

Energy Code Compliance Paths, Which One Will Work Best For Your Project?



U.S. Department of Energy
Building Energy Codes Program
Provider Number: I014
Course Number: BECPWS01

Shaunna Mozingo
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Course Description

This class takes a look at the flexibility and options built into the International Energy Conservation Code as well as the various paths of compliance that can be taken and what type of documentation is needed for each path. We will look at how *COMcheck*, *REScheck*, ASHRAE 90.1, HERS Raters, and the "Mandatory" items of the code are affected or put into play depending on the path you choose.

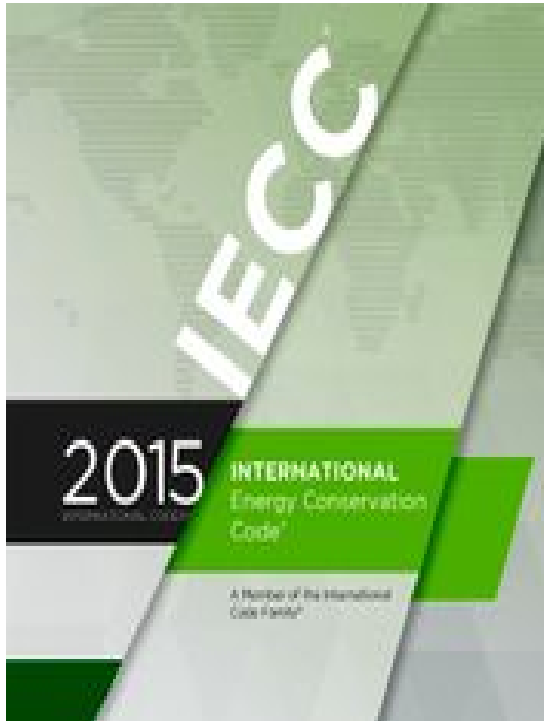


Learning Objectives

At the end of the this course, participants will be able to:

- To understand the flexibility built in the International Energy Conservation Code (IECC) and to identify the various paths of compliance made available at building design.
- To understand the Prescriptive approach to complying with the IECC or ASHRAE 90.1, and how to document compliance on plan sets, including any accompanying documentation that may be needed or used.
- To understand the Total UA Alternative approach to complying with the IECC and how the *COMcheck* and *REScheck* software fits into the picture.
- To understand the various performance approaches in the IECC for both commercial and residential design. The students will look at Simulated Performance Approach vs. the Energy Rating Index for residential compliance as well as different options for commercial performance approaches.

The look and layout of the 2015 IECC



The IECC covers both:

- **Commercial (CE) chapters 1-6**

and

- **Residential (RE) chapters 1-6**

Residential VS Commercial

Definition of Residential per IECC is different than that found in the IRC and IBC:

RESIDENTIAL BUILDING

- For this code, includes detached one- and two family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane



How is the IECC used for this type of building?

COMMERCIAL BUILDING. For this code, all buildings that are not included in the definition of "Residential buildings."

New since the 2012

R101.2 Scope

- Starting with the 2012 IECC, in addition to the code applying to the buildings , it now also applies to the **building sites and associated systems and equipment.**

Things like:

- Pools
- Exterior Lighting
- Equipment Buildings
- On-Site Renewables



101.3: Intent

This code shall regulate the design and construction of the buildings for the effective use and conservation of energy over the useful life of each building.

This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective.

This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.



102.1: Alternate Materials- Method of Construction, Design or Insulating Systems

The code is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been approved by the code official as meeting the intent of the code.

2015: the material, method or work offered is, for the purpose intended, at least the equivalent of the prescribed in this code.

**Organic-n-sustainable
insulation made from
mushrooms**

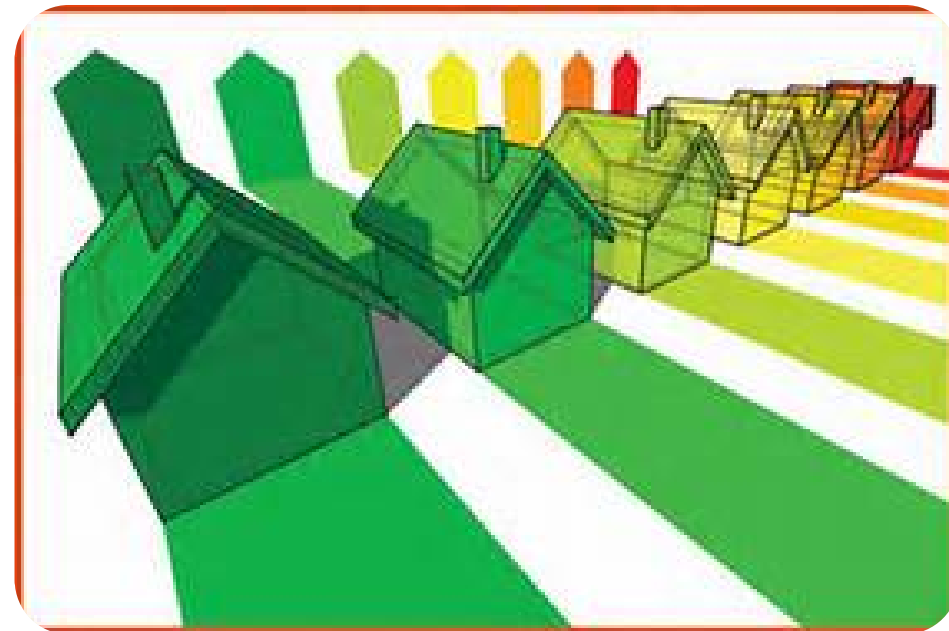


102.1.1: Above Code Programs

The code official or other AHJ shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code.

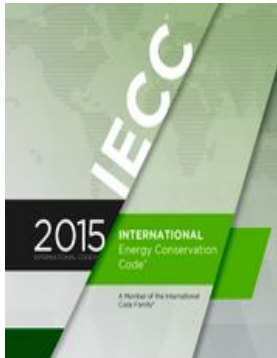
Buildings approved in writing by such an energy efficiency program shall be considered in compliance with this code.

The requirements identified as “mandatory” in Chapter 4 shall be met.



Pathways through the 2015 IECC Residential Provisions

- Prescriptive
- UA Trade off
- Simulated Performance
- Energy Rating Index



IECC

- **The Prescriptive Path:** By the book, just tell me what I have to do and that's what I'll do.



SECTION R402 BUILDING THERMAL ENVELOPE

Prescriptive path ways through code

- **R402.1 General (Prescriptive).**

- The building thermal envelope shall meet the requirements of Sections R402.1.1 through R402.1.4.
- Sections R402.1.1
 - R-value table specification
- Section R402.1.3
 - U-factor table specification
- Section R402.1.4.
 - Total UA Alternative Approach

- R402.1.2 R-value computation
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 (Attics)
- **Computed R-values shall not include an R-value for other building materials or air films**

2015 Prescriptive R-value Table Compliance Specification

Declare to the Code official that the pathway for compliance is the prescriptive path



TABLE R402.1.2
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	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

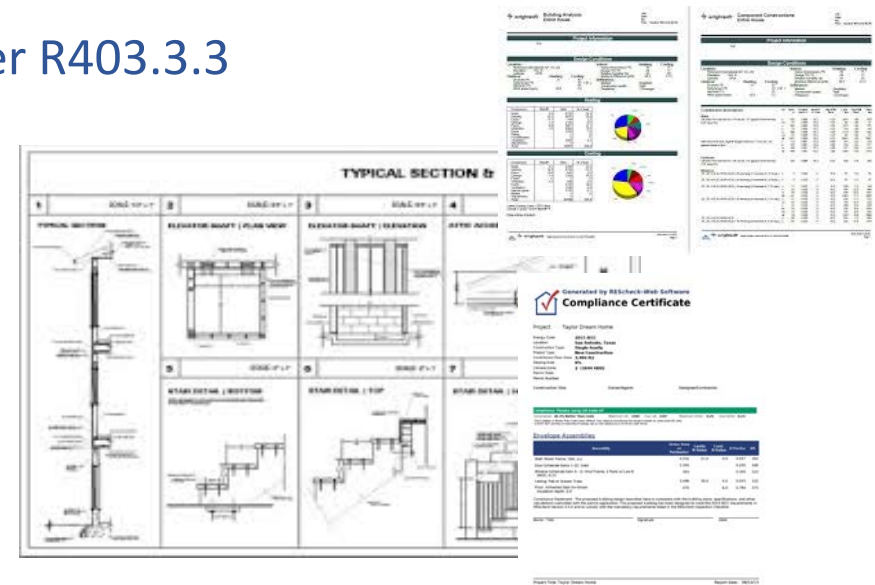
For SI: 1 foot = 304.8 mm.

- R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table.
- The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.
- "15/19" means R-15 continuous insulation 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 insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
- 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 Climate Zones 1 through 3 for heated slabs.
- There are no SHGC requirements in the Marine Zone.
- Basement wall insulation is not required in warm-humid locations as defined by Figure [R301.1](#) and Table [R301.1](#).
- Or insulation sufficient to fill the framing cavity, R-19 minimum.
- The first value is cavity insulation, the second value is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- The second R-value applies when more than half the insulation is on the interior of the mass wall.

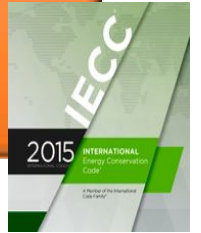
Showing Compliance with the R-value method

Plans, documents and reports that specify:

- ✓ Declaration of the path chosen
- ✓ All applicable values from Table R402.1.2
- ✓ Details and descriptions of how the mandatory items will be met
 - ☐ Air barrier and Insulation details per Table R402.4.1.1
 - ☐ System control requirements of R403.1
 - ☐ Duct sealing per R403.3.2 and testing if applicable per R403.3.3
 - ☐ Mechanical System piping insulation per R403.4
 - ☐ Service hot water system compliance per R403.5
 - ☐ Mechanical Ventilation per R403.6
 - ☐ Equipment sizing per R403.7
 - ☐ Snow melt controls per R403.9
 - ☐ Pool and spas per R403.10
 - ☐ Lighting equipment per R404



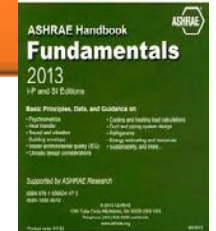
R402.1.4 U-factor Alternative



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	CRAWL SPACE WALL U-FACTOR
1	0.50	0.75	0.035	<u>0.084</u>	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	<u>0.084</u>	0.165	0.064	0.360	0.477
3	0.35	0.55	0.030	<u>0.060</u>	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.35	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.32	0.55	0.026	<u>0.045</u>	0.060	0.033	0.050	0.055
7 and 8	0.32	0.55	0.026	<u>0.045</u>	0.057	0.028	0.050	0.055

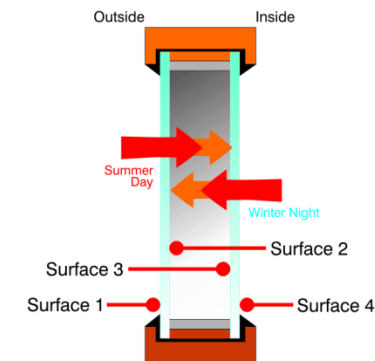
- **An assembly** with a U-factor equal to or less than that specified in Table R402.1.4 shall be permitted as an alternative to the R-value in Table R402.1.2
- Example: Climate zone 5 framed wall
 - U- .060 = R-16.67
 - R-value table requires cavity insulation at R20 or 13+5
 - 1/20 = U.05 Plus sheathing, air film, etc.

