

2021 IECC: Code Basics, Simplifying Code Compliance & Submitted Questions Answered

10.17.2023



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Providing effective energy strategies for buildings and communities



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Presenters:

Shawn Maurer



Ryan Siegel



Learning Objectives

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

1. Navigate the layout of the 2021 IECC
2. Communicate the scope and applicability of the energy code
3. Apply energy code requirements to real world example scenarios
4. Describe some of the common design decisions that can lead to added expense and complexity

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 State Energy Office**

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



Energy Code Training Program

- Technical support

energycode@illinois.edu

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

Archived – Energy Code Basics: How to Use the IECC

Archived – 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

TODAY – 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



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Home > Energy Code Training > Illinois Energy Conservation Code

Click [here](#) for the 2022 Chicago Energy Transformation Code.

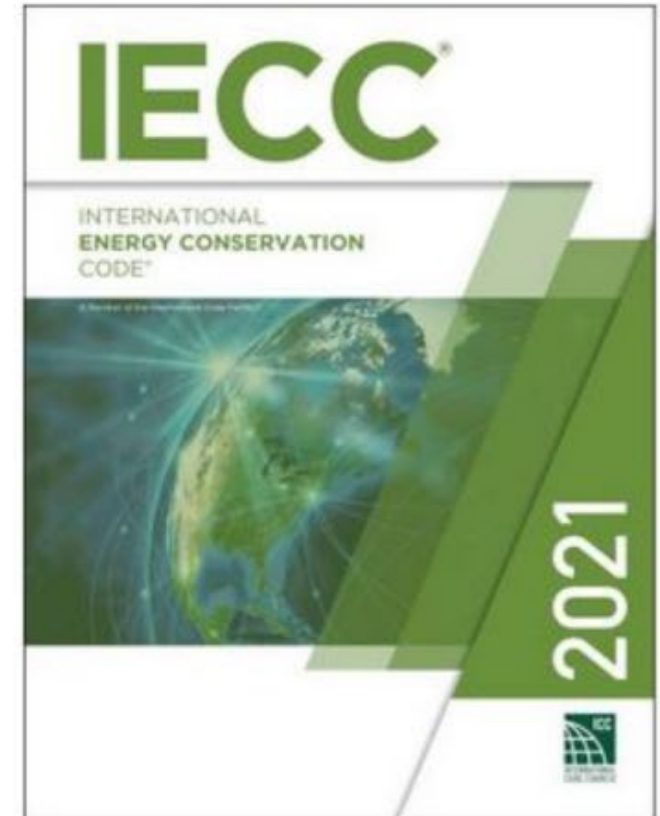
Updated Illinois Energy Conservation Code (2021 IECC with IL Amendments) is expected to be effective in 2023

The updated Illinois Energy Conservation Code, based on the 2021 IECC with Illinois Amendments, is expected to become effective in **2023** (tentative).

The separate documents can be accessed here:

- [2021 IECC](#)
- Illinois Amendments are not yet available

Coming SOON



Access to 2021 IECC & IL Amendments

Menu Search all of Digital Codes

All Codes <

Legend Information

CODE SECTIONS MY NOTES

2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

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PREFACE

ARRANGEMENT AND FORMAT OF THE 2021 IECC

ABBREVIATIONS AND NOTATIONS

IECC—COMMERCIAL PROVISIONS

CHAPTER 1 [CE] SCOPE AND ADMINISTRATION

CHAPTER 2 [CE] DEFINITIONS

CHAPTER 3 [CE] GENERAL REQUIREMENTS

CHAPTER 4 [CE] COMMERCIAL ENERGY EFFICIENCY

IECC
INTERNATIONAL ENERGY CONSERVATION CODE
2021

2021 International (IECC)
Add to Favorites

The 2021 IECC® addresses energy efficiency on several resources and the impact of energy usage on the environment.

Related Titles

2021 Complete Revision History to the 2021 I-Codes - IECC: Successful Changes and Public Comments

2021 Significant Changes to the International Energy Conservation Code

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

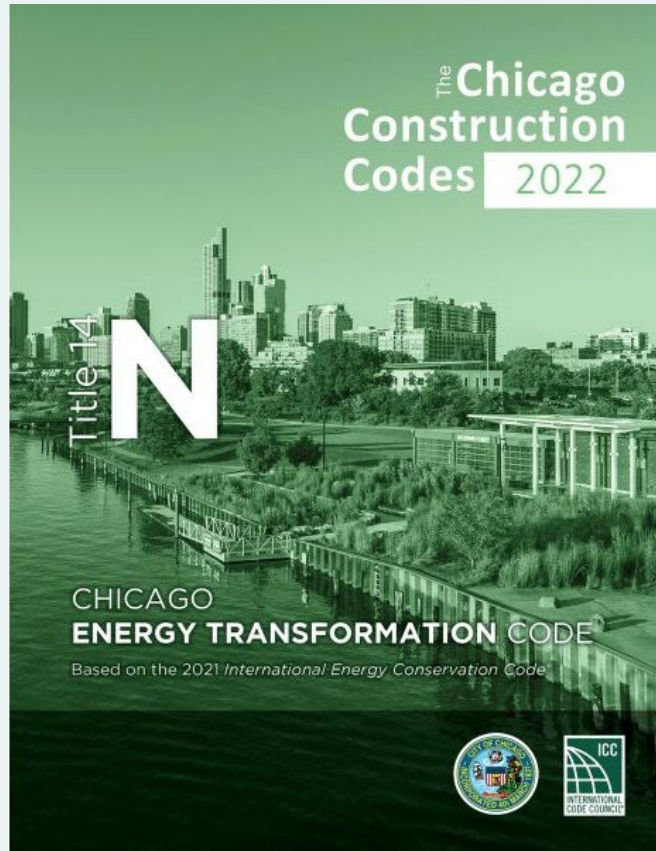
C101.1.3 Adaptation. The Board may appropriately adapt the International Energy Conservation Code to apply to the particular economy, population, distribution, geography and climate of the State and construction within the State, consistent with the public policy objectives of the EEB Act.

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*."

IECC

Navigation & Language

Navigating the IECC

2021 IECC

Chapter 1: Scope And Administration

Chapter 2: Definitions

Chapter 3: General Requirements

Chapter 4: Commercial/Residential Energy Efficiency

Chapter 5: Existing Buildings

Chapter 6: Referenced Standards

Appendices

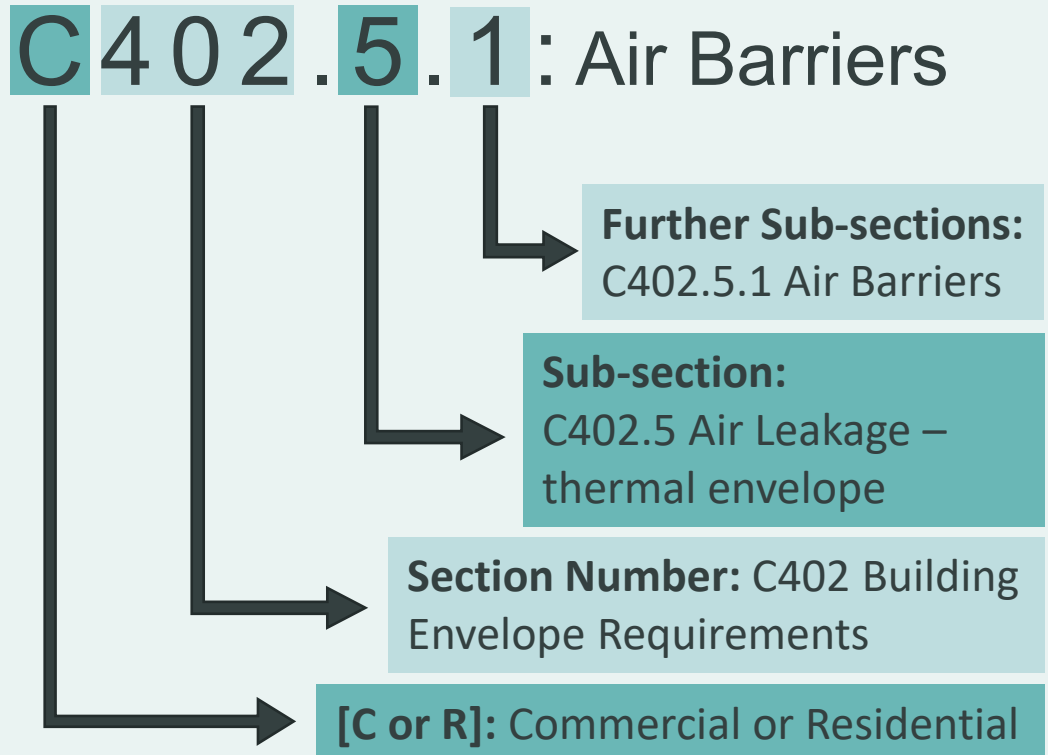
CA/RA: Board of Appeals

CB/RB: Solar-Ready Provisions

CC/RC: Zero Energy Building Provisions

Navigating the IECC

Code Section Numbers



C402.5 Air leakage—thermal envelope. **P**

The *building thermal envelope* shall comply with Sections C402.5.1 through Section C402.5.11.1, or compliance is based on such testing, the building shall also comply with Sections C402.5.7, C402.5.

Premium Code Insights :



Code Change Details



Hearing Videos



Key Changes

C402.5.1 Air barriers. **P**

A continuous air barrier shall be provided throughout the *building thermal envelope*. The *continuous assemblies composing the building thermal envelope*, or any combination thereof. The air barrier

Exception: Air barriers are not required in buildings located in *Climate Zone 2B*.

Premium Code Insights :



Code Change Details



Hearing Videos

C402.5.1.1 Air barrier construction.

The *continuous air barrier* shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope
2. Air barrier joints and seams shall be sealed, including sealing transitions in places as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner that is recommended by the manufacturer. Joints and seams associated with penetrations shall be sealed in a manner that is recommended by the manufacturer. Joints and seams shall be in a manner that is recommended by the manufacturer. Ceilings.
4. Recessed lighting fixtures shall comply with Section C402.5.10. Where similar objects

C402.5.1.2 Air barrier compliance. **P**

A continuous air barrier for the opaque building envelope shall comply with the following:

Language of the IECC

- Throughout the code, ‘**shall**’ is an important term to look for.

C101.1 Title.

This code **shall** be known as the *Energy Conservation Code* of [NAME OF JURISDICTION], and **shall** be cited as such. It is referred to herein as “this code.”

- Throughout the code, ‘**may**’ is an important term to look for.

C406.2.5 More than 10-percent cooling efficiency improvement.

Where equipment exceeds the minimum annual cooling and heat rejection efficiency requirements by more than 10 percent, energy efficiency credits for cooling **may** be determined using Equation 4-12, rounded to the nearest whole number. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER and IPLV.

$$EEC_{HEC} = EEC_{10} [1 + ((CEI - 10 \text{ percent}) \div 10 \text{ percent})]$$

(Equation 4-12)

where:

EEC_{HEC} = Energy efficiency credits for cooling efficiency improvement.

EEC_{10} = Section C406.2.4 credits from Tables C406.1(1) through C406.1(5).

CEI = The lesser of: the improvement above minimum cooling and heat rejection efficiency requirements or 15 percent.

- Definitions are only located in Chapter 2. They are not included within provision language.

Language of the IECC

- Definitions may be in different locations than anticipated

BELOW-GRADE WALL. See “Wall, below-grade.”

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, peripheral edges of floors, roof knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

WALL, BELOW-GRADE. A wall associated with the basement or first story of the building that is part of the *building thermal envelope*, is not less than 85 percent below grade and is on the exterior of the building.

Language of the IECC

- Be aware, the code does not use oxford commas.

C401.3 Thermal envelope certificate.

A permanent thermal envelope certificate shall be completed by an *approved* party. Such certificate shall be posted on a wall in the space where the space conditioning equipment is located, a utility room or other *approved* location. If located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. A copy of the certificate shall also be included in the construction files for the project. The certificate shall include the following:

1. *R*-values of insulation installed in or on ceilings, roofs, walls, foundations and slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*.
2. *U*-factors and *solar heat gain coefficients* (SHGC) of fenestrations.
3. Results from any *building* envelope air leakage testing performed on the *building*.

Where there is more than one value for any component of the building envelope, the certificate shall indicate the area-weighted average value where available. If the area-weighted average is not available, the certificate shall list each value that applies to 10 percent or more of the total component area.

- Pay attention to ‘**through**’ and ‘**or**’ in reference to required sections.

C503.2 Building envelope.

New building envelope assemblies that are part of the *alteration* shall comply with Sections C402.1 through C402.5.

Exception: Where the existing building exceeds the fenestration area limitations of Section C402.4.1 prior to alteration, the building is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.

C503.2.1 Roof replacement.

Roof replacements shall comply with Section C402.1.3, C402.1.4, C402.1.5 or C407 where the existing roof assembly is part of the *building thermal envelope* and contains insulation *entirely above the roof deck*. In no case shall the *R*-value of the roof insulation be reduced or the *U*-factor of the roof assembly be increased as part of the *roof replacement*.

Chapter 1 – Scope and Administration

C/R101.2 Scope of the Energy Code

The energy code applies to **buildings** and the **buildings' sites** and associated systems and equipment.

- Includes detached garages, parking structures, permanently installed lighting and equipment, and support facilities on the **building site**
- **Building site** is the continuous property attributed to a single entity that owns the building on that site.

