

25517  
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# Key Items for Plan Review & Site Inspection: 2018 IECC Residential

8.26.2020



# SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

*Providing effective energy strategies for buildings and communities*

ICC Preferred Provider # 2396  
ICC Course # 25517

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



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



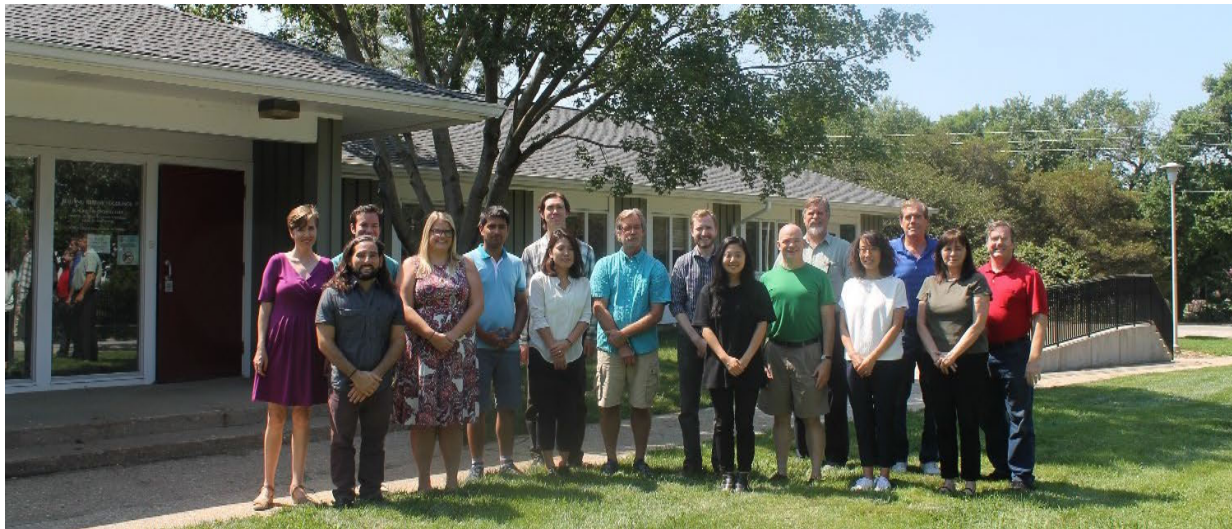
## Learning Objectives

1. Understand energy code plan review requirements for residential buildings
2. Understand energy code site inspection requirements for residential buildings
3. Learn energy code compliance documentation process for plan review and inspections for residential buildings

## 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



[www.smartenergy.illinois.edu/energy-code/](http://www.smartenergy.illinois.edu/energy-code/)

### TRAINING AND SUPPORT SERVICES



Workshops



Webinars



Online courses



Technical support

### ENERGY CODE RESOURCES



What is the Illinois  
Energy Conservation Code?



Frequently asked questions



Useful websites

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

<https://codes.iccsafe.org/content/IECC2018P4>

<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 for the 2018 International Energy Conservation Code. The top navigation bar includes 'All Codes > I-Codes' and a search box for 'Code Titles'. The main content area is titled '2018 International Energy Conservation Code' with a sub-header 'First Printing: Aug 2017'. A left sidebar contains a table of contents with links to various sections like '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'. The main content area includes a 'Legend' section explaining navigation options, a 'My Notes and Bookmarks' section, and an 'Associated Titles' section listing previous editions of the code.

## 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 errata 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 2020/2021 Series Webinars

Key items for plan review & Inspection: 2018 IECC

- Commercial Envelope: October 28<sup>th</sup> (tentative)
- Case Study/Lessons Learned: January 27<sup>th</sup> (tentative)
- Commercial Lighting: March 24<sup>th</sup> (tentative)
- Commercial HVAC: May 26<sup>th</sup> (tentative)

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

# When Does the Code Apply?

# Building Permit Application Triggers Energy Code

2015 International Residential Code, Chapter 1, Section 105, 105.2 Work Exempt from Permit – subject to local codes but generally, the following list applies:

- Building:
  - 1 story detached accessory structures <200sf; finish work; window awnings <54” extension and without supplemental support; moveable fixtures (cases, racks, counters, etc...)
  - Pools less than 24” deep
- Electrical:
  - Cord-and-plug temporary decorative lighting, Replacement of lamps.
- Gas/Mechanical:
  - Portable equipment; piping within a permitted piece of equipment; replacement of parts that don’t alter or make unsafe existing equipment; self-contained refrigeration ≤10lb of refrigeration
- Plumbing:
  - Minor leak repair (no replacement of materials); clearing of blockages.

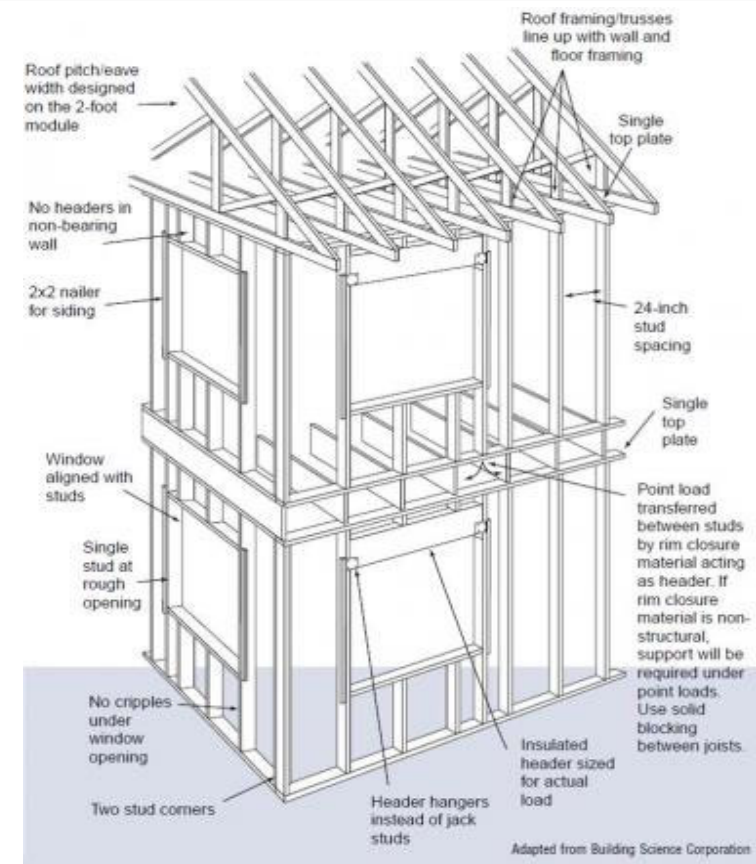
## Am I in a Residential Building?

- 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. Construction Documents [R103.2]
2. Inspections [R105]
  - a) Footing and foundation
  - b) Framing and rough-in
  - c) Plumbing rough-in
  - d) Mechanical rough-in
  - e) Final



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

# #1. R103.2 Construction Documents

## R103.2 Construction Documents

- The following shall be on the Construction Documents at a minimum:
  - Insulation materials and their R-values
  - Fenestration U-factors and SHGC
  - Area-weighted U-factors and SHGC calculations
  - Mechanical System design criteria
  - Mechanical and service water-heating systems and equipment types, sizes and efficiencies
  - Equipment and system controls
  - Duct sealing, duct and pipe insulation and location
  - Air sealing details

# Referencing Between Drawings and Specifications

- Best to have in a single source (prints or specifications) to avoid missing or conflicting data.
- If in both, include cross references to aid in speed of review.  
Also good to have a summary table of locations

|                                   | Sheet             | Spec     |
|-----------------------------------|-------------------|----------|
| Insulation Material               |                   | 07-21-16 |
| Insulation R-values               | A-6               |          |
| Fenestration U-factors            | A-8               |          |
| Fenestration SHGC                 | A-8               |          |
| Area-weighted U-factor and SHGC   | A-8               |          |
| Mechanical System Design Criteria | M-4               | 11-06-30 |
| Equipment and system controls     |                   | 11-06-30 |
| Duct Sealing                      | M-3               | 23-06-30 |
| Duct Insulation                   | M-3               | 23-06-30 |
| Pipe Insulation                   | M-2 & P-2         | 23-06-30 |
| Air Sealing Details               | A-20 through A-25 |          |

NRJ3



## Slide 16

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**NRJ3** I like this Table. Good idea. What happens if the two conflict? Could there maybe be a third column that is labeled In Conflict? or something like that. And then a fourth for Notes?

Nemeth, Robert J, 8/20/2020

# Plan Review - Code Compliance Summary Page

- Many jurisdictions include a summary form as part of application to be included in plan drawings. – Example from Peoria
- Not required, but can be helpful in review process

## BUILDING PERMIT APPLICATION

To the applicant: Please complete this application in its entirety as to what applies to your project. **THANK YOU**

|  |  |
|--|--|
| <b>PROPERTY OWNER NAME &amp; ADDRESS</b> | <b>CONTRACTOR NAME &amp; ADDRESS (if other than owner)</b> |
| _____                                    | _____  |
| _____                                    | _____  |
| _____                                    | _____  |

**PHONE:** \_\_\_\_\_ **PHONE:** \_\_\_\_\_

**EMAIL:** \_\_\_\_\_ **EMAIL:** \_\_\_\_\_

**CONSTRUCTION SITE PARCEL ID NUMBER:** \_\_\_\_\_

**CONSTRUCTION SITE 911 ADDRESS★:** \_\_\_\_\_

An address must be assigned to the parcel by the County Clerk's Office, Room 101, before we can issue any building permits.

|                        |                                   |                |
|------------------------|-----------------------------------|----------------|
| Roofers Certificate #: | (State requirement for new homes) | E.C. Permit #: |
| *PL Permit #: PL       | EL Permit #: EL                   | HVPermit #: HV |

\*A copy of Illinois plumbing license & State plumbing contractor's license is required for work completed by anyone other than homeowner.