R402.1.5 Total UA alternative



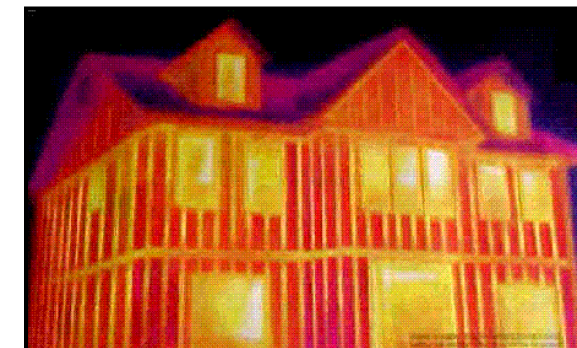
- A method for performing conductive energy trade offs
 - Trading off the R-values and U-factors of the thermal envelope
 - Mathematically making the R-value and U-factor paths equal

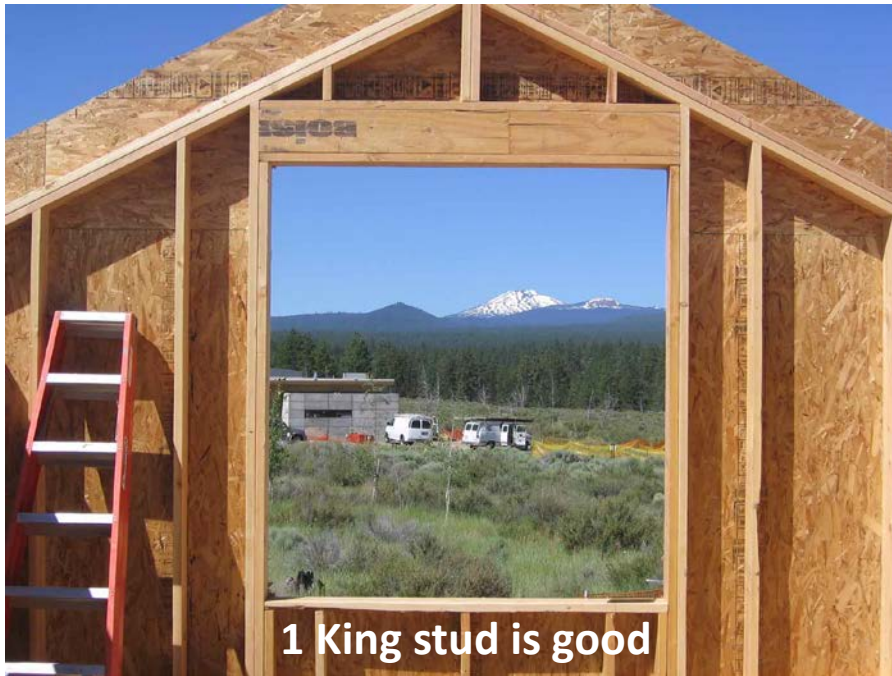
Conduction = Heat Flow through Materials



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- 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 R402.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table R402.1.1. **The UA calculation shall include the thermal bridging effects of framing materials.**





1 King stud is good



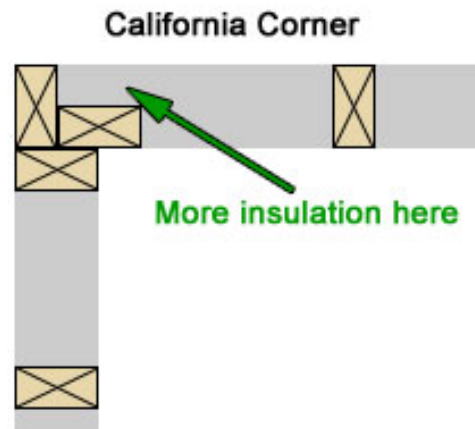
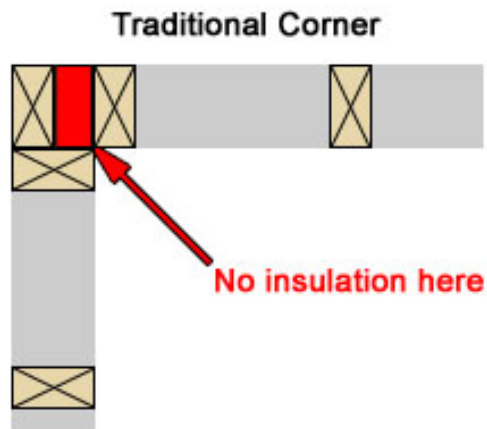
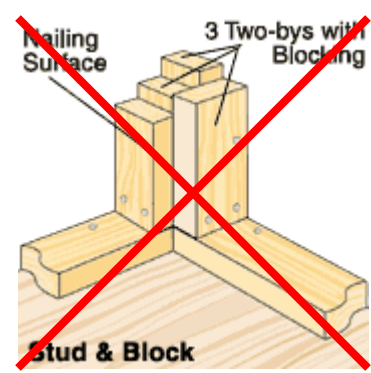
Maybe 15 King studs is even better??????????



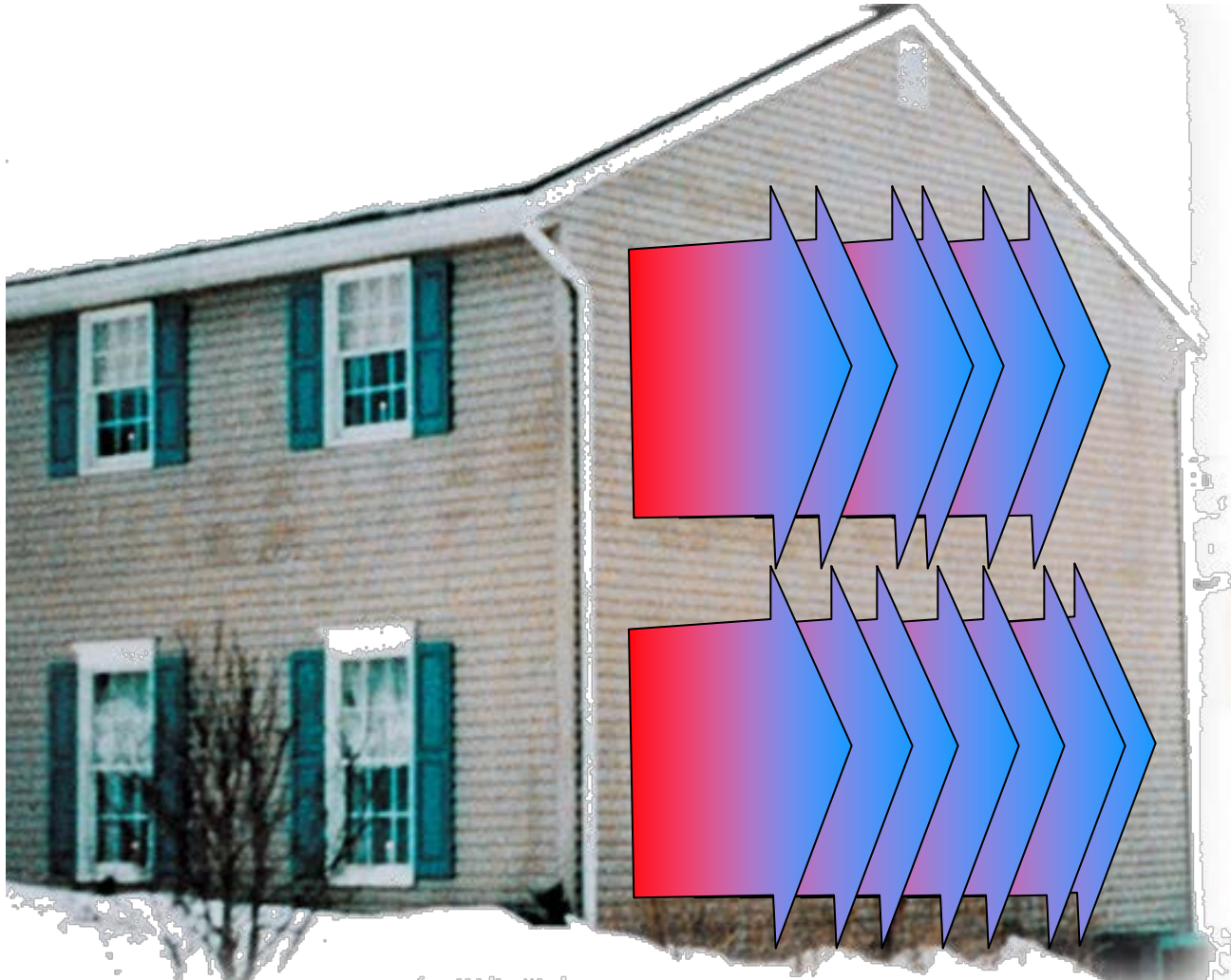
2 King studs is better



What about 6 King studs?



Thermal Bridging – Stud Loss



R-values per inch

- Wood: ~ 1
- Insulation: ~ 3.5 to 7

Minimum Wall Studs | Buil x

← → ↺ <https://basc.pnnl.gov/resource-guides/minimum-wall-studs> ☆

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ENERGY

Energy Efficiency &
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Guides A-Z

ENERGY STAR Certified Homes

Zero Energy Ready Home

EPA Indoor airPLUS

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FIND PUBLICATIONS:

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Minimum Wall Studs

Please [Register](#) or [Login](#) to Provide Feedback.

Scope

Description

Success

Climate

Training

CAD

Compliance

More

Sales

Scope

Reduced Thermal Bridging

Minimum stud spacing of 16-inch on-center for 2 x 4 walls in [all climate zones](#); and in [climate zones 5 through 8](#), 24-inch on-center for 2 x 6 framing.

A. 16 inches for 2 x 4 framing on center in all climate zones.

B. 24 inches for 2 x 6 framing on center in climate zones 5 to 8.


ENERGY STAR Certified Homes Notes:


[Note: Guidance for ENERGY STAR Certified Homes Version 3.0, Revision 08 is coming soon.]

All items of 4.4.5a-4.4.5e of the ENERGY STAR Thermal Enclosure System Rater Checklist must be installed to comply with ENERGY STAR Certified Homes (Version 3.0, Revision 07).

Mass walls utilized as the thermal mass component of a passive solar design (e.g., a Trombe wall) are exempt from this Item. To be eligible for this exemption, the passive solar design shall be comprised of the following five components: an aperture or collector, an absorber, thermal mass, a distribution system, and a control system. [See DOE's guidance for passive solar home design.](#)

Mass walls that are not part of a passive solar design (e.g., CMU block or log home enclosure) shall either utilize the strategies outlined in Item 4.4 (of the ENERGY STAR Thermal Enclosure System Rater Checklist). Or, the pathway in the assembly with the least thermal resistance, as determined using a method consistent with the 2009 ASHRAE Handbook of Fundamentals, shall provide $\geq 50\%$ of the applicable assembly resistance, defined as the reciprocal of the mass wall equivalent U-factor in the 2009 IECC – Table 402.1.3. Documentation identifying the pathway with the least thermal resistance and its resistance value shall be collected by the rater and any Builder Verified or Rater Verified box under Item 4.4 (of the ENERGY STAR Thermal Enclosure System Rater Checklist) shall be checked.





MOBILE FIELD KIT

The Building America Field Kit allows you to save items to your profile for review or use on-site.

or

20



SHGCs and U-Factors

	World's Best Window Co. Millennium 2000+ Vinyl-Clad Wood Frame Double Glazing • Argon Fill • Low E Product Type: Vertical Slider	
ENERGY PERFORMANCE RATINGS		
U-Factor (U.S./I-P)	Solar Heat Gain Coefficient	
0.35	0.32	
ADDITIONAL PERFORMANCE RATINGS		
Visible Transmittance	Air Leakage (U.S./I-P)	
0.51	0.2	
Condensation Resistance	—	
<small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org</small>		

Twin Houses

2015 IECC reference design house

- Geometric Twin
- 2015 IECC prescriptive envelope U-factors in (Table 402.1.4)

VS.

Builder's desired house

- Geometric Twin
- Envelope U-factors based on Builder's Specification



If the Builder's house has the same or lower area weighted U-factors - then it meets the intent of code

What's the easiest way to verify and document compliance with the the Total UA alternative path?



Project

Untitled.rck - REScheck 4.6.0 Code: 2012 IECC

File Edit View Options Code Tools Help

Project

Envelope

Mechanical

Requirements

Location

StateColorado

CityWestminster

Project Type

☒ New Construction ☐ Addition ☐ Alteration

Building Characteristics

☒ 1- and 2-Family, Detached ☐ Multifamily

Conditioned Floor Area1000ft²

☒ All ducts and air handlers located within conditioned spaces
[Explanation of duct testing requirements...](#)

☐ Project includes a thermally isolated sunroom

☐ Project includes a pool or inground permanent spa

☐ Project includes an interior wood-burning fireplace

Project Details (optional)

This information will appear on the compliance certificate.

Edit Project Details...

Title/Site/Permit

Shaunna's House
7998 Raleigh Place
Westminster, CO 80030
Permit #: 15-0001 Permit Date: 02/04/2015

Owner/Agent

Shaunna Mozingo
Email: smozingo@coloradocode.net

Designer/Contractor

Noo Nu-Thin
No House Too Leaky Construction
0015 ACH Drive
Infiltrate, CO 80015
Email: liketheleaks@leaky.com

Notes

No envelope assemblies specified

TBD%

Compliance Method: UA Trade-Off Max. UA0 Your UA0

Select the building's location and construction type

Example



Untitled.rck - REScheck Latest Version Code: 2015 IECC

File Edit View Options Code Tools Help

Project Envelope Mechanical

Ceiling Skylight Wall Window Door Basement Floor Crawl Wall

	Component	Assembly	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	UA
	Building							
1	Ceiling 1	Flat Ceiling or Scissor Truss	400	ft2	40	0.0	0.035	14
2	Wall 1	Wood Frame, 16" o.c.	640	ft2	20	0.0	0.082	46
3	Window 1	Vinyl Frame:Double Pane	64	ft2			.30	26
4	Door 1	Solid	20	ft2			0.6	12
5	Floor 1	All-Wood Joist/Truss:Ove...	400	ft2	30	0.0	0.047	19

Compliance Passes Max. UA 134 Your UA 128 4.5 % Better Than Code

Enter the R-value of the insulating sheathing.

Reports

Shaunnas House ResCheck.rck - REScheck 4.6.0 Code: 2012 IECC

File Edit View Options Code Tools Help

Project Envelope Mechanical Requirements

Location

State Colorado

City Westminster

Project Type

☒ New Construction ☐ Addition ☐ Alteration

Building Characteristics

☒ 1- and 2-Family, Detached ☐ Multifamily

Conditioned Floor Area 1000 ft2

☒ All ducts and air handlers located within conditioned spaces

[Explanation of duct testing requirements...](#)

☐ Project includes a thermally isolated sunroom

☐ Project includes a pool or inground permanent spa

☐ Project includes an interior wood-burning fireplace

Project Details (optional)

This information will appear on the compliance certificate.

