2018 IRC Update

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1

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2

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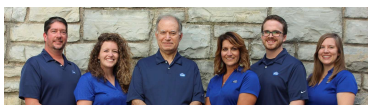
2

Pennsylvania Housing Research Center

- The Pennsylvania Housing Research Center (PHRC) provides and facilitates education, training, innovation, research, and dissemination to the residential construction industry for the purpose of improving the quality and affordability of housing.
- Educational programs and publications by the PHRC address a wide range of topics relevant to the home building industry and are designed to reach a diverse audience: builders, code officials, remodelers, architects, developers, engineers, planners, landscape architects, local government officials, educators, etc. to provide professional development and continuing education



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Description

In accordance with the requirements of Act 45 of 1999 as amended, the Pennsylvania Uniform Construction Code (UCC) Review and Advisory Council (RAC) completed the review of the 2018 I-Codes on April 29, 2021. The code provisions that were adopted during this process will take effect in the first quarter of 2022 with the official effective date to be confirmed. This program will review implications of transitioning to 2018 ICC base codes, discuss PA legislative and RAC amendments, and dive into some highlights of the new code provisions for residential construction. This program will also take a closer look at air sealing, stucco and stone wall assemblies, and the updated PA Alternative Residential Energy Provisions.

4

4

Learning Objectives

1. Review the overall PA Uniform Construction Code update process and timeline for implementation in 2022.
2. Discuss and highlight some of the most substantial and noteworthy code provision changes that will impact design, cost, and occupant safety.
3. Dive deeper into various code changes that will more substantially impact residential construction, including increased building envelope airtightness requirements.
4. Understand available resources to further study best practices that may be impacted by code changes, specifically focusing on those that affect the building enclosure.

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Outline – Five Parts

1. PA UCC Residential Code Update: Part 1
2. PA UCC Residential Code Update: Part 2
3. PA Alternative Residential Energy Provisions Update
4. Adapting to Tighter Enclosures through Scopes of Work
5. Adapting Stucco & Stone Assemblies to Changing Codes

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6

PA UCC Residential Code Update: Part 1

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7

Description

In accordance with the requirements of Act 45 of 1999 as amended, the Pennsylvania Uniform Construction Code (UCC) Review and Advisory Council (RAC) completed the review of the 2018 I-Codes on April 29, 2021. The code provisions that were adopted during this process will take effect in the first quarter of 2022 with the official effective date to be confirmed. This session will review implications of transitioning to 2018 ICC base codes, discuss PA legislative and RAC amendments, and dive into some highlights of the new code provisions for residential construction.

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8

8

Learning Objectives

1. Review the overall PA Uniform Construction Code update process and timeline for implementation in 2022.
2. Discuss the implications of transitioning to the 2018 ICC base codes, including the International Residential Code and International Energy Conservation Code for residential construction.
3. Examine the legislative and RAC amendments to the published 2018 ICC codes that will impact residential construction in Pennsylvania.
4. Evaluate the top highlights of the new code provisions that will have a substantial impact on project design, performance, and budget for residential construction.

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Fundamental Questions

- What is the UCC?
- What is changing?
- When is it changing?
- Where do I go for more information?

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What is the UCC?

- What is the Uniform Construction Code?
  - Pennsylvania's statewide building code
- How does the UCC relate to ICC codes?
  - The UCC Administration and Enforcement regulation adopts ICC codes on a triennial basis, per Act 36 of 2017.
  - The previous adoption of the 2015 codes, with amendments, took effect on October 1, 2018.

11

11

What is the UCC (continued)?

- Are the ICC codes adopted word-for-word, or are amendments allowed?
  - Two types of amendments will impact enforceable codes:
    1. Statutory amendments
    2. Amendments by the UCC Review & Advisory Council (RAC)

12

12

Review: Code Review Process

- 8/31/2017 - ICC Officially Publishes 2018 ICC Family of Codes
- RAC Initiate PA Review of 2018 ICC Family of Codes (vote on items not changed to reviewed)
- RAC Opens Public Comment on 2018 ICC Family of Codes/Public Comment Closed
- TAC Committee Applications are Opened/TAC Committee Applications are Closed
- RAC Receives Public Comment and Assigns Comments to TAC's
- TAC Final Reports are Posted for Public Review
- Three (3) RAC Public Hearings (East/Harrisburg/West)
- Five (5) RAC Meetings to Deliberate
- 4/22/2021 - Draft Report Presented to the RAC
- 4/29/2021 - Final Report Approved by RAC
- 4/29/2021 - Final Report Submitted to Dept. L&I
- 1st 2022 - Quarter Go Live

13

13

Industrialized Housing Act

- The Department of Community and Economic Development, under section 5 of the Industrialized Housing Act (35 P.S. § 1651.5), is authorized to promulgate rules and regulations to interpret and make specific provisions of the act to assure the health, safety and welfare of the people of this Commonwealth by requiring safe and sanitary industrialized housing.

http://www.pacodeandbulletin.gov/Display/pabull?file=/secure/pabulletin/data/vol48/48-30/1172.html

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What is Changing?

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UCC Residential Code Summary

Base code

+

Statutory Amendments

+

RAC amendments

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List of Statutory Amendments

- What are statutory amendments?
- Full list of statutory amendments to the UCC:
  - https://www.dli.pa.gov/ucc/Pages/Regulations-and-Statutes.aspx

17

17

Statutory Amendments

- Act 13 of 2004: Stairway tread & riser requirements
- Act 92 of 2004: Smoke alarm requirements
- Act 108 of 2006: Siding installation, lumber grading, & coal-fired boilers
- Act 9 of 2007: Concrete & masonry foundations
- Act 1 of 2011: Log walls, fire sprinklers, fire protection of floors, & wall bracing

18

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UCC RAC Report

https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

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19

What does the RAC Report Address?

- Code adoptions for all UCC codes
- Specific amendments resulting from RAC review process (with amended language included)
- Note: PHRC Webinar from June 3, 2021 covers this information in detail
  - http://bit.ly/PHRCWebinar_PAUCC2018ICC

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20

When is it Changing?

- Anticipated effective date for UCC code changes:

February 14, 2022

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21

When is it Changing?

- **Phase-in period**
  - "Where a design or construction contract was signed before the effective date [2/14/22] of regulations for a subsequent Uniform Construction Code or International Fuel Gas Code issued under this act, the permit may be issued under the Uniform Construction Code or International Fuel Gas Code in effect at the time the design or construction contract was signed if the permit is applied for within six months of the effective date of the regulation or the period specified by a municipal ordinance, whichever is less."

22 Act 36 of 2017

22

More Questions & Clarification

- **What is defined as a contract?**
  - "design or construction contract"
- **Important dates:**
  - 2/14/22: Effective date of regulations
    - Contract signed on or after 2/14/22 is subject to new (2018) codes
  - 8/13/22: Last day of phase-in period

23

23

General Scenarios

- **Contract signed before 2/14/22**
  - Can apply for permit before 8/14/22 and be subject to previous (2015 base) UCC codes
  - If permit application submitted on or after 8/14/22, subject to new (2018 base) codes
- **Contract signed after 2/14/22**
  - Subject to new (2018 base) codes

24

24

Industrialized Housing

- Timeline for industrialized housing will be determined once regulations are finalized by DCED
- Most recent adoption (for reference):
  - *"All new industrialized homes entering the first stage of production on or after April 1, 2019, must be constructed in accordance with the applicable 2015 codes including the 2014 National Electric Code."*

25 http://www.pacodeandbulletin.gov/Display/pabull?file=/secure/pabulletin/data/vol48/48-30/1172.html

25

Where Do I Go for More Information?

- PA UCC RAC Report:
  - https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf
- 2018 IRC
  - https://codes.iccsafe.org/content/IRC2018
- 2018 IECC
  - https://codes.iccsafe.org/content/iecc2018

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UCC Energy Code Summary

Chapter 11 | Residential Provisions | Coming Soon!

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PA Alternative Residential Energy Provisions

- Compliance allowed by UCC Title 34, Chapter 403
- Intent:
  - simpler to build to and easier to enforce
  - more rational and flexible
  - focused on Pennsylvania in terms of climatic and other conditions; and,
  - equivalent to the provisions of the International Energy Conservation Code (IECC)
- Prescriptive (vs. requiring modeling)
- Allows trade-offs

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28

Discussion Break

- What were the most significant challenges during the last code transition?
- Concerns for this code cycle?

29

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What are the Big Changes?

1. Stucco & stone wall assemblies
2. Insulation & fenestration requirements
3. Blower door testing target

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1. Stucco & Stone Wall Assemblies

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1. Stucco & Stone Assemblies

- Exterior plaster provisions in the IRC were heavily modified in the 2021 version.
- These provisions were adopted by the UCC RAC to be included with the 2018 code adoption.

32

32

2021 IRC R703.7 Exterior Plaster (Stucco)

- Installation of exterior plaster shall be in compliance with ASTM C926-2018B, ASTM C1063-2018B and the provisions of this code.

https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

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2021 IRC R703.7.1 Lath

- Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063-2018B. Expanded metal, welded wire, or woven wire lath shall be attached to wood framing members or furring. Where the exterior plaster is serving as wall bracing in accordance with Table R602.10.4, the lath shall be attached directly to framing. The lath shall be attached with 1-1/2-inch-long (38 mm), 11-gage nails having a 7/16 -inch (11.1 mm) head, or 7/8 -inch-long (22.2 mm), 16-gage staples, spaced not more than 7 inches (178 mm) on center along framing members or furring and not more than 24 inches (610 mm) on center between framing members or furring, or as otherwise approved. Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C1063-2018B. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Section R703.15, R703.16 or R703.17. Where lath is attached to furring installed over foam sheathing, the furring connections shall be in accordance with Section R703.15, R703.16 or R703.17.

34 https://www.dll.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

34

2015 IRC R703.7.3 Water-Resistive Barriers

- **Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.**
  - Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.

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

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2021 IRC R703.7.3 Water-Resistive Barriers

- Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall comply with Section R703.7.3.1 or R703.7.3.2.

*R703.2 = 2018 provisions

36 https://www.dll.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

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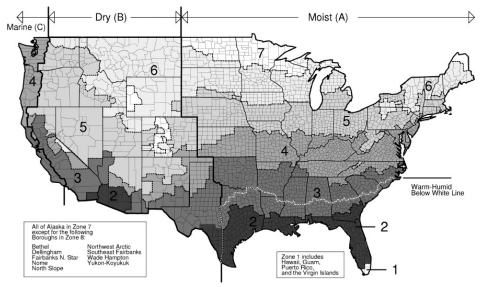

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

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2021 IRC R703.7.3.1 Dry Climates

- **In Dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:**
  1. The water-resistive barrier shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a water-resistive barrier complying with ASTM E2556-10, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier shall be directed between the layers.
  2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556-10, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water-absorbing layer, or a designed drainage space.

https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

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2021 IRC R703.7.3.2 Moist or Marine Climates

- **In the Moist (A) or Marine (C) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:**
  1. In addition to complying with Section R703.7.3.1, a space or drainage material not less than 3/16 inch (5 mm) in depth shall be added to the exterior side of the water-resistive barrier.
  2. In addition to complying with Section R703.7.3.1, Item 2, drainage on the exterior of the water-resistive barrier shall have a drainage efficiency of not less than 90 percent, as measured in accordance with ASTM E2273-2018 or Annex A2 of ASTM E2925-17.

https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

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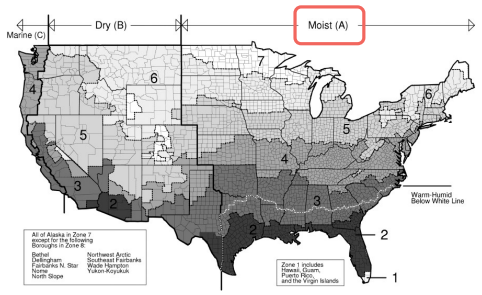

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Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

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What is a Rainscreen?

- A rainscreen is a *system* that provides an air space within a wall assembly to promote drainage and drying of that assembly
  - Accelerates the evaporation of undrained moisture behind exterior cladding
  - Helps to dry wall that accumulates moisture seasonally
- Common rainscreen products / systems
  - Furring strips
  - Three-dimensional mesh

41

41

Types of Rainscreen Systems

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42

How is Stone Impacted?

- R703.12 Adhered masonry veneer installation
- R703.12.3 Water-resistive barrier.
  - A water-resistive barrier shall be installed as required by Section R703.2 and shall comply with the requirements of Section R703.7.3.

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44 https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

44

Note on Stone Installation

- The National Concrete Masonry Association (NCMA) published an installation guide for adhered manufactured stone veneer.
  - https://ncma.org/wp-content/uploads/2020/08/MSV_InstallationGuide_5thEd_4thPrinting.pdf
- This guide is used by many adhered manufactured stone veneer manufacturers for installation recommendations.

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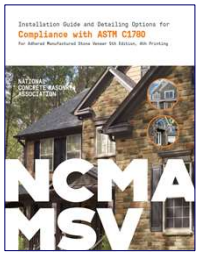
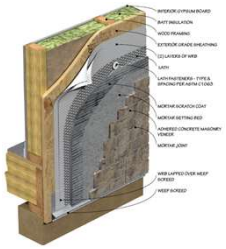
NCMA Installation Guide





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46

Note on Stone Installation

- **Currently, the NCMA MSV Installation Guide states:**
  - Rainscreens are optional building techniques used to improve the drainage of incidental water behind the cladding and reduce drying time. Rainscreen products (such as drainage mats or formed polymer sheeting) or construction techniques (such as strapping or furring) that create a capillary break/air space between the cladding and the water resistive barrier can be effectively incorporated into AMSV applications. Refer to the manufacturer's recommendation for rainscreen / drainage system applications with adhered manufactured stone veneer wall systems. Details of various applications utilizing rainscreen drainage plane systems can be found in Figures 35-38. Building codes may allow a single layer of a water resistive barrier when a drainage space is incorporated in the wall system (i.e. rainscreen). Requirements for rainscreens vary by region. Verify local jurisdictional requirements regarding the use and application of rainscreens and/or drainage products.

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47

Recommendations

- Review manufacturer installation guidelines
- Talk with your code officials
- Work with contractors and suppliers to discuss options

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48

48

Stucco & Stone Webinar

Adapting Stucco & Stone Assemblies to Changing Codes

February 15, 2022
1:00pm

49

49

2. Insulation & Fenestration Requirements

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2. Insulation & Fenestration Requirements

- 2018 Table N1102.1.2 (R402.1.2) was adopted and effectively reset some of the modifications made during the 2015 review process
  - Note: amendment was made to fenestration requirement in Climate Zone 3, which does not apply to Pennsylvania

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Climate Zones in PA

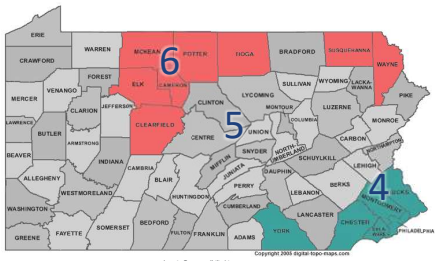

Image Source: digital-topo-maps.com

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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	BAWSEMENT[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 + 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.

53

2018 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	0.32	0.55	0.40	49	20 or 13 + 5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13 + 5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

54

Glazing Performance

- **Measures of performance**
  - U-Factor
  - Solar Heat Gain Coefficient
  - Visible Transmittance
  - Air Leakage

55

3. Blower Door Testing Target

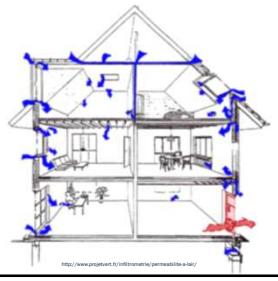
56

2018 IRC N1102.4.1.2 (R402.4.1.2) Testing

- The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding five air changes per hour in Climate Zones 1 and 2, and three air changes per hour in Climate Zones 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the building official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the building official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

57

Airtightness Requirement: 3 ACH50



- Measured in Air Changes Per Hour at 50 Pascals (ACH50 / ACH_{50})
  - 50 pascals – equivalent to 20 MPH wind on the house

Value we need (Air Changes Per Hour @ 50 Pascals) | Value from the blower door pressure gauge (Cubic Feet Per Minute @ 50 Pascals) | Constant (60 minutes per hour) | Volume of the House (Cubic Feet)

$$ACH_{50} = \frac{CFM_{50} \times 60}{V} < 3$$

58

58

Air Sealing Webinar

Adapting to Tighter Enclosures through Scopes of Work

November 9, 2021

1:00pm

59

59

Recommendation: Getting Started

- Review the 2018 IRC & IECC online
  - Consider investing in additional ICC resources
- Print copy of RAC report
- Review statutory amendments

60

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Where Do I Go for More Information?

