

2021 IECC for Existing Residential Buildings

9/26/2023



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Providing effective energy strategies for buildings and communities



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Presenters:

Robert Schlorff



Shawn Maurer



Learning Objectives

By the end of the presentation, participants will be able to:

1. Navigate the layout of Chapter 5 of the IECC for Residential Buildings.
2. Define the scope and applicability of the energy code as it applies to existing residential buildings.
3. Explain the differences in code requirements for Additions, Alterations, Repairs, and Historic Residential Buildings.
4. Apply real world examples to better understand the requirements of Chapter 5 for residential projects.

Who We Are



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Our mission: Reduce the energy footprint of Illinois and beyond



What We Do

We are an applied research program at the University of Illinois.

We assist buildings and communities in achieving energy efficiency, saving money, and becoming more sustainable.

We help facilities become more energy efficient.

We educate.

We research.

We advocate for a greener future.



SEDAC is the Illinois Energy Conservation Code Training Provider



This training program is sponsored by **Illinois EPA Office of Energy**

SEDAC is a Preferred Education Provider with the International Code Council (ICC). Credits earned on completion of this program will be reported to ICC for ICC members. Certificates of Completion will be issued to all participants.



This workshop is approved for 1 LU/HSW CES credits from the American Institute of Architects (AIA). Credits earned on completion will be reported for AIA members.



Energy Code Assistance

Technical support

- energycode@sedac.org
- 800.214.7954

Online resources at

smartenergy.illinois.edu/energy-code

- Workshops
- Webinars
- Online on-demand training modules



SEDAC Energy Code Training Series

Energy Code Webinar Schedule

08.22.23 – ARCHIVED – Energy Code Basics

09.26.23 – TODAY! – Existing Residential Buildings

11.14.23 – Residential Stretch Code

12.12.23 – Q&A Review – How We Answer Energy Code Questions

02.20.24 – Commercial Stretch Code

04.09.24 – Simplified Code Compliance

05.21.24 – Existing Commercial Buildings

06.11.24 – Q&A Review – How We Answer Energy Code Questions

Registration: <https://smartenergy.illinois.edu/events>

SEDAC Energy Code In-person Workshops

10.24.23 – Workshop 1

Energy Code Basics, Simplifying Code Compliance & Q&A Review

– Location: Springfield, IL

03.19.24 – Workshop 2

Energy Code Basics, Simplifying Code Compliance & Q&A Review

– Location: TBD

Registration: <https://smartenergy.illinois.edu/events>

Illinois Energy Conservation Code

Updated Illinois Energy Conservation Code (2021 IECC with IL Amendments) is expected to be effective in the Fall of 2023.

Current amendments are in 2nd round of public comment and expected to be approved.

We will continue to update our site with the latest information.



Access to 2021 IECC & IL Amendments

IL Amendments DRAFT:
CDB May 2023 Board Book
pp 026-069

**CHAPTER 1 [CE]
SCOPE AND ADMINISTRATION**

**SECTION C101
SCOPE AND GENERAL REQUIREMENTS**

C101.1 Title. This code shall be known as the *International Energy Conservation Code of [NAME OF JURISDICTION]* and shall be cited as such: *Illinois Energy Conservation Code* or "this Code" and shall mean:

With respect to the State facilities covered by 71 Ill. Adm. Code 600.Subpart B:

This Part, all additional requirements incorporated within Subpart B (including the 2018 International Energy Conservation Code, including all published errata but excluding published supplements that encompass ASHRAE 90.1-2016), and any statutorily authorized adaptations to the incorporated standards adopted by CDB are effective July 1, 2019.

With respect to the privately funded commercial facilities covered by 71 Ill. Adm. Code 600.Subpart C:

This Part, all additional requirements incorporated within Subpart C (including the 2018 International Energy Conservation Code, including all published errata and excluding published supplements that encompass ASHRAE 90.1-2016), and any statutorily authorized adaptations to the incorporated standards adopted by CDB are effective July 1, 2019.

