

SIGNIFICANT IECC RESIDENTIAL CHANGES



2012 RESIDENTIAL ENERGY CONSERVATION CODE

IECC 2009



IECC 2012

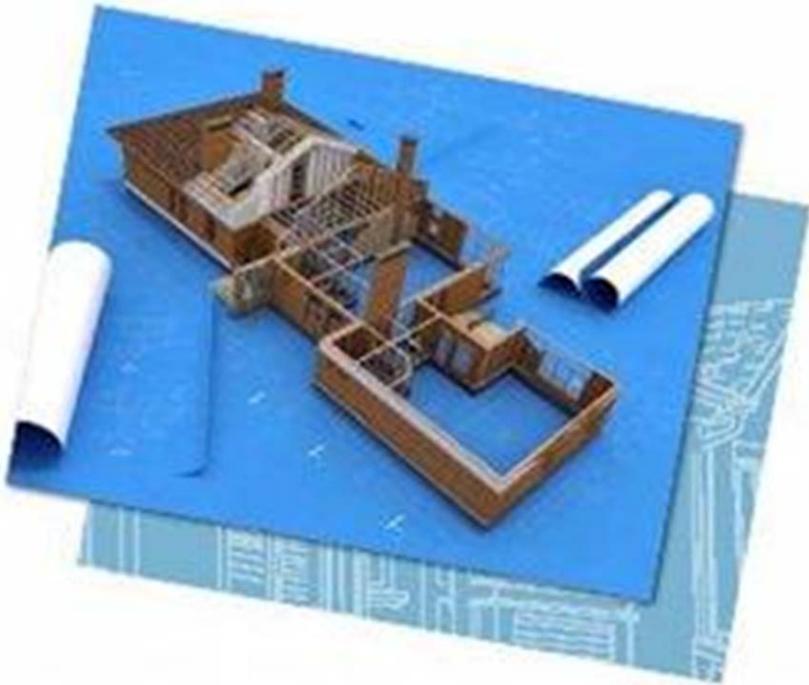
Edited & Presented by

Don Vigneau, AIA

for DCS/OEDM

Design Trades Conference

Today's Presentation

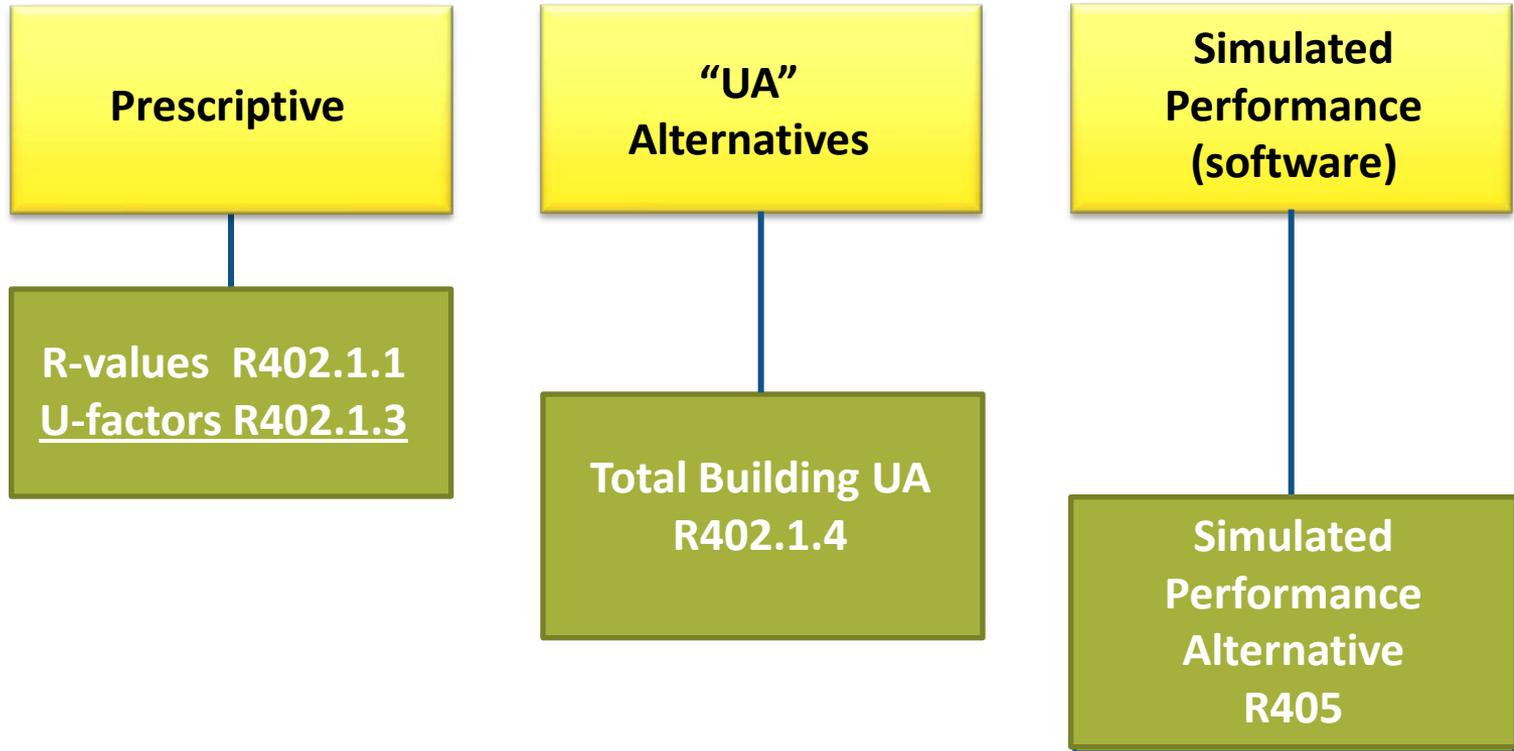


An overview of the significant code change proposals recommended for the 2012 Edition of the ICC Residential Energy Code; published Errata; CT proposed Amendments and deletions

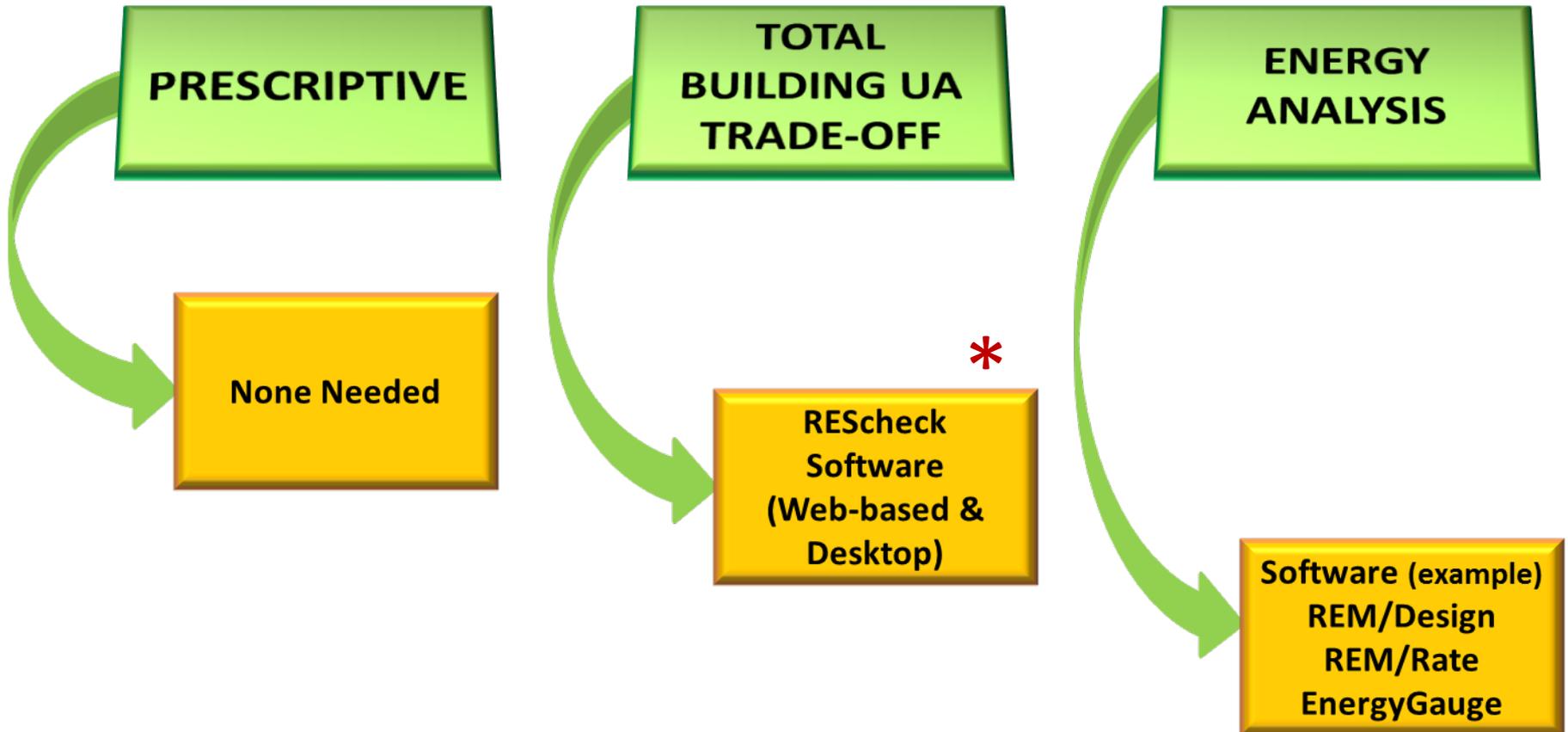
Detailed information is available at:
<http://www.iccsafe.org/cs/codes/Pages/09-10cycle.aspx>