[Edit Project Details...](#)

Title/Site/Permit

Shaunna's House

7998 Raleigh Place

Date: 02/04/2015

de.net

ction

n

Notes

View / Print Report

Report types:

☒ Compliance Certificate

☒ Inspection Checklist

☒ Panel Certificate

Will these reports be submitted for approval?
(i.e., project data is complete and 'final')

☐ Yes

☐ No

OK Cancel

Fails

251.9 % Worse Than Code

Compliance Method: UA Trade-Off Max. UA 239 Your UA 841

27



REScheck Software Version

Compliance Certificate

Project Title: Liberty

Energy Code: IECC
Location: Liberty (Casey), Kentucky
Construction Type: Single Family
Building Orientation: Bldg. orientation unspecified
Glazing Area Percentage: 18%
Heating Degree Days: 4788
Climate Zone: 4

Construction Site: Woodrum Ridge
Liberty, KY
Owner/Agent: C. Church

Step 1: Verify the project information matches the information on the plans. The code, city and state, and construction type will impact energy code compliance.

Compliance: Passes using UA trade-off

Compliance: Maximum UA: 888 Your UA: 860

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	3614	38.0	0.0		108
Basement Wall 1: Solid Concrete or Masonry Orientation: Unspecified Wall height: 10.1' Depth below grade: 9.3' Insulation depth: 10.0'	2905	13.0	0.0		150
Window 1: Wood Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	75			0.350	26
Wall 1-First Floor: Wood Frame, 16" o.c. Orientation: Unspecified	3000	21.0	0.0		141
Window 2: Wood Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	390			0.350	137
Door 1: Glass SHGC: 0.40 Orientation: Unspecified	116			0.350	41



REScheck Software Version

Compliance Certificate

Project Title: Liberty

Energy Code: IECC
Location: Liberty (Casey), Kentucky
Construction Type: Single Family
Building Orientation: Bldg. orientation unspecified
Glazing Area Percentage: 18%
Heating Degree Days: 4788
Climate Zone: 4

Construction Site: Woodrum Ridge
Liberty, KY
Owner/Agent: C. Church

Step 2: Verify the project complies with the applicable code. The Maximum UA must be greater than or equal to Your UA to demonstrate compliance.

Compliance: Passes using UA trade-off

Compliance: Maximum UA: 888 Your UA: 860

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	3614	38.0	0.0		108
Basement Wall 1: Solid Concrete or Masonry	2905	13.0	0.0		150
Orientation: Unspecified					
Wall height: 10.1'					
Depth below grade: 9.3'					
Insulation depth: 10.0'					
Window 1: Wood Frame:Double Pane with Low-E	75			0.350	26
SHGC: 0.40					
Orientation: Unspecified					
Wall 1-First Floor: Wood Frame, 16" o.c.	3000	21.0	0.0		141
Orientation: Unspecified					
Window 2: Wood Frame:Double Pane with Low-E	390			0.350	137
SHGC: 0.40					
Orientation: Unspecified					
Door 1: Glass	116			0.350	41
SHGC: 0.40					
Orientation: Unspecified					

Reading the Reports

compliance-report-20150223_074446_996.pdf - Adobe Acrobat Pro

File Edit View Window Help

Create [Icons]

1 / 10 [Navigation Icons] 139% [Tools Comment Share]

Permit Date: **02/04/2015**
Permit Number: **15-0001**

Construction Site:
7998 Raleigh Place
Westminster, CO 80030

Owner/Agent:
Shaunna Mozingo
smozingo@coloradocode.net

Designer/Contractor:
Noo Nu-Thin
No House Too Leaky Construction
0015 ACH Drive
Infiltrate, CO 80015
liketheleaks@leaky.com

Here's Your Sign → **Compliance: Fails using UA trade-off**

Compliance: **251.9% Worse Than Code** Maximum UA: **239** Your UA: **841**

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.

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Cathedral Ceiling	700	0.0	0.0	0.599	413
Skylight 1: Wood Frame:Single Pane	11			0.600	7
Ceiling 2: Flat Ceiling or Scissor Truss	300	19.0	0.0	0.051	15

30

7:50 AM

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	3614	38.0	0.0		108
Basement Wall 1: Solid Concrete or Masonry Orientation: Unspecified Wall height: 10.1' Depth below grade: 9.3' Insulation depth: 10.0'	2905	13.0	0.0		150
Window 1: Wood Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	75			0.350	26
Wall 1-First Floor: Wood Frame, 16" o.c. Orientation: Unspecified	3000	21.0	0.0		141
Window 2: Wood Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	390			0.350	137
Door 1: Glass SHGC: 0.40 Orientation: Unspecified	116			0.350	41
Door 2: Solid Orientation: Unspecified	18			0.350	6
Wall 2- 2nd floor: Wood Frame, 16" o.c. Orientation: Unspecified	2384	21.0	0.0		114
Window 3: Wood Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	390			0.350	137

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, and other

Step 3: Verify the correct Assembly components for the building envelope are shown. For example, a floor over a crawl is vented to the outside; the crawl wall would not be part of the building envelope and should not be shown on the report.



REScheck Software
Compliance

Project Title: Liberty

Energy Code: IECC
Location: Liberty (Casey), Kentucky
Construction Type: Single Family
Building Orientation: Bldg. orientation unspecified
Glazing Area Percentage: 18%
Heating Degree Days: 4788
Climate Zone: 4

Construction Site:
Woodrum Ridge
Liberty, KY

Owner/Agent:
C. Church

Designer/Contractor:

Compliance: Passes using UA trade-off

Compliance: Maximum UA: 888 Your UA: 860

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	3614	38.0	0.0		108
Basement Wall 1: Solid Concrete or Masonry Orientation: Unspecified Wall height: 10.1' Depth below grade: 9.3' Insulation depth: 10.0'	2905	13.0	0.0		150
Window 1: Wood Frame: Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	75			0.350	26
Wall 1-First Floor: Wood Frame, 16" o.c. Orientation: Unspecified	3000	21.0	0.0		141
Window 2: Wood Frame: Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	390			0.350	137
Door 1: Glass SHGC: 0.40 Orientation: Unspecified	116			0.350	41

Step 4: Verify the Gross Area or Perimeter values represent the proposed house. Verify window area is correct by using 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.



REScheck Software Compliance

Project Title: Liberty

Energy Code: IECC
Location: Liberty (Casey), Kentucky
Construction Type: Single Family
Building Orientation: Bldg. orientation unspecified
Glazing Area Percentage: 18%
Heating Degree Days: 4788
Climate Zone: 4

Construction Site:
Woodrum Ridge
Liberty, KY

Owner/Agent:
C. Church

Designer/Contractor:

Compliance: Passes using UA trade-off

Compliance: Maximum UA: 880 Your UA: 860

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	3614	38.0	0.0		108
Basement Wall 1: Solid Concrete or Masonry Orientation: Unspecified Wall height: 10.1' Depth below grade: 9.3' Insulation depth: 10.0'	2905	13.0	0.0		150
Window 1: Wood Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	75			0.350	26
Wall 1-First Floor: Wood Frame, 16" o.c. Orientation: Unspecified	3000	21.0	0.0		141
Window 2: Wood Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	390			0.350	137
Door 1: Glass SHGC: 0.40 Orientation: Unspecified	116			0.350	41

Step 5: Verify the insulation R-values shown on the building plans meet or exceed the values in the Cavity R-Value and/or 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 the framing.



REScheck Software Compliance

Step 6: Verify the window and door U-factors shown on the building plans meet or exceed what is shown on the documentation.

Project Title: Liberty

Energy Code: IECC
Location: Liberty (Casey), Kentucky
Construction Type: Single Family
Building Orientation: Bldg. orientation unspecified
Glazing Area Percentage: 18%
Heating Degree Days: 4788
Climate Zone: 4

Construction Site:
Woodrum Ridge
Liberty, KY

Owner/Agent:
C. Church

Designer/Contractor:

Compliance: Passes using UA trade-off

Compliance: Maximum UA: 880 Your UA: 860

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	3614	38.0	0.0		108
Basement Wall 1: Solid Concrete or Masonry Orientation: Unspecified Wall height: 10.1' Depth below grade: 9.3' Insulation depth: 10.0'	2905	13.0	0.0		150
Window 1: Wood Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	75			0.350	26
Wall 1-First Floor: Wood Frame, 16" o.c. Orientation: Unspecified	3000	21.0	0.0		141
Window 2: Wood Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Unspecified	390			0.350	137
Door 1: Glass SHGC: 0.40 Orientation: Unspecified	116			0.350	41

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: All-Wood Joist/Rafter/Truss	2,415	38.0	0.0		72
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			0.300	111
Exterior Wall 2: Wood Frame, 16" o.c. Orientation: Back	834	20.0	0.0		38
Window 2: Vinyl Frame:Double Pane with Low-E SHGC: 0.40 Orientation: Back	149			0.350	52
Door 2: Opaque Orientation: Back	40			0.500	20
Exterior Wall 3: Wood Frame, 16" o.c. Orientation: Front	492	20.0	0.0		29
Exterior Wall 4: Wood Frame, 16" o.c. Orientation: Back	632	20.0	0.0		36

**Verify Compliance
Statement is Signed**

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2009 IECC requirements in REScheck Version 4.4.4 REVIEW and to comply with the mandatory requirements listed in the REScheck Inspection Checklist.

Name - Title

Signature

Date



2015 IECC Energy Efficiency Certificate

Insulation Rating	R-Value
Above-Grade Wall	20.00
Below-Grade Wall	20.00
Floor	38.00
Ceiling / Roof	49.00
Ductwork (unconditioned spaces):	_____

Glass & Door Rating	U-Factor	SHGC
Window	0.27	
Door	0.50	

Heating & Cooling Equipment	Efficiency
Heating System: _____	_____
Cooling System: _____	_____
Water Heater: _____	_____

Name: _____ Date: _____	
Comments	

Compliance Checklist Built In To REScheck



REScheck Software Version 4.6.2

Inspection Checklist

Energy Code: 2015 IECC









Requirements: 0.0% were addressed directly in the REScheck software

Text in the "Comments/Assumptions" column is provided by the user in the REScheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Pre-Inspection/Plan Review	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
103.1, 103.2 [PR1] ² ①	Construction drawings and documentation demonstrate energy code compliance for the building envelope. Thermal envelope represented on construction documents.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
103.1, 103.2, 403.7 [PR3] ² ①	Construction drawings and documentation demonstrate energy code compliance for lighting and mechanical systems. Systems serving multiple dwelling units must demonstrate compliance with the IECC Commercial Provisions.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
302.1, 403.7 [PR2] ² ①	Heating and cooling equipment is sized per ACCA Manual S based on loads calculated per ACCA Manual J or other methods approved by the code official.	Heating: Btu/hr _____ Cooling: Btu/hr _____	Heating: Btu/hr _____ Cooling: Btu/hr _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

Envelope

2009 IECC	Foundation Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
402.1.1 [FO1] ¹ 	Slab edge insulation R-value.	R-_____ <input type="checkbox"/> Unheated <input type="checkbox"/> Heated	R-_____ <input type="checkbox"/> Unheated <input type="checkbox"/> Heated	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not Comply <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.2, 402.2.8 [FO2] ¹ 	Slab edge insulation installed per manufacturer's instructions.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not Comply <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
402.1.1 [FO3] ¹ 	Slab edge insulation depth/length.	_____ ft	_____ ft	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not Comply <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
402.1.1 [FO4] ¹ 	Conditioned basement wall insulation R-value. Where internal insulation is used, verification may need to occur during Insulation Inspection. Not required in warm-humid locations in Climate Zone 3.	R-_____	R-_____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not Comply <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.2 [FO5] ¹ 	Conditioned basement wall insulation installed per manufacturer's instructions.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not Comply <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
402.2.7 [FO6] ¹ 	Conditioned basement wall insulation depth of burial or distance from top of wall.	_____ ft	_____ ft	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not Comply <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.2.1 [FO11] ² 	A protective covering is installed to protect exposed exterior insulation and extends a minimum of 6 in. below grade.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not Comply <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
403.8 [FO12] ² 	Snow- and ice-melting system controls installed.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not Comply <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	



REScheck Software Version 4.6.2 Compliance Certificate

Project Jones Residence - Plan 3677

Energy Code: 2015 IECC
Location: Boulder, Colorado
Construction Type: Single-family
Project Type: New Construction
Orientation: Bldg. faces 180 deg. from North
Conditioned Floor Area: 6,780 ft²
Glazing Area: 18%
Climate Zone: 5 (5554 HDD)
Permit Date: October 17, 2011
Permit Number:

Construction Site: Owner/Agent: JJ. Jones Designer/Contractor: Done Right Construction

Compliance: Passes using UA trade-off

Compliance: **3.4% Better Than Code** Maximum UA: **554** Your UA: **535**
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.