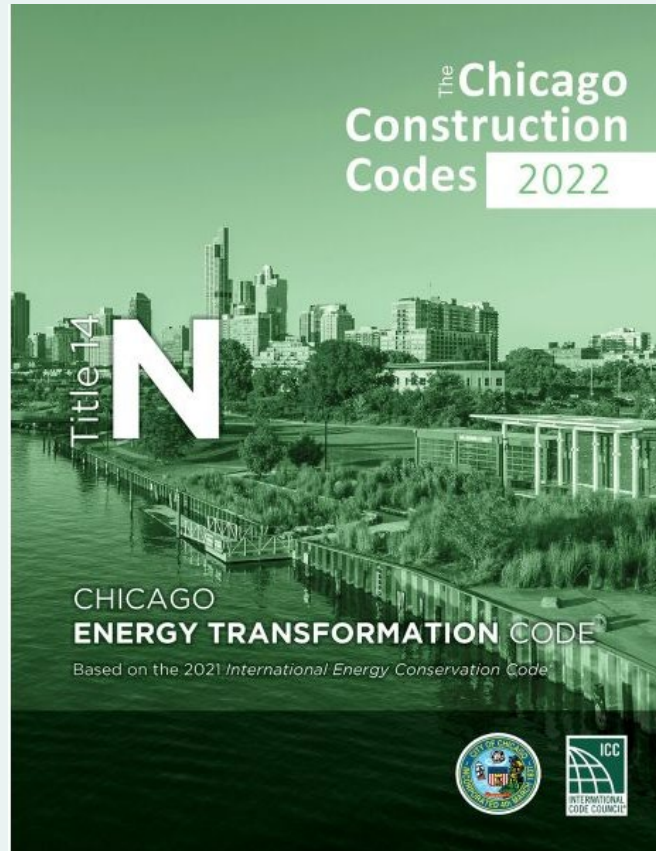
C101.1.3 Adaptation. The Board may appropriately adapt the International Energy Conservation Code to apply to the particular economy, population, distribution, geography and climate of the State and construction within the State, consistent with the public policy objectives of the EEB Act.

C101.5 Compliance. Residential buildings shall meet the provisions of IECC—Residential Provisions. Commercial buildings shall meet the provisions of IECC Commercial Provisions—the *Illinois Energy Conservation Code* covered by 71 Ill. Adm. Code 600.Subpart C. The local authority having jurisdiction (AHJ) shall establish its own procedures for enforcement of the Illinois Energy Conservation Code. Minimum compliance shall be demonstrated by submission of:

1. Compliance forms published in the ASHRAE 90.1 User's Manual; or
2. Compliance Certificates generated by the U.S. Department of Energy's COMcheck™ Code compliance tool; or
3. Other comparable compliance materials that meet or exceed, as determined by the AHJ, the compliance forms published in the ASHRAE 90.1 User's Manual or the U.S. Department of Energy's COMcheck™ Code compliance tool; or
4. The seal of the architect/engineer as required by Section 14 of the Illinois Architectural Practice Act [225 ILCS 305], Section 12 of the Structural

<https://codes.iccsafe.org/content/IECC2021P2>

Access to Chicago Energy Transformation Code



<https://codes.iccsafe.org/codes/illinois/Chicago>

ARTICLE XIII. **CHICAGO ENERGY CONSERVATION CODE**

SECTION 1. The Municipal Code of Chicago is hereby amended by inserting a new Title 14N, as follows:

TITLE 14N ENERGY CONSERVATION CODE

PART I – COMMERCIAL PROVISIONS

CHAPTER 14N-C1 SCOPE AND PURPOSE

14N-C1-C001 Adoption of the commercial provisions of the International Energy Conservation Code by reference.

The commercial provisions of the *International Energy Conservation Code*, 2018 edition, second printing, and all erratum thereto identified by the publisher (hereinafter referred to as "IECC-CE"), except Appendix CA, are adopted by reference and shall be considered part of the requirements of this title except as modified by the specific provisions of this title.

If a conflict exists between a provision modified by this title and a provision adopted without modification, the modified provision shall control.

14N-C1-C002 Citations.

Provisions of IECC-CE which are incorporated into this title by reference may be cited as follows:

14N-C[IECC-CE chapter number]-[IECC-CE section number]

14N-C1-C003 Global modifications.

The following modifications shall apply to each provision of IECC-CE incorporated into this title:

1. Replace each occurrence of "*International Codes*" with "*Chicago Construction Codes*."
2. Replace each occurrence of "*International Building Code*" with "*Chicago Building Code*."
3. Replace each occurrence of "ASME A17.1" or "ASME A17.1/CSA B44" with "the *Chicago Conveyance Device Code*."
4. Replace each occurrence of "NFPA 70" with "the *Chicago Electrical Code*."