- PA UCC RAC Report:
  - https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf
- 2018 IRC
  - https://codes.iccsafe.org/content/IRC2018
- 2018 IECC
  - https://codes.iccsafe.org/content/iecc2018

61

61

Questions?

www.phrc.psu.edu

62

62

PA UCC Residential Code Update: Part 2

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63

Description

In accordance with the requirements of Act 45 of 1999 as amended, the Pennsylvania Uniform Construction Code (UCC) Review and Advisory Council (RAC) completed the review of the 2018 I-Codes on April 29, 2021. The code provisions that were adopted during this process will take effect in the first quarter of 2022 with the official effective date to be confirmed. This session will build on Part 1 by providing an overview of the most substantial changes between the 2015 and 2018 ICC base codes for residential construction.

64

64

Learning Objectives

1. Review the most efficient ways to find out which code provisions have changed between the 2015 and 2018 ICC codes, including available ICC resources.
2. Discuss and highlight some of the most substantial and noteworthy code provision changes that will impact design, cost, and occupant safety.
3. Dive deeper into various code changes that will more substantially impact residential construction, including increased building envelope airtightness requirements.
4. Understand available resources to further study best practices that may be impacted by code changes, specifically focusing on those that affect the building enclosure.

65

65

How Will the Changes Be Presented?

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"Section of Change" – "Provision Modified or Not Adopted"

- Change Type – Addition, Modification or Clarification
- Change Summary – Summary of the significant change
- Code language with changes in RED

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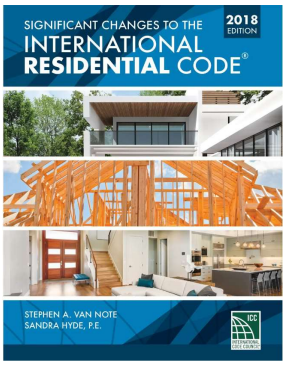
Today's Information

- International Code Council. (2018). *2018 Significant Changes to the International Residential Code*, ICC, Country Club Hill, Ill.



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References

- 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.
- International Code Council. (2017). *2018 International Residential Code*, ICC, Country Club Hill, Ill.
- International Code Council. (2018). *2018 Significant Changes to the International Residential Code*, ICC, Country Club Hill, Ill.

69

69

Building Construction Significant Changes

70

70

R104.11 – Alternative Materials and Methods of Construction

- Change Type: Modification
- Change Summary: The process to gain compliance through the alternative materials and methods provisions now requires an application by the owner or owner's authorized agent and gives authority to the building official to approve based on a prescriptive list of equivalencies.
- R104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. The building official shall have the authority to approve an alternative material, design or method of construction upon application of the owner or the owner's authorized agent. The building official shall first finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Compliance with the specific performance-based provisions of the International Codes shall be an alternative to the specific requirements of this code. Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved.

71

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

71

R302.2 – Townhouse Separation

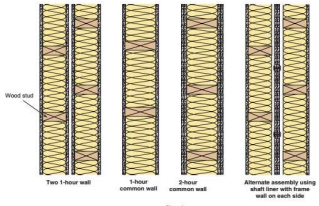
- **Change Type:** Modification
- **Change Summary:** Two paths for achieving the fire-resistant separation between townhouse dwelling units—two 1-hour walls or a common wall—are spelled out in the townhouse provisions.
- R302.2 Townhouses. Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or Section R302.2.2.
  - R302.2.1 Double Walls. Each townhouse shall be separated by two 1-hour fire-resistance rated wall assemblies tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.
  - R302.2.2 Common Walls. Common walls separating townhouses shall be assigned a fire-resistance rating in accordance with Item 1 or 2. The common wall shared by two townhouses shall be constructed without plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be in accordance with Chapters 34 through 43. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

72

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

72

R302.2 – Townhouse Separation



Note: Gypsum wallboard and wood stud assemblies must meet all materials, dimensions, spacing, installation and fastening requirements of the specific tested assembly

Typical fire-resistant-rated wall assemblies for separating townhouse dwelling units

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

73

73

R302.4.2 – Membrane Penetrations

- **Change Type:** Modification
- **Change Summary:** Listed luminaires that have been tested for the application are specifically permitted for fire-resistant-rated ceiling membrane penetrations.
- R302.4.2 Membrane penetrations. Membrane penetrations shall comply with Section R302.4.1. Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.

Exceptions:

- 1.through 3. No change to text
- 4.Ceiling membrane penetrations by listed luminaires or by luminaires protected with listed materials that have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

74

74

R302.5 – Dwelling-Garage Opening Protection – Not adopted per RAC Report; 2009 IRC

- **Change Type:** Modification
- **Change Summary:** An automatic-closing device is now permitted as an alternative to a self-closing device for the door between the garage and dwelling.
- RAC amended this and removed from UCC

75

75

R302.13 – Fire Protection of Floors above Crawl Spaces – Act 1 of 2011?

- **Change Type:** Modification
- **Change Summary:** Fire-resistant membrane protection is now required for the applicable floor framing materials above crawl spaces containing fuel-fired or electric-powered heating appliances.
- R302.13 Fire protection of floors. Floor assemblies that are not required elsewhere in this code to be fire-resistance rated, shall be provided with a 1/2-inch (12.7 mm) gypsum wallboard membrane, 5/8-inch (16 mm) wood structural panel membrane, or equivalent on the underside of the floor framing member. Penetrations or openings for ducts, vents, electrical outlets, lighting, devices, luminaires, wires, speakers, drainage, piping and similar openings or penetrations shall be permitted.
- Exceptions:
  1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section P2904, NFPA 13D, or other approved equivalent sprinkler system.
  2. Floor assemblies located directly over a crawl space not intended for storage or for the installation of fuel-fired or electric-powered heating appliances.
  3. 3.and 4. No change to text

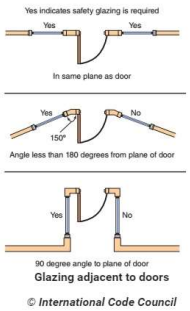
76

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

76

R308.4.2 – Glazing Adjacent to Doors

- **Change Type:** Modification
- **Change Summary:** Glazing within 24 inches of the hinge side of an in-swinging door now requires safety glazing where the glazing is at an angle less than 180 degrees from the plane of the door.
- R308.4.2 Glazing adjacent to doors. Glazing in an individual fixed or operable panel adjacent to a door shall be considered to be a hazardous location where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the floor or walking surface and it meets either of the following conditions:
  - 1.Where the glazing is within 24 inches of either side of the door in the plane of the door in a closed position.
  - 2.Where the glazing is on a wall perpendicular to less than 180 degrees from the plane of the door in a closed position and within 24 inches of the hinge side of an in-swinging door.



77

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

77

R310.1 – Emergency Escape and Rescue Openings

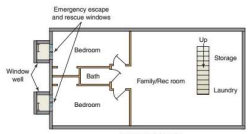
- **Change Type:** Modification
- **Change Summary:** Emergency escape and rescue openings are no longer required for bedrooms in basements when the dwelling unit is protected with an automatic fire sprinkler system and other conditions are met.
- R310.1 Emergency escape and rescue opening required. Basements, habitable attics and every sleeping room shall have not less than one operable emergency escape and rescue opening. Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way, or to a yard or court that opens to a public way.
- Exceptions:
  1.Storm shelters and basements used only to house mechanical equipment not exceeding a total floor area of 200 square feet (18.58 m2).
  2.Where the dwelling or townhouse is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
    2.1.One means of egress complying with Section R311 and one emergency escape and rescue opening.
    2.2.Two means of egress complying with Section R311.

78

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

78

R310.1 – Emergency Escape and Rescue Openings



Basement floor plan

2015 IRC required emergency escape and rescue opening in each bedroom

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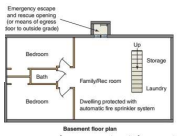

Basement floor plan

2018 IRC does not require emergency escape and rescue openings in basement bedrooms when meeting conditions

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79

Source: International Code Council (ICC), (2018), 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

79

R310.3 – Area Wells for Emergency Escape and Rescue Doors

- **Change Type:** Modification
- **Change Summary:** R310.3 Emergency escape and rescue doors. Where a door is provided as the required emergency escape and rescue opening, it shall be a side-hinged door or a slider. Where the opening is below the adjacent grade, it shall be provided with an area well.
- R310.3.1 Minimum door opening size. The minimum net clear height opening for any door that serves as an emergency and escape rescue opening shall be in accordance with Section R310.2.1.
- R310.3.2 Area Wells. Area wells shall have a width of not less than 36 inches (914 mm). The area well shall be sized to allow the emergency escape and rescue door to be fully opened.
- R310.3.2.1 Ladder and steps. Area wells with a vertical depth greater than 44 inches (1118 mm) shall be equipped with a permanently affixed ladder or steps usable with the door in the fully open position. Ladders or steps required by this section shall not be required to comply with Section R311.7. Ladders or rungs shall have an inside width of not less than 12 inches (305 mm), shall project not less than 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center vertically for the full height of the exterior stairwell.

80

Source: International Code Council (ICC), (2018), 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

80

R311.7.1, R311.7.8 – Handrail Projection

- **Change Type:** Modification
- **Change Summary:** A new exception to the handrail projection limitation provides for adequate clearance behind the handrail when it passes a projection of a floor, landing or tread return.
- R311.7.1 Width. Stairways shall be not less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. The clear width of stairways at and below the handrail height, including treads and landings, shall be not less than 31½ inches (787 mm) where a handrail is installed on one side and 27 inches (698 mm) where handrails are installed on both sides.
  Exception: The width of spiral stairways shall be in accordance with Section R311.7.10.1.
- R311.7.8.2 Handrail Projection. Handrails shall not project more than 4 ½ inches on either side of the stairway.
  Exception: Where nosings of landings, floors, or passing flights project into the stairway reducing the clearance at passing handrails, handrails shall project not more than 6 ½ inches into the stairway, provided that the stair width and handrail clearance are not reduced to less than that required.
- R311.7.8.3 Handrail Clearance. Handrails adjacent to a wall shall have a space of not less than 1 ½ inches (38 mm) between the wall and the handrails.

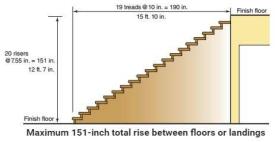
81

Source: International Code Council (ICC), (2018), 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

81

R311.7.3 – Maximum Stair Rise between Landings

- **Change Type:** Modification
- **Change Summary:** The maximum rise of a flight of stairs has increased by 4 inches, from 147 to 151 inches.
- R311.7.3 Vertical rise. A flight of stairs shall not have a vertical rise larger than 151 inches between floor levels or landings.



Maximum 151-inch total rise between floors or landings

Source: International Code Council (ICC), (2018), 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

82

82

R311.7.11, R311.7.12 – Alternating Tread Devices and Ships Ladders

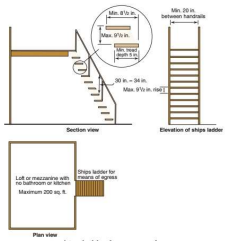
- **Change Type:** Modification
- **Change Summary:** Alternating tread devices and ships ladders are now permitted as a means of egress for serving lofts that do not exceed 200 square feet in area.
- R311.7.11 Alternating tread devices. Alternating tread devices shall not be used as an element of a means of egress. Alternating tread devices shall be permitted provided that the required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches (508 mm).
  - Exception: Alternating tread devices are allowed to be used as an element of a means of egress for lofts, mezzanines, and similar areas of 200 gross square feet (18.6 m2) or less where such devices do not provide exclusive access to a kitchen or bathroom.
- R311.7.12 Ships ladders. Ships ladders shall not be used as an element of a means of egress. Ships ladders shall be permitted provided that a required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches.
  - Exception: Ships ladders are allowed to be used as an element of a means of egress for lofts, mezzanines, and similar areas of 200 gross square feet (18.6 m2) or less where such devices do not provide exclusive access to a kitchen or bathroom.

Source: International Code Council (ICC), (2018), 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

83

83

R311.7.11, R311.7.12 – Alternating Tread Devices and Ships Ladders – Cont.



Ships ladder for means of egress

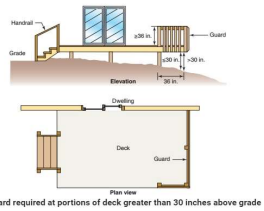
Source: International Code Council (ICC), (2018), 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

84

84

R312.1 – Guards

- **Change Type:** Clarification
- **Change Summary:** The guard requirements only apply to the specific portion of a walking surface that exceeds 30 inches above grade.
- R312.1 Guards. Guards shall be provided in accordance with Sections R312.1.1 through R312.1.4.
- R312.1.1 Where required. Guards shall be provided for those portions of open-sided walking surfaces, including stairs, ramps and landings, that are located more than 30 inches (762 mm) measured vertically to the floor or grade below at any point within 36 inches (914 mm) horizontally to the edge of the open side. Insect screening shall not be considered as a guard.



Guard required at portions of deck greater than 30 inches above grade

PHRC

85

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

85

R314 – Smoke Alarms – Modified - 2015 IRC

- **Change Type:** Modification
- **Change Summary:** The exemption for interconnection of alarms during alterations based on feasibility has been removed from the code. **Added back in due to RAC report to stay with 2015 language**
- R314.2.2 Alterations, repairs and additions. Where alterations, repairs or additions requiring a permit occur, the individual dwelling unit shall be equipped with smoke alarms located as required for new dwellings.
- Exceptions:
  - 1.Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of a porch or deck.
  - 2.Installation, alteration or repairs of plumbing or mechanical systems.
- Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual dwelling unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.
  - Exception: Interconnection of smoke alarms in existing areas shall not be required where alterations or repairs do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available that could provide access for interconnection without the removal of interior finishes. – 2015 IRC ADDED BACK IN PER RAC REPORT

PHRC

86

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

86

R315 – Carbon Monoxide Alarms

- **Change Type:** Modification
- **Change Summary:** Interconnection is now required where multiple carbon monoxide alarms are required in a dwelling unit.
- R315.2.2 Alterations, repairs and additions. Where alterations, repairs or additions requiring a permit occur, the individual dwelling unit shall be equipped with carbon monoxide alarms located as required for new dwellings.
- Exceptions:
  - 1.Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.
  - 2.Installation, alteration or repairs of plumbing or mechanical systems.
- R315.5 Interconnectivity. Where more than one carbon monoxide alarm is required to be installed within an individual dwelling unit in accordance with Section R315.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual dwelling unit. Physical interconnection of carbon monoxide alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.
  - Exception: Interconnection of carbon monoxide alarms in existing areas shall not be required where alterations or repairs do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available that could provide access for interconnection without the removal of interior finishes.

PHRC

87

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

87

R317.3 – Fasteners in Treated Wood

- **Change Type:** Modification
- **Change Summary:** Staples in preservative-treated wood and fireretardant-treated wood are now required to be made of stainless steel.
- R317.3.1 Fasteners for preservative-treated wood. Fasteners, including nuts and washers, for preservative-treated wood shall be of hot-dipped, zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Coating types and weights for connectors in contact with preservative-treated wood shall be in accordance with the connector manufacturer's recommendations. In the absence of manufacturer's recommendations, a minimum of not less than ASTM A 653 type G185 zinc-coated galvanized steel, or equivalent, shall be used.
- Exceptions:
  1. ½-inch-diameter (12.7 mm) or greater steel bolts.
  2. Fasteners other than nails, staples, and timber rivets shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum.
  3. Plain carbon steel fasteners in SBX/DOT and zinc borate preservative-treated wood in an interior, dry environment shall be permitted.

