Mechanical and Energy Code Changes for Buildings in the IECC, IMC and IFGC

2014 Fall Seminar

Based on the

2012 IECC (MN Rule chapters 1322 & 1323), and the 2012 IMC and IFGC (MN Rules, chapter 1346) as amended

As presented by

DOLI-Construction Codes and Licensing Division
Instructors: Scott Nelson and Don Sivigny

MINNESOTA DEPARTMENT OF LABOR & INDUSTRY

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Contractor enforcement (Residential)	651/284-5069	

Additional Department Seminars

IRC/Radon/Admin

09/24/14	Detroit Lakes
10/01/14	Duluth
10/08/14	Burnsville
10/14/14	St. Cloud
10/22/14	Winona
11/04/14	Willmar
11/13/14	St. Paul
11/19/14	Mankato
12/04/14	Maple Grove

Energy/Mechanical

09/24/14	St. Paul
10/01/14	Willmar
10/08/14	Maple Grove
10/15/14	Mankato
10/22/14	Duluth
11/04/14	Detroit Lakes
11/12/14	Burnsville
11/19/14	St. Cloud
12/04/14	Winona

2014 Fall Seminar on Residential Energy and Mechanical code provisions

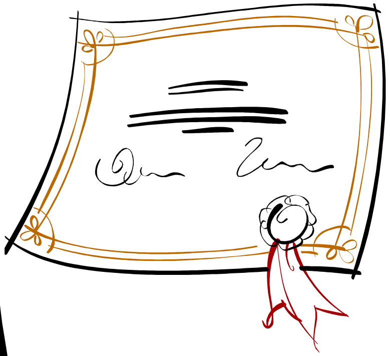
Sign In Sheet

NAME	AM	PM

❖Attendance

Name	QB, License or Certification #	AM- Sign -In	PM sign- In
Jim Peterson	012345-PM		
Don Sivigny	QB 654321		
Don Sivigny	BO 0002126		
Jim Peterson	0123456-WM		

❖Completion Certificates



❖ Course Evaluations

2014 FALL CCLD SEMINAR SURVEY

Seminar Date ____________ Seminar Location ____________________

	Excellent	Very Good	Fair	Poor
What was your overall impression of the seminar?	☐	☐	☐	☐

____
____
____
____

	Excellent	Very Good	Fair	Poor
How would you rate the content of the seminar?	☐	☐	☐	☐

____
____
____
____

How would you rate the instructors based on:

	Excellent	Very Good	Fair	Poor
Knowledge of seminar material	☐	☐	☐	☐
Engaging Audience/Responsiveness	☐	☐	☐	☐
Style of presentation	☐	☐	☐	☐
Setting and maintaining an appropriate pace	☐	☐	☐	☐

____
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	Excellent	Very Good	Fair	Poor
How would you rate the seminar location?	☐	☐	☐	☐

____
____
____

We would appreciate your suggestions for topics for future seminars:

____
____
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____
____

Housekeeping Items

- Restrooms

Housekeeping Items

- ❖ Cell Phones, Tablets, Computers, etc.

Housekeeping Items

- Coffee Breaks

Class Schedule

- 8:00 – 8:10 AM Class Syllabus, Introduction and information
- 8:10- 9:45 AM Residential Energy Code Chapters 1-3 Envelope Provisions
- 9:45 – 10:00 AM Morning Break
- 10:00 – 12:00PM Residential Energy Code Chapters 4-5 Envelope Provisions
- 12:00 - 1:00 PM Lunch Break
- 1:00 - 2:30 PM Residential Mech. Vent. Make Up Air Comb Air requirements
- 2:30 - 2:45 PM Afternoon Break
- 2:45 – 4:15 PM Mechanical Code 1346
- 4:15 - 4:30 PM Brief Energy code changes for Commercial Bldgs.
- 4:30 PM Adjourn & hand out certificates

About todays Program

The program will include some items that are changing, with the adoption of the new 2012 International Energy Conservation Code (IECC), the International Mechanical Code (IMC), and the International Fuel Gas Code (IFGC) as they apply to Residential buildings and a brief introduction to some of the Energy changes for Commercial Buildings.