**WATER SUPPLY:**  HD Well # \_\_\_\_\_  Public Water- Supplier\* \_\_\_\_\_

**SEWER SUPPLY:**  HD Septic # \_\_\_\_\_  Public Sewer- Agency\* \_\_\_\_\_

|                              |                    |                      |                                       |
|------------------------------|--------------------|----------------------|---------------------------------------|
| <b>STRUCTURE DIMENSIONS:</b> | <b>TOTAL AREA:</b> | <b># OF STORIES:</b> | <b>TOTAL HEIGHT:</b> (ground to peak) |
| Principal _____ x _____      | _____ sq. ft.      | _____                | _____ ft _____ in                     |
| Part Fin. Bsmt _____ x _____ | _____ sq. ft.      | _____                | _____ ft _____ in                     |
| Gar/Shed _____ x _____       | _____ sq. ft.      | _____                | _____ ft _____ in                     |
| Deck/Porch _____ x _____     | _____ sq. ft.      | Fence/Other _____    | _____ x _____ ft or total distance    |

|  |            |  |   |   |   |                                |                                |                                |
|--|------------|--|---|---|---|--------------------------------|--------------------------------|--------------------------------|
| <b>FOUNDATION</b>  | TYPE:      | <input type="checkbox"/> Basement                        | <input type="checkbox"/> Crawl                                      | <input type="checkbox"/> Slab   | Basement Finished: <input type="checkbox"/> Yes <input type="checkbox"/> No |                                |                                |                                |
|  | MATERIAL:  | <input type="checkbox"/> Block                           | <input type="checkbox"/> Poured                                     | <input type="checkbox"/> Gravel                                       | <input type="checkbox"/> Dirt   | <input type="checkbox"/> Other |                                |                                |
| <b>INTERIOR</b>  | WALLS:     | <input type="checkbox"/> Drywall                         | <input type="checkbox"/> Plaster                                    | <input type="checkbox"/> Unfinished                                   | <input type="checkbox"/> Other:   |                                |                                |                                |
|  | BEDRMS:    | # Existing: _____  | # To be added: _____  | TOTAL: _____  |   |                                |                                |                                |
|  | BATHRMS:   | # Existing: _____  | # To be added: _____  | TOTAL: _____  |   |                                |                                |                                |
|  | HEAT:      | <input type="checkbox"/> Electric                        | <input type="checkbox"/> Gas  | <input type="checkbox"/> Geothermal                                   | <input type="checkbox"/> Wood   | <input type="checkbox"/> Solar | <input type="checkbox"/> None  | <input type="checkbox"/> Other |
|  | FIREPLACE: | <input type="checkbox"/> Yes <input type="checkbox"/> No | WHIRLPOOL: <input type="checkbox"/> Yes <input type="checkbox"/> No | CENTRAL AIR: <input type="checkbox"/> Yes <input type="checkbox"/> No |   |                                |                                |                                |
|  | FLU TYPE:  | <input type="checkbox"/> Brick                           | <input type="checkbox"/> Direct Vent                                | <input type="checkbox"/> Metalbestos                                  | <input type="checkbox"/> Other:   |                                |                                |                                |
| <b>PLUMBING FIXTURES:</b>  |            | # Existing: _____  | # To be added: _____  | TOTAL: _____  |   |                                |                                |                                |
| Fixtures include: floor drains, water heaters, bidets, lavs, bathtubs, sinks, toilets, showers, washers, floor drains, sewage ejector  |            |  |   |   |   |                                |                                |                                |
| <b>ELECTRICAL:</b> New service: <input type="checkbox"/> Yes <input type="checkbox"/> No Wiring/Rewiring: <input type="checkbox"/> Yes <input type="checkbox"/> No Generator: <input type="checkbox"/> Yes <input type="checkbox"/> No |            |  |   |   |   |                                |                                |                                |
| <b>EXTERIOR</b>  | WALLS:     | <input type="checkbox"/> Aluminum                        | <input type="checkbox"/> Brick                                      | <input type="checkbox"/> Metal  | <input type="checkbox"/> Vinyl  | <input type="checkbox"/> Wood  | <input type="checkbox"/> Combo | <input type="checkbox"/> Other |
|  | ROOF:      | <input type="checkbox"/> Asphlt Shngl                    | <input type="checkbox"/> Tile                                       | <input type="checkbox"/> Concrete                                     | <input type="checkbox"/> Slate  | <input type="checkbox"/> Metal | <input type="checkbox"/> Wood  | <input type="checkbox"/> Other |



# Plan Review - Code Compliance Summary Page

- Example from Chicago Bldg. Dept. for Energy Code Specifically
- Could be copied into plan page for easy reference for officials and designers

| 3. Compliance Method  |  |   |
|---|--|---|
| <input type="checkbox"/>  | <b>A. COMcheck (RECOMMENDED)</b>                 | <i>visit <a href="http://www.energycodes.gov/comcheck">www.energycodes.gov/comcheck</a> for more info</i> |
| A COMcheck compliance certificate demonstrating the project's compliance with IECC-2018 or ASHRAE 90.1-2016 is attached to this compliance statement. Accurate information about the project was entered into COMcheck.   |  |   |
| <input type="checkbox"/>  | <b>B. IECC Prescriptive Path</b>                 |   |
| A report or narrative substantiating how the project complies with the prescriptive requirements of the Energy Conservation Code, including C402, C403, C404, and C405 is attached to this compliance statement. The project meets C406 by providing (select one):              |  |   |
| <input type="checkbox"/>  | more efficient HVAC performance                  | <input type="checkbox"/> reduced lighting power density system  |
| <input type="checkbox"/>  | on-site supply of renewable energy               | <input type="checkbox"/> dedicated outdoor air system for HVAC  |
| <input type="checkbox"/>  | enhanced envelope performance                    | <input type="checkbox"/> reduced air infiltration   |
| <input type="checkbox"/>  |  | <input type="checkbox"/> enhanced lighting controls   |
| <input type="checkbox"/>  |  | <input type="checkbox"/> high-efficiency service water heating  |
| <input type="checkbox"/>  |  | <input type="checkbox"/> exception: prev. occupied tenant space   |
| <input type="checkbox"/>  | <b>C. IECC Total Building Performance Method</b> |   |
| The project complies with C407 and a compliance report meeting the requirements of C407.4.1 is attached to this compliance statement. An explanation of any error or warning messages appearing in the simulation tool output is also attached.                                 |  |   |
| <input type="checkbox"/>  | <b>D. ASHRAE 90.1 Prescriptive Path</b>          |   |
| The project complies with sections 5, 6, 7, 8, 9 and 10 of ASHRAE 90.1-2016, as detailed below, and complete compliance forms from the 2016 edition of the 90.1 User's Manual or equivalent documentation is attached to this compliance statement. (select one in each column) |  |   |
| <input type="checkbox"/>  | 5.5 prescriptive building envelope               | <input type="checkbox"/> 6.3 simplified HVAC  |
| <input type="checkbox"/>  | 5.6 building envelope trade-off                  | <input type="checkbox"/> 6.5 HVAC prescriptive path   |
| <input type="checkbox"/>  |  | <input type="checkbox"/> 6.6 HVAC alternative compliance path   |
| <input type="checkbox"/>  |  | <input type="checkbox"/> 9.5 lighting - building area method  |
| <input type="checkbox"/>  |  | <input type="checkbox"/> 9.6 lighting - space-by-space method   |
| <input type="checkbox"/>  | <b>E. ASHRAE 90.1 Energy Cost Budget</b>         |   |
| The project complies with section 11 of ASHRAE 90.1-2016, and documentation complying with section 11.7 is attached to this compliance statement.   |  |   |
| <input type="checkbox"/>  | <b>F. ASHRAE 90.1 Performance Rating Method</b>  |   |
| The project complies with normative appendix G of ASHRAE 90.1-2016, and a simulated performance report, complying with section G1.3, is attached to this compliance statement.  |  |   |

# Plan Review – Envelope

# Code Compliance in Schedule Sheets

| WINDOW AND DOOR SCHEDULE |                         |             |                    |                   |                                 |                   |      |      |                           | IL-ECC 2018 REQUIREMENT |                        |                           |
|--------------------------|-------------------------|-------------|--------------------|-------------------|---------------------------------|-------------------|------|------|---------------------------|-------------------------|------------------------|---------------------------|
| TAG                      | TYPE                    | MATERIAL    | NOMINAL DIM. (WXH) | PROJECTION FACTOR | MANUF-MODEL NO.                 | ASSEMBLY U-FACTOR | SHGC | VT   | AIR LEAKAGE RATE (CFM/SF) | CODE U-FACTOR           | CODE SHGC FOR GIVEN PF | CODE AIR LEAKAGE (CFM/SF) |
| W1                       | FIXED                   | ANNO. ALUM. | 7'0" x 7'0"        | 0.15              | ABC WINDOW-D999 SERIES OR EQUAL | 0.33              | 0.38 | 0.51 | 0.16                      | 0.38                    | SEW: 0.38, N:0.51      | 0.20                      |
| W1A                      | FIXED & CASEMENT        | ANNO. ALUM. | 7'0" x 7'0"        | 0.15              | ABC WINDOW-D999 SERIES OR EQUAL | 0.35              | 0.39 | 0.51 | 0.18                      | 0.38                    | SEW: 0.38, N:0.51      | 0.20                      |
| W2                       | CASEMENT                | ANNO. ALUM. | 4'6" x 2'3"        | 0.15              | ABC WINDOW-D999 SERIES OR EQUAL | 0.42              | 0.39 | 0.51 | 0.18                      | 0.45                    | SEW: 0.38, N:0.51      | 0.20                      |
| SW1                      | SKYLIGHT                | ANNO. ALUM. | 2'10" x 5'2"       | 0.00              | SKLT CO - TH123 OR EQUAL        | 0.40              | 0.38 | 0.53 | 0.18                      | 0.50                    | 0.40                   | 0.30                      |
| W5                       | STOREFRONT FIXED        | ANNO. ALUM. | SEE PLAN A301-A305 | 0.15              | SFT CO. - CW123 OR EQUAL        | 0.36              | 0.38 | 0.53 | 0.05                      | 0.38                    | SEW: 0.38, N:0.51      | 0.06                      |
| D1                       | STOREFRONT - ENTRY DOOR | GLASS/METAL | 3'0" - 7'6"        | 0.15              | SFT CO. - DW321 OR EQUAL        | 0.60              | 0.38 | 0.53 | 0.18                      | 0.77                    | SEW: 0.38, N:0.51      | 1.00                      |
| D2                       | OPAQUE SWINGING DOOR    | METAL       | 3'0" - 7'6"        | 0.15              | AMERICAN DOOR - #89 OR EQUAL    | 0.35              | N/A  | N/A  | 0.18                      | 0.37                    | N/A                    | N/A                       |

Sample fenestration schedule with added code-compliance summary



# Plan Review – Insulation Summary in Notes/Details

- In architectural plan summary page, include table with insulation summary
  - Code required R-value/U-factor, Design values, and applicable areas
  - For fenestration, also include code and design SHGC.
- For UA trade-offs, include minimally compliant UA vs. calculated UA