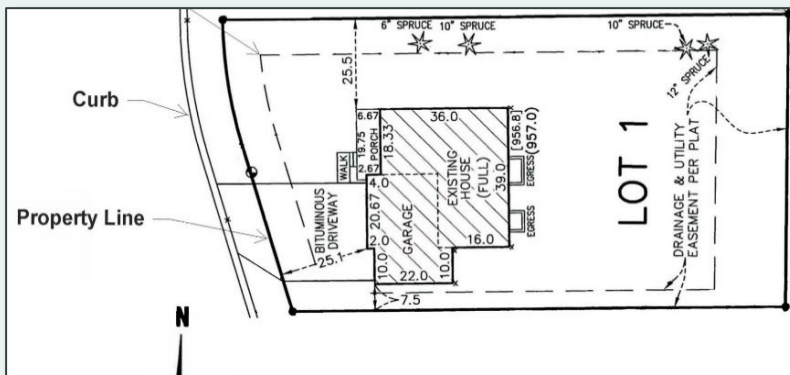


Image source: www.cityofsavage.com/government/departments-divisions/planning-and-zoning/property-information



C/R101.3 Intent of the Energy Code

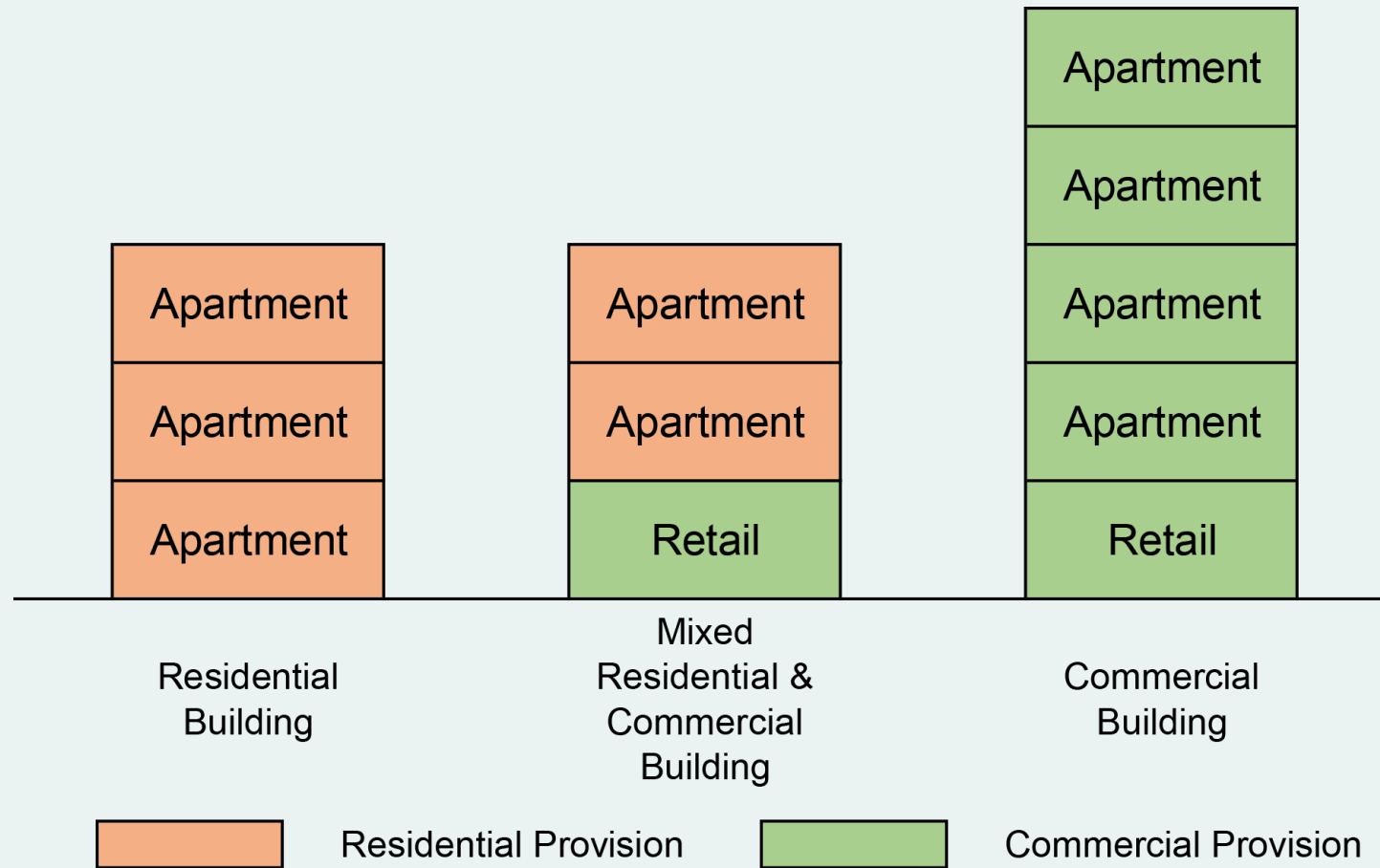
- Regulates design and construction of buildings for effective use of energy over the useful life of the building.
- Intended to be flexible to allow for innovative designs.
- Shall not abridge ***safety, health, or environmental*** requirements of other codes or local ordinances.



The energy code often calls out exceptions for ***health & safety*** within prescriptive measures.

C/R101.5 Commercial & Residential

The IECC is split between these two classifications and has specific requirements for each



For *mixed buildings*, the **commercial** provisions apply to the **commercial portion**, the **residential** provisions apply to the **residential portion**

C/R103 Compliance Process

Must submit initial **Construction Documents** to **Code Official** for review

Construction Documents

Must
Include

- ✓ Compliance Path
- ✓ Insulation materials and R-values
- ✓ Fenestration specifications (U-factor and SHGC)
- ✓ Mechanical system design criteria
- ✓ Equipment types, capacities, and efficiencies
- ✓ Economizer description
- ✓ Equipment & system controls
- ✓ Fan HP and controls
- ✓ Duct location, sealing and insulation
- ✓ Lighting fixture schedule and daylight zones
- ✓ Air barrier details and location
- ✓ Thermal envelope depiction

C/R103 Compliance Process

Construction Documents:

- ✓ Lighting fixture schedule and daylight zones

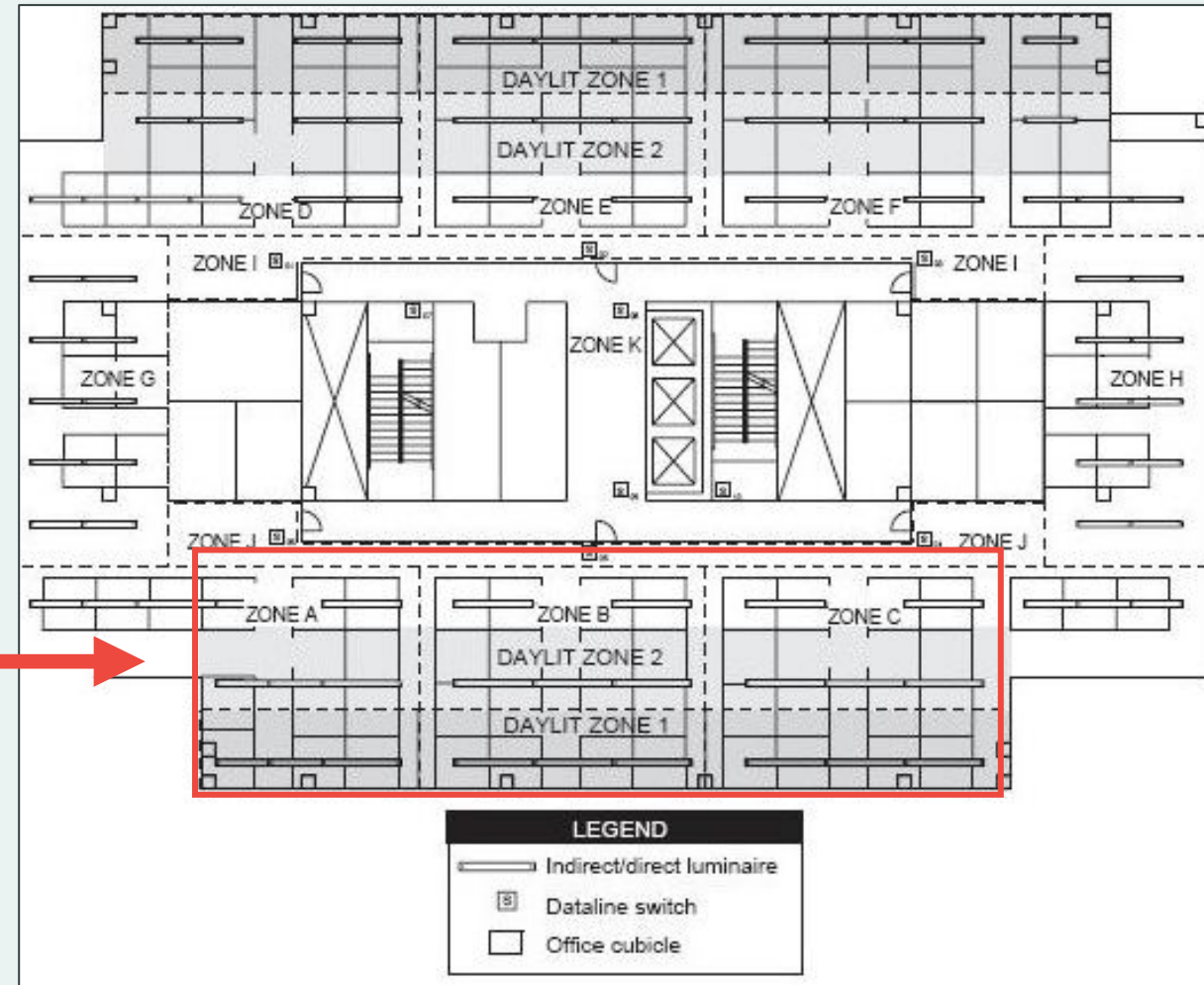


Image source:
<http://aboutlightingcontrols.org/EducationExpress/courses/e105-lighting-control-system-design-part-3-control-zoning/page/0/15>

C/R105 Inspections

The following inspections must be completed by the *Code Official*, his or her designated agent, or an *approved agency*:

- ✓ **Footing and foundation insulation**
- ✓ **Thermal envelope installation**
- ✓ **Plumbing systems**
- ✓ **Mechanical systems**
- ✓ **Electrical/lighting systems**
- ✓ **Final inspection**

Often, plumbing, mechanical and electrical can be completed in one inspection.

Note: Some controls for HVAC may be checked at final inspection. However, this ***is not*** the same as System Commissioning.



Image source: www.energy.gov/eere/buildings/articles/energy-codes-101-what-are-they-and-what-does-role

Chapter 2 – Definitions

C/R200 Key Building Type Definitions

Group R – Buildings or portions of buildings that contain any of the following occupancies as established in the International Building Code:

- *Group R-1*
- *Group R-2 or Group R-4* where located more than three stories in height above grade plane

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

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

C/R200 Key Space Definitions

Building – any structure used or intended for supporting or sheltering *any* use or occupancy, including mechanical, service water, and power systems on the building site and supporting the building.

Conditioned Space – Area, room, or space within a building thermal envelope and directly or indirectly heated or cooled.

Greenhouse – Structure or thermally isolated area...that maintains a specialized sunlit environment exclusively used for cultivation, protection, or maintenance of plants erected for a period of *at least 180 days*.

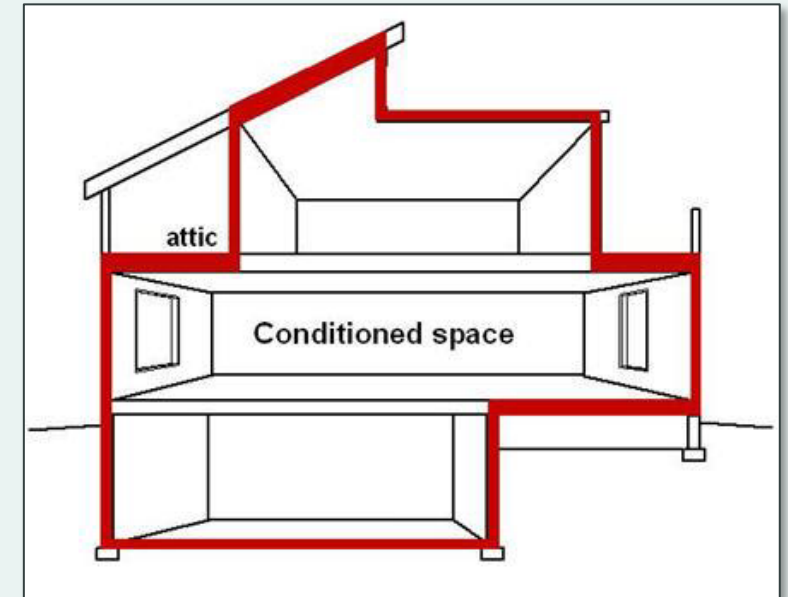


Image source: <https://www.bpihomeowner.org/blog/bpi-phrase-month-building-envelope>

C/R200 Dwelling or Sleeping Unit?

Dwelling Unit – Single unit providing complete independent living facilities for 1 or more occupants, including permanent living, sleeping, eating, cooking, and sanitation.

Sleeping Unit – Room or space in which occupants sleep that can include permanent provisions for living, eating, and either sanitation or kitchen facilities, but not both. *(These spaces in dwelling units are NOT considered sleeping units.)*

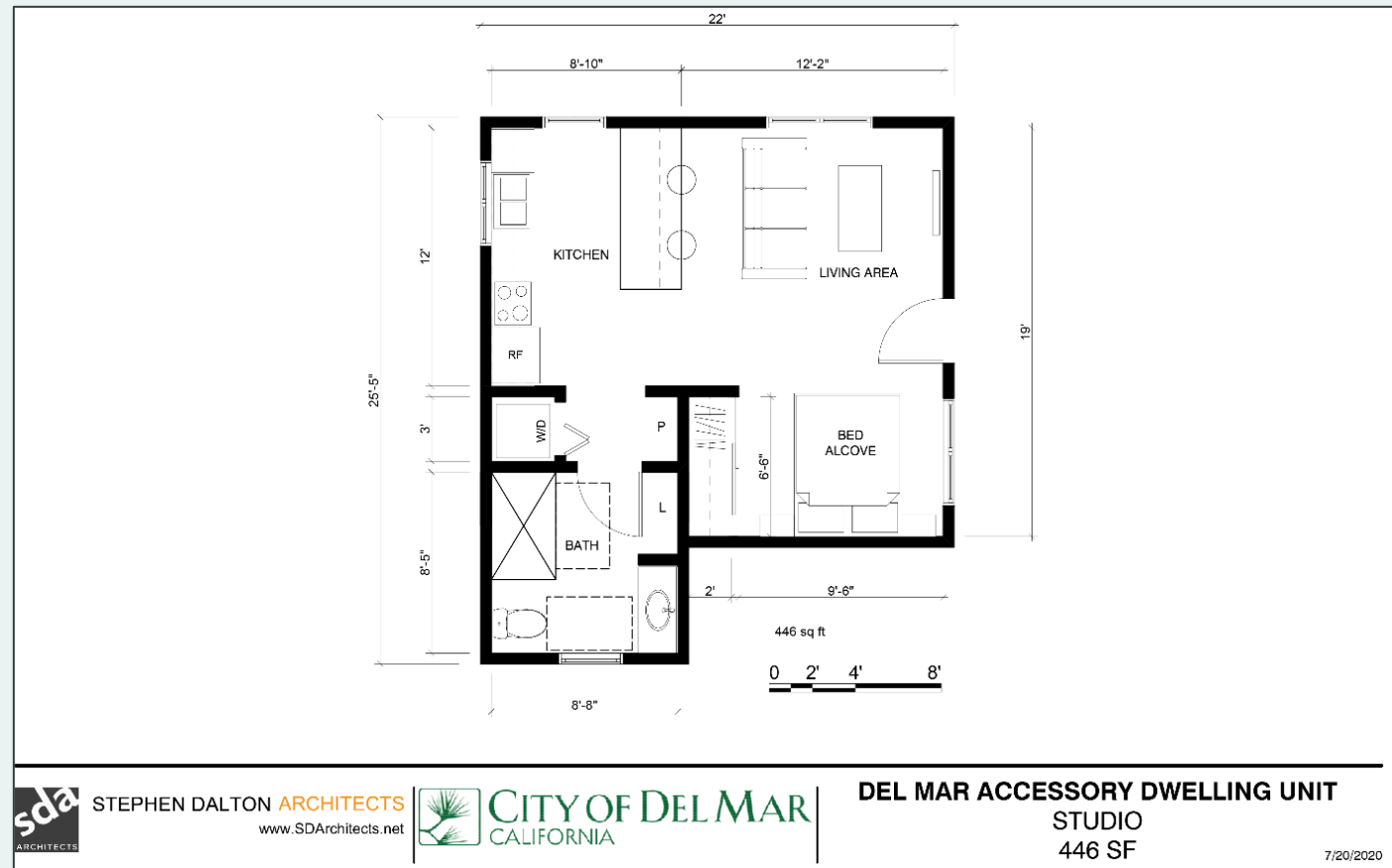


Image source: <https://www.delmar.ca.us/815/ADU-Sample-Floor-Plans>

C/R200 Key Assembly Definitions

Wall, Above-Grade – Exterior wall that is more than 15% above grade on the exterior of the building including peripheral edges of floors (rim joist) between-floor spandrels, knee walls, dormer walls, gable ends, walls enclosing a mansard roof, and skylight shafts. *(50% for residential)*

Wall, Below-Grade – An exterior basement or 1st story wall that is 85% or more below grade. *(50% for residential)*

Low-Sloped Roof – Roof having slope of less than 2 vertical units per 12 horizontal units.