This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying 7 hours of credit towards the Residential Building Contractor/Remodeler, Residential Roofer, Manufactured Home Installer, and Minnesota Building Official continuing education requirements. MS § 326B.0981, Subd. 11, and Mn. Rule

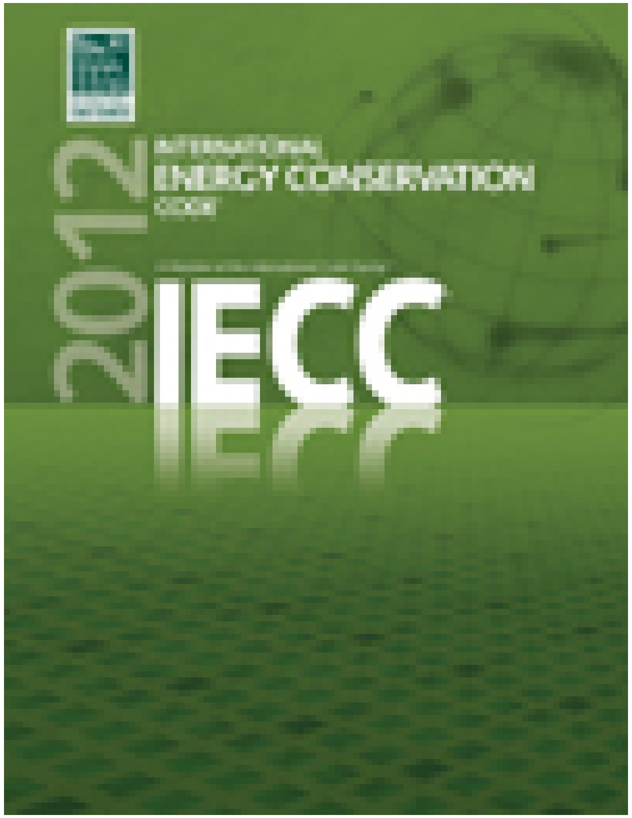
MS § 326B.0981, Subd. 11, and Mn. Rule

Disclaimer

The text in this presentation does not necessarily represent actual code language. The presented text may summarize, highlight or generalize the code section. Additional provisions or exceptions may be included in the actual code section. Cites to the code sections are given for the purpose of verifying the complete provisions of the section at the time the program was written.

Residential Energy Code Envelope Provisions; Minnesota Rules Chapter 1322

2012 International Energy Conservation Code Fundamentals



Based on the 2012 International Energy Conservation Code® (IECC®)

Arrangement and format of the 2012 IECC

Arrangement and format of the 2012 IECC

- **The IECC contains two separate sets of provisions.**

Arrangement and format of the 2012 IECC

- Each set of provisions is independent; Both commercial and residential Provisions contain a chapter in:
  - Scope and Administration, chapter 1
  - Definitions, chapter 2
  - General Requirements, chapter 3
  - Energy Efficiency Requirements applicable to buildings within its scope, chapter 4
  - Referenced Standards, chapter 5
  - Index

IECC page vii

Table of Contents

IECC COMMERCIAL PROVISIONS C-1	IECC RESIDENTIAL PROVISIONS R-1
Chapter 1 Scope and Administration C-3	Chapter 1 Scope and Administration R-3
Chapter 2 Definitions C-7	Chapter 2 Definitions R-7
Chapter 3 General Requirements C-11	Chapter 3 General Requirements R-11
Chapter 4 Commercial Energy Efficiency C-29	Chapter 4 Residential Energy Efficiency R-29
Chapter 5 Referenced Standards.C-77	Chapter 5 Referenced Standards R-41
Index C-83	Index R-43

Arrangement and format of the 2