## Compliance: Fails using UA trade-off

Compliance: **87.5% Worse Than Code**

Maximum UA: **335**

Your UA: **628**

The % Better or Worse Than Code Index reflects how close to compliance the house is based on code trade-off rules. It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

## Envelope Assemblies

| Assembly  | Gross Area or Perimeter | Cavity R-Value | Cont. R-Value | U-Factor | UA  |
|---|-------------------------|----------------|---------------|----------|-----|
| Ceiling: Flat Ceiling or Scissor Truss  | 960                     | 23.0           | 0.0           | 0.043    | 41  |
| Wall: Wood Frame, 16" o.c.  | 2,418                   | 15.0           | 0.0           | 0.077    | 147 |
| Door: Solid Door (under 50% glazing)  | 40                      |                |               | 0.300    | 12  |
| Window 1: Metal Frame   | 18                      |                |               | 1.000    | 18  |
| Window: Vinyl Frame   | 450                     |                |               | 0.300    | 135 |
| Basement: Solid Concrete or Masonry<br>Wall height: 7.0'<br>Depth below grade: 5.0'<br>Insulation depth: 0.0' | 854                     | 0.0            | 0.0           | 0.322    | 275 |

## R402.4 Air Barrier Construction

The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

Be sure to include appropriate detailing for building joints and fenestration. (See table R402.4.1.1)

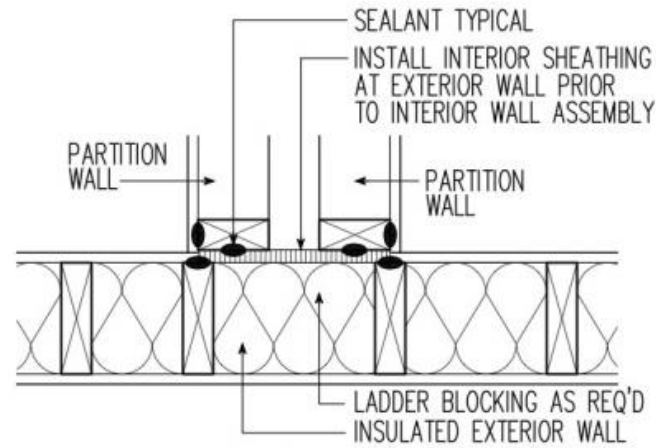
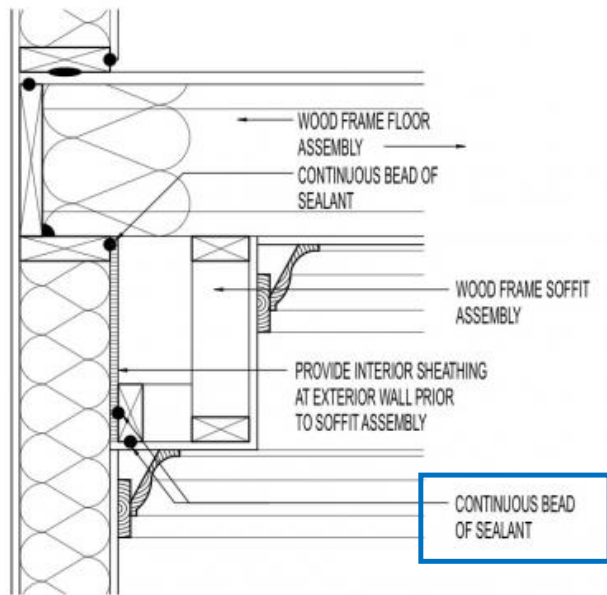
**TABLE R402.4.1.1**  
**AIR BARRIER AND INSULATION INSTALLATION<sup>a</sup>**

| <b>COMPONENT</b>     | <b>AIR BARRIER CRITERIA</b>   | <b>INSULATION INSTALLATION CRITERIA</b>   |
|----------------------|---|---|
| General requirements | A continuous air barrier shall be installed in the building envelope.<br>The exterior thermal envelope contains a continuous air barrier.<br>Breaks or joints in the air barrier shall be sealed.   | Air-permeable insulation shall not be used as a sealing material.                   |
| Ceiling/attic        | 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.<br>Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed. | The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. |

# Plan Review – Air Barrier/Thermal Barrier Details

- Section views of walls and details of joints between dissimilar materials should show the continuity of the thermal and air barriers clearly. Show sealing compounds between joints/materials, too.

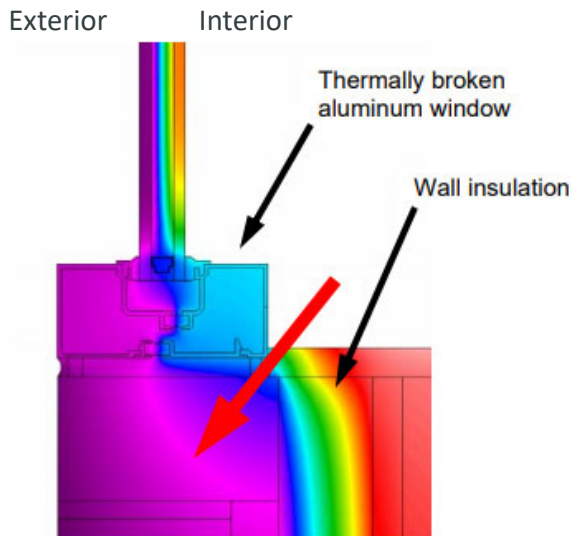
Image Source: <https://basc.pnnl.gov/cad-files>





# Impact of Thermal Alignment Between Assemblies

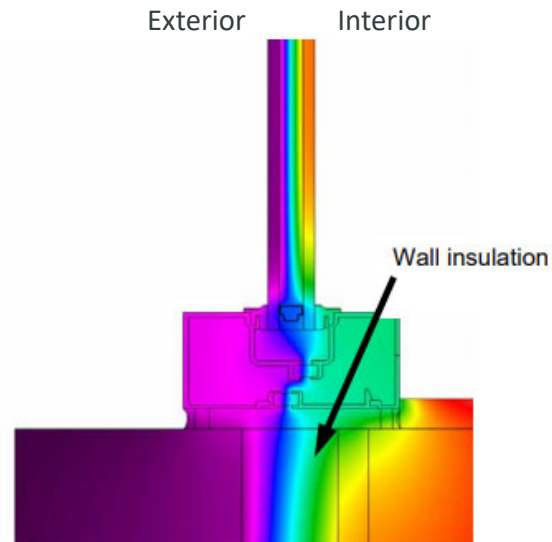
- Aligning thermal barrier between assemblies ensures minimized thermal bridging.
- Example below shows aligning window thermal break with wall insulation to minimize sill bridging



**Figure 4**

THERM model results showing heat flow path between insulation and window frame (red arrow)

$T_{\text{interior}} = 70^{\circ}\text{F}$   
 $T_{\text{exterior}} = 0^{\circ}\text{F}$



**Figure 5**

Alignment of the window with the wall insulation provides better continuity between insulating components and lowers heat loss at the window perimeter

$T_{\text{interior}} = 70^{\circ}\text{F}$   
 $T_{\text{exterior}} = 0^{\circ}\text{F}$

## Slide 24

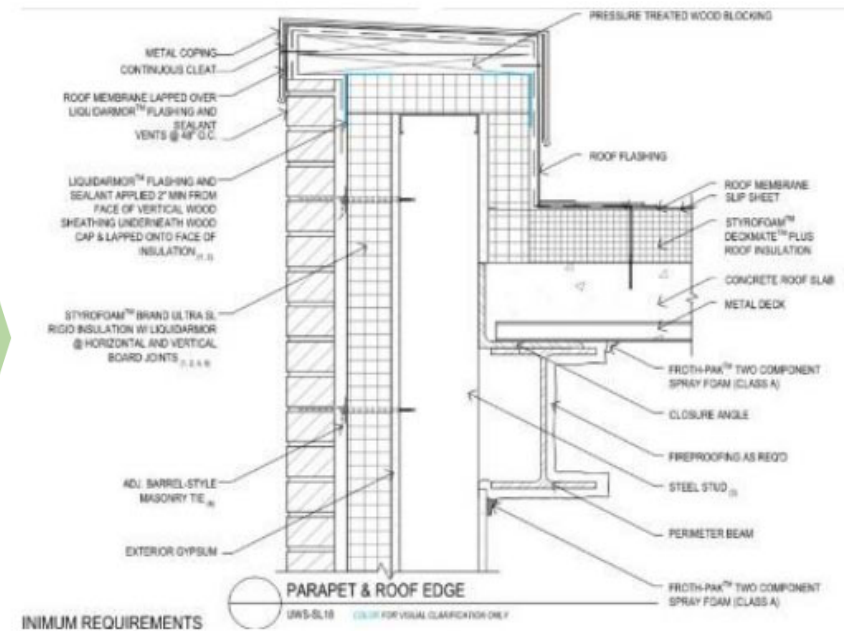
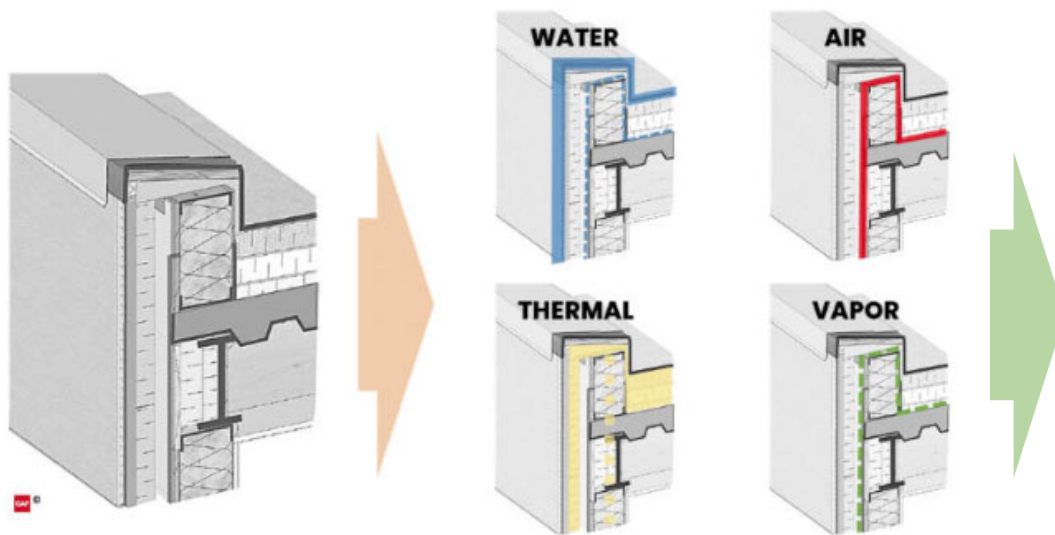
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**NRJ5** I would label Inside and Outside so that viewers don't have to figure it out themselves, or if someone downloads the file and wonders about it.

