

Residential Energy Code Key Requirements in Illinois: 2018 IECC

6.2.2020



Providing effective energy strategies for buildings and communities

ICC Preferred Provider # 2396
ICC Course # 24838



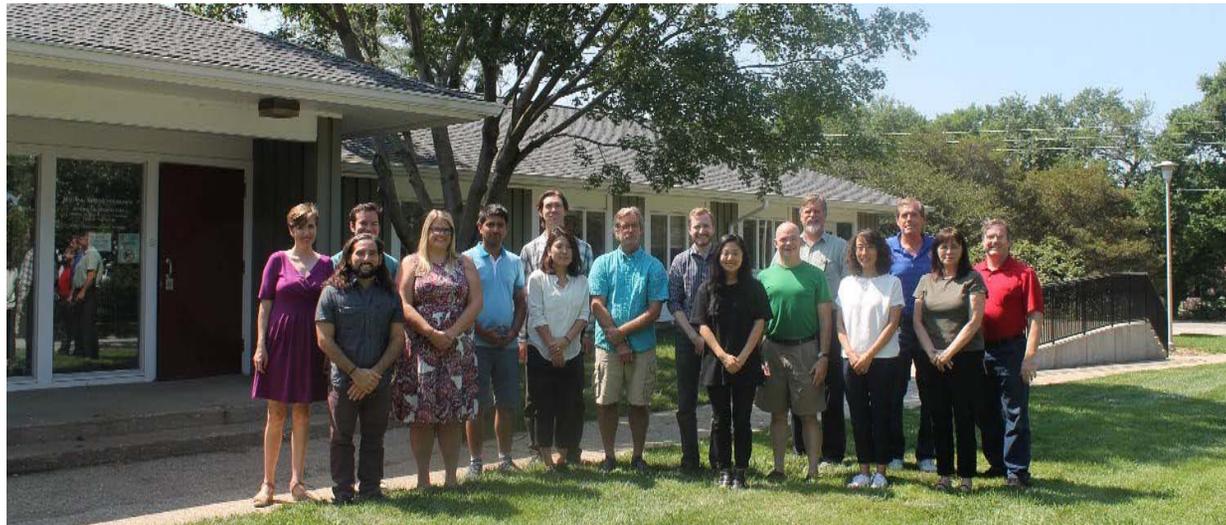
Learning Objectives

1. Learn about the changes in the updated Illinois Energy Conservation Code (2015 IECC to 2018 IECC).
2. Identify key Illinois Energy Conservation Code compliance issues in the residential provisions
3. Understand how to comply with the current Illinois Energy Conservation Code for residential building design and construction

Who We Are

The Smart Energy Design Assistance Center (SEDAC) is an applied research program at University of Illinois.

Our mission: Reduce the energy footprint of Illinois and beyond.



SEDAC is the Illinois Energy Conservation Code Training Provider



This training program is sponsored by **Illinois State Energy Office**



Energy Code Training Program

- Technical support
energycode@sedac.org
800.214.7954
- Online resources at [sedac.org/energy-code](https://www.sedac.org/energy-code)
- Workshops
- Webinars
- Online on-demand training modules



Illinois Energy Conservation Code

Energy Code Training

Illinois Energy Conservation Code

Workshops

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Resources

Frequently Asked Questions

Contact us

Illinois Energy Conservation Code

Effective date of 2018 IECC for State of Illinois: July 1, 2019

The updated Illinois Energy Conservation Code based on the 2018 IECC with Illinois Amendments became effective on **July 1, 2019**. For permit applications started on or after July 1, 2019, this code applies.

In accordance with the **Energy Efficient Building Act**, the **Capital Development Board** (CDB) is required to review and adopt the most current version of the International Energy Conservation Code (IECC) within one year of its publication date. The Code will then become effective in Illinois within 6 months following its adoption by the CDB. The CDB, in conjunction with the **Illinois Environmental Protection Agency** and the **Illinois Energy Conservation Advisory Council**, initiates the cycle for the Illinois Energy Conservation Code to be updated every three years.

The 2018 Illinois Energy Conservation Code can be accessed here:

- [2018 IECC](#)
- [Illinois amendments](#)

Effective date of 2018 IECC for City of Chicago: June 1, 2019

For permit applications started on or after June 1, 2019, the Chicago Energy Conservation Code (Title 14N of the Municipal Code), based on the 2018 edition of the International Energy Conservation Code applies. Solar requirements for roof coverings are still applicable and can be found in Section 1515 of the Chicago Building Code (Title 14B). For more details on the Chicago Energy Conservation Code and required Energy Conservation Compliance Statement, please visit the Department of Buildings, City of Chicago [website](#).



Illinois Energy Conservation Code



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Illinois Energy Conservation Code

The Illinois Energy Conservation Code requires design and construction professionals to follow the latest published edition of the International Energy Conservation Code (IECC) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1 "Energy Standard for Buildings except Low-Rise Residential Buildings" including amendments adopted by the Capital Development Board.

State Funded Facilities must comply with ASHRAE 90.1 per 20 ILCS 3105/10.09-5. See Subpart B of the [Illinois Energy Conservation Code](#) for more information. The 2013 edition of ASHRAE 90.1 went into effect on 1/1/16.

Privately Funded Commercial Facilities must comply with IECC per 20 ILCS 3125. See Subpart C of the [Illinois Energy Conservation Code](#) for more information. The 2015 edition of the IECC went into effect on 1/1/16.

Residential Buildings must comply with IECC per 20 ILCS 3125. See Subpart D of the [Illinois Energy Conservation Code](#) for more information. The 2018 edition of the IECC went into effect on 1/1/16.

July 2019
State Funded Facilities no longer need to comply with the ASHRAE 90.1

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Illinois Energy Conservation Code

The Illinois Energy Conservation Code requires design and construction professionals to follow the latest published edition of the International Energy Conservation Code (IECC) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1 "Energy Standard for Buildings except Low-Rise Residential Buildings" including amendments adopted by the Capital Development Board.

State Funded Facilities must comply with the IECC per 20 ILCS 3125. See Subpart B of the [Illinois Energy Conservation Code](#) for more information. The 2018 edition of the IECC went into effect on 7/1/19.

Privately Funded Commercial Facilities must comply with IECC per 20 ILCS 3125. See Subpart C of the [Illinois Energy Conservation Code](#) for more information. The 2018 edition of the IECC went into effect on 7/1/19.

Residential Buildings must comply with IECC per 20 ILCS 3125. See Subpart D of the [Illinois Energy Conservation Code](#) for more information. The 2018 edition of the IECC went into effect on 7/1/19.

Additional information including training opportunities, interpretations and frequently asked questions can be found on the [Illinois Environmental Protection Agency's web site](#).

Upcoming Training Opportunities for the 2018 Illinois Energy Conservation Code are being provided by the Smart Energy Design Assistance Center. For more information, please use the following link, <https://smartenergy.illinois.edu/upcoming-energycode-events>.

Updates to the Illinois Energy Conservation Code

ILLINOIS CODES

[Building Codes & Regulations](#)

[Illinois Accessibility Code](#)

[Illinois Administrative Code](#)

[Illinois Energy Conservation Code](#)

[State Building Code Information](#)

Access to 2018 IECC, Illinois Amendments & Chicago Energy Conservation Code

<https://codes.iccsafe.org/content/IECC2018P3>

<https://www2.illinois.gov/cdb/business/codes/IllinoisAccessibilityCode/Documents/2018%20Illinois%20Specific%20Amendment%20with%20Modifications%20Shown.pdf>

<https://codes.iccsafe.org/content/document/1491>

The screenshot shows the ICC International Code Council website interface. At the top, there is a search bar with the text "Search Code Titles". Below the search bar, the main content area displays "2018 International Energy Conservation Code" with a sub-header "First Printing: Aug 2017". A left-hand navigation menu lists various sections: COPYRIGHT, PREFACE, EFFECTIVE USE OF THE INTERNATIONAL ENERGY CONSERVATION CODE, IECC—COMMERCIAL PROVISIONS, CHAPTER 1 [CE] SCOPE AND ADMINISTRATION, CHAPTER 2 [CE] DEFINITIONS, CHAPTER 3 [CE] GENERAL REQUIREMENTS, CHAPTER 4 [CE] COMMERCIAL ENERGY EFFICIENCY, CHAPTER 5 [CE] EXISTING BUILDINGS, CHAPTER 6 [CE] REFERENCED STANDARDS, APPENDIX CA SOLAR-READY ZONE—COMMERCIAL, INDEX, IECC—RESIDENTIAL PROVISIONS, CHAPTER 1 [RE] SCOPE AND ADMINISTRATION, CHAPTER 2 [RE] DEFINITIONS, CHAPTER 3 [RE] GENERAL REQUIREMENTS, and CHAPTER 4 [RE] RESIDENTIAL. Below the navigation menu, there is a "Legend" section explaining the chapter listing and navigation options. A "My Notes and Bookmarks" section is also visible, showing recent annotations and purchase options for premium access.

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.

C101.1.2 Adoption. The Board shall adopt

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 Engineering Licensing Act [225 ILCS 340] and Section 14 of the Illinois Professional Engineering Practice Act [225 ILCS 325].

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."

SEDAC TOP 10 Series Webinars

Top 10 Requirements You Should Know: 2018 IECC

- Residential: September 12 (Archived)
- Commercial Envelope: October 16 (Archived)
- Commercial Lighting: December 18 (Archived)
- Commercial HVAC: January 29 (Archived)
- COMcheckTM & REScheckTM Walk-through: May 6 (Archived)

Registration: <https://smartenergy.illinois.edu/energy-code-training/webinars>

Am I in a Residential Building?