Vertical Fenestration – Fixed or operable glazed openings or glass block oriented more than 60° from horizontal.

Skylight – Glazed opening installed at a slope less than 60° from horizontal.

C/R200 Key Fenestration Definitions

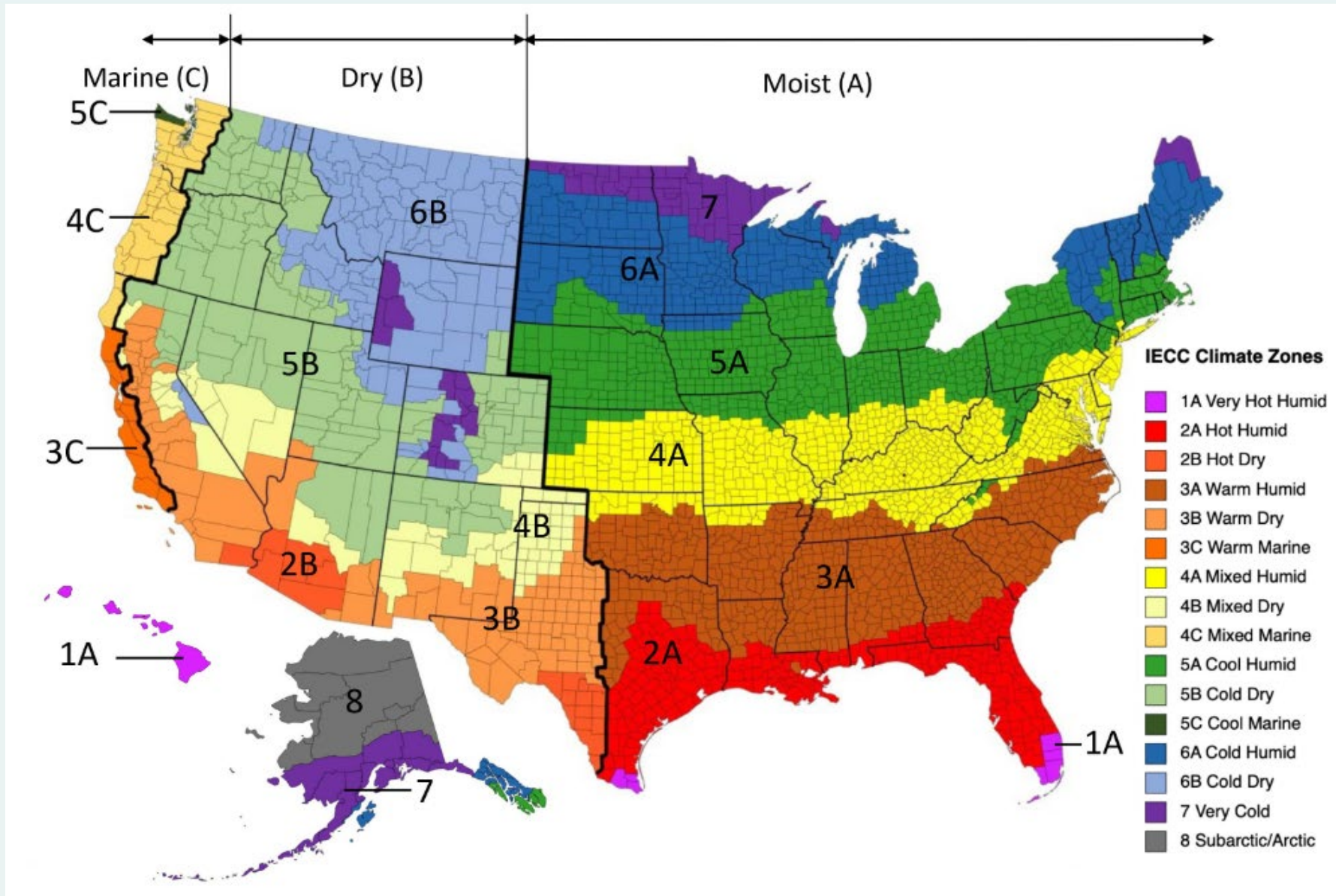
U-factor (Thermal Transmittance)– The coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate or heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/h x ft² x °F) [W/(m² x K)].

Solar Heat Gain Coefficient (SHGC)– The ratio of the solar heat gain entering the space through the fenestration assembly to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation that is then reradiated, conducted or convected into the space.

Visible Transmittance (VT)– The ratio of visible light entering the space through the fenestration product assembly to the incident visible light. Visible transmittance includes the effects of glazing material and frame and is expressed as a number between 0 and 1.

Chapter 3 – General Requirements

C/R301 Climate Zones



Climate Zone designations are also found in **Table C/R301.1** Listed by state and county

C/R302 Design Conditions

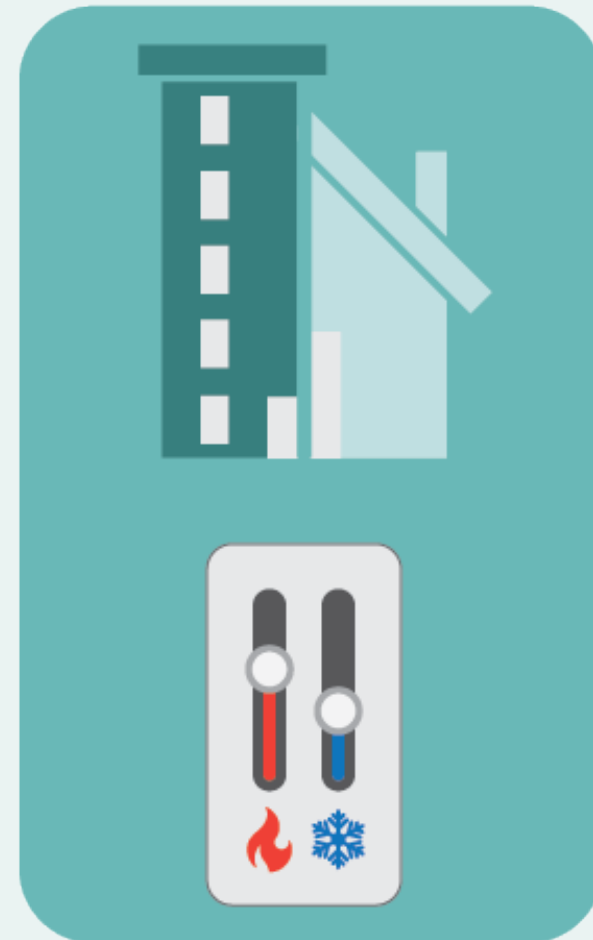
C/R302.1 Interior Design Conditions:

Assumed default values to be used for heating and cooling load calculations in the absence of other information.

- **Maximum 72 °F for heating**
- **Minimum 75 °F for cooling**

Important factor for setting up models and when following the Performance Paths or Energy Rating Index (ERI) path for residential

- *Alternative interior design conditions may be allowed with sufficient justification.*



C/R303 Thermal Envelope Product Identification

C/R303.1: Sets identification requirements for insulation

- Must have visible label on insulation product, or certificate of R-value included in documentation.
- Blown attic insulation must have markers placed every 300sf, oriented to attic access, indicating insulation depth.
- Labels & markers must be readily visible during inspections.
- Fenestration products must have NFRC 100 label or certification. Garage doors can also be certified by ANSI/DASMA 105.
- Insulated siding shall be determined by ASTM C1363.



Image source:

<https://www.greenbuildingadvisor.com/article/does-poorly-installed-insulation-decrease-r-value>

C/R303 Default Fenestration Values

C/R303.1.3: Default fenestration & door U-factors and SHGC for glazing that does not have an NFRC 100 label or certification

- Heavily penalizes fenestration, so make sure to have NFRC rating!

TABLE C303.1.3(1)

DEFAULT GLAZED WINDOW, GLASS DOOR AND SKYLIGHT U-FACTORS

| FRAME TYPE | WINDOW AND GLASS DOOR | | SKYLIGHT | |
|--------------------------|-----------------------|--------|----------|--------|
| | Single | Double | Single | Double |
| Metal | 1.20 | 0.80 | 2.00 | 1.30 |
| Metal with Thermal Break | 1.10 | 0.65 | 1.90 | 1.10 |
| Nonmetal or Metal Clad | 0.95 | 0.55 | 1.75 | 1.05 |
| Glazed Block | 0.60 | | | |

TABLE C303.1.3(2) DEFAULT OPAQUE DOOR U-FACTORS

| DOOR TYPE | OPAQUE U-FACTOR |
|--|-----------------|
| Uninsulated Metal | 1.20 |
| Insulated Metal (Rolling) | 0.90 |
| Insulated Metal (Other) | 0.60 |
| Wood | 0.50 |
| Insulated, nonmetal edge, max 45% glazing, any glazing double pane | 0.35 |

TABLE C303.1.3(3) DEFAULT GLAZED FENESTRATION SHGC AND VT

| | SINGLE GLAZED | | DOUBLE GLAZED | | GLAZED BLOCK |
|------|---------------|--------|---------------|--------|--------------|
| | Clear | Tinted | Clear | Tinted | |
| SHGC | 0.8 | 0.7 | 0.7 | 0.6 | 0.6 |
| VT | 0.6 | 0.3 | 0.6 | 0.3 | 0.6 |

Note: See Chapter 6 for Referenced standards like NFRC 100

C303 Installation Requirements

C303.2: Details specific installation practices for certain materials

1. Foundation insulation must be protected by a rigid, opaque, and weather-resistant covering. The covering shall extend at least 6" below finished grade.
2. For insulation board installed in 2 or more layers, either the manufacturers specific instruction should be followed, or lacking instruction, the boards shall have staggered edge joints.

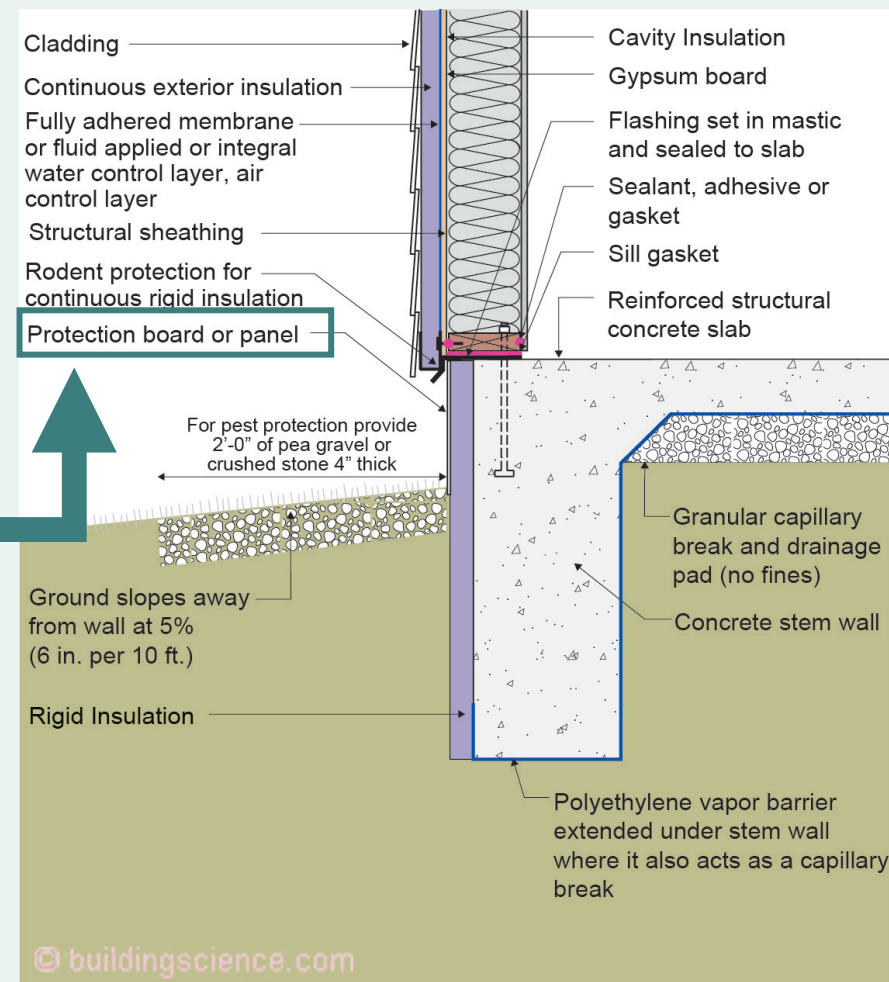


Image source:

<https://buildingscience.com/documents/building-science-insights/bsi-142-foundation-insulation-protection>

Chapter 4 – Energy Efficiency

Chapter 4: Layout

Chapter 4: Commercial Energy Efficiency

C401: General

C402: Building Envelope Requirements

C403: Building Mechanical Systems

C404: Service Water Heating

C405: Electrical Power and Lighting Systems

C406: Additional Efficiency Requirements

C407: Total Building Performance

C408: Maintenance Information and System Commissioning

Follows construction process:

- **Thermal envelope requirements**
 - Insulation levels, specific assembly requirements, air leakage, and entryways
- **Mechanical system design**
 - Proper system sizing, minimum efficiencies, control systems, duct construction, and insulation of ducts and pipes.
- **Lighting and Power Systems**
 - Lighting control requirements, maximum lighting power allowances, and miscellaneous electric load monitoring and control

Chapter 4: Residential Energy Efficiency

R401: General

R402: Building Thermal Envelope

R403: Systems

R404: Electrical Power and Lighting Systems

R405: Total Building Performance

R406: Energy Rating Index Compliance Alternative

R407: Tropical Climate Region Compliance Path

R408: Additional Efficiency Package Options

Chapter 4: Choosing Compliance Path

Prescriptive

- Simple checklist for compliance
- *Less flexible*
- UA Trade-offs allow some flexibility for thermal envelope assemblies

Performance

- *Most flexible* compliance path
- Most complex to properly document
 - Need (2) accurate energy models
 - Model inputs need to be documented
- Reports often not automatically generated

ERI (Residential only)

- *Similar to performance*, but single model needed
 - ERI reference design is built by software from inputs
- Results in index score used for compliance
- Software prints required reports

Chapter 4: Prescriptive Path Compliance

Chapter 4: Commercial Energy Efficiency

C401: General

C402: Building Envelope Requirements

C403: Building Mechanical Systems

C404: Service Water Heating

C405: Electrical Power and Lighting Systems

C406: Additional Efficiency Requirements

C407: Total Building Performance

C408: Maintenance Information and System Commissioning

Checklist of met requirements

- COMCheck and RESCheck build these checklists automatically
- Usually used for UA Trade-offs, but also works for Prescriptive R-value compliance as well
- IECC also provides checklist forms for prescriptive compliance:

<https://www.iccsafe.org/building-safety-journal/bsj-technical/simplified-international-energy-conservation-code-residential-compliance/>



<https://www.energycodes.gov/comcheck>



<https://www.energycodes.gov/rescheck>

Note: IECC checklists were developed for use by Code Officials or Jurisdictions. This helps verify the most impactful prescriptive requirements, but not all.