Nemeth, Robert J, 8/20/2020

# Impact of Thermal Alignment Between Assemblies (2)

- Alignment of thermal barrier between wall and above-deck roof insulation often a difficult detail. Again, call out sealing between differing materials and joints between assemblies.

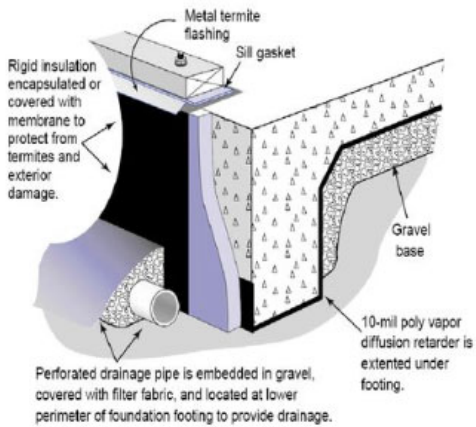


Source: <https://www.buildingenclosureonline.com/articles/88782-ceu-parapetscontinuity-of-control-layers>

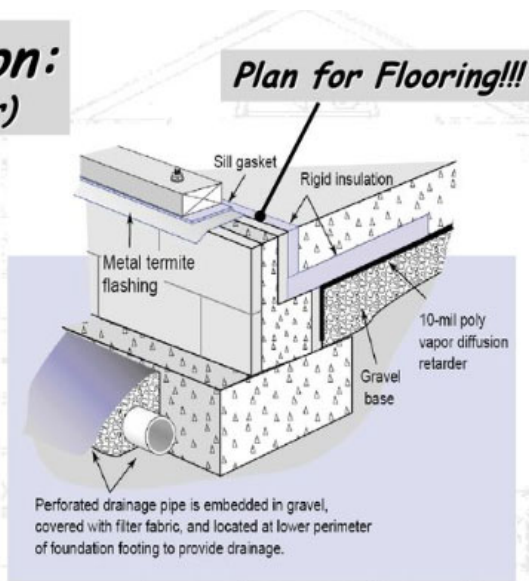
# Slab Edge Thermal Details

- R-10 for slab edge, R-5 under heated (hydronic or electric) slab on grade.

## Slab Edge Insulation: (Climate Zones 4 and higher)

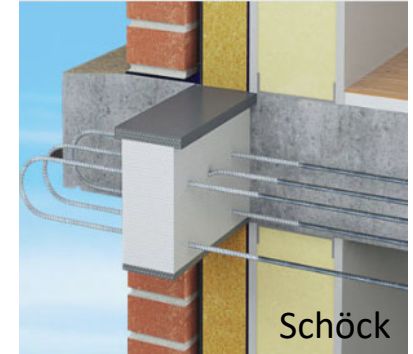
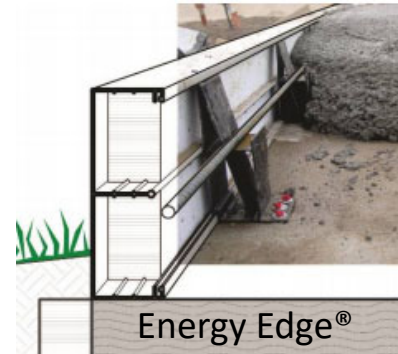


Exterior



Interior

Various supported edge insulation technologies.




# Plan Review - Mechanical

# Mechanical Compliance Summary

| System           | Type       | Size        | Efficiency |
|------------------|------------|-------------|------------|
| Heating          | Forced Air | 80,000 BTUh | 92% AFUE   |
| Air Conditioning | Forced Air | 36,000 BTUh | 13 SEER    |
| Water Heating    | Heat Pump  | 50 gal      | 3.5 EF     |

- As with Architectural Summary for envelope, a summary can be inserted at the mech. schedule, or as the 1<sup>st</sup> mechanical page with other summary items.
- Summary covers R103.2 required information: design criteria, system types, efficiencies...

| FORM J1 <sub>AE</sub> • ABRIDGED VERSION of MANUAL J, 8TH EDITION |      |                           |          |                  |        |   |
|---|------|---------------------------|----------|------------------|--------|---|
| Project   | Home | Design State & City       | Illinois | Champaign/Urbana |        | <br>Block Load |
| Indoor Design Heating db  | 70   | @ Outdoor (Winter) 99% db | 2        | HTD              | 68     |   |
| Indoor Design Cooling db  | 75   | @ Outdoor (Summer) 1% db  | 92       | CTD              | 17     |   |
| Indoor Design Cooling RH  | 50%  | Grains Difference         | 35       | Daily Range      | Medium |   |
| Latitude  | 40   | Elevation                 | 754      | ACF              | 0.978  |   |

# System Control Narratives

- Document initial thermostat settings/schedule
- ie: M-F 9-5 65/85 NRJ6
- All other times 70/78



## Slide 29

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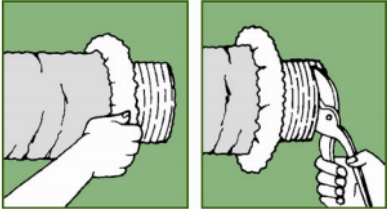
**NRJ6** I think we should also mention Nest and similar thermostats that are self-learning. Far more sophisticated than simple set schedules. You've got enough room on the slide and most importantly, it would provide color!

Nemeth, Robert J, 8/20/2020

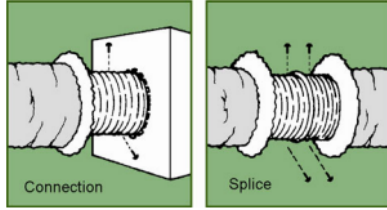


# Duct Sealing

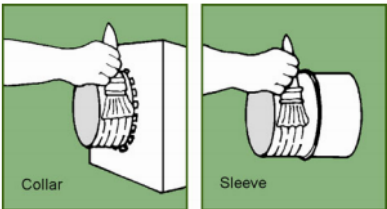
1. After cutting duct to desired length, fold back jacket and insulation exposing core. Trim core ends squarely using suitable metal shears. Determine optional sealing method (Steps 2 or 5) before proceeding.



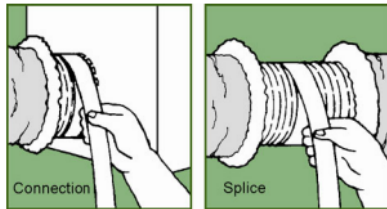
4. Secure to collar/sleeve using #8 sheet metal screws spaced equally around circumference. Use 3 screws for diameters under 12" [300 mm] and 5 screws for diameters 12" [300 mm] and over.



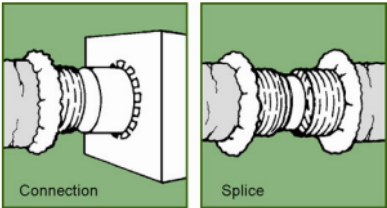
2. When mastics are required and for pressures 4" w.g. [1000 Pa] and over, seal joint with mastic applied uniformly to the outside surface of collar/sleeve. (Disregard this step when not using mastics and proceed to Step 3).



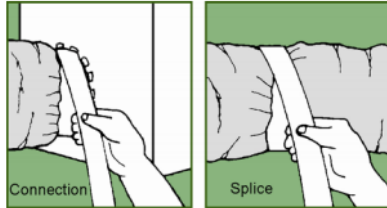
5. For pressures under 4" w.g. [1000 Pa] seal joint using 2 wraps of duct tape applied over screw heads and spirally lapping tape to collar/sleeve. (Disregard this step when using mastics per Step 2).



3. Slide at least 1" [25 mm] of core over metal collar for attaching duct to take off or over ends of a 4" [100 mm] metal sleeve for splicing 2 lengths of duct.



6. Pull jacket and insulation back over core. Tape jacket with 2 wraps of duct tape. A clamp may be used in place of or in combination with the duct tape.



## NOTES:

1. For uninsulated air ducts and air connectors, disregard references to insulation and jacket.
2. Use mastics listed and labeled to Standard UL 181B and marked "181B-M" on container.
3. Use tapes listed and labeled to Standard UL 181B and marked "181B-FX".
4. Nonmetallic clamps shall be listed and labeled in accordance with Standard UL 181B and marked "181B-C".

20

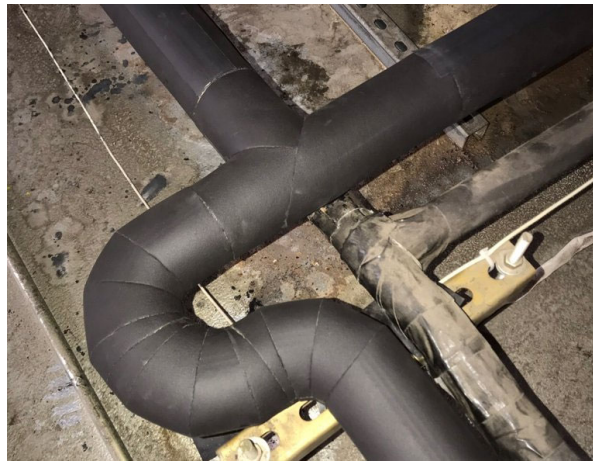
ADC Flexible Duct Performance & Installation Standards, 5th Edition

- Details commonly missing in drawings for sealing at joints between ducts.
- Most details maintain proper duct radius and transitions, proper install of diffusers away from bends, etc...
- Duct sealing and joining depends on materials.
  - Excellent flex-duct reference
  - <https://flexibleduct.org/images/ADC~IR5E.pdf>

