August 28th, 2018 – Brian Wolfgang

Residential Energy Code Update

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PennState College of Engineering | PENNSYLVANIA HOUSING RESEARCH CENTER

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Description

- On May 1, 2018, the PA Uniform Construction Code (PA UCC) Review and Advisory Council (RAC) submitted their report to the Department of Labor and Industry adopting the majority of code provisions contained in the 2015 International Code Council (ICC) Model Codes. Specifically related to energy, there are significant differences between the current 2009 base energy code and the 2015 IRC Chapter 11 and the residential portion of the 2015 IECC. This session will provide an overview of the changes to the energy-related provisions in the UCC that will become enforceable on October 1, 2018 as well as the overall impact on home performance and energy efficiency.

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Learning Objectives

- Describe the major energy-related residential changes in the 2015 I-Codes and their potential impact on home design, construction, and performance.
- Analyze the energy code compliance paths available in the PA Uniform Construction Code and the impact that these paths have on the construction process.
- Evaluate the impact on project budgets and logistics of 2015 airtightness requirements, including mandatory blower door testing.
- Assess the challenges in adapting to new energy code provisions and identify resources and tips for achieving compliance.

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Pennsylvania's Energy Codes: Oct 1, 2018

PA Alternative Residential Energy Provisions 2018

OR

Chapter 11 of IRC 2015

OR

Residential Provisions of IECC 2015

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PA Alternative Residential Energy Provisions

- Based on the 2009 IECC
- Compliance allowed by UCC Title 34, Chapter 403
- Created and published by the Pennsylvania Housing Research Center
  - Based on guidance from L&I, this document is currently being updated by a subcommittee of the PHRC Industry Advisory Council
  - Updated PA Alternative Residential Energy Provisions will be available online by October 1, 2018

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How Does The PA Alternative Work?

- This compliance path allows for some modifications in energy efficiency or trade-offs.
- To provide for equivalent performance, the building owner or agent must choose one of the energy enhancement options as an entrance requirement for this path.

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Is The PA Alternative Being Updated?

- **Yes!**
  - A draft of updated PA Alternative Residential Energy Provisions has been submitted to PA Labor & Industry for review.
- **When will the new version be available?**
  - Once L&I has completed their review and PHRC staff has made any necessary changes, the PA Alt will be made available ASAP.
- **What's the best way to find out when it is available?**
  - Join our mailing list!

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Pennsylvania's Energy Codes: Oct 1, 2018

PA Alternative Residential Energy Provisions 2018

OR

Chapter 11 of IRC 2015

OR

Residential Provisions of IECC 2015

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2015 IECC Table R402.1.2

2015 IRC Table N1102.1.2

Table N1102.1.2 (R402.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b,e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[i]	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] or 18 + 4.5[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

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. "10/19" means R-10 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.

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

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure N1101.10 and Table N1101.10.

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

h. 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.

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

j. R-13 insulation shall be permitted in place of R-20 requirement provided the wall framing factor is 20% or less or exterior walls with 24" o.c. nominal vertical stud spacing.

Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, Ill.

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2015 IECC Table R402.1.2

2015 IRC Table N1102.1.2

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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] or 18 + 6.5[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

Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, Ill.

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Window Performance Metrics

Image Source: http://www.nfrc.org/energy-performance-label/

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U-Factor

- **Thermal Transmittance (U-Factor)**
  - Rate at which a glazing unit transmits non-solar heat flow
  - Includes heat transfer by conduction, convection, and radiation
  - Area-weighted average (including glazing, frame, edge of glazing), not just center of glass

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Solar Heat Gain Coefficient (SHGC)

- **Solar Heat Gain Coefficient (SHGC)**
  - Ratio of solar heat passing through glass to solar heat falling on the glass at 90° angle
  - Fraction of solar radiation admitted through the unit and released as heat within the structure
    - Windows with high SHGC's allow more solar heat gain during the winter months (can be desirable in heating climates)
- **Impact: Solar heat gained through windows can account for up to 40% of the heat removed through summer air conditioning**
  - *Source: Residential Energy (Krigger)*

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Climate Zones in PA

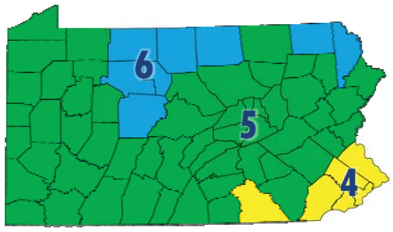

Image Source: Building Codes Assistance Project

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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] or 18 + 6.5[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

Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, Ill.