2021 IECC Arrangement

Chapters	Subjects
1-2	Administration and definitions
3	Climate zones and general materials requirements
4	Energy efficiency requirements
5	Existing buildings requirements
6	Referenced standards



Poll #1

How comfortable are you with applying the energy code to existing buildings?

- I just apply the energy code as if it is a new building.
- I think I can manage, but regularly have questions about compliance.
- I'm fairly confident in applying the code to existing buildings.
- No problem, bring on the renovation projects!

How much of your work is Existing Buildings

- Less than $\frac{1}{4}$
- $\frac{1}{4}$ to less than $\frac{1}{2}$
- $\frac{1}{2}$ to less than $\frac{3}{4}$
- $\frac{3}{4}$ or more

2021 IECC R501

General

2021 IECC Section R501 General

- **R501.1** Scope
- **R501.2** Compliance with IECC
- **R501.3** Maintenance
- **R501.4** Compliance with Other Codes
- **R501.5** New & Replacement Materials
- **R501.6** Historic Buildings

R501.1 Scope

The provisions of this chapter shall control the *alteration, repair, addition, and change of occupancy* of the existing buildings and structures.



Addition



Alteration



Repair



Change of Occupancy

Each of these types of existing building work have specific compliance requirements covered by Chapter 5.

R501.2 Compliance

R501.2 details when existing buildings must comply with Chapter 5 of the code.

- Each type of existing building work has specific levels of compliance that must be met

R502 – Additions	Strict Compliance
R503 – Alterations	Moderate Compliance
R504 - Repairs	Limited Compliance
R505 – Change of use/occupancy	Strict Compliance

- Relocation is mentioned but does not have a specific compliance section
 - Applies addition and alteration together to account for relocation.



Image Source:

<https://interestingengineering.com/culture/here-is-how-engineers-move-buildings> moving the Harriet Rees house in Chicago, IL

R501.3 Maintenance

- Buildings should be maintained in a safe and sanitary condition
- Building components required by the IECC shall be maintained at IECC edition under which they were installed, **i.e. performance can't be reduced.**
- Requirements in Chapter 5 shall not provide a basis for removal or abrogation of existing energy conservation or life-safety systems
- Maintenance does not require maintained system to be brought up to current code
 - Patching, painting, or resurfacing
 - Component replacements in equipment
 - Lighting repairs



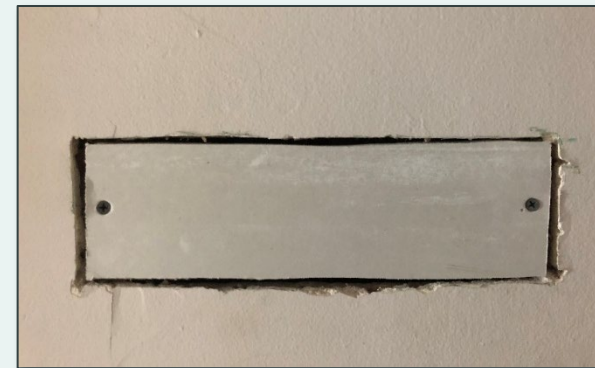
Image source:

<https://www.energy.gov/energysaver/maintaining-your-air-conditioner>

R503 Alteration vs R504 Repair

When is new work considered an alteration vs. a repair?
Is there a % of area/equipment requirement?

- 2021 IECC Definition of “repair”: The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.
- Specific items that may require permit identified in Section R504
- If permit not required, compliance not triggered. Generally, non-permit work considered maintenance or repair.
- Alterations often change performance of existing buildings; e.g. new wall sheathing material, change in insulation levels, or changing the type of HVAC system.



Drywall patching (above) is a repair that does not trigger energy code compliance, where adding roof insulation (below) might.



R501.5 New and replacement materials

- Materials permitted by the applicable code for new construction should be used.
- Like materials shall be permitted for repairs, provided hazards to life, health, or property are not created.
- Hazardous materials shall not be used where the code for new construction would not allow their use in buildings of similar occupancy, purpose and location.



Lead Paint



Asbestos pipe insulation

Asbestos abatement resources: <https://dph.illinois.gov/topics-services/environmental-health-protection/asbestos.html>

Lead abatement resources:

<https://dph.illinois.gov/content/dam/soi/en/web/idph/files/publications/get-theleadout-homeowner-lead-based-paint-abatement-guide-042016.pdf>

Historic Buildings

Historic Building: Any building or structure that is one or more of the following:

1. Listed or certified as eligible for listing by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places.
2. Designated as historic under an applicable state or local law.
3. Certified as a contributing resource within a National Register-listed, state-designated or locally designated historic district.