88

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

88

R317.3 – Fasteners in Treated Wood – Cont.

TABLE R507.2.3 FASTENER AND CONNECTOR SPECIFICATIONS FOR DECKS[a,b]

ITEM	MATERIAL	MINIMUM FINISH/COATING	ALTERNATE FINISH/COATING[a]
Nails and timber rivets	In accordance with ASTM F1667	Hot-dipped galvanized per ASTM A153	Stainless steel, silicon bronze or copper
Bolts[c] Lag screws[d] (including nuts and washers)	In accordance with ASTM A307 (bolts), ASTM A563 (nuts), ASTM F844 (washers)	Hot-dipped galvanized per ASTM A153, Class C (Class D for ¾-inch diameter and less) or mechanically galvanized per ASTM B695, Class 55 or 410 stainless steel	Stainless steel, silicon bronze or copper
Metal connectors	Per manufacturer's specification	ASTM A653 type G185 zinc coated galvanized steel or post hot-dipped galvanized per ASTM A123 providing a minimum average coating weight of 2.0 oz./ft^2 (total both sides)	Stainless steel

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Equivalent materials, coatings and finishes shall be permitted.
b. Fasteners and connectors exposed to salt water or located within 300 feet of a salt water shoreline shall be stainless steel.
c. Holes for bolts shall be drilled a minimum 1/32 inch and a maximum 1/16 inch larger than the bolt.
d. Lag screws ½ inch and larger shall be predrilled to avoid wood splitting per the National Design Specification (NDS) for Wood Construction.
e. Stainless-steel-driven fasteners shall be in accordance with ASTM F1667.

89

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

89

R324.6 – Roof Access for Photovoltaic Solar Energy Systems

- **Change Type:** Addition
- **Change Summary:** Requirements for roof access and pathways for firefighters have been introduced into the IRC provisions for rooftopmounted photovoltaic solar energy systems.
- R324.6 Roof access and pathways. Roof access, pathways, and setback requirements shall be provided in accordance with Sections R324.6.1 through R324.6.2.1. Access and minimum spacing shall be required to provide emergency access to the roof, to provide pathways to specific areas of the roof, provide for smoke ventilation opportunity areas, and to provide emergency egress from the roof.
- Exceptions:
  - 1.Detached, nonhabitable structures, including but not limited to, detached garages, parking shade structures, carports, solar trellises, and similar structures shall not be required to provide roof access.
  - 2.Roof access, pathways, and setbacks need not be provided where the code official has determined that rooftop operations will not be employed.
  - 3.These requirements shall not apply to roofs with slopes of 2 units vertical in 12 units horizontal (17-percent slope) or less.
- R324.6.1 Pathways. Not fewer than two pathways, on separate roof planes from lowest roof edge to ridge and not less than 36 inches (914 mm) wide, shall be provided on all buildings. Not fewer than one pathway shall be provided on the street or driveway side of the roof. For each roof plane with a photovoltaic array, a pathway not less than 36 inches wide (914 mm) shall be provided from the lowest roof edge to ridge on the same roof plane as the photovoltaic array, on an adjacent roof plane, or straddling the same and adjacent roof planes. Pathways shall be over areas capable of supporting fire fighters accessing the roof. Pathways shall be located in areas with minimal obstructions such as vent pipes, conduit, or mechanical equipment.
- R324.6.2 Setback at ridge. For photovoltaic arrays occupying not more than 33 percent of the plan view total roof area, not less than an 18-inch (457 mm) clear setback is required on both sides of a horizontal ridge. For photovoltaic arrays occupying more than 33 percent of the plan view total roof area, not less than a 36-inch (914 mm) clear setback is required on both sides of a horizontal ridge.
- R324.6.2.1 Alternative setback at ridge. Where an automatic sprinkler system is installed within the dwelling in accordance with NFPA 13D or Section P2904, setbacks at ridges shall comply with one of the following:
  - 1.For photovoltaic arrays occupying not more than 66 percent of the plan view total roof area, not less than an 18-inch (457 mm) clear setback is required on both sides of a horizontal ridge.
  - 2.For photovoltaic arrays occupying more than 66 percent of the plan view total roof area, not less than a 36-inch (914 mm) clear setback is required on both sides of a horizontal ridge.

90

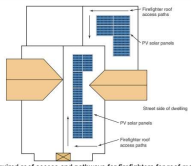
Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

90

R324.6 – Roof Access for Photovoltaic Solar Energy Systems - Cont.

TABLE 3-1 Minimum Ridge Setback

Array Percent of Roof Area	Fire Sprinkler System	Minimum Setback on Both Sides of Ridge (inches)
≤ 33 %	No	18
> 33%	No	36
≤ 66 %	Yes	18
> 66%	Yes	36



Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

Required roof access and pathways for firefighters for roof-mounted PV solar systems

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91

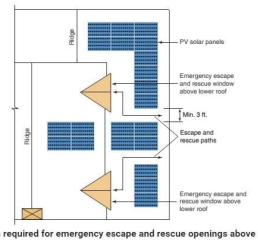
R324.6.2.2 – Solar Panels near Emergency Escape and Rescue Openings

- **Change Type:** Addition
- **Change Summary:** Rooftop-mounted photovoltaic solar energy panels and modules are not permitted to be installed directly below emergency escape and rescue openings
- R324.6.2.2 Emergency escape and rescue opening. Panels and modules installed on dwellings shall not be placed on the portion of a roof that is below an emergency escape and rescue opening. A pathway not less than 36-inches (914 mm) wide shall be provided to the emergency escape and rescue opening.

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

92

R324.6.2.2 – Solar Panels near Emergency Escape and Rescue Openings – Cont.



A 36-inch-wide pathway is required for emergency escape and rescue openings above roof-mounted PV solar panels.

© International Code Council

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

93

R507.3.1 – Minimum Footing Size for Decks

- **Change Type:** Addition
- **Change Summary:** Table R507.3.1 has been added and provides the minimum residential deck footing sizes based on Live or Ground Snow Load (highest case load)

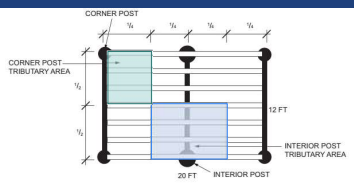
TABLE R507.3.1 MINIMUM FOOTING SIZE FOR DECKS

LIVE OR GROUND SNOW LOAD[b] (psf)	TRIBUTARY AREA (sq. ft.)	LOAD BEARING VALUE OF SOILS[a, c, d] (psf)											
		1500[e]			2000[e]			2500[e]			≥ 3000[e]		
		Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness (inches)
40	20	12	14	6	12	14	6	12	14	6	12	14	6
	40	14	16	6	12	14	6	12	14	6	12	14	6
	60	17	19	6	15	17	6	13	15	6	12	14	6
	80	20	22	7	17	19	6	15	17	6	14	16	6
	100	22	25	8	19	21	6	17	19	6	15	17	6
	120	24	27	9	21	23	7	19	21	6	17	19	6
	140	26	29	10	22	25	8	20	23	7	18	21	6
	160	28	31	11	24	27	9	21	24	8	20	22	7

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

94

R507.3.1 – Minimum Footing Size for Decks – Cont.



TRIBUTARY AREA – CORNER POST
LENGTH IS ½ OF TOTAL LENGTH = 20 FT × ½ = 5 FT
WIDTH IS ½ OF TOTAL WIDTH = 12 FT × ½ = 6 FT
AREA = 5 FT × 6 FT = 30 FT²

TRIBUTARY AREA – INTERIOR POST
LENGTH IS ½ OF TOTAL LENGTH = 20 FT × ½ = 10 FT
WIDTH IS ½ OF TOTAL WIDTH = 12 FT × ½ = 6 FT
AREA = 10 FT × 6 FT = 60 FT²

Commentary Figure R507.3.1DECK TRIBUTARY AREA

95

2015 IRC Section R806.2 Roof Ventilation *2015 IRC per RAC Report

- **The reduction net free ventilation can be reduced from 1/150 to 1/300 provided one or more of the following conditions are met:**
  1. CZs 6, 7 & 8, a class I or II vapor retarder is installed
  2. Not less than 40% and not more than 50% of ventilation in upper portion less than or equal to 3 feet below the ridge (previously 50%-80%)

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

96

Energy, Mechanical, Electrical Plumbing Significant Changes

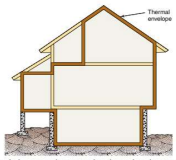
97

97

N1101.6 – Definition of Thermal Envelope

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

- **Change Type:** Clarification
- **Change Summary:** The revised definition for building thermal envelope clarifies that it is an assembly of materials enclosing conditioned space or creating a boundary between conditioned and unconditioned space.
- BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floors, ceilings, roofs and any other building element assemblies that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.



The building thermal envelope is an assembly of elements that provide a boundary between conditioned space and unconditioned space.

98

98

N1101.6, Tables N1101.10.3(1) & N1101.10.3(2) – Fenestration Definitions and U-Factors

- **Change Type:** Clarification
- **Change Summary:** The definitions for skylights and vertical fenestration have been moved under the definition for fenestration, and a definition for opaque door has been added.
- FENESTRATION. Products classified as either vertical fenestration or skylights.
  - Skylights. Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees (1.05 rad) from horizontal.
  - Vertical Fenestration. Windows that are fixed or operable, opaque doors, glazed doors, glazed block and combination opaque/glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of not less than 60 degrees (1.05 rad) from horizontal.
- OPAQUE DOOR. A door that is not less than 50 percent opaque in surface area.

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

99

99

N1102.2.2 – Reduction of Ceiling Insulation

- **Change Type:** Modification
- **Change Summary:** When applying the exception for insulation in ceilings without attics, the insulation must extend to the outside of the top plate.
- N1102.2.2 (R402.2.2) Ceilings without attic spaces. Where Section N1102.1.2 requires insulation R-values greater than R-30 in the ceiling and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation R-value for such roof/ceiling assemblies shall be R-30. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section N1102.1.2 shall be limited to 500 square feet (46 m2) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section N1102.1.4 and the Total UA alternative in Section N1102.1.5.

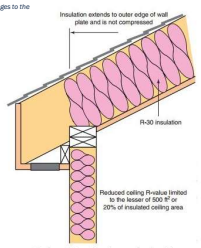
100

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

100

N1102.2.2 – Reduction of Ceiling Insulation – Cont.

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.



Reduced R-value for vaulted ceiling

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101

101

N1103.3.2, N1103.3.3 – Duct Sealing and Testing

- **Change Type:** Clarification
- **Change Summary:** If not part of the heating or cooling system ductwork, ducts serving heat or energy recovery ventilators do not require an air leakage test.
- N1103.3.2 (R403.3.2) sealing (mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1.
- N1103.3.3 (R403.3.3) Duct testing (Mandatory).Ducts shall be pressure tested to determine air leakage by one of the following methods:
  - 1.Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
  - 2.Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.
- Exceptions:
  - 1.A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.
  - 2.A duct air leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.
- A written report of the results of the test shall be signed by the party conducting the test and provided to the building official.

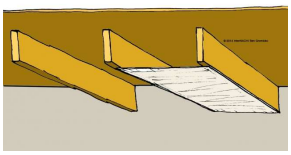
102

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

102

2018 IRC N1103.3.5 - Not Adopted per RAC Report

- **Topic:** Ducts & building cavities
- **Code Section Summary:** 2015 IECC does not allow building cavities to be used as ducts or plenums
- **PA Amendment:**
  - Exclude 2018 IECC Section R403.3.5 (2015 IRC Section N1103.3.5)
  - Adopt 2009 IECC Section R403.2.3 (2009 IRC Section N1103.2.3)



103

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

103

N1103.3.6, N1103.3.7 – Ducts Buried within Ceiling Insulation

- **Change Type:** Addition
- **Change Summary:** New provisions address the methods, minimum coverage requirements and thermal benefits for ducts buried within ceiling insulation, and when those ducts are considered inside the building thermal envelope.
- 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 insulation of an R-value not less than R-8.
  - 2.At all points along each duct, the sum of the ceiling insulation R-values above the top of the duct, and against and below the bottom of the duct shall be not less than R-19, excluding the duct R-value.
  - 3.In climate zones 1A, 2A and 3A, the supply ducts 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 M1601.4.6.
- Exception: Sections of supply ducts less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

104

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

104

N1103.3.6, N1103.3.7 – Ducts Buried within Ceiling Insulation – Cont.

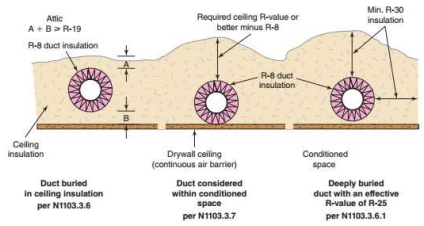
- **Change Type:** Addition
- N1103.3.6.1 (R403.3.6.1) Effective R-value of deeply buried ducts. Where using a simulated energy performance analysis, sections of ducts that are installed in accordance with Section N1103.3.6, located directly on, or within 5.5 inches (140 mm) of the ceiling, surrounded with blown-in attic insulation having an R-value of R-30 or greater and located such that the top of the duct is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation R-value of R-25.
- 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 is located completely within the continuous air barrier and within the building thermal envelope.
  - 2.The ducts are buried within ceiling insulation in accordance with Section N1103.3.6 and all of the following conditions exist:
    - 2.1The air handler is located completely within the continuous air barrier and within the building thermal envelope.
    - 2.2The 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 N1103.3.4, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m2) of conditioned floor area served by the duct system.
    - 2.3The 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.

105

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

105

N1103.3.6, N1103.3.7 – Ducts Buried within Ceiling Insulation – Cont.



Ducts buried within ceiling insulation

Source: International Code Council (ICC), (2018), 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

106

106

N1104.1 – Lighting

- **Change Type:** Modification
- **Change Summary:** The required percentage of permanent lighting fixtures having high-efficacy lamps has increased from 75% to 90%.
- N1104.1 (R404.1) Lighting equipment (Mandatory).Not less than 90 percent of the permanently installed lighting fixtures shall contain only high-efficacy lamps.

High-efficacy lamps, such as LED lamps, are required in 90 percent of permanent lighting fixtures

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Source: International Code Council (ICC), (2018), 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

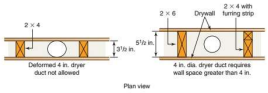
107

107

M1502.4.2 – Concealed Dryer Exhaust Ducts

Source: International Code Council (ICC), (2018), 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

- **Change Type:** Modification
- **Change Summary:** Wall and ceiling cavities enclosing dryer exhaust ducts must provide sufficient space that the 4-inch duct is not squeezed out of its round shape.
- M1502.4.2 Duct installation. Exhaust ducts shall be supported at intervals not to exceed 12 feet (3658 mm) and shall be secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Exhaust duct joints shall be sealed in accordance with Section M1601.4.1 and shall be mechanically fastened. Ducts shall not be joined with screws or similar fasteners that protrude more than ⅛ inch (3.2 mm) into the inside of the duct. Where dryer exhaust ducts are enclosed in wall or ceiling cavities, such cavities shall allow the installation of the duct without deformation.



Dryer exhaust duct in concealed spaces

108

108

M1503 – Domestic Cooking Exhaust Equipment

- **Change Type:** Modification
- **Change Summary:** "Domestic cooking exhaust equipment" is the preferred terminology for "kitchen exhaust" because it is more descriptive and includes all of the components of the exhaust system.