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Envelope Changes: Zone 4

Component	2009 (or current)	2015
Fenestration U-Factor	0.35	0.35
Skylight U-Factor	0.60	0.55
Glazed Fenestration SHGC	NR	0.40
Ceiling R-Value	38	49
Wood Frame Wall R-Value	13	20 or 13+5
Mass Wall R-Value	5/10	8/13
Floor R-Value	19	19
Basement Wall R-Value	10/13	10/13
Slab R-Value & Depth	10, 2ft	10, 2ft
Crawlspace Wall R-Value	10/13	10/13

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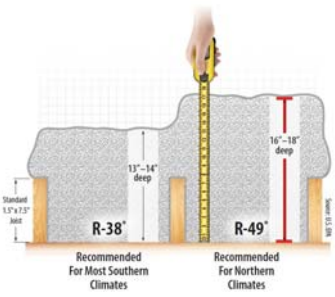
Source: International Code Council (ICC). (2008). 2009 International Residential Code, Country Club Hill, Ill. International Code Council. (2014). 2015 International Residential Code, ICC, Country Club Hill, Ill.

Attic Insulation

- How much thicker?



* Recommended Dept. of Energy attic insulation levels for commonly used fiberglass, mineral wool, and cellulose insulation assuming about R-3 per inch.

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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] or 18 + 6.5[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

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Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, Ill.

Envelope Changes: Zone 5

Component	2009 (or current)	2015
Fenestration U-Factor	0.35	0.32
Skylight U-Factor	0.60	0.55
Glazed Fenestration SHGC	NR	NR
Ceiling R-Value	38	49
Wood Frame Wall R-Value	20 or 13+5	20 or 13+5
Mass Wall R-Value	13/17	13/17
Floor R-Value	30	30
Basement Wall R-Value	10/13	15/19
Slab R-Value & Depth	10, 2ft	10, 2ft
Crawlspace Wall R-Value	10/13	15/19

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Source: International Code Council (ICC). (2008). 2009 International Residential Code, Country Club Hill, Ill. International Code Council. (2014). 2015 International Residential Code, ICC, Country Club Hill, Ill.

Basement Wall Insulation

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2015 IRC Table N1102.1.2

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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
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6	0.32	0.55	NR	49	20 + 5 or 13 + 10[h] or 18 + 6.5[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

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Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, Ill.

Envelope Changes: Zone 6

Component	2009 (or current)	2015
Fenestration U-Factor	0.35	0.32
Skylight U-Factor	0.60	0.55
Glazed Fenestration SHGC	NR	NR
Ceiling R-Value	49	49
Wood Frame Wall R-Value	20 or 13+5	20+5, 18+6.5, or 13+10
Mass Wall R-Value	15/19	15/20
Floor R-Value	30	30
Basement Wall R-Value	10/13	15/19
Slab R-Value & Depth	10, 4ft	10, 4ft
Crawlspace Wall R-Value	10/13	15/19

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Source: International Code Council (ICC). (2008). 2009 International Residential Code, Country Club Hill, Ill. International Code Council. (2014). 2015 International Residential Code, ICC, Country Club Hill, Ill.

2015 IECC Table R402.1.2 *Amendment*

2015 IRC Table N1102.1.2

- **Topic:** Climate zone 6 wood frame wall R-value
- **Code Section Summary:** Additional option added using combination of cavity and continuous exterior insulation
- **PA Amendment:** R18+6.5 is now an option along with R20+5 and R13+10

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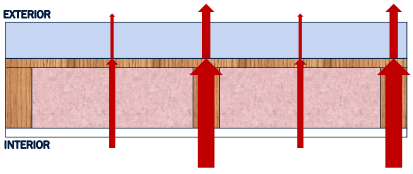
Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, Ill.