Original proposals, Committee recommendations, public comments and final approved changes can be found at the website for every specific proposal brought before the ICC membership and considered for inclusion in the 2012 I-Codes.

IECC COMPLIANCE - THREE OPTIONS



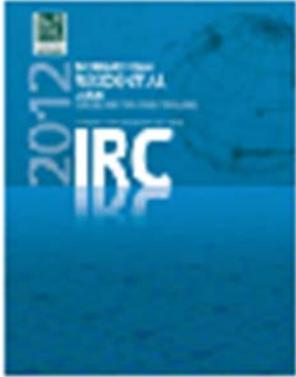
CODE COMPLIANCE TOOLS



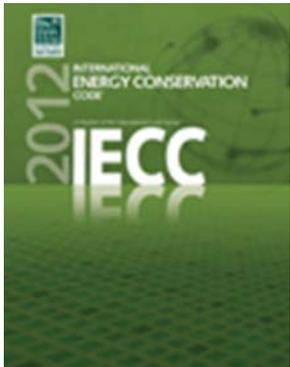
www.energycodes.gov/rescheck/

4 **Version 4.6.1.2 (includes 2015)**

Relationship Between IRC & IECC



VS



- ✓ IECC addresses only energy
- ✓ IECC addresses residential and commercial;
- ✓ IRC addresses all R-3 Residential topics (*structural, plumbing, etc.*),
 - Allows builder to carry only one code book
 - Chapter 11 covers energy efficiency
- ✓ IRC addresses subsets of residential;
 - detached one- and two-family dwellings
 - townhouses 3 stories or fewer
- ✓ 2012 consolidates *Residential Provisions* with IRC energy Chapter 11 (actually a change to the IRC, not the IECC)

HOW DOES MY PROJECT NEED TO COMPLY?

IECC

R-2/R-3/R-4 - three stories or less in height

IRC

One- and two-family dwellings



IECC 2012 CHANGES [RE]

Five Principal Areas

- R101 ADMINISTRATION
- R202 DEFINITIONS
- R402 ENVELOPE
- R403 MECHANICAL/SWH
- R404 LIGHTING



FINDING THE CERTIFICATE - R101.3

- Insulation values
- U & SHGC factors(*)
- Envelope air leakage
- Duct leakage
- Equipment types/ efficiencies



REScheck Software Version 4.2.0
Compliance Certificate

Project Title: North Meadows Development

Energy Code: 2000 IECC
 Location: Greensboro, North Carolina
 Construction Type: Single Family
 Glazing Area Percentage: 15%
 Heating Degree Days: 3865

Construction Site: _____ Owner/Agent: _____ Designer/Contractor: _____
 Permit Date: 3/17/00

Compliance: Passes

Compliance: **14.8% Better Than Code** Maximum UA: 467 Your UA: 388

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	729	38.0	0.0		22
Ceiling 2: Flat Ceiling or Scissor Truss	592	30.0	0.0		21
Wall 1: Wood Frame, 16" o.c.	1647	13.0	6.0		82
Door 1: Glass	84			0.400	34
Window 1: Vinyl Frame, Double Pane with Low-E	204			0.450	92
Door 2: Solid	20			0.540	11
Wall 2: Wood Frame, 16" o.c.	276	13.0	0.0		21
Door 3: Solid	18			0.350	5
Floor 1: All-Wood Joist/Truss, Over Unconditioned Space	938	19.0	0.0		44
Floor 2: All-Wood Joist/Truss, Over Outside Air	32	30.0	0.0		1
Floor 3: Slab-On-Grade/Unheated	62		8.0		64
Insulation depth: 2.0'					

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 2000 IECC requirements in REScheck Version 4.2.0 and to comply with the mandatory requirements listed in the REScheck Inspection Checklist.

Name - Title _____ Signature _____ Date _____

Project Notes:

Previously saved project information:
 1010 Construction Ave.
 Greensboro, North Carolina
 Guilford County
 Caretti Builders, Inc.
 120 W. St.
 Greensboro, NC 27411

Project Title: North Meadows Development Report date: 02/10/09
 Data filename: C:\Program Files\Check\REScheck420\example.rox Page 1 of 4

CT AMENDS: R103.1

- R103.1 General (AMD)
 - *Two sets of construction documents and other supporting data shall be submitted to the building official at the time of application for the building permit. The construction documents and designs submitted shall be prepared by a registered design professional when required by the provisions of Chapters 390 or 391 of the Connecticut General Statutes.*

CT AMENDS: R103.1 (CONT.)

- Exception

- *The building official may waive the submission of construction documents and other supporting data not required to be prepared by a registered design professional if the work proposed is not required by the provisions of this code, or the building official determines that the nature of the work applied for is such that review of the construction documents is not necessary to obtain compliance with this code.*

R103.2 / N1101.8 INFORMATION ON CONSTRUCTION DOCUMENTS

- Insulation materials
- R values, U factors & area weighting
- Mechanical & SWH design criteria, sizes, efficiencies; controls
- Duct sealing, insulation & locations
- Air sealing details



INFORMATION ON PLANS - *R103.2*

**** PLUS ****

- Thermal Calculations
- Air sealing details
- Fan motors
- ~~Economizers~~
- ~~Light fixture schedule~~



CT AMENDS: R103.5

- R103.5 Retention Of Construction Documents
 - *One set of approved construction documents shall be retained by the building official for a period as set forth in the records/disposition schedule adopted pursuant to Chapter 188 of the Connecticut General Statutes*



CT AMENDS: - R106.1

- R106.1 General (AMD)

- *The codes and standards referenced in this code shall be those listed in Chapter 5, and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference. Any reference to the ICC codes shall mean the Regulation of Connecticut State Agencies known as the State Building Code adopted pursuant to section 29-252 of the Connecticut General Statutes*

CT AMENDS: R107.2

(AMD) R107.2 Schedule of Permit Fees

- *Each municipality shall establish a schedule of fees for each construction document review, building permit, certificate of approval and certificate of occupancy. A schedule of adopted fees shall be posted for public view.*