SECTION M1503

RANGE HOODS DOMESTIC COOKING EXHAUST EQUIPMENT

- M1503.1 General. Domestic cooking exhaust equipment shall comply with the requirements of this section.
- M1503.2 Domestic cooking exhaust. Where domestic cooking exhaust equipment is provided it shall comply with one of the following:
  - 1.The fan for overhead range hoods and downdraft exhaust equipment not integral with the cooking appliance shall be listed and labeled in accordance with UL 507.
  - 2.Overhead range hoods and downdraft exhaust equipment with integral fans shall comply with UL 507.
  - 3.Domestic cooking appliances with integral downdraft exhaust equipment shall be listed and labeled in accordance with ANSI Z21.1 or UL 858.
  - 4.Microwave ovens with integral exhaust for installation over the cooking surface shall be listed and labeled in accordance with UL 923.
- M1503.2.1 Open top broiler exhaust. Domestic open-top broiler units shall be provided with a metal exhaust hood, having a thickness of not less than 0.0157-inch (0.3950 mm) (No. 28 gage). Such hoods shall be installed with a clearance of not less than ¼ inch (6.4 mm) between the hood and the underside of combustible material or and cabinets. A clearance of not less than 24 inches (610 mm) shall be maintained between the cooking surface and the combustible material and cabinets. The hood width shall be not less than the width of the broiler unit and shall extend over the entire unit.
- Exception: Broiler units that incorporate an integral exhaust system, and that are listed and labeled for use without an exhaust hood, shall not be required to have an exhaust hood.

109

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

109

M1503.6 – Makeup Air for Kitchen Exhaust System

- **Change Type:** Modification
- **Change Summary:** Makeup air for domestic cooking exhaust systems is no longer required if all fuel-burning appliances in the dwelling unit have a direct vent or mechanical draft vent system.
- M1503.6 Makeup air required. Where one or more gas-, liquid-, or solid-fuel- burning appliance that is neither direct-vent nor uses a mechanical draft venting system is located within a dwelling unit's air barrier, each exhaust system capable of exhausting in excess of 400 cubic feet per minute (0.19 m3/s) shall be mechanically or naturally passively provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with not fewer than one damper complying with Section M1503.6.2.
  - Exception: Makeup air is not required for exhaust systems installed for the exclusive purpose of space cooling and intended to be operated only when windows or other air inlets are open.
- M1503.6.1 Location. Kitchen exhaust makeup air shall be discharged into the same room in which the exhaust system is located or into rooms or duct systems that communicate through one or more permanent openings with the room in which such exhaust system is located. Such permanent openings shall have a net cross-sectional area not less than the required area of the makeup air supply openings.
- M1503.6.2 Makeup air dampers. Where makeup air is required by Section M1503.6, makeup air dampers shall comply with this section. Each damper shall be a gravity damper or an electrically operated damper that automatically opens when the exhaust system operates. Dampers shall be accessible for inspection, service, repair and replacement without removing permanent construction or any other ducts not connected to the damper being inspected, serviced, repaired or replaced. Gravity or barometric dampers shall not be used in passive makeup air systems except where the dampers are rated to provide the design makeup airflow at a pressure differential of 0.01 inch w.c. (3 Pa) or less.

110

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

110

G2406.2 – Prohibited Locations for Appliances

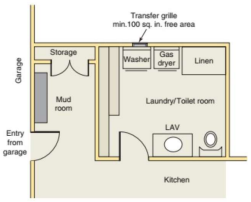
- **Change Type:** Modification
- **Change Summary:** A gas-fired clothes dryer is now allowed to be installed in a bathroom or toilet room where a permanent opening communicates with other permitted spaces.
- G2406.2 (303.3) Prohibited locations. Appliances shall not be located in sleeping rooms, bathrooms, toilet rooms, storage closets or surgical rooms, or in a space that opens only into such rooms or spaces, except where the installation complies with one of the following:
- 1.through 5. No change to text.
- 6.A clothes dryer is installed in a residential bathroom or toilet room having a permanent opening with an area of not less than 100 square inches (0.06 m2) that communicates with a space outside of a sleeping room, bathroom, toilet room, or storage closet.

111

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

111

G2406.2 – Prohibited Locations for Appliances – Cont.



Gas clothes dryer permitted in a toilet room

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112

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

112

G2411.2, G2411.3 – Electrical Bonding of CSST

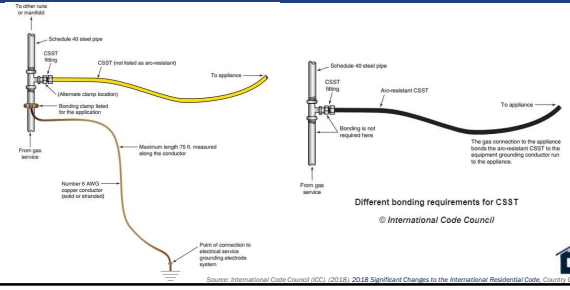
- **Change Type:** Modification
- **Change Summary:** The existing provisions for electrical bonding apply to CSST without an arc-resistant jacket or coating and a new section addresses electrical continuity and bonding of arc-resistant CSST.
- (G2411.3) (310.3) Arc-resistant CSST. This section applies to corrugated stainless steel tubing (CSST) that is listed with an arc-resistant jacket or coating system in accordance with ANSI LC1/CSA 6.26. The CSST shall be electrically continuous and bonded to an effective ground fault current path. Where any CSST component of a piping system does not have an arc-resistant jacket or coating system, the bonding requirements of Section G2411.2 shall apply. Arc-resistant-jacketed CSST shall be considered to be bonded where it is connected to an appliance that is connected to the appliance grounding conductor of the circuit that supplies that appliance.

113

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

113

G2411.2, G2411.3 – Electrical Bonding of CSST – Cont.



Different bonding requirements for CSST

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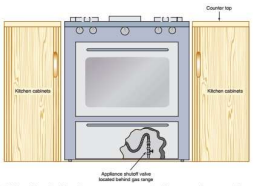
114

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

114

G2420.5.1 – Shutoff Valve Location

- **Change Type:** Clarification
- **Change Summary:** Shutoff valves located behind movable appliances are considered as meeting the requirement for access.
- G2420.5.1 (409.5.1) Located within same room. The shutoff valve shall be located in the same room as the appliance. The shutoff valve shall be within 6 feet (1829 mm) of the appliance, and shall be installed upstream of the union, connector or quick disconnect device it serves. Such shutoff valves shall be provided with access. Shutoff valves serving movable appliances, such as cooking appliances and clothes dryers, shall be considered to be provided with access where installed behind such appliances. Appliance shutoff valves located in the firebox of a fireplace shall be installed in accordance with the appliance manufacturer's instructions.



Shutoff valve behind gas range meets the requirement for access

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115

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

115

G2447.2 – Commercial Cooking Appliances

- **Change Type:** Modification
- **Change Summary:** Commercial cooking appliances are now permitted in dwelling units when installed in accordance with an engineered design and the manufacturer's instructions.
- G2447.2 (623.2) Prohibited location. Cooking appliances designed, tested, listed and labeled for use in commercial occupancies shall not be installed within dwelling units or within any area where domestic cooking operations occur.
- Exceptions:
  1. Appliances that are also listed as domestic cooking appliances.
  2. Where the installation is designed by a licensed professional engineer in compliance with the manufacturer's installation instructions.

Commercial cooking appliances are permitted with an engineered design

Artazum/Shutterstock.com

116

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

116

P2503.7 – Air Testing of PEX Piping

- **Change Type:** Modification
- **Change Summary:** Compressed-air testing of PEX water-supply piping is now allowed when testing is in accordance with the manufacturer's instructions.
- P2503.7 Water-supply system testing. Upon completion of the water-supply system or a section of it, the system or portion completed shall be tested and proved tight under a water pressure of not less than the working pressure of the system or, for piping systems other than plastic, by an air test of not less than 50 psi (345 kPa). This pressure shall be held for not less than 15 minutes. The water used for tests shall be obtained from a potable water source.
  - Exception: For PEX piping systems, testing with a compressed gas shall be an alternative to hydrostatic testing where compressed air or other gas pressure testing is specifically authorized by the manufacturer's instructions for the PEX pipe and fittings products installed at the time the system is being tested, and compressed air or other gas testing is not otherwise prohibited by applicable codes, laws, or regulations outside of this code.

117

Source: International Code Council (ICC), (2018), *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

117

P2713.1 – Bathtub Overflow

- **Change Type:** Bathtub overflow outlets are no longer required.
- **Change Summary:** Overflow outlets are no longer required for bathtubs.
- P2713.1 Bathtub waste outlets and overflows. Bathtubs shall be equipped with a waste outlet that is not less than 11/2 inches (38 mm) in diameter. The waste outlet shall be equipped with a water-tight stopper. Where an overflow is installed, the overflow shall be not less than 11/2 inches (38 mm) in diameter.

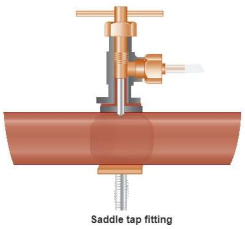
118

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

118

P2906.6.1 – Saddle Tap Fitting on Water Distribution Piping – NOT adopted by RAC

- ~~**Change Type:** Addition~~
- ~~**Change Summary:** Saddle tap fittings are no longer permitted on water distribution system piping.~~
- ~~P2906.6.1 Saddle tap fittings. The use of saddle tap fittings and combination saddle tap and valve fittings shall be prohibited.~~



Saddle tap fitting

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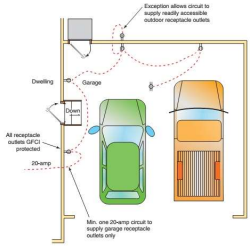
119

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

119

E3703.5 – Garage Branch Circuits

- **Change Type:** Addition
- **Change Summary:** A separate 20-ampere branch circuit is now required to serve receptacle outlets of attached garages and detached garages with electric power.
- E3703.5 Garage branch circuits. In addition to the number of branch circuits required by other parts of this section, not less than one 120-volt, 20 ampere branch circuit shall be installed to supply receptacle outlets in attached garages and in detached garages with electric power. This circuit shall not have other outlets. [210.11(C)(4)]
  - Exception: This circuit shall be permitted to supply readily accessible outdoor receptacle outlets. [210.11(C)(4) Exception]



20-amp circuit to supply garage receptacle outlets

© International Code Council

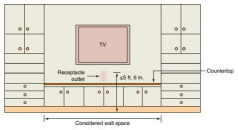
120

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

120

E3901.2 – Wall Space for Receptacle Distribution

- **Change Type:** Modification
- **Change Summary:** Cabinets with countertops are now considered wall space in determining required locations for general purpose receptacle outlets.
- E3901.2 General purpose receptacle distribution. In every kitchen, family room, dining room, living room, parlor, library, den, sun room, bedroom, recreation room, or similar room or area of dwelling units, receptacle outlets shall be installed in accordance with the general provisions specified in Sections E3901.2.1 through E3901.2.3 (see Figure E3901.2).
- E3901.2.1 Spacing. Receptacles shall be installed so that no point measured horizontally along the floor line of any wall space is more than 6 feet (1829 mm), from a receptacle outlet. [210.52(A)(1)]
- E3901.2.2 Wall space. As used in this section, a wall space shall include the following: [210.52(A)(2)]
  - 1.Any space that is 2 feet (610 mm) or more in width, including space measured around corners, and that is unbroken along the floor line by doorways and similar openings, fireplaces, and fixed cabinets that do not have countertops or similar work surfaces.
  - 2.and 3. No change to text.



Cabinets with countertops or work surfaces are counted as wall space

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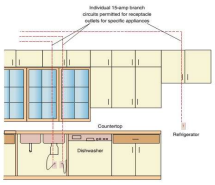
121

Source: International Code Council (ICC), (2018). 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

121

E3901.3 – Appliances on 15 Amp Circuits

- **Change Type:** Modification
- **Change Summary:** An individual 15-ampere branch circuit is permitted to serve any specific kitchen appliance.
- E3901.3 Small appliance receptacles. In the kitchen, pantry, breakfast room, dining room, or similar area of a dwelling unit, the two or more 20-ampere small-appliance branch circuits required by Section E3703.2, shall serve all wall and floor receptacle outlets covered by Sections E3901.2 and E3901.4 and those receptacle outlets provided for refrigeration appliances. [210.52(B)(1)]
- Exceptions:
  1. In addition to the required receptacles specified by Sections E3901.1 and E3901.2, switched receptacles supplied from a general-purpose branch circuit as defined in Section E3903.2, Exception 1 shall be permitted. [210.52(B)(1) Exception No. 1]
  2. In addition to the required receptacles specified by Section E3901.2, a receptacle outlet to serve a specific appliance shall be permitted to be supplied from an individual branch circuit rated at 15 amperes or greater. [210.52(B)(1) Exception No. 2]



Receptacle outlet for a specific appliance can be on an individual 15-amp branch circuit

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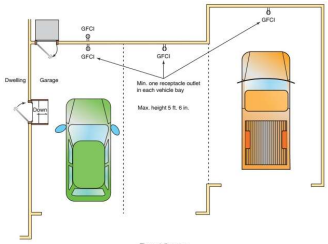
122

Source: International Code Council (ICC), (2018). 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

122

E3901.9 – Garage Receptacle Outlet Location

- **Change Type:** Modification
- **Change Summary:** A receptacle outlet must be located in each vehicle bay in a garage.
- E3901.9 Basements, garages and accessory buildings. Not less than one receptacle outlet, in addition to any provided for specific equipment, shall be installed in each separate unfinished portion of a basement, in each vehicle bay not more than 5.5 feet above the floor in attached garages; in each vehicle bay not more than 5.5 feet above the floor in detached garages that are provided with electrical power and in accessory buildings that are provided with electric power. [210.52(G)(1), (2), and (3)]



Receptacle outlet required in each vehicle space in garage

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123

Source: International Code Council (ICC), (2018). 2018 Significant Changes to the International Residential Code, Country Club Hill, Ill.

123

Questions?

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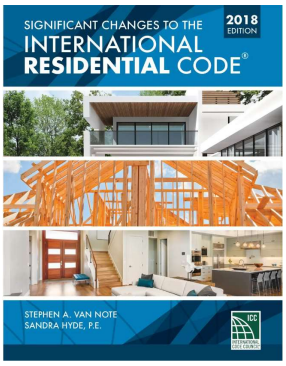
124

124

Today's Information

- International Code Council. (2018). *2018 Significant Changes to the International Residential Code*, ICC, Country Club Hill, Ill.



125

125

References

- 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.
- International Code Council. (2017). *2018 International Residential Code*, ICC, Country Club Hill, Ill.
- International Code Council. (2018). *2018 Significant Changes to the International Residential Code*, ICC, Country Club Hill, Ill.

126

126

PA UCC Residential Code Update: Part 2

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127

PA Alternative Residential Energy Provisions Update

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128

Description

- The Pennsylvania Uniform Construction Code (UCC) Review and Advisory Council (RAC) completed the review of the 2018 I-Codes on April 29, 2021. The code provisions that were adopted during this process will take effect in the first quarter of 2022. These changes trigger an update of the PA Alternative Residential Energy Provisions. The Pennsylvania Alternative Residential Energy Provisions were developed with the intent of being: simpler to build and easier to enforce; more rational and flexible; focused on Pennsylvania in terms of climatic and other conditions; and, equivalent to the provisions of the International Energy Conservation Code (IECC) in terms of energy efficiency. This session will dig into the updated version of this standard.

129

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129

Learning Objectives

1. Discuss the overall intent of the PA Alternative Residential Energy Provisions as an energy code compliance path, including flexibility and simplicity.
2. Evaluate the available energy enhancement options that can be used as entrance requirements for this compliance path, including upgrades to building enclosure elements, higher efficiency equipment, and renewable energy generation.
3. Identify available trade-offs that are provided due to the inclusion of an energy enhancement option, such as alternative building enclosure parameters, and their effect on building performance.
4. Identify the impact of electing to use this compliance path on the permit and inspection process.

130

130

Code Update: What is Changing?

131

131

UCC Energy Code Summary: 2/14/22

Chapter 11 | Residential Provisions | Coming Soon!