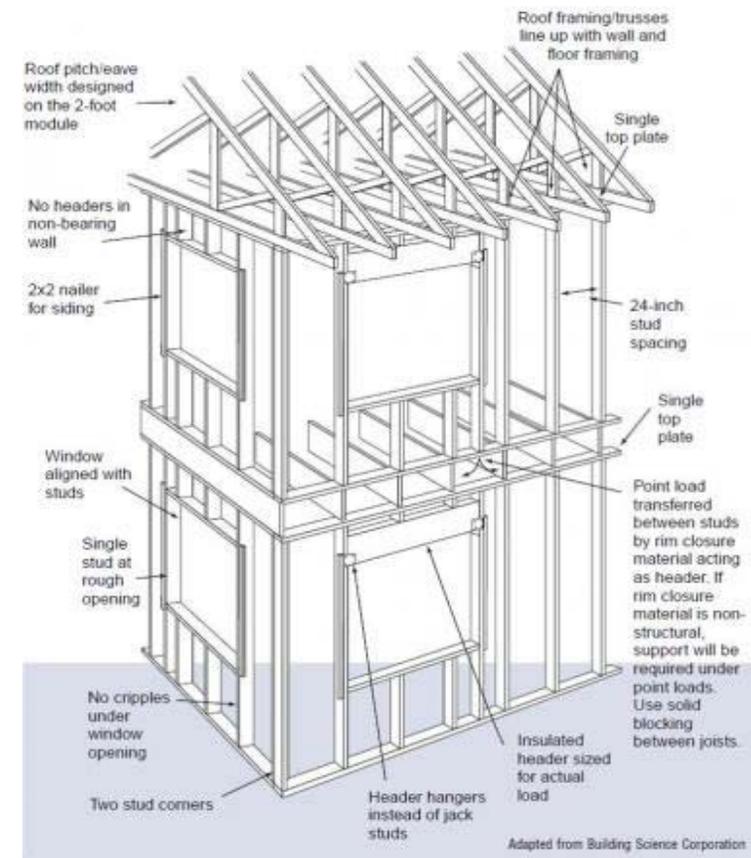
A detached one-family or two-family dwelling or any building that is 3 stories or less above grade (4 or less in Chicago) that contains multiple dwelling units, in which the occupants reside on a primarily permanent basis.

Examples: Townhouse, row house, apartment house, convent, monastery, rectory, fraternity or sorority house, dormitory, rooming house



Key Requirements: 2018 IECC Residential Provisions

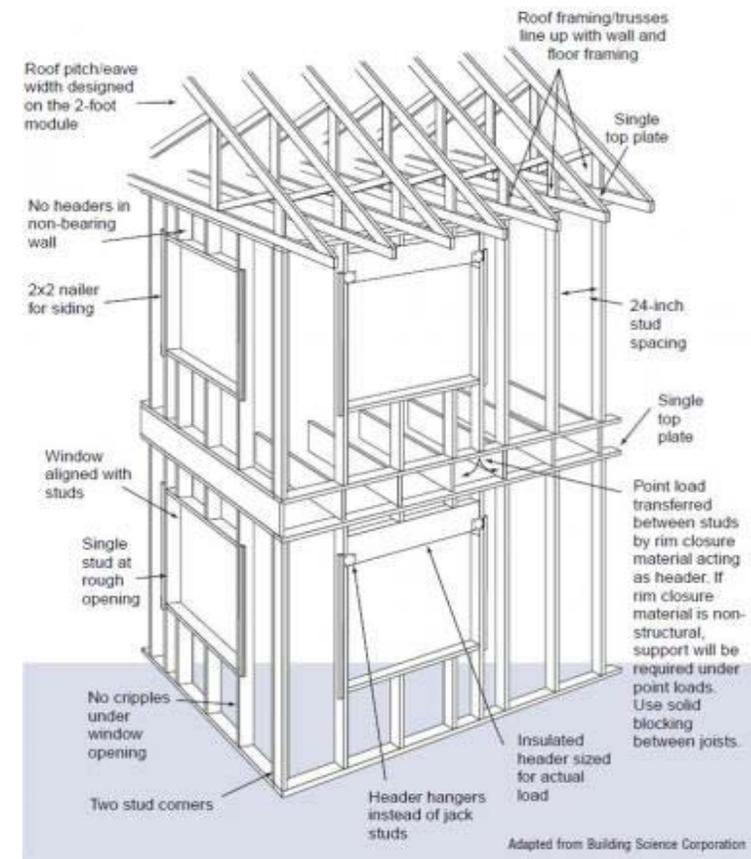
1. Energy Certificate [R401.3]
2. Low-energy Buildings [R402.1]
3. Insulation [R402.1, R402.2]
4. Envelope Sealing [R402.4]
5. Blower Door Testing [R402.4.1.2]
6. Maximum Fenestration U-factor [R402.5]
7. Systems, Multiple Dwelling [R403.8]



<https://basc.pnnl.gov/images>

Key Requirements: 2018 IECC Residential Provisions

8. Duct Insulation, Sealing & Testing [R403.3]
9. Pipe Insulation [R403.4, R403.5.3]
10. Hot Water Circulation [R403.5]
11. HVAC Load & Sizing [R403.7]
12. Ventilation [R403.6]
13. Lighting [R404.1, R402.4.5]
14. Additions / Alterations [R502, R503]



<https://basc.pnnl.gov/images>

#1. R401.3 Certificate (Mandatory)

R401.3 Certificate (Mandatory)

- Permanently posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the building
- Don't cover or obstruct the visibility of other required labels
- Includes the following:
 - R-values of insulation installed for the thermal building envelope, including ducts outside conditioned spaces
 - U-factors and SHGC for fenestration
 - Results from any required duct system and building envelope air leakage testing
 - Types and efficiencies of heating, cooling and service water heating equipment

IECC Sample Energy Efficiency Certificate

Energy Efficiency Certificate					
Insulation Rating		R-Value		R-Value	
Ceiling /Roof	Attic	R- 38	Vaulted	R- 30	
	Walls	Frame		R- 20	Mass
Floors	Basement	R- 10	Crawl space	R- 10	
	Over unconditioned space	R- 19	Slab edge	R- 10	
Ducts	Attic	R- 8	Other	R- N/A	
Air Leakage Test Results					
Blower door	3.0	ACH/50 Pa.	Duct testing	4.0	Cfm/100 ft ²
Fenestration Rating		NFRC U-Factor		NFRC SHGC	
Window	U- 0.32			0.40	
Opaque door	U- 0.32			N/A	
Skylight	U- 0.55			0.40	
Equipment Performance		Type		Efficiency	
Heating system	Gas forced-air			90%	AFUE
Cooling system	Central AC			15	SEER
Water heater	Gas (Storage-type)			0.57	EF
Indicate if the following have been installed (an efficiency shall not be listed)					
<input type="checkbox"/>	electric furnace	<input type="checkbox"/>	gas-fire unvented room heater	<input type="checkbox"/>	baseboard electric heater
Designer/builder					
Code edition	2012 IRC	Date	01/2/2013		

<https://shop.iccsafe.org/media/wysiwyg/material/0726S2-sample.pdf>

**TABLE 401.9
ENERGY EFFICIENCY CERTIFICATE**

Builder, Permit Holder or Registered Design Professional	
Print Name:	
Signature:	
Property Address:	
Date:	
Insulation Rating – List the value covering largest area to all that apply	R - Value
Ceiling/roof:	R -
Wall:	R -
Floor:	R -
Closed Crawl Space Wall:	R -
Closed Crawl Space Floor:	R -
Slab:	R -
Basement Wall:	R -
Fenestration:	
U-Factor	
Solar Heat Gain Coefficient (SHGC)	
Building Air Leakage	
<input type="checkbox"/> Visually inspected according to 402.4.2.1 OR	
<input checked="" type="checkbox"/> Building Air Leakage Test Results (Sec. 402.4.2.2)	
ACH50 [Target: 5.0] or	
CFM50/SFSA [Target: 0.30]	
Name of Tester/Company:	
Date:	Phone:
Ducts:	
Insulation	R -
Total Duct Leakage Test Result (Sect. 403.2.2) (CFM25 Total/100SF) [Target: 6]	
Name of Tester/Company:	
Date:	Phone:
Certificate to be displayed permanently	

<https://www.pdfFiller.com/>

#2. R402.1 Low-energy Buildings

R402.1 Low-energy buildings

- Low-energy buildings, or portions thereof, separated from the remainder of the building by building thermal envelope assemblies complying with this section shall be exempt from the building thermal envelope provisions (peak design $<3.4 \text{ Btu/h/ft}^2$ or 1.0 watt/ft^2 for space conditioning)



#3. R402.1 & R402.2 Insulation (Prescriptive)

R402.1.2 Insulation and Fenestration Criteria

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b,e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^c WALL R-
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19 10/13	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

R-5 Insulation under the full slab area of a heated slab in addition to required slab edge insulation R-value for slabs

REScheck Insulation Inputs?

Edit Basement Assembly Named *North Finished Basement*

Please select:

- Solid Concrete or Masonry
- Masonry Block w/ Empty Cells
- Masonry Block w/ Integral Insulation
- Wood Frame
- Insulated Concrete Forms
- Other

Component: North Finished Basement

Gross Area: 187.75

Orientation: Front side

Cavity R-Value: 15

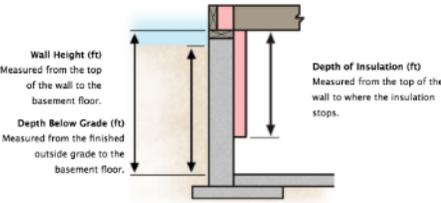
Continuous R-Value: 0

Wall Height (ft): 9

Depth Below Grade: 8.5

Depth of Insulation (ft): 9

Enter the specified dimensions using feet (not inches) in the boxes provided. A basement wall less than 50% below grade is considered an above-grade wall and must be entered using the "Wall" button.



Wall Height (ft)
Measured from the top of the wall to the basement floor.

Depth Below Grade (ft)
Measured from the finished outside grade to the basement floor.

Depth of Insulation (ft)
Measured from the top of the wall to where the insulation stops.

Cancel Apply

REScheck foundation requirements follow the 2018 IECC, but don't account for IL amendments. Be aware, may have a compliant foundation per IL Energy Code, but doesn't pass REScheck in Climate Zone 5a. (IL reduced requirements from 15/19 to 10/13.)