# Plan Review - Plumbing

## Focus on detail drawings for proper insulation of pipes

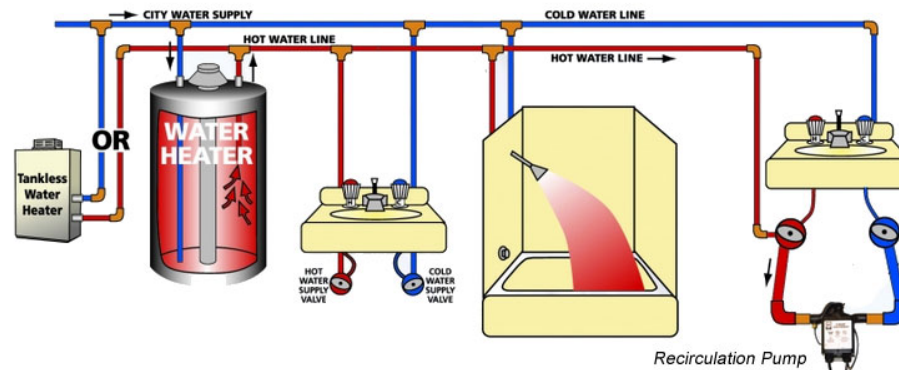
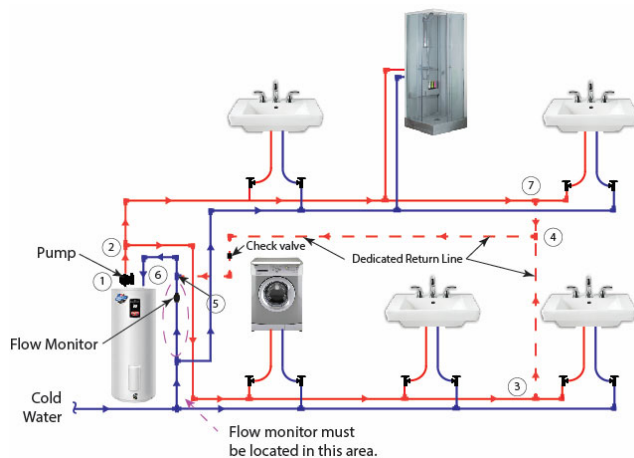
- Identify locations that may require insulation
  - Mechanical System piping (both lines [ $>105F$  or  $<55F$ ])
  - Typically lines adjacent to hot water tank (3/4" or larger)
  - Dedicated hot water recirculation systems
  - Other items in R403.5.3



Mitered joints ensure no compression or splitting open of insulation.

## R403.5.1.1 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.”
- R403.5.2: “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  $\leq 104$  °F.”



# Plan Review - Electrical

## Required Documentation for R404




- Lighting fixture schedule with lumens, wattage, and quantities.
- Helpful to include lumens per watt

| Fixture | Lumens | Wattage | Lm/W | Fixture Quantity | % of total |
|---------|--------|---------|------|------------------|------------|
| A       | 1100   | 12      | 92   | 50               | 35%        |
| B       | 840    | 9       | 93   | 72               | 50%        |
| C       | 635    | 65      | 10   | 12               | 8%         |
| D       | 450    | 6       | 75   | 8                | 6%         |
| E       | 536    | 12      | 45   | 2                | 1%         |

# Plan Review – Software Compliance

# Plan Review with Software Compliance

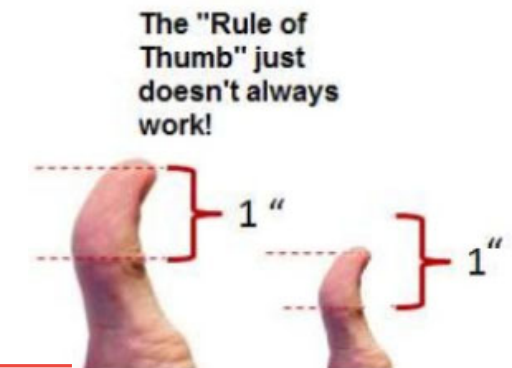
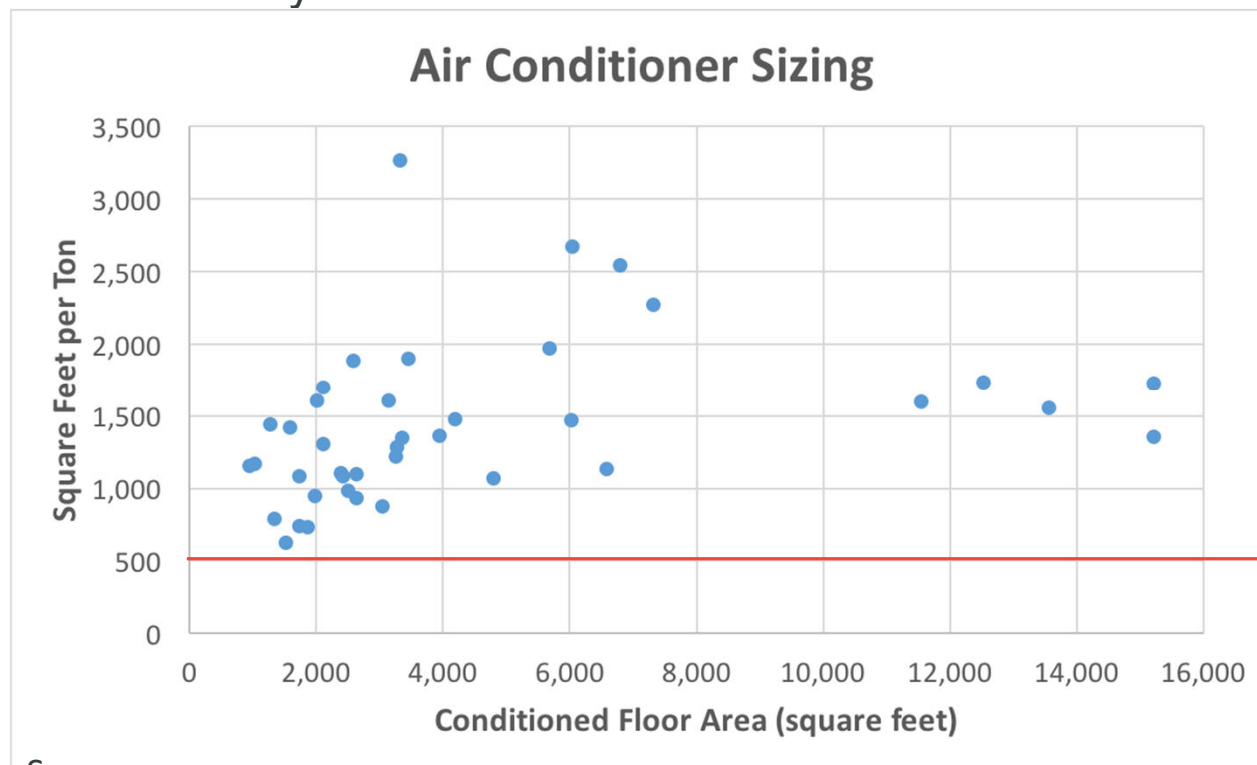
REScheck makes process easy with each code section's documentation requirements in a checklist – can fill in location of information in plans/specs.

| Section # & Req.ID  | Foundation Inspection   | Plans Verified Value | Field Verified Value | Complies?  | Comments/Assumptions                                 |
|---|---|----------------------|----------------------|--|--|
| 402.1.1 [FO4] <sup>1</sup><br>   | Conditioned basement wall insulation R-value. Where interior insulation is used, verification may need to occur during Insulation Inspection. Not required in warm-humid locations in Climate Zone 3. | R-____<br>R-____     | R-____<br>R-____     | <input type="checkbox"/> Complies<br><input type="checkbox"/> Does Not<br><input type="checkbox"/> Not Observable<br><input type="checkbox"/> Not Applicable | <i>See the Envelope Assemblies table for values.</i> |
| 303.2 [FO5] <sup>1</sup><br>   | Conditioned basement wall insulation installed per manufacturer's instructions.   |                      |                      | <input type="checkbox"/> Complies<br><input type="checkbox"/> Does Not<br><input type="checkbox"/> Not Observable<br><input type="checkbox"/> Not Applicable |  |
| 402.2.9 [FO6] <sup>1</sup><br> | Conditioned basement wall insulation depth of burial or distance from top of wall.  | ____ ft              | ____ ft              | <input type="checkbox"/> Complies<br><input type="checkbox"/> Does Not<br><input type="checkbox"/> Not Observable<br><input type="checkbox"/> Not Applicable | <i>See the Envelope Assemblies table for values.</i> |



# What about Rules of Thumb?

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

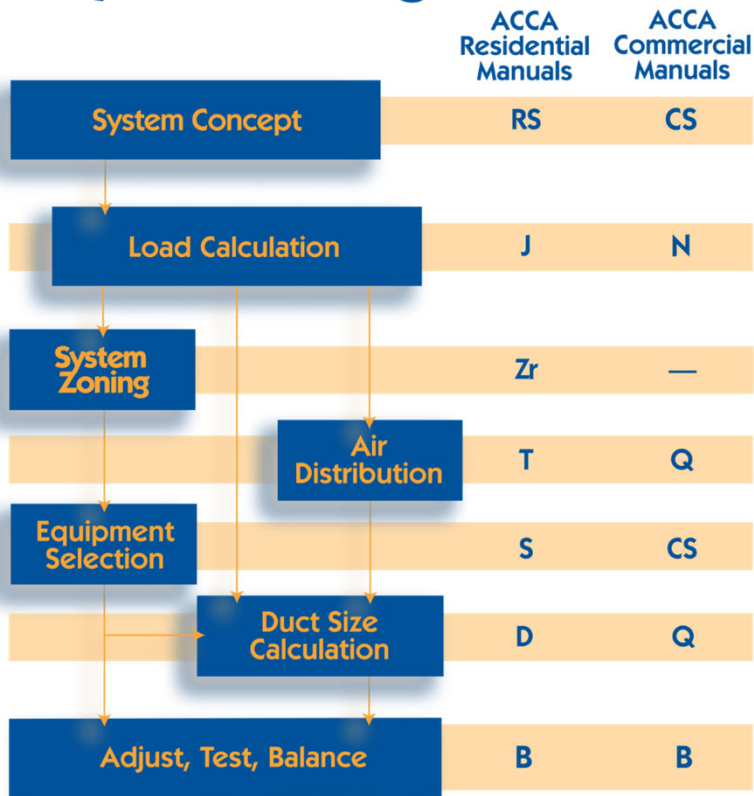


Source :

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

# 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

# Manual J Outdoor Design Conditions

NRJ8


| Location              | Elevation<br>Feet | Latitude<br>Degrees<br>North | Winter                     | Summer                    |                            |                            |                            |                            |                        |
|-----------------------|-------------------|------------------------------|----------------------------|---------------------------|----------------------------|----------------------------|----------------------------|----------------------------|------------------------|
|                       |                   |                              | Heating<br>99% Dry<br>Bulb | Cooling<br>1% Dry<br>Bulb | Coincide<br>nt Wet<br>Bulb | Design<br>Grains<br>55% RH | Design<br>Grains<br>50% RH | Design<br>Grains<br>45% RH | Daily<br>Range<br>(DR) |
| Pocatello AP          | 4454              | 43                           | 0                          | 90                        | 60                         | -41                        | -34                        | -28                        | H                      |
| Twin Falls AP         | 4150              | 42                           | 2                          | 95                        | 61                         | -44                        | -37                        | -31                        | H                      |
| <b>Illinois</b>       |                   |                              |                            |                           |                            |                            |                            |                            |                        |
| 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](https://farm-energy.extension.org/wp-content/uploads/2019/04/7.-Outdoor_Design_Conditions_508.pdf)

