SIGNIFICANT IECC RESIDENTIAL CHANGES

IECC 2009 ⇨ IECC 2012

Edited & Presented by Don Vigneau, AIA

for Office of Education & Data Management / CT DCS

1

Today's Presentation

An overview of the significant code change proposals approved for the 2012 Edition of the ICC Residential Energy Code; published Errata; CT Amendments / deletions; references to IECC Commercial & other ICC Codes

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.

Relationship Between IRC & IECC

✓IECC addresses only energy

✓IRC addresses all topics *(structural, plumbing, etc.), solely for Use group R3 structures*

Allows builder to carry only one code book

Chapter 11 covers energy efficiency

✓ 2012 consolidated *Residential Provisions* with IRC energy Chapter *11* (actually a change to the IRC, not the IECC)

✓ IECC addresses both residential and commercial; IRC addresses subsets of residential;

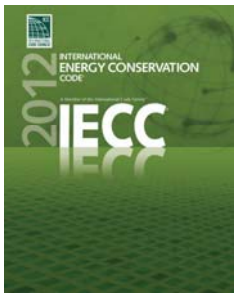
•detached one- and two-family dwellings and

•townhouses 3 stories or fewer

FORMATTING – DIVISIONS
CE / RE

CONTENTS [RE]*

- 1. Administration/Scope
- 2. Definitions
- 3. General Requirements
- 4. Residential Efficiency*
- 5. Reference Standards
- Index



4

DOES MY PROJECT NEED TO COMPLY WITH THE IECC [RE]? - *R101.2 SCOPE*

[CE] Definition - All Buildings Other Than:

- ✓ One- and two-family residential
- ✓ R-2, R-3, R-4 three stories or less in height

5

IECC 2012 ENERGY CODE RESIDENTIAL CHANGES

Five Principal Areas

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

http://www.energycodes.gov/events/energycodes/documents/ecodes11/EC2011_2012iecc_residential_update.pdf

INFORMATION ON CERTIFICATE - *R101.3*

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

7

INFORMATION ON CONSTRUCTION DOCUMENTS - R*103.2*

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

8

INFORMATION - *R103.2*

**** PLUS ****

- Thermal Calculations
- Air sealing details

~~Economizers*~~

- Fan motors
- ~~Light fixture schedule*~~

9

CT AMENDMENTS *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 AMENDMENTS *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.*

CT AMENDMENTS *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 AMENDMENTS - *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 AMENDMENTS *R107.2*

- **R107.2 Schedule of Permit Fees (AMD)**
  - *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 AMENDMENTS *R108.4*

- **R108.4 Failure To Comply (DEL)**
  - *Delete in its entirety and replace with:*
    - **R108.4 Unlawful Continuance (ADD)**
      - *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 Statues*

CT AMENDMENTS *R109.1*

- **Section R109 Board Of Appeals (DEL)**
  - **Delete this section in its entirety and replace with the following:**
    - **R109.1 Means of Appeal (ADD)**
      - *Means of appeal shall be in accordance with Section 112 of the 2012 International Building Code portion of the 2015 State Building Code*

CT AMENDMENTS – *R201.3*

- **R201.3 Terms Defined In Other Codes (AMD)**
  - *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 (CT)
- Whole-house ventilation

AMENDED (AMD)
- Residential building
- Skylight (*R405.5.2*)*

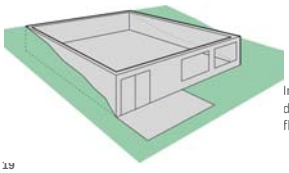
NOT APPLICABLE [CE]
- Entrance door* (RE12)
- Full Cutoff Luminaire
- Visible Transmittance* (dynamic glazing)

18

BELOW-GRADE WALLS - *R202*

- ✓ ≥ 50% below grade - each wall*
- ✓ Otherwise treat as above-grade wall

Climate Zones	R-Value
1-2	0
3	5/13
4	10/13
4c-8	15/19



Insulated from top of basement wall down to 10 ft below grade or basement floor, whichever is less