R501.6 Historic Buildings

Buildings or portions of buildings that are designated as historically significant are exempt from the provisions of the energy code if it modifies the form, fabric, or function of the building or building component.

One of the following must submit report to code official:

- Owner
- Registered Design Professional
- Representative of State Historic Preservation Office
- Representative of Historic Preservation AHJ



Image Source:

https://en.wikipedia.org/wiki/Alexander_Briggs_House

Addition to historic building

- An addition must be built to existing code.

Additions do not receive historic building exemptions!

- Historic portion of building can be preserved in existing condition.



Image Source: <https://wedc.org/blog/building-additions-in-historic-commercial-districts/>

Poll #2

Which of the following projects would be exempt from updating to current efficiency requirements of the energy code per the existing buildings provisions?

1. Rear addition to a home in a historic district
2. Conditioning a previously unfinished basement
3. Replacing the domestic water heater in a home
4. Repairing the boiler in a townhome complex

2021 IECC R502 Additions

Requirements for Additions

- **Addition** is “an extension or increase in the **conditioned space** floor area, number of stories or height of a building or structure.”
- Additions to an existing building, building system or portion thereof shall conform to the code as it relates to new construction **without** requiring the **unaltered portion** of the existing building or building system to comply.
- Additions should not create an unsafe condition or overload existing building systems.
- Additions can comply with the code alone or include the existing building’s performance.
- Additions converting unconditioned to conditioned space need to comply with R502.2, other additions typically comply with R502.3

Change in Space Conditioning

- Any nonconditioned space that is altered to become conditioned space shall be required to be brought into full compliance with the code and is also covered by the “Additions” section of Chapter 5.

Examples:

- Converting an unconditioned garage to conditioned garage or living space
- Converting an attic to a finished attic space

- Assemblies modified as part of the addition shall comply with the R503 Alterations portion of the code
- Untouched portions of the existing building are not required to be updated to current code

