-grade foundation. 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 90.1-2007 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.

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, equipment efficiency, 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. The *Comments/Notes/Findings* column may be used if additional space is needed. For example, windows in the building may have a different U-factor than sliding glass doors. In another case, the checklist asks for the efficiency of all HVAC equipment, which might require multiple entries with differing units of measurement. 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 *Comments/Notes/Findings* area of the checklist or on a separate worksheet. A similar approach should be taken for fenestration SHGC.

- 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 *Comments/Notes/Findings* area of the checklist or a separate worksheet.

Commercial Building Data Collection Checklist*

ANSI/ASHRAE/IESNA Standard 90.1-2007

KEY	[1]	High Impact (Tier 1)	[2]	Medium Impact (Tier 2)	[3]	Low Impact (Tier 3)	C	Complex Mechanical

Building ID:_____ Climate Zone: _____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

State:_____ County:_____ Jurisdiction:_____

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

Building Use: ☐ Office ☐ Retail/Mercantile ☐ Warehouse/Storage ☐ Education/School ☐ Lodging/Hotel/Motel

☐ Restaurant/Dining/Fast Food ☐ Public Assembly/Religious ☐ Healthcare ☐ High-Rise Residential ☐ Other

Building Ownership: ☐ State-owned ☐ Local government-owned ☐ National account ☐ Speculative ☐ Private ☐ Other

Project Type: ☐ New Building ☐ Existing Building Addition ☐ Existing Building Renovation Valuation (If Renovation): $_____

90.1-2007 Section #	Plan Review	Complies			Comments/Assumptions[1]
		Y	N	N/A	
4.2.2 [PR1][1]	Plans and/or specifications provide all information with which compliance can be determined for the **building envelope** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
4.2.2, 6.4.2 [PR2][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **mechanical systems and equipment** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
4.2.2, 7.4.1 [PR3][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **service water heating systems and equipment** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
4.2.2, 8.4.1.1, 8.4.1.2 [PR4][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **lighting and electrical systems and equipment** and delineate and document where exceptions to the standard are claimed. Information provided should include interior and exterior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	☐	☐	☐	
6.7.2.4 [PR5][1]	Detailed instructions for HVAC systems commissioning included on the plans or specifications for ≥50,000 ft^2.	☐	☐	☐	
8.4.1.1 [PR6][2]	Feeder connectors sized in accordance with approved plans.	☐	☐	☐	
8.4.1.2 [PR7][2]	Branch circuits sized for maximum drop of 3%.	☐	☐	☐	

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 Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Footing / Foundation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
5.5.3.3 [FO1][2]	Below-grade wall insulation R-value.	R-_____	☐	☐	☐	
5.8.1.2 [FO2][2]	Below-grade wall insulation installed per manufacturer's instructions.		☐	☐	☐	
5.5.3.5 [FO3][2]	Slab edge insulation R-value.	R-_____ ☐ Unheated ☐ Heated	☐	☐	☐	
5.8.1.2 [FO4][2]	Slab edge insulation installed per manufacturer's instructions.		☐	☐	☐	
5.5.3.5 [FO5][2]	Slab edge insulation depth/length.	_____ ft	☐	☐	☐	
5.8.1.7 [FO6][1]	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities.		☐	☐	☐	
5.8.1.7.3 [FO7] [1]	Insulation in contact with the ground has ≤0.3% water absorption rate per ASTM C272.		☐	☐	☐	
6.3.2, 6.4.4.1, 6.4.4.2 [FO8][1]	Piping, ducts and plenum are insulated and sealed when installed in or under a slab.	R-_____	☐	☐	☐	
6.4.3.8 [FO9][3]	Freeze protection and snow/ice melting system sensors for future connection to controls.		☐	☐	☐	
6.5.8.2, 7.4.3 [FO10][1]	Any SWH piping in or under slab is insulated.	R-_____	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Framing / Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
5.4.3.2 [FR1][3]	Fenestration meets maximum air leakage requirements.	_____ cfm/ ft^2	☐	☐	☐	
5.4.3.2 [FR2][3]	Doors meet maximum air leakage requirements.	_____ cfm/ ft^2	☐	☐	☐	
5.4.3.2 [FR3][3]	Fenestration and doors labeled for air leakage.		☐	☐	☐	
5.4.3.4 [FR4][3]	Vestibules installed per approved plans.		☐	☐	☐	
5.5.3.1 [FR5][1]	Roof insulation R-value.	R-_____ ☐ Above deck ☐ Metal ☐ Attic	☐	☐	☐	
5.8.1.2 [FR6][1]	Roof insulation installed per manufacturer's instructions.		☐	☐	☐	
5.5.4.2.1, 5.5.4.2.2 [FR7][1]	Performance compliance approach submitted for vertical fenestration area >40% or skylight area >5%.		☐	☐	☐	
5.5.4.3a [FR8][1]	Vertical fenestration U-Factor.	U-_____	☐	☐	☐	
5.5.4.3b [FR9][1]	Skylight fenestration U-Factor.	U-_____	☐	☐	☐	
5.5.4.4.1 [FR10][1]	Vertical fenestration SHGC value.	SHGC: _____	☐	☐	☐	
5.5.4.4.2 [FR11][1]	Skylight SHGC value.	SHGC: _____	☐	☐	☐	
5.8.2.1 [FR12][2]	Fenestration products rated in accordance with NFRC.		☐	☐	☐	
5.8.2.2 [FR13][1]	Fenestration products are certified as to performance labels or certificates provided.		☐	☐	☐	
5.8.2.3, 5.5.3.6 [FR14][2]	U-factor of opaque doors associated with the building thermal envelope meets requirements.	U-_____ ☐ Swinging ☐ Nonswinging	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Plumbing Rough-In Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
7.4.3 [PL1][2]	Piping for recirculating and non-recirculating service hot-water systems insulated.	☐	☐	☐	
7.4.4.1 [PL2][3]C	Temperature controls installed on service water heating systems (≤120 ºF to max temp for intended use).	☐	☐	☐	
7.4.4.2 [PL3][1]	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	☐	☐	☐	
7.4.6 [PL4][3]	Heat traps Installed on non-circulating storage water tanks.	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
6.4.1.4, 6.4.1.5 [ME1][2]	HVAC equipment efficiency verified. Non-NAECA HVAC equipment labeled as meeting 90.1.	Efficiency: _____	☐	☐	☐	
6.4.1.5.2 [ME2][3]	PTAC and PTHP with sleeves 16 in by 42 in. labeled "for replacement only".		☐	☐	☐	
6.4.3.4.1 [ME3][3]	Stair and elevator shaft vents have motorized dampers that automatically close.		☐	☐	☐	
6.4.3.4.2, 6.4.3.4.3, 6.4.3.4.4 [ME4][3]	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.		☐	☐	☐	
6.4.3.4.5 [ME5][3]C	Ventilation fans >0.75 hp have automatic controls to shut off fan when not required.		☐	☐	☐	
6.4.3.9 [ME6][1]	Demand control ventilation provided for spaces >500 ft^2 and >40 people/1000 ft^2 occupant density and served by systems with air side economizer, auto modulating outside air damper control or design airflow >3,000 cfm.		☐	☐	☐	
6.4.4.1.1 [ME7][3]	Insulation exposed to weather protected from damage. Insulation outside of the conditioned space and associated with cooling systems is vapor retardant.		☐	☐	☐	
6.4.4.1.2 [ME8][2]	HVAC ducts and plenums insulated.	R-_____	☐	☐	☐	
6.4.4.1.3 [ME9][2]	HVAC piping insulation thickness.	_____ in.	☐	☐	☐	
6.4.4.2.1 [ME10][2]	Ducts and plenums sealed based on static pressure and location.		☐	☐	☐	
6.4.4.2.2 [ME11][3]C	Ductwork operating >3 in. water column requires air leakage testing.		☐	☐	☐	
6.5.1, 6.5.1.1.1, 6.5.1.1.2, 6.5.1.1.3, 6.5.1.3 [ME12][1]	Air economizers provided where required, meet the requirements for design capacity, control signal, and high-limit shut-off and integrated economizer control.		☐	☐	☐	
6.5.1.1.4 [ME13][2]	Return air and outdoor air dampers meet minimum air leakage requirements.		☐	☐	☐	
6.5.1.1.5 [ME14][1]	Means provided to relieve excess outside air.		☐	☐	☐	
6.5.1.2,	Water economizers provided where required,		☐	☐	☐	

90.1-2007 Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
6.5.1.2.1, 6.5.1.2.2, 6.5.1.3 [ME15][1] C	meet the requirements for design capacity, maximum pressure drop and integrated economizer control and heating system impact.					
6.5.1.4 [ME16][1]	Economizer operation will not increase heating energy use during normal operation.		☐	☐	☐	
6.5.2.1 [ME17] [1]	Zone controls can limit simultaneous heating and cooling and sequence heating and cooling to each zone.		☐	☐	☐	
6.5.2.2.3 [ME18] [2] C	Hydronic heat pump systems connected to a common water loop meet heat rejection and heat addition requirements.		☐	☐	☐	
6.5.2.3 [ME19] [3]C	Dehumidification controls provided to prevent reheating, recooling, mixing of hot and cold airstreams or concurrent heating and cooling of the same airstream.		☐	☐	☐	
6.5.2.4 [ME20] [3]C	Water economizer specified on hydronic cooling and humidification systems designed to maintain inside humidity at > 35 ºF dewpoint if an economizer is required.		☐	☐	☐	
6.5.3.1.2 [ME21] [2]	HVAC fan motors not larger than the first available motor size greater than the bhp.	bhp: _____	☐	☐	☐	
6.5.3.2.1 [ME22] [2] C	VAV fan motors ≥10 hp to be driven by mechanical or electrical variable speed drive, or have a vane-axial fan with variable pitch blades, or have controls or devices to limit fan motor demand to ≤30% of design wattage at 50% design air volume at static pressure of 1/3 total rated static pressure of the fan.	☐ VSD ☐ Vane axial fan ☐ Other	☐	☐	☐	
6.5.3.2.2 [ME23] [2] C	VAV fans have static pressure sensors positioned so setpoint ≤1/3 total design pressure.		☐	☐	☐	
6.5.3.2.3 [ME24] [2] C	Reset static pressure setpoint for DDC controlled VAV boxes reporting to central controller based on the zones requiring the most pressure.		☐	☐	☐	
6.5.4.1 [ME25] [3]C	HVAC pumping systems >10 hp designed for variable fluid flow.		☐	☐	☐	
6.5.4.2 [ME26] [3]C	Reduce flow in pumping systems >10 hp. to multiple chillers or boilers when others are shut down.		☐	☐	☐	
6.5.4.3 [ME27] [3]C	Temperature reset by representative building loads in pumping systems >10 hp for chiller and boiler systems > 300,000 Btu/h.		☐	☐	☐	
6.5.4.4 [ME28] [3]C	Two-position automatic valve interlocked to shut off water flow when hydronic heat pump with pumping system >10 hp is off.		☐	☐	☐	
6.5.5.2 [ME29] [3]C	Fan systems with motors ≥7.5 hp associated with heat rejection equipment to have capability to operate at 2/3 of full-speed and auto speed controls to control the leaving fluid temp or condensing temp/pressure of heat rejection device.		☐	☐	☐	
6.5.6.1 [ME30][1]	Exhaust air energy recovery on systems ≥5,000 cfm and 70% of design supply air.		☐	☐	☐	