Table R402.4.1.1

**TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	<p>A continuous air barrier shall be installed in the building envelope.</p> <p>The exterior thermal envelope contains a continuous air barrier.</p> <p>Breaks or joints in the air barrier shall be sealed.</p>	<p>Air-permeable insulation shall not be used as a sealing material.</p>
Ceiling/attic	<p>The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed.</p> <p>Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.</p>	<p>The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.</p>
Walls	<p>The junction of the foundation and sill plate shall be sealed.</p> <p>The junction of the top plate and the top of exterior walls shall be sealed.</p> <p>Knee walls shall be sealed.</p>	<p>Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, <i>R</i>-value, of not less than <i>R</i>-3 per inch.</p> <p>Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.</p>
Windows, skylights and doors	<p>The space between framing and skylights, and the jambs of windows and doors, shall be sealed.</p>	<p>—</p>

3 Grades of Insulation Installation

- **Grade I** is the best. This means that the insulation is installed according to the manufacturer's instructions. It completely fills the cavity in the case of air-permeable insulation and also is encapsulated on six sides (with an exception for IECC climate zones 1-3). It's cut around electrical junction boxes, split around wires and pipes, and generally not compressed.
- **Grade II** is second best. There's some allowance for imperfections in the installation but overall, it's still not too bad. The HERS Standards say a Grade II installation can have "moderate to frequent installation defects: gaps around wiring, electrical outlets, plumbing and other intrusions; rounded edges or "shoulders"; or incomplete fill..."
- **Grade III** is the lowest grade. It has "substantial gaps and voids."
- The energy rating software models these three grades differently. When the rater enters Grade I, the software calculates according 100% of the cavity insulation having the R-value entered. When the rater enters Grade II, the software models the cavities as having 98% of their area insulated to the given R-value and 2% uninsulated. For Grade III, 95% of the cavity area is calculated with the given R-value and 5% is treated as uninsulated. (The reason for these particular numbers should become clear to you below.)

2 Parameters for Assigning a Grade to Installation

1. **Missing insulation.** When a cavity in a building assembly has insulation installed in a way that leaves gaps, that affects the amount of heat that flows across the building envelope. More heat will pass through assemblies that have gaps. The more gaps there are, the worse the grade it gets.
2. **Compression and incomplete fill.** Compression is a common problem with fiberglass batt insulation because the batts are often not cut to the proper size for the cavity.



R402.2.9 Basement Walls

IECC Definition of a *Basement Wall*:

A wall 50 percent or more below grade and enclosing *conditioned space*.

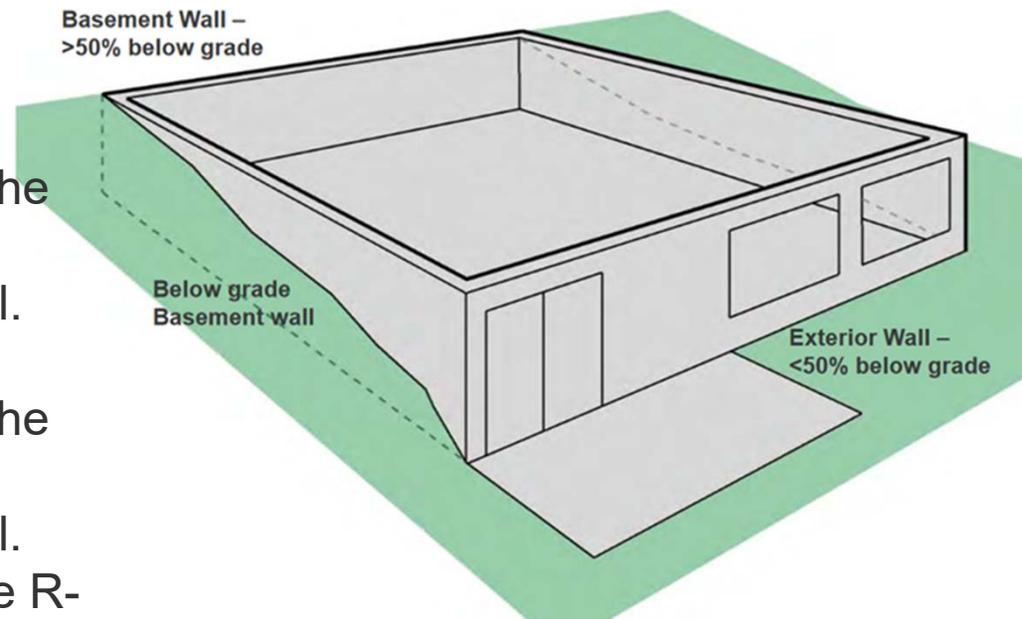
Basement wall insulation requirements:

IL: 10/13

10/13 means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall.

15/19 means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation on the interior of the basement wall.

Alternatively, compliance with “15/19” shall be R-13 cavity insulation on the interior of the basement walls plus R-5 continuous insulation on the interior or exterior of the home.

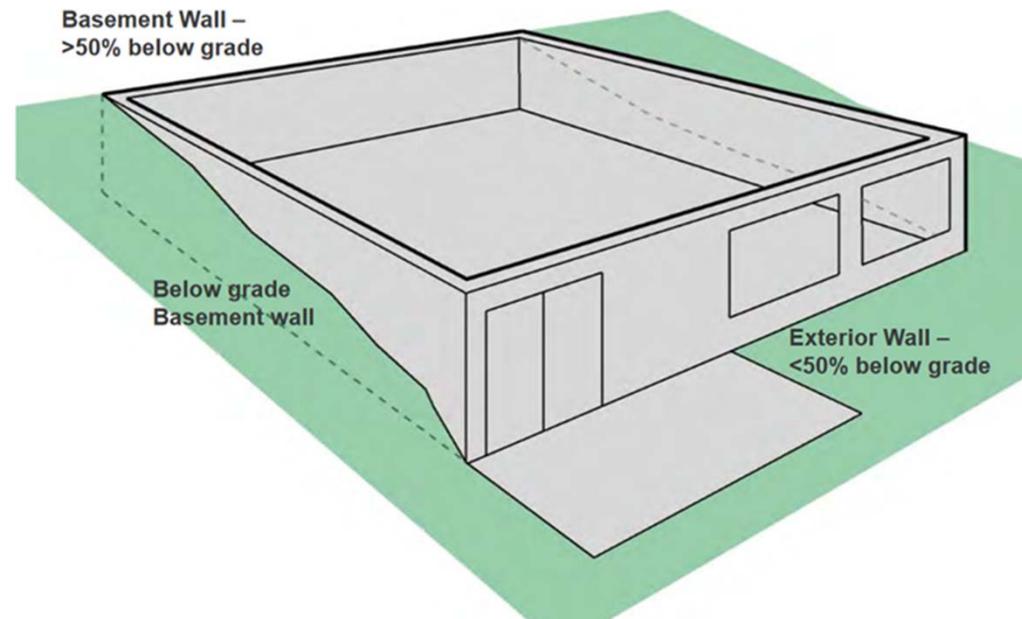


R402.2.9 Basement Walls

Insulate to within 6" of the basement floor (or closer)

Walls associated with conditioned basements may be insulated from the top of the basement wall down to 4' below grade when the Basement R-value is at least 15/19

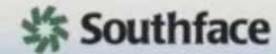
15/19 means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation on the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement walls plus R-5 continuous insulation on the interior or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



**#4. R402.4 Air
Leakage (Mandatory)
Envelope Sealing**

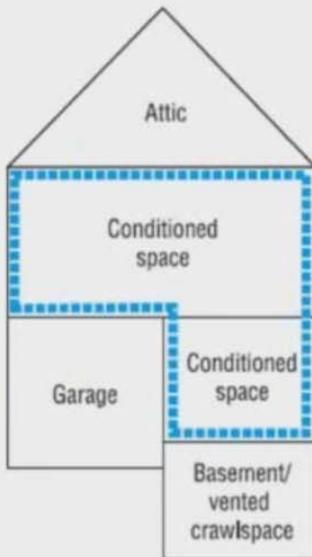
First Need to Identify Where Thermal Envelope Is

Building Thermal Envelope

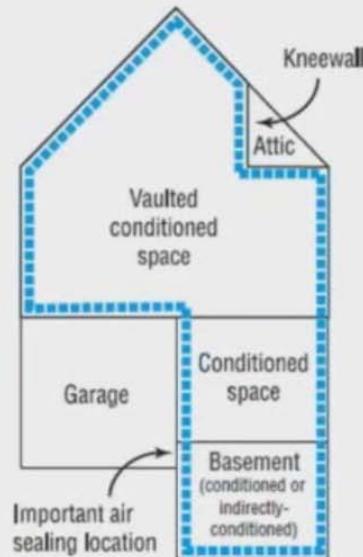


The *building thermal envelope* is the barrier that separates the conditioned space from the outside or unconditioned spaces. The building envelope consists of two parts - an air barrier and a thermal barrier that must be both continuous and contiguous (touching each other). In a typical residence, the building envelope consists of the roof, walls, windows, doors, and foundation. Examples of unconditioned spaces include attics, vented crawlspaces, garages, and basements with ceiling insulation and no HVAC supply registers.