19

CT AMENDMENTS - *R202*

- *Greenhouse* **(ADD)**
  - *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 AMENDMENTS - *R202*

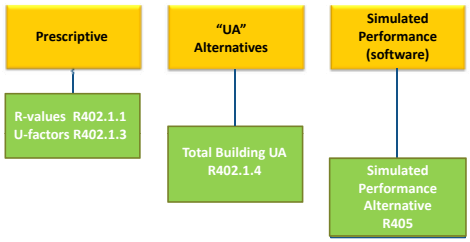
- *Sunroom* **(AMD)**
  - *A one-story structure, enclosing a habitable space, with glazing in excess of 40 per cent of the gross area of the exterior walls and roof, and with the area of windows and doors operable to the exterior equal to a minimum of 20 per cent of the area of the sunroom floor*

SUMMARY OF RESIDENTIAL CHANGES

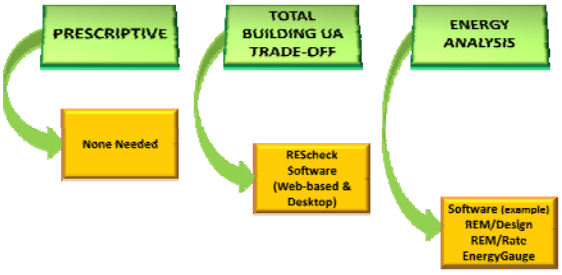
- **Increased performance :** envelope, windows, skylights
- **Increased duct tightness** (reduced allowed leakage)
- **Reduced allowable air leakage:** envelope & duct systems
- **Requires supply & exhaust ventilation** (IRC R702.7; IBC 1405.3)
- **Greater HVAC/SHW efficiencies** (commercial equipment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

22

IECC COMPLIANCE - THREE OPTIONS



CODE COMPLIANCE TOOLS



24

ENVELOPE: CONTROL LAYER PRIORITIES

- WATER

- AIR

- WATER VAPOR

- THERMAL

www.buildingscience.com

FENESTRATION U-FACTORS - *R402.1.1*

- Doors U-0.32
- Windows U-0.32
- Skylights U-0.55
- SHGC N/R

26

INSULATION AND FENESTRATION REQUIREMENTS 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,e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE	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]	19/20	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.

a. *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.

b. 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.

c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or [illegible] 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.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. 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.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

Table Notes

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	5/13[f]
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

- "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)

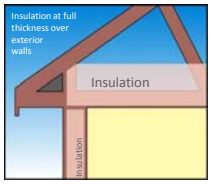
28

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

29

CEILINGS WITH ATTICS - *R402.2.1: EXCEPTION*



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

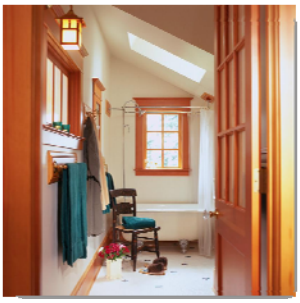
- ✓ **If insulation is full height over exterior wall top plate**
  - **R-30 complies where R-38 is required**
  - **R-38 complies where R-49 is required**

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

30

CEILINGS WITHOUT ATTIC SPACES - *R402.2.2*

- ✓ R-30 allowed for 500 ft² or 20% total insulated ceiling area, whichever is less, in 'cathedral' ceilings where
  - ✓ Insulation levels are required > R-30
  - ✓ Not sufficient amount of *cavity* space to meet higher levels
- ✓ *This does not apply to 'cathedral' trusses*



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

31

STEEL-FRAME CEILINGS

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

32

STEEL-FRAME WALLS - *R402.2.6; TABLE R402.2.6*

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

- ✓ "R-X + Y" means R-X cavity plus R-Y continuous

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

33

STEEL JOIST FLOORS - *R402.2.6; TABLE R402.2.6*

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

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

Wood Frame R-value Requirement	Cold-Formed Steel Equivalent R-value[a]
Steel Joist Floor[b]	
R-13	R-19 in 2x6, or R-19 + 6 in 2x8 or 2x10
R-19	R-19 + 6 in 2x6, or R-19 + 12 in 2x8 or 2x10