Chapter 4: Performance Path Compliance

Chapter 4: Commercial Energy Efficiency

- C401: General
- C402: Building Envelope Requirements
- C403: Building Mechanical Systems
- C404: Service Water Heating
- C405: Electrical Power and Lighting Systems
- C406: Additional Efficiency Requirements
- C407: Total Building Performance**
- C408: Maintenance Information and System Commissioning

C407/R405: Designers must document input to computer models

Code officials need to verify inputs match requirements of tables

C407.4.1(1) or R405.4.2(1).

- Tables themselves can be used as checklists for both parties
- eQuest has compliance review for ASHRAE 90.1 Appendix G
 - *No other pathways have built in compliance checks*

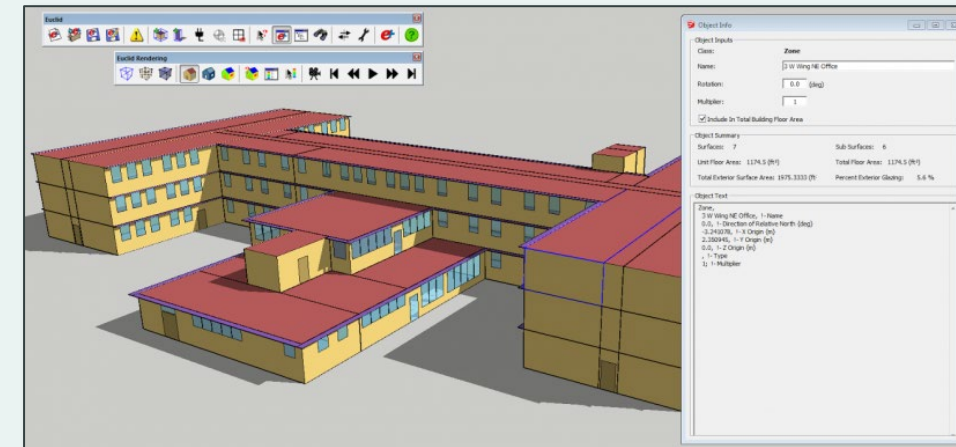


Image source:
<https://www.energy.gov/eere/buildings/articles/openstudio-comes-full-polygon>

C407.5: Software Capability Requirements

Chapter 4: Commercial Energy Efficiency

C401: General

C402: Building Envelope
Requirements

C403: Building
Mechanical Systems

C404: Service Water
Heating

C405: Electrical Power
and Lighting Systems

C406: Additional
Efficiency Requirements

C407: Total Building Performance

C408: Maintenance
Information and System
Commissioning

1. Simulate building operations for **8,760 hours**
2. Use approved climate data for **1 year**: Temperatures, insolation, humidity, and wind speed
3. Model **10 or more** thermal zones
4. Model thermal mass effects
5. Include hourly variations in occupancy, lighting, plug loads, thermostat settings, ventilation, service water use, equipment availability, and process loads
6. Use part-load performance curves for HVAC equipment
7. Use performance/efficiency curves for HVAC equipment
8. Print a checklist/report for code official review documenting **Table C407.4.1(1)/R405.4.2(1)** inputs



R406: ERI Compliance Option

Compliance software must be approved by
ANSI/RESENT/ICC 301

Approved software produces appropriate reports and documentation

- Multiple programs available
 - Ekotrope
 - EnergyGage
 - REM/Rate



REM/RateTM

Chapter 4: Residential Energy Efficiency

R401: General

R402: Building Thermal Envelope

R403: Systems

R404: Electrical Power and Lighting Systems

R405: Total Building Performance

R406: Energy Rating Index Compliance Alternative

R407: Tropical Climate Region Compliance Path

R408: Additional Efficiency Package Options

R409: PHIUS Compliance Option

Documentation to be provided to the code official prior to issuance of *building permit*

- List of compliance features
- PHIUS precertification letter

Documentation to be provided to the code official prior to issuance of *certificate of occupancy*

- PHIUS 2021 (or later) project certificate

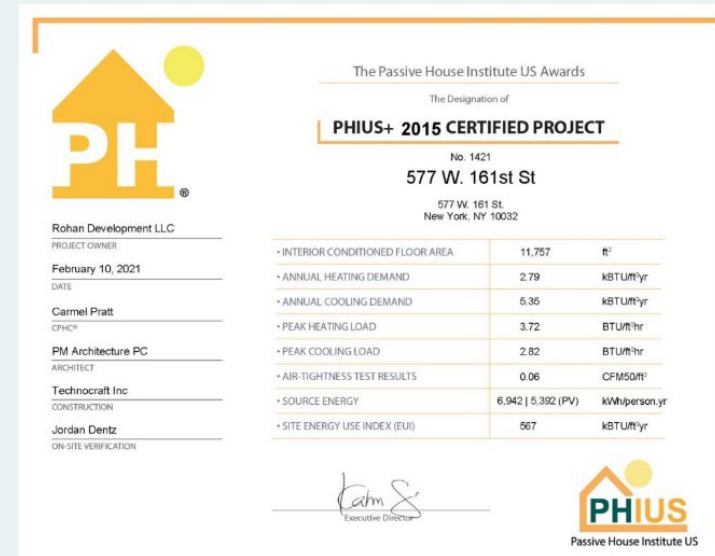
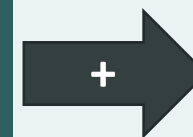


Image source: pmarchitecture.com

Illinois Amendment
R409: PHIUS Alternative
Compliance Option*

*Coming fall of 2023



Chapter 4: Residential Energy Efficiency

R401: General

R402: Building Thermal Envelope

R403: Systems

R404: Electrical Power and Lighting Systems

R405: Total Building Performance

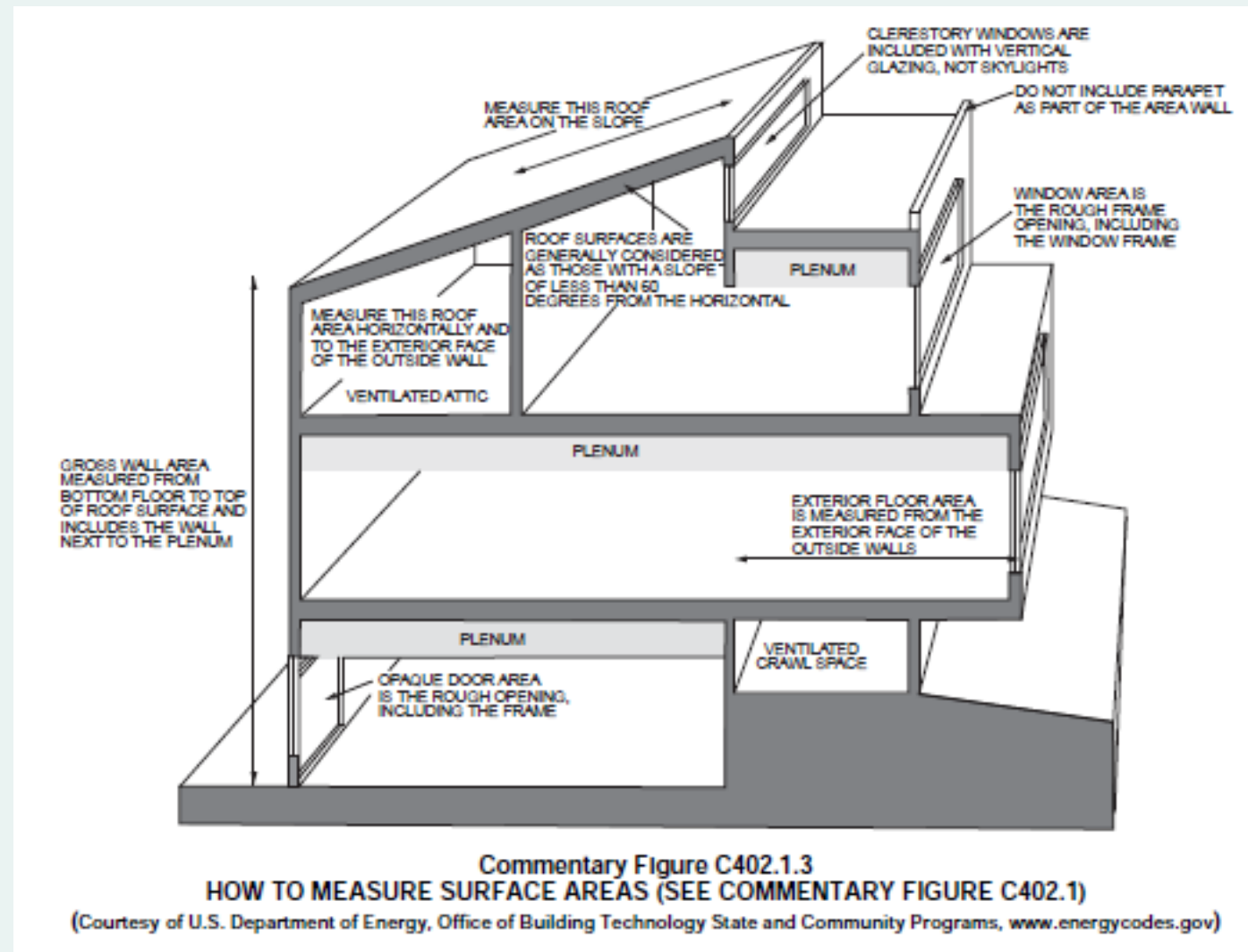
R406: Energy Rating Index Compliance Alternative

R407: Tropical Climate Region Compliance Path

R408: Additional Efficiency Package Options

Chapter 4: Understanding Building Areas

- **Roof area:** measured from exterior face of wall, excludes area for service openings and skylights.
- **Wall area:** Includes exterior walls from top of lowest floor to top floor roof deck, including clerestories, plenum spaces, and joist cavities. Excludes parapet heights.
- **Fenestration areas:** Include rough opening of doors and windows, not just the glazed area.



Chapter 4: Ground-Floor Wall Insulation

Chapter 4: Commercial Energy Efficiency

C401: General

C402: Building Envelope Requirements

C403: Building Mechanical Systems

C404: Service Water Heating

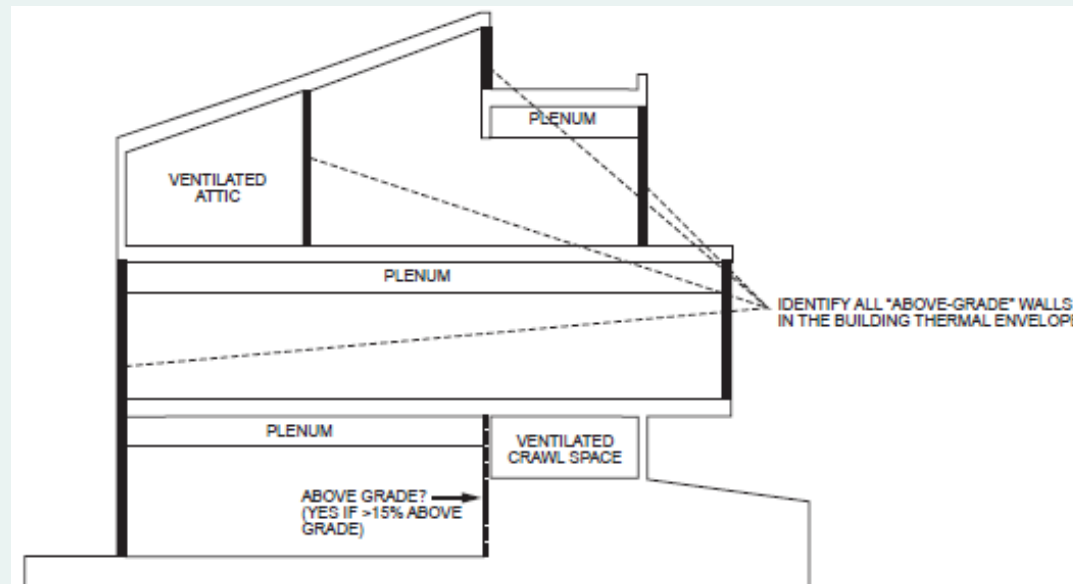
C405: Electrical Power and Lighting Systems

C406: Additional Efficiency Requirements

C407: Total Building Performance

C408: Maintenance Information and System Commissioning

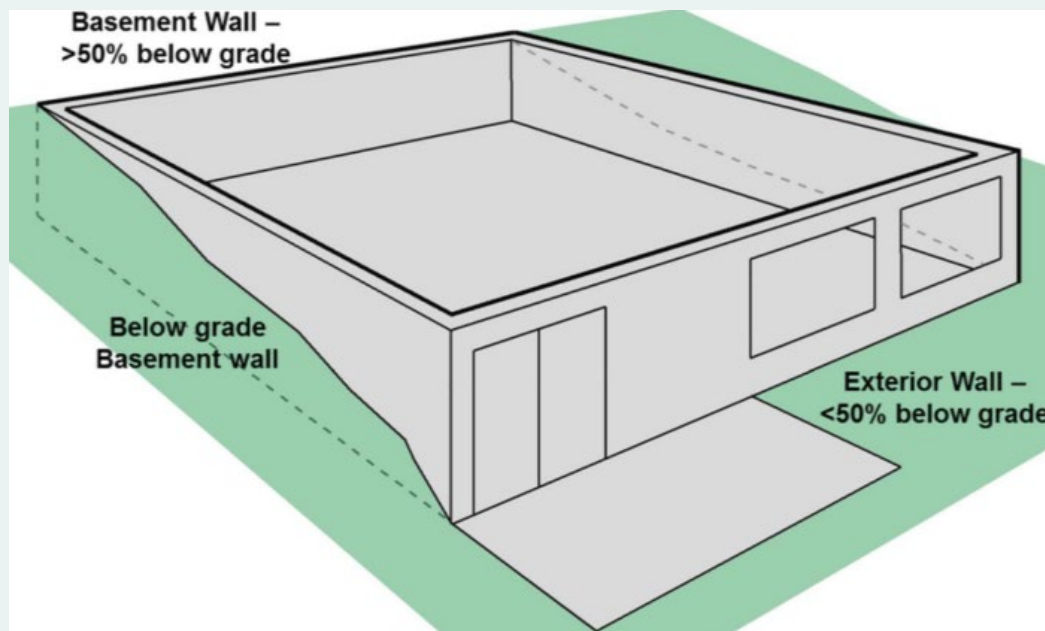
| Commercial | Non-Group R | Group R |
|-----------------------|-------------|-------------|
| CZ 4 Above Grade Mass | R-9.5 c.i. | R-11.4 c.i. |
| CZ 5 Above Grade Mass | R-11.4 c.i. | R-13.3 c.i. |
| CZ 4 Below Grade | R-7.5 c.i. | R-10.0 c.i. |
| CZ 5 Below Grade | R-7.5 c.i. | R-10.0 c.i. |



Commentary Figure C402.2.2
 REQUIREMENTS FOR EXTERIOR ABOVE-GRADE WALLS
 (Courtesy of U.S. Department of Energy, Office of Building Technology State and Community Programs, www.energycodes.gov)

Chapter 4: Ground-Floor Wall Insulation

| Residential | Option 1 | Option 2 |
|-----------------------|-----------|--------------------------|
| CZ 4 Above Grade Mass | R-8 Ext. | R-13 Int. |
| CZ 5 Above Grade Mass | R-13 Ext. | R-17 Int. |
| CZ 4 Below Grade | R-10 c.i. | R-13 |
| CZ 5 Below Grade | R-15 c.i. | R-19 or R-13+R-5 c.i. |



Chapter 4: Residential Energy Efficiency

R401: General

R402: Building Thermal Envelope

R403: Systems

R404: Electrical Power and Lighting Systems

R405: Total Building Performance

R406: Energy Rating Index Compliance Alternative

R407: Tropical Climate Region Compliance Path

R408: Additional Efficiency Package Options

Chapter 5 – Existing Buildings

Chapter 5: Existing Buildings

In general, *new* assemblies must meet requirements for *new construction*, overall building efficiency can not be reduced, existing cavities that are opened *must* be insulated (*only required to fill cavity*), new work must not create unsafe conditions.