Ranges: -4-10 88-93



FORM J1<sub>AE</sub> • ABRIDGED VERSION of MANUAL J, 8TH EDITION

| Project                  |                       | Home            |   | Design State & City |     | Illinois    |             | Champaign/Urbana |              |  |
|--------------------------|-----------------------|-----------------|---|---------------------|-----|-------------|-------------|------------------|--------------|---|
| Indoor Design Heating db |                       | 70              | @ Outdoor (Winter) 99% db                         |                     | 2   | HTD         |             | 68               |              |   |
| Indoor Design Cooling db |                       | 75              | @ Outdoor (Summer) 1% db                          |                     | 92  | CTD         |             | 17               |              |   |
| Indoor Design Cooling RH |                       | 50%             | Grains Difference                                 |                     | 35  | Daily Range |             | Medium           |              |   |
| Latitude                 |                       | 40              | Elevation   |                     | 754 | ACF         |             | 0.978            |              |   |
|                          |                       | Glass Direction | Construction Detail                               |                     |     | Heating HTM | Cooling HTM | Net Area         | Heating BTUH | Cooling BTUH  |
| 6A                       | Windows & Glass Doors | N               | Double Pane Window                                |                     |     | 37.40       | 23.00       | 35               | 1309         | 805   |
|                          |                       | E/W             | Double Pane Window                                |                     |     | 37.40       | 71.00       | 182              | 6788         | 12887   |
|                          |                       | S               | Double Pane Window                                |                     |     | 37.40       | 37.00       | 53               | 1982         | 1961  |
|                          |                       | E/W             | Single Pane Window                                |                     |     | 86.36       | 86.00       | 69               | 5959         | 5934  |
|                          |                       | N               | Double Pane Window                                |                     |     | 37.40       | 23.00       | 61               | 2272         | 1397  |
|                          |                       | E/W             | Double Pane Window                                |                     |     | 37.40       | 65.59       | 118              | 4404         | 7723  |
|                          |                       | S               | Double Pane Window                                |                     |     | 37.40       | 26.31       | 52               | 1935         | 1361  |
| 6B                       | Skylights             |                 |   |                     |     |             |             |                  |              |   |
|                          |                       |                 |   |                     |     |             |             |                  |              |   |
|                          |                       |                 |   |                     |     |             |             |                  |              |   |
| 7                        | Wood & Metal Doors    | a               | Metal, Polystyrene core, w storm                  |                     |     | 14.28       | 5.46        | 42               | 600          | 229   |
|                          |                       | b               |   |                     |     |             |             |                  |              |   |
|                          |                       | c               |   |                     |     |             |             |                  |              |   |
| 8                        | Above Grade Walls     | a               | 12B-0s, frame constrution, no board, R-11, Siding |                     |     | 6.60        | 2.34        | 2280             | 15039        | 5330  |
|                          |                       | b               | 15A-0fc-x, concrete block, no board, no finish    |                     |     | 20.67       | 5.29        | 244              | 5044         | 1291  |
|                          |                       | c               |   |                     |     |             |             |                  |              |   |

## Slide 41

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**NRJ7** How does one select grains difference? the 35 is for 50% RH on the previous page. why was 50% selected?

Nemeth, Robert J, 8/21/2020

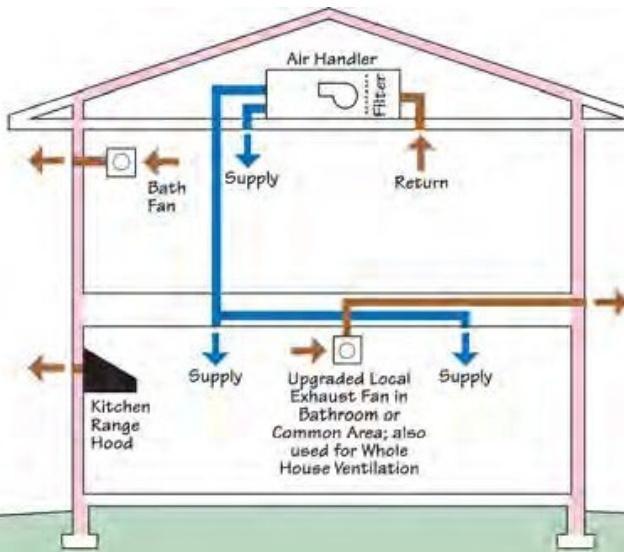
**RS1** Grains are calculated by the speed sheet. the 50% is adjustable from I believe 40-60%.

Ryan Siegel, 8/25/2020

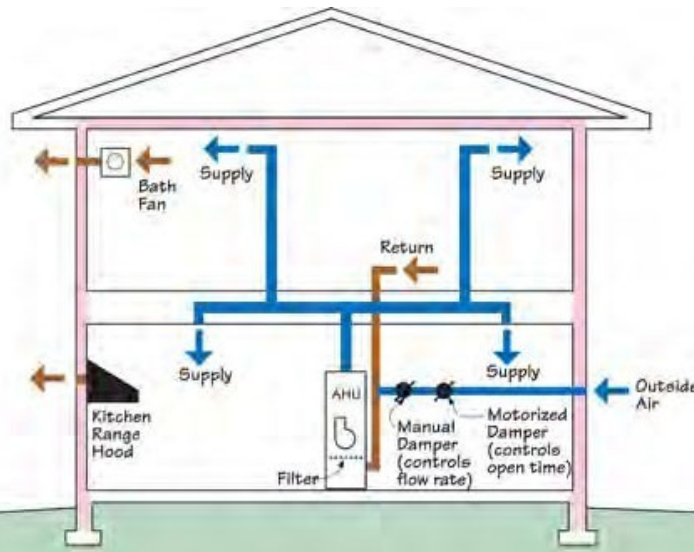
|   |                             |  |  |   |                   |   |        |                                     |       |       |
|---|-----------------------------|--|--|---|-------------------|---|--------|-------------------------------------|-------|-------|
| 9   | Below Grade Walls           | a  | 15A-0fc-x, concrete block, no board, no finish |   | 10.06             |   | 610    | 6139                                |       |       |
|   |                             | b  |  |   |                   |   |        |                                     |       |       |
| 10  | Ceilings                    | a  | 16C-21, vented attic, R-21, light shingles     |   | 2.99              | 1.89  | 1055   | 3157                                | 1996  |       |
|   |                             | b  |  |   |                   |   |        |                                     |       |       |
|   |                             | c  |  |   |                   |   |        |                                     |       |       |
|   | Partition Ceilings          | d  |  |   |                   |   |        |                                     |       |       |
|   |                             | e  |  |   |                   |   |        |                                     |       |       |
| 11  | Passive Floors              | a  |  |   |                   |   |        |                                     |       |       |
|   |                             | b  |  |   |                   |   |        |                                     |       |       |
|   | Exposed Floors              | c  |  |   |                   |   |        |                                     |       |       |
|   | Slab (Perimeter Ft.)        | d  |  |   |                   |   |        |                                     |       |       |
|   | Basement Floor              | e  | 21A-20, 20' min slab                           |   | 1.84              |   | 122    | 224                                 |       |       |
|   | Partition Floors            | f  |  |   |                   |   |        |                                     |       |       |
|   |                             | g  |  |   |                   |   |        |                                     |       |       |
| 12  | Infiltration                | Envelope Leakage   | Semi-Tight                                     | Heated & Cooled<br>Floor Area = Sq. Ft. |                   | Above Grade = Cu. Ft.                       |        | 951                                 |       |       |
|   |                             | No. of Fireplaces  | 1  |   |                   |   |        |                                     |       |       |
| 13  | Internal Gains              | Number of Bedrooms   |  |   | 4                 | Occupants                                   |        |                                     | 5     | 1150  |
|   |                             | Appliance - 1200 BTUH  |  |   |                   |   |        |                                     |       | 1200  |
| 14  | Sub Totals                  |  |  |   |                   |   |        |                                     | 55802 | 43264 |
| 15  | Duct Loss & Gain            | 7F-Ducts in Conditioned Space  |  |   |                   |   |        |                                     |       |       |
|   |                             | R-Value = 6  | Leakage Class .12/.24                          |   |                   | <input checked="" type="checkbox"/>         |        | <input checked="" type="checkbox"/> |       |       |
|   |                             | Installed Square Feet of Surface or Default = 1  |  |   | Supply            | 1   | Return | 1                                   |       |       |
| 16  | Ventilation                 | Combustion Air From Conditioned Space <input type="checkbox"/> Furnace <input type="checkbox"/> Water Heater |  |   | None              |   |        |                                     |       |       |
| 19  | Blower Heat Gain            | Manufacturer's performance data has no blower heat discount  |  |   |                   |   |        |                                     |       | 1707  |
| 20  | Total Sensible Loss or Gain |  |  |   |                   |   |        |                                     | 55802 | 44971 |
| Enter Company Name Here<br>Enter Company Address Here<br>Enter Company City, State and Zip Code Here<br>Enter Company Phone Numbers Here<br>Enter Website or Email Address Here |                             |  |  |   | 21                | Latent Infiltration load for cooling        |        |                                     |       |       |
|   |                             |  |  |   |                   | Latent load for occupants                   |        |                                     |       | 1000  |
|   |                             |  |  |   |                   | Latent load for plants                      | Small  | Medium                              | Large |       |
|   |                             |  |  |   |                   | Latent load for duct in unconditioned space |        |                                     |       |       |
|   |                             |  |  |   |                   | Latent ventilation load for cooling         |        |                                     |       |       |
|   |                             |  |  |   | Total Latent Gain |   |        |                                     | 1000  |       |