CT AMENDS: R108.4

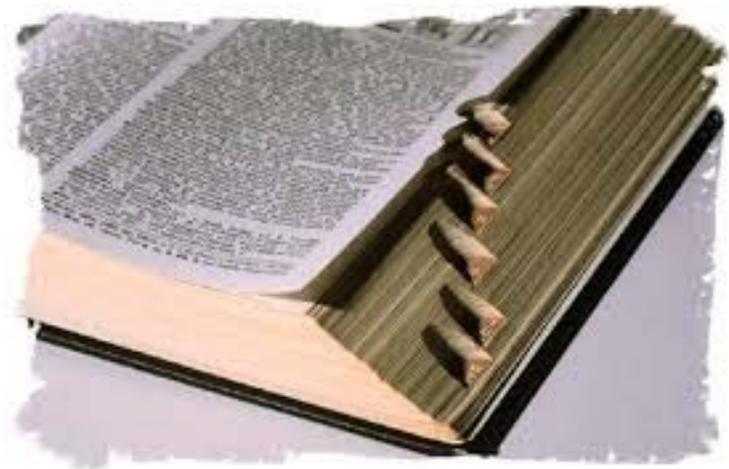
- (DEL) ~~R108.4 Failure To Comply~~
 - *Delete in its entirety and replace with:*
- (ADD) R108.4 Unlawful Continuance
 - *Any person who shall continue any work in or about the structure after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be liable for penalties in accordance with section 29-254a of the Connecticut General Statutes*

CT AMENDS: R109.1

- (DEL) ~~R109 Board Of Appeals~~
 - Delete 109.1, .2 & .3 entirely and replace with the following:
- (ADD) R109.1 Means of Appeal
 - *Means of appeal shall be in accordance with Section 113 of the 2012 International Building Code portion of the 2015 State Building Code*

CT AMENDS: - *R201 Definitions*

- (AMD) R201.3 Terms Defined In Other Codes
 - *Where terms are not defined in this code and are defined in other codes adopted as portions of the 2015 State Building Code, such terms shall have the meanings ascribed to them as in those codes*



DEFINITIONS AND ERRATA* - R202

NEW (ADD)

- Continuous air barrier
- Demand recirculation water system
- Fenestration product - site built
- Greenhouse
- Whole-house ventilation

AMENDED (AMD)

- Residential building
- Skylight (R405.5.2)*

NOT APPLICABLE [CE]

- Entrance door* (RE12)
- Full Cutoff Luminaire
- Visible Transmittance* (dynamic glazing)

CT AMENDS: - R202 (2009)

- (AMD) *Greenhouse* ≤ 400 sf
 - *A one-story structure, enclosing a nonhabitable space, with glazing in excess of 50 percent of the gross area of the exterior walls and roof*



CT AMENDS: - R202 (2009)

- (AMD) *Sunroom* ≤ 500 *sf*
 - *A one-story structure, enclosing a habitable space, with glazing in excess of 40 per cent of the gross area of the exterior walls and roof, and with the area of windows and doors operable to the exterior equal to a minimum of 20 per cent of the area of the sunroom floor*

A Primer:

CONTROL LAYERS



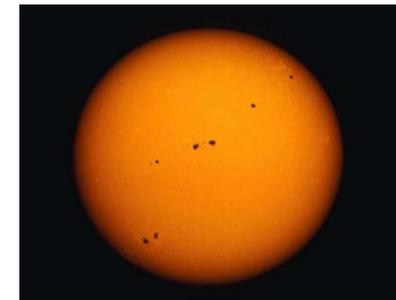
- WATER

- AIR



- WATER VAPOR

- THERMAL



Chapter 4 - RESIDENTIAL CHANGES

- Increased performance : envelope, windows, skylights
- Reduced allowable air leakage: envelope & duct systems
- Increased duct tightness (reduced allowed leakage)
- Requires supply & exhaust ventilation (IRC R702.7; IBC 1405.3)
- Greater HVAC/SHW efficiencies (commercial equipment tables)
- Mandatory Equipment Sizing based on loads ACCA S & J
- Increased H/E lighting by socket count or by fixture

INSULATION AND FENESTRATION PERFORMANCE By Climate Zone - *Table R402.1.1*

**TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a**

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b,c}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ^e	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 ^b	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5 ^b	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5 ^b	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10 ^b	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 ^b	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-15 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.
- First value is cavity insulation, second is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.
- The second R-value applies when more than half the insulation is on the interior of the mass wall.

REDUCTION IN CONTINUOUS INSULATION THICKNESS - TABLE R402.1.1 (Note "h")

- Note 'h' allows for a reduced R-value not more than R-3 for the continuous insulation over not more than 40% of structural sheathing to maintain a uniform total "insulated sheathing plus c.i. thickness."
- The full continuous minimum R-value must be installed over the remainder of the wall



[e.g.] BELOW-GRADE WALLS - R402.1

Table R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS
BY COMPONENT

CLIMATE ZONE	...	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE
1		13	0
2		13	0
3		19	5/13f
4 except Marine		19	10/13
5 and Marine 4		30^g	15/19
6		30 ^g	15/19
7 and 8		38 ^g	15/19

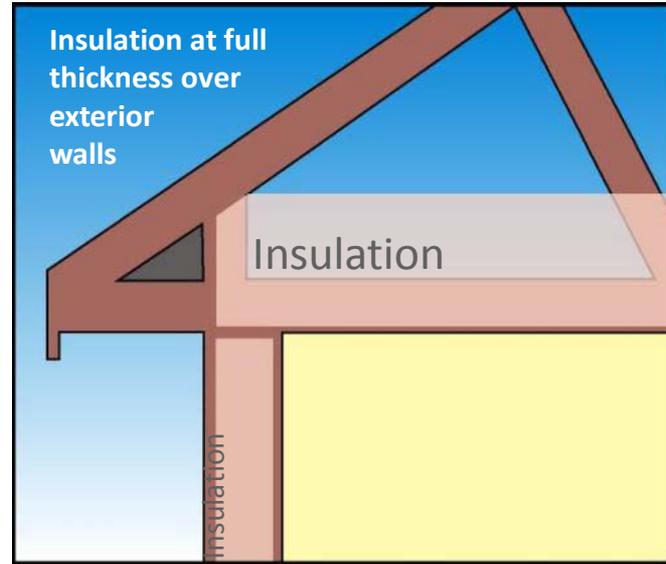
- Note 'c' "X/Y" means R-X continuous or R-Y cavity
- 15/19 requirement can be met with R-19 cavity (interior) or R-15 continuous (exterior)

Fenestration U-Factors - Table R402.1.1



- Doors U-0.32
- Windows U-0.32
- Skylights U-0.55
- SHGC N/R
- V/T [CE]

CEILING WITH ATTICS - R402.2.1: EXCEPTION



Prescriptive R-value path encourages raised heel truss (*aka, energy truss*)

- ✓ If insulation is full height over exterior wall top plate
 - R-38 complies where R-49 is required



Note: Reductions ONLY apply to the R-value prescriptive path, not the U-factor or Total UA alternatives

CEILING WITHOUT ATTIC SPACES - R402.2.2

- ✓ R-38 allowed for 500 ft² or 20% total insulated ceiling area, whichever is less, in 'cathedral' ceilings where:
 - ✓ R-49 Insulation levels would be required
 - ✓ Insufficient framing *cavity* space to meet tabular levels
- ✓ *This does not apply to 'cathedral' trusses*



Note: Reduction ONLY applies to the R-value prescriptive path, not the U-factor or Total UA alternatives

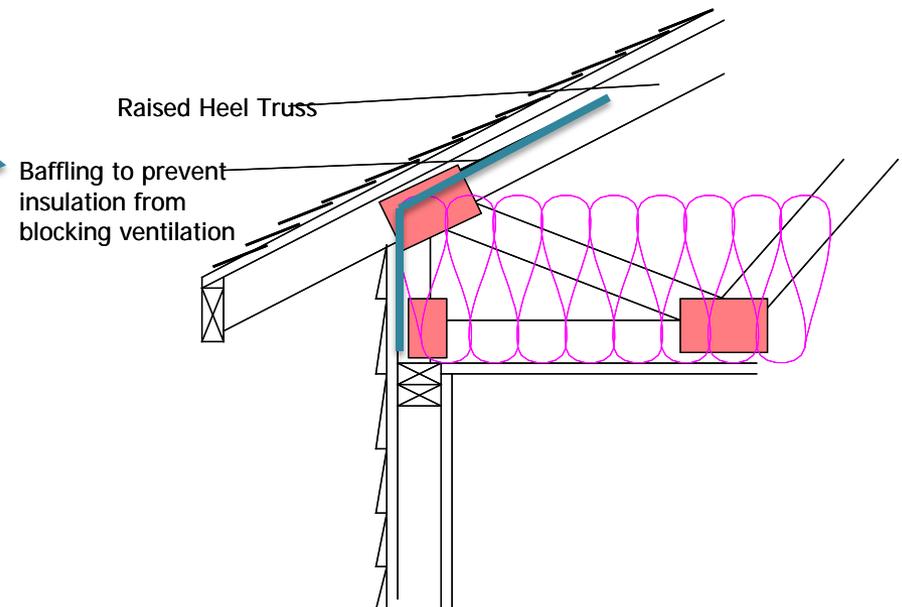
EAVE BAFFLES - R402.2.3

Baffles for air permeable insulations in vented attics:

- ✓ Installed adjacent to soffit and eave vents
- ✓ To maintain an opening \geq size of vent
- ✓ To extend over top and ends of attic insulation
- ✓ May be of any solid material



Baffle



STEEL-FRAME CEILINGS / WALLS

Section R402.2.6; Table R402.2.6

Table keys on the wood-frame requirement for the corresponding building component

Table R402.2.6
Steel-Frame Ceiling, Wall and Floor
Insulation
(R-Value)

Wood Frame R-value Requirement	Cold-Formed Steel Equivalent R-value ^a
Steel Truss Ceilings^b	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings^b	
R-30	R-38 in 2x4, or 2x6, or 2x8 R-49 any framing
R-38	R-49 2x4, or 2x6, or 2x8, or 2x10
Steel Framed Wall	
R-13	R-13 + 4.2 or R-19 +2.1, or R-21 +2.8 or R-0+9.3 or R-15+R-3.8 or R-21 + 3.1
R-13+R-3	R-0 + 11.2 or R-13 +6.1, or R-15 +5.7 or R-19+5.0 or R-21+4.7

CT AMENDS: SUNROOMS, GREENHOUSES

R402.2.12 - Table R402.2.12

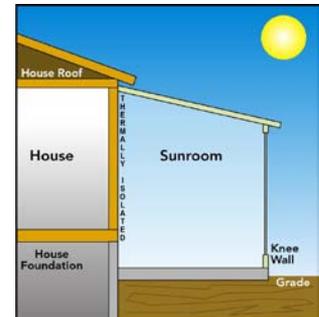
(NEW) (Add) Table R402.2.12. Prescriptive envelope component criteria for residential greenhouses (≤ 400 sf) and sunrooms (≤ 500 sf).

a. Two feet minimum depth slab-on grade perimeter insulation.

BUILDING COMPONENT	MINIMUM R-VALUE	
	IECC	CT Amends
Opaque ceiling	R 24	R 19
Floor over unheated space [CT]	?-R30	R 19
Opaque wall	R 13	R 11
Slab perimeter insulation	R 10	R 5
<hr/>		
Sunroom fenestration ($\geq 40\%$)	U 0.45	U 0.50 / U 0.45
* Greenhouse fenestration ($\geq 50\%$)	-	U 0.60
Skylights	U 0.70	???

*

- ✓ There are no skylight amendments for these CT amendments
- ✓ Cannot use RESCheck



(AMD) SEALING AIR LEAKAGE- *Table R402.4.1.1*

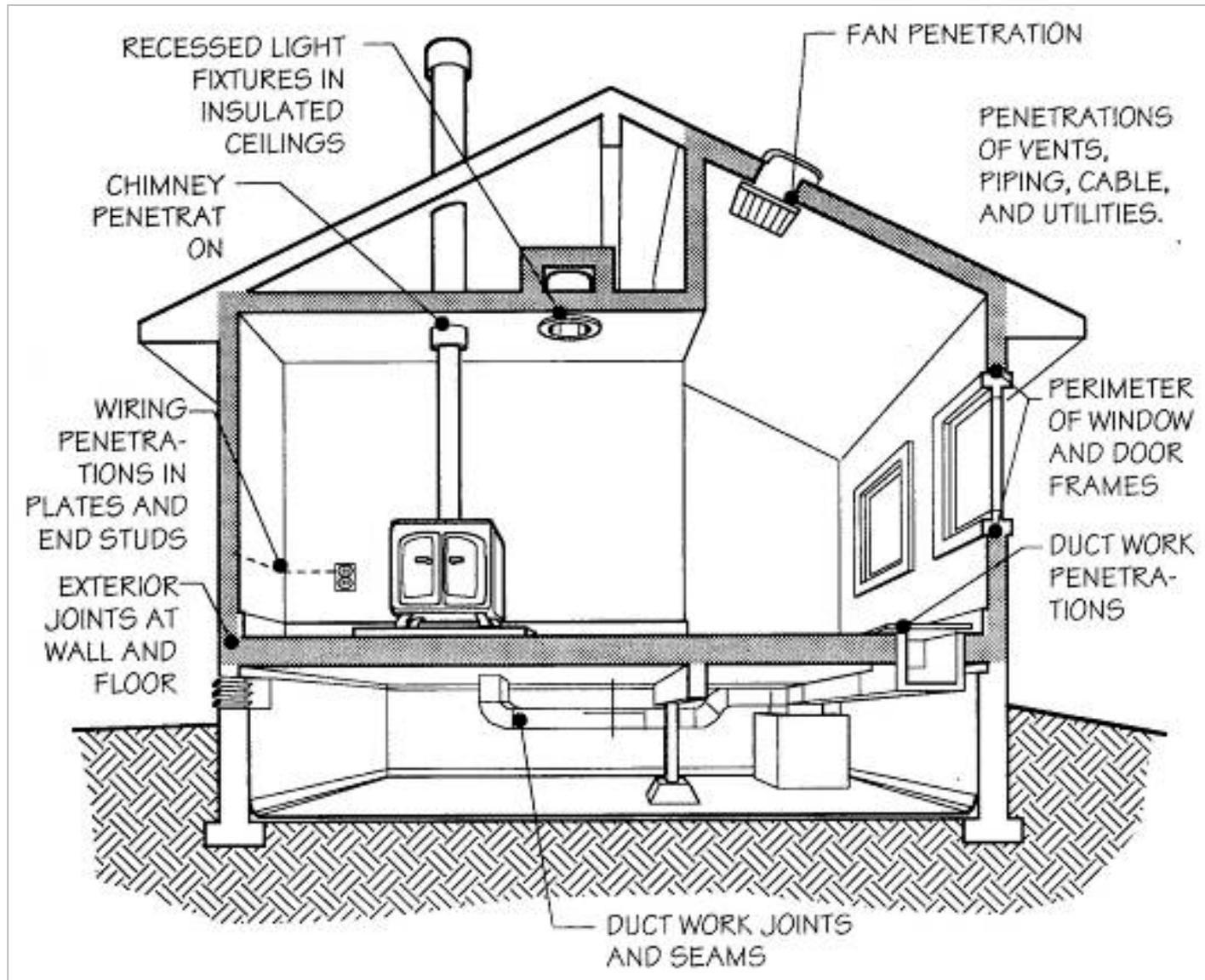


TABLE R402.4.1.1 AIR BARRIER/INSULATION INSTALLATION (Mandatory)

Component	Criteria
Air barrier and thermal barrier	<p>A continuous air barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.</p> <p>Air-permeable insulation shall not be used as a sealing material.</p>
Ceiling/attic	<p>The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed.</p> <p>Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.</p>
Walls	<p>Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed.</p> <p>The junction of the top plate and top of exterior walls shall be sealed.</p> <p>Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.</p> <p>Knee walls shall be sealed.</p>
Windows, skylights and doors	<p>The space between window/door jambs and framing and skylights and framing shall be sealed.</p>
Rim joists	<p>Rim joists shall be insulated and include the air barrier.</p>
Floors (including above-garage and cantilevered floors)	<p>Insulation shall be installed to maintain permanent contact with underside of subfloor decking.</p> <p>The air barrier shall be installed at any exposed edge of insulation.</p>

(partial table)

Air Barrier Materials - R402.4.1 (INFO for Table)

Materials with air permeance ≤ 0.004 cfm/ft² under pressure differential of 0.3 in. w.g. tested in accordance with ASTM E 2178 (*C402.4.1.2.1*)

Material	Thickness (minimum)
Plywood	3/8 in.
Oriented strand board	3/8 in.
Extruded polystyrene insulation board	½ in.
Foil-faced urethane insulation board	½ in.
Closed cell spray foam minimum density of 1.5 pcf	1-1/2 in.
Open cell spray foam density between 0.4 and 1.5 pcf	4.5 in.
Exterior gypsum sheathing or interior gypsum board	½ in.
Cement board	½ in.
Built up roofing membrane	Any
Modified bituminous roof membrane	Any
Fully adhered single-ply roof membrane	Any
A Portland cement/sand parge, stucco, or gypsum plaster	5/8 in.
Cast-in-place and precast concrete	Any
Sheet metal or aluminum	Any