132

132

PA Alternative Residential Energy Provisions

- Compliance allowed by UCC Title 34, Chapter 403
- Intent:
  - simpler to build to and easier to enforce
  - more rational and flexible
  - focused on Pennsylvania in terms of climatic and other conditions; and,
  - equivalent to the provisions of the International Energy Conservation Code (IECC)
- Prescriptive (vs. requiring modeling)
- Allows trade-offs

133

133

PA Alternative Residential Energy Provisions

- Based on the 2018 IECC and UCC Amendments
- Compliance allowed by UCC Title 34, Chapter 403
- Created and published by the Pennsylvania Housing Research Center
- Allows trade-offs

134

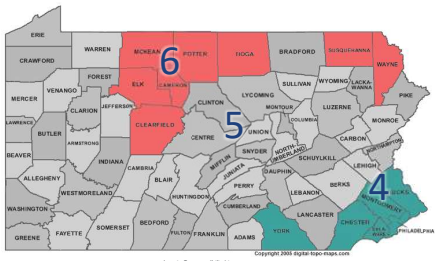
134

2018 IRC & IECC Updates: Residential Energy

135

135

Climate Zones in PA



136

Image Source: digital-topo-maps.com

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136

2018 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	BAWSEMENT[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	0.32	0.55	0.40	49	20 or 13 + 5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13 + 5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

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137

137

2018 IRC Table N1102.1.2 Footnotes

a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not 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: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation on the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation shall not be required in warm-humid locations as defined by Figure N1101.7 and Table N1101.7.

g. Alternatively, insulation sufficient to fill the framing cavity providing not less than an R-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section N1102.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

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138

138

How is the PA Alternative Developed?

139

139

Discussion Break

- Are builders using the PA Alternative?
- Challenges with enforcement?

140

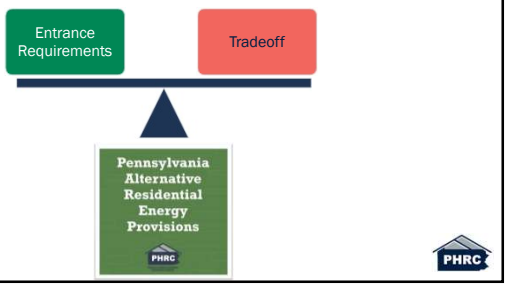
140

2021 PA Alternative Residential Energy Provisions

141

141

PA Alternative Residential Energy Provisions



142

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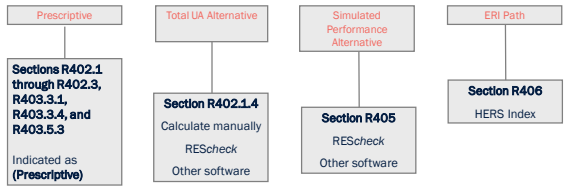
142

142

IECC Compliance Options



143

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143

143

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Scope Clarification

SECTION PA100

GENERAL

PA101 Scope. The provisions of this document regulate energy efficiency for the design and construction of buildings regulated by the 2018 International Residential Code (IRC) as incorporated in the PA Uniform Construction Code (UCC) in the Commonwealth of Pennsylvania. In addition, the provisions of this document only apply to new construction of one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures not more than three stories above grade plane in height and are not applicable to alteration, repair, addition, and change of occupancy of existing buildings and structures.

Exception: Portions of the building envelope that do not enclose conditioned space.

144

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144

144

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Energy Enhancement Options

Table PA104
Energy Enhancement Options

Option	Description		Minimum efficiency by climate zone		
			South (4)	Central (5)	North (6)
1	Ductless heat pumps		8.5 HSPF and 15 SEER	10 HSPF and 15 SEER	10 HSPF and 15 SEER
2	All air ducts located inside the thermal envelope		Compliant	Compliant	Compliant
3	Geothermal or water source heat pump installed		Compliant	Compliant	Compliant
4	Improved efficiency air source heat pump installed		9.5 HSPF and 19 SEER	9.5 HSPF and 19 SEER	11 HSPF and 19 SEER
5	Improved efficiency condensing furnace installed		92 AFUE	95 AFUE	95 AFUE
6	Exterior continuous insulation		R20+10	R20+10	R20+15
7	Improved efficiency windows		U-factor = 0.21	U-factor = 0.19	U-factor = 0.15
8	Package: Improved efficiency windows and higher attic R-value with raised heel truss[a]	Windows	U-factor = 0.25	U-factor = 0.21	U-factor = 0.19
		Attic	R-value = 60	R-value = 60	R-value = 60
9	Package: Improved efficiency windows and heat pump water heater	Windows	U-factor = 0.25	U-factor = 0.21	U-factor = 0.19
		Heat Pump Water Heater	Compliant	Compliant	Compliant

Notes:
a. Full height of uncompressed insulation shall extend over the top plate at the eaves.
b. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

145

145

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PA Climate Zone Map

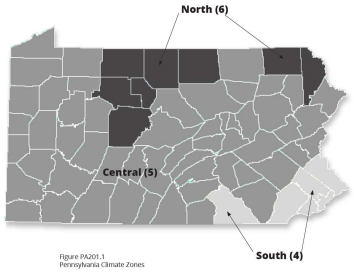

Figure PA201.1
Pennsylvania Climate Zones

146

146

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Energy Enhancement Options

Choose ONE of the following Energy Enhancement Options to qualify for the alternative path.

147

147

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Energy Enhancement Options

1. Ductless heat pumps

Minimum efficiency by climate zone		
South (4)	Central (5)	North (6)
8.5 HSPF *and* 15 SEER	10 HSPF *and* 15 SEER	10 HSPF *and* 15 SEER

Notes:
a. Full height of uncompressed insulation shall extend over the top plate at the eaves.
b. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

Image Source: http://synergy-green-builders.com/tag/mini-split-pumps/

148

148

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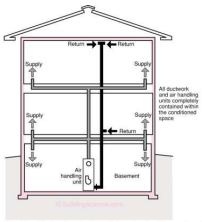
Energy Enhancement Options

2. All air ducts located inside the thermal envelope



Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.

Minimum efficiency by climate zone		
South (4)	Central (5)	North (6)
Compliant	Compliant	Compliant

Notes:
a. Full height of uncompressed insulation shall extend over the top plate at the eaves.
b. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

Image Source: https://buildingscience.com/documents/information-sheets/information-sheet-ducts-in-conditioned-space

149

149

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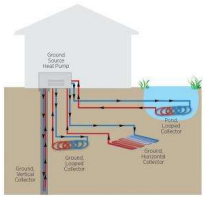
Energy Enhancement Options

3. Geothermal or water source heat pump installed



Minimum efficiency by climate zone		
South (4)	Central (5)	North (6)
Compliant	Compliant	Compliant

Notes:
a. Full height of uncompressed insulation shall extend over the top plate at the eaves.
b. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

Image Source: https://basc.pnnl.gov/resource-guides/geothermal-heat-pumps

150

150

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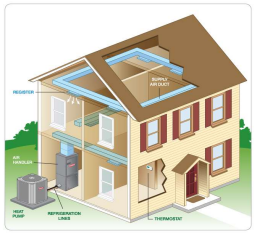
Energy Enhancement Options

4. Improved efficiency air source heat pump installed



Minimum efficiency by climate zone		
South (4)	Central (5)	North (6)
9.5 HSPF *and* 19 SEER	9.5 HSPF *and* 19 SEER	11 HSPF *and* 19 SEER

Notes:
a. Full height of uncompressed insulation shall extend over the top plate at the eaves.
b. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

Image Source: https://www.goodmanmfg.com/resources/heating-cooling-101/how-a-heat-pump-works

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151

151

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Energy Enhancement Options

5. Improved efficiency condensing furnace installed

Minimum efficiency by climate zone		
South (4)	Central (5)	North (6)
92 AFUE	95 AFUE	95 AFUE

Notes:
a. Full height of uncompressed insulation shall extend over the top plate at the eaves.
b. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

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152

152

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Energy Enhancement Options

6. Exterior continuous insulation

Minimum efficiency by climate zone		
South (4)	Central (5)	North (6)
R20+10	R20+10	R20+15

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153

153

DRAFT

Energy Enhancement Options

7. Improved efficiency windows

Minimum efficiency by climate zone		
South (4)	Central (5)	North (6)
U-factor = 0.21	U-factor = 0.19	U-factor = 0.15

Image Source: http://peoriasiding.com/tag/best-replacement-windows-in-illinois/

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154

154

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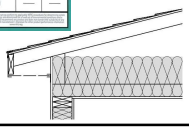
Energy Enhancement Options

8. Package: Improved efficiency windows & higher attic R-value with raised heel truss



	Minimum efficiency by climate zone		
	South (4)	Central (5)	North (6)
Windows	U-factor = 0.25	U-factor = 0.21	U-factor = 0.19
Attic	R-value = 60	R-value = 60	R-value = 60

Notes:
a. Full height of uncompressed insulation shall extend over the top plate at the eaves.

Image Source: TOP - http://peoriasiding.com/tag/best-replacement-windows-in-illinois/
BOTTOM – 2018 PA Alternative Energy Provisions

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155

155

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Energy Enhancement Options

9. Package: Improved efficiency windows & heat pump water heater

	Minimum efficiency by climate zone		
	South (4)	Central (5)	North (6)
Windows	U-factor = 0.25	U-factor = 0.21	U-factor = 0.19
Heat Pump Water Heater	Compliant	Compliant	Compliant

Image Source: LEFT - http://peoriasiding.com/tag/best-replacement-windows-in-illinois/
RIGHT – http://westinghousewaterheating.com/electric-heat-pump-water-heater.html

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156

156

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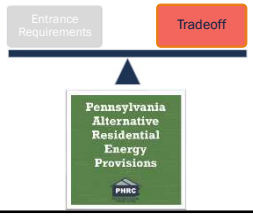
Energy Tradeoffs

- ALL of the following are allowed as a reduction when at least one energy enhancement option has been met.



157

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157

157

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PA Climate Zone Map

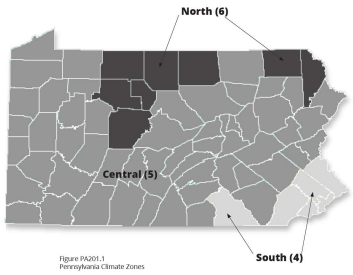

Figure PA201.1
Pennsylvania Climate Zones

158

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158

158

2018 IRC Section N1102.2.2

- Ceilings without attic spaces
  - Where Section N1102.1.2 requires insulation R-values greater than R-30 in the ceiling and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation R-value for such roof/ceiling assemblies shall be R-30. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed.
  - This reduction of insulation from the requirements of Section N1102.1.2 shall be limited to 500 square feet (46 m2) or 20 percent of the total insulated ceiling area, whichever is less.

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

159

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159

159

DRAFT

Energy Tradeoffs

1. Cathedral ceilings: R-30 insulation, for up to 75% of the total *living space* square footage area

PA302.2 Ceilings without attic spaces. Where the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, such as cathedral ceilings, the minimum required insulation for such roof/ceiling assemblies shall be R-30. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section PA301 shall be limited to 75% of the total *living space* square footage area.

160

160

2018 IRC Section N1102.2.4

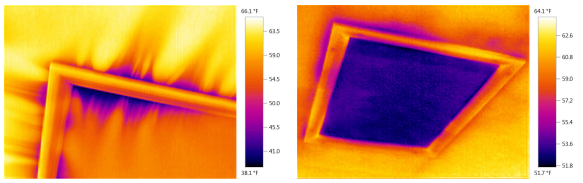
- **Access hatches and doors**
  - Access doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces.

161

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

161

Attic Access Gone Wrong



162

162

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Energy Tradeoffs

2. Attic Hatches: R-20 instead of full insulation req't

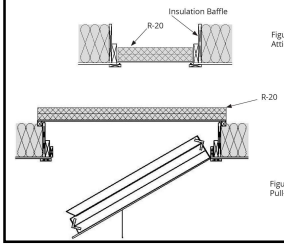

Figure PA302.3 (1)
Attic Hatch

Figure PA302.3 (2)
Pull-Down Stairs

PA302.4 Access hatches and doors. Access hatches and doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weather stripped. Both vertical and horizontal access hatches shall be insulated to a minimum of R-20 with rigid foam permanently attached to the access hatch. This is not intended to restrict the use of proprietary products meeting the intent of this provision. Side hinged access door shall meet the fenestration requirements of Table PA301.

A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed. The purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened. Areas around access hatches required to service equipment shall provide a permanent means of maintaining the installed R-value of the insulation.

Exception: Vertical doors that provide access from conditioned to unconditioned spaces shall be permitted to meet the fenestration requirements of Table PA301 based on the applicable climate zone specified in section PA201.1.

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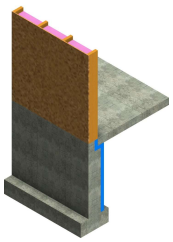
163

2018 IRC Section N1102.2.10

- **Slab-on-grade floors**
  - The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall



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Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

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164

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Energy Tradeoffs

3. Slab edge insulation: Thermal break

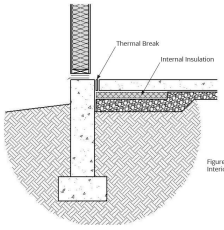

Figure PA302.7.2
Interior Slab Insulation

PA302.9.2 Interior Insulation. Interior insulation shall be installed from the bottom of the slab and extend the distance provided in Table PA301 by any combination of vertical insulation or horizontal insulation extending under the slab. The slab edge shall be separated from the foundation wall by a continuous ½ inch thermal break as per Figure PA302.8.(2) A thermal break shall be created by a material suitable for ground contact, which includes, but is not limited to, asphalt impregnated fiber board or extruded polystyrene. Slab-edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation.

Note: The provisions in PA302.9.2 only apply to unheated slabs. For heated slabs, refer to requirements in 2018 IRC Table N1102.1.2 (R402.1.2) and 2018 IRC Section N1102.2.10 (R402.2.10).

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165

165

2018 IRC Section N1102.3.4

- **Opaque door exemption**
  - One side-hinged opaque door assembly not greater than 24 square feet (2.22 m2) in area shall be exempt from the U-factor requirement in Section N1102.1.2.

166

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

166

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Energy Tradeoffs

4. Opaque doors: 54ft² U-factor exemption (instead of 24ft²)

PA303.4 Opaque door exemption. One door assembly, including side hinged opaque doors, sidelights and transoms, up to 54 square feet (5.02 m²) in area is exempted from the U-factor requirement in Table PA301.

167

Image Source: http://openi.co/prehung-exterior-french-doors/exterior-french-doors-interior-rustic-wood-prehung-installing-with/

167

N1101.6, Tables N1101.10.3(1) & N1101.10.3(2) – Fenestration Definitions and U-Factors

- **Change Type:** Clarification
- **Change Summary:** The definitions for skylights and vertical fenestration have been moved under the definition for fenestration, and a definition for opaque door has been added.
- FENESTRATION. Products classified as either vertical fenestration or skylights.
  - Skylights. Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees (1.05 rad) from horizontal.
  - Vertical Fenestration. Windows that are fixed or operable, opaque doors, glazed doors, glazed block and combination opaque/glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of not less than 60 degrees (1.05 rad) from horizontal.
- OPAQUE DOOR. A door that is not less than 50 percent opaque in surface area.

168

Source: International Code Council (ICC). (2018). *2018 Significant Changes to the International Residential Code*, Country Club Hill, Ill.

168

2018 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	BAWSEMENT[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	0.32	0.55	0.40	49	20 or 13 + 5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13 + 5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

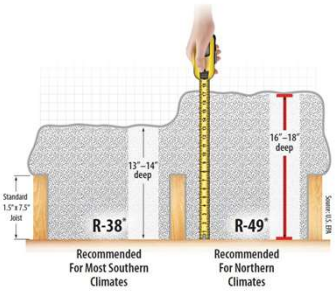
Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

169

169

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.