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	2,415	49.0	0.0	0.026	63
Wall 1: Wood Frame, 16" o.c. Orientation: Front	911	20.0	0.0	0.059	30
Window 1: Vinyl Frame:Double Pane Orientation: Front	369			0.270	100
Door 1: Solid Orientation: Front	40			0.500	20
Wall 2: Wood Frame, 16" o.c. Orientation: Back	834	20.0	0.0	0.059	38
Window 2: Vinyl Frame:Double Pane with Low-E Orientation: Back	149			0.350	52
Door 2: Solid Orientation: Back	40			0.500	20
Wall 3: Wood Frame, 16" o.c. Orientation: Left side	492	20.0	0.0	0.059	29
Wall 4: Wood Frame, 16" o.c. Orientation: Right side	632	20.0	0.0	0.059	36
Window 3: Vinyl Frame:Double Pane with Low-E Orientation: Right side	15			0.350	5
Knee Wall West: Wood Frame, 16" o.c. Orientation: Left side	69	20.0	0.0	0.059	4
Knee Wall East: Wood Frame, 16" o.c. Orientation: Right side	84	20.0	0.0	0.059	5

Project Title: Jones Residence - Plan 3677
Data filename: C:\Users\d3k420\Documents\Jones Residence.Boulder.Co.rck

Report date: 02/11/16
Page 1 of 10

REScheck

Free download at

<https://www.energycodes.gov>

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CONFERENCE
March 21-24, 2016
Tucson, AZ

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March 21-24, 2016
Tucson, Arizona.

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- REScheck**

Technical Assistance

- Help Desk

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Select a state

News

- Recognizing the Value of Energy Efficiency's Multiple Benefits
- Energy Efficiency Efforts Face Obstacles in New Buildings and Retrofits
- Appraisal Institute, Building Codes Assistance Project Offer "Green" Appraisal Guidance
- New CABA report highlights crucial role of controls for achieving and maintaining zero net energy buildings
- Pew Research Center "As American homes get bigger, energy efficiency gains are wiped out"
- New building codes study shares important lessons for research and evaluation

Social Media

Twitter Facebook YouTube RSS

Look how houses have changed



Why is this a 100 year old house?

- Drafty, uncomfortable, yet very durable houses
 - Why?
- Expectation?



Building a House Today



- What have we done to houses to meet our expectations?
 - Thermal Insulation
 - Tighter Building Envelopes
 - Heating & Cooling Systems
- Yet are our Houses are not always
 - comfortable
 - Durable
 - Safe
 - Energy Efficiency
 - Environmental

Systems Thinking

- Holistic approach rather than a component approach.
- Synergy
 - The various parts work together
 - **Achieving** what could not be achieved before!
- Meeting the Expectations
 - Safe
 - Comfort
 - Durable
 - Efficient
 - Environmental



R405 Performance-based compliance

- Energy Analysis
 - A method for performing whole house performance energy trade offs
 - **Conduction** - Trading off R-values and U-factors
 - Convection – Energy moving with air infiltration and exfiltration
 - **Radiation** – Trade offs created by energy moving from areas of high concentrations to low concentration through open space.

Energy moves from warm to cold



The Reference Home/Twin Home Concept Used by modeling software for Code

2015 reference design house Built from table 405.5.2(1)

- The reference home is the **geometric twin** of the rated home *configured to a standard set of thermal performance characteristics*:
- I.e. The 2015 IECC Prescriptive path



vs.

Rated Home: Builders desired house

- The home you are building and evaluating, compared to the “Reference” home in order to quantify performance and demonstrate compliance with the Energy code.



Energy Costs



- **405.3 Performance-based compliance.** Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the standard reference design.

Documentation

405.4.1

- Compliance software tools.
 - Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the code official.




Compliance report


405.4.2

- Compliance software tools shall generate a report that documents that the proposed design has annual energy costs less than or equal to the annual energy costs of the standard reference design. The compliance documentation shall include the following information:

1. Address of the residence;
2. An inspection checklist documenting the building component characteristics of the proposed design as listed in Table 404.5.2(1). The inspection checklist shall show the estimated annual energy cost for Both the standard reference design and the proposed design;
3. Name of individual completing the compliance report; and
4. Name and version of the compliance software tool.



The Energy Code Inspection Checklist is the best way to demonstrate the energy specifications that are being used in the house for the house to comply the annual cost matrix of code compliance.



ENERGY CODE INSPECTION CHECKLIST

Date:	February 01, 2011	Rating No.:	21290
Building Name:	Example Code House	Rating Org.:	EnergyLogic Inc.
Owner's Name:	Example Code House	Phone No.:	970.532.3220 1.800.315.0459
Property:	5939 Best place to live	Rate's Name:	Robby Schwarz
Address:	Colorado Springs, CO 80924	Rate's No.:	02
Builder's Name:		Rating Type:	Based On Plans
Weather Site:	Colorado Springs, CO	Rating Date:	1/12/2011
File Name:	C-Springs - 5939 Best place to live REM12.9-1.M		

Building Information:

Conditioned Area (sq ft):	3275
Conditioned Volume (cubic ft):	30045
Insulated Shell Area (sq ft):	6828

The items below will be inspected for energy code certification. Any deviation from these specifications should be brought to the attention of Robby Schwarz, as soon as possible to assure that the project will still comply with energy code requirements.

Ceilings:

[] 1. Attic: R38 Blow Open G1 (1480 s.f.)
R-25.0 continuous insulation, R-13.0 cavity insulation.
Name: Flat Insulation Grade: I II III Face / Inset
Comments/Location: _____

[] 2. Attic: R30 Blow Open G1 (184 s.f.)
R-17.0 continuous insulation, R-13.0 cavity insulation.
Name: Flat eave Insulation Grade: I II III Face / Inset
Comments/Location: _____

Above-Grade Walls:

[] 1. Wall: x4 16oc FBR15 G1 (205 s.f.) Between conditioned space and ambient
R-0.0 continuous insulation, R-15.0 cavity insulation.
Name: Front 2x4 Insulation Grade: I II III Face / Inset
Comments/Location: _____

REMRate - Residential Energy Analysis and Rating Software v12.9
This information does not constitute any warranty of energy cost or savings.
© 1995-2010 Architectural Energy Corporation, Boulder, Colorado.

The submittal code compliance documents are based on plans. We utilize the construction documents to do a take off of the home to build the home inside the computer model.

2015 IECC Energy Cost Compliance



Property
2015 ERI Base House
1234 Place to Live
Denver, CO 80221

Organization
EnergyLogic, Inc
(970) 556-0839
Robby Schwarz

HERS
Confirmed
2/10/2015
Rating No:34332
Rater ID: 1215211

Weather: Denver, CO
2015 ERI Compliance
2015 Prescriptive Path HERS

Builder

Annual Energy Cost

	\$/yr	
	2015 IECC	As Designed
Heating	604	616
Cooling	220	144
Water Heating	185	185
SubTotal - Used to Determine Compliance	1008	945
Lights & Appliances	822	811
Photovoltaics	-0	-0
Service Charge	0	0
Total	1830	1756

Mandatory Requirements

Annual Energy Cost Check	PASSES
Duct Insulation R-Value Check (per Section 405.2)	PASSES
Window U-Value and SHGC Check (per Section 402.5)	PASSES
Home Infiltration (Section 402.4.1.2)	PASSES
Duct Leakage (Section 403.3.3)	PASSES
Mechanical Ventilation (Section 403.6)	PASSES
Mechanical Ventilation Fan Efficacy (Section 403.6.1)	PASSES
Mandatory Requirements Check Box (IECC 15)	PASSES

This home MEETS the annual energy cost requirements of Section 405 of The 2015 International Energy Conservation Code based on a climate zone of 5B. In fact, this home surpasses the requirements by 6.3%.

Name | Robby Schwarz
Organization | EnergyLogic, Inc

Signature |
Date | 14 February 2015

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set equal to those in the design home as specified in the 2015 IECC. These standards are subject to change, and software updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.



Home Energy Rating Certificate

Example Code House

5939 Best place to live

Colorado Springs, CO 80924



5 Stars

Based On Plans

Uniform Energy Rating System

1 Star	1 Star Plus	2 Stars	2 Stars Plus	3 Stars	3 Stars Plus	4 Stars	4 Stars Plus	5 Stars	5 Stars Plus
500-401	400-301	300-251	250-201	200-151	150-101	100-91	90-86	85-71	70 or Less

Energy Efficient

HERS Index: 74

General Information

Conditioned Area:	3275 sq. ft.	HouseType:	Single-family detached
Conditioned Volume:	30045 cubic ft.	Foundation:	Conditioned basement
Bedrooms:	5		

Mechanical Systems Features

Heating:	Fuel-fired air distribution, Natural gas, 92.3 AFUE.
Water Heating:	Conventional, Natural gas, 0.58 EF, 50.0 Gal.
Duct Leakage to Outside:	0.00 CFM.
Ventilation System:	Exhaust Only: 50 cfm, 59.0 watts.
Programmable Thermostat:	Heating: Yes Cooling: Yes

Building Shell Features

Ceiling Flat:	R-38, R-30	Exposed Floor:	R-50
Vaulted Ceiling:	NA	Window Type:	Low E .34 / .31
Above Grade Walls:	R-15, R-23, R-13	Infiltration:	
Foundation Walls:	R-13.0	Rate:	Htg: 1060 Clg: 1060 CFM50
Slab:	R-0.0 Edge, R-0.0 Under	Method:	Blower door test

Lights and Appliance Features

Percent Fluorescent Pin-Based:	0.00	Clothes Dryer Fuel:	Electric
Percent Fluorescent CFL:	3.00	Range/Oven Fuel:	Electric
Refrigerator (kWh/yr):	775.00	Ceiling Fan (cfm/Watt):	70.40
Dishwasher Energy Factor:	0.66		

The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

REM/Rate - Residential Energy Analysis and Rating Software v12.9

This information does not constitute any warranty of energy cost or savings.

© 1985-2010 Architectural Energy Corporation, Boulder, Colorado.

Rating Number: 21290

Certified Energy Rater: Robby Schwarz

Rating Date: 1/12/2011

Rating Ordered For: Example Code House

Estimated Annual Energy Cost

Based On Plans

Use	MMBtu	Cost	Percent
Heating	41.1	\$441	20%
Cooling	0	\$0	0%
Hot Water	25.2	\$251	11%
Lights/Appliances	40.3	\$1259	57%
Photovoltaics	-0.0	\$-0	-0%
Service Charges		\$240	11%
Total		\$2190	100%

This home meets or exceeds the minimum

criteria for all of the following:

EPA ENERGY STAR Version 2 Home

2012 International Energy Conservation Code
2012 International Energy Conservation Code
2012 International Energy Conservation Code
2012 International Energy Conservation Code
2015 International Energy Conservation Code

The Home energy rating certificate is not a true code compliance document as the HERS Index score is not used to demonstrate code compliance. However, if the homes meets the intent of code it will be listed on this certificate and it is often interesting to see what the projected HERS index of the home is.

Home Energy Rating Provider

EnergyLogic, Inc.

O.O. Box N

Berthoud, CO 80513

1-800-315-0459

www.nrglogic.com



Certified Energy Rater

HOME CERTIFIED TO MEET THE PROVISIONS OF THE 2012 INTERNATIONAL ENERGY CONSERVATION CODE

This home built at

12596 Place to live, Lafayette, CO

by

exceeds the minimum requirements for the 2012 International Energy Conservation Code

5/8/09

Building Features

Ceiling Flat: R-38
Vaulted Ceiling: NA
Above Grade Walls: R-23
Foundation Walls: R-11.0
Exposed Floor: R-43
Slab: R-0.0 Edge, R-0.0 Under
Duct: NA

Duct Leakage to Outside: 50.00 CFM @ 25 Pascals
Total Duct Leakage: 1.00 CFM @ 25 Pascals
Infiltration: Htg: 0.12 Clg: 0.12 ACHnat
Window: U-Value = 0.330, SHGC = 0.350
Heating: Fuel-fired air distribution, Natural gas, 92.3 AFUE.
Cooling: Air conditioner, Electric, 13.0 SEER.
Water Heating: Instant water heater, Natural gas, 0.82 EF, 0.0 Gal.

The organization below certifies that the proposed building design described herein is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2012 IECC requirements in compliance with Chapter 4 based on Climate Zone 5B and with all mandatory requirements.

Name: Robby Schwarz

Signature: _____

Organization: EnergyLogic Inc.