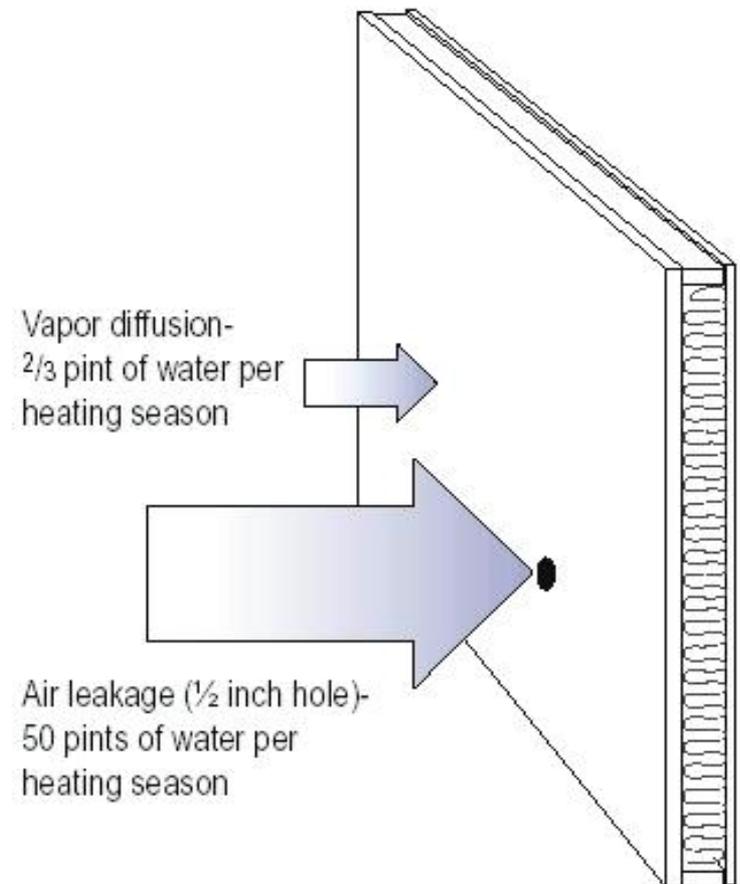
1998 AIRTIGHT STUDY

SINGLE FAMILY - ACH

- Mean Age: 20-30yr
- Multiply # by 20 for test
- Tight: 0.19-0.24
- Good: 0.48-0.59
- Typical: 0.96-1.18
- Leaky: 1.93-2.35

- Canada: 0.11+
- ASHRAE 62 min. 0.35

MOISTURE MIGRATION PRIORITIES
Significantly more water vapor travels through a wall by air leakage than by diffusion



AIR BARRIER - COMMON WALLS

N/R

- There is no requirement for an air barrier or insulation in common walls between conditioned living spaces of adjacent dwelling units in townhouses and multi-family dwellings



BUILDING THERMAL ENVELOPE *(Mandatory)*

R402.4.1 & R402.1.2 - AIR LEAKAGE

Show compliance - R402.1.2

- ✓ Air barrier installation
- ✓ Whole-house pressure test
- ✓ Procedures for testing outlined
- ✓ Testing may occur any time after creation of all building envelope penetrations*
- ✓ Signed report shall be provided

Air Leakage Rate	Climate Zone	Test Pressure
ACH \leq 5	1-2	50 Pascals
ACH \leq 3	3-8	50 Pascals



VAPOR RETARDER (CT 402.6) - 2007 IECC

INFO- MOVED IN 2009 IRC / 2012 IBC

IECC / IRC

Moisture Control

- R202 Definitions
- R302.10.1 Insulation
- R408.1 crawl spaces
- R506.2.3 Slabs
- R601.3 Walls (Table)
- R806.4 Attics
- N1102.2.9 Crawl Space
- M1601.4.5 Ducts

(Was in IECC 402.5/N1102.5)

IBC

Moisture Control

- 202 Definitions
- 719 Insulation facings
- 1203.3.2 Crawl Space.4
- 1405.3 Frame Walls
- 1502 Roofs (general)
- 1910.1 Floor Slabs

(Was in IECC 502.5)

MOISTURE DIFFUSION IN MATERIALS *[info]*

MATERIAL	PERM RATING	VAPOR RETARDER(?)
½" GWB	38 -42	NO
TYVEK	52	NO
Latex <u>Primer</u>	7.0 – 10.0	NO
7/16" OSB (w/exterior glue)*	0.77* – 3.48	SOMETIMES
1" XPS	0.40 – 1.60	SOMETIMES
7/16" Plywood (exterior glue)	0.70	YES
Kraft Paper Facing	1.0	YES
2 mil polyethylene	0.06 – 0.22	YES
Alkyd-base or V/R paint	< 0.05	YES
1 mil aluminum foil laminate	< 0.05	YES
½" GWB + VWC	0.05 – 0.80	YES

IRC SECTION R601.3 - Vapor Retarder

New vapor retarder requirements allow the use of a coat of vinyl paint to satisfy the requirement in Zone 5 when:

- A **vapor-impermeable insulating sheathing** with a minimum value of **R-5** is located **outside** of a 2x4 stud wall with **wall cavities insulated to R-3.4 per inch**;
- A **vapor-impermeable insulating sheathing** with a minimum value of **R-7.5** is located **outside** of a 2x6 stud wall with **wall cavities insulated to R-3.4 per inch**;



WOOD-BURNING FIREPLACES *(Mandatory)*

SECTION R402.4.2; TABLE R402.4.1.1

New wood-burning fireplaces shall have tight-fitting flue dampers (and outdoor combustion air - 2009).

~~Fireplaces shall have gasketed doors~~



SINGLE / MULTI-FAMILY RESIDENTIAL MECHANICAL SYSTEMS AND EQUIPMENT

NAECA

Equipment efficiency set by Federal law,
not the I-Codes

NATIONAL APPLIANCE EFFICIENCY ACT

- *NAECA* says: Code cannot require higher efficiencies than are set by standards adopted in 1987; amended by Environmental Protection Acts 1992/2005
- Equipment efficiency tables are being amended starting in 2013 and continuing to 2016 (NOFR 9/12)
- Even if CT were to stay on IECC 2009 the tables still will be amended to more efficient equipment standards

HVAC / SWH CHANGES

- No building cavities used as plenums
- Tighter duct sealing
- Duct testing - either rough or final
- Mechanical ventilation for whole house
- ACCA loads/equipment sizing requirements
- Table 403.4.2 Insulate pipe
- Pool heaters/switches/pool covers



SEALED AIR HANDLER - R403.2.2.1

Air handlers to be leak-tested at the factory and have a manufacturer's designation for air leakage of $\leq 2\%$ of design air flow rate per ASHRAE 193



DUCT TIGHTNESS TESTS - R403.2.2

Duct tightness shall be verified by:

✓ Post construction test

- Total leakage: ≤ 4 cfm/per 100 ft² (6)
- All register boots taped or sealed

✓ Rough-in test

- Total leakage: ≤ 4 cfm/per 100 ft² (8)
- all register boots taped or sealed
- if air handler not installed at time of test, total air leakage ≤ 3 cfm/per 100 ft²

Exception: Duct tightness test is not required if the air handler and all ducts are located within building thermal envelope



BUILDING CAVITIES - R403.2.3 - MANDATORY

Framing cavities cannot be used as ducts or plenums or jump ducts



R-3 PIPE INSULATION *R-403.4*

Largest Ø in Run (inches)	3/8	1/2	3/4	>3/4
Max. Run Length (feet)	30	20	10	5

Piping:

1. > 3/4 inch diameter
2. > one dwelling unit
3. To kitchen outlets
4. Outside conditioned space
5. To distribution manifold
6. Under floor slab
7. Buried piping
8. Recirc. Supply & returns
9. Runs more than Table max.