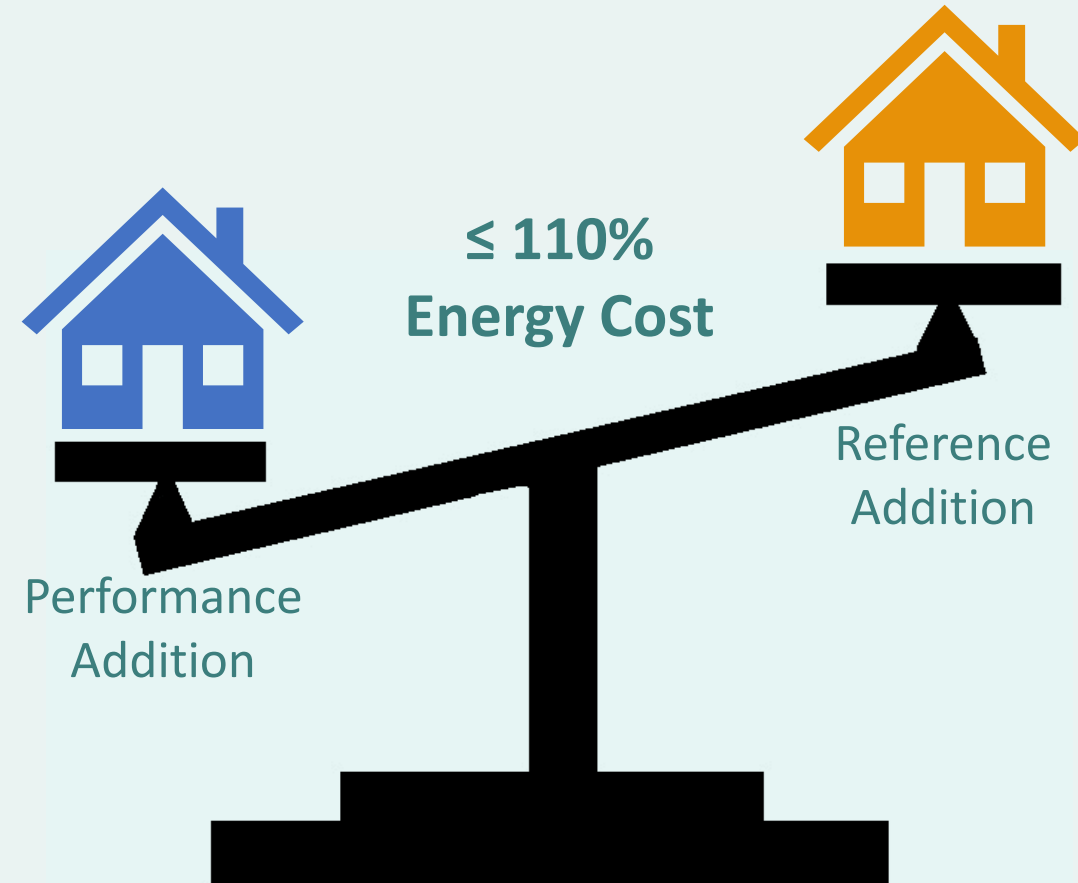


Diagram showing an addition to the right side of the residence.

Exceptions to Full Compliance

Performance path for new construction requires proposed design to have less energy cost than a reference design.

- Exception 1: When using performance path compliance for the **addition alone**, the addition is allowed 110% of the annual energy cost determined by Section R405.2.
 - This allows a 10% additional spending on energy than the projected energy costs for a single building (existing building + addition) to account for connecting the addition to the existing building



Full Compliance Exception #2

For new construction, prescriptive compliance can be obtained if the proposed building insulation and area factor (UA) is less than or equal to prescriptive values.

- Exception 2: If the **addition plus existing building's** Total UA per R402.1.5 is less than the existing building total UA before the addition, the addition is compliant as the overall building performance is improved.
 - Requires alterations to the existing building to improve existing UA along with addition, which may trigger additional compliance with R503.



$$UA_{\text{Exist}} + UA_{\text{Add}}$$



$$< UA_{\text{Exist}}$$

Full Compliance Exception #3

- Exception 3: When using the performance path, if the **addition plus existing building** energy cost budget is less than the existing building before the addition, the addition is compliant, as the overall building performance is improved.
 - Again, requires alteration to the existing building to compensate for added energy consumption of the addition.



⚡\$_{Exist} + ⚡\$_{Add}



< ⚡\$_{Exist}

Section R502 - Additions

Additions considered alone must meet the prescriptive requirements for:

- **Building envelope performance**
 - Additions are exempt from air leakage testing but must still perform air sealing work detailed in R402.4.1
- **Heating and cooling systems**
 - Ducts extended from an existing system are exempt
 - Must ensure existing system is not overloaded by serving the addition
- **Service hot water systems**
 - New systems must comply, extensions of existing systems must be insulated according to code.
- **Lighting**



Image source: www.basc.pnnl.gov

Building Envelope

New building envelope assemblies that are part of the addition shall comply with the following sections

- **R402.1** – Thermal envelope requirements & exceptions for low-energy buildings (<1W/sf space conditioning), unconditioned spaces, and log homes.
- **R402.2** – Prescriptive requirements for specific assemblies (walls, foundations, roofs, floors, etc..)
- **R402.3.1 through R402.3.5** – Fenestration requirements
- **R402.4** – Air sealing requirements