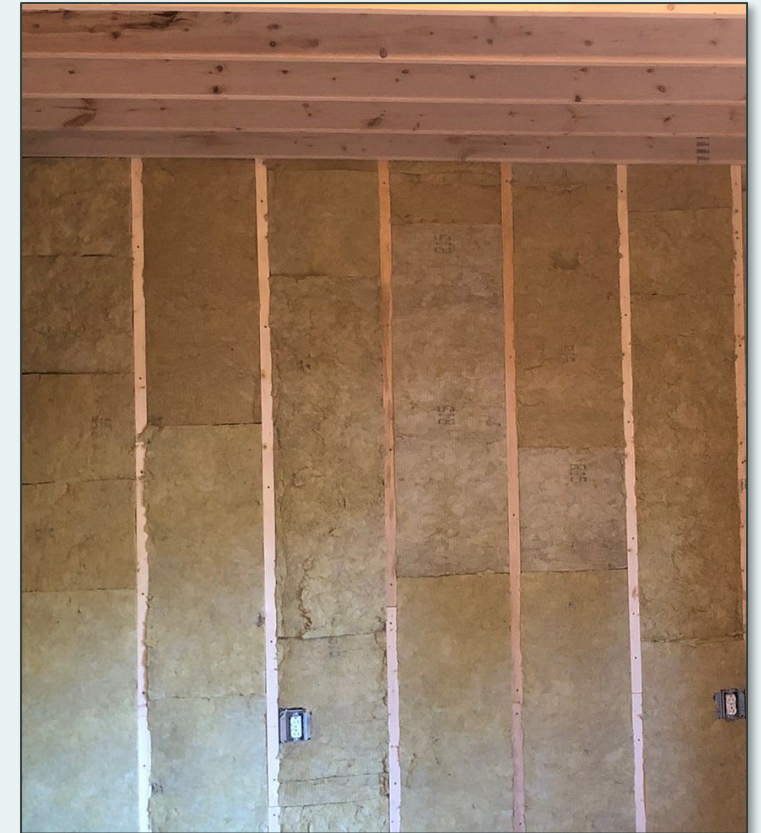


Image source:
<https://www.embue.com/deep-energy-retrofits-part-1>

Chapter 6 – Referenced Standards

Chapter 6: Referenced Standards

CHAPTER 6 [CE] REFERENCED STANDARDS

User note:

About this chapter: Chapter 6 lists the full title, edition year and address of the promulgator for all standards that are referenced in the code. The section numbers in which the standards are referenced are also listed.

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 108.

AAMA

American Architectural Manufacturers Association
1827 Walden Office Square
Suite 550
Schaumburg, IL 60173-4268

AAMA/WDMA/CSA 101/I.S.2/A440—17: North American Fenestration Standard/Specification for Windows, Doors, and Skylights
Table C402.5.5

NFRC

National Fenestration Rating Council, Inc.
6305 Ivy Lane, Suite 140
Greenbelt, MD 20770

100—2020 Procedure for Determining Fenestration Products U-factors
R303.1.3

200—2020 Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
R303.1.3

400—2020 Procedure for Determining Fenestration Product Air Leakage
R402.4.3

Appendices

Appendices to the 2021 IECC

CB: Solar-Ready Zone - Commercial

RB: Solar-Ready Provisions – Detached One- and Two-Family Dwellings and Townhouses

CC: Zero Energy Commercial Building Provisions

RC: Zero Energy Residential Building Provisions

Chapter 4 – Specific Examples

Chapter 4: Conditioned Space Questions

A common residential question:

Does my heated, detached garage need to meet the insulation requirements of the IECC, even if it's not cooled?

- The garage is part of the parcel the house is on, thus covered by the energy code as is the rest of the house (in new construction).
- A heated garage meets the definition of a *conditioned space* and must meet full insulation requirements.

Chapter 4: Conditioned Space Questions

A common residential question:

Does my sunroom with a fire-place need to meet the insulation requirements of the IECC?

- The fireplace is a source of heating, so the sunroom is a *conditioned space*.
 - Insulation can be less if thermally isolated per R402.2.12.
- If the sunroom is open to the rest of the house or not thermally isolated, it is indirectly *conditioned space*.
 - Must meet full insulation requirements.

Chapter 4: Commercial Outdoor Heating

Commercial has specific outdoor heating section: **C403.13**

1. Heating outside a building must be **radiant** and have occupancy sensing device or timer to shut off
2. Snow- and Ice-melt systems must have controls that shut off system when freezing conditions don't exist (*pavement above 50 °F and without precipitation, and outdoor air above 40 °F*)
3. Freeze-Protection systems must shut off when outdoor air is over 40 °F or fluid cannot freeze.
4. Interlock controls for conditioned spaces that can be opened to the outdoors must reset thermostats to 90 °F cooling and 55 °F heating and shut off system when OAT is between setpoints

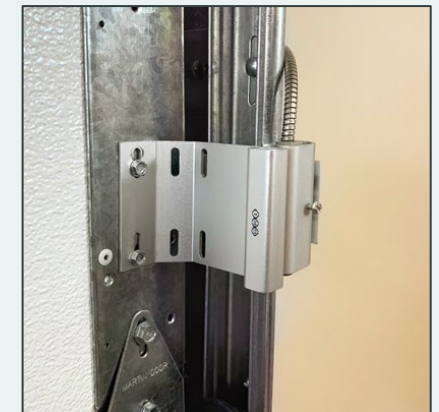


Image source: Control By Web

What about Residential buildings?

Chapter 4: Residential Outdoor Heating?

Common question about permanent gas-fired or electric fire pits and patio heaters

Does energy code govern these?

- Per IL Admin Code: If permit is required, energy code applies to the building.
- Per IECC R101.2: IECC scope covers residential **buildings, building sites, and associated systems and equipment**
- R403.7 requires sizing of heating and cooling systems per ACCA Manuals J and S.
- Without an enclosure, Manual J and S can't apply. We thus conclude **permanent** outdoor heating is **not permitted** per R403.7.



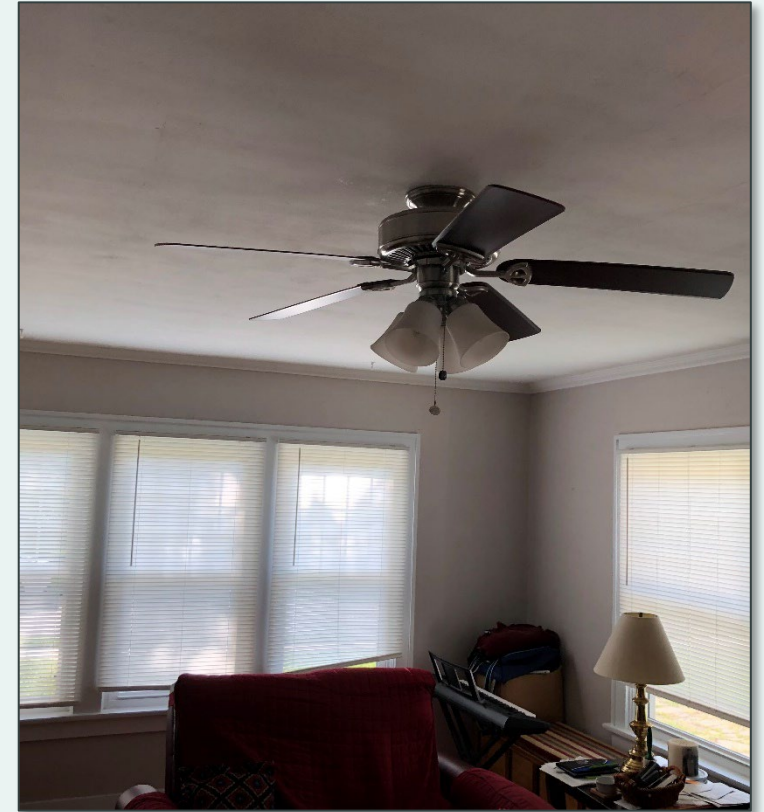
Image source: <https://www.thespruce.com/az-patio-heaters-tall-glass-tube-heater-review-4686134>

Portable systems are permissible, as they do not require a permit.

Chapter 4: Sleeping Unit Lighting

Sleeping units vs ***Dwelling units*** have differing lighting requirements

- **C405.1.1: *Dwelling units*** shall have no less than **90%** of permanent lighting be high-efficacy.
- ***Sleeping units*** should meet the above requirement, or C405.3 LPD requirements for appropriate building or space use category.
 - ***Sleeping units*** have a control requirement to switch off lighting and receptacles within 20 minutes of unoccupancy.
(*not required in dwelling units*).



Simplifying Code Compliance – Envelope Measures

Passive Strategies reduce HVAC size/loads

*Buildings are systems of systems
Simplifying one area may simplify another*

Better envelopes generally reduce HVAC needs

*Smaller HVAC loads reduce system complexity,
size, and upfront costs.*



Low Energy Buildings (C402.1.1 & R402.1Ex 1.1)

Low Energy Building: Those with a peak energy for space conditioning of less than 3.4 Btu/SF or 1.0 W/SF

Exempts envelope from Section C402/R402

Generally applies to semi-heated storage buildings and warehouses



U-Factor vs R-value Tables

R-value Tables Specify assemblies

Table C402.1.3

Table R402.1.3

U-value Tables Specify limits

Table C402.1.4

Table R402.1.2

U-value enables more flexibility

| CLIMATE ZONE | WOOD FRAME WALL U-FACTOR | CLIMATE ZONE | WOOD FRAME WALL R-VALUE ⁹ |
|--------------------|--------------------------|--------------------|---|
| 0 | 0.084 | 0 | 13 or 0& 10ci |
| 1 | 0.084 | 1 | 13 or 0& 10ci |
| 2 | 0.084 | 2 | 13 or 0& 10ci |
| 3 | 0.060 | 3 | 20 or 13& 5ci ^h or 0& 15ci ^h |
| 4 except Marine | 0.045 | 4 except Marine | 30 or 20&5ci ^h or 13& 10ci ^h or 0&20ci ^h |
| 5 and Marine 4 | 0.045 | 5 and Marine 4 | 30 or 20&5ci ^h or 13& 10ci ^h or 0&20ci ^h |
| 6 | 0.045 | 6 | 30 or 20&5ci ^h or 13& 10ci ^h or 0&20ci ^h |
| 7 and 8 | 0.045 | 7 and 8 | 30 or 20&5ci ^h or 13&10ci ^h or 0&20ci ^h |

Keep Fenestration <30% C402.4.1.1

Exceeding 30% (up to 40%) requires:

- At least 50% floor area in daylight zone for buildings up to 2 stories above grade
- At least 25% floor area in daylight zone for buildings greater than 2 stories above grade
- Requires daylight responsive controls
- Visible Transmittance at least 110% of SHGC

DENCo.
EUROPEAN WINDOWS & DOORS

ENERGY PERFORMANCE RATINGS

| U-Factor (USA) | Solar Heat Gain Coefficient (SHGC) | Air Permeability (Euro) | Visible Transmittance |
|-------------------|------------------------------------|-------------------------|-----------------------|
| 0.26 | | | |
| U-Factor (Metric) | 0.61 | Class C2 | 0.82 |
| 1.45 | | | |

ENERGY STAR Certified in Highlighted Regions
ENERGY STAR certificado en regiones seleccionadas

ENERGY STAR logo and map of the United States.

JELD-WEN
WINDOWS & DOORS
Brickmould Vinyl Horizontal Slider
Double-glazing with Grid, LowE and Argon fill
JEL-A-538-02573-00000

NATIONAL Fenestration Rating Council (NFRC) logo and CERTIFIED logo.

ENERGY PERFORMANCE RATINGS
EVALUACIÓN DE RENDIMIENTO ENERGÉTICO

| U-FACTOR (Factor U) | SOLAR HEAT GAIN COEFFICIENT (Coeficiente de Ganancia de Energía Solar) |
|-------------------------------------|--|
| 0.30 (U.S./J-P) 1.70 (Métrico/SI) | 0.46 |

ADDITIONAL PERFORMANCE RATINGS
EVALUACIÓN SUPLEMENTARIA DE RENDIMIENTO

| VISIBLE TRANSMITTANCE (Transmisión de Luz Visible) | AIR LEAKAGE (Infiltración de Aire) |
|--|---------------------------------------|
| 0.55 | ≤ 0.3 (U.S./J-P) ≤ 1.5 (Métrico/SI) |

American Architectural Manufacturers Association (AAMA) logo and text: "Manufacturer of Certified Products".