90.1-2007 Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
6.5.6.2, 6.5.6.2.1, 6.5.6.2.2 [ME31] [3]C	Condenser heat recovery system that can heat water to 85 ºF or provide 60% of peak heat rejection is installed for preheating of service hot water in 24/7 facility, water cooled systems reject >6 MMBtu, SHW load ≥1 MMBtu.		☐	☐	☐	
6.5.7.1 [ME32] [2]	Kitchen hoods >5K cfm have make up air ≥50% of exhaust air volume.		☐	☐	☐	
6.5.7.2 [ME33][1]C	Fume hoods exhaust systems ≥15,000 cfm have VAV hood exhaust and supply systems, direct make-up air or heat recovery.		☐	☐	☐	
6.5.8.1 [ME34] [3]	Unenclosed spaces that are heated use only radiant heat.		☐	☐	☐	
6.5.9 [ME35][1] C	Hot gas bypass limited to: ≤240 kBtu/h – 50% >240 kBtu/h – 25%		☐	☐	☐	
7.4.2 [ME36][2]C	Service water heating equipment meets efficiency requirements.		☐	☐	☐	
7.5.1 [ME37][2] C	Combined space and water heating system not allowed unless standby loss less than calculated maximum. AHJ has approved or combined connected load <150 KBtu/h.		☐	☐	☐	
7.5.2 [ME38][2] C	Service water heating equipment used for space heating complies with the service water heating equipment requirements.		☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Rough-In Electrical Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
9.4.1.1 [EL1] [2]	Automatic lighting control to shut off all building lighting installed in buildings >5,000 ft^2.	☐	☐	☐	
9.4.1.2 [EL2] [2]	Independent lighting control installed per approved lighting plans and all manual control readily accessible and visible to occupants.	☐	☐	☐	
9.4.1.3 [EL3] [2]	Automatic lighting controls for exterior lighting installed.	☐	☐	☐	
9.4.1.4 [EL4] [1]	Verify separate lighting control devices for specific uses installed per approved lighting plans.	☐	☐	☐	
9.4.2 [EL5] [3]	Ballasted one and three lamp fixtures with >30 W/lamp have two lamp tandem wired ballasts when ≥2 fixtures in same space on same control.	☐	☐	☐	
9.4.3 [EL6] [1]	Exit signs do not exceed 5 watts per face.	☐	☐	☐	
9.4.4 [EL7] [1]	Exterior grounds lighting over 100 W provides >60 m/W unless on motion sensor or fixture is exempt from scope of code or from external LPD.	☐	☐	☐	
9.6.2 [EL8] [1]	Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.	☐	☐	☐	
10.4.1 [EL9] [2]	Electric motors meet requirements where applicable.	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Insulation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
5.4.3.1 [IN1][1]	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed or weather stripped to minimize air leakage.		☐	☐	☐	
5.5.3.1 [IN2][1]	Roof insulation R-value.	R-_____	☐	☐	☐	
5.8.1.2, 5.8.1.3 [IN3][1]	Roof insulation installed per manufacturer's instructions. Blown or poured loose-fill insulation is installed only where the roof slope is ≤3 in 12.		☐	☐	☐	
5.5.3.1 [IN4][3]	Skylight curbs insulated to the level of roofs with insulation above deck or R-5.	R-_____	☐	☐	☐	
5.5.3.1.1 [IN5][3]	High-albedo roofs meet solar reflectance of 0.70 and thermal emittance of 0.75 or SRI of 82.	SR: _____ SRI: _____	☐	☐	☐	
5.5.3.2 [IN6][1]	Above-grade wall insulation R-value.	R-_____ ☐ Mass ☐ Metal ☐ Steel ☐ Wood	☐	☐	☐	
5.8.1.3 [IN7][1]	Above-grade wall insulation installed per manufacturer's instructions.		☐	☐	☐	
5.5.3.4 [IN8][2]	Floor insulation R-value.	R-_____ ☐ Mass ☐ Steel ☐ Wood	☐	☐	☐	
5.8.1.3 [IN9][2]	Floor insulation installed per manufacturer's instructions.		☐	☐	☐	
5.8.1.1 [IN10][2]	Building envelope insulation is labeled with R-value or insulation certificate providing R-value and other relevant data.		☐	☐	☐	
5.8.1.4 [IN11][2]	Eaves are baffled to deflect air to above the insulation.		☐	☐	☐	
5.8.1.5 [IN12][2]	Insulation is installed in substantial contact with the inside surface separating conditioned space from unconditional space.		☐	☐	☐	
5.8.1.6 [IN13][2]	Recessed equipment installed in building envelope assemblies does not compress the adjacent insulation.		☐	☐	☐	
5.8.1.7 [IN14][2]	Exterior insulation is protected from damage with a protective material.		☐	☐	☐	
5.8.1.7.1 [IN15][2]	Attics and mechanical rooms have insulation protected where adjacent to attic or equipment		☐	☐	☐	

90.1-2007 Section #	Insulation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
	access.					
5.8.1.7.2 [IN16] [2]	Foundation vents do not interfere with insulation.		☐	☐	☐	
5.8.1.8 [IN17] [3]	Insulation intended to meet the roof insulation requirements not installed on top of a suspended ceiling.		☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____
Date:_____ Name of Evaluator(s): _____

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

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

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

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Final Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
5.4.3.3 [FI1] [1]	Weatherseals installed on all loading dock cargo doors in Climate Zones 4-8.	☐	☐	☐	
6.4.3.1.1 [FI2] [2]	Heating and cooling to each zone is controlled by a thermostat control.	☐	☐	☐	
6.4.3.1.2, 6.4.3.2, 6.4.3.3, 6.4.3.3.1, 6.4.3.3.2 [FI3] [2]	Temperature controls have the following features: dead band controls, setpoint overlap restrictions, off-hour controls, automatic shutdown, setback controls.	☐	☐	☐	
6.4.3.3.3 [FI4] [2]	Systems with air capacity >10,000 cfm include optimum start controls.	☐	☐	☐	
6.4.3.5 [FI5] [3]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐	☐	☐	
6.4.3.7 [FI6] [3]C	When humidification and dehumidification is provided to a zone simultaneous operation is not possible.	☐	☐	☐	
6.7.2.1 [FI7] [3]	Furnish HVAC "as-built" drawings submitted within 90 days of system acceptance.	☐	☐	☐	
6.7.2.2 [FI8] [3]	Furnish O&M manual for HVAC systems.	☐	☐	☐	
6.7.2.3 [F9] [1]C	An air and/or hydronic system balancing report is provided for HVAC systems serving zones >5,000 ft^2 of conditioned area.	☐	☐	☐	
6.7.2.4 [FI0] [1]C	Verify HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	☐	☐	☐	
7.4.4.3 [FI11] [3]	Public lavatory faucet water temperature not greater than 110 ^{o}F.	☐	☐	☐	
7.4.4.4 [FI12] [3]	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank.	☐	☐	☐	
7.4.5.1 [FI13] [3]C	Pool heaters are equipped with on/off switch and no continuous burning pilot light.	☐	☐	☐	
7.4.5.2 [FI14] [2]C	Pool covers are provided for heated pools and pools heated to >90˚F have a cover ≥R-12.	☐	☐	☐	
7.4.5.3 [FI15] [3]C	Time switches are installed on all pool heaters and pumps.	☐	☐	☐	
8.7.1 [FI16] [3]	Furnished as-built drawings for electric power systems.	☐	☐	☐	
8.7.2 [FI17] [3]	Furnished O&M manual for electrical power systems and equipment.	☐	☐	☐	
9.1.3 [FI8] [1]	Installed lamps and fixtures are consistent with what is shown on the approved lighting plans.	☐	☐	☐	

Additional Comments/Assumptions: _____

Evaluator Assessment

Please provide a general description of what was discovered during the onsite evaluation, and a professional estimate of what you feel the compliance rating should be, regardless of the individual metrics scored above. Include your assessment of the most impactful energy requirements for this particular building.