170

170

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Energy Tradeoffs

5. CZ4 Attic Insulation: R-38 insulation (instead of R-49)

Table PA301
Insulation and Fenestration Requirements by Component[a]

Climate Zone	Fenestration[b] U-factor	Skylights[b] U-factor	Glazed Fenestration SHGC[b,e]	Ceiling R-value	Wood Frame Wall R-value	Mass Wall R-value[h]	Floor R-value	Basement[c] Wall R-value	Slab[d] R-value and depth	Crawlspace[c] Wall R-value
South (4)	0.32	0.55	0.4	38	20[h] or 13+5[g]	8/13	19	10/13	10, 2 ft	10/13
Central (5)	0.30	0.55	NR	49	20[h] or 13+5[g]	13/17	30[f]	10/13	10, 2 ft	10/13
North (6)	0.30	0.55	NR	49	23, 20+5[g], , or 13+10[g]	15/20	30[f]	10/13	10, 4 ft	10/13

Image Source: 2021 PA Alternative Energy Provisions

171

171

2018 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	BAWSEMENT[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	0.32	0.55	0.40	49	20 or 13 + 5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13 + 5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

172

172

Basement Wall Insulation

173

173

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Energy Tradeoffs

6. Basement Walls: R-10 insulation option (instead of R-15)

Table PA301
Insulation and Fenestration Requirements by Component[a]

Climate Zone	Fenestration[b] U-factor	Skylights[b] U-factor	Glazed Fenestration SHGC[b,e]	Ceiling R-value	Wood Frame Wall R-value	Mass Wall R-value[h]	Floor R-value	Basement[c] Wall R-value	Slab[d] R-value and depth	Crawlspace[c] Wall R-value
South (4)	0.32	0.55	0.4	38	20[h] or 13+5[i]	8/13	19	10/13	10, 2 ft	10/13
Central (5)	0.30	0.55	NR	49	20[h] or 13+5[i]	13/17	30[j]	10/13	10, 2 ft	10/13
North (6)	0.30	0.55	NR	49	23, 20+5[i], or 13+10[i]	15/20	30[j]	10/13	10, 4 ft	10/13

174

174

2018 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	BAWSEMENT[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	0.32	0.55	0.40	49	20 or 13 + 5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13 + 5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

175

175

DRAFT Energy Tradeoffs

7. CZ6 Walls: Cavity-Only Wall Insulation Option

Table PA301
Insulation and Fenestration Requirements by Component[a]

Climate Zone	Fenestration[b] U-factor	Skylights[b] U-factor	Glazed Fenestration SHGC[b,e]	Ceiling R-value	Wood Frame Wall R-value	Mass Wall R-value[k]	Floor R-value	Basement[c] Wall R-value	Slab[d] R-value and depth	Crawlspace[c] Wall R-value
South (4)	0.32	0.55	0.4	38	20[h] or 13+5[i]	8/13	19	10/13	10, 2 ft	10/13
Central (5)	0.30	0.55	NR	49	20[h] or 13+5[i]	13/17	30[f]	10/13	10, 2 ft	10/13
North (6)	0.30	0.55	NR	49	23 or 20+5[i], or 13+10[i]	15/20	30[f]	10/13	10, 4 ft	10/13

176

176

UCC Energy Code Summary: 2/14/22

Chapter 11

+

Residential Provisions

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PA Alternative Residential Energy Provisions
Coming Soon!

177

177

Questions?

www.phrc.psu.edu

178

178

PA Alternative Residential Energy Provisions Update

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179

179

Adapting to Tighter Enclosures through Scopes of Work

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180

180

Description

One of the core aspects of any high-performance building is the ability to control air infiltration through the building enclosure. As Pennsylvania's Uniform Construction Code updates to the 2018 ICC codes, the main airtightness requirement will shift from a blower door result of 5 ACH50 down to 3 ACH50. What will it take for the residential construction industry to adapt to this change? This session will focus on the execution and installation of air sealing details around the building enclosure. Often, the keys to success involve properly designed details and material specifications, thus utilizing a well-crafted air sealing scope of work for subcontractors.

181

181

Learning Objectives

1. Review the code provisions that are changing within Pennsylvania's Uniform Construction Code that address enclosure airtightness.
2. Discuss the challenges associated with aiming for 3 ACH50 instead of 5 ACH50 based on past experiences from other jurisdictions and case studies.
3. Analyze the role of scopes of work in subcontractor selection and management.
4. Examine ways to improve the air sealing process overall to maximize energy and cost efficiency in residential structures.

182

182

Code Update: What is Changing?

183

183

UCC Residential Code Summary: 2/14/22

Base code

\+ Statutory Amendments +

RAC amendments

184

184

UCC Energy Code Summary: 2/14/22

Chapter 11

\+

Residential Provisions

\+ PA Alternative Residential Energy Provisions

Coming Soon!

185

185

Why Does Air Sealing Matter?

186

186

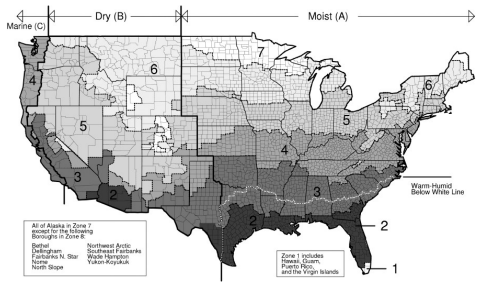
2018 IRC N1102.4.1.2 (R402.4.1.2) Testing

- The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding five air changes per hour in Climate Zones 1 and 2, and three air changes per hour in Climate Zones 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the building official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the building official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

187

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

187



188

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

188

Climate Zones in PA

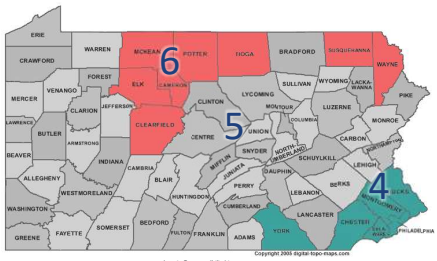


Image Source: digital-topo-maps.com

189

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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 5 ACH_{50} if tested
  - 50 Pa simulates roughly a 20 mph wind on all sides of the home

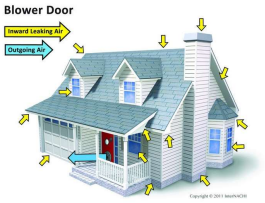

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Image Source: https://www.naeci.com/blower-door-testing

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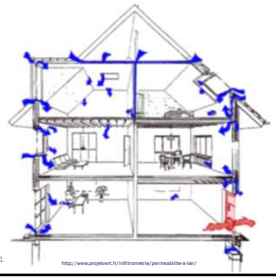
190

Airtightness Requirement: 3 ACH50



- Measured in Air Changes Per Hour at 50 Pascals (ACH50 / ACH_{50})
  - 50 pascals – equivalent to 20 MPH wind on the house

Value we need (Air Changes Per Hour @ 50 Pascals) | **Value from the blower door pressure gauge** (Cubic Feet Per Minute @ 50 Pascals) | **Constant** (60 minutes per hour)

$$ACH_{50} = \frac{CFM_{50} \times 60}{V} < 3$$

Volume of the House (Cubic Feet)

191

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Adapting to 3 ACH50

- **How does a builder transition to a tighter requirement?**
  - Analyze current scope of work with various contractors
  - Test and adapt NOW
  - Consider and plan to avoid common pitfalls

192

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192

What if Current Methods Aren't Enough?

- Which contractors perform air-sealing tasks on your projects?
- Do you have a tangible or written scope of work?
- How do they know that enough is enough?

193

193

How Do We Air Seal?

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General Air Barrier *Methods*

- Drywall Method
- Spray Foam Method
- Sheathing Method
- Housewrap Method

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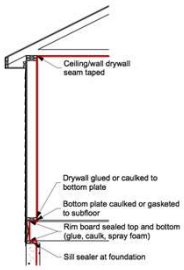
Drywall Method



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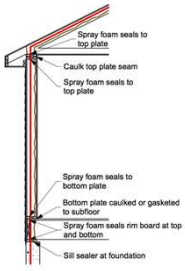
Spray Foam Method



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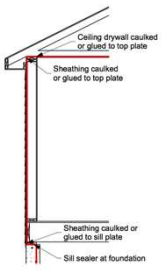
Sheathing Method



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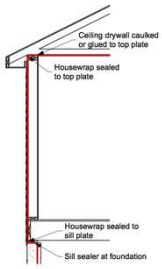
Housewrap Method



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2018 IRC and Air Sealing

205

205

N1102.4 Air Leakage

- The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R1102.4.1 through R1102.4.5.

206

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

206

N1102.4.1 Building Thermal Envelope

- The building thermal envelope shall comply with Sections N1102.4.1.1 and N1102.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.
  - N1102.4.1.1 – Installation
  - N1102.4.1.2 – Testing

207

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

207

N1102.4.1.1 Installation

- The components of the building thermal envelope as listed in Table N1102.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.4.1.1, as applicable to the method of construction. Where required by the building official, an approved third party shall inspect all components and verify compliance.

208

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

208

Table N1102.4.1.1 Air Barrier and Insulation Installation

- General requirements
- Ceiling/attic
- Walls
- Windows, skylights and doors
- Rim joists
- Floors
- Crawl space walls
- Shafts, penetrations
- Narrow cavities
- Garage separation
- Recessed lighting
- Plumbing and wiring
- Shower / tub on exterior wall
- Electrical / phone box on exterior walls
- HVAC register boots
- Concealed sprinklers

209

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

209

Walls

- Air Barrier Criteria
  - The junction of the foundation and sill plate shall be sealed.
  - The junction of the top plate and the top of exterior walls shall be sealed.
  - Knee walls shall be sealed.
- Insulation Installation Criteria
  - Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with material having an R-value of R-3 per inch min.
  - Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.

210

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

210

211 Image Source: https://www.jlconline.com/how-to/exterior/sealing-the-foundation-to-the-framing_o

211

212

212

Windows, Skylights and Doors

- **Air Barrier Criteria**
  - The space between window/door jambs and framing, and skylights and framing shall be sealed.
- **Insulation Installation Criteria**

213 Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

213

214

214

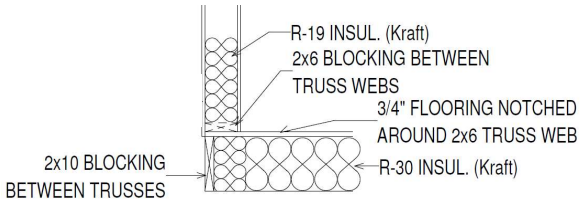
Floors

- **Air Barrier Criteria**
  - The air barrier shall be installed at any exposed edge of insulation.
- **Insulation Installation Criteria**
  - Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing or continuous insulation.

215

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

215



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Scope of Work

217

217

What if Current Methods Aren't Enough?

- Which contractors perform air-sealing tasks on your projects?
- Do you have a tangible or written scope of work?
- How do they know that enough is enough?

218

218

If You're Not Meeting 3 ACH50 Today…

- Two pathways:
  1. Expand your scope of work through:
     - Attention to detail (better execution)
     - Improved materials
     - Attack more areas of leakage
  2. Improve the overall design:
     - Simplify details
     - Set up contractors for success

219

219

1. Expanded Scope of Work

- What are some "next level" air sealing strategies?
  - Improved sill plate detail
  - More attention to interior partitions
  - Focus on penetrations through ceiling into attic

220

220

2. Better Design

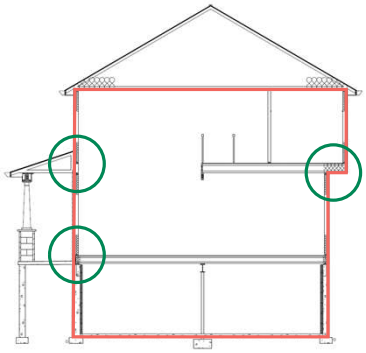
- What are some ways to improve the overall design?
  - Avoid unnecessary corners, intersections, and junctions
  - Bring ductwork into conditioned space
  - Use strategies such as the "pen test" to identify challenging details

221

221

Pen Test

- Identify air barriers and intersections



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Don't Forget Who is Involved

- Which contractors impact overall air sealing (aside from the primary air sealing sub)?
  - Framing crew
  - MEP contractors
  - Exterior cladding/siding crew

223

223

Discussion Break

- What are you seeing that is effective?
- What will be the biggest challenges in reaching 3 ACH50 in your area?

224

224

Review: Whole-House Mechanical Ventilation

225

225

2018 Ventilation Requirements

- **R303.4 Mechanical Ventilation**
  - Where the air infiltration rate of a dwelling unit is 5 air changes per hour or less where tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section N1102.4.1.2, the dwelling unit shall be provided with whole-house mechanical ventilation in accordance with Section M1505.4.

226 Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

226

M1505.4: Whole-House Mechanical Ventilation System

- **M1505.4.1System design.** The whole-house ventilation system shall consist of one or more supply or exhaust fans, or a combination of such, and associated ducts and controls. Local exhaust or supply fans are permitted to serve as such a system. Outdoor air ducts connected to the return side of an air handler shall be considered as providing supply ventilation.

227 Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

227

M1505.4: Whole-House Mechanical Ventilation System

- **M1505.4.3 Mechanical ventilation rate.** The whole house mechanical ventilation system shall provide outdoor air at a continuous rate as determined in accordance with Table M1505.4.3(1) or Equation 15-1.
  - Ventilation rate in cubic feet per minute = (0.01 x total square foot area of house) + [7.5 x (number of bedrooms + 1)]

228 Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

228

2018 IRC Table M1505.4.3 (1) & (2)

TABLE M1505.4.3(1)
CONTINUOUS WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM AIRFLOW REQUIREMENTS

DWELLING UNIT FLOOR AREA (square feet)	NUMBER OF BEDROOMS				
	0 - 1	2 - 3	4 - 5	6 - 7	> 7
	Airflow in CFM				
< 1,500	30	45	60	75	90
1,501 - 3,000	45	60	75	90	105
3,001 - 4,500	60	75	90	105	120
4,501 - 6,000	75	90	105	120	135
6,001 - 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

TABLE M1507.3.3(2)
INTERMITTENT WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor	4	3	2	1.5	1.3	1.0

229

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

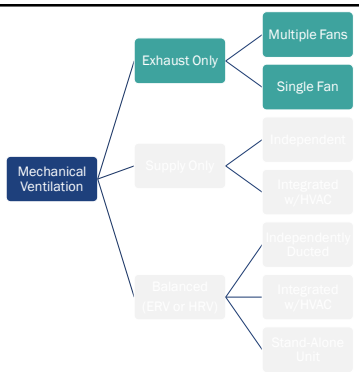
229

3 Design Solutions For Whole-House Mechanical Ventilation

- Exhaust-only
- Supply-only
- Balanced system

230

230



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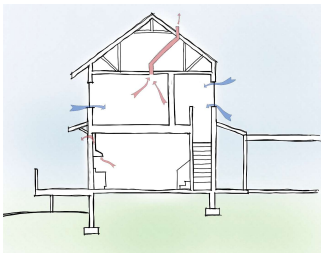
Exhaust-Only Ventilation



Source: Ventilation Requirements & Code Changes, Ventilation Science & Requirements; Hamer Center

232

232

How Exhaust-Only Ventilation Works

- Exhaust-only ventilation systems utilize spot ventilation typically through bathroom exhaust fans
- By depressurizing portions of the home, fresh air is brought in through gaps and cracks in the envelope

233

233

Exhaust-Only Option

- Programmable bath fan

Image Source: https://na.panasonic.com/us/whispergreen-selecttm-fan-50-80-110-cfm

234

234

Exhaust-Only Placement Consideration

- **Master Bath**
  - Pathway from fan to remainder of the home
  - Noise
- **Hall Bath**
  - Pathway from fan to remainder of the home if Jack & Jill is the only option
  - More direct path for air flow

235

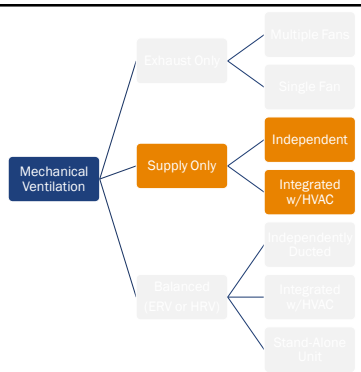
235

Exhaust-Only Pros/Cons

PROS	CONS
• Simple installation and minimal required duct work	• Lack of control over where the infiltrating air enters
• Affordable (low installation and operating cost)	• Outdoor air may not be evenly distributed
• Commonly used	• Must install control switch for manual override