PROTECTION OF PIPING INSULATION

R403.3.1 (MANDATORY)

✓ Protect from weather and damage, including

- Sunlight
- Moisture
- Wind
- Maintenance personnel

- Provide shielding from solar radiation that can cause degradation of insulation
- Adhesive tape not allowed



MECHANICAL VENTILATION

R403.5 & TABLE R403.5.1

Supply and
exhaust air

- IRC/M1507.3
- IMC Tabl.403.3
- HRV? / ERV?



WHOLE HOUSE FAN EFFICIENCY - R403.5.1

(NEW) TABLE R403.5.1

MECHANICAL VENTILATION SYSTEM FAN EFFICIENCY

FAN LOCATION	AIR FLOW MIN CFM	EFFICIENCY	MAX AIRFLOW
Range Hoods	Any	2.8cfm/watt	Any
In-line Fan	Any	2.8cfm/watt	Any
Bathroom/Utility	10	1.4cfm/watt	<90cfm
Bathroom/Utility	90	2.8cfm/watt	Any

Exception: Integral equipment fan motors shall be electronically commutated

DESIGN LOADS/EQUIPMENT SIZING - R403.6

ACCA Standards

- J - Load Calculations
- S - Equipment Selection
- D - Duct Design* (N/R)

- ASHRAE/ACCA 183 [CE]

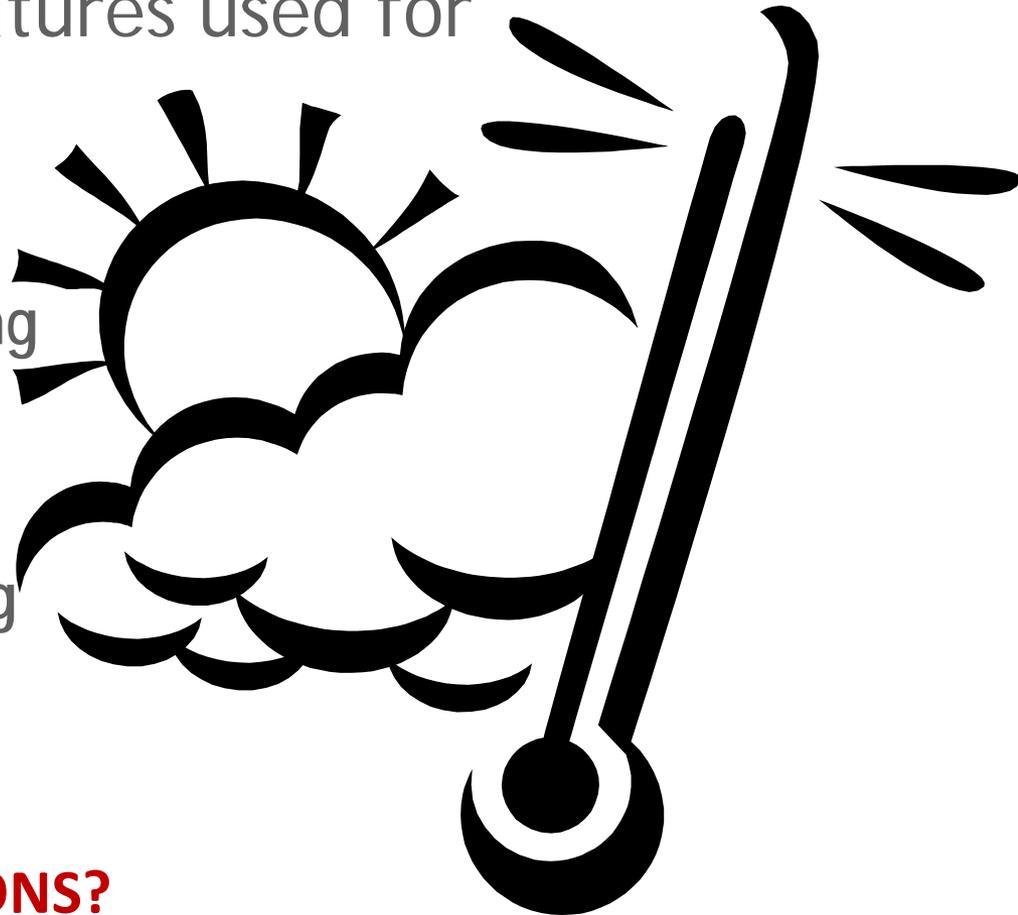


<http://www.acca.org/store/product.php?pid=97>

INTERIOR DESIGN CONDITIONS* - R302.1

Interior design temperatures used for Load Calculations:

- Max 72° F for Heating
- Min 75° F for Cooling



OUTDOOR DESIGN CONDITIONS?

http://cdo.ncdc.noaa.gov/climatenormals/clim81_supp/CLIM81_Sup_02.pdf

HEATED POOL COVERS

IECC 2009 ⇨ 2012



- Heated pools only:

- 2009 - If heated to $>90^{\circ}\text{F}$, vapor-retardant pool cover at least R-12

- Exception: Over 60 % of energy from site-recovered or solar energy source

- 2012 - Heated pools and permanently installed spas shall be provided with a vapor-retardant cover

- Exception: Over 70 % of the energy for heating from site-recovered energy

LIGHTING ALLOWANCE OPTIONS - *R404.1*

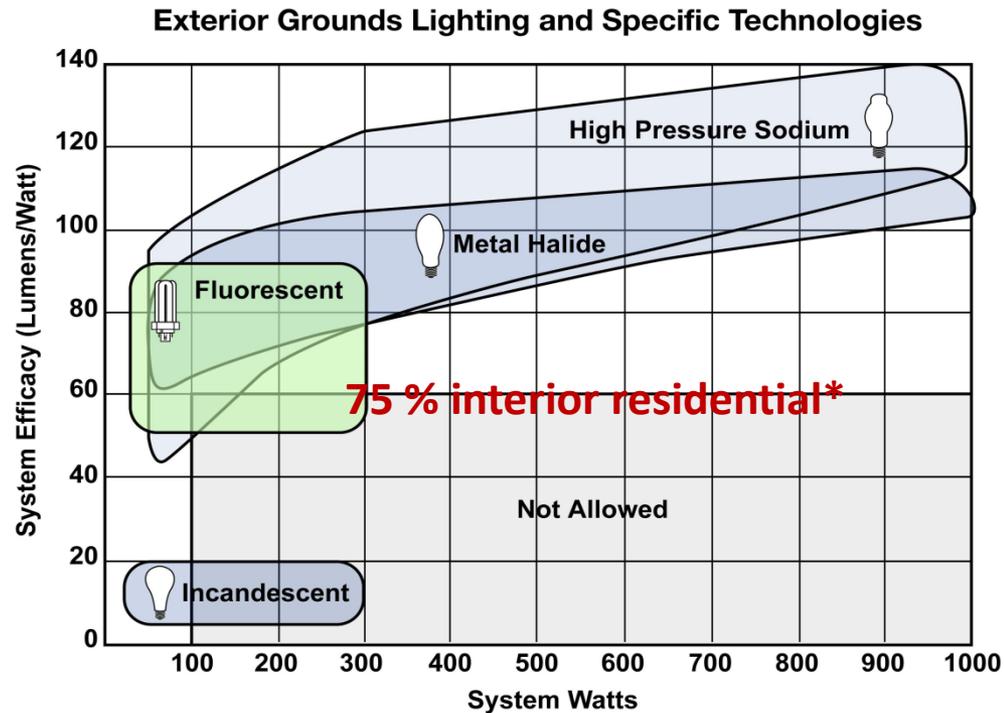
- SOCKETS
- FIXTURES



EXCEPTIONS: Low-voltage lighting; no fuel gas pilots

LIGHTING EQUIPMENT *R404 (Prescriptive)*

- R404.1 A minimum of 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps, OR a minimum of 75 percent of the permanently installed fixtures shall contain only high-efficiency lamps
- C405.1 Exception: (ILPA) + Controls + equipment in multi-family dwelling units: regulated indirectly by this Section



REScheck 4.6.1.2 (includes 2015 IECC)



REScheck Software Version 4.5.0

Inspection Checklist

Energy Code: 2012 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, 403.7 [PR3] 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, 403.6 [PR2] ² 	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:

RESCheck 4.6.1.2 (includes 2015 IECC)