Date: March 04, 2012

*The 2012 International Energy Conservation Code is a registered trademark of the International Code Council, Inc. ("ICC").
No version of this software has been reviewed or approved by ICC or its affiliates.
REM/Rate - Residential Energy Analysis and Rating Software v12.97*

Other Reporting

AIR LEAKAGE REPORT

Date: June 04, 2014 Rating No.: Demo Play House

Building Name: Best Builder Rating Org.: EnergyLogic, Inc

Owner's Name: Best Builder's Homeowner Phone No.: (970) 556-0839

Property: 1234 Place to live Rater's Name: Robby Schwarz

Address: Denver, CO 80026 Rater's No.: 9124083

Builder's Name:

Weather Site: Denver, CO Rating Type: Confirmed

File Name: 2009 - 2012 IECC Play #2.blg Rating Date: 2/11/2013

Whole House Infiltration	Blower door test	
	Heating	Cooling
Natural ACH:	0.16	0.12
ACH @ 50 Pascals:	2.64	2.64
CFM @ 25 Pascals:	1020	1020
CFM @ 50 Pascals:	1600	1600
Eff. Leakage Area: [sq.in]	87.8	87.8
Specific Leakage Area:	0.00016	0.00016
ELA/100 sf shell: [sq.in]	1.05	1.05

Duct Leakage	Leakage to Outside Units	
	CFM @ 25 Pascals:	
	CFM25 / CFMfan:	0.0139
	CFM25 / CFA:	0.0065
	CFM per Std 152:	N/A
	CFM per Std 152 / CFA:	N/A
	CFM @ 50 Pascals:	39
	Eff. Leakage Area: [sq.in]	2.15
	Thermal Efficiency:	N/A
	Total Duct Leakage Units	CFM25/CFA
	Total Duct Leakage:	0.0212

Ventilation	Mechanical:	Exhaust Only
	Sensible Recovery Eff. (%):	0.0
	Total Recovery Eff. (%):	0.0
	Rate (cfm):	83
	Hours/Day:	24.0
	Fan Watts:	15.0
	Cooling Ventilation:	No Ventilation

ASHRAE 62.2 - 2010 Ventilation Requirements

For this home to comply with ASHRAE Standard 62.2 - 2010 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, a minimum of 69 cfm of mechanical ventilation must be provided continuously, 24 hours per day. Alternatively, an intermittently operating mechanical ventilation system may be used if the ventilation rate is adjusted accordingly. For example, a 137 cfm mechanical ventilation system would need to

2012 IECC Certificate

6739 Raritan Dr, Denver, CO 80221

Building Envelope Insulation

Ceiling Flat:	R-38.0
Vaulted Ceiling:	NA
Above Grade Walls:	R-18.0
Foundation Walls:	R-11.0
Exposed Floor:	R-19.0
Slab:	R-0.0 Edge, R-0.0 Under
Infiltration:	Htg: 3.00 Clg: 3.00 ACH50
Duct:	NA
Total Duct Leakage:	1.00 CFM @ 25 Pascals

Window Data	U-Factor	SHGC
Window:	0.320	0.400

Mechanical Equipment

HEAT: Fuel-fired air distribution, Natural gas, 93.0 AFUE.
COOL: Air conditioner, Electric, 13.0 SEER.
DHW: Conventional, Natural gas, 0.62 EF, 50.0 Gal.

Builder or Design Professional

Signature _____

Section R406 of the 2015 IECC

Energy Rating Index Compliance Alternative

- What is an Energy Rating Index



Code Book misprint and the Errata

er·ra·tum

i' rätəm, -'rā-, -'rat-/ *noun*

plural noun: **errata**

An error in printing or writing.

A list of corrected errors appended to a book or published in a subsequent issue of a journal.

Download errata at <http://www.iccsafe.org/errata-central/>

- **R406.2 Mandatory requirements.** Compliance with this section requires that the ~~mandatory~~ provisions identified in Sections ~~R401.2~~ R401 through R404 labeled as ‘mandatory’ and Section R403.5.3 be met. The building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficient in Table 402.1.2 or 402.1.4 of the 2009 *International Energy Conservation Code*.

Mandatory sections of the 2015 IECC

- R402.4 Air leakage (Mandatory)
 - Table R402.4.1.1
 - R402.4.1.2 Testing
 - **Air leakage rate not exceeding 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8**



R406.1 Mandatory Requirements

- The building thermal envelope shall be **greater than or equal** to levels of efficiency and Solar Heat Gain Coefficient in Table 402.1.1 or 402.1.3 of the **2009 *International Energy Conservation Code***.



2009 IECC vs. 2015 IECC Prescriptive Table

Climate Zone	Window U-Factor	Window SHGC	Ceiling R-Value	Wood Framed Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value and Depth	Crawl Space Wall R-Value
1	1.2 NR	0.30 0.25	R-30	R-13	R-3/4	R-13	0	0	0
2	0.65 0.40	0.30 0.25	R-30 38	R-13	R-4/6	R-13	0	0	0
3	0.35 0.35	0.30 0.25	R-30 38	R-13 20 or 13+5	R-5/8 8/13	R-19	R-5/13	0	R-5/13
4 except Marine	0.35 0.35	NR 0.40	R-38 49	R-13 20 or 13+5	R-5/10 8/13	R-19	R-10/13	R-10, 2ft	R-10/13
5 and Marine 4	0.35 0.32	NR	R-38 49	R-20 or 13+5	R-13/17	R-30	R-10/13 15/19	R-10, 2ft	R-10/13 15/19
Climate Zone 6	0.35 0.32	NR	R-49	R-20 or 13+5 20+5 or 13+10	R-15/20	R-30	R-15/19	R-10, 4ft	R-10/13 15/19
Climate Zone 7 & 8	0.35 0.32	NR	R-49	R-21 20+5 or 13+10	R-19/21	R-38	R-15/19	R-10, 4ft	R-10/13 15/19

R406.3.1 ERI reference design

- The *ERI reference design* shall be configured such that it meets the minimum requirements of the *2006 International Energy Conservation Code* prescriptive requirements
- The proposed residential building shall be shown to have an annual total normalized Modified Loads that are less than or equal to the annual total Loads of the *ERI reference design*



Home

Uniform Energy Rating System

1 Star	1 Star Plus	2 Stars	2 Stars Plus
500-401	400-301	300-251	250-201

HERS Index: **55**

General Information

Conditioned Area: 4481 sq. ft.
Conditioned Volume: 43734 cubic ft.
Bedrooms: 3

Mechanical Systems Features

Heating: Fuel-fired
Water Heating: Instant water
Cooling: Air conditioning
Duct Leakage to Outside: 50.00 CFM
Ventilation System: Exhaust On
Programmable Thermostat: Heating: Yes

Building Shell Features

Ceiling Flat: R-38
Vaulted Ceiling: NA
Above Grade Walls: R-23
Foundation Walls: R-11.0
Slab: R-0.0 Edge

Lights and Appliance Features

Percent Interior Lighting: 100.00
Percent Exterior Lighting: 0.00
Refrigerator (kWh/yr): 775.00
Dishwasher Energy Factor: 0.46

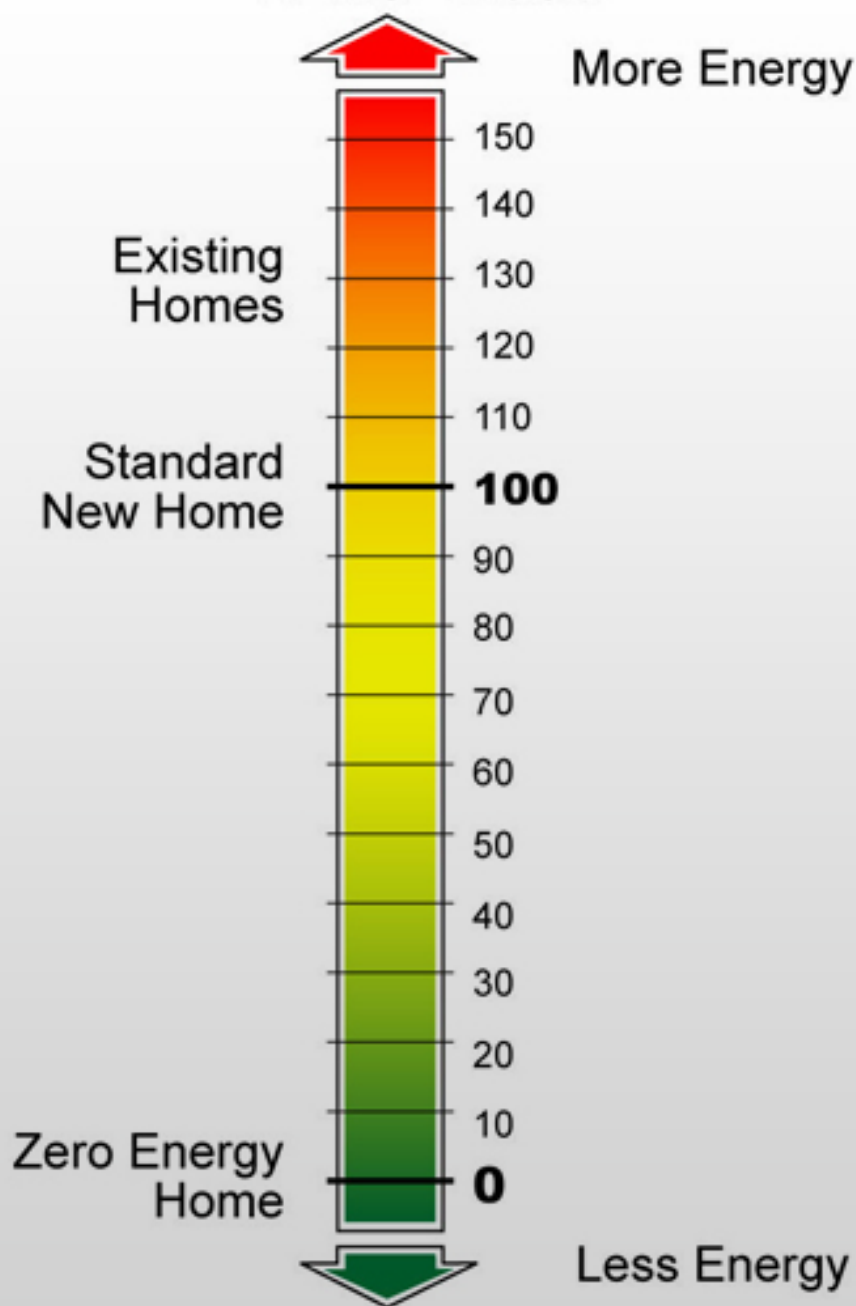
The Home Energy Rating Standard

REM/Rate - Residential

This information does not

© 1985-2012 American

HERS® Index



ID: 16805
Rater: Robby Schwarz
Date: 5/8/09
For: Best Built Homes

Estimated Annual Energy Cost

Confirmed Rating

MMBtu	Cost	Percent
58.1	\$459	28%
2.6	\$79	5%
15.2	\$111	7%
33.1	\$994	60%
-0.0	\$-0	-0%
	\$0	0%
	\$1643	100%

meets or exceeds the minimum

criteria for all of the following:

ENERGY STAR Version 2.5 Home

International Energy Conservation Code

International Energy Conservation Code

International Energy Conservation Code

Rating Provider



Certified Energy Rater

Twin Houses

ERI reference design house

- Geometric Twin
- 2006 IECC prescriptive requirements



VS. Builder's desired house

- Geometric Twin
- Mandatory 2009 IECC Envelope R-Values
- 2015 IECC Mandatory Requirements



The Builder's house must have the Energy Rating Index Required by code, or lower, to meet the intent of code

Table R406.4 Maximum Energy Rating Index

Climate Zone	Energy Rating Index
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

- Compliance based on an ERI analysis requires that the *rated design* be shown to have an ERI less than or equal to the appropriate value listed in Table R406.3, when compared to the *ERI reference design*

Features that Impact the ERI

(Lower the score)

- Mechanical equipment
 - High efficiency furnace
 - High efficiency AC
 - High efficiency water heater
- More R-value than required by the 2009 IECC
- House orientation with the ERI
- House tightness below 3 ACH50
- Duct leakage to the outside
- Duct location
- Whole house fan
- CFL or LED Lighting above 75%
- High efficiency appliances
- Solar



Pathways for Commercial Buildings Compliance



IECC Commercial Compliance Options

1

● ASHRAE 90.1-2013

OR

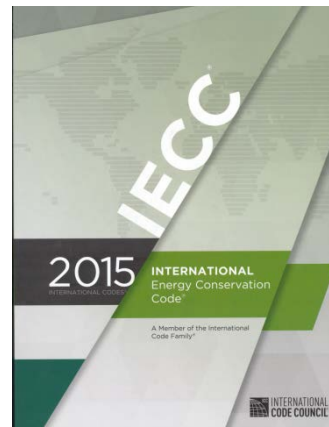
2

2015 IECC - **Prescriptive**

- C402 - Envelope
- C403 - Mechanical
- C404 - SWH
- C405 - Lighting

AND

- Pick One Efficiency Option in C406:

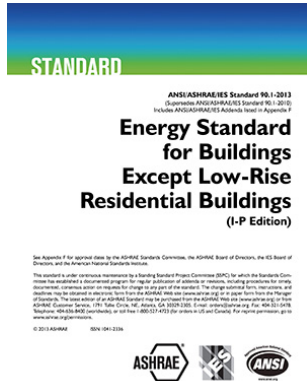


OR

2015 IECC - **Performance**

3

- C407 – Total Building Performance
- C402.5 – Air Leakage
- C403.2 – Provisions applicable to all mechanical systems
- C404 - SWH
- Lighting Mandatory Sections
 - C405.2
 - C405.3
 - C405.4
 - C405.6
- Building energy cost to be $\leq 85\%$ of standard reference design building