236

236



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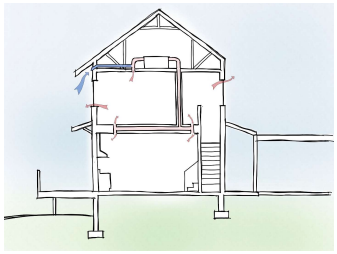
237

Supply-Only Ventilation



Source: Ventilation Requirements & Code Changes, Ventilation Science & Requirements; Hamer Center

238

238

How Supply-Only Ventilation Works

- Supply-only ventilation typically involves a duct and fan that brings outside air into the return line of a forced air system
- The forced air system/air handler circulates the fresh air throughout the home
- By pressurizing all or portions of the home, stale indoor air is forced out through gaps & cracks

239

239

Supply-Only Pros/Cons

PROS	CONS
• More even air distribution • Minimal addition of ductwork • Known fresh air source	• Potential to add warm, humid air into exterior walls during winter months due to pressurization • Adds additional loads to HVAC design

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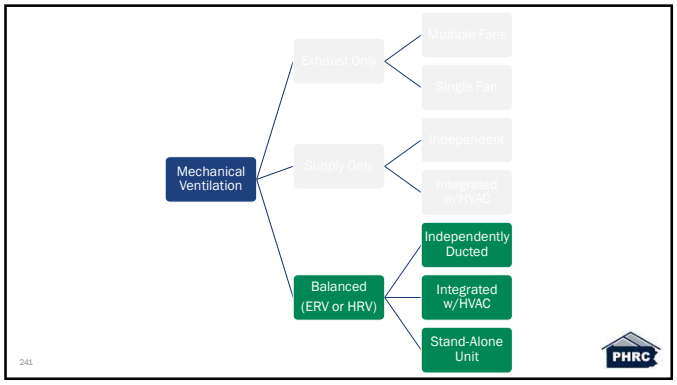

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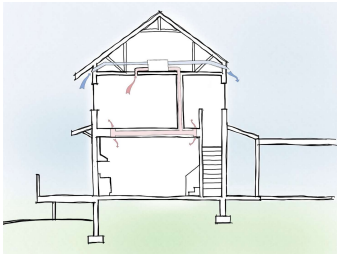
Balanced System Option



Source: Ventilation Requirements & Code Changes, Ventilation Science & Requirements; Hamer Center

242

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242

How a Balanced System Works

- Balanced ventilation systems combine supply and exhaust systems
- Most systems have built-in heat recovery capabilities so that heat is transferred between the exhaust air and the supply air
- Some systems are also capable of transferring moisture

243

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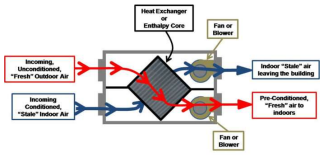
243

Heat Recovery Ventilator: What is it?

- HRVs provide balanced exhaust and supply ventilation with a heat exchanger to transfer heat between air streams



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Source: https://basc.pnnl.gov/images/heat-recovery-ventilator-hrv-or-energy-enthalpy-recovery-ventilator-erv

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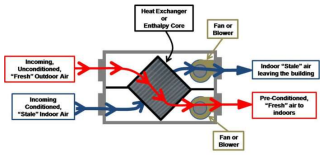
Energy Recovery Ventilator: What is it?

- ERVs provide balanced exhaust and supply ventilation with a core that transfers heat and moisture between air streams



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Source: https://basc.pnnl.gov/images/heat-recovery-ventilator-hrv-or-energy-enthalpy-recovery-ventilator-erv

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Balanced Pros/Cons

PROS

- A balanced system transfers heat which increases comfort and decreases the load on the HVAC system
- A balanced system maintains a neutral pressure difference which in turn reduces the strain on the building thermal envelope

CONS

- Highest installed cost option for whole-house mechanical ventilation
- Requires regular maintenance and filter changes

246

246

The Challenge

If exhaust-only ventilation strategies rely on fresh air entering the home through gaps and cracks in the enclosure, what happens when fewer gaps and cracks are available?

or

If exhaust-only ventilation is a common strategy but builders must tighten up enclosures per new codes, when does this strategy reach its limit?

247

247

Questions?

www.phrc.psu.edu

248

248

Adapting to Tighter Enclosures through Scopes of Work

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249

249

Adapting Stucco & Stone Assemblies to Changing Codes

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Description

With Pennsylvania's Uniform Construction Code (UCC) updating to the 2018 ICC codes in early 2022, one of the critical changes that building professionals will need to consider involves stucco and stone wall assemblies. During the UCC code adoption process, provisions impacting stucco and stone were adopted based on language out of the 2021 International Residential Code. This session will dive into the changes that will have a significant impact on the design and installation of exterior plaster assemblies.

251

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251

Learning Objectives

1. Review the code provisions adopted into the PA Uniform Construction Code that impact stucco and stone wall assemblies.
2. Discuss the impact of new lath installation provisions for exterior plaster assembly including fastener layout and spacing.
3. Examine the implications on building performance of new water-resistive barrier requirements that impact both stucco and stone assemblies.
4. Understand the new requirements for rainscreen gaps in stucco and stone wall assemblies, including associated material options, costs, and performance.

252

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Code Update Overview

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What is Changing?

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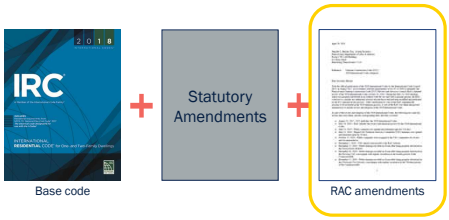
UCC Residential Code Summary



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Exterior Plaster - Stucco

Exterior Plaster Section will apply to hardcoat stucco and the adhered masonry veneer section (thin veneer stone, thin brick, etc.) will refer to parts of this as well.

256

256

Exterior Plaster Assemblies

- Exterior plaster provisions in the IRC were heavily modified in the 2021 version.
- These provisions were adopted by the UCC RAC to be included with the 2018 code adoption.

257

257

2021 IRC R703.7 Exterior Plaster (Stucco & Adhered Masonry Veneer)

- Installation of exterior plaster shall be in compliance with ASTM C926-2018B, ASTM C1063-2018B and the provisions of this code.

258

https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

258

ASTM C926-18B Coincides with 2021 IRC Exterior Plaster

- **Standard Specification for Application of Portland Cement Based Plaster**
- **1. Scope**
  - 1.1 This specification covers the requirements for the application of full thickness Portland cement-based plaster for exterior (stucco) and interior work.
  - 1.2 This specification sets forth tables for proportioning of various plaster mixes and plaster thickness.

259

Source: ASTM International. ASTM C926-18B Standard Specification for Application of Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

259

ASTM C1063-18B Coincides with 2021 IRC Exterior Plaster (including ASTM C1861 Lath Accessories)

- **Standard Specification for Installation of Lathing and Furring**
- **1. Scope**
  - 1.1 This specification covers the minimum requirements for lathing and furring for the application of exterior and interior Portland cement-based plaster as in Specification C 926 or Specification C 841.

260

Source: ASTM International. ASTM C1063-18B Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

260

Exterior Plaster: Hardcoat Stucco and Adhered Masonry Veneer


261

261

Exterior Plaster: Hardcoat Stucco and Adhered Masonry Veneer

- Stucco will follow the 2021 Exterior plaster section (703.7 Exterior plaster)

262

262

Exterior Plaster: Hardcoat Stucco and Adhered Masonry Veneer

- Adhered masonry veneer will follow the 2018 Section R703.12
- Adhered masonry veneer installation will refer to the 2021 Exterior Plaster section:
  - R703.7.1 which is installation of lath and all accessories
  - R703.7.3 water resistive barriers which will include a rainscreen drainage space

263

263

Building Science: Why Have There Been Moisture Failures?

Moisture Failures Appear First in Hygroscopic Claddings

264

265

266

Reservoir Cladding

- What is a reservoir cladding?
  - Materials that absorb moisture from the surrounding environment and have significant moisture storage capacity
  - Examples:
    - Brick veneer
    - Adhered manufactured stone masonry veneer
    - Hardcoat stucco
    - Wood

267

Mid to late 90's: Something Changed

- Construction in the mid- to late-1990s changed?
- Problems began to surface in 2004 in Pennsylvania

268

268

Changes in Construction (Mid to Late 90's)

- Tighter buildings – larger moisture difference between inside and outside
- More insulation – Less energy flow – Less drying
- More windows – Lots of glass
- Variety of materials on same wall
- Vinyl windows – Insulated glass
- Central air – Cooler on the inside (inward vapor drive)
- OSB instead of plywood
- Contractors only applying scratch & finish
- Furring strips not used anymore
- Synthetic Stucco? Less permeable?

269

269

Enhanced Drying Potential is Now Needed With a Rainscreen Gap

- Allows for Increased Drainage
- Allows a space for air to move. Creating more drying potential, called back ventilation.
- Allows for condensation to occur, and then drain and dry.
- Allows for the cladding and wall system to dry both ways to the rainscreen gap

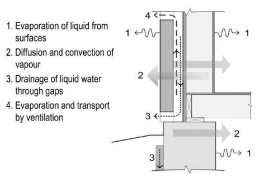

Figure 2: Wall System Drying Mechanisms (Straube & Burnett 2005)

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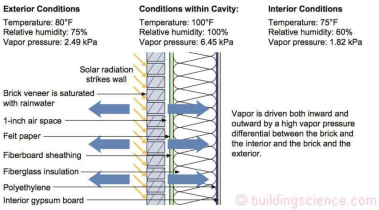
Masonry Construction Taught Us This



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2021 IRC R703.7.3 Water-Resistive Barriers

- Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall comply with Section R703.7.3.1 or R703.7.3.2.

*R703.2 = 2018 provisions

272 https://www.dll.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

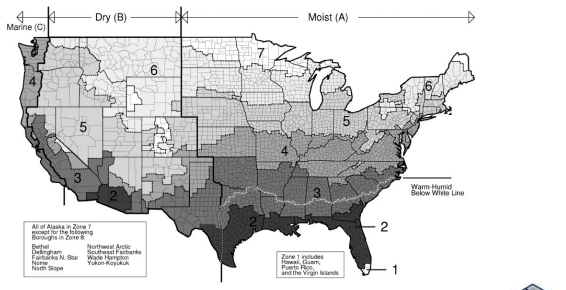
272

2018 IRC R703.2 Water-Resistive Barrier

- One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. No.15 asphalt felt shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). Other approved materials shall be installed in accordance with the water-resistive barrier manufacturer's installation instructions. The No. 15 asphalt felt or other approved water-resistive barrier material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

273 Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

273



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Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

274

2021 IRC R703.7.3.1 Dry Climates

- **In Dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:**
  1. The water-resistive barrier shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a water-resistive barrier complying with ASTM E2556-10, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier shall be directed between the layers.
  2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556-10, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water-absorbing layer, or a designed drainage space.

275

https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

275

2021 IRC R703.7.3.2 Moist or Marine Climates

- **In the Moist (A) or Marine (C) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:**
  1. In addition to complying with Section R703.7.3.1, a space or drainage material not less than 3/16 inch (5 mm) in depth shall be added to the exterior side of the water-resistive barrier.
  2. In addition to complying with Section R703.7.3.1, Item 2, drainage on the exterior of the water-resistive barrier shall have a drainage efficiency of not less than 90 percent, as measured in accordance with ASTM E2273-2018 or Annex A2 of ASTM E2925-17.

276

https://www.dli.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

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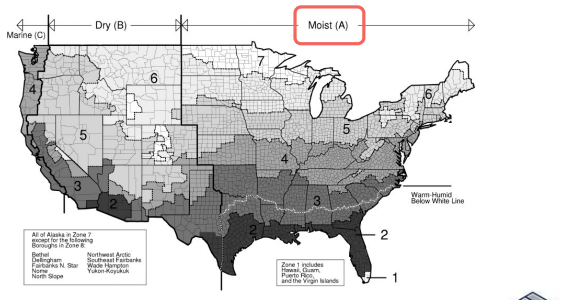

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Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

277

Grade D Building Paper is **NOT** ASTMD226 Felt and is Not #15, #30 or 15 LB or 30 LB Felt

- What is Grade D Building Paper?
  - It is an asphalt saturated kraft paper with a minimum water resistance of 10 minutes by ASTMD779 and has a vapor permeability rating of more than 5 perms.
- Felts do not meet code under exterior plaster "Stucco and Adhered Veneer"

278

278

One Layer Provided it Is Grade D 60 Minute Or meets ASTM2556 Type II, Then Place Rainscreen

279

279

What is a Rainscreen?

- A rainscreen is a *system* that provides an air space within a wall assembly to promote drainage and drying of that assembly
  - Accelerates the evaporation of undrained moisture behind exterior cladding
  - Helps to dry wall that accumulates moisture seasonally
- Common rainscreen products / systems
  - Furring strips
  - Three-dimensional mesh
  - A Rainscreen (Drainage Space is now required for exterior stucco and adhered veneer masonry)

280

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Types of Rainscreen Systems

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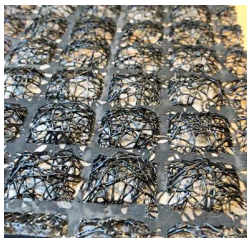
Types of Rainscreen Systems



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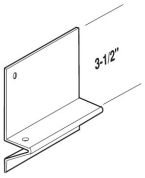
Install Code Approved Water Resistive Barrier With Correct Flashing Integration

283

283

Integrate Weep Screed With Water Resistive Barrier Over Vertical Leg

- Vertical leg must be minimum 3 ½"
- Terminates the wall
- Allows for a means of draining water from behind the drainage plane to the exterior. This is a flashing which must direct water to the exterior surface of cladding.
- Provides a capillary break for water that would wick up from the ground transported by masonry or stucco



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ASTM C1063-18B Accessories 7.11.4 Lathing Accessory Water Management Requirements:

- 7.11.4.1 Where a defined drainage space is provided over the water-resistive barrier under lath and cement plaster, the ground dimension of lathing accessories with solid attachment flanges installed behind the water resistive barrier and defined drainage space to facilitate drainage, such as weep screeds, designated drainage screeds, expansion joints and drainage flashings, shall accommodate the defined drainage space dimension and specified cement plaster thickness

Source: ASTM International. ASTM C1063-18B Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

285

ASTM C1063-18B Accessories
7.11.4 Lathing Accessory Water Management Requirements:

286

Source: ASTM International. ASTM C1063-18B Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

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286

ASTM C1063-18B Accessories
5.3.1 Lathing Accessories, Furring Accessories and Fasteners—Specification C1861

- Refers us to ASTMC1861-18 Standard Specifications for Lathing and Furring Accessories, and Fasteners, for interior and Exterior Portland Cement-Based Plaster.
- 3.2.3 drainage surface, n—the sloped or non-sloped, perforated or non-perforated surface element of a lathing accessory that facilitates a drainage function, by directing water from behind the stucco cladding to the exterior of the stucco cladding.

287

Source: ASTM International. ASTM C1063-18B Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

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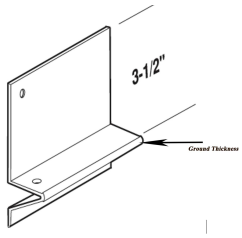
Weep Screed ASTM C1063-18B

- 7.11.4.1 Where a defined drainage space is provided "ground dimension of lathing accessories ", shall accommodate the defined drainage space dimension and specified cement plaster thickness
- This means for 7/8" Stucco we need a minimum 5 mm (use ¼" drainage space) and minimum 7/8" for our stucco. Total ground thickness minimum 1 1/8" ground thickness.
- For Adhered Veneer we need a minimum 5 mm (use ¼" drainage space) minimum ½" for scratch coat. Total ground thickness minimum ¾".