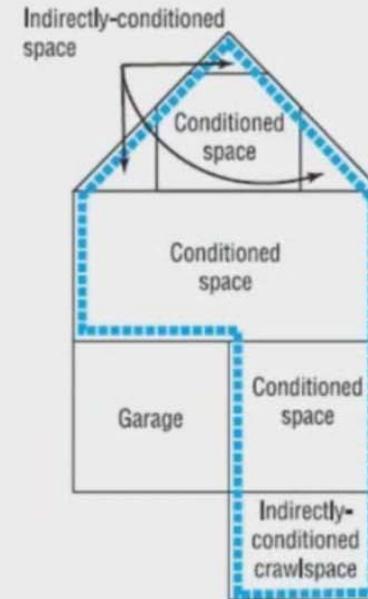
Example 1



Example 2



Example 3



R402.4 Air Leakage (Mandatory 2 Step Process)

R402.4.1.1 Installation

- The components of the building thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in the Table
- Where required by the code official, an approved third party shall inspect all components and verify compliance

R402.4.1.2 Testing

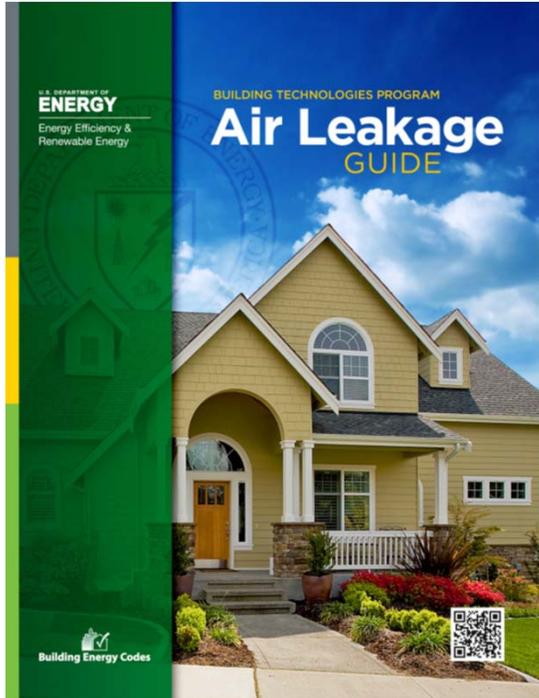
- The building shall be tested and verified as having an air leakage rate of:
 - 4 ACH50 in Illinois
 - Requirement of a written report

Table R402.4.1.1

**TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	<p>A continuous air barrier shall be installed in the building envelope.</p> <p>The exterior thermal envelope contains a continuous air barrier.</p> <p>Breaks or joints in the air barrier shall be sealed.</p>	<p>Air-permeable insulation shall not be used as a sealing material.</p>
Ceiling/attic	<p>The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed.</p> <p>Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.</p>	<p>The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.</p>
Walls	<p>The junction of the foundation and sill plate shall be sealed.</p> <p>The junction of the top plate and the top of exterior walls shall be sealed.</p> <p>Knee walls shall be sealed.</p>	<p>Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, <i>R</i>-value, of not less than <i>R</i>-3 per inch.</p> <p>Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.</p>
Windows, skylights and doors	<p>The space between framing and skylights, and the jambs of windows and doors, shall be sealed.</p>	<p>—</p>

Air Leakage Guide

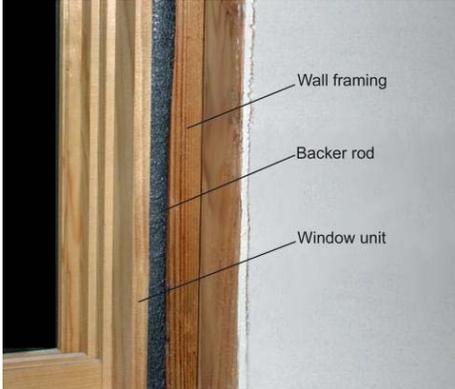


https://www.energycodes.gov/sites/default/files/documents/BECP_Building%20Energy%20Code%20Resource%20Guide%20Air%20Leakage%20Guide_Sep12011_v00_lores.pdf

A tight house will:

- Have lower heating bills due to less heat loss
- Have fewer drafts and be more comfortable
- Reduce the chance of mold and rot because moisture is less likely to enter and become trapped in cavities
- Have a better performing ventilation system
- Potentially require smaller heating and cooling equipment capacities.

Examples of Air Sealing



Common Air Leak Locations



Another REScheck Note!

Since REScheck doesn't have IL Amendments, the performance path used in the program assumes 3ACH, the 2018 IECC requirement. IL Amendments currently allow 4ACH to pass.

REScheck performance path is limited. It has no ability to adjust envelope leakage rate for improvement beyond code

Project Envelope Mechanical Compliance (0.6%) ✓

Check Compliance Save Report

Project Info:

Project Title*

Energy Code: What's my code?

Location

Project Type

New Construction

Addition

Alteration

Compliance Method

UA Trade-Off

Performance Alternative

Building Characteristics

Construction Type

1- and 2-Family, Detached

Multifamily

Conditioned Floor Area

Orientation - Front Faces Enable:

Features

All ducts and air handlers are located within conditioned spaces: Yes No

Duct(s) are buried in ceiling insulation: Yes No

Thermally isolated sunroom: Yes No

Pool or inground spa: Yes No

Interior wood-burning fireplace: Yes No

**#5. R402.4 Air
Leakage (Mandatory)
Blower door testing**

R402.4.1.2 Blower Door Testing

- **Mandatory** for residential construction
- Residential air leakage rate not to exceed 4 air changes per hour @ 50 pascals
- Where required by code official, testing shall be conducted by an approved third party.
- Testing performed after creation of all penetrations of the building thermal envelope



Bloor Door Testing for Multifamily Housing

Low-rise multifamily

- Air leakage not exceeding 0.25 cubic feet per minute of enclosure area (all six sides) at 50 Pascal.
- Sampling methodology available for buildings >7 units



<https://www.mncee.org/blog/may-2019/research-sidesteps-obstacles-measuring-air-tightne/>

**#6. R402.5 Maximum
Fenestration U-factor
(Mandatory)**

R402.1.5 or R405 UA Alternative or Simulated Performance

- Area-weighted average maximum fenestration U-factor
- Vertical fenestration: 0.48
- Skylights: 0.75



#7. R403.8 Systems Serving Multiple Dwelling Units (Mandatory)

R403.8 Systems serving multiple units

- Service Water Heating or HVAC
- Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the IECC – Commercial Provisions instead of R403



#8. R403.3 Duct Insulation, Sealing & Testing

R403.3.1 Duct Insulation (Prescriptive)

Supply and return ducts in attics:

- Min. R-8 for ducts ≥ 3 inches. Min. R-6 for ducts < 3 inches in dia.

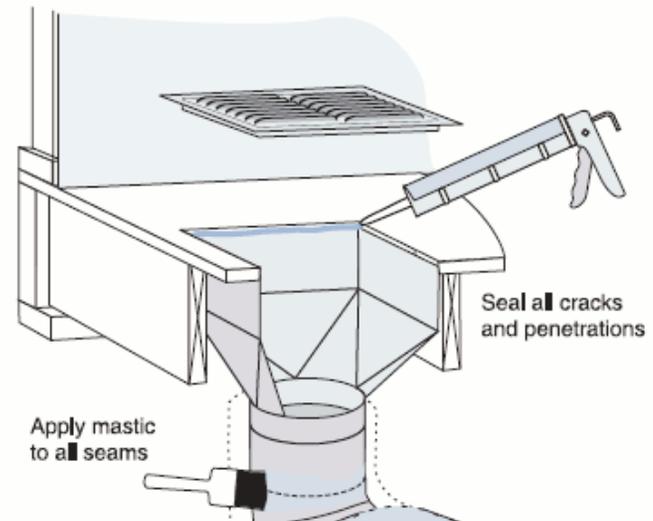
Supply and return ducts in other areas:

- Min. R-6 for ducts ≥ 3 inches. Min. R-4.2 for ducts < 3 inches in dia.

Exception: Ducts located completely inside the building thermal envelope

Location	Duct Diameter	
	$\geq 3''$	$< 3''$
Attic	R-8	R-6
Conditioned Space	NR	NR
Vented Crawlspace	R-6	R-4.2
Conditioned Crawlspace	NR	NR
Basement - Conditioned	NR	NR
Basement - Unconditioned	R-6	R-4.2
Exterior Walls	R-6	R-4.2

Examples of Duct Sealing



R403.3.3 Duct Testing (Mandatory)

Ducts shall be pressure tested to determine air leakage by one of the following methods:

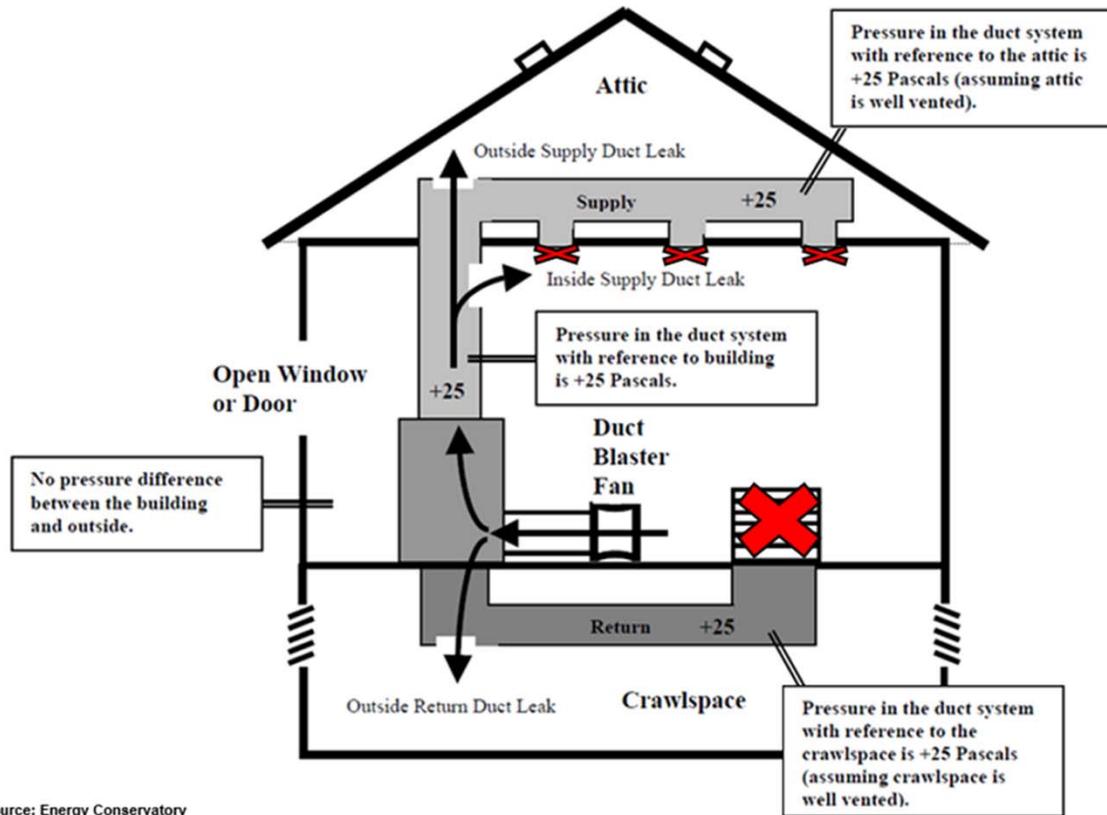
1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions

1. A duct air-leakage test shall not be required where the ducts and air-handlers are located entirely within the building thermal envelope.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the Code Official.