Avoid Mandatory Skylights C402.4.2

Limiting general lighting power to <math><0.5\text{ W/SF}</math> avoids required skylights:

- Applies to office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, manufacturing area, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation depot or workshop
- Spaces at least 2,500 SF with at least 75% of ceiling height greater than 15 feet



Simplify air barrier compliance C402.5.3

New Commercial Buildings Require Envelope Testing:

- 0.4 CFM/SF Envelope to pass
- 0.4-0.6 CFM/SF Envelope allowed to pass with diagnostic testing and remediation



Sealed combustion or alternative appliances C402.5.5

Spaces with combustion air supplied through openings in an exterior wall for a space conditioning appliance:

- Requires room to be thermally isolated from the conditioned space
- Gasketed doors
- Water lines and ducts insulated



Operable Openings Interlocking C402.5.11

Avoiding operable openings to the outdoors larger than 40 sf. avoids needing to install opening interlocks, which in turn avoids requiring:

- Operable openings to be interlocked with heating and cooling systems
- Raising cooling setpoint to 90 °F and lowering heating setpoint to 55 °F

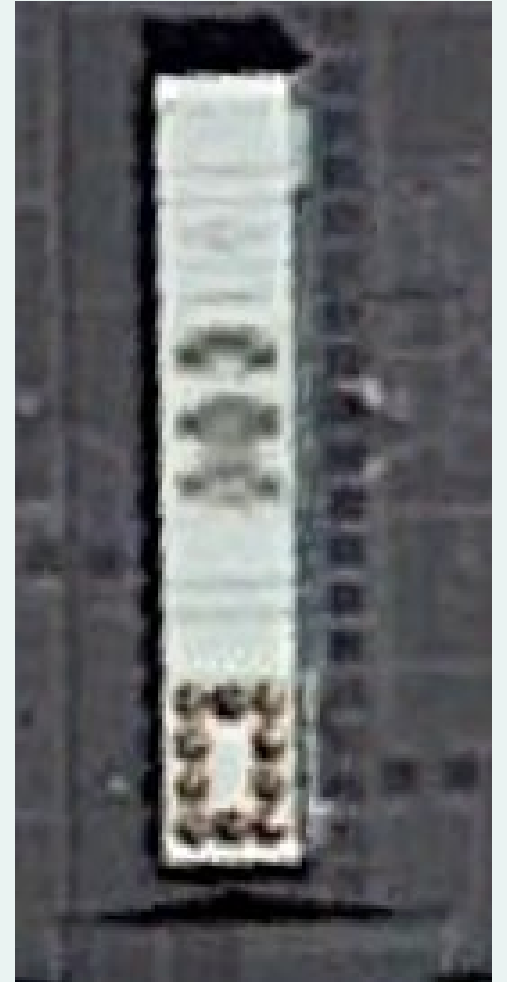


Simplifying Code Compliance – HVAC Measures

Zone isolation C403.2.1

Avoiding having HVAC system zones over 25,000 SF. or covering multiple floors requiring isolation areas avoids:

- Installing isolation devices and controls
- Easier system balancing
- Reduced points for commissioning



Fault Detection and Diagnostics C403.2.3

Fault detection and diagnostics systems that monitor HVAC System's performance could be avoided by keeping gross conditioned area under 100,000 SF.

Avoids:

- Installing sensors and monitoring devices
- Additional programming and commissioning costs
- Need for authorized personnel to monitor FDD system



Two-position Valve C403.4.3.3

Limiting heat pump system pumping capacity to 10hp or less avoids the need for two-position automatic valves

- *Consider upsizing piping and using low-head loss designs to reduce pressure drop*
 - *Low head loss design includes avoiding 90° bends, and using Y-fittings instead of T's*



Image courtesy www.rmi.org, A.B. Lovins

Part Load Controls C403.4.4

Installing hydronic systems less than 300,000 Btu/h in power avoids installing controls for:

- Automatic reset of the water supply temperatures based on building heating and cooling demand
- Automatic variation of fluid flow for hydronic systems
- Installation of VFD pumps



Need of Economizers C403.5

Installing small cooling systems avoids the need to install economizers

- Install small chilled water systems with capacity below climate zone limits

| Climate Zone | Local CHW | Air-Cooled or District CHW |
|--------------|-----------------|----------------------------|
| 4A | 720,000 Btu/h | 940,000 Btu/h |
| 5A | 1,320,000 Btu/h | 1,720,000 Btu/h |

- Install individual fan systems with cooling capacity $\leq 54,000$ Btu/h in buildings with occupancy other than *Group R*
- Install individual fan systems with cooling capacity $\leq 270,000$ Btu/h in buildings with *Group R* occupancy



Energy Recovery Systems C403.7.4.2

Limit ventilation air to avoid the need to install energy recovery systems

- Limits range from 40-26,000 CFM depending on % ventilation air and operating hours per year

Alternatively:

Install ERVs to avoid the requirement for demand control ventilation per C403.7.1 Exception #1.

Depending on facility, a few ERVs may be easier to install and control than DCV controls.



High pressure duct systems C403.12.2.3

Avoid designing/installing ducts and plenums operating at static pressure 3" or more to avoid the need for leak testing

Reduce duct static pressure with:

- Oversized filter banks (lower velocity = lower pressure drop and longer service life)
- Large-radius bends
- Low-friction take-offs like Y's instead of T's
- AVOIDING FLEX-DUCT



Heated Water Supply Piping Length C404.5.1

Use point of use water heating to avoid complex domestic water circulation controls

- Use high performance water fixtures to limit demand/circuit size



Image courtesy of SupplyHouse.com

Images courtesy of Grainger.com

Simplifying Code Compliance – Lighting Measures

Occupant sensor controls C405.2.1

Limit room size to enable use of wall switch type occupant sensors

- Easier to commission and lower cost



Open Plan Office Controls (C405.2.1.3)

Controlling all fixtures in a control zone avoids the need to interlace sensors or have multiple circuits/controls in space



Time-switch Controls (C405.2.2)

Use occupant sensing controls in spaces that otherwise require time switch controls to avoid complicated time-switches



Light Reduction Controls (C406.3)

Getting general lighting power density <0.45
W/SF avoids the need to install light reduction controls

- Also likely to qualify for C406.3



Daylight-responsive controls (C405.2.4)

Reducing lighting power by **at least 40%** avoids need to install daylight responsive controls

- Per C405.2.4 Exception #3
- Can also help qualify for C406.3



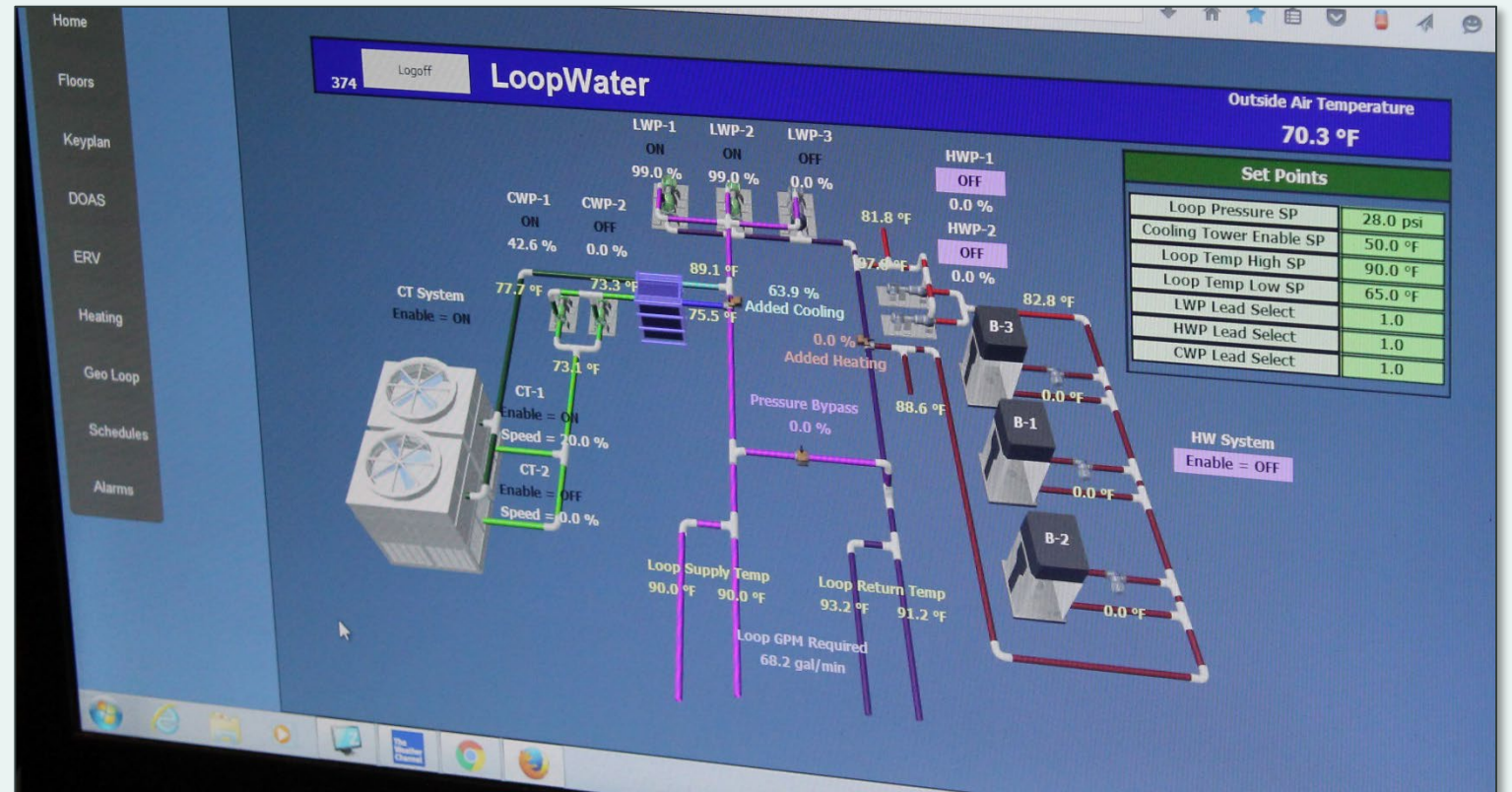
Consolidate Time Switch Controls (C405.2.7.2 & C405.2.7.3)

Using the 1 hr after closing/1 hr before opening for both decorative lighting shutoff and other exterior lighting setbacks enables a single time switch to serve both



Simplify Commissioning (C408)

Simplifying controls simplifies commissioning



Simplifying Code Compliance – Residential

Passive House (R401.9)

Passive House Certifications simplifies Energy Code Compliance



Image source: https://passivehouse.com/03_certification/02_certification_buildings/05_wallplaque/05_wallplaque.html

Attic Access (R402.2.4)

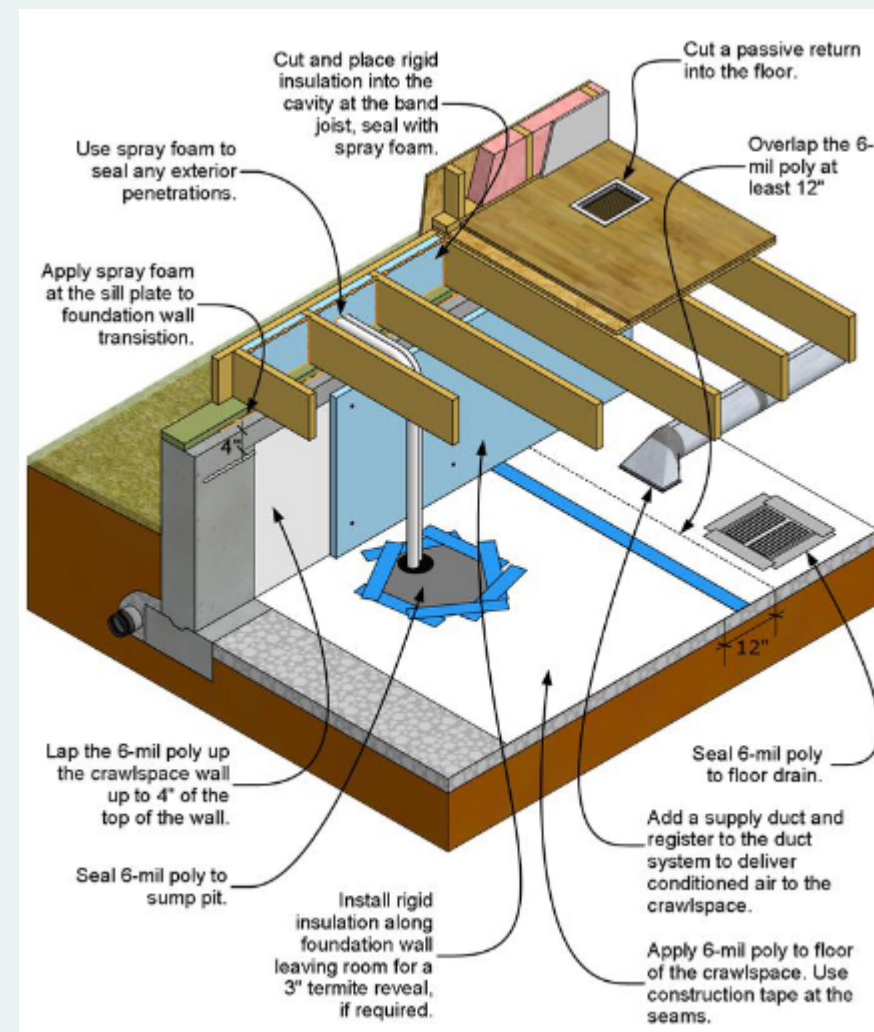
Installing unconditioned attic access outside thermal envelope avoids needing to insulate and air sealed the access hatch.



Crawl Space (R402.2.10)

Treat crawl space as short basement to improve ease of insulation

- Do not vent
- Insulate walls
- Draw stale air out using ventilation system
- Install slab (easier, more permanent vapor control than installing just vapor barrier)



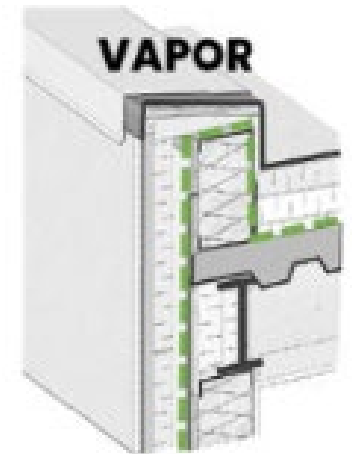
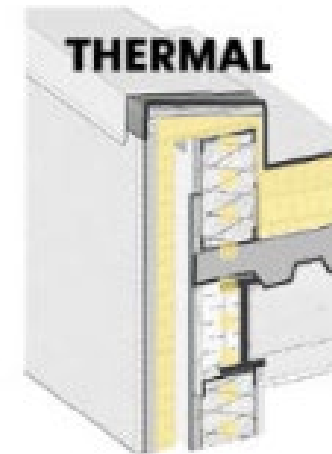
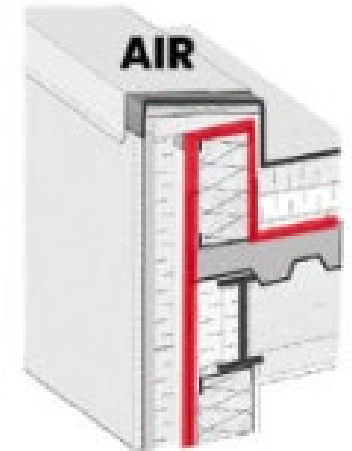
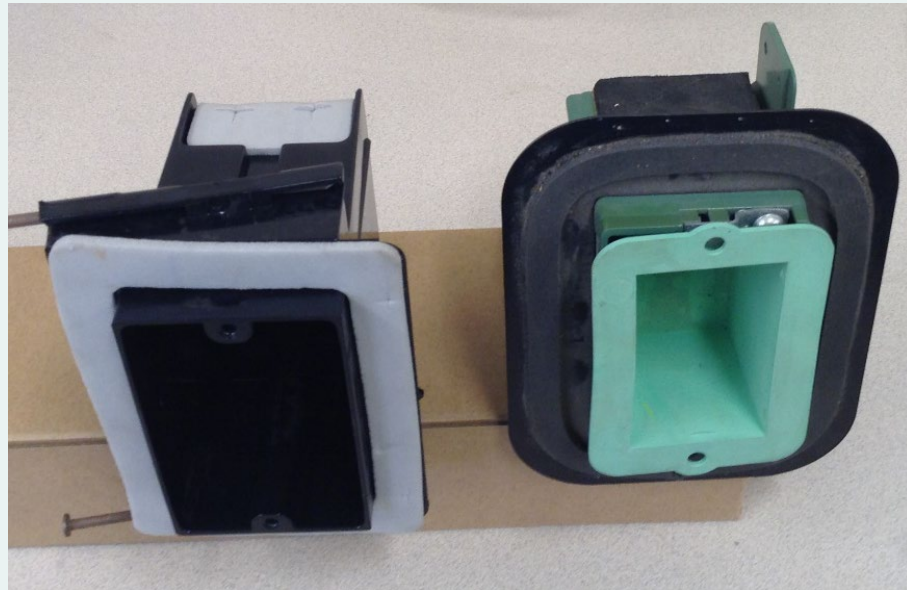
Improve Air Sealing Accuracy (R402.4.1.2)

- Test envelope to the **0.3 CFM/SF_{envelope}**
- More indicative of air sealing quality than 3 ACH
 - CFM/SF_{envelope} usually beneficial for smaller dwellings as smaller volume makes ACH target more difficult
 - Larger square footage 0.3 CFM/SF_{envelope} will be a more stringent target than 3 ACH.