Section # & Req.ID	Framing / Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
403.2.1 [FR12] ¹ 	Supply ducts in attics are insulated to $\geq R-8$. All other ducts in unconditioned spaces or outside the building envelope are insulated to $\geq R-6$.	R-____ R-____	R-____ R-____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.2.2 [FR13] ¹ 	All joints and seams of air ducts, air handlers, and filter boxes are sealed.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.2.3 [FR15] ² 	Building cavities are not used as ducts or plenums.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.3 [FR17] ² 	HVAC piping conveying fluids above 105 °F or chilled fluids below 55 °F are insulated to $\geq R-3$.	R-____	R-____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.3.1 [FR24] ²	Protection of insulation on HVAC piping.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.4.2 [FR18] ² 	Hot water pipes are insulated to $\geq R-3$.	R-____	R-____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

TOOLS



ENERGY STAR Qualified Homes, Version 3 (Rev. 03) Thermal Enclosure System Rater Checklist

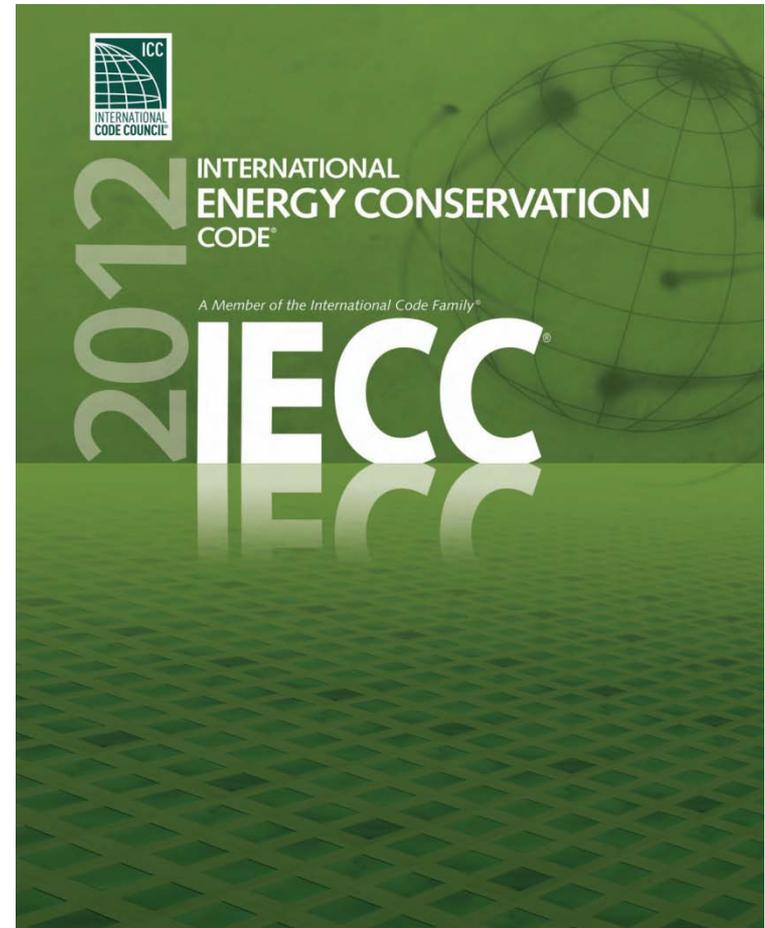
Home Address: _____		City: _____		State: _____	
Inspection Guidelines		Must Correct	Builder Verified ¹	Rater Verified	N/A
1. High-Performance Fenestration					
1.1 Prescriptive Path: Fenestration shall meet or exceed ENERGY STAR requirements ²		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.2 Performance Path: Fenestration shall meet or exceed 2009 IECC requirements ²		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Quality-Installed Insulation					
2.1 Ceiling, wall, floor, and slab insulation levels shall meet or exceed 2009 IECC levels ^{3,4,5}		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2 All ceiling, wall, floor, and slab insulation shall achieve RESNET-defined Grade I installation or, alternatively, Grade II for surfaces with insulated sheathing (see checklist item 4.4.1 for required insulation levels)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Fully-Aligned Air Barriers⁶					
At each insulated location noted below, a complete air barrier shall be provided that is fully aligned with the insulation as follows:					
<ul style="list-style-type: none"> • At interior surface of ceilings in all Climate Zones; also, at interior edge of attic eave in all Climate Zones using a wind baffle that extends to the full height of the insulation. Include a baffle in every bay or a tabbed baffle in each bay with a soffit vent that will also prevent wind washing of insulation in adjacent bays • At exterior surface of walls in all Climate Zones; and also at interior surface of walls for Climate Zones 4-8^{7, 8} • At interior surface of floors in all Climate Zones, including supports to ensure permanent contact and blocking at exposed edges^{9,10} 					
3.1 Walls					
3.1.1 Walls behind showers and tubs		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.2 Walls behind fireplaces		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.3 Attic knee walls / Sloped attics ¹¹		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.4 Skylight shaft walls		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.5 Wall adjoining porch roof		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.6 Staircase walls		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.7 Double walls		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.8 Garage rim / band joist adjoining conditioned space		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.9 All other exterior walls		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2 Floors					
3.2.1 Floor above garage		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.2 Cantilevered floor		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.3 Floor above unconditioned basement or vented crawlspace		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3 Ceilings					
3.3.1 Dropped ceiling/soffit below unconditioned attic		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.2 Sloped ceilings ¹¹		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.3 All other ceilings		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Reduced Thermal Bridging					
4.1 For insulated ceilings with attic space above (i.e., non-cathedralized ceilings), uncompressed insulation extends to the inside face of the exterior wall below at the following levels: CZ 1 to 5: $\geq R-21$; CZ 6 to 8: $\geq R-30$ ¹²		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2 For slabs on grade in CZ 4 and higher, 100% of slab edge insulated to $\geq R-5$ at the depth specified by the 2009 IECC and aligned with thermal boundary of the walls ¹³		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.3 Insulation beneath attic platforms (e.g., HVAC platforms, walkways) $\geq R-21$ in CZ 1 to 5; $\geq R-30$ in CZ 6 to 8		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4 Reduced thermal bridging at walls (rim / band joists are exempted) using one of the following options:					
4.4.1 Continuous rigid insulation, insulated siding, or combination of the two; $\geq R-3$ in Climate Zones 1 to 4, $\geq R-5$ in Climate Zones 5 to 8 ^{13,14} , OR;		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.2 Structural Insulated Panels (SIPs), OR;		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.3 Insulated Concrete Forms (ICFs), OR;		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.4 Double-wall framing ¹⁵ , OR;		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5 Advanced framing, including all of the items below:					
4.4.5a All corners insulated $\geq R-6$ to edge ¹⁶ , AND;		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5b Minimum stud spacing of 16" o.c. for 2 x 4 framing in all Climate Zones and, in Climate Zones 5 through 8, 24" o.c. for 2 x 6 framing unless construction documents specify other spacing is structurally required ²⁰		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5c Minimum stud spacing of 16" o.c. for 2 x 4 framing in all Climate Zones and, in Climate Zones 5 through 8, 24" o.c. for 2 x 6 framing unless construction documents specify other spacing is structurally required ²⁰		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5d Minimum stud spacing of 16" o.c. for 2 x 4 framing in all Climate Zones and, in Climate Zones 5 through 8, 24" o.c. for 2 x 6 framing unless construction documents specify other spacing is structurally required ²⁰		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5e Minimum stud spacing of 16" o.c. for 2 x 4 framing in all Climate Zones and, in Climate Zones 5 through 8, 24" o.c. for 2 x 6 framing unless construction documents specify other spacing is structurally required ²⁰		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/InspectionChecklists.pdf

IECC 2012 ENERGY CODE COMMERCIAL [CE] CHANGES

Seven Principal Areas

- ENVELOPE
- DEFINITIONS
- MECHANICAL*
- HOT WATER*
- LIGHTING*
- ADDED EFFICIENCY OPTION
- SYSTEM COMMISSIONING(new)
- MANDATORY OPTIONS (new)



HVAC AND SWH SYSTEMS - R403.2 (MULTIFAMILY)

USE CE 403 MECHANICAL & C404 SWH

- ✓ Controls
- ✓ Heat pump supplementary heat
- ✓ Ducts
 - Sealing (Mandatory) - **post-construction test option**
 - Insulation (Prescriptive) - unchanged
- ✓ HVAC piping insulation
- ✓ Service hot water circulating systems
- ✓ Ventilation
 - Dampers
- ✓ Equipment sizing
- ✓ Multiple dwelling units: systems - Snow melt controls
- ✓ Pools and in-ground permanently installed spas

SIMPLE VERSUS COMPLEX SYSTEMS

Simple systems

- Unitary/package HVAC equipment
- One zone - single thermostat

Section C403.3
Simple Systems

Buildings served by unitary or packaged HVAC each serving 1 zone controlled by 1 thermostat. Two-pipe heating systems serving multiple zones are included if no cooling system is installed

Complex systems

- All equipment not covered under Section C403.3

Section C403.4
Complex Systems

All buildings served by HVAC systems not covered under 503.3

CONTROLS C403.2.4.4(MANDATORY)

Shutoff Dampers

Motorized dampers that will automatically shut when the system or spaces are not in use.