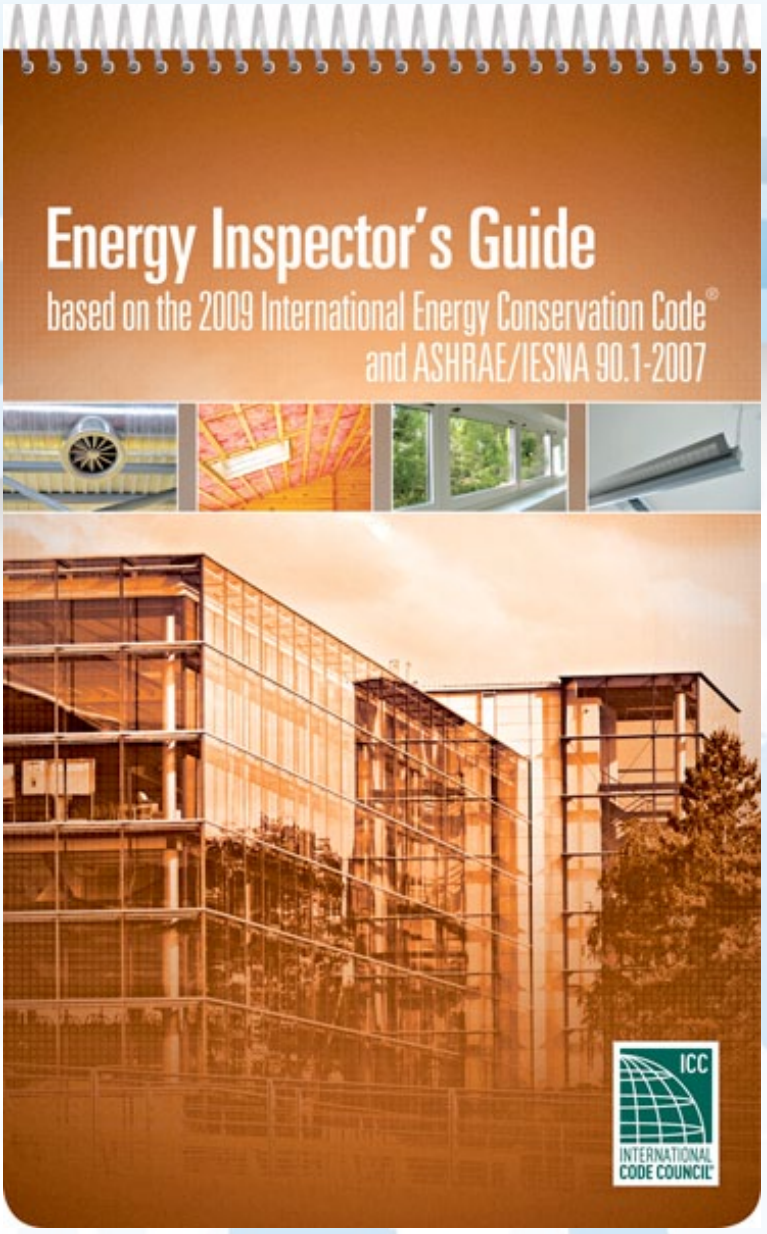
_____

KEY	1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)	C	Complex Mechanical

ICC ENERGY INSPECTOR'S GUIDE

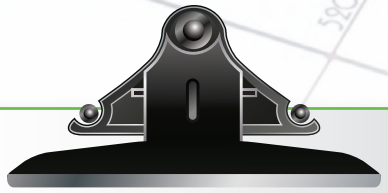
Your ideal resource for effective, accurate, consistent, and complete commercial and residential energy provisions. This handy pocket guide is organized in a manner consistent with the inspection sequence and process for easy use on site. Increase inspection effectiveness by focusing on the most common issues relevant to energy conservation.

You can find this product at **www.iccsafe.org/DOEreferences**.



Commercial

Training and Support



What's in it FOR ME?

In this section you'll find:

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

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Standard 90.1-2007 and 2009 IECC – Building Envelope, Mechanical, and Lighting Requirements

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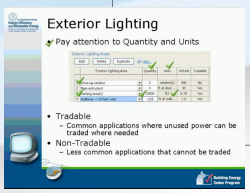

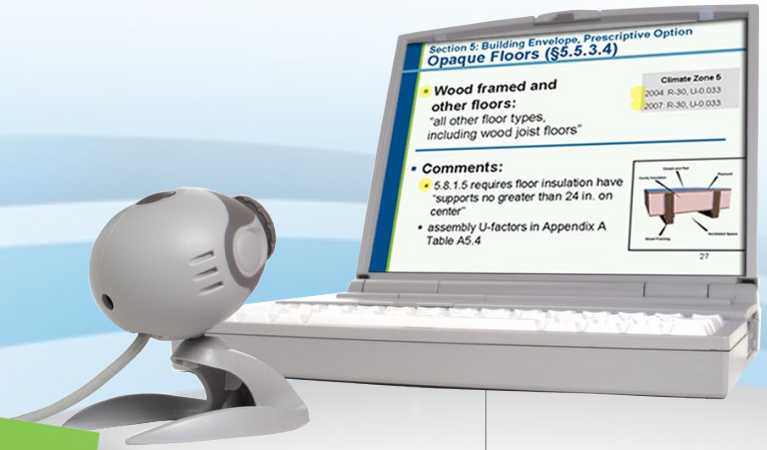

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ICC INTERNATIONAL CODE COUNCIL Commercial TRAINING

Training Seminars

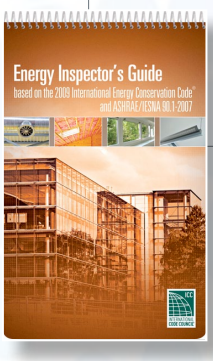
2009 IECC Update

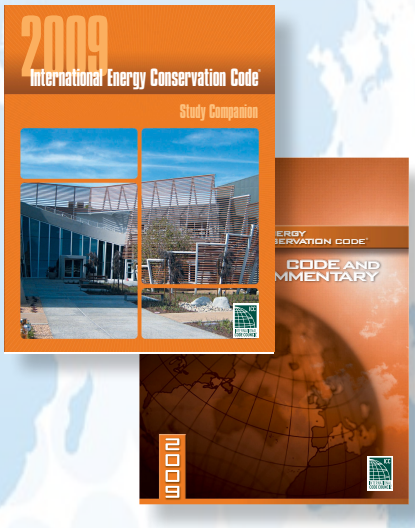
"This seminar introduces participants to the major changes from the 2006 IECC to the 2009 IECC. Participants will discuss the changes, reasons for the changes, and take part in knowledge review activities. Information presented will allow participants to apply these new code requirements to design, plan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

2009 IECC Fundamentals

Online Certification Practice Course
2009 IECC Commercial Energy Plan Examiner Certification Exam Practice Course

Online CEU
2009 IECC Commercial Energy Plans Examiner Online Renewal Update





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

SUPPORT FOR CODE OFFICIALS

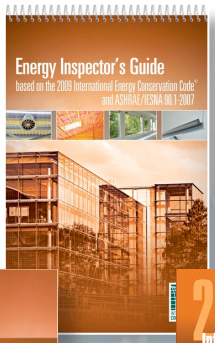
Whether you're looking for published resources, frequently asked questions, or technical support, **BECP's Solutions and Help Center** will point you in the right direction.

Building Energy Codes Commercial SUPPORT

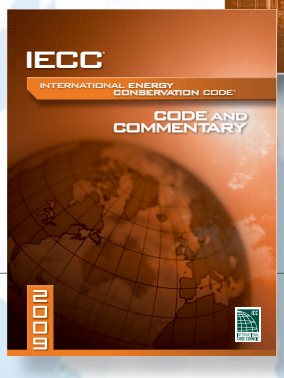
Find more at **www.energycodes.gov/help**

Commercial 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



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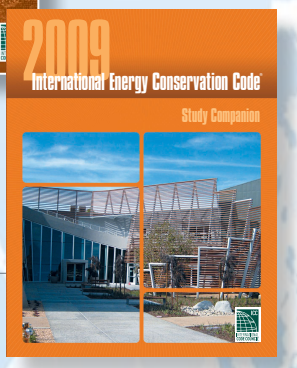


2009 International Energy Conservation Code® ***Study Companion***

COMMERCIAL CODES
Examples of Frequently Asked Questions (FAQs)

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 commercial energy code your state has adopted. Often, commercial buildings must comply with a certain version of either the International Code Council's (ICC's) International Energy Conservation Code (IECC) or ASHRAE Standard 90.1 – *Energy Standard for Buildings Except Low-Rise Residential Buildings*. 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 COM*check*™ software** at no charge, or simply launch COM*check*-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**)**. ASHRAE Standard 90.1 can be purchased from the ASHRAE website (www.ashrae.org). With new DOE funding, the 2009 IECC and Standard 90.1-2007 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, whether you are complying with the IECC or ASHRAE 90.1. In the IECC you will need the information from Table 502.2 (1) and Table 502.3. In ASHRAE 90.1 the information is found in Table 5.5-1-8, insulation levels for high albedo roofs can be found in Table 5.5.3.1, and SHGC multipliers for permanent projections is in Table 5.5.4.4.1 They are several ways to get this information:

- Call, or stop by, your local building department and ask them.
- Obtain a copy of the code book (see above).
- 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: My project has both businesses and homes; is it residential or commercial?

A: For mixed-use buildings that are three stories or less and have residential and commercial space, the way to determine if the entire building can shown to meet code under residential or commercial is the percentage of the space types. If the residential is 10% or less of the overall building then the entire building can fall under commercial. It is always easier to show compliance for the entire exterior thermal building envelope instead of breaking the building apart. If using COM*check*™, the apartments would be multi-family under the space-types option and the other areas should also be designated according to their activities. Remember, if the building is four stories or greater, it is commercial.

Q: Do the last IECC versions reference the ASHRAE Standard in such a way as to require the commissioning work described in them?

A: ASHRAE Standards 90.1-2004 and 90.1-2007 require plans and specs to include detail descriptions for commissioning of HVAC systems and their controls in buildings with conditioned space greater than 50,000 square feet.

- The 2009 IECC allows a code user to use either 90.1-2007 in its entirety (including the HVAC requirements) or to use the requirements in Chapter 5 of the 2009 IECC. Chapter 5 of the 2009 IECC does not have any specific commissioning requirements. There are air system and hydronic system balancing requirements, but nothing specifically labeled "commissioning" or "functional testing". Commissioning requirements have been proposed for the IECC before and will be discussed for the 2012 IECC.

COM*check*™-specific FAQs

Q: Can I use COMcheck™ in my state?