Duct Testing



Source: Energy Conservatory

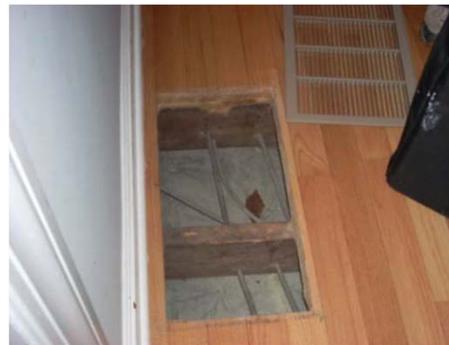
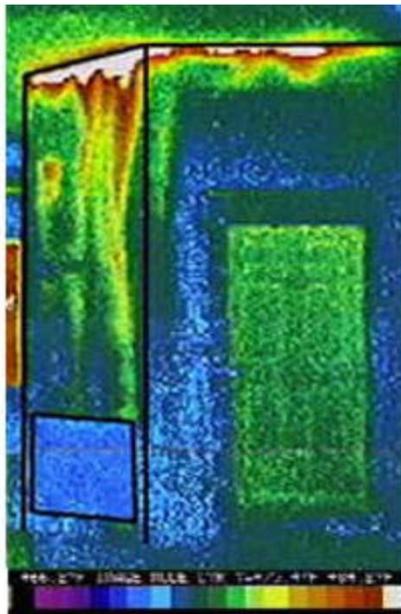
https://paenergycode.com/duct_testing/default.html



Old Practices Now Forbidden

R403.3.5 Building cavities (Mandatory).

Building framing cavities shall not be used as ducts or plenums.



Another REScheck note!

Add HVAC Assembly Named *HVAC* ×

Please select:

- Furnace
- Boiler
- Heat Pump
- Air Conditioner

Component:

HVAC

! Important Information ×

System Efficiency Units

- Furnace/Boiler: AFUE
- Heat pump heating: HSPF
- Heat pump cooling/AC: SEER

Cancel

Apply

Again, if using the REScheck performance path, the program doesn't have inputs for duct leakage, which can be improved beyond the baseline model for a performance credit.

If taking credit for these types of gains, may want to use TREAT, HEED, REMRate or other modeling software.

#9. R403.4 & R403.5.3 Pipe Insulation

R403.4 Mechanical System Piping Insulation (Mandatory)

Mechanical system piping capable of carrying fluids greater than 105F or less than 55F shall be insulated to an R-value of not less than R-3

Piping insulation exposed to weather shall be protected from damage including sunlight, moisture, equipment maintenance and wind. Adhesive tapes shall be prohibited.



R403.5.3 Hot Water Pipe Insulation (Prescriptive)

Insulation for hot water piping with a thermal resistance , R-value, of not less than R-3 shall be applied to the following

1. Piping $\frac{3}{4}$ inch and larger in nominal diameter.
2. Piping serving more than one dwelling unit.
3. Piping located outside the conditioned space.
4. Piping from the water heater to a distribution manifold.
5. Piping located under a floor slab.
6. Buried piping.
7. Supply and return piping in recirculating systems other than demand recirculating systems.



<https://basc.pnnl.gov/images/hot-water-heating-pipes-insulated-1-inch-jacketed-fiberglass>

**#10. R403.5.1
Circulation Systems
& R403.5.2 Demand
Recirculation
Controls (Mandatory)**

R403.5.1 Circulation Systems & R403.5.2 Demand Recirculation

R403.5.1.1: “Controls...shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water.”

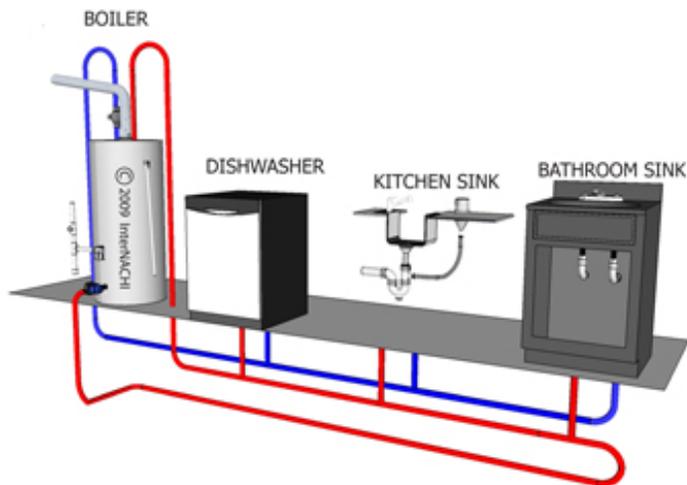
R403.5.3: “The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance...The controls shall limit the temperature of the water entering the cold-water piping to ≤ 104 °F.”

Both code sections essentially have a demand-based component to circulation pump “ON” command. The shut-off method is the difference between the two.

R403.5.1 Circulation Systems & R403.5.2 Demand Recirculation

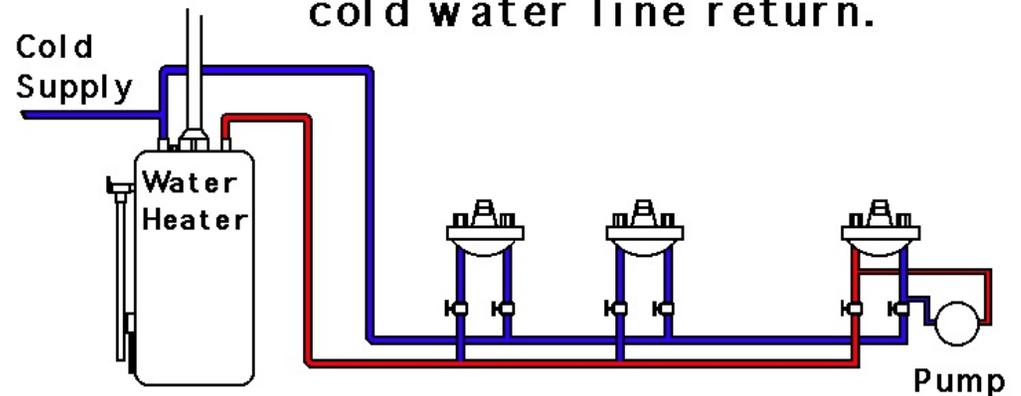
Commonly find circulation systems that circulate water continuously to ensure entire loop is always hot. Should cycle to maintain loop temperature.

DEDICATED LOOP HOT WATER RECIRCULATION SYSTEM



<https://www.nachi.org/hot-water-recirculation-systems.htm>

Circulating system using cold water line return.



<http://hotwaterrecirculatingpump.com/>

#11. R403.7 HVAC Equipment Load & Sizing (Mandatory)

Before Codes, How HVAC Systems Used to be Sized

Big Picture:

Simplistic Design Approach

Instructions

1. Print this page.
2. Carefully cut out the holes.
3. Stand on curb across the street and hold page 1 foot from your face.
4. Find the hole that's the closest match.
5. Size HVAC accordingly

HVAC Sizing Chart



1 1/2 TO 2 TON



2 1/2 TO 3 1/2 TON

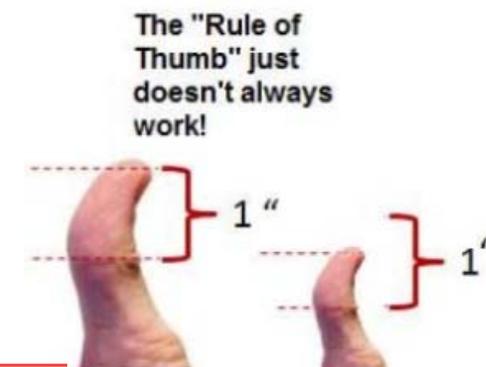
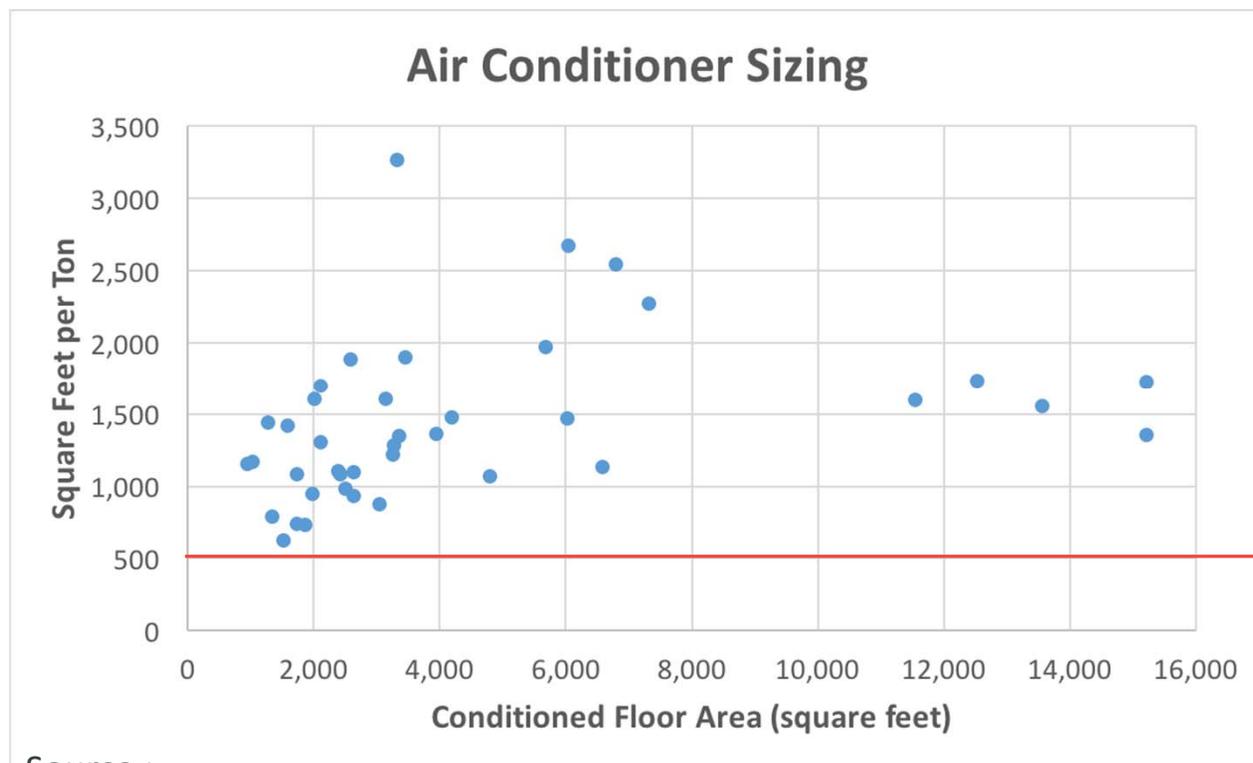


4 TO 5 TON

https://www.energy.gov/sites/prod/files/2013/12/f5/webinar_hvac_calculatingloads_20110428.pdf

What about Rules of Thumb?