# Ventilation Types (Negative, Positive, Balanced)

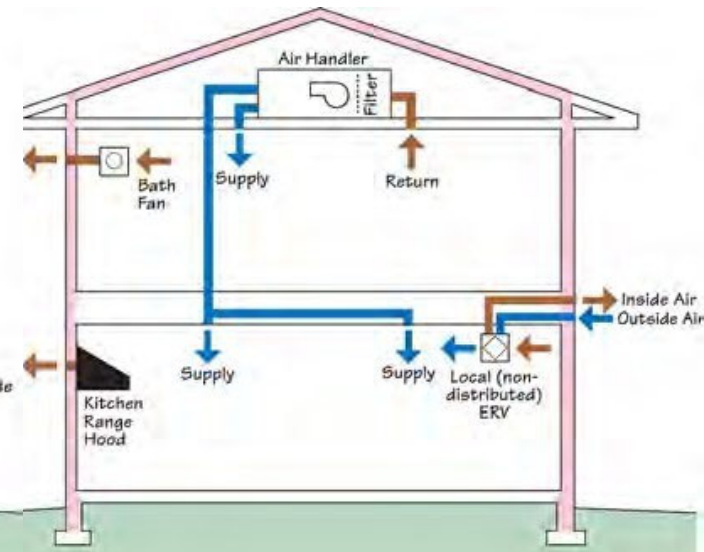
Negative  
Infiltration



Positive  
Exfiltration



Balanced  
Neither



NRJ9



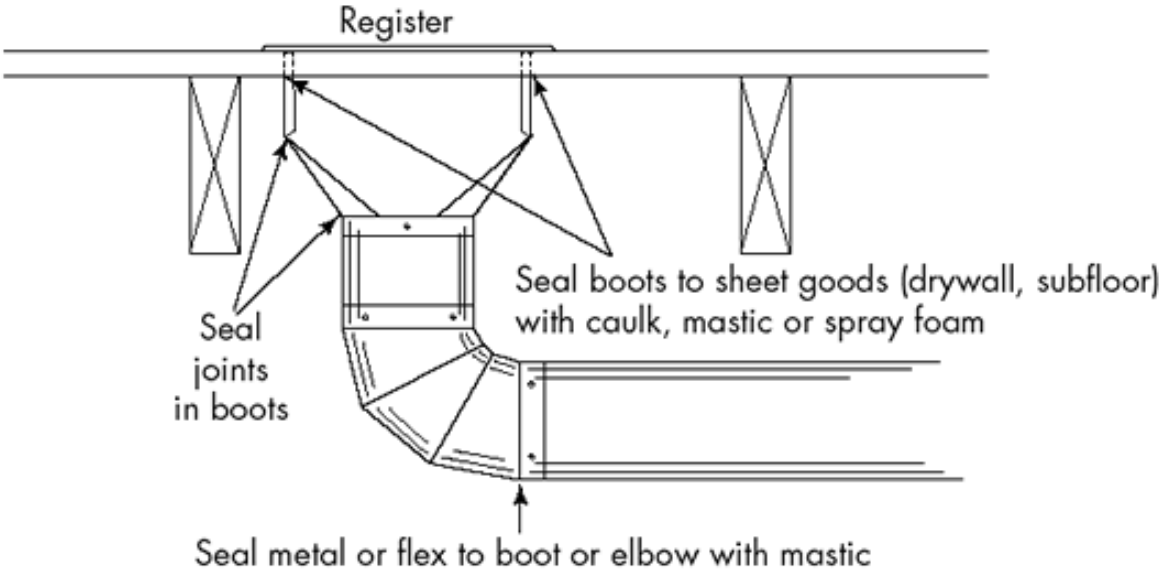
## Slide 43

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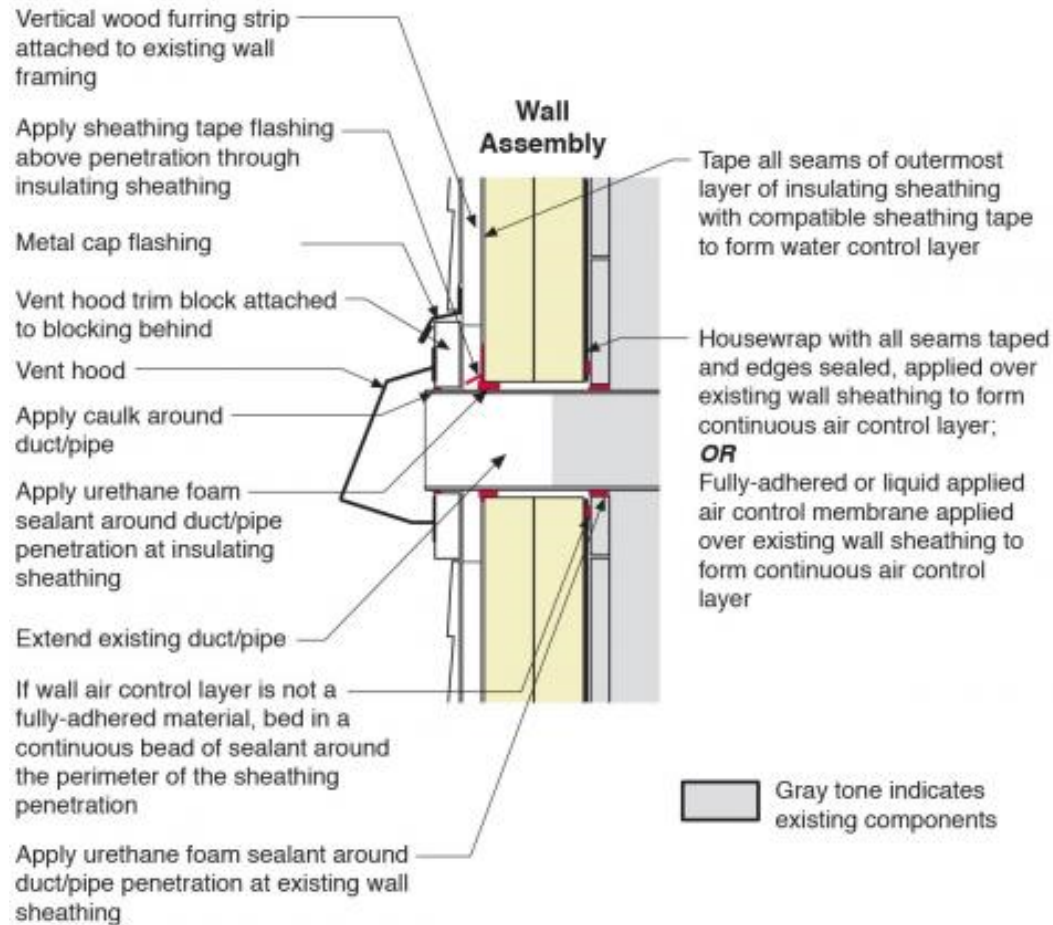
**NRJ9** I would label the drawings. I thought we already had this slide from one of our prior presentations.  
Nemeth, Robert J, 8/21/2020

# Duct sealing details

## Boots



# Air sealing details

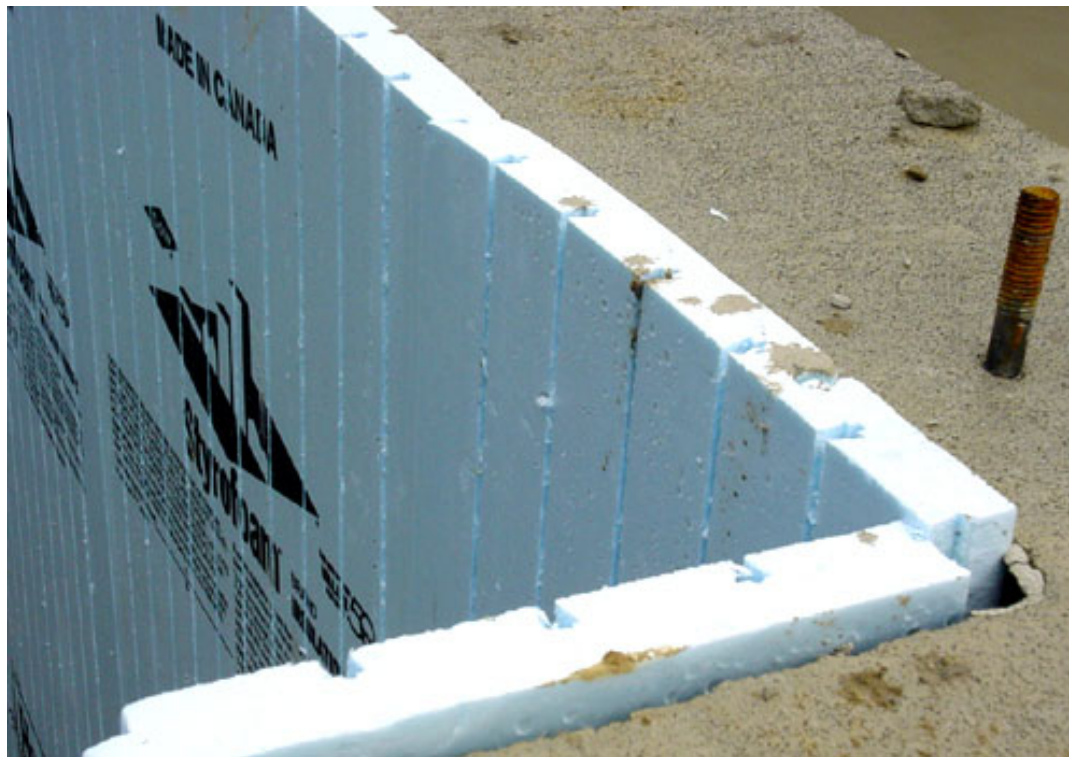


## #2. R105 Inspections

## #2a. R105.2.1 Footing and foundation

## R105.2.1 Footing and foundation

- Checking R-value location, thickness, depth of burial and protection of insulation



# 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

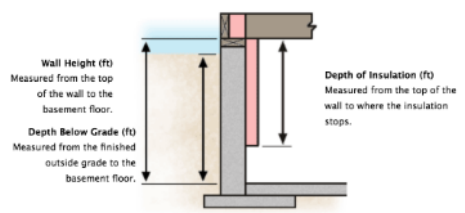
Continuous R-Value: 0

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.)