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

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 commercial software products at this time to comply using this approach, but future versions of the COM*check*™ software will include the DOE-2 energy analysis engine to perform the necessary calculations needed to determine compliance. Samples of performance software available 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 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 COM*check*™, 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 (ft^2) and insulation R-value of new ceiling,
- Exterior walls – gross area (ft^2) 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 (ft^2) of windows and/or doors with U-factor from NFRC label or default table in the help section of COM*check*™.
- Floor – gross area (ft^2) 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 only lighting (or mechanical, or envelope)?

A: COM*check*™ will calculate compliance for your project as you define it. For example, if your project is a tenant improvement with new interior lighting, new exterior lighting and mechanical, you would not need to fill in the envelope tab. Conversely, if your project is new construction of an unoccupied commercial shell and there is no interior lighting or mechanical system, you would not fill out those tabs.

Q: Please explain how to use different wattage luminaire and comply with the code.

A: For example, does my lighting comply, if my building that is using a Halo H71CT 6" ceiling insulated Recessed Housing which accepts a R-30 type bulb, the bulb specified is a "15 Watt CFL, Light Bulb - 65 W Equal-Warm White 27000K - R30 Reflector - Energy Miser FE-R30-15W-27k", can this information be input into the COM*check*™ Compliance Software as 15 Watt CFL, instead of a 65 Watt incandescent to show that it is in compliance?

- The 2006 IECC requires that screw-based luminaries be counted for compliance based on the rated wattage of the luminaire. The basis for this requirement is that after occupancy and initial lamp burnout, any wattage lamp could be put in and the maximum luminaire wattage rating most reasonably represents true lighting application. This can make compliance difficult if a lower wattage lamp is intended to be used. This is why some designers contract with manufacturers to label luminaries with a lower wattage rating that ensures that future lamp replacements are limited to this maximum wattage. COM*check*™ is a tool that follows the adopted codes; therefore, the labeled wattage of the luminaire is the appropriate input for code compliance and the COM*check*™ tool.

Code Notes

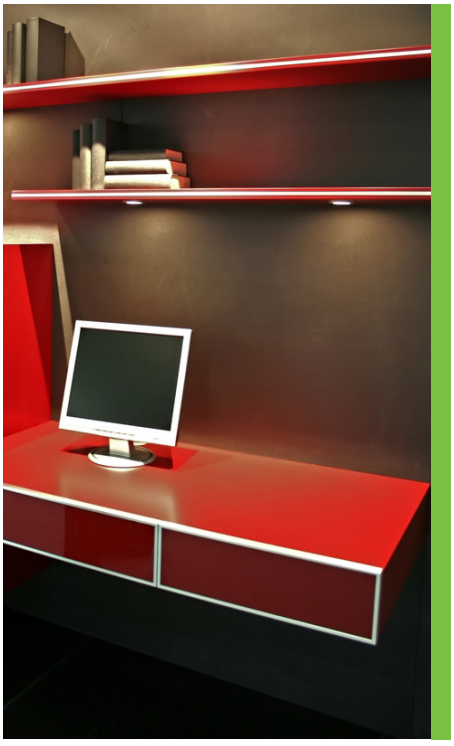
Task Lighting in Offices

[ASHRAE 90.1-2007, 2009 IECC].

Defining task lighting. The appropriate treatment of task lighting for energy code compliance has always been a potentially confusing issue. The intent of ANSI/ASHRAE/IESNA Standard 90.1-2007 (as well as previous versions back to 1999) and the International Energy Conservation Code® (IECC) (including versions back to 2003) is for task lighting to be included in compliance calculations when it is part of the lighting design. This applies to office spaces where task lighting is common as well as other spaces where task lighting may appear in various forms.

Current office lighting design trends are evolving to incorporate more task and less overhead ambient lighting. These designs provide more flexibility and may require less installed power. The power density requirements in Standard 90.1 and IECC accommodate this design trend by requiring compliance for the entire lighting design, including task lighting. The wording in the definition of installed interior lighting power (in ASHRAE 90.1-2007) clearly notes that "…all permanently installed general, task, and furniture lighting systems and luminaires" must be included as part of the lighting power density for compliance. The IECC does not have a similar specific definition that relates to task lighting, but the intent and expected application are the same.

Current office lighting design trends are evolving to incorporate more task and less overhead ambient lighting.



Furniture-mounted task lighting

Furniture-mounted task lighting is often used in office spaces. In some cases, this furniture-mounted lighting is a planned element of the overall lighting design and by definition should be included for compliance. In other cases, furniture is a future tenant responsibility and the complete space lighting design is composed of typical overhead and other permanent luminaires only. Any lighting that was not part of the overall design and is brought in later by tenants, whether it is furniture mounted or portable, would not be included as part of energy compliance.

When considering code compliance for renovations, similar compliance guidelines would apply. Furniture or task lighting that is part of the design for the new lighting after renovations needs to comply with the Standard's guidelines for task lighting. Note that Standard 90.1 requires that all task lighting be separately controlled from general lighting. Standard 90.1-2007 and IECC 2009 both include an exception to counting the wattage of furniture-mounted task lighting as part of the lighting power density compliance when the task lighting is controlled by occupancy sensing or similar automatic shutoff.

Plan Review

1. Verify that the lighting schedule specifies all designed lighting. For task lighting that is considered part of the overall design, but not yet specified (for example, undershelf task lighting that will be brought in as part of furniture systems by a tenant), the compliance documentation should provide an accounting or estimate of this lighting as part of the complete space design.
2. Verify that the manufacturer's data on furniture and other equipment that incorporates task lighting, and which is part of the lighting design of the space, specify how the task lighting will be shut off. It should be shut off either by an integral control device or other accessible control visible to the occupant within the intended space.
3. Verify that any supplemental task lighting being claimed under the exemption is controlled with an automatic sensor.

Field Inspection

1. Verify that installed supplemental lighting has an integral control device. For furniture-mounted task lighting that is being exempted, the control must be automatic, such as an occupancy sensor.
2. Verify that non-exempted task lighting can be manually switched on and off either within the equipment/furniture or in a location accessible by the occupant.

Code Citations*

- ASHRAE 90.1-2007, 3.2 Installed Interior Lighting Power.
  - The power in watts of all permanently installed general, task, and furniture lighting systems and luminaires.
- ASHRAE 90.1-2007, 9.4.1.4 Additional Controls.
  - d. *Task Lighting* - supplemental task lighting, including permanently installed undershelf or undercabinet lighting shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided that the control device is readily accessible and located so that the occupant can see the controlled lighting.
- IECC 2009, Section 505.5.1 Total connected interior lighting power.
  - The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment.
- IECC 2009, Section 505.5.1.3 Other Luminaires.
  - The wattage of all other lighting equipment shall be the wattage of the lighting equipment verified through data furnished by the manufacturer or other approved sources.

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Code Notes

Automatic Lighting Shutoff for Tenant Spaces (Located at: www.energycodes.gov/help/notes.stm)

[ASHRAE 90.1-2007, 2009 IECC]. Automatic shutoff capability for all interior building lighting (with exceptions) is required by ANSI/ASHRAE/IESNA Standard 90.1-2007 (as well as previous versions back to 1999) and the 2009 International Energy Conservation Code® (IECC) (including versions back to 2003) for buildings over 5,000 square feet. The energy-saving intent of the requirement is to be sure that unnecessary lights are turned off, such as those not needed after the end of the business day. The requirement itself ensures that the control is available so that occupants can set up automatic shutoff of lighting.

The requirement does have important exceptions including: lighting intended for 24-hour operation, lighting in spaces where patient care is rendered, and lighting in spaces where automatic shutoff would endanger the safety or security of the room or occupants. The IECC has a specific exception for sleeping units within hotels, motels, boarding houses, and similar buildings, while Standard 90.1 considers these spaces exempted under the 24-hour-operation exemption.

Retail strip mall with several types of occupants. Each type of occupant will have different lighting needs.

The size threshold issue and tenant spaces

The 5,000-square-foot threshold was originally included because of the potential impracticality and relative high cost of whole-building control systems for smaller buildings. This threshold is easy to apply for single-tenant buildings and for buildings with structured or uniform operating hours because the building schedule can be easily programmed into a whole-building system.

However, some building types with multiple tenant occupancies do not lend themselves to practical application of whole-building control. One classic example is the typical retail strip mall. If a strip mall is over 5,000 square feet in total, the code language (as written in the controls section) technically requires complete, automatic shutoff for the building as a whole. Because each retail business will typically have different operating schedules, it is difficult and often impractical to apply a whole-building control system.

Typically, individual tenant businesses (such as those in a strip mall structure) will have separate electrical feeds and firewalls between adjoining tenants, effectively making them separate business entities. In these cases, the whole building automatic shutoff is intended to be applied on a tenant business basis; those individual businesses less than 5,000 square feet would not have to comply with the automatic lighting shutoff requirement. The intent in both ASHRAE 90.1 and the IECC code is to apply this requirement in a practical manner. ASHRAE 90.1 interpretations and IECC staff opinions are likely to focus on the uniqueness of business schedules and separate electrical services in determining appropriate application of the 5,000-square-foot threshold. It is anticipated that future versions of Standard 90.1 (2010 and beyond) and IECC (2012 and beyond) will eliminate the 5,000-square-foot exception because costs have come down on whole-building controls and the requirement already offers an alternative in the form of individual space occupancy sensors or other automatic controls.

Plan Review

1. Verify that the lighting and/or electrical control plans specify controls to be installed that meet the provisions of the code, including the control area limitations. Check individual tenant space sizes for an applicable exemption.

2. Verify from the design submission (plans and specifications) that the control has appropriate scheduling capability in sufficient detail for the intended use of the space or building. An appropriate scheduling control should be capable of maintaining the type of day (weekday or weekend) and appropriate lighting schedule for that day type.

Field Inspection

1. Verify that controls installed meet the capabilities and requirements as shown on the plans.

2. Verify the automatic control device will shut off during the designated or programmed times as scheduled for each day of the week.