Note: Additions are exempt from leakage testing in R402.4.1.2 *Per R502.3.1.*

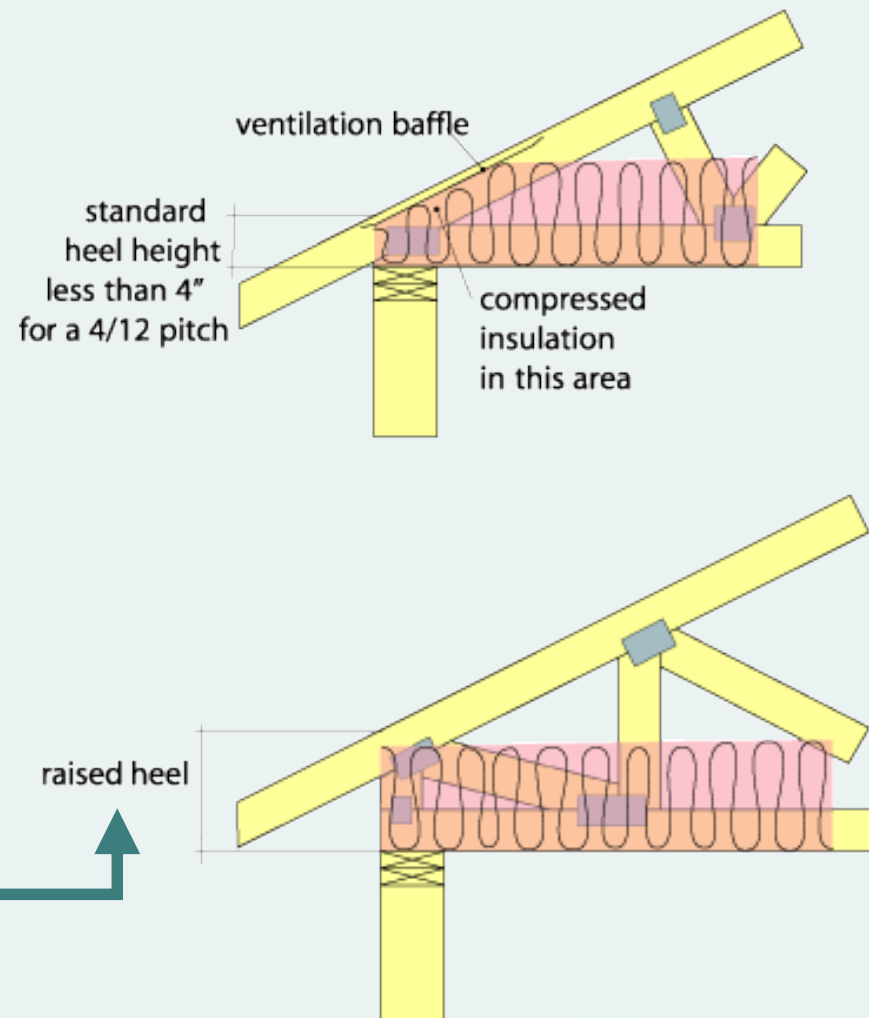


Image source: www.greenbuildingadvisor.com

Special Chapter 4 Applications

Section R402.2 – Opaque Assemblies

- R402.2.1 allows R-38 instead of R-49 (CZ4) and R-49 instead of R-60 (CZ5) roof insulation if 100% of ceiling or attic area is uncompressed, full depth insulation extends over the wall top plate.
- Easy way to minimize insulation costs with raised-heel trusses



Clarifying Chapter 4 Compliance (cont.)

Section R402.3 - Fenestration

- Area-weighted U-factor can be used
- For >50% glazed products, area-weighted SHGC can be used
- If the addition is a sunroom or heated garage that remains thermally isolated from the house, reduced insulation values can be used for compliance.
 - R-19 (CZ4) or R-24 (CZ5) for ceilings and R-13 for walls.

Note: Reduced insulation does not apply to detached heated *and cooled* garages.



Image source:

<https://www.energy.gov/energysaver/passive-solar-homes>

Section R402 compliance

Section R402.4:

- Envelope must be air sealed per this section
 - Seal around air barrier penetrations
 - Seal seams between materials and assembly joints
 - Seal around windows
- Existing building additions are exempt from air leakage testing requirements



Image source: www.energy.gov courtesy Flickr user [Alyson Hurt](#)

Heating & Cooling Systems

R502.4 - HVAC ducts newly installed as part of an addition shall comply with section R403

- Exception: Where ducts from an existing heating and cooling system are extended to an addition
- Any other mechanical components of addition must meet applicable R403 requirements, event though not specified in R502.4 (this is covered in R502.1)
- System sizing, efficiency, ventilation, controls, etc...



Image source: www.energy.gov

Service Hot Water Systems

New service hot water system that are part of the addition shall comply with Section R403.5

Section R403.5 Compliance:

- If circulation is employed, must have demand-based flow controls
- If heat trace used to maintain hot water temperature, must meet UL515 or IEEE 515.1
- Pipes must be insulated to at least R-3



Image source: www.energy.gov

Lighting

New lighting systems that are part of the addition shall comply with Section R404.1

Section R404.1 compliance:

- All permanent interior and exterior Luminaires (fixtures) must be ≥ 45 lumens per watt and Lamps (light source) ≥ 65 lumens per watt
- Permanent exterior lighting shall have dimming and daylight responsive controls per C405.4
 - Exception: for single-family and townhouse homes and lighting that is solar-powered or controlled by motion sensors



Image source: www.energy.gov

Poll #3

A contractor is working on a 720sf detached garage conversion to a heated and cooled space using a 1.25 ton heat pump (20.8 Btu/sf). Select all the following that apply to this project.