IECC Additional Efficiency Package Options

Section C406

- One additional efficiency feature must be selected to comply with the IECC



Enhanced lighting controls



Dedicated Outdoor Air System

TABLE C405.4.2(1)
INTERIOR LIGHTING POWER ALLOWANCES:
BUILDING AREA METHOD

BUILDING AREA TYPE	LPD (W/ft ²)
Automotive facility	0.80
Convention centers	1.01
Courthouse	1.01
Dining, bar lounge/leisure	0.9
Dining, cafeteria/cafeteria food	0.95
Dining, family	0.57
Dormitory	0.84
Exercise center	0.67
Fire station	1.19
Gymnasium	1.17
Health care clinic	0.75
Hospital	0.51
Hotel/motel	0.91
Library	1.02
Manufacturing facility	0.62
Motion picture theater	0.21
Museum	0.81
Office	1.39
Parking garage	0.87
Performance arts theater	0.87
Police station	1.0
Post office	1.25
Religious building	0.87
Retail	0.91
School/university	0.89
Sports arena	0.70
Town hall	0.66
Transportation	1.19
Warehouse	0.88
Workshop	1.19

TABLE C405.4.3(1)
INTERIOR LIGHTING POWER ALLOWANCES:
BUILDING AREA METHOD

BUILDING AREA TYPE	LPD (W/ft ²)
Automotive facility	0.80
Convention centers	1.01
Courthouse	1.01
Dining, bar lounge/leisure	0.9
Dining, cafeteria/cafeteria food	0.95
Dining, family	0.57
Dormitory	0.84
Exercise center	0.67
Fire station	1.19
Gymnasium	1.17
Health care clinic	0.75
Hospital	0.51
Hotel/motel	0.91
Library	1.02
Manufacturing facility	0.62
Motion picture theater	0.21
Museum	0.81
Office	1.39
Parking garage	0.87
Performance arts theater	0.87
Police station	1.0
Post office	1.25
Religious building	0.87
Retail	0.91
School/university	0.89
Sports arena	0.70
Town hall	0.66
Transportation	1.19
Warehouse	0.88
Workshop	1.19

10% more efficient

More Efficient Lighting System

TABLE C405.2.3(1)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY Before 1/1/2018	MINIMUM EFFICIENCY As of 1/1/2018	TEST PROCEDURE*
Air conditioners, air cooled	< 65,000 Btu/h	All	Split System	13.0 SEER	13.0 SEER	AHRI 210-240
			Single Package	13.0 SEER	14.0 SEER	
Through-the-wall (RTU)	≤ 30,000 Btu/h	All	Split System	12.0 SEER	12.0 SEER	
			Single Package	12.0 SEER	12.0 SEER	
Small commercial air conditioners	< 15,000 Btu/h	All	Split System	11.0 SEER	11.0 SEER	AHRI 340-290
			Electric Resistance (or None)	11.2 SEER	11.2 SEER	
			Split System and Single Package	11.4 SEER	11.4 SEER	
			Split System and Single Package	11.0 SEER	11.0 SEER	
Air conditioners, air cooled	2,240,000 Btu/h and < 2,760,000 Btu/h		Split System and Single Package	11.2 SEER	11.2 SEER	AHRI 340-290
			Split System and Single Package	11.0 SEER	11.0 SEER	
			Split System and Single Package	10.8 SEER	10.8 SEER	
			Split System and Single Package	11.2 SEER	11.2 SEER	
Air conditioners, water cooled	< 65,000 Btu/h					AHRI 340-290
	2,240,000 Btu/h and < 2,760,000 Btu/h					
	2,240,000 Btu/h and < 2,760,000 Btu/h					
	2,760,000 Btu/h					

10% more efficient



High Efficiency HVAC



Onsite Renewables



Solar Thermal/More Efficient SWH

IECC Chapter 5 Prescriptive – 402.1.3 Insulation component R-value-based method.

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

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings ^{a, b}	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, above grade																
Mass	R-5.7ci ^c	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-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	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-7.5ci	R-13+ R-17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-15.6ci or R-20 + R-10ci	R-13 + R-15.6ci or R-20 + R-10ci
Walls, below grade																
Below-grade wall ^d	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass ^e	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30 ^f	R-30 ^f	R-30 ^f	R-30 ^f	R-30 ^f
Slab-on-grade floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below
Heated slabs ^g	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-10 for 24" below	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 36" below	R-15 for 36" below	R-15 for 36" below	R-20 for 48" below	R-20 for 24" below	R-20 for 48" below	R-20 for 48" below	R-20 for 48" below
Opaque doors																
Nonswinging	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

C402.1.4 Assembly U-factor, C-factor or F-factor-based method.

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD^{a, b}

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.044	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021
Walls, above grade																
Mass	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.061	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.057	U-0.064	U-0.052	U-0.045	U-0.045
Wood framed and other ^c	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
Walls, below grade																
Below-grade wall ^c	C-1.140 ^e	C-1.140 ^e	C-1.140 ^e	C-1.140 ^e	C-1.140 ^e	C-1.140 ^e	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092
Floors																
Mass ^d	U-0.322 ^e	U-0.322 ^e	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066 ^e	U-0.066 ^e	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
Slab-on-grade floors																
Unheated slabs	F-0.73 ^e	F-0.73 ^e	F-0.73 ^e	F-0.73 ^e	F-0.73 ^e	F-0.73 ^e	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs ^f	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.65	F-0.65	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-0.55
Opaque doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37

What about COMcheck?



- **C402.1.5 Component performance alternative.**
- Building envelope values and fenestration areas determined in accordance with Equation 4-2 shall be permitted in lieu of compliance with the U-, F- and C-factors in Tables C402.1.3 and C402.1.4 and the maximum allowable fenestration areas in Section C402.4.1.
- $A + B + C + D + E \leq \text{Zero}$ (Equation 4-2)
- **THIS IS WHAT'S BEHIND THE SCENES IN COMCHECK. THIS IS ONLY FOR THE THERMAL ENVELOPE! Trade offs are allowed in the envelope.**
- **The mechanical and lighting portions of ComCheck are compliance reports only and do not allow any trade-offs within them. These reports are a convenient way to show compliance.**

COMcheck

Untitled.cck - COMcheck 4.0.2 Review Code: 2015 IECC

File Edit View Options Code Help

Project Envelope Interior Lighting Exterior Lighting Mechanical Requirements

Location

State: Colorado

City: Denver

Climate zone: 5b

Project Type

☒ New Construction ☐ Addition ☐ Alterations

Compliance Options

Efficiency Options: Unspecified

Air Barrier Options: Unspecified

Project Details (optional)

Edit Project Details... on the compliance certificate.

Title/Site/Permit

Owner/Agent: Jo schmo CO

Designer/Contractor

Building Envelope Area Types Interior Lighting Method and Areas Exterior Lighting Areas

Add Delete Duplicate

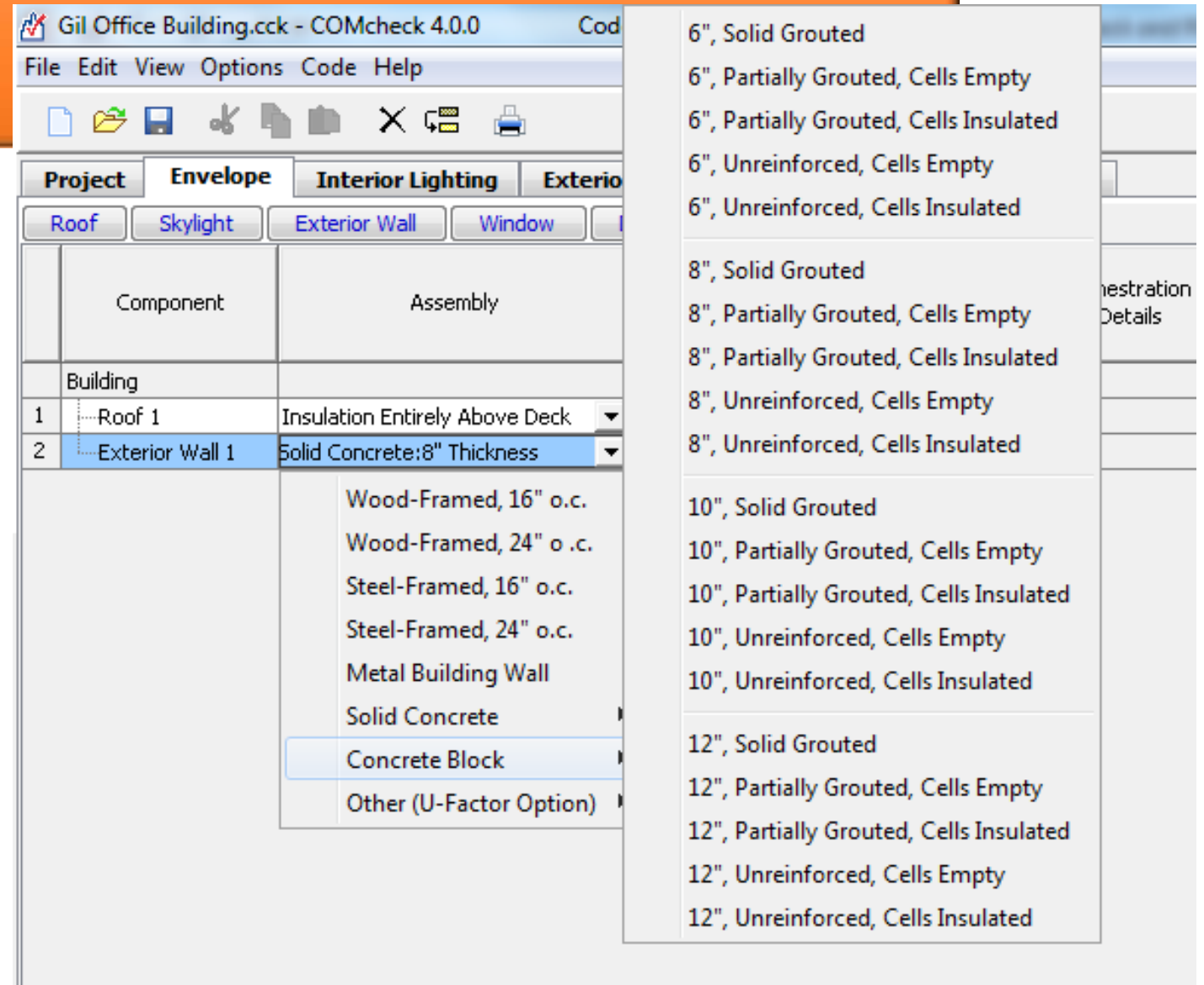
	Building Type	Area Description	Area	Wft2	Space Conditioning
1	Click to select building type.				Nonresidential

Envelope 0.0% Interior Lighting TBD Exterior Lighting TBD

2:24 PM 1/30/2016

COMcheck

- Easy to use software
- Drop down menus with common construction assemblies



COMcheck

Building Envelope Area Types Interior Lighting Method and Areas Exterior Lighting Areas

Add Delete Duplicate

	Building Type	Area Description	Area	W/ft2	Space Conditioning
1	Click to select building type.	Automotive facility Convention center Courthouse Dining: bar lounge/leisure Dining: cafeteria/fast food Dining: family Dormitory Exercise center Fire station Gymnasium Health care clinic Hospital Hotel Library Manufacturing facility Motel Motion picture theater Multifamily Museum Office			ntial

Requirements

Building Envelope Area Types Interior Lighting Method and Areas Exterior Lighting Areas

Add Delete Duplicate

	Building Type	Area Description	Area	W/ft2	Space Conditioning
1	Office		10000	0.9	Nonresidential Nonresidential Residential

COMcheck

Building Envelope Area Types Interior Lighting Method and Areas Exterior Lighting Areas

☐ Building Area Method (apply building envelope area types to interior lighting)

☒ Area Category (Space-By-Space) Method

Add Delete Duplicate

	Area Category	Area Description	Area	Ceiling Height (ft)	W/ft2
1	Click to select category.	Common Space Types			
		Courthouse/Police Station/Penitentiary			
		Automotive			
		Bank/Office			
		Dormitory			
		Gymnasium/fitness center			
		Healthcare Clinic/Hospital			
		Hotel			
		Library			
		Manufacturing			
		Museum			
		Parking Garage			
		Convention Center			
		Fire Stations			
		Post Office			
		Religious building			
		Retail			
		Sports Arena			
		Transportation			
		Warehouse			
		Atrium			
		For auditorium			
		For performing arts theater			
		For motion picture theater			
		Classroom / Lecture / Training			
		Conference / Meeting / Multipurpose			
		Corridor / Transition			
		Bar/lounge/leisure dining			
		Family dining area			
		Dressing/fitting room performing arts theater			
		Electrical/mechanical			
		Food preparation			
		Laboratory for classrooms			
		Laboratory for medical/industrial/research			
		Lobby			
		Lobby for performing arts theater			
		Lobby for motion picture theater			
		Locker room			
		Lounge recreation			
		Office - Enclosed			
		Office - Open plan			
		Restroom			
		Sales area			
		Stairway			
		Storage			
		Workshop			