Code Citations*

ASHRAE Standard 90.1-2007, Section 9.4.1.1 and 2009 IECC, Section 505.2.2.2, Automatic Lighting Shutoff

Interior lighting in buildings larger than 5000 ft^2 shall be controlled with an automatic control device to shut off building lighting in all spaces. This automatic control device shall function on either

1. A scheduled basis using a time-of-day operated control device that turns lighting off at specific programmed times—an independent program schedule shall be provided for areas of no more than 25,000 ft2 but not more than one floor or
2. An occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space or
3. A signal from another control or alarm system that indicates the area is unoccupied.

The following shall not require an automatic control device:

1. Lighting intended for 24-hour operation
2. Lighting in spaces where patient care is rendered
3. Lighting in spaces where an automatic shutoff would endanger the safety or security of the room or building occupant(s).

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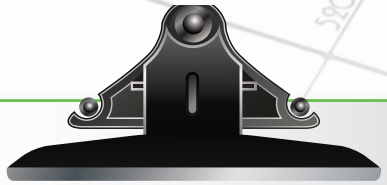
Further Resources

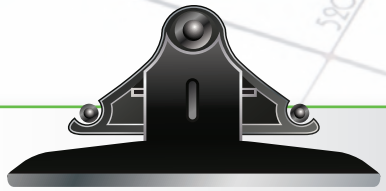


What's in it FOR ME?

In this section you'll find:

- **For Your Customers:** Flyers of resources from both BECP and ICC to help your building department provide answers and solutions. When local building professionals and owners ask about energy codes and standards, these flyers may come in handy.
- **Hot off the Presses:** The latest news on the world of energy codes, including BECP's *Setting the Standard* quarterly newsletter and other occasional articles as they are released. Make sure to register your packet to receive news and updates to other packet materials. Just visit: **www.energycodes.gov/publications/packetRegistration.php**
- **State and Local Resources:** we've left this tab open for code officials to insert energy codes guidance from closer to home.

For your Customers



In this section you'll find:

- ☑ Materials from BECP and ICC to help you direct others to energy codes answers.

What's in it FOR ME?

Building Energy Codes Assistance

Building Energy Codes Assistance for States and Stakeholders	**Status of State Energy Codes**	Check on the current code status of any U.S. state or territory using BECP's interactive map tool. Also find links to state specific portions of BECP's recent nationwide analysis reports, state-level energy official contact information, and many other details.	www.energycodes.gov/states
	Technical Assistance to States	BECP provides specialized technical assistance to the states in the form of economic analysis, code comparisons, webcast training, and compliance material development requested by states to help them adopt, upgrade, implement, and enforce their building energy codes.	www.energycodes.gov/states/techAssist.stm
	Compliance Assistance	BECP has developed an approach states and local jurisdictions can use for measuring compliance with building energy codes, including a variety of tools and resources such as inspection checklists.	www.energycodes.gov/arra/compliance_evaluation.stm
No-cost Compliance Tools	**Residential Code Compliance Software**	RES*check*™ and RES*check*-*Web*™	www.energycodes.gov/software.stm
	Commercial Code Compliance Software	COM*check*™ and COM*check*-*Web*™	
Training	**Building Energy Codes University (BECU)**	To help stakeholders broaden and deepen their knowledge of building energy codes, BECP is collecting its diverse training resources in an extensive Building Energy Codes University (BECU) that features webcasts, training videos, self-paced online courses, presentations, and other BECP materials and tools.	www.energycodes.gov/becu/
Solutions and Help Center	**Building Energy Codes Solutions**	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.	www.energycodes.gov/help
Advocacy	**The Building Codes Assistance Project (BCAP)**	BCAP is an initiative of the Alliance to Save Energy, the American Council for an Energy-Efficient Economy, and the Natural Resource Defense Council that provides states with code advocacy assistance on behalf of DOE.	www.bcap-energy.org

The U.S. Department of Energy's Building Energy Codes Program is an information resource on national model energy codes. We work with other government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger building energy codes and provide assistance to those who have an impact on energy code adoption and compliance.

BECP Website:
www.energycodes.gov

BECP Technical Support:
techsupport@becp.pnl.gov
www.energycodes.gov/help

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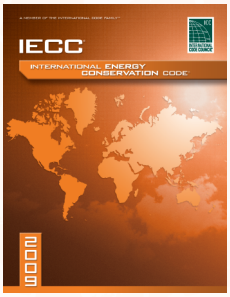
Helpful Code Tools from ICC



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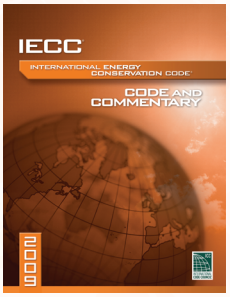

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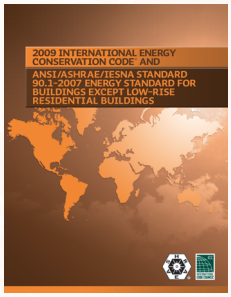

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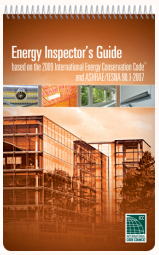

D

E

A: 2009 INTERNATIONAL ENERGY CONSERVATION CODE®

Encourages energy conservation through efficiency in envelope design, mechanical systems, lighting systems, and the use of new materials and techniques. New requirements address: energy savings, R-values in various regions, window and door U-factor and SHGC values, and more. (94 pages)

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CODE AND COMMENTARY TOGETHER!

B: 2009 IECC: CODE AND COMMENTARY

Includes the full text of the IECC, including tables and figures, followed by corresponding commentary at the end of each section in a single document.

- Read expert Commentary after each code section.
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FROM ICC AND ASHRAE!

C: 2009 IECC® ANDASHRAE/IESNA STANDARD 90.1-2007

This convenient publication contains 2009 IECC and ANSI/ASHRAE/IESNA *Standard 90.1-2007: Energy Standard for Buildings Except Low-Rise Residential Buildings* in a single volume to provide you with the information you need to achieve optimal energy conservation. (359 pages)

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D: ENERGY INSPECTOR'S GUIDE: BASED ON THE 2009 INTERNATIONAL ENERGY CONSERVATION CODE® AND ASHRAE/IESNA 90.1-2007

Your ideal resource for effective, accurate, consistent, and complete commercial and residential energy provisions. This handy pocket guide is organized in a manner consistent with the inspection sequence and process for easy use on site. Increase inspection effectiveness by focusing on the most common issues relevant to energy conservation. (100 pages)

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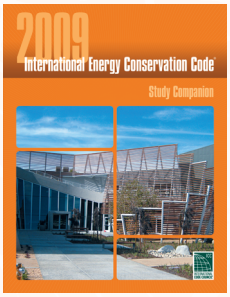

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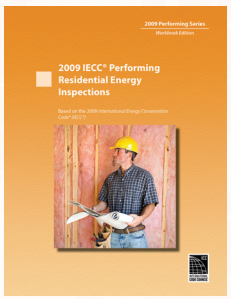

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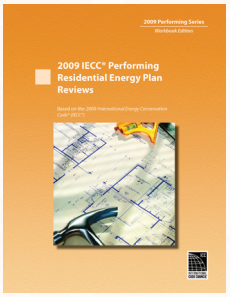

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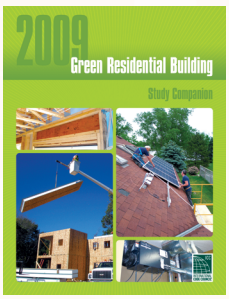

E

A: FLASH CARDS: 2009 IECC
Provides code users, students and exam candidates with an effective, time-tested, easy-to-use method for study and information retention. Prepared and reviewed by code experts to ensure accuracy and quality. (60 cards)
#1821S09 | LIST $17 | **ICC MEMBER $13.50**

B: 2009 INTERNATIONAL ENERGY CONSERVATION CODE® STUDY COMPANION
Provides an overview of the energy conservation provisions of the 2009 IECC®, including the requirements for both residential and commercial energy efficiency.
- 10 study sessions
- 20-question quiz at end of each study session
- 200 total study questions with answer key

Great resource for Certification exams: Commercial Energy Inspector, Commercial Energy Plans Examiner, Residential Energy Inspector/Plans Examiner, or Green Building—Residential Examiner. (188 pages)
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C: 2009 IECC® PERFORMING RESIDENTIAL ENERGY INSPECTIONS TRAINING WORKBOOK
Intended to help the building inspector, to identify those areas to inspect on the site that were approved in the review and ensure compliance with the IECC®.
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Intended to help the energy plan reviewer to identify those areas to inspect in the structure after approval in the review and ensure compliance with the IECC®. Kit includes plans, plan review record and workbook.
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D: 2009 IECC® FUNDAMENTALS RESIDENTIAL PROVISIONS FOR BUILDERS TRAINING WORKBOOK
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2009 IECC® FUNDAMENTALS RESIDENTIAL PROVISIONS FOR DESIGNERS TRAINING WORKBOOK
Build understanding of the intent of the code through case studies and real examples that are tailored to address the perspective of the design professional.
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A comprehensive self-study guide for the requirements of *ICC 700-2008: National Green Building Standard™* and the referenced sections of the 2009 IRC and IECC®. The Study Companion's 16 study sessions provide learning objectives, applicable code text and commentary, and a list of questions summarizing key points for study. A quiz at the end of each study session enables users to test their knowledge of the material. The answer key indicates the correct response and reference for each of the 256 total questions. (330 pages)
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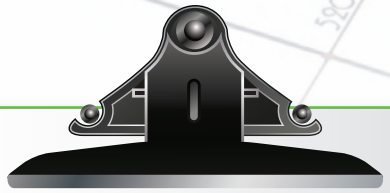
Hot off the Presses



In this section you'll find:

- DOE's *Setting the Standard* quarterly newsletter
- Codes-related articles as they are released

What's in it FOR ME?

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

SETTING THE STANDARD

Volume 14, Issue 3 July 2010

Welcome to Charlotte!

If you've just arrived at *Energy Codes 2010: The Future is Now*, welcome! The U.S. Department of Energy's (DOE's) Building Energy Codes Program (BECP) is thrilled that you've joined us for this annual training event. Or perhaps there is still time to make your last-minute arrangements at **www.energycodes.gov/events/energycodes**. The future of energy codes is now—be a part of the conversation!