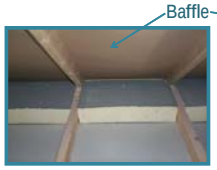
✓ "R-X + Y" means R-X cavity plus R-Y continuous

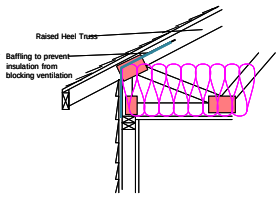
34

EAVE BAFFLES - *R402.2.3*

For air permeable insulations in vented attics, baffle

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





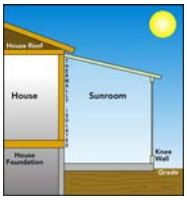
35

CT SUNROOM REQUIREMENTS - *R402.2.12*

(NEW) (Add) Table R402.2.12. Prescriptive envelope component criteria for residential greenhouses and sunrooms.
a. Two feet minimum depth slab-on grade perimeter insulation.

OPAQUE BUILDING COMPONENT	MINIMUM R-VALUE
Opaque ceiling	R-19
Floor over unheated space	R-19
Opaque wall	R-11
Slab-on-grade perimeter insulation	R-5[a]

2012 Edition	CT Amendments	
✓ Ceiling Insulation		
– Zones 5-8 R-24	R-19	(R-24)
✓ Wall Insulation		
– All zones R-13	R-11	(R-13)
✓ Fenestration U-Factor		
– Zones 4-8 0.45	0.45	(same)
✓ Skylight U-Factor		
– Zones 4-8 0.70	0.70	(same)



36

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

- ~~Joints, seams, penetrations~~
- ~~Windows and doors, jambs & framing~~
- ~~Utility penetrations~~
- ~~Dropped ceilings and chases; knee walls~~
- ~~Walls/ceilings adjacent to unconditioned garage~~
- ~~Exterior walls at tubs and showers~~
- ~~Common walls at dwelling units~~
- ~~Attic access openings~~
- ~~Rim joist junction~~
- ~~Other infiltration sources~~

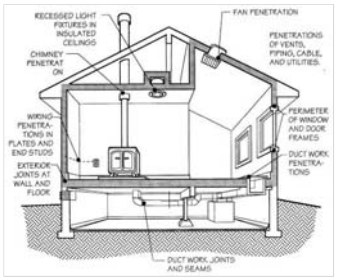


TABLE R402.4.1.1 AIR BARRIER/INSULATION/INSTALLATION

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

(partial table)

38

*Air Barrier Materials - *R402.4.1 (INFO ONLY)*

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)

These materials meet this requirement:

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

*AIR BARRIER - COMMON WALLS N/R

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

40

BUILDING THERMAL ENVELOPE

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

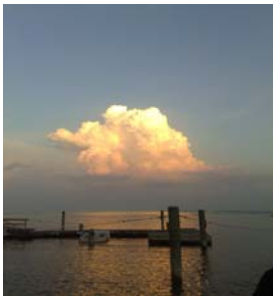
Air Leakage Rate	Climate Zone	Test Pressure
≤ 5 ACH	1-2	50 Pascals
≤ 3 ACH	3-8	50 Pascals

41

AIR – WHAT'S IN IT?