1. Insulation is exempt as space is a low-energy building.
2. Air leakage testing is exempt as this is an existing building conversion.
3. Ducts for the HVAC system do not need to be insulated or tested for air sealing.
4. A performance model of the garage can perform 10% worse than the garage modeled to meet the current energy code.

R503 Alterations

Definition of Alteration

- **Alteration** is “any construction, retrofit or renovation to an existing structure other than repair or addition. Also, a change in a building, electrical, gas, mechanical or plumbing system that involves an extension, addition or change to the arrangement, type or purpose of the original installation.”
- Alterations shall be such that only manipulated parts of the building need be brought into compliance with the code, provided existing unaltered structures and systems maintain their existing level of conformance with the code (cannot be made worse)

Building Envelope

- Envelope alterations need to comply with all sections of R402 except for air leakage testing. Specific requirements that refer to the whole building have been excluded from compliance as well, since alterations usually only impact parts of buildings.
- However, there are some exceptions for full compliance for alterations...



Image source:

<https://passivetopositive.wordpress.com/projects/weinberg-commons/>

Alterations Excepted from Compliance

Exceptions

1. Storm windows installed over existing fenestration
2. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation
3. Construction where the existing roof, wall or floor cavity is not exposed



Image source: www.energy.gov



Image source:
www.greenbuildingadvisor.com

Alterations Excepted from Compliance

Exceptions

4. Roof recover (adding a new covering over an existing covering)
5. Roofs without cavity insulation and with sheathing or insulation exposed during alteration shall have insulation added above or below the sheathing.
6. Surface-applied window films
7. For roofing without cavity insulation that has sheathing or insulation exposed during re-roofing, insulation shall be added above or below the sheathing.



Image source: www.millershomeimprovement.com



Image source: www.energy.gov

Heating & Cooling Systems

- HVAC ducts **newly installed** as part of an alteration must comply with Section R403
- Includes all subsections of R403.
 - Insulation
 - Installation and air sealing
 - Leakage testing
- Exception: Where ducts from an existing heating and cooling system are **extended** to an addition



Image source: www.basc.pnnl.gov

Service Hot Water Systems

Service water-heating systems and equipment that are altered must comply with Section R403.5 to meet the energy code.

- Includes all subsections of R403.5.
 - Circulation system controls (if installed)
 - Pipe insulation



Image source: www.energy.gov

Lighting Systems

Alterations to lighting systems shall comply with section R404.1

- Permanent lighting must be high-efficacy
- Exception: Alterations that replace <10% of the luminaires in a space, provided the alterations do not increase the installed interior lighting power



Image source: www.energy.gov

Poll #4

A contractor is replacing a low-slope condo roof with new decking and membrane. The insulation is below the roof deck in the framing cavities. What does the owner need to do to comply with the energy code?

1. Install above deck continuous insulation that results in a combined U-factor of U-0.024. (Approx. R-41.7)
2. Ensure the cavities are filled with blown-in insulation and that is enough.
3. Fill the cavities and fur out the interior to ensure full R-60 insulation.
4. Just replace the decking and membrane with no added insulation.

R504 Repairs

Definition of Repair

Repair is “The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.”

The following are defined as repairs that may be confused with alterations, so code calls them out:

- Glass-only replacements in an existing sash and frame
- Roof repairs
- Repairs where only the bulb, the ballast, or both within the existing luminaires are replaced, provided that the replacement does not increase the installed interior lighting power



R505
Change of
Occupancy or Use

Definition of Change of Occupancy or Use

- Any space that is converted to a dwelling unit or portion thereof from another use or occupancy shall comply with this code.
 - Converting a garage into dwelling space
 - Converting unconditioned basement into living space
- Converting space to commercial, see C505



Image source:

<https://www.greenbuildingadvisor.com/article/carmic-house-taming-a-basement-from-hell>

General

- Spaces that undergo a change in occupancy that increases the demand for fossil fuel or electricity shall be brought up to the code.
 - Any unconditioned space that is altered to become a conditioned space shall comply with section R502.
- When using simulated performance option in Section R405, if the total energy cost is <110% of the cost permitted by Section R405.2, the change in occupancy is compliant with the performance path.



Image source: www.energy.gov

Poll #5



Would the work required for this situation fall under the provisions for a repair, or alteration (see slide photo)?

1. Repair Provisions
2. Alteration Provisions

Questions?

energycode@illinois.edu

800-214-7954