"Green" and "Sustainable" More than Buzzwords in New Codes and Beyond

During the first decade of the 21st century, "green" and "sustainable" became part of our society's shared language. However, like a great song that gets far too much radio play, the terms have nearly worn out their welcome—and have left many wondering what they really mean. As a new decade begins, the world of building efficiency is showing what "green" can mean by offering sustainable building guidelines that can be adopted, implemented, and enforced in local jurisdictions.

Local and statewide efforts over the last decade have been broadening the scope of energy codes to include comprehensive sustainability measures. Until recently, states and local jurisdictions interested in sustainable development and green building codes have had no choice but to develop their own programs. The results have included successful programs such as Austin, Texas's Austin Energy® Green Building Program and Build it Green, a non-profit organization in California. These and other similar programs vary widely in scope—from a requirement to perform a certain percentage above baseline energy code(s) to a comprehensive rating system, as in the U.S. Green Building Council's (USGBC's) Leadership in Energy and Environmental Design (LEED) or the Green Building Initiative's Green Globes®. ENERGY STAR, a joint efficiency effort of the EPA and DOE, has also been adopted as the minimum energy code in many jurisdictions in New York. Today, new options are surfacing that allow jurisdictions to rely on adopted, codified language maintained by a national code body.

One example is the ANSI/ASHRAE/IESNA/USGBC[1] Standard 189.1-2009, a commercial building energy code published in January 2010. Standard 189.1 examines new factors to determine a building's total impact and performance including site sustainability; water use efficiency; indoor environmental air quality; impact on the atmosphere, materials, and resources; as well as building commissioning and operation practices. The standard also has a close cousin in the development stage: ASHRAE/ASHE[2] Standard 189.2: *Design, Construction and Operation of Sustainable High Performance Health Care Facilities*—a building sector with unique needs and unmatched energy use.

The International Code Council's (ICC's) collaborative development effort with the American Institute of Architects and the American Society for the Testing of Materials resulted in the widely anticipated International Green Construction Code (IGCC)–which also references Standard 189.1 as an alternative. Like 189.1, the IGCC applies to commercial buildings; however, it also references ICC-700-2008 National Green Building Standard, a code previously co-authored with the National Association of Homebuilders. IGCC Public Version 1.0 was released in March 2010, revealing a performance-based approach that allows jurisdictions to determine which code provisions are applicable to their needs. The IGCC also addresses siting, materials, air quality, water, commissioning, and operation. Proposed changes to the Public Version 1.0 of the IGCC were collected until May 14, and a public hearing will be held August 14-22 in Chicago. For both codes, the trend to include these considerations will require deep partnerships between the building and planning departments in adopting jurisdictions.

Efforts toward sustainable buildings have not gone unnoticed. Last month, the *New York Times* reported on the U.S. Conference of Mayors' endorsement of the IGCC. That very evening from the oval office, President Obama mentioned stronger building efficiency standards as part of the solution to the nation's dependence on fossil fuels. Green building is certainly coming of age, but the codes community knows its growing pains are far from over—it will take unprecedented collaboration and a variety of well-designed codes, standards, and programs to achieve the goal of lasting energy savings.

1 The American National Standards Institute; American Society of Heating, Refrigerating and Air-Conditioning Engineers; Illuminating Engineering Society of North America; the United States Green Building Council

2 American Society of Heating, Refrigerating and Air-Conditioning Engineers; American Society for Healthcare Engineering

An Evening of Sustainability

On Tuesday, July 20th, *Energy Codes 2010* will feature a special dinner event that will place national green building codes and programs at center stage, with speakers from Standard 189.1, the IGCC, LEED, and the new ENERGY STAR for Homes 3.0. Guests will enjoy a great meal, refreshments, door prizes, and entertainment. Proud Sponsors: ICC, ASHRAE, Edison Electric Institute, and USGBC.

Challenging the Status Code

The world of residential and commercial building energy code development is looking ahead to one event: the final action hearings of the 2012 International Energy Conservation Code (IECC), which will be held in Charlotte, North Carolina, from October 28 to November 1. In this column, BECP has covered progress toward a hefty goal: to develop a new edition of the IECC that is 30% more stringent than the 2006 IECC while also remaining feasible for the building design and construction industries, amenable for adoption and enforcement within jurisdictions, and beneficial to building tenants and owners—no small task. As of July 1, the International Code Council (ICC) has received all public comments on the results of the first hearing on all code changes late last year. Public comments that DOE submitted are posted at **www.energycodes.gov/IECC2012**. With these and other comments in hand, the ICC is creating a final action hearing agenda, which will be posted at **www.iccsafe.org/cs/codes/pages/cycle.aspx** by August 26. In addition, *Setting the Standard* and **www.energycodes.gov** will continue to keep you posted on the latest IECC developments.

Raising the Standard of Energy Efficiency

The goal of 30 percent improvement over ANSI/ASHRAE/IESNA Standard 90.1-2004 is coming into focus. The May issue of *Setting the Standard* reported that the latest progress indicator (which measures headway on creating Standard 90.1-2010) reaches up to 18.3% site energy savings. BECP is continually checking the progress toward the goal based on activities and decisions within the commercial code community. As this issue of *Setting the Standard* is going to press, DOE has just participated in two major events in the commercial codes arena.

Summer Meeting of ASHRAE SSPC 90.1

ASHRAE's Standing Standard Project Committee (SSPC) 90.1 met in Albuquerque, New Mexico June 26-30, during ASHRAE's Annual Conference. At the conclusion of the meeting, the ASHRAE Board of Directors approved the final addenda to be included in Standard 90.1-2010. Following the meeting, BECP and DOE estimated that energy savings for Standard 90.1-2010 are currently 21.7% to 24.8% site energy (depending on how ventilation rates are handled) above Standard 90.1-2004 as a progress indicator to ASHRAE. A number of significant addenda remain that would need to be approved by ASHRAE and subsequently survive potential appeals. These addenda include major changes to the building envelope and economizer requirements.

BECP is continually checking the progress toward the goal based on activities and decisions within the commercial code community.

Public Comments Collected for the 2012 IECC

Public comments were due July 1, 2010 for the 2012 IECC—which also has major commercial code changes at stake. DOE prepared public comments and reviewed them with various stakeholders, including ASHRAE. DOE is also collaborating with the American Institute of Architects (AIA) and New Buildings Institute (NBI) on a public comment related to EC147, the 2012 IECC code change proposal which completely overhauls the commercial section of the IECC. DOE's goal for the stringency of the commercial chapter of the 2012 IECC is that it be equivalent to Standard 90.1-2010, which will be the reference standard for the 2012 IECC. As shown above, DOE's public comments are available at **www.energycodes.gov/IECC2012**.

With ASHRAE's Summer Meeting and the 2012 IECC comment deadline having spanned just a few days, it has been a busy summer for the model energy codes. When the dust settles, both codes are expected to offer substantial efficiency gains over their predecessors.

Look for these energy-saving changes in the new versions of Standard 90.1 and the commercial chapter of the IECC

- **Envelope, new requirements for:**
  - Metal buildings
  - Daylighting and daylighting controls
  - Minimum skylight areas in some occupancies
  - Cool roofs in climate zones 1-3
  - Continuous air barriers.
- **Lighting, new requirements for:**
  - Differentiation of exterior lighting power by location (urban, suburban, rural, national parks)
  - Interior and exterior lighting controls
  - More occupancy sensors and after hours exterior dimming/shut-off
  - Revised Lighting Power Densities (to reflect improved efficacy and model corrections)
- **Mechanical, new requirements for:**
  - Expanded economizer
  - HVAC commissioning on larger pieces of equipment
  - Outdoor air dampers (including some motorized controls)
  - More stringent chiller and Direct Expansion (DX) units efficiency
  - Integrated Energy Efficiency Ratio (IEER) for DX units
  - Ventilation reset
  - Single Variable Air Volume (VAV) system
  - Energy recovery ventilation in more climates and applications
- **Integration of a renewable energy option into IECC code compliance**

Code Collaboration: Stakeholders and States

Spring Training

This spring and early summer, BECP has continued to develop collaborative partnerships with roughly 20 key national organizations to help foster awareness of codes-related efforts and inform continuing DOE support to states and other stakeholders.

In May, BECP's David Conover and Mark Halverson presented at CONSTRUCT 2010, the annual conference of the Construction Specifications Institute (CSI). Their presentation focused on the updates to national model energy codes and standards and status of state energy criteria for new and renovated commercial buildings. They also covered activities underway that will facilitate implementation of energy codes by the building industry and highlighted areas that are commonly found to be out of compliance. These presentation materials are available at **www.energycodes.gov/publications/presentations.stm**.

The American Institute of Architects (AIA) annual convention, held in early June, included BECP's David Conover and Pam Cole presenting along with Jessyca Henderson, Director of Sustainability Advocacy for the AIA. The session covered the current status of state energy code adoption and gave a forward-looking, architecture-focused view of changes to energy codes over the next 10 years. Understanding code adoption and implementation allows designers to recognize problem areas or constraints and identify possible modifications, specifications, and contractual documents that govern a building's design and construction. David also recorded a podcast for the *AIA PodNet*, which is available at **info.aia.org/aia/AIAPodnet.cfm**.

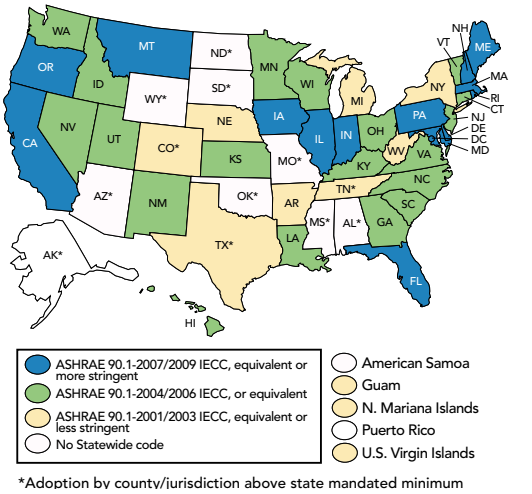
BECP is also working closely with ICC to select and tailor helpful DOE/BECP resource materials to support the energy-related efforts of code officials. BECP and ICC are jointly developing a Building Energy Codes Resource Guide: Code Officials Edition, which will operate as a portable "toolkit" to aid code officials as they enforce energy codes. This collection of plan review and inspection resources will be released this fall, and made available at ICC's annual meeting in Charlotte, North Carolina.