COMcheck

Building Envelope Area Types Interior Lighting Method and Areas Exterior Lighting Areas

Exterior Lighting Zone: Unspecified

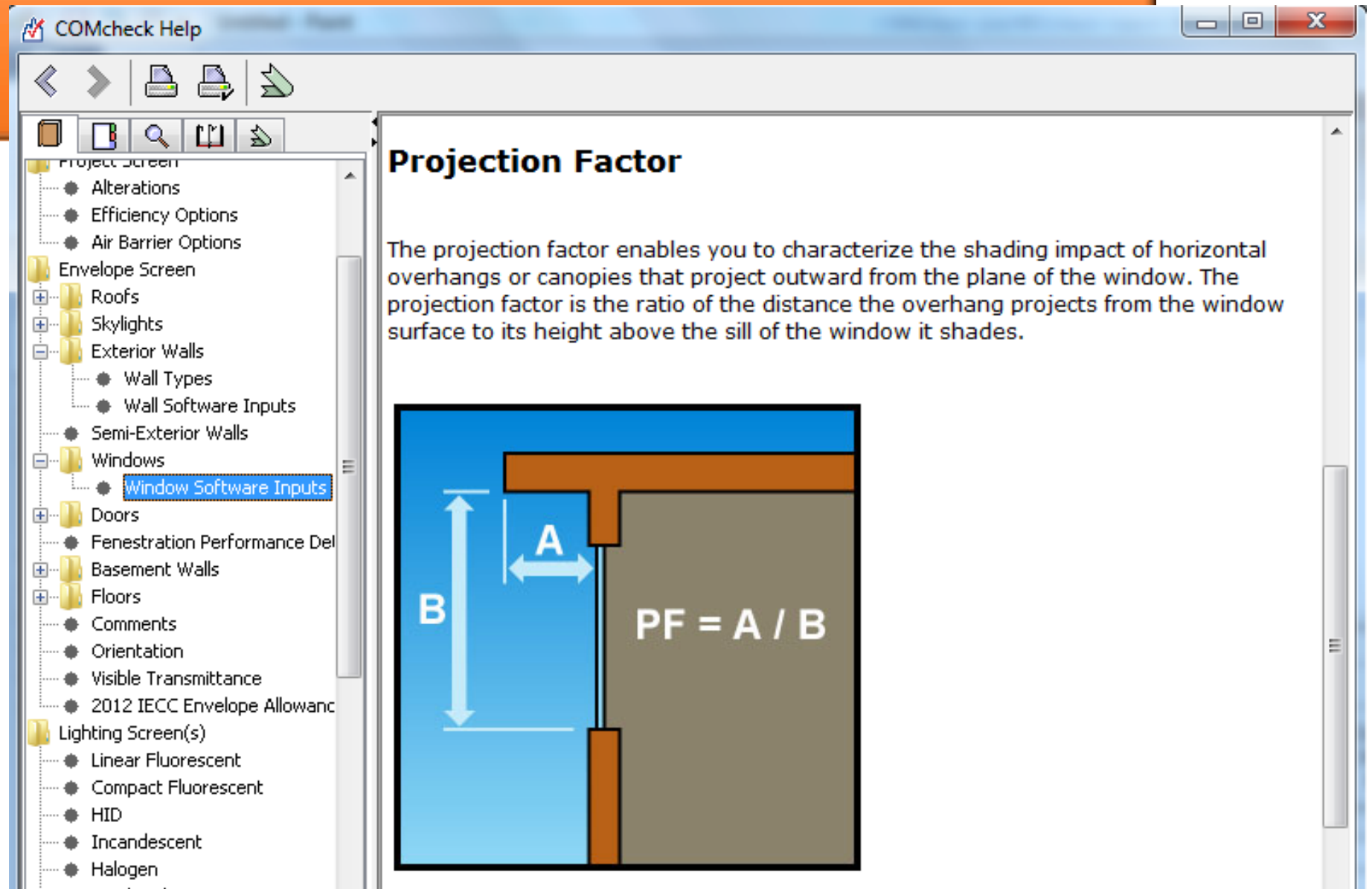
Add Delete

	Exterior Lighti	Units	W/Unit	Tradable

Residentially zoned area
Residential mixed use area
Neighborhood business district
High activity metropolitan commercial district
Light industrial area with limited nighttime use
Developed area in national or state park
Developed area on forest land
Developed rural area
Other
Unspecified

COMcheck

Helpful hints and tools that are easily accessed while entering data



COMcheck

	Building							
1	Roof 1	Insulation Entirely Above Deck			1 - Office (Nonresi...			10000 ft2
2	Exterior Wall 1	Solid Concrete:8" Thickness	Medium...		1 - Office (Nonresi...	Furring: Wood		5000 ft2
3	Window 1	Metal Frame with Thermal Break:Fixed			Code default	Glazing: Double Pane ...		500 ft2
4	Door 1	Glass (> 50% glazing):Metal Frame, Entrance Door						
5	Basement Wall 1	Solid Concrete:8" Thickness	Medium...					

Basement Walls

Enter the specified dimensions in feet (not inches) in the boxes provided.
Basement walls are walls that are partially or fully below grade.
Ignore portions of walls that are more than 10 ft below grade.

The diagram shows a cross-section of a basement wall. A horizontal line represents the finished outside grade. The wall extends from this grade down to a basement floor. Two vertical dimension lines are shown: one from the grade to the top of the wall, and another from the grade to the basement floor.

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

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

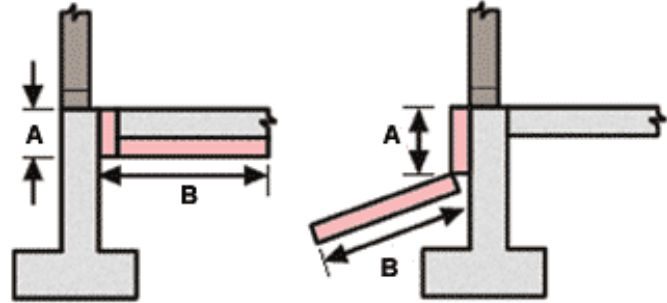
OK Cancel

COMcheck

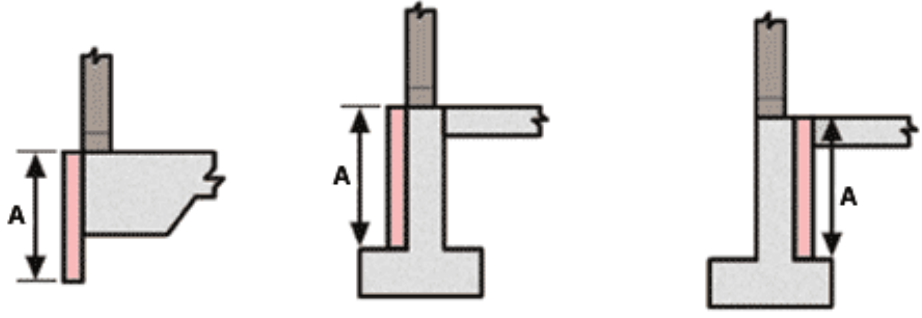
Slab-On-Grade Floors

Construction Details... Insulation: None

Click construction details to select the insulation position and depth (ft.).



Horizontal With Vertical Slab Insulation
($A + B = \text{Insulation Depth}$;
If $A > B$, Enter As Vertical Insulation)



Vertical Insulation ($A = \text{Insulation Depth}$)

OK Cancel

COMcheck

Gil Office Building.cck - COMcheck 4.0.0 Code: 2012 IECC


File Edit View Options Code Help

Project Envelope Interior Lighting Exterior Lighting Mechanical Requirements

Roof Skylight Exterior Wall Window Door Basement Floor

	Component	Assembly	Concrete Density	Building Area Type	Fenestration Details	Construction Details	Gross Area	
	Building							
1	Roof 1	Insulation Entirely Above...		1 - Office (No...			10000	ft2
2	Exterior Wall 1	Solid Concrete:8" Thickness	Medium...	1 - Office (No...		Furring: W...	5000	ft2
3	Window 1	Metal Frame with Thermo...			Code default	Glazing: Doubl...	500	ft2
4	Door 1	Glass (> 50% glazing):M...			Code default	Glazing: Tinted	100	ft2
5	Basement Wall 1	Solid Concrete:8" Thickness	Medium...	1 - Office (No...		Furring: N...	0	ft2
6	Floor 1	Slab-On-Grade:Unheated		1 - Office (No...		Insulation:...	500	ft

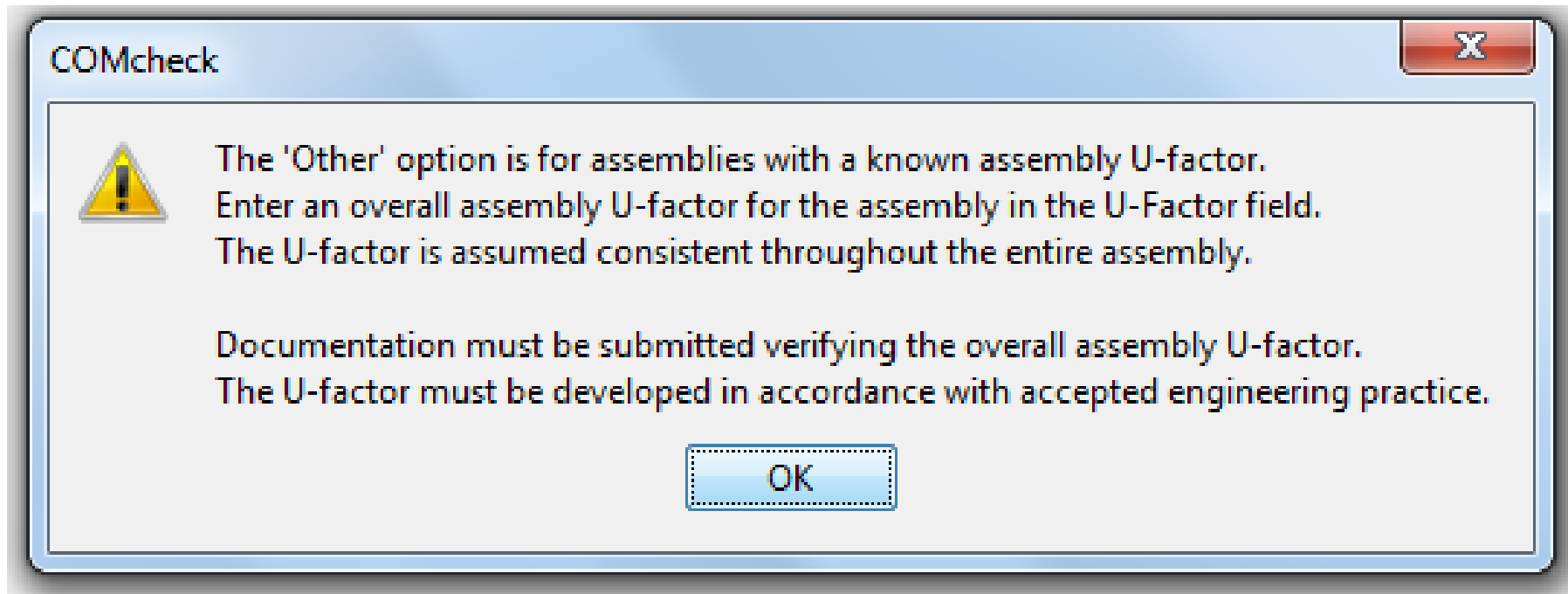
COMcheck

 Be sure to enter running length (perimeter) for slab-on-grade assemblies in the Gross Area or Slab Perimeter column.

All other components should be entered in square feet.

OK

COMcheck



Project Information

Energy Code: 2012 IECC
 Project Title:
 Location: Castle Rock, Colorado
 Climate Zone: 5b
 Project Type: New Construction
 Vertical Glazing / Wall Area: 20%
 Skylight / Roof Area: 1%

Construction Site:

Owner/Agent:

Designer/Contractor:

Building Area

1-Office : Nonresidential

Floor Area

71146

Additional Efficiency Package

Reduced interior lighting power. Requirements are implicitly enforced within interior lighting allowance calculations.