✓ Exceptions

- Gravity dampers permitted in buildings ≤ 2 stories
- Gravity dampers permitted for outside air intake or exhaust airflows of 300 cfm (0.14m³/s) or less.

SYSTEM CONTROLS C403.2.4.1

(MANDATORY)

Control required for each system

- ✓ if zoned for each zone



MOTOR NAMEPLATE HORSEPOWER *C403.2.10.2*

(Mandatory)

Selected fan motor to be no larger than first available motor size greater than bhp

Fan bhp on design documents

Exceptions

- ✓ Fans ≥ 5 bhp, where first available motor larger than bhp has nameplate rating within 50% of bhp, next larger nameplate motor size may be selected
- ✓ Fans ≥ 6 bhp, where first available motor larger than bhp has nameplate rating within 30% of bhp, next larger nameplate motor size may be selected
- ✓ Fans less than 5 bhp are exempt

SERVICE WATER HEATING - C404

Table C404.2 Minimum Performance of Water-Heating Equipment

✓ Water Heater Types Covered

- Electric Storage
- Gas and Oil Storage
- Instantaneous Water Heaters - Gas and Oil
- Hot water boilers - gas and oil
- Pool heaters
- Unfired storage tanks

Temperature Controls (C404.3)

Heat Traps (C404.4)



HOT WATER SYSTEM CONTROLS - C404.6

Ability to turn off circulating hot water pumps and heat trace tape when there is limited demand

- ✓ Automatically or manually
- ✓ Ready access to controls



POOLS AND IN-GROUND PERMANENTLY INSTALLED SPAS

C404.7 (Mandatory)

Heaters (*C404.7.1*)

- ✓ Readily accessible on-off switch mounted outside heater so heater can be shut off without adjusting thermostat setting
- ✓ Natural gas or LPG fired pool heaters will not have continuously burning pilot lights

Time switches or other control method (*C404.7.2*)

- ✓ Automatic controls required to turn heaters and pumps on a preset schedule
- ✓ Exceptions
 - Where public health standards require 24 hour operation
 - Where pumps are required to operate solar and waste heat recovery pool heating systems

Note: heaters, pumps and motors with built-in timers meet this requirement

SUGGESTED RESOURCES

- **ICC 2012 Codes**
- www.iccsafe.org/content/historical-free-resources
- **ICC 2015 Codes**
- <http://codes.iccsafe.org/I-Codes.html#all>

- **DOE Resource Guides for air leakage, HVAC**
- <https://www.energycodes.gov/resource-center/resource-guides>
- **DOE Resources for RESCheck Basics**
- <https://www.energycodes.gov/sites/default/files/becu/rescheckbasics.pdf>
- **DOE Video on Duct Testing**
- <https://www.energycodes.gov/training-courses/duct-testing>
- **Energy Star Checklists**
- http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/InspectionChecklists.pdf

BECP - YOUR RESOURCES



Additional resources, including:

- *Code Notes*
- *Technical Assistance to Users*
- *Energy Codes 101*
- *Setting the Standard*
- *Training Materials*
- *Resource Center*

*Are available through the
Building Energy Codes Program*

www.energycodes.gov

ADDITIONAL DOE RESOURCES

Building Energy Codes Assistance for States	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.	http://www.energycodes.gov/states/techAssist.stm
	State Compliance Assistance	BECP has developed an approach states can use for measuring compliance with building energy codes.	http://www.energycodes.gov/arral/compliance_evaluation.stm
No-cost Compliance Tools	Residential Code Compliance Software	REScheck™ and REScheck-Web™ 	http://www.energycodes.gov/software.stm
	Commercial Code Compliance Software	COMcheck™ and COMcheck-Web™ 	
Training	Codes University	To help stakeholders broaden and deepen their knowledge of building energy codes, BECP is collecting its diverse training resources in an extensive Codes University that features webcasts, training videos, self-paced online courses, presentations, and other BECP materials and tools.	www.energycodes.gov/training
Resource Center	Building Energy Codes Knowledge Base	This knowledge base provides a variety of different media types, including articles, graphics, online tools, presentations, and videos that anyone can use to create their own training and presentations.	http://resourcecenter.pnl.gov/
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

QUESTIONS?

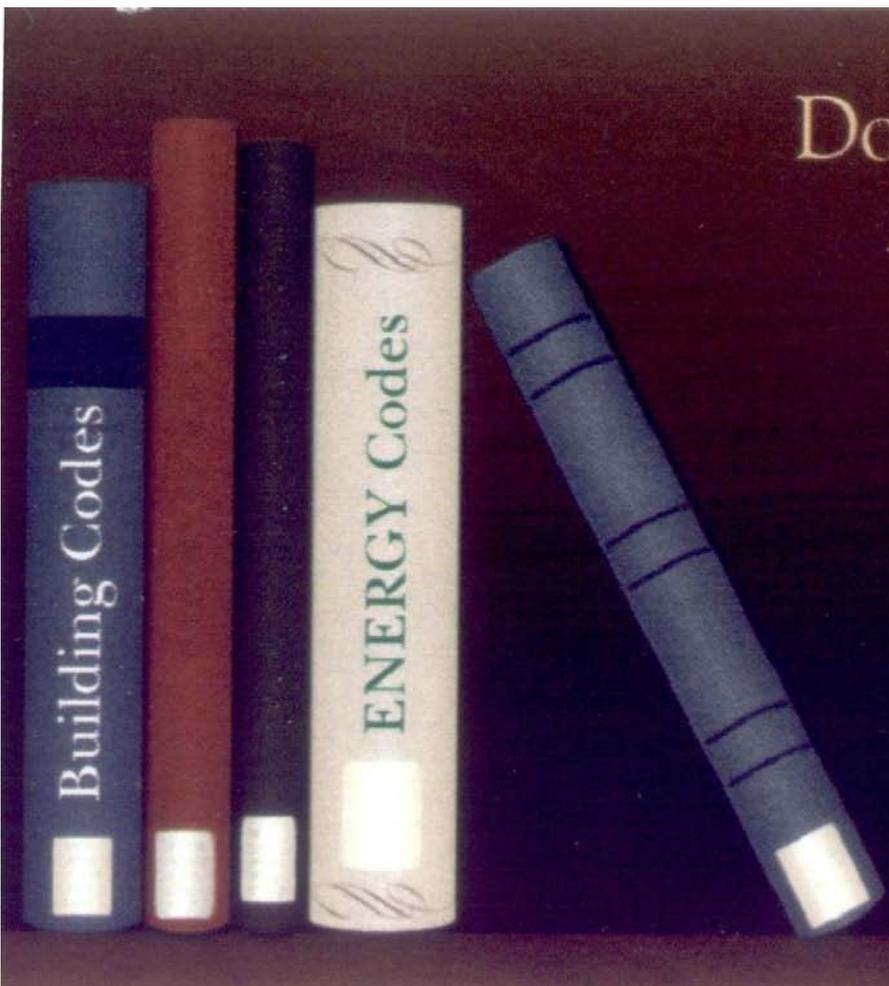
Energy efficient vehicle

Runs on oats and grass

CAUTION

Do not step in exhaust





Donald J. Vigneau, A.I.A.

Adoptions / Advocacy / Training
djv_aia@yahoo.com

3 Wormwood Hill Road
Mansfield, CT 06250

[860] 742-1102 (B)

[860] 808-8807(M)