BECP maintains a collaborative and supportive relationship with the five regional energy efficiency partnerships (EEPs). These efforts range from preparing code change submissions to supporting specific regions on code changes and at regional training events. Recently, BECP's Eric Makela and David Conover have been reviewing several proposed state code amendments in conjunction with the EEPs. Assisting the regional partnerships in their adoption efforts is one of the many outreach priorities for BECP in its support of the states.

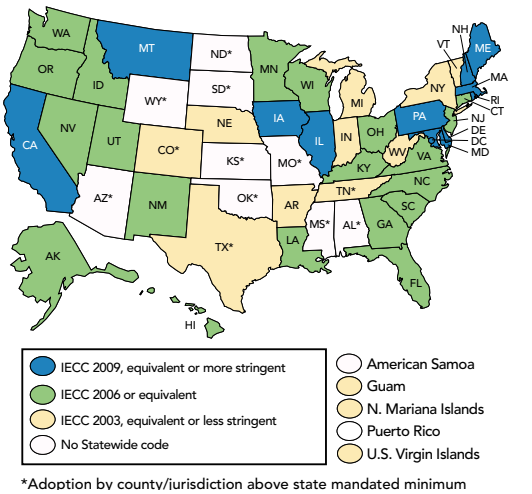
States Measure Compliance, Adopt Codes

Today's energy codes landscape includes many ongoing efforts and activities at the state level. In addition to adopting more stringent energy codes, many state governments are exploring ways to measure compliance—after all, codes and standards do not capture the multiple benefits of energy savings unless buildings follow them. In March, BECP released *Measuring State Energy Code Compliance*, a report that presents BECP's cumulative recommendations in support of states that wish to measure compliance. As these procedures and alternatives are refined and tested, companion web tools and print resources are being released at **www.energycodes.gov/arra/compliance_evaluation.stm**; these include a brief step-by-step companion guide, a custom sample generator for each state (see next page), building evaluation checklists, print- and web-based jurisdictional surveys, and a data analysis tool to manage results and help states generate metrics. BECP's recommendations and companion resources are being developed with the goal of making compliance measurement as easy and cost-effective as possible for states and jurisdictions. Nationally, these measurements will break new ground in understanding the effectiveness of energy codes: compliance data of these proportions have never been collected. At the state level, these efforts will uncover ways to achieve greater energy savings.

As for code adoption, many states are progressing to more stringent energy codes. Since January 2010, twelve states have aggressively adopted more recent national model energy codes than were previously in effect. Below you'll see a status of state codes (top: commercial, bottom: residential) as of July 1, 2010.



*Adoption by county/jurisdiction above state mandated minimum



*Adoption by county/jurisdiction above state mandated minimum

Making Compliance Easier with Next-Generation Tools

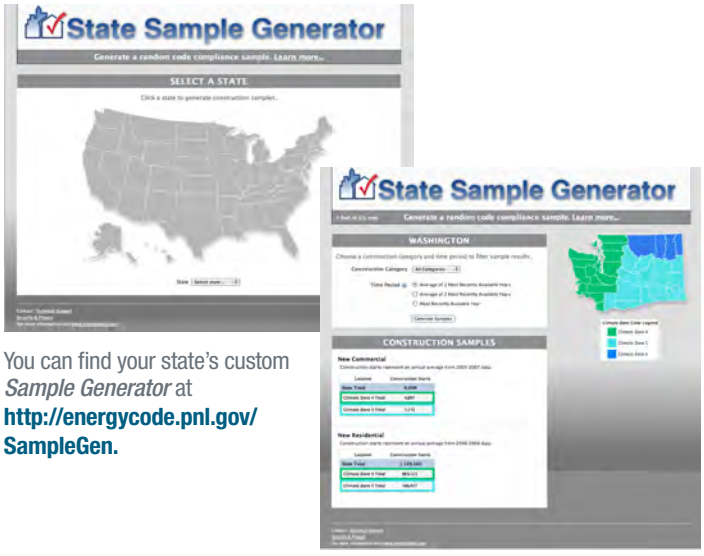
Aside from continual updates to RES*check*™ and COM*check*™, BECP's software development team has several software and web tools in the works that are tailored to help specific groups. Below is a sneak preview of two examples: a sample generator to help states easily obtain a valid sample of buildings to evaluate, and a new way for members of the design industry to simplify performance-based compliance.

State Sample Generator

The previous page of this newsletter gives the context in which the following tool will be used: states measuring compliance with their energy codes. Before evaluating compliance, states must first determine which buildings to inspect. BECP recommends the evaluation of a statistically significant number of buildings in each of the following four building populations:

- Residential new construction
- Commercial new construction
- Residential renovations
- Commercial renovations.

Within each population, roughly 44 building projects should be selected randomly, and in such a manner as to provide a representative sample with respect to building type and size, location by county and climate zone, and various other factors. This complex process is made simple by using BECP's *State Sample Generator*, an automated way to generate a random and representative sample of buildings for all four populations within each state. The tool combines recent construction starts and permitting data from McGraw-Hill (commercial) and census data (residential), along with other state-specific information and BECP compliance measurement strategies. The result is a web tool that takes the math out of the compliance measurement process and allows states to focus staff time in other areas.



You can find your state's custom *Sample Generator* at **http://energycode.pnl.gov/SampleGen.**

Simplifying Performance-Based Code Compliance

Building designers, architects, and engineers can use energy simulation software, such as DOE's EnergyPlus, to evaluate potential energy-saving measures. However, preparing the input in a way that accurately represents the building is a costly, labor-intensive process. As a result, energy analysis is often postponed to a later point in the design process, resulting in a greatly reduced number of cost-effective options for boosting efficiency than if it had been considered from the start.

To help provide readily available energy simulation and energy code compliance solutions, BECP is working to simplify commercial code compliance based on building performance simulation using EnergyPlus. Current efforts are focused on several different approaches for simplifying the inputs required and for providing flexibility to users, depending on their needs:

1) Users who have an available EnergyPlus Input Data File (IDF) generated from another source can import that file into COM*check*™ where code compliance can be determined. Where additional information is needed to determine compliance, the user will be able to provide that additional information via the COM*check*™ Graphical User Interface (GUI) screens, which are being enhanced to load the existing building geometry and other information contained in the imported IDF file.

2) For users without an existing IDF, newly developed input screens combined with the existing COM*check*™ screens will allow a user to enter all information needed for performance-based compliance directly within COM*check*™.

3) COM*check*™ will also be able to accept gbXML data generated from other tools, such as Computer Aided Design (CAD) tools. The data available from these other tools will be loaded into the COM*check*™ screens, and additional information provided in order to determine performance-based compliance.

4) Performance-based envelope-only compliance will also be supported in the future. This compliance option will be available with very minimal additional inputs from what is already required for a COM*check*™ trade-off compliance calculation.

One of the key components needed to enable the first three of these compliance approaches is a GUI that enables the user to define the thermal zones in the building. Currently, BECP is focused on the development of this GUI, and on forming partnerships with vendors to collaborate on these solutions.

The big-picture goal is to use advances in information technology to support users whose design work will result in higher performing buildings.

BECP's current suite of software and web tools is available at www.energycodes.gov/software.stm.

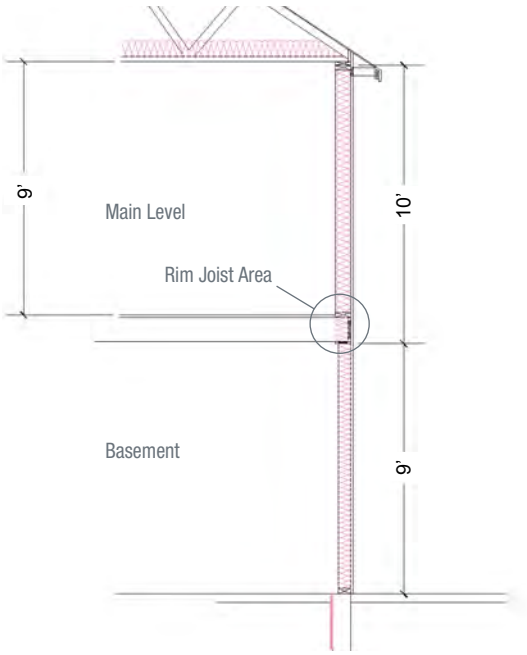
Email questions about residential and commercial energy codes to BECP Technical Support at techsupport@becp.pnl.gov, or submit an inquiry at www.energycodes.gov/help/helpdesk.php.

Ask an Expert

Residential

Q Where does the rim joist come into the equation when doing take-offs for RES*check*™?

A If you have a one-story house, the rim joist that forms the floor system is considered part of the floor and must be insulated to the same level as the floor insulation. If you have a two- or more story house, the rim joist between the two floors is considered part of the exterior wall system and needs to be insulated at that level. Though you can choose to insulate to a lower level, the insulation R-value will need to be traded off using a tool like RES*check*™. If you have a two-story house, the rim joist above the first floor is added into the total square footage of the second floor, above-grade wall. For example, if the second floor is a 9 feet above-grade wall and the rim joist is approximately 1 foot, the calculation includes the 1 foot by adding the value to the 9 feet above grade wall, and multiplying it by the length of the wall in order to apply the total square footage of above-grade wall area. If the rim joist is not insulated to the same level as the above-grade wall on a two- or more story house, then you will have to enter the rim joist area separately in RES*check*™. This calculation can easily be done by multiplying the measurement of the perimeter (excluding any unconditioned garage area) by the height of the rim joist.



Include rim joists as part of the exterior wall area.