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U- Factor ₍₆₎
Roof 1: Insulation Entirely Above Deck, [Bldg. Use 1 - Office]	20286	---	30.0	0.032	0.039
Skylight 1: Metal Frame:Glass, With Curb, Perf. Specs.: Product ID NA, SHGC 0.31, [Bldg. Use 1 - Office] (b)	288	---	---	0.290	0.500
Exterior Wall 1: Steel-Framed, 16" o.c., [Bldg. Use 1 - Office]	20826	18.0	0.0	0.110	0.064
Window 1: Metal Frame with Thermal Break:Fixed, Perf. Specs.: Product ID Marko 2450, SHGC 0.35, [Bldg. Use 1 - Office] (b)	2281	---	---	0.380	0.380
Window 2: Metal Frame with Thermal Break:Fixed, Perf. Specs.: Product ID Marko 2450, SHGC 0.35, PF 1.36, [Bldg. Use 1 - Office] (b)	900	---	---	0.380	0.380
Door 1: Glass (> 50% glazing):Metal Frame, Non-Entrance Door, Perf. Type: Energy code default, Double Pane with Low-E, Clear , SHGC 0.70, PF 0.10, [Bldg. Use 1 - Office]	900	---	---	0.800	0.770
Door 2: Glass (> 50% glazing):Metal Frame, Non-Entrance Door, Perf. Type: Energy code default, Double Pane with Low-E, Clear , SHGC 0.70, PF 1.36, [Bldg. Use 1 - Office]	628	---	---	0.800	0.770
Door 3: Glass (> 50% glazing):Metal Frame, Entrance Door, Perf. Type: Energy code default, Double Pane, Clear , SHGC 0.70, [Bldg. Use 1 - Office]	140	---	---	0.800	0.770
Door 4: Insulated Metal, Swinging, [Bldg. Use 1 - Office]	24	---	---	0.140	0.370
Exterior Wall 2: Concrete Block:10", Solid Grouted, Normal Density, Furring: Metal, [Bldg. Use 1 - Office]	2687	11.4	0.0	0.140	0.078



Mechanical Compliance Certificate

Project Information

Energy Code: 2012 IECC
Project Title: [REDACTED]
Location: Castle Rock, Colorado
Climate Zone: 5b
Project Type: New Construction

Construction Site:

Owner/Agent:

Designer/Contractor:

Additional Efficiency Package

Reduced interior lighting power. Requirements are implicitly enforced within interior lighting allowance calculations.

Mechanical Systems List

Quantity	System Type & Description
1	HVAC System 1 (Multiple-Zone): VRF, Air Cooled w/ Heat Recovery Heat Pump Heating Mode: Capacity = 1324 kBtu/h, No minimum efficiency requirement applies Cooling Mode: Capacity = 1392 kBtu/h, , Air Economizer No minimum efficiency requirement applies Fan System: None
1	Water Heater 1: Gas Instantaneous Water Heater, Capacity: 0 gallons, Input Rating: 199 Btu/h w/ Circulation Pump Proposed Efficiency: 98.00 EF, Required Efficiency: 0.67 EF

Mechanical 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 2012 IECC requirements in COMcheck Version 4.0.0 and to comply with the mandatory requirements listed

Project Type: **New Construction**

Project Title : [REDACTED]

Construction Site:

Owner/Agent:

Designer/Contractor:

Additional Efficiency Package: **Reduced interior lighting power.** Requirements are implicitly enforced within interior lighting allowance calculations.

Section 2: Interior Lighting and Power Calculation

A	B Floor Area	C Allowed Watts / ft2	D Allowed Watts
Automotive facility	15982	0.82	13105
Office	8384	0.85	7128
Total Allowed Watts =			20232

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)
Automotive facility (15982 sq.ft.)				
LED X: EXIT SIGN: Other:	1	12	5	Exempt
Exemption:Exit Signs, Safety or Emergency Lighting				
LED: A/AX/A1: Other:	1	87	45	3915
LED: B: Other:	1	6	30	180
LED: L: Other:	1	10	24	240
LED: G: Other:	1	38	241	9158
Office (8384 sq.ft.)				
LED X: EXIT SIGN: Other:	1	9	5	Exempt
Exemption:Exit Signs, Safety or Emergency Lighting				
LED: Q: Other:	1	2	39	78
LED: P: Other:	1	9	96	864
LED: D: Other:	1	68	43	2924
LED: B: Other:	1	26	30	780
LED: P2: Other:	1	1	174	174
LED copy 1: N: Other:	1	16	18	288
LED copy 1: P1: Other:	1	1	96	96
LED copy 2: S: Other:	1	4	40	160
Total Proposed Watts =				18857

Interior Lighting PASSES: Design 7% better than code.

2012 IECC

Section 1: Project Information

Project Type: **New Construction**

Project Title : [REDACTED]

Construction Site:

Owner/Agent:

Designer/Contractor:

Additional Efficiency Package: **High efficiency HVAC.** Systems that do not meet the performance requirement will be identified in the mechanical requirements checklist report.

Section 2: Interior Lighting and Power Calculation

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B x C)
STORAGE (Warehouse:Fine material storage)	20785	1.4	29099
MANUFACTURING (Manufacturing:Detailed manufacturing)	20703	1.3	26914
OFFICE (Common Space Types:Office - Open plan)	3562	1	3562
CONFERENCE ROOM (Common Space Types:Conference / Meeting / Multipurpose)	797	1.2	956
LAB (Common Space Types:Laboratory for medical/industrial/research)	5800	1.8	10440
Total Allowed Watts =			70971

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)
STORAGE (Warehouse:Fine material storage 20785 sq.ft.)				
Linear Fluorescent 1: S1/S1EM: NEW HIGH BAY: 46" T5 HO 54W: Electronic:	8	119	432	51408
Linear Fluorescent 2: R1/R1EM: NEW PARABOLIC: 48" T8 32W: Electronic:	3	10	91	910
Linear Fluorescent 2 copy 1: R2/R2EM: NEW LENSED: 48" T8 32W: Electronic:	2	3	64	192
Linear Fluorescent 2 copy 1: (E): EXISTING PARABOLIC: 48" T8 32W: Electronic:	3	142	91	12922
Linear Fluorescent 2 copy 2: W1EM: NEW WALL: 48" T8 32W: Electronic:	2	3	64	192
Linear Fluorescent 2 copy 2: (E): EXISTING 1'X4': 48" T8 32W: Electronic:	1	36	32	1152
Compact Fluorescent 1: (E): EXISTING CAN DOWNLIGHT: Triple 4-pin 26W: Electronic:	1	34	28	952
Linear Fluorescent 2 copy 3: (E): EXISTING 4' STRIP: 48" T8 32W: Electronic:	1	42	32	1344
Linear Fluorescent 8: (E): EXISTING 2'X2': 24" T8 17W: Electronic:	2	11	35	385
Linear Fluorescent 1 copy 1: (E): EXISTING HIGH BAY: 46" T5 HO 54W: Electronic:	4	6	222	1332
Compact Fluorescent 1 copy 1: (E): EXISTING PENDANT: Triple 4-pin 26W: Electronic:	1	3	28	84
MANUFACTURING (Manufacturing:Detailed manufacturing 20703 sq.ft.)				
OFFICE (Common Space Types:Office - Open plan 3562 sq.ft.)				
CONFERENCE ROOM (Common Space Types:Conference / Meeting / Multipurpose 797 sq.ft.)				
LAB (Common Space Types:Laboratory for medical/industrial/research 5800 sq.ft.)				
Total Proposed Watts =				70873

Interior Lighting PASSES: Design 0.1% better than code.



Exterior Lighting Compliance Certificate

Project Information

Energy Code: 2012 IECC
 Project Title: [REDACTED]
 Project Type: New Construction
 Exterior Lighting Zone: 2 (Residential mixed use area)

Construction Site: Owner/Agent: Designer/Contractor:

Allowed Exterior Lighting Power

A Area/Surface Category	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (B X C)
Illuminated length of facade wall or surface	111 ft	2.5	No	278
Parking area	1717 ft ²	0.06	Yes	103
Illuminated length of facade wall or surface	200 ft	2.5	No	500
Total Tradable Watts (a) =				103
Total Allowed Watts =				881
Total Allowed Supplemental Watts (b) =				600

(a) Wattage tradeoffs are only allowed between tradable areas/surfaces.

(b) A supplemental allowance equal to 600 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Proposed Exterior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
<u>Illuminated length of facade wall or surface (111 ft): Non-tradable Wattage</u>				
LED 1: J1: LED Panel 70W: Exemption: Advertising or directional signage	1	28	70	Exempt
<u>Parking area (1717 ft²): Tradable Wattage</u>				
LED 2: G: Other:	1	6	58	348
<u>Illuminated length of facade wall or surface (200 ft): Non-tradable Wattage</u>				
LED 3: J: Other:	1	14	35	490
Total Tradable Proposed Watts =				348

Exterior Lighting PASSES: Design 50% better than code

Exterior Lighting 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 exterior lighting systems have been designed to meet the 2012 IECC requirements in COMcheck Version 4.0.0 and to comply with the mandatory requirements listed

SECTION C407

TOTAL BUILDING PERFORMANCE

- **C407.1 Scope.**
- This section establishes criteria for compliance using total building performance. The following systems and loads shall be included in determining the total building performance: heating systems, cooling systems, service water heating, fan systems, lighting power, receptacle loads and process loads.
- **C407.2 Mandatory requirements.**
- Compliance with this section requires that the criteria of Sections C402.5, C403.2, C404 and C405 be met.
- **C407.3 Performance-based compliance.**
- Compliance based on total building performance requires that a proposed building (proposed design) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the standard reference design.

Simulation software

EnergyPlus



C407.6.1 Specific approval.

Performance analysis tools complying with the applicable subsections of Section C407 and tested according to ASHRAE Standard 140 shall be permitted to be approved. Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction. The code official shall be permitted to approve tools for a specified application or limited scope.

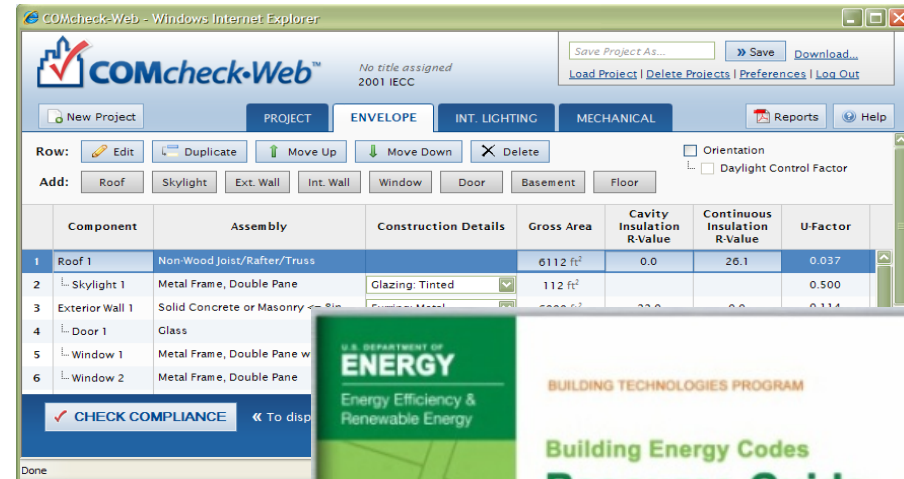
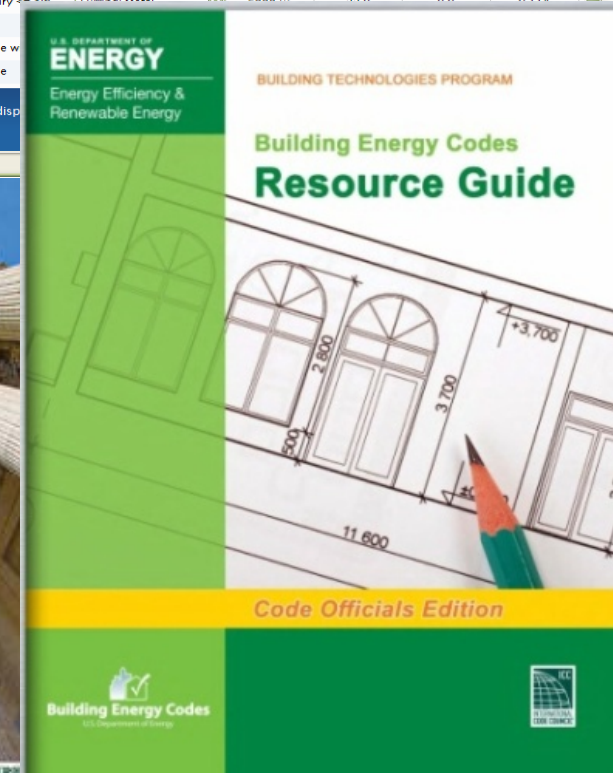
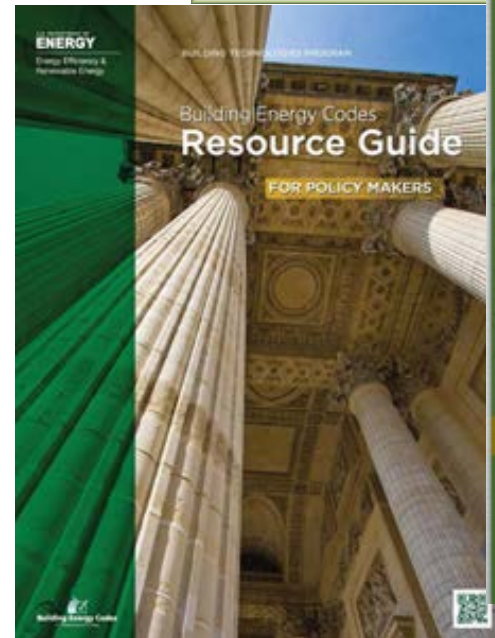


OpenStudio



U.S. DOE: BECP Resources

- ▶ Compliance software
- ▶ Technical support
- ▶ Code Notes
- ▶ Publications
- ▶ Resource guides
- ▶ Training materials



Thank you!

Shaunna Mozingo

Colorado Code Consulting LLC

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