Control Layer Location (R402.4.5 & R402.4.6)

Move thermal and air control layers to extreme exterior to avoid need for sealed recessed lighting & electrical/communication boxes



<https://www.buildingenclosureonline.com/articles/88782-ceu-parapetscontinuity-of-control-layers>

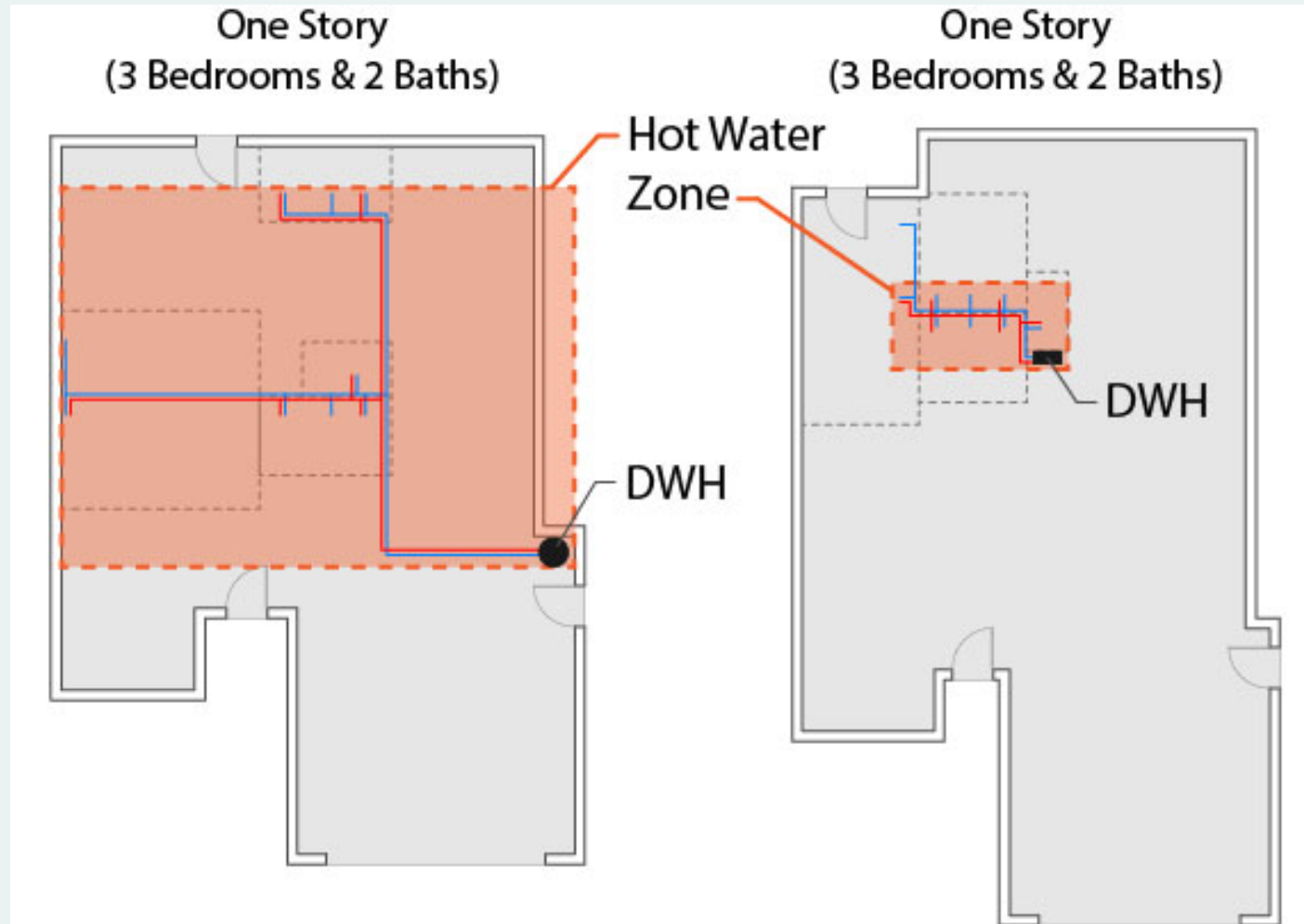
Ductwork location (R408.2.4)

Ductwork inside thermal envelope lessens air sealing stringency (8CFM/100SF vs 4CFM/100SF)



Compact Water Heating System (R403.5.1 & R408.2.3)

- Limits the desire/need for circulation or temperature maintenance systems
- Locate water heater near need for hot water



Balanced Ventilation (R403.6.3)

Avoids the difficulty of not achieving desired ventilation rate due to tighter envelope

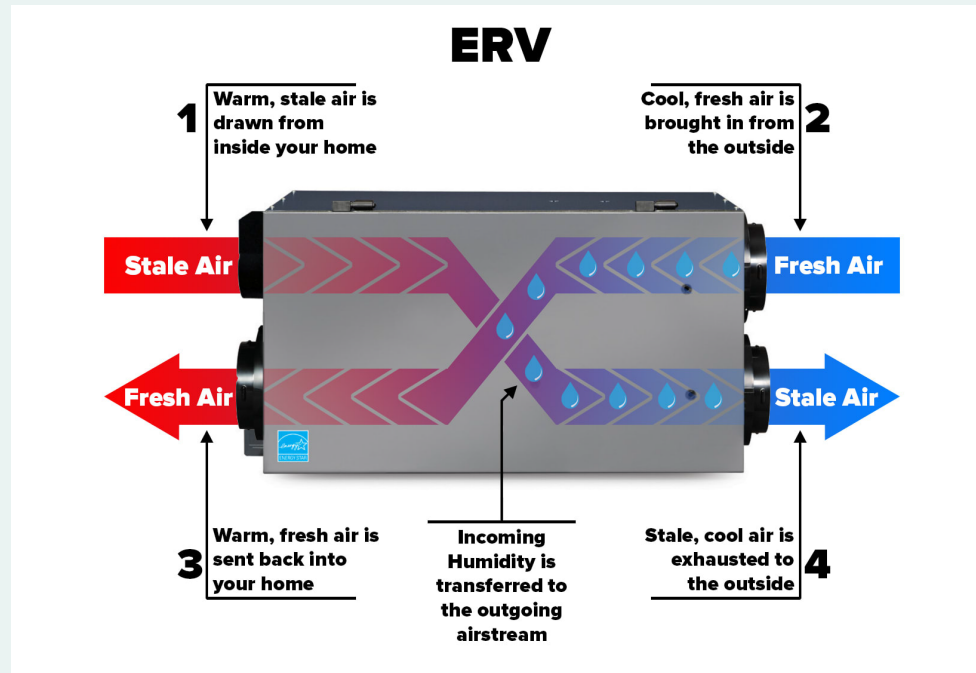


Image courtesy of Ferguson Supply

Outdoor Pool/Spa Cover (R403.10.3)

Use heat pump or on-site energy recovery heating to avoid need for cover on outdoor pool or permanent spa



Image courtesy of DOE

Exterior Lighting Power (R404.3)

Limit total exterior lighting power to **30 watts or less** to avoid additional control requirements

- Generally easy for single-family and small multi-family
- Can be more difficult with large multi-family with pathway lighting.

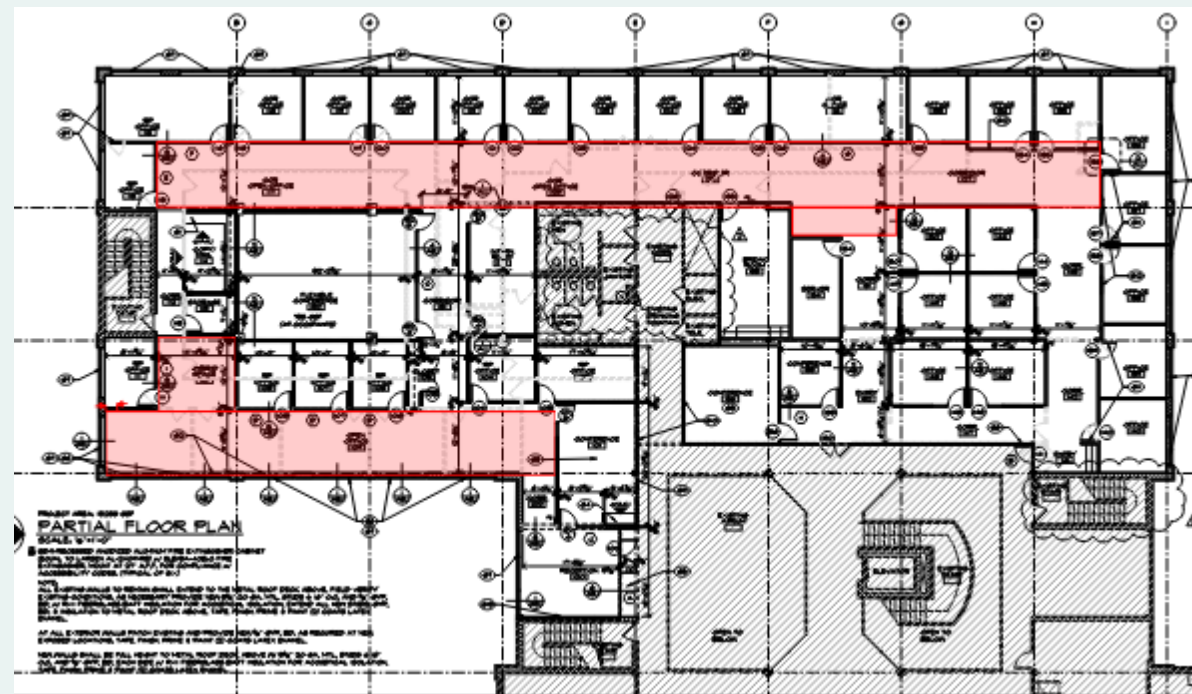


Questions and Answers

Lighting Controls

Highlighted Area labeled Open Office, What controls are needed?

- May depend on if all open office or part is corridor



Lighting Controls

C405.2.1.1 Occupant sensor control function. **P**

Occupant sensor controls in warehouses shall comply with Section C405.2.1.2. Occupant sensor controls in open plan office areas shall comply with Section C405.2.1.3. Occupant sensor controls in corridors shall comply with Section C405.2.1.4. Occupant sensor controls for all other spaces specified in Section C405.2.1 shall comply with the following:

C405.2.1.3 Occupant sensor control function in open plan office areas. **P**

Occupant sensor controls in open plan office spaces less than 300 square feet (28 m²) in area shall comply with Section C405.2.1.1. Occupant sensor controls in all other open plan office spaces shall comply with all of the following:

1. The controls shall be configured so that general lighting can be controlled separately in control zones with floor areas not greater than 600 square feet (55 m²) within the open plan office space.
2. General lighting in each control zone shall be permitted to automatically turn on upon occupancy within the control zone. General lighting in other unoccupied zones within the open plan office space shall be permitted to turn on to not more than 20 percent of full power or remain unaffected.
3. The controls shall automatically turn off general lighting in all control zones within 20 minutes after all occupants have left the open plan office space.

Exception: Where general lighting is turned off by time-switch control complying with Section C405.2.2.1.

4. General lighting in each control zone shall turn off or uniformly reduce lighting power to an unoccupied setpoint of not more than 20 percent of full power within 20 minutes after all occupants have left the control zone.

C405.2.1.4 Occupant sensor control function in corridors. **P E**

Occupant sensor controls in corridors shall uniformly reduce lighting power to an occupied setpoint not more than 50 percent of full power within 20 minutes after all occupants have left the space.

Exception: Corridors provided with less than two footcandles of illumination on the floor at the darkest point with all lights on.

Receptacle Controls

I have a question about the new section of the 2021 IECC regarding controlled receptacles. If there is an existing building that has a tenant space being renovated and most of the existing receptacles in that space are to remain, do I need to comply with this section of the code and replace receptacles with controlled type?

C405.11 Automatic receptacle control.

The following shall have automatic receptacle control complying with Section C405.11.1:

1. At least 50 percent of all 125V, 15- and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy or print functions, breakrooms, classrooms and individual workstations, including those installed in modular partitions and module office workstation systems.
2. At least 25 percent of branch circuit feeders installed for modular furniture not shown on the construction documents.

Roofing Insulation

I have a 3-flat residential building and am to replace the roof. It is a wood-framed flat roof with built-up roofing on the exterior. There is no continuous insulation above the roof decking, and in the past 10-15 years, I have attempted to blow in some insulation in the roof cavities. What insulation do I need to install?

C503.2.1 Roof replacement.

Roof replacements shall comply with Section C402.1.3, C402.1.4, C402.1.5 or C407 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck. In no case shall the R-value of the roof insulation be reduced or the U-factor of the roof assembly be increased as part of the roof replacement.

C503.1 General.

Alterations to any building or structure shall comply with the requirements of Section C503. Alterations shall be such that the existing building or structure is not less conforming to the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Exception: The following alterations need not comply with the requirements for new construction, provided that the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Surface-applied window film installed on existing single-pane fenestration assemblies reducing solar heat gain, provided that the code does not require the glazing or fenestration to be replaced.
3. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Roof recover.
6. Air barriers shall not be required for roof recover and roof replacement where the alterations or renovations to the building do not include alterations, renovations or repairs to the remainder of the building envelope.

Roofing Insulation

I am looking for some help on a reroof question. If the old roof insulation is completely removed down to the deck and the existing RTU curbs are not tall enough to allow the R-30 required. Do they have to raise the curbs?

C503.2.1 Roof replacement. **P**

*Roof replacements shall comply with Section C402.1.3, C402.1.4, C402.1.5 or C407 where the existing roof assembly is part of the *building thermal envelope* and contains insulation *entirely above the roof deck*. In no case shall the *R-value* of the roof insulation be reduced or the *U-factor* of the roof assembly be increased as part of the *roof replacement*.*

C503.1 General. **P**

*Alterations to any *building* or structure shall comply with the requirements of Section C503. Alterations shall be such that the existing *building* or structure is not less conforming to the provisions of this code than the existing *building* or structure was prior to the *alteration*. Alterations to an existing *building*, *building system* or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing *building* or *building system* to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing *building systems*.*

Lighting Controls

I am doing an upgrade of some lighting. Do I have to upgrade the controls as well?

C503.5 Lighting systems.

New lighting systems that are *part of the alteration* shall comply with Sections C405 and C408.