Agricultural-use greenhouse structure

Commercial

Q Are agricultural-use greenhouse structures required to comply with the 2009 IECC?

A Greenhouses and other unique industrial buildings like certain manufacturing plants present a tough subject area for energy codes. The primary concern is the building envelope. To use greenhouses as an example, their lighting is typically exempt from energy codes, but the building shell is not. Standard 90.1-2007 offers an exception for "equipment and portions of building systems that use energy primarily to provide for industrial, manufacturing, or commercial processes." None of these terms are formally defined; therefore, if you consider the building envelope to be a "portion of a building system that uses energy," you can make a case that the building envelope is exempt. However, if you are using the 2009 IECC, no such exemption exists. Some state codes explicitly address these building types. Contact the code official for your jurisdiction to seek a more specific answer.

CALENDAR OF Events

What's going on?

August 14-22 International Green Construction Code Public Comment Hearing
The Westin O'Hare, Rosemont, IL

The International Code Council will continue the development process of International Green Construction Code (IGCC) with this public comment hearing. Comments on the IGCC Public Version 1.0 were collected in May, and the August hearing will lead to the release of Public Version 2.0 in November.
www.iccsafe.org/cs/IGCC

August 15-29 ACEEE Summer Study on Energy Efficiency in Buildings 2010
Asilomar Conference Center, Pacific Grove, CA

The 2010 ACEEE Summer Study is the ACEEE conference on Energy Efficiency in Buildings with a blend of presentations and informal meetings. Professionals will gather to discuss the technological basis for, and practical implementation of, reducing energy use and climate impacts associated with buildings. Individuals interested in addressing energy efficiency and climate change issues associated with buildings through innovative technologies, programs, and policies are encouraged to attend.
Email: info@aceee.org **www.aceee.org/conf/10ss/**

August 24-26 Green Building Focus Conference & Expo 2010
Birmingham-Jefferson Convention Complex, Birmingham, AL

Green Building Focus will offer global and U.S. sustainable development experts to educate regional built environment professionals as well as government officials and interested investors. Topics will cover the latest international trends, techniques, technologies and materials in green building. Practical, case-study based presentations and breakout sessions will be complemented by an exhibition of green building products and services. **www.greenbuildingfocus.com/default.aspx?id=1345**

webSITE Inspection

BECP is beginning to roll out materials within *Building Energy Codes University* (BECU), a one-stop codes resource that enhances BECP's education and training resources: **www.energycodes.gov/becu**. New products available now within BECU include the Building Energy Codes 101 series: a book, training manual, and presentation that stakeholders can download and use to learn (and teach) about the world of energy codes. Also premiering is a series of training presentations for building evaluators, complete with video clips that show real-world scenarios and building features.

Drumroll, please: BECP recently listed The Top Ten Reasons for Energy Codes. Check it out at www.energycodes.gov/publications/general.

TRAINING Events

July 19-22 *Energy Codes 2010: The Future is Now!*
Westin Charlotte Hotel, Charlotte, North Carolina

Energy Codes 2010 will provide hands-on training and face-to-face networking through various training activities with other members in the energy codes community. It represents a unique opportunity to bring together a diverse mix of building energy codes stakeholders, discuss current codes-related issues, and receive consistent technical training on building energy codes and standards. After the event, training materials/videos will become training resources at **www.energycodes.gov.**
www.energycodes.gov/events/energycodes

August 19 Oregon-Specific COM*check*™
This webcast is a training event for the Oregon-specific section of the DOE compliance software COM*check*™. The new commercial code goes into effect on July 1, 2010. This webcast will include a live Q&A session.
Online Webcast/Register online: **bit.ly/Oregon-COMcheck**.

October 12-14 Excellence in Building Conference & EXPO
Portland, Oregon, Marriott Downtown Waterfront

The Excellence in Building Conference and EXPO targets building science education. This 3-day event offers educational sessions at all levels of competency, covering all details of the construction process. Building science professionals can gather new ideas in products and techniques, including practice success stories to help increase energy efficiency in residential building and remodeling.
www.eeba.org/conference/program.htm

SOFTWARE Updates on the Way

Exchange Data with RES*check*™ and COM*check*™

BECP's online tools now have the ability to exchange data with other applications using standard data exchange protocols. Builders, designers, architects, and engineers who use software tools that require data inputs similar to those required by BECP's *Check* tools (RES*check*™ and COM*check*™) may find this new feature a time-saving way to export their data from one software application into the *Check* tools, or vice versa. Candidates for such exchange include Computer Aided Design (CAD) tools, loads calculation tools, and cost estimating tools. BECP welcomes input from its *Check* users on which tools they would like to see capable of data exchange with either RES*check*™ or COM*check*™. BECP is seeking partnerships with vendors to help make data exchange possible. To provide input or discuss partnership, please contact Linda Connell, BECP Software Development Team Lead, at linda.connell@pnl.gov.

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

Setting the Standard is published by the Building Energy Codes Program of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy at the Pacific Northwest National Laboratory. Its purpose is to encourage information exchange among building industry professionals and organizations, state and local code officials, and researchers to facilitate timely development and early adoption of the building energy conservation standards. The Building Energy Codes Program would like to continue sending you information about energy codes and compliance tools, but if you would like your name removed from our contacts list, go to www.energycodes.gov/unsubscribe.stm. Send comments and contributions to Ross Carper at Pacific Northwest National Laboratory (techsupport@becp.pnl.gov).

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www.energycodes.gov
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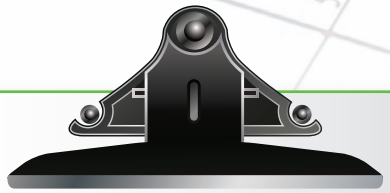
Building Energy Codes Website:
www.energycodes.gov
Tech Support:
www.energycodes.gov/help/DOEassistance.stm

PNNL-SA-73814

State and Local Resources



In this section fill out your resource guide by inserting any state and local resources here:

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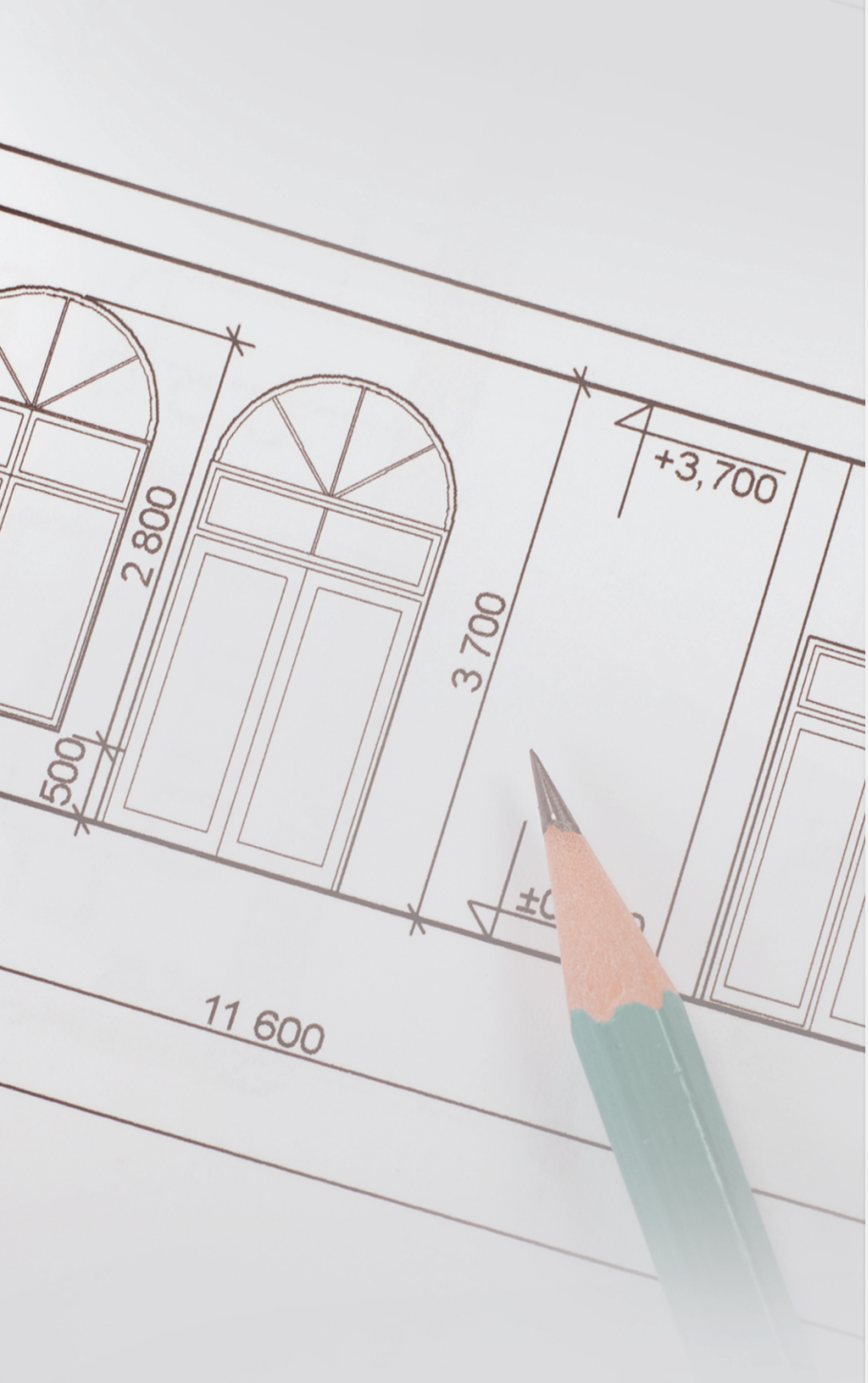
What's in it FOR ME?



BUILDING TECHNOLOGIES PROGRAM

The U.S. Department of Energy's Building Energy Codes Program is an information resource on national model energy codes. We work with other government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger building energy codes and provide assistance to those who have an impact on energy code adoption and compliance.

BECP Website:
www.energycodes.gov

BECP Technical Support:
techsupport@becp.pnl.gov
www.energycodes.gov/help

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

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