Common old rule-of-thumb for residential HVAC sizing was 1 ton of cooling for every 500sf - 600sf.



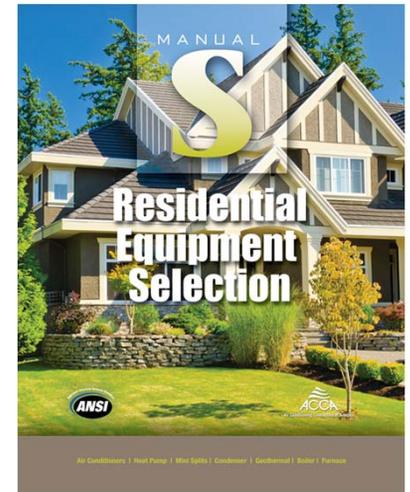
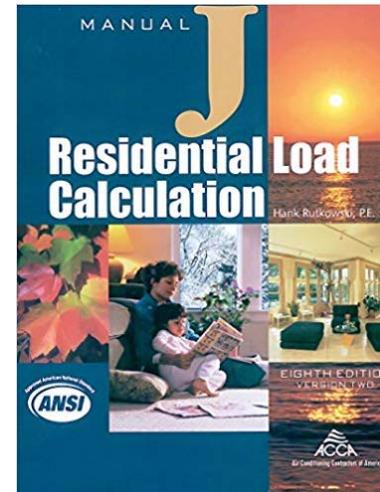
Source :

<https://www.energyvanguard.com/blog/air-conditioner-sizing-rules-of-thumb-must-die>

R403.7 Equipment Sizing & Efficiency Rating (Mandatory)

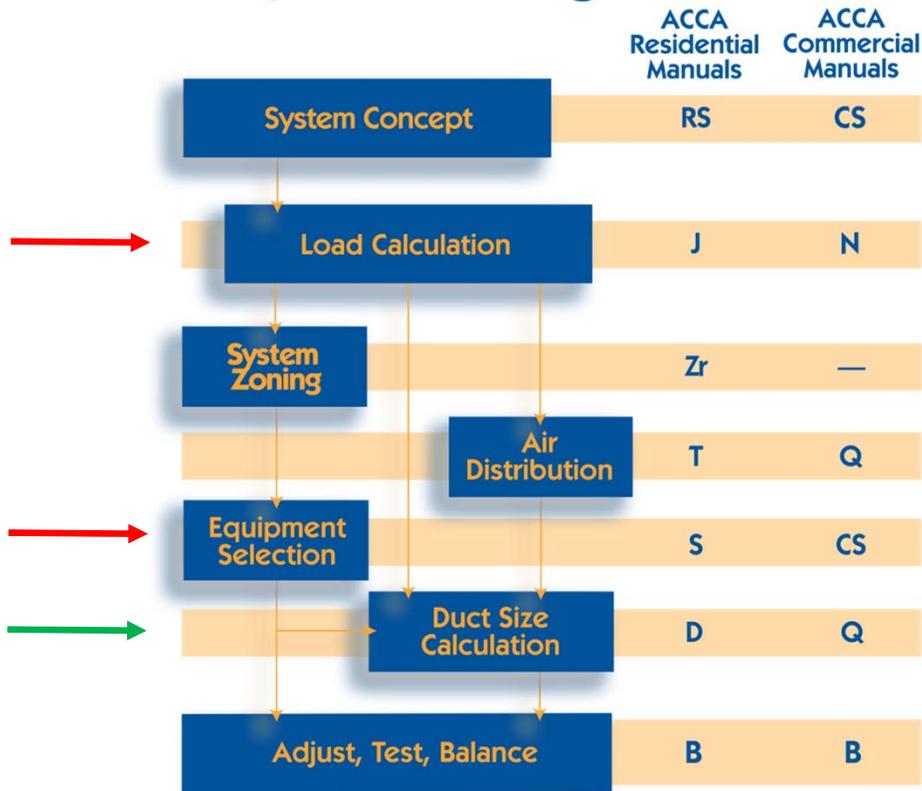
Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on *building* loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies.

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 locations where the equipment is installed.



Mechanical System Design Process

System Design Process



<https://www.acca.org/standards/technical-manuals>

ACCA Technical manuals cover design, installation and maintenance for residential and light commercial HVAC systems.

HVAC Design Impacts

- 1st construction costs
- Comfort
- Indoor air quality
- Building durability
- Energy efficiency
- Higher customer satisfaction/ lower call backs

Why the Emphasis on Sizing Equipment?

What has changed?

- Thermal envelopes have improved substantially
- Air tightness is now an important part of envelope construction
- Natural ventilation greatly reduced
- Rooms have much lower loads (Lighting)
- More moisture is retained

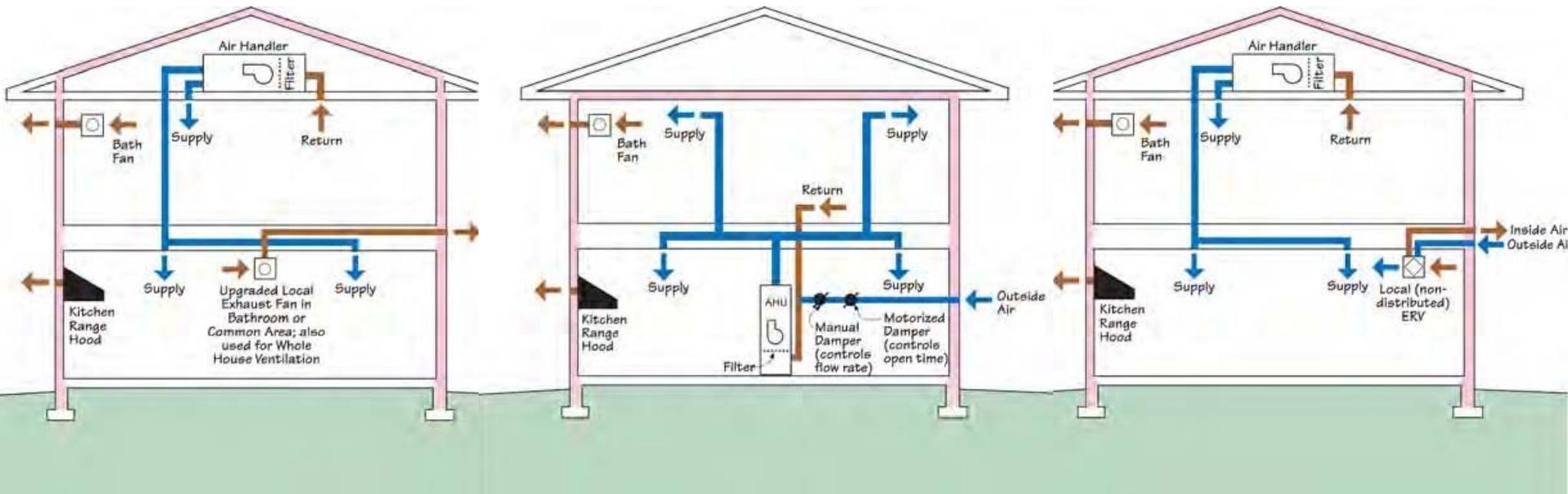
Manual J Outdoor Design Conditions

Location	Elevation Feet	Latitude Degrees North	Winter	Summer					
			Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincide nt Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)
Pocatello AP	4454	43	0	90	60	-41	-34	-28	H
Twin Falls AP	4150	42	2	95	61	-44	-37	-31	H
Illinois									
Aurora	706	41	-1	91	76	42	49	55	M
Belleville, Scott AFB	453	38	10	93	77	46	53	59	M
Bloomington	875	40	-2	90	74	31	38	44	M
Carbondale	411	37	7	93	77	46	53	59	M
Champaign/Urbana	754	40	2	92	74	28	35	41	M
Chicago, Meigs Field	593	41	3	89	73	27	34	40	M
Chicago, Midway AP	620	41	0	91	73	24	31	37	M
Chicago, O'Hare AP	668	42	-1	88	73	29	36	42	M
Chicago CO	647	41	2	91	74	30	37	43	L
Danville	696	40	1	90	74	31	38	44	M
Decatur	682	39	3	91	75	36	43	49	M

https://farm-energy.extension.org/wp-content/uploads/2019/04/7.-Outdoor_Design_Conditions_508.pdf

**#12. R403.6
Mechanical
Ventilation
(Mandatory)**

Ventilation Types (Negative, Positive, Balanced)

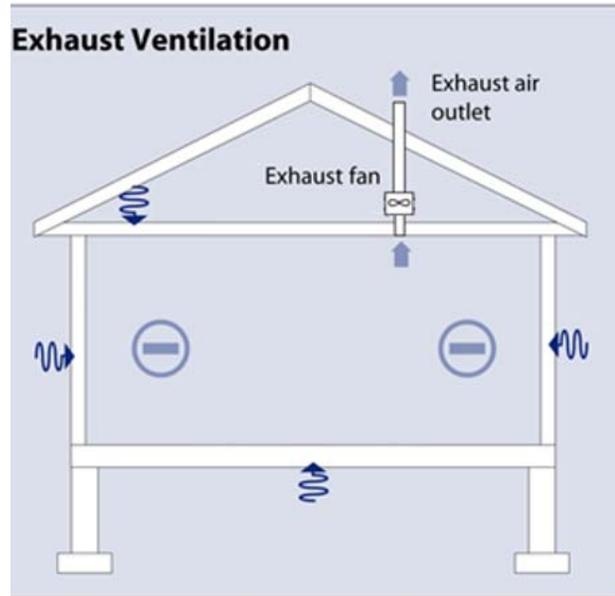


Exhaust Only Ventilation (Negative Ventilation)

Exhaust only systems use one or more fans to remove stale air. This depressurizes the building, so fresh air enters through leaks in the envelope.