COMPOSITION OF AIR - BY PERCENTAGE

1. NITROGEN
2. OXYGEN
3. H_2O



42

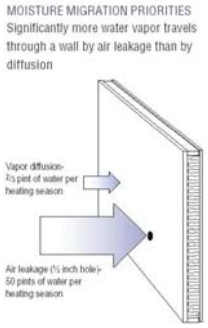
*1998 AIRTIGHT STUDY

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 DIFFUSION IN MATERIALS

MATERIAL	PERM RATING	VAPOR RETARDER(?)
½" GWB	38 -42	NO
TYVEK	52	NO
Latex Primer	7.0 – 10.0	NO
7/16" OSB (w/exterior glue)*	0.77* – 3.48	SOMFTIMFS
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

44

*VAPOR RETARDER (CT 402.6) – 2007 IECC - MOVED IN 2009 IRC / 2012 IBC

IECC / IRC

Moisture Control

- 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)

45

*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:

- An **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**;
- An **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**;

46

WOOD-BURNING FIREPLACES - *R402.4.2 (AMD) AND 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~~

47

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 ≤ 2% of design air flow rate per ASHRAE 193

48

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

49

BUILDING CAVITIES - *R403.2.3 - MANDATORY*

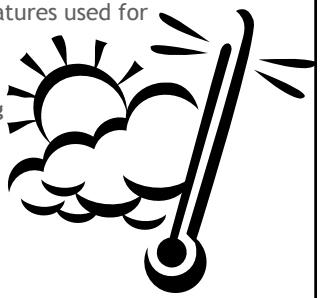
Framing cavities cannot be used as ducts or plenums

50

*INTERIOR DESIGN CONDITIONS - *R302.1*

Interior design temperatures used for Load Calculations:

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



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

R-3 PIPE INSULATION *R-403.4*

Largest Ø in Run (inches)	3/8	1/4	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.

52

PROTECTION OF PIPING INSULATION
R403.3.1 (MANDATORY)

✓ If exposed to weather,

- protect from damage, including
  - Sunlight
  - Moisture
  - Equipment maintenance
  - Wind
- Provide shielding from solar radiation that can cause degradation of material
- Adhesive tape is not allowed

53

MECHANICAL VENTILATION
R403.5 & TABLE R403.5.1

- IRC/M1507.3
- IMC 4303.3
- HRV / ERV?

54

WHOLE HOUSE FAN EFFICIENCY – *R403.5.1*

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

55

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

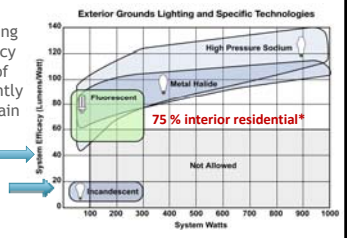
561

POOL COVERS - *R403.9.3*

- For heated pools:
  - **2009** - If heated to >90°F, vapor-retardant pool cover at least R-12
    - **Exception:** Over 60 % of energy derived 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 EQUIPMENT *R404 (PRESCRIPTIVE)*

- **R404.1** A minimum of **75 percent** of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps (**50**) OR a minimum of 75 percent of the permanently installed fixtures shall contain only high-efficiency lamps
- ***C405.1** Exception: (ILPA) Controls and equipment in multi-family dwelling units regulated indirectly by this Section



INDIVIDUAL LIGHTING OPTIONS - *R404.1*

- SOCKETS
- FIXTURES

EXCEPTIONS: **Low-voltage lighting; no fuel gas pilots**

59

MULTI-FAMILY RESIDENTIAL MECHANICAL SYSTEMS AND EQUIPMENT *R403.7*

NAECA

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

60

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 will be amended starting in 2013 and continuing to 2016 (NOFR 9/12)
- Even if CT should stay on IECC 2009 the tables will still be amended to more efficient equipment standards

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

62

SIMPLE VERSUS COMPLEX SYSTEMS

Simple systems

- Unitary/packaged 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

SYSTEM CONTROLS *C403.2.4.1*
(MANDATORY)

Control required for each system
- ✓ if zoned for each zone

64

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 < 3 stories
  - Gravity dampers permitted for outside air intake or exhaust airflows of 300 cfm (0.14m3/s) or less.