# **#2b. R105.2.2 Framing and rough-in**



## R105.2.5 Framing and rough-in

- Checking types of insulation and corresponding R-value and location and proper installation, fenestration properties such as U-factor and SHGC and proper installation, and air leakage controls



|   |  |
|---|--|
| <br>National Fenestration<br>Rating Council®<br><b>CERTIFIED</b>  | <b>World's Best<br/>Window Co.</b><br>Millennium 2000+<br>Vinyl-Clad Wood Frame<br>Double Glazing • Argon Fill • Low E<br>Product Type: <b>Vertical Slider</b> |
| <b>ENERGY PERFORMANCE RATINGS</b>   |  |
| U-Factor (U.S./I-P)<br><b>0.30</b>  | Solar Heat Gain Coefficient<br><b>0.30</b>   |
| <b>ADDITIONAL PERFORMANCE RATINGS</b>   |  |
| Visible Transmittance<br><b>0.51</b>  | Air Leakage (U.S./I-P)<br><b>0.2</b>   |
| <small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.<br/>www.nfrc.org</small> |  |



## 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.



## R402.4.1.2 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

Date of Test: 11/1/2019

Customer: SEDAC  
1 St Marys Ave  
Champaign, IL 61920  
Phone: 2173006495  
Website: sedac.org

### Test Results

1. Airflow at 50 Pascals:  
(50 Pa = 0.2 w.c.)

2234 CFM50 (+/- 0.6 %)  
2.73 ACH50  
0.4519 CFM50/ft2 floor area  
0.3369 CFM50/ft2 surface area



# 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/>

**#2c. R105.2.3  
Plumbing rough-in**

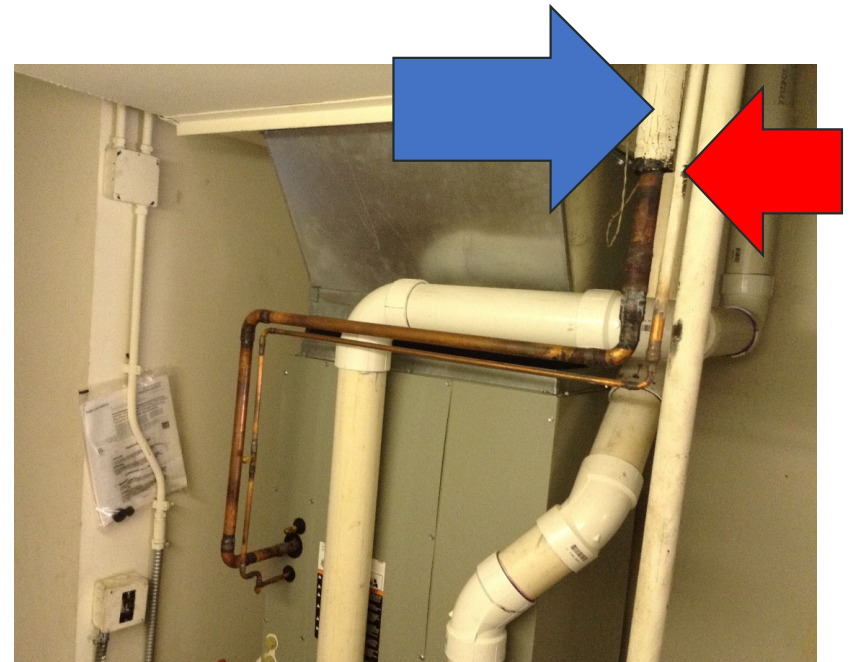
## R105.2.3 Plumbing rough-in

- Types of insulation, corresponding R-value, protection, and required controls



## 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.



## R403.8 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

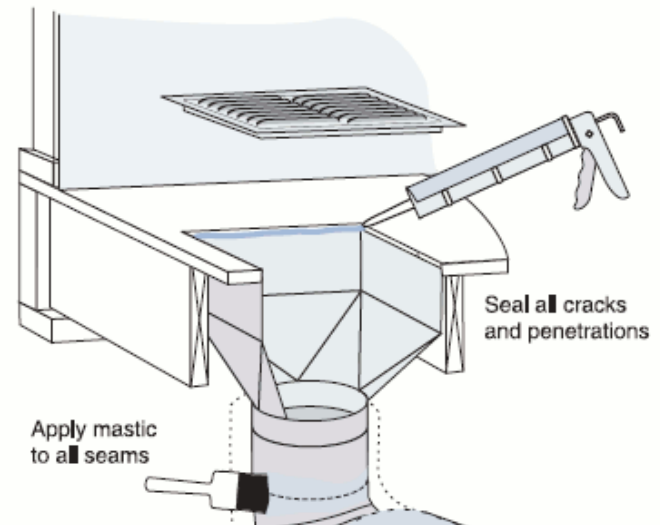
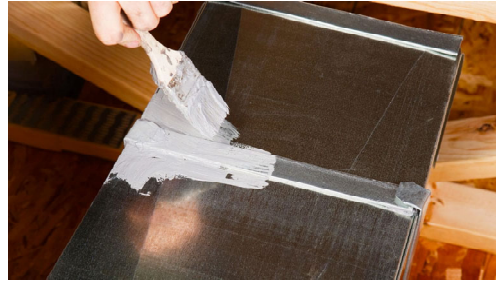
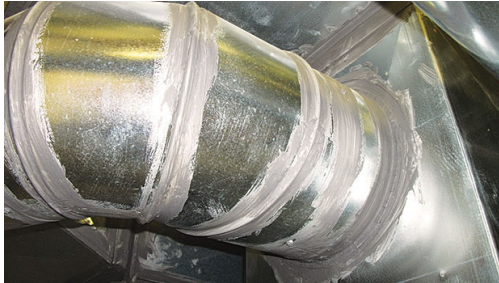




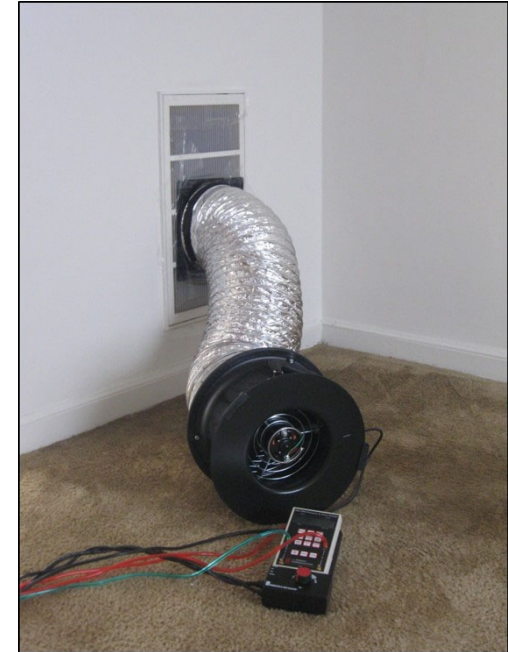
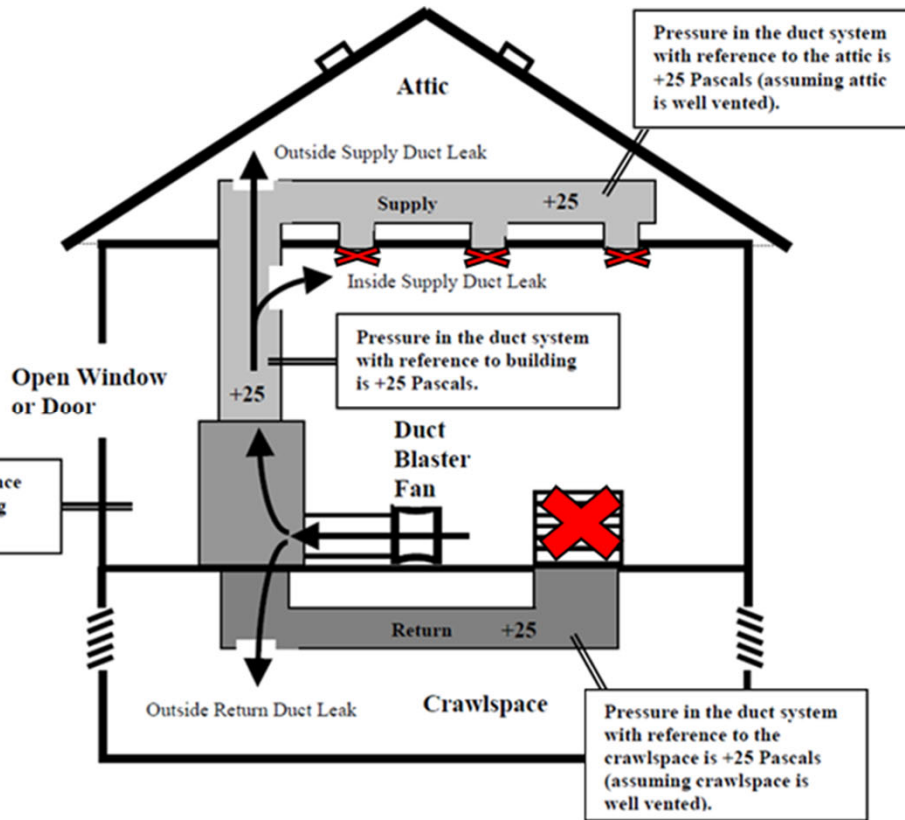
**#2d. R105.2.4**  
**Mechanical rough-in**



# Examples of Duct Sealing



# Duct Testing



Source: Energy Conservatory

[https://paenergycode.com/duct\\_testing/default.html](https://paenergycode.com/duct_testing/default.html)

## R403.8 Systems serving multiple units

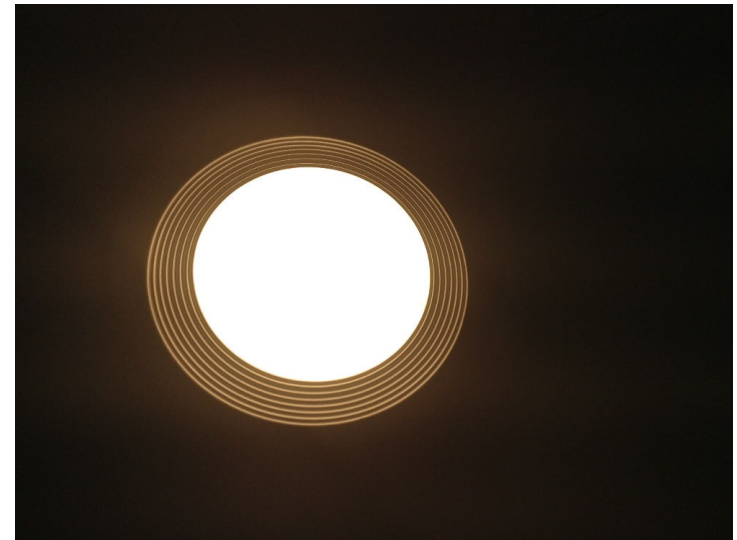
- Service Water Heating or HVAC
- Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the IECC – Commercial Provisions instead of R403



**#2e. R105.2.5 Final**

## R105.2.5 Final

- Any required remaining building systems, equipment, and controls and their operation and the required number of high efficacy fixtures





**Questions?**

**[energycode@sedac.org](mailto:energycode@sedac.org)**

**800-214-7954**