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Source: ASTM International. ASTM C1063-18B Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

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2021 IRC Section R703.7.2.1 Exterior Plaster Flashing at Foundation

- R703.7.2.l Weep screeds. A minimum 0.019-inch (0.5 mm) (No. 26 galvanized sheet gage), corrosion-resistant weep screed or plastic weep screed, with a minimum vertical attachment flange of 3 1/2 inches (89 mm), shall be provided at or below the foundation plate line on exterior stud walls in accordance with ASTM C926. The weep screed shall be placed not less than 4 inches (l 02 mm) above the earth or 2 inches (51 mm) above paved areas and shall be of a type that will allow trapped water to drain to the exterior of the building. The weather-resistant barrier shall lap the attachment flange. The exterior lath shall cover and terminate on the attachment flange of the weep screed.
- ASTMC1063 "Locate the bottom edge of the weep screed lathing accessory not less than 1 in (25mm) below the joint formed by the foundation and framing."

289

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

289

2018 IRC Section R703.7.2.1 Adhered Masonry Veneer Section Flashing at Foundation

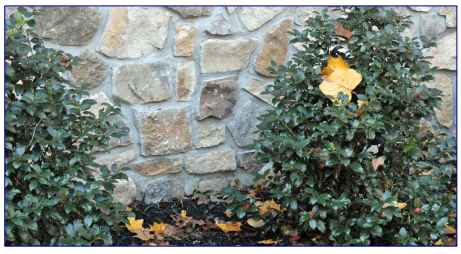
- R703.12.1 Clearances. On exterior stud walls, adhered masonry veneer shall be installed:
  - Minimum 4 inches (102mm) above the earth.
  - Minimum of 2 inches (51 mm) above paved areas: or
  - Minimum ½" (12.7mm) above exterior walking surfaces which are supported by the same foundation that supports the exterior wall.
- R703.12.2 Flashing at foundation. A corrosion-resistant screed or flashing of a minimum 0.019-inch (0.48mm) or 26-gage galvanized or plastic with a minimum vertical attachment flange of 3 ½ inches (89mm) shall be installed to extend a minimum of 1 inch (25mm) below the foundation plate line on exterior stud walls in accordance with Section R703.4.

290

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

290

Weep Screed Not Used



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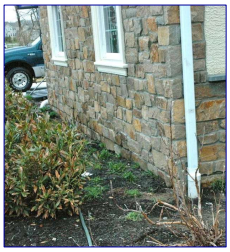
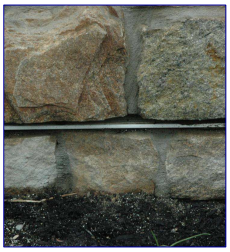
Weep Screed Installed Properly





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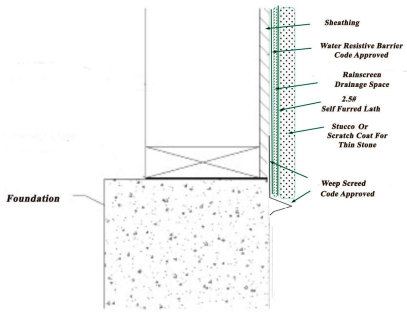

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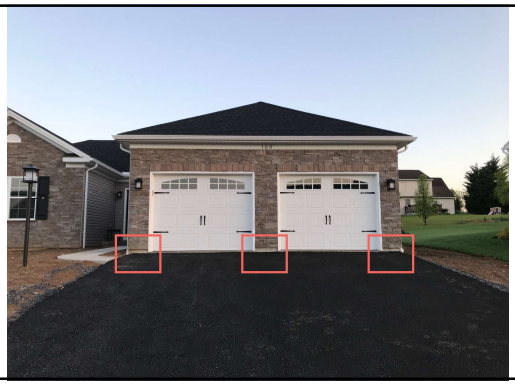

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Install Rainscreen Drainage Gap Over Water Resistive Barrier

297

297

Install Lath Over Rainscreen Drainage Gap

298

298

Expansion Gap Between All Dissimilar Substrates

- ASTMC1063 7.11.7 Casing Bead—Install a casing bead lathing accessory or other suitable means, at locations to separate cement plaster from dissimilar materials, penetrating elements, load bearing members and to avoid transfer of structural loads.
- ASTMC926 7.3.4 Separation shall be provided where plaster abuts dissimilar construction materials or openings. (See A2.1.3.)
- ASTMC926 A2.1.3 Sealing or caulking of V-grooves, exposed ends, and edges of plaster panels or exterior work to prevent entry of water shall be provided. "Good Practices to caulk the Joint"

Source: ASTM International. ASTM C926-18B Standard Specification for Application of Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

Source: ASTM International. ASTM C1063-18B Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

299

Casing Bead Installation

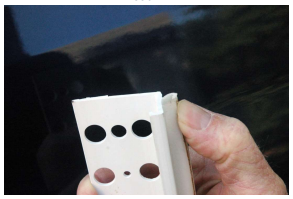
Casing Bead Installed

Backer Rod Inserted

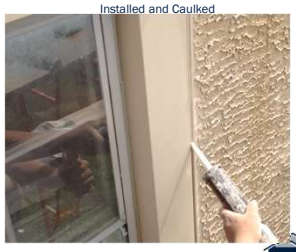
300

Casing Bead Installation

Casing With Expansion Flange Ready to Caulk



Installed and Caulked



301

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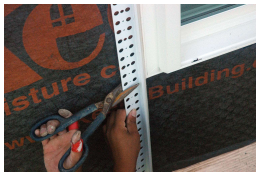
Casing Bead Installation All Penetrations

Casing With Expansion Flange Ready to Caulk

Casing Bead On Top Of Rainscreen



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Casing Bead Installation All Penetrations

Under Sill of Penetration

Up Opposite Side of Penetration

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Casing Bead Installation All Penetrations

Integrate Under Drip Cap of Window

Installed

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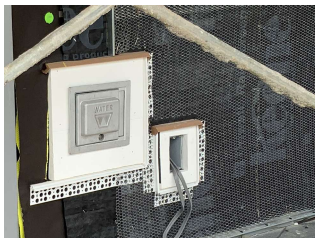
Casing Bead Installation All Penetrations



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Casing Bead Installation All Dissimilar Materials

Install To Trim and Soffit

Installed To Trim Under Soffit

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2021 IRC R703.7.1 Lath

- Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063-2018B. Expanded metal, welded wire, or woven wire lath shall be attached to wood framing members or furring. Where the exterior plaster is serving as wall bracing in accordance with Table R602.10.4, the lath shall be attached directly to framing. The lath shall be attached with 1-1/2-inch-long (38 mm), 11-gage nails having a 7/16 -inch (11.1 mm) head, or 7/8 -inch-long (22.2 mm), 16-gage staples, spaced not more than 7 inches (178 mm) on center along framing members or furring and not more than 24 inches (610 mm) on center between framing members or furring, or as otherwise approved. Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C1063-2018B. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Section R703.15, R703.16 or R703.17. Where lath is attached to furring installed over foam sheathing, the furring connections shall be in accordance with Section R703.15, R703.16 or R703.17.

307 https://www.dll.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

307

ASTM C1063-18B

- Staples and nails shall penetrate wood framing not less than ¾".
- Screws used to attach metal plaster base to metal framing members shall project not less than 3⁄8 in. (10 mm) through the metal framing member
- A1.1 All wood-based sheathing shall be installed with a 1⁄8-in. (3 mm) minimum gap around all panel edges and between openings for doors and windows. NOTE A1.1—This 1⁄8-in. (3 mm) gap is intended to accommodate expansion. Linear expansion that is not accommodated by an expansion gap can cause stress on the stucco membrane resulting in stucco cracks

308 *Source: ASTM International. ASTM C1063-18B Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.*

308

2021 IRC R703.7.1 Lath

- Fastening pattern is to be minimum every 7" vertically on the framing members. Which is a change from 2015 code.
- "Fastening between wood framing members shall not be prohibited"
- The code has recognized it is difficult not to fasten between framing members by accident. Good practice is to reduce amount of fastener holes by trying to avoid fastening between framing members.

309 https://www.dll.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

309

More Requirements For Lath

- **ASTMC926 7.3.3 Portland cement-based plaster shall be applied on furred metal plaster base when the surface of solid backing consists of gypsum board, gypsum plaster, wood, or rigid foam board-type products. " Not Flat" " Also called dimpled lath and self furred SF"**
- ASTMC1063 Shall be 2.5 Lb lath on she**athed framed walls 16" and 24" on center.**
- Must meet **C847 Specification for metal lath** "minimum width of lath 27" and minimum length is 97" "**weight 2.5 LB or 3.4 LB Plus or minus 10%. Galvanized metal lath shall have a G60 coating** in accordance with specification A653/A653M

Source: ASTM International. ASTM C926-18B Standard Specification for Application of Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

Source: ASTM International. ASTM C1063-18B Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster. West Conshohocken, PA: ASTM International, 2018.

310

310

Make Sure it is the Correct Lath!

311

311

2021 IRC R703.7.1 Lath

- Exception: Lath is not required over masonry, cast-in-place concrete, precast concrete or stone substrates prepared in accordance with ASTM C1063-2018B.

- **703.7.1.1 Furring.** Where provided, furring shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm), minimum 3/4-inch (19 mm) metal channels, or self-furring lath, and shall be installed in accordance with ASTM C1063-2018B. Furring shall be spaced not greater than 24 inches (600 mm) on center and, where installed over wood or cold-formed steel framing, shall be fastened into framing members.

https://www.dll.pe.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

312

312

2021 IRC R703.7.2 Plaster (for Stucco)

- Plastering with cement plaster shall be in accordance with ASTM C926-2018B. Cement materials shall be in accordance with one of the following:
  1. Masonry cement conforming to ASTM C91-2018A, Type M, S or N.
  2. Portland cement conforming to ASTM C150-2018, Type I, II or III.
  3. Blended hydraulic cement conforming to ASTM C595-2018, Type IP, IS (< 70), IL, or IT (S < 70).
  4. Hydraulic cement conforming to ASTM C1157-11, Type GU, HE, MS, HS or MH.
  5. Plastic (stucco) cement conforming to ASTM C1328-12.
- Plaster shall be not less than three coats where applied over metal lath or wire lath and shall be not less than two coats where applied over masonry, concrete, pressure preservative-treated wood or decay-resistant wood as specified in Section R317.1 or gypsum backing. If the plaster surface is completely covered by veneer or other facing material or is completely concealed, plaster application need be only two coats, provided the total thickness is as set forth in Table R702.1(1).
- On wood-frame construction with an on-grade floor slab system, exterior plaster shall be applied to cover, but not extend below, lath, paper and screed.
- The proportion of aggregate to cementitious materials shall be as set forth in Table R702.1(3).

313

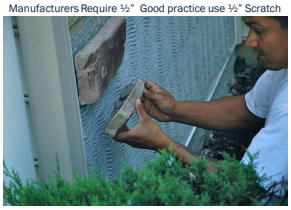
https://www.dll.pa.gov/ucc/Documents/ICC-Code-Review-2018-Final-Report.pdf

313

Stucco 3 Coat
Adhered Masonry Veneer 1 Scratch Coat

3/8" Scratch, 3/8" Brown, 1/8" Finish 7/8" Nominal

3/8" Minimum Scratch Coat per 3.3C of TMS 602 Most Manufacturers Require ½" Good practice use ½" Scratch



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2018 IRC Section R703.12
Adhered Masonry Veneer Installation

- Adhered masonry veneer shall comply with the requirements of Section R703.7.3 [exterior plaster – water-resistive barriers] and the requirements of Sections 12.1 and 12.3 of TMS 402.
- Adhered masonry veneer shall be installed in accordance with Section R703.7.1 [exterior plaster – lath], Article 3.3C of TMS 602 or the *manufacturer's instructions*.

315

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

315

Building code requirements for masonry structures TMS402 /602-16

- 12.3.2.1 Unit sizes- Adhered veneer units shall not exceed 2 5/8 in (66.7 mm) in specified thickness, 36 in. (914 mm) in any face dimension, nor more than 5 ft sq. (0.46 msq) in total face area, and shall not weigh more than 15 psf (75 kg/msq)
- 12.3.2.2 Wall area limitations – The height, length, and area of adhered veneer shall not be limited
- 12.3.2.3 Backing- Backing shall provide a continuous, moisture-resistant surface to receive the adhered veneer. Backing is permitted to be masonry, concrete , or metal lath and Portland cement plaster applied to masonry, concrete, steel framing , or wood framing.
- 12.3.2.4 Adhesion developed between adhered veneer units and backing shall have a shear strength of at least 50 psi (345 kPa) based on gross unit surface area when tested in

316 Source: The Masonry Society (2016). Building Code Requirements and Specification for Masonry Structures, Longmont, CO.

316

Building code requirements for masonry structures TMS402 /602-16

- 3.3 C. Placing adhered veneer
- 1 Brush a paste of neat Portland cement on the backing and on the back of the veneer unit.
- 2 Apply Type S mortar to the backing and to the veneer unit.
- 3 Tap the veneer unit into place, completely filling the space between the veneer unit and the backing. Sufficient mortar shall be used to create a slight excess to be forced out between the edges of the veneer units. The resulting thickness of the mortar in back of the veneer unit shall not be less than 3/8 in (9.5 mm) nor more than 1 ¼ in . (31.8 mm).
- 4 Tool the mortar joint with a round jointer when the mortar is thumbprint hard.

317 Source: The Masonry Society (2016). Building Code Requirements and Specification for Masonry Structures, Longmont, CO.

317

Adhered Masonry: What does "Manufacturer's Instructions" Mean?

- *R703.12 Adhered Masonry Veneer*. Adhered Masonry Veneer-Shall be installed in accordance with section703.7.1, article 3.3C of TMS602 or the with manufacturers instructions.
- *Definition in the IRC 2018 Code*
  - **Adhered Stone or Masonry Veneer.** Stone or masonry veneer secured and supported through the adhesion of an approved bonding material applied to an approved backing.

Source: International Code Council (ICC). (2017). 2018 International Residential Code, Country Club Hill, Ill.

318

Adhered Masonry Veneer

Approved Bonding Material

Approved Backing

319

319

Adhered Veneer Manufacturers Recommendations

- Manufacturers may ask you to do more than is required in the codes discussed.
- One common addition is that they may require a polymer modified mortar to be used to increase adhesion.
- Some products may only be for use interior.
- Always check their recommendations.

320

Questions?

www.phrc.psu.edu

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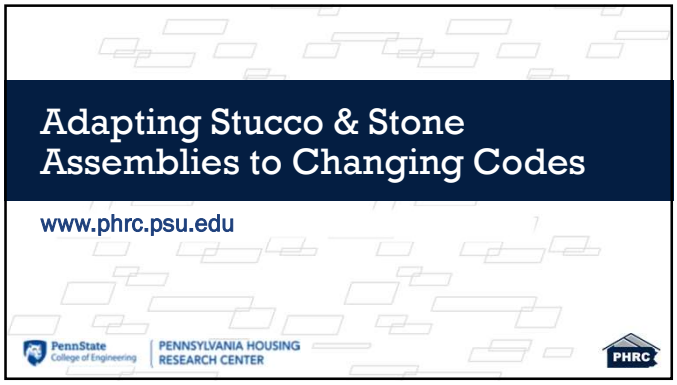
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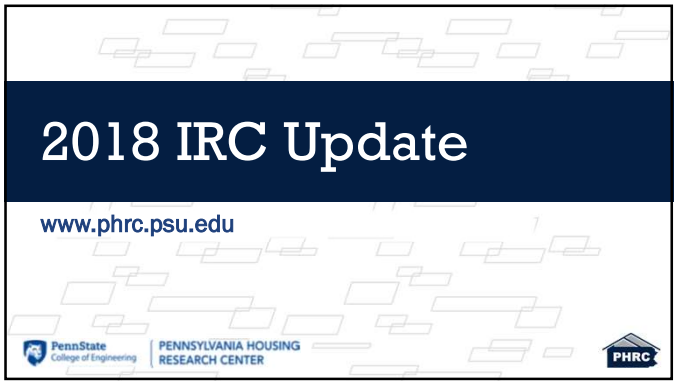
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323