Exhaust only ventilation systems are the most common design. This strategy is usually accomplished with a bath fan, which then serves as both local exhaust and whole-building ventilation.

This ventilation method is the most affordable option, but it has a few drawbacks.

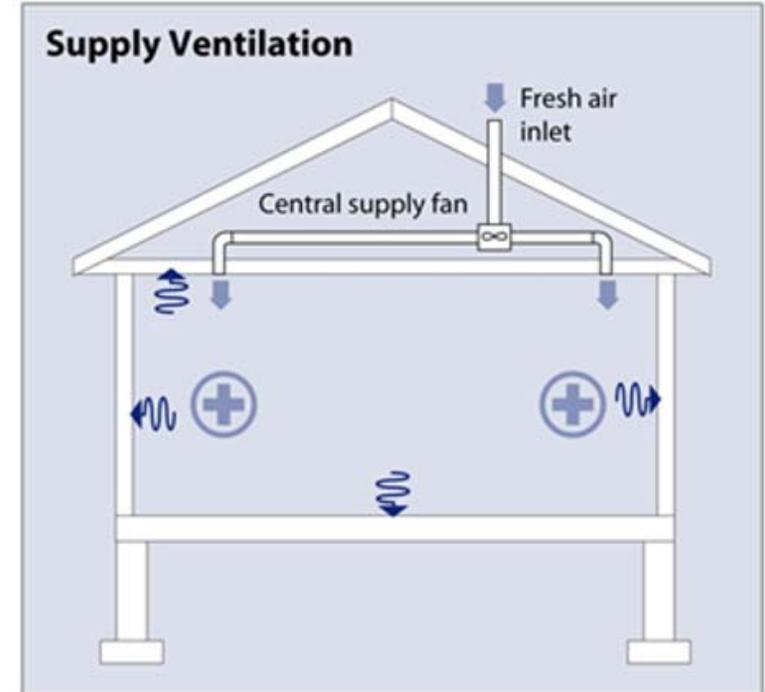
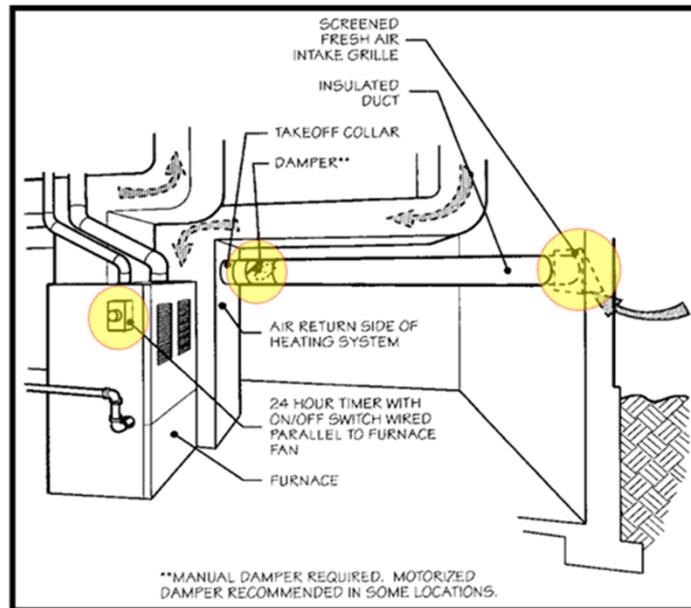


On multi-speed models, just below the easy-to-remove grille, there are dials to adjust continuous CFM levels and maximum back to continuous ventilation delay timing.

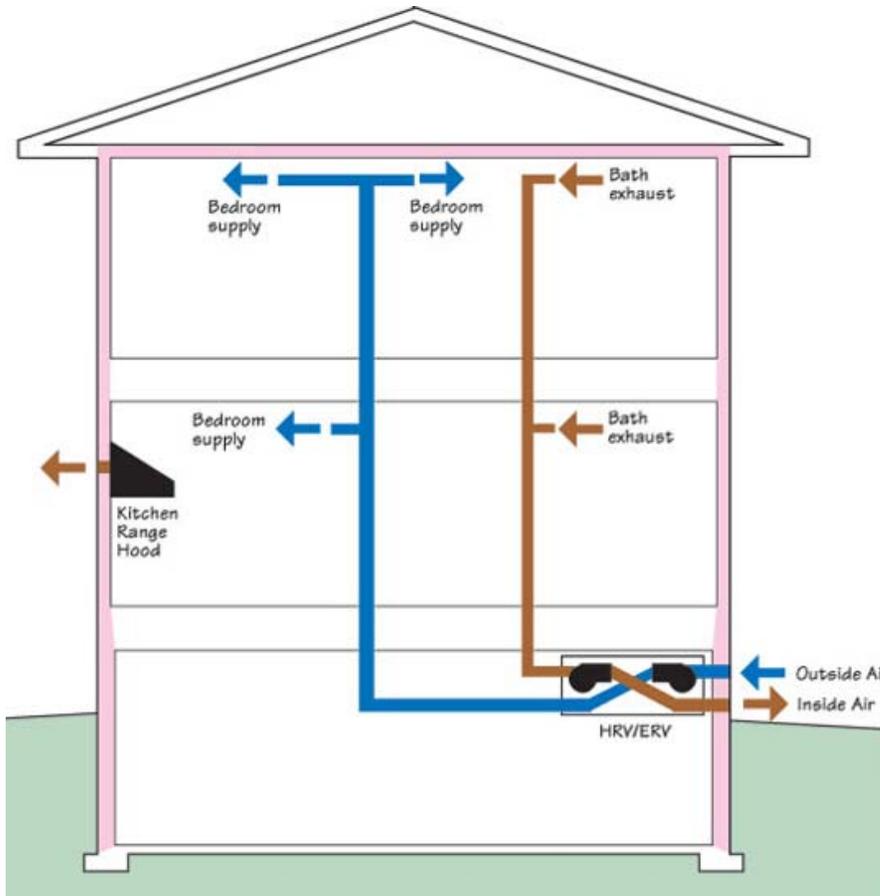
Supply Only Ventilation Types (Positive Ventilation)

Supply only systems use one or more fans to push fresh air into the building. They pressurize the building so stale air is pushed out through leaks in the envelope.

A commonly used approach to supply-only ventilation is the addition of an outdoor air intake to the return stream of a ducted system.

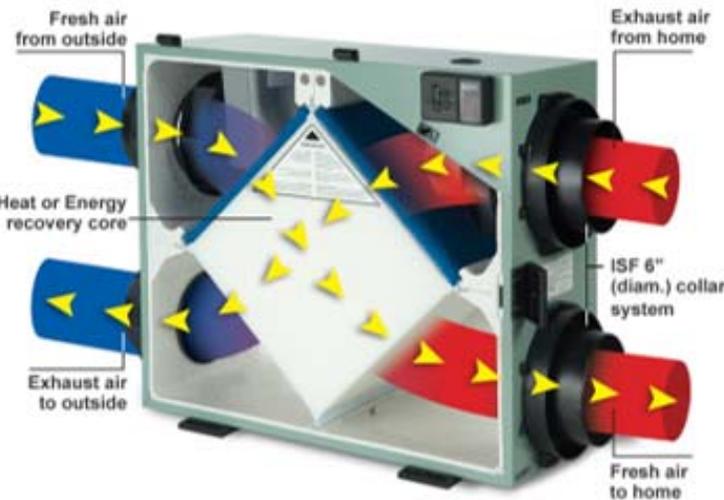


Balanced Ventilation



Balanced systems use a balanced combination of fan-driven supply and exhaust air. The supply fans bring in the same amount of air that the exhaust fans pull out, so no pressure differences are created in the house by them.

When there are two air streams, the opportunity exists to move heat and moisture from one stream into the other, improving energy use and comfort. Therefore, balanced ventilation is typically done with a pre-designed, all-in-one, system. This diagram shows how it works. We call the devices HRV's and ERV's: heat recovery ventilators and energy recovery ventilators.



Balanced ventilation is the most preferable option, but it is also the most expensive and complicated to install

Illinois Amendments Not Included in 2018 IECC

R403.6.2 Recirculation of air. (2018 IRC M1505.2)

R403.6.3 Exhaust equipment. (2018 IRC M1505.3)

R403.6.4 Whole-house mechanical ventilation system. (2018 IRC M1505.4)

- R403.6.4.1 System Design (2018 IRC M1505.4.1)
- R403.6.4.2 System Controls. (2018 IRC M1505.4.2)

R403.6.6 Mechanical Ventilation Rate. (2018 IRC M1505.4.3)

R403.6.4.3.1 Different Occupant Density.