65

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

bhp = brake horsepower

66

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)*

67

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

68

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

69

SIMULATED PERFORMANCE ALTERNATIVE - *R405*

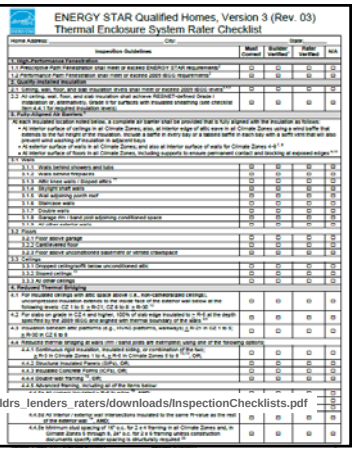
2009 Introduced
- Building Components
- Reference Design
- Proposed Design
- 11 Table Notes
- Default Efficiencies

2012 Amends
- Glazing: 40% to 15%
- Skylights: NONE
- HVAC: Heat Pump std.

2012 ADDS
- Orientation
- Interior shade fraction
- Air exchange rate
- Thermal distribution

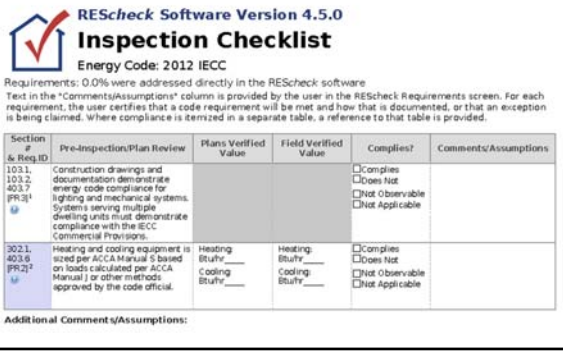
70

TOOLS


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

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

RES*Check* 4.5.0.2


RES*check* 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 [PR.3][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.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
302.1, 403.6 [PR.2][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____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

RES*Check* 4.5.0.2

Section # & Req.ID	Framing / Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
403.2.1 [FR1.2][1]	Supply ducts in attics are insulated to ≥R-8. All other ducts in unconditioned spaces or outside the building envelope are insulated to ≥R-6.	R-___ R-___	R-___ R-___	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
403.2.2 [FR1.3][1]	All joints and seams of air ducts, air handlers, and filter boxes are sealed.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
403.2.3 [FR1.5][1]	Building cavities are not used as ducts or plenums.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
403.3 [FR1.7][1]	HVAC piping conveying fluids above 105 ºF or chilled fluids below 55 ºF are insulated to ≥R-3.	R-___	R-___	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
403.3.1 [FR2.4][1]	Protection of insulation on HVAC piping.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
403.4.2 [FR1.8][1]	Hot water pipes are insulated to ≥R-3.	R-___	R-___	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

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

SUGGESTED RESOURCES

- **DOE Resource Guides for air leakage, HVAC**
- https://www.energycodes.gov/resource-center/resource-guides
- **DOE Resources for RES*Check* 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

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/tech/asst.stm
	State Compliance Assistance	BECP has developed an approach states can use for measuring compliance with building energy codes.	http://www.energycodes.gov/states/compliance_evaluation.stm
No-cost Compliance Tools	Residential Code Compliance Software	REScheck™.com; REScheck-Web™ RESCheck	http://www.energycodes.gov/software.stm
	Commercial Code Compliance Software	COMcheck™ and COMcheck-Web™ COMCheck	
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 Resources 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

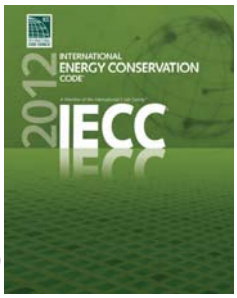
CAUTION

Do not step in exhaust

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)



http://www.energycodes.gov/events/energycodes/documents/ecodes11/EC2011_2012iecc_commercial_update.pdf

COMMERCIAL: TWO CODE OPTIONS

Connecticut IECC adoption requires commercial buildings to comply with one of two codes:

- 2012 IECC Chapter 4[CE]
  - 15% more efficient than 2009

OR (must use one or the other)