Exception: *Alterations* that replace less than 10 percent of the luminaires in a space, provided that such *alterations* do not increase the installed interior lighting power.

Domestic Hot Water

I have a former space with restroom changing to a pretzel shop adding a 3-pan sink, mop sink, and handwash sink. Do I need to add a circulation system?

C503.4 Service hot water systems.

New service hot water systems that are part of the *alteration* shall comply with Sections C404 and C408.

C404.5.1 Maximum allowable pipe length method.

The maximum allowable piping length from the nearest source of heated water to the termination of the fixture supply pipe shall be in accordance with the following. Where the piping contains more than one size of pipe, the largest size of pipe within the piping shall be used for determining the maximum allowable length of the piping in Table C404.5.1.

1. For a public lavatory faucet, use the "Public lavatory faucets" column in Table C404.5.1.
2. For all other plumbing fixtures and plumbing appliances, use the "Other fixtures and appliances" column in Table C404.5.1.

C404.6 Heated-water circulating and temperature maintenance systems.

Heated-water circulation systems shall be in accordance with Section C404.6.1. Heat trace temperature maintenance systems shall be in accordance with Section C404.6.2. Controls for hot water storage shall be in accordance with Section C404.6.3. Automatic controls, temperature sensors and pumps shall be in a location with *access*. Manual controls shall be in a location with *ready access*.

HVAC Sizing

I have a condenser replacement permit in which the heat loss according to Manual J is 18,811 and they are specifying 2.5 ton or 30,000 Btu's. This may be correctly sized, but wouldn't they need to give me a reason for why it is oversized?

R403.7 Equipment sizing and efficiency rating. P

Heating and cooling *equipment* shall be sized in accordance with ACCA Manual S based on *building* loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies. New or replacement heating and cooling *equipment* shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the *equipment* is installed.

From Manual S
Document from ACCA

| | | | |
|---|-----------------------|--|---|
| 3 | Equipment Performance | Equipment selected satisfies Total Btus (for cooling the Sensible and Latent load) | Is the total heating capacity of the selected equipment $\leq 140\%$ of the designed total heating load? (If not reduce equipment size) E |
| | | | Is the total cooling capacity of the selected equipment $\leq 115\%$ of the designed total cooling load? (If not reduce equipment size) F |
| | | | Does the "Sensible" and/or "Latent" capacities of the selected equipment meet the load's requirements? G |

UA Tradeoff

I received a ResCheck report indicating a UA tradeoff and the walls were 2x4 with R-13 insulation and no continuous which I know doesn't comply with the R-value table. Is the UA tradeoff valid and how does it work.

R402.1.5 Total UA alternative.

Where the total *building thermal envelope* UA, the sum of *U*-factor times assembly area, is less than or equal to the total UA resulting from multiplying the *U*-factors in Table R402.1.2 by the same assembly area as in the proposed *building*, the *building* shall be considered to be in compliance with Table R402.1.2. The UA calculation shall be performed using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. In addition to UA compliance, the [SHGC requirements of Table R402.1.2](#) and the [maximum fenestration *U*-factors of Section R402.5](#) shall be met.

UA Tradeoff

Envelope Assemblies

| Assembly | Gross Area or Perimeter | Cavity R-Value | Cont. R-Value | Prop. U-Factor | Req. U-Factor | Prop. UA | Req. UA |
|---|-------------------------|----------------|---------------|----------------|---------------|----------|---------|
| Ceiling: Flat Ceiling or Scissor Truss | 960 | 23.0 | 23.0 | 0.022 | 0.026 | 21 | 25 |
| Wall: Wood Frame, 16" o.c. | 2,418 | 15.0 | 0.0 | 0.077 | 0.060 | 147 | 115 |
| Door: Solid Door (under 50% glazing) | 40 | | | 0.300 | 0.300 | 12 | 12 |
| Window 1: Vinyl Frame | 18 | | | 0.200 | 0.300 | 4 | 5 |
| Window: Vinyl Frame | 450 | | | 0.200 | 0.300 | 90 | 135 |
| Basement: Solid Concrete or Masonry Wall height: 7.0' Depth below grade: 5.0' Insulation depth: 6.0' | 854 | 0.0 | 10.0 | 0.076 | 0.050 | 65 | 43 |

Maximum UA: **335** Your UA: **339**

Roof Insulation

We're having difficulty interpreting the required R-values for a 2 and 5 story Residential buildings in Chicago. I thought it was R= 30 exterior walls and R=42 roofs with all insulation above concrete low-slope roofs?

RESIDENTIAL BUILDING. Means a detached one-family or two-family dwelling or any building that is three stories or less in height above grade that contains multiple dwelling units, in which the occupants reside on a primarily permanent basis, such as a townhouse, a row house, an apartment house, a convent, a monastery, a rectory, a fraternity or sorority house, a dormitory, and a rooming house; provided, however, that when applied to a building located within the boundaries of a municipality having a population of 1,000,000 or more, the term "RESIDENTIAL BUILDING" means a building containing one or more dwelling units, not exceeding four (4) stories above grade, where occupants are primarily permanent.

Roof Insulation

| CLIMATE ZONE | CEILING R-VALUE |
|-----------------|-----------------|
| 4 except Marine | 60 |
| 5 and Marine 4 | 60 |

Residential Requirements

| CLIMATE ZONE | 4 EXCEPT MARINE | | 5 AND MARINE 4 | |
|-------------------------------------|-----------------|---------|----------------|---------|
| | All other | Group R | All other | Group R |
| Roofs | | | | |
| Insulation entirely above roof deck | R-30ci | R-30ci | R-30ci | R-30ci |

Commercial Requirements

Sunroom Fireplace

I would like to install a gas fireplace in my sunroom, but I am being told that I can't. Why?

CONDITIONED SPACE. An area, room or space that is enclosed within the *building thermal envelope* and that is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling.

Sunroom Fireplace

The Code does not specify the look and feel of heating or cooling appliances. As such, the fireplace would be a heating appliance and thereby make the space directly heated and subject to the Energy Code provisions. There are some relaxed insulation requirements for conditioned sunrooms in R402.2.12 and R402.3.5.

R402.2.12 Sunroom and heated garage insulation. P

Sunrooms enclosing conditioned space and heated garages shall meet the insulation requirements of this code.

Exception: For *sunrooms and heated garages provided thermal isolation, and enclosed conditioned space*, the following exceptions to the insulation requirements of this code shall apply:

1. The minimum ceiling insulation *R*-values shall be *R-19 in Climate Zones 0 through 4 and R-24 in Climate Zones 5 through 8*.
2. The minimum wall insulation *R*-value shall be *R-13 in all climate zones*. Walls separating a *sunroom or heated garage with thermal isolation* from *conditioned space* shall comply with the *building thermal envelope* requirements of this code.

R402.3.5 Sunroom and heated garage fenestration. P

Sunrooms and heated garages enclosing conditioned space shall comply with the fenestration requirements of this code.

Exception: In Climate Zones 2 through 8, for *sunrooms and heated garages with thermal isolation* and enclosing *conditioned space*, the fenestration *U*-factor shall not exceed 0.45 and the skylight *U*-factor shall not exceed 0.70.

New fenestration separating a sunroom or heated garage with thermal isolation from conditioned space shall comply with the building thermal envelope requirements of this code.

Ductwork Insulation

I am replacing rooftop units with exposed horizontal ductwork. The new units will require some additional ductwork to connect to the existing. The existing has an internal liner and am planning to install the same in the new ductwork. How much insulation do I need to install on the new ductwork outside? Can I account for the insulation value of the liner?

C403.12.1 Duct and plenum insulation and sealing.

Supply and return air ducts and plenums shall be insulated with not less than R-6 insulation where located in unconditioned spaces and where located outside the building with not less than R-8 insulation in *Climate Zones 0 through 4* and not less than R-12 insulation in *Climate Zones 5 through 8*. Ducts located underground beneath buildings shall be insulated as required in this section or have an equivalent thermal distribution efficiency. Underground ducts utilizing the thermal distribution efficiency method shall be *listed* and *labeled* to indicate the R-value equivalency. Where located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by not less than R-8 insulation in *Climate Zones 0 through 4* and not less than R-12 insulation in *Climate Zones 5 through 8*.

Exceptions:

1. Where located within equipment.
2. Where the design temperature difference between the interior and exterior of the duct or plenum is not greater than 15°F (8°C).

Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.

Exterior Sign Controls

I have an internally-lit exterior sign and want to know what controls it needs.
Is it *'façade'* or *'decorative'*, something else?

C405.2.7.2 Building facade and landscape lighting. P

Building facade and landscape lighting shall automatically shut off from not later than 1 hour after business closing to not earlier than 1 hour before business opening.

C405.2.7.3 Lighting setback. P

Lighting that is not controlled in accordance with Section C405.2.7.2 shall [comply with the following](#):

1. Be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:
 - 1.1. From not later than midnight to not earlier than 6 a.m.
 - 1.2. From not later than one hour after business closing to not earlier than one hour before business opening.
 - 1.3. During any time where activity has not been detected for 15 minutes or more.
2. Luminaires serving outdoor parking areas and having a rated input wattage of greater than 78 watts and a mounting height of 24 feet (7315 mm) or less above the ground shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent during any time where activity has not been detected for 15 minutes or more. Not more than 1,500 watts of lighting power shall be controlled together.

Enacting Ordinances

What ordinances does my municipality need to adopt to comply with the state's energy code requirements?

Nothing specifically required. Best practice would be to specify “current IL Energy Conservation Code” rather than a specific version to avoid conflict between local ordinance and state law.

Commissioning

Is 3rd party commissioning mandatory in 2021 IECC?

C408.2 Mechanical systems and service water-heating systems commissioning and completion requirements.

Prior to the final mechanical and plumbing inspections, the *registered design professional or approved agency* shall provide evidence of mechanical systems *commissioning* and completion in accordance with the provisions of this section.

C408.3.1 Functional testing. P

Prior to passing final *inspection*, the *registered design professional or approved agency* shall provide evidence that the *lighting* control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the *construction documents* and manufacturer's instructions. Functional testing shall be in accordance with Sections C408.3.1.1 through C408.3.1.3 for the applicable control type.

2024 IECC Adoption

Are we expecting adoption of the 2024 IECC in 2025?

Yes: in accordance with the Energy Efficient Building Act (20 ILCS 3125), the most recent IECC shall be adopted within 12 months of 1st publication and take effect within 6 months thereafter.

1st publication of 2024 IECC anticipated December 2023.

Sleeping Rooms

Do sleeping rooms (hotel rooms) require a “master switch” at entrance/exit door location?

2. *Sleeping units* shall have control devices or systems that are configured to automatically switch off all permanently installed luminaires and switched receptacles within 20 minutes after all occupants have left the unit.

Exceptions:

1. Lighting and switched receptacles controlled by card key controls.
2. Spaces where patient care is directly provided.

Roofing Repairs

What are the requirements for roofing repairs?

ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purpose of its maintenance.

SECTION C504 REPAIRS

C504.1 General.

Buildings and structures, and parts thereof, shall be repaired in compliance with Section C501.3 and this section. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered to be part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section C501.3, ordinary *repairs* exempt from *permit* and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section.

Where a building was constructed to comply with ANSI/ASHRAE/IESNA 90.1, repairs shall comply with the standard and need not comply with Sections C402, C403, C404 and C405.

C504.2 Application.

For the purposes of this code, the following shall be considered to be repairs:

1. Glass-only replacements in an existing sash and frame.
2. *Roof repairs*.
3. Air barriers shall not be required for *roof repair* where the repairs to the building do not include *alterations*, renovations or *repairs* to the remainder of the building envelope.

Do I need Energy Recovery

Climate zone 5A, 34,000CFM total, 7,700CFM Outside air (23%);
Does this require energy recovery per Table C403.7.4.2(1) or C403.7.4.2(2)?

TABLE C403.7.4.2(1) ENERGY RECOVERY REQUIREMENT (Ventilation systems operating less than 8,000 hours per year)

| CLIMATE ZONE | PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE | | | | | | | |
|----------------------------|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---------|
| | ≥ 10% and < 20% | ≥ 20% and < 30% | ≥ 30% and < 40% | ≥ 40% and < 50% | ≥ 50% and < 60% | ≥ 60% and < 70% | ≥ 70% and < 80% | ≥ 80% |
| | Design Supply Fan Airflow Rate (cfm) | | | | | | | |
| 3B, 3C, 4B, 4C, 5B | NR | NR | NR | NR | NR | NR | NR | NR |
| 0B, 1B, 2B, 5C | NR | NR | NR | NR | ≥ 26,000 | ≥ 12,000 | ≥ 5,000 | ≥ 4,000 |
| 6B | ≥ 28,000 | ≥ 26,5000 | ≥ 11,000 | ≥ 5,500 | ≥ 4,500 | ≥ 3,500 | ≥ 2,500 | ≥ 1,500 |
| 0A, 1A, 2A, 3A, 4A, 5A, 6A | ≥ 26,000 | ≥ 16,000 | ≥ 5,500 | ≥ 4,500 | ≥ 3,500 | ≥ 2,000 | ≥ 1,000 | > 120 |
| 7, 8 | ≥ 4,500 | ≥ 4,000 | ≥ 2,500 | ≥ 1,000 | > 140 | > 120 | > 100 | > 80 |

For SI: 1 cfm = 0.4719 L/s.

NR = Not Required.

TABLE C403.7.4.2(2) ENERGY RECOVERY REQUIREMENT (Ventilation systems operating not less than 8,000 hours per year)

| CLIMATE ZONE | PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE | | | | | | | |
|------------------------|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|
| | ≥ 10% and < 20% | ≥ 20% and < 30% | ≥ 30% and < 40% | ≥ 40% and < 50% | ≥ 50% and < 60% | ≥ 60% and < 70% | ≥ 70% and < 80% | ≥ 80% |
| | Design Supply Fan Airflow Rate (cfm) | | | | | | | |
| 3C | NR | NR | NR | NR | NR | NR | NR | NR |
| 0B, 1B, 2B, 3B, 4C, 5C | NR | ≥ 19,500 | ≥ 9,000 | ≥ 5,000 | ≥ 4,000 | ≥ 3,000 | ≥ 1,500 | ≥ 120 |
| 0A, 1A, 2A, 3A, 4B, 5B | ≥ 2,500 | ≥ 2,000 | ≥ 1,000 | ≥ 500 | ≥ 140 | ≥ 120 | ≥ 100 | ≥ 80 |
| 4A, 5A, 6A, 6B, 7, 8 | ≥ 200 | ≥ 130 | ≥ 100 | ≥ 80 | ≥ 70 | ≥ 60 | ≥ 50 | ≥ 40 |

Code Going Too Far?

Is the energy code still cost effective and resource efficient?

PNNL determined a 30-year life cycle savings of \$1,047 per home including added mortgage costs vs. decreased utility costs. Simple payback of improvements of 16.2 years.

Code specifies performance rather than materials and specific techniques

Current insulation Requirements

What are the wall & ceiling insulation requirements?

Commercial: Table C402.1.3 (R-values) or Table C402.1.4 (U-factors)

Residential: Table R402.1.2 (U-factors) or Table R402.1.3 (R-values)

U-factor provides more flexibility in assembly choices; R-value and U-factor approximately equivalent



Questions?

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