R403.6.4.3.2 Airflow Measurement

R403.6.4.4 Local Exhaust Rates (2018 IRC M1505.4.4)

Illinois Amendments: <https://www2.illinois.gov/cdb/business/codes/Pages/IllinoisEnergyConservationCode.aspx>

Link to 2018 IRC: <https://codes.iccsafe.org/content/IRC2018>

**#13. R404.1, R402.4.5
Lighting (Mandatory)**

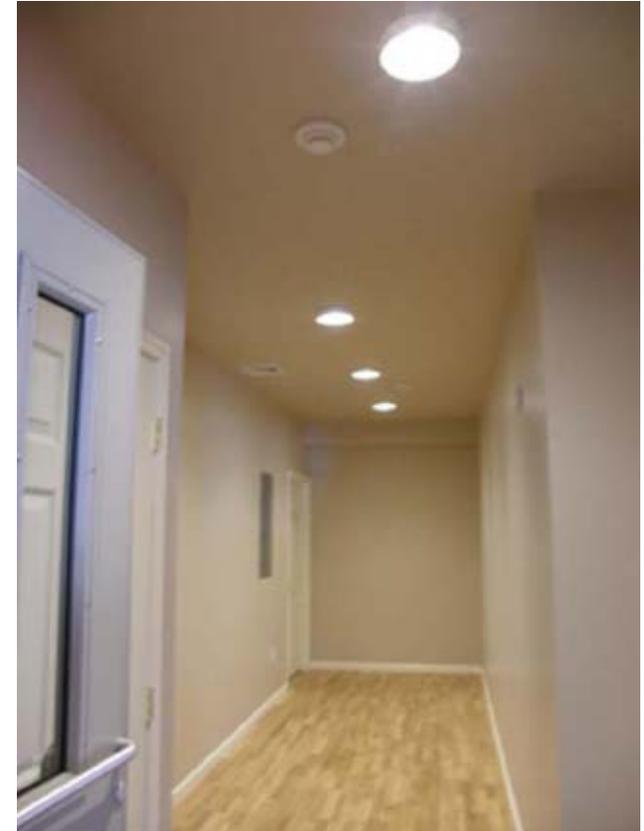
R404.1 Lighting Equipment (Mandatory)

Illinois Amendments Definitions

High-Efficacy Lamps. Compact fluorescent lamps, light-emitting diode (LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps with an efficacy of not less than 65 lumens per watt or light fixtures of not less than 55 lumens per watt.

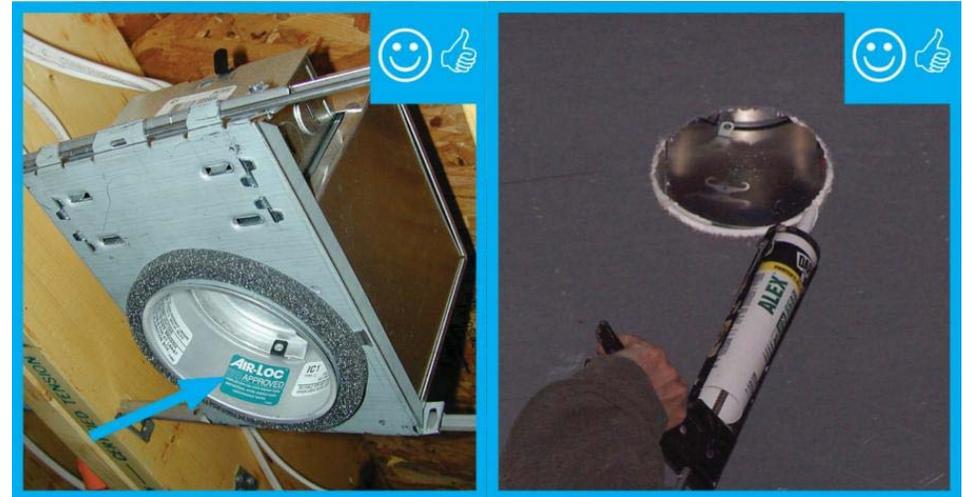
Not less than 90 percent of the permanently installed fixtures shall contain only high-efficacy lamps

Low voltage exception removed for 2018 IECC



R402.4.5 Recessed Lighting

Recessed luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. Recessed luminaires shall be IC-rated and labeled as having an air-leakage rate of not greater than 2.0 cfm when tested in accordance with ASTM E283 at a pressure differential of 1.57 psf (75 PA). Recessed luminaires shall be sealed with a gasket or caulked between the housing and interior wall or ceiling covering.



#14. R502, R503 Additions / Alterations

R502.1 Additions

Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code.

Additions shall be deemed to comply with this code where the addition alone complies, where the existing building and addition comply with this code as a single building, or where the building with the addition does not use more energy than the existing building.



R503.1 Alterations

Alterations to any building or structure shall comply with the requirements of the code for new construction. 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 they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code.



R503.1 Alterations Exception

The following are not required to comply provided the energy use of the building is not increased:

1. Storm windows 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
4. Roof recover (See definition)
5. Roofs w/o insulation in the cavity and where the sheathing or insulation is exposed during the reroofing shall be insulated either above or below the sheathing
6. Surface applied window film installed on existing single pane fenestration to reduce solar heat gain provided that the code does not require the glazing or fenestration to be replaced

R503.1 Alterations Exception



R503.1.1 Roof Membrane Peel & Replacement

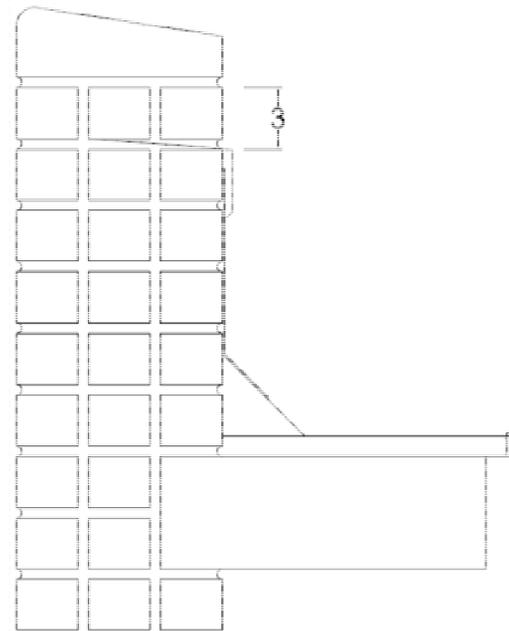
*This provision is narrow and not likely to apply as flat roofs are rarely replaced before there is a leak which would require work to be carried out on the roof insulation, eliminating the ability to use the provision.

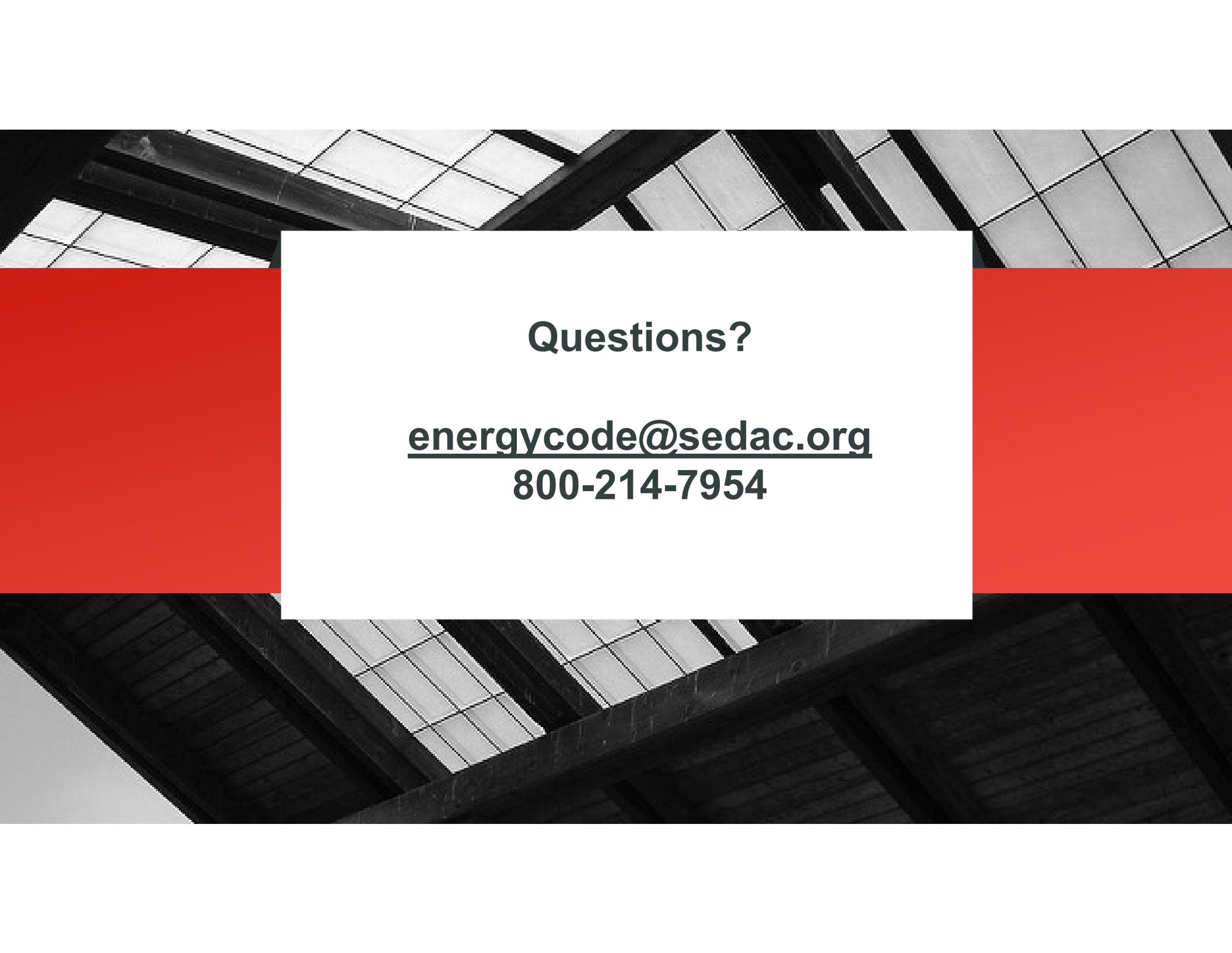
Roof membrane peel and replacement – Where an existing weather resisting roof membrane alone is removed, exposing insulation or sheathing and only a new weather resisting roof membrane is installed.

R503.1 Alterations

Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they 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 systems.





Questions?

energycode@sedac.org

800-214-7954