- ASHRAE Standard 90.1-2010
  - 19% more efficient than 2007

SUMMARY OF COMMERCIAL CHANGES

- *Increased performance :* *envelope, windows, skylights*
- **Reduced allowable air leakage:** *envelope, duct systems*
- **Reduced maximum glazing** (*except for daylighting*)
- **Required daylighting** *for certain types of uses* < 10,000 sf
- **Adds automatic lighting controls** *for daylighting strategies*
- **More automatic HVAC controls** *greater efficiency*
- **Additional Efficiency Options** *HVAC / Lighting / Renewables*
- **Commissioning** *all HVAC systems* > 400kBtu (*A/C*) 600k (*heat*)

80

ENVELOPE: INSULATION

New requirements for insulation:

IECC Version	Above Roof Deck R-Value	Metal Roof R-Value	Above-Grade Metal Frame Wall R-Value	Above-Grade Wood Frame Wall R-Value	Unheated Slab R-Value, Depth
2009 IECC	20 continuous	13+13	19	13+3.8	NR **(other)**
2012 IECC	**25** continuous	**19+11** LS	**13+13**	13+3.8 **or 20**	10, 2 ft.

IECC Version	Opaque Swing Door	Opaque Roll-up or Sliding Door
2009 IECC	U-0.70	U-0.50
2012 IECC	**U-0.61**	**R-4.75**

ENVELOPE: 30% FENESTRATION

- 40% of window area allowed, only if:
  - 50% of conditioned floor area is daylighted
  - Automatic daylighting controls are installed,
  - Visible transmittance is 1.1x the SHGC
- 5% of skylight area allowed, only if:
  - Daylighting zones use automatic controls
- Skylight area minimums for some buildings*
- SHGC adjustments based on window orientations

HVAC: DCVS AND ERVS

- Demand Controlled Ventilation (DCV) is to be used for spaces larger than 500sf with average occupant loads of 25 persons/1,000sf (down from 40/1,000sf).
  - Some exemptions apply
- Energy Recovery Ventilation (ERV) systems now required for all systems with greater than 30% outside air.
  - Sizing varies depending on % outside air
  - Changes in some ERV exemptions

HVAC: ECONOMIZERS

- Economizers are now required for all systems with cooling capacities over 33,000 Btu/h (down from 54,000 Btu/h)
  - Some new exemptions apply
- New design requirements for complex HVAC systems
  - High limit shutoff controls required
  - Integrated economizer control requirements

LIGHTING: CONTROLS

- Automatic time switches required in all areas, with exemptions
- Occupancy sensors required in nearly all rooms
  - Must have 30 min. shutoff and "manual-on" or automatic-on to 50% power
- Manual or automatic Daylighting controls required in most spaces
  - Zones not to exceed 2,500sf

ADDITIONAL EFFICIENCY PACKAGE

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

- More efficient lighting system (consistent with 90.1-2010), **OR**
- More efficient HVAC system, **OR**
- Installation of onsite renewables to 3% of the regulated energy

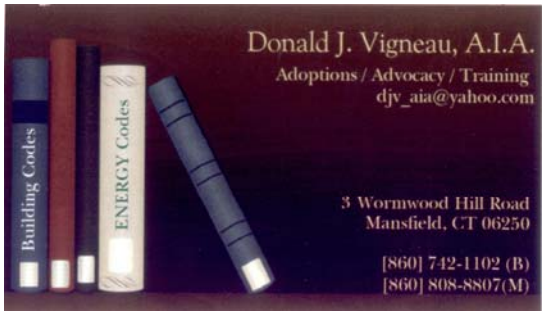


BUILDING COMMISSIONING – *C408*

Design professional must provide evidence of mechanical systems commissioning, noted in construction documents unless

- Total cooling capacity ≤ 480,000 Btu/h, and
- Total heating capacity ≤ 600,000 Btu/h

Commissioning plan, reports, and documentation must be approved by code official and provided to building owner.


Building Codes
ENERGY Codes
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)

88