Why Exterior? Reduced Thermal Bridging



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Exterior Insulation: Considerations

- Hygrothermal loading
  - Double vapor retarder / barrier
- Wall bracing
- Cladding attachment
- Water-resistive barrier placement
  - Flashing
- Window & door installation

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Drying Potential

- Assuming an assembly will get wet, will it be able to dry?
  - Through proper source control, occupant behavior, and assembly design, all building assemblies *must be designed so that they can* ***dry*** to the *interior, exterior, or both*.

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Exterior Foam for Condensation Control

- Insulated sheathing raises the temperature of the interior side of the exterior sheathing
  - BUT, enough insulation must be provided on the outside of the wall system in order to raise the temperature high enough
    - If not enough insulation provided, condensation is still a risk, but the drying potential of the wall has now been reduced
    - *Value-engineering* should take this into consideration

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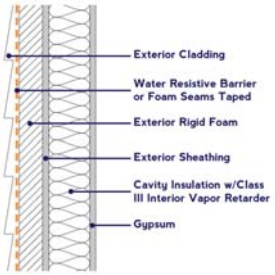
Assembly w/Exterior Insulation

- Where are the control layers?



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2015 IECC Section R202 *Amendment*

2015 IRC Section N1101.6

- **Topic:** Framing factor definition
- **Code Section Summary:** New definition was added to allow for addition of footnote j to Table R402.1.2 (see next section)
- **PA Amendment:** "Framing Factor. The fraction of the total building component area that is structural framing."

Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, Ill.

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2015 IECC Table R402.1.2 *Amendment*

2015 IRC Table N1102.1.2

- **Topic:** New footnote
- **Code Section Summary:** Addition of footnote j
- **PA Amendment:** "j. R-18 insulation shall be permitted in place of R-20 requirement provided the wall framing factor is 20% or less on exterior walls with 24" o.c. nominal vertical stud spacing."

Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, Ill.

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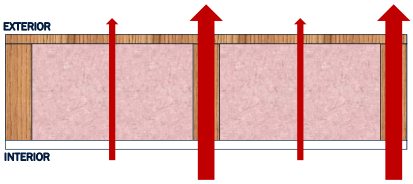
Thermal Bridging



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2015 IECC Section R403.3 *Amendment*

2015 IRC Section N1103.3

- **Topic:** Ducts
- **Code Section Summary:** 2015 IECC is silent on buried ducts and does not define ducts located within conditioned space
- **PA Amendment:** Adds sections on ducts buried within ceiling insulation & ducts located in conditioned space

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Source: International Code Council. (2014). 2015 International Energy Conservation Code, ICC Country Club Hill, Ill.
Image Source: https://www.energyvanguard.com/blog/buried-ducts-allowed-2018-building-code

2015 IECC Section R403.3.6

2015 IRC Section N1103.3.6

- **R403.3.6 Ducts buried within ceiling insulation**
  - Where supply and return air ducts are partially or completely buried in ceiling insulation, such ducts shall comply with all of the following:
    1. The supply and return ducts shall have an insulation R-value not less than R-8.
    2. At all points along each duct, the sum of the ceiling insulation R-value against and above the top of the duct, and against and below the bottom of the duct, shall be not less than R-19, excluding the R-value of the duct insulation.
    3. In Climate Zones 1A, 2A and 3A, the supply ducts shall be completely buried within ceiling insulation, insulated to an R-value of not less than R-13 and in compliance with the vapor retarder requirements of Section 604.11 of the International Mechanical Code or Section M1601.4.6 of the International Residential Code, as applicable.
       - Exception: Sections of the supply duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

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Buried Ducts

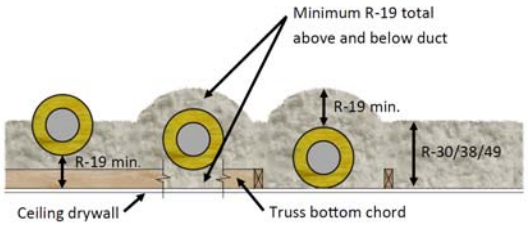

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Image Source: Home Innovation Research Labs (2017). HVAC Ducts Buried within Ceiling Insulation in a Vented Attic (Buried Ducts)

2015 IECC Section R403.3.7

2015 IRC Section N1103.3.7

- **R403.3.7 Ducts located in conditioned space.**
  - For ducts to be considered as inside a conditioned space, such ducts shall comply with either of the following:
    1. The duct system shall be located completely within the continuous air barrier and within the building thermal envelope.
    2. The ducts shall be buried within ceiling insulation in accordance with Section R403.3.6 and all of the following conditions shall exist:
       - 2.1. The air handler is located completely within the continuous air barrier and within the building thermal envelope.
       - 2.2. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the building thermal envelope in accordance with Section R403.3.4, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of conditioned floor area served by the duct system.
       - 2.3. The ceiling insulation R-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation R-value, less the R-value of the insulation on the duct.

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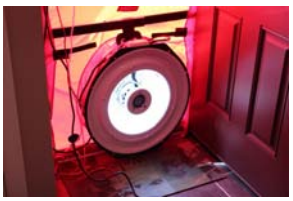
2015 IECC Section R402.4.1.2 *Amendment*

2015 IRC Section N1102.4.1.2

- **Topic:** Air leakage testing
- **Code Section Summary:** 2015 IECC mandates air leakage testing and the rate to not exceed 3ACH50 in climate zones 3-8
- **PA Amendment:** Changes the requirement to not exceed 5ACH50 in climate zones 1-8



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Source: International Code Council. (2014). 2015 International Energy Conservation Code, ICC Country Club Hill, Ill.

2009 N1102.4.2: Air Leakage Demonstration

- **N1102.4.2 – Air sealing and insulation. Building envelope airtightness and insulation installation shall be demonstrated to comply with one of the following options:**
  - N1102.4.2.1 – **Testing option.** Tested air leakage is less than 7 ACH when tested with a blower door at a pressure of 50 pascals.

    OR
  - N1102.4.2.2 – **Visual Inspection**

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Source: International Code Council. (2014). 2015 International Energy Conservation Code, ICC Country Club Hill, Ill.

Blower Door Concept

- **Depressurize the home to an exaggerated pressure difference to quantify air infiltration and compare with established benchmarks**
- **ACH_{50} = Air Changes per Hour at pressure difference of 50 Pa**
  - Current limit in Pennsylvania is 7 ACH_{50} if tested
  - 50 Pa simulates roughly a 20 mph wind on all sides of the home

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Image Source: https://www.naecl.com/blower-door-testing

2015 IECC Section R402.4.1.2 *Amendment*

2015 IRC Section N1102.4.1.2

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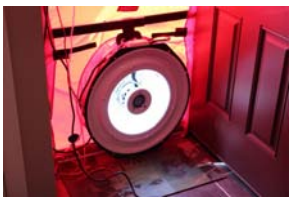

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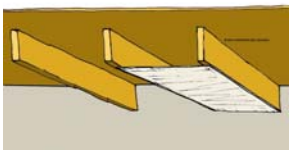
Source: International Code Council. (2014). 2015 International Energy Conservation Code, ICC Country Club Hill, Ill.

2015 IECC Section R403.3.5 *Amendment*

2015 IRC Section N1103.3.5

- **Topic:** Ducts & building cavities
- **Code Section Summary:** 2015 IECC does not allow building cavities to be used as ducts or plenums
- **PA Amendment:** 2015 language was not adopted, therefore 2009 language still applies (building framing cavities shall not be used as supply ducts)



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Source: International Code Council. (2014). 2015 International Energy Conservation Code, ICC Country Club Hill, Ill.
Image Source: https://www.nachi.org/building-cavities-supply-return-ducts.htm

2015 IECC Section R406.4 *Amendment*

2015 IRC Section N1106.4

- **Topic:** Energy Rating Index
- **Code Section Summary:** 2015 IECC added a new compliance path using an Energy Rating Index (HERS index)
- **PA Amendment:** ERI target values were amended. Footnote a was added:
  - "a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of R406.2 and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4."

Climate Zone	2015 IECC	Amended Targets
4	54	62
5	55	61
6	54	61

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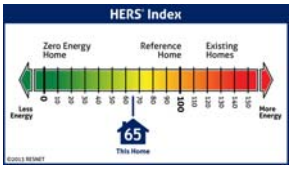
Source: International Code Council. (2014). 2015 International Energy Conservation Code, ICC Country Club Hill, Ill.

How Is A HERS Rating Calculated?

- **Certified RESNET HERS Rater conducts an energy rating on a specific home (often using REM/Rate)**
- **The analysis is compared to a 'reference home'– a designed-model home of the same size and shape as the actual home**
  - Reference home designed to meet the 2006 IECC and given a score of 100



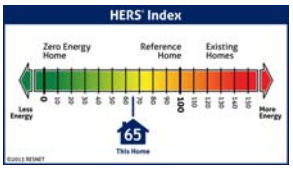
48

Source: www.hersindex.com

HERS Index Scale

- Existing homes > 100
- Reference home = 100
- Net-zero energy = 0

- 1 point lower =
  1% reduction



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Source: www.hersindex.com

HERS and the Code

- According to DOE, a home complying with the 2009 IECC (minimum) would be ~15-20% more energy efficient than 2006

Climates	2009 IECC HERS Index Scores
Zone 1 — 2	79
Zone 3	78
Zone 4 — 5	82
Zone 6	83
Zone 7	85
Zone 8	86
U.S. Average	82

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Source: RESNET Energy Rating Index Performance Path Fact Sheet

2015 IECC Section R406.4

2015 IRC Section N1106.4

- **Topic:** Energy Rating Index
- **Code Section Summary:** 2015 IECC added a new compliance path using an Energy Rating Index (HERS index)
- **PA Amendment:** ERI target values were amended. Footnote a was added:
  - "a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of R406.2 and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4."

Climate Zone	2015 IECC	Amended Targets
4	54	62
5	55	61
6	54	61

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Source: International Code Council. (2014). 2015 International Energy Conservation Code, ICC Country Club Hill, Ill.

2015 IRC Section N1103.3.3 & N1103.3.4

2015 IECC Section R403.3.3 & R403.3.4

Duct Testing Scenario	2009 cfm/100ft²	2015 cfm/100ft²
Rough-in Test w/Air Handler	6.0	4.0
Rough-in Test w/out Air Handler	4.0	3.0
Post-Construction Test (leakage to outdoors)	8.0	N/A
Post-Construction Test (total leakage)	12.0	4.0

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Source: International Code Council (ICC). (2008). 2009 International Residential Code, Country Club Hill, Ill. International Code Council. (2014). 2015 International Residential Code, ICC, Country Club Hill, Ill.

2015 IRC Section N1103.5.3 Hot Water Pipe Insulation

- 2015 IECC Section R403.5.3
- Hot water pipe insulation of R-3 now required for the following:
  1. Piping ¾" or larger
  2. Piping that services more than one dwelling unit
  3. Piping located outside of conditioned space
  4. Piping from the water heater to a distribution manifold
  5. Piping located under a floor slab
  6. Buried piping
  7. Supply and return piping in recirculation systems other than demand recirculation systems

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Source: International Code Council (ICC). (2008). 2009 International Residential Code, Country Club Hill, Ill.

Summary: PA Energy Codes - Oct 1, 2018

PA Alternative Residential Energy Provisions 2018

OR

Chapter 11 of IRC 2015

OR

Residential Provisions of IECC 2015

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Questions?

www.phrc.psu.edu

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References

- International Code Council. (2008). *2009 International Energy Conservation Code*, ICC, Country Club Hill, Ill.
- International Code Council. (2014). *2015 International Energy Conservation Code*, ICC, Country Club Hill, Ill.
- International Code Council. (2008). *2009 International Residential Code*, ICC, Country Club Hill, Ill.
- International Code Council. (2014). *2015 International Residential Code*, ICC, Country Club Hill, Ill.
- Pennsylvania Housing Research Center. (2012). *2009 Pennsylvania's ALTERNATIVE Residential Energy Provisions*, PHRC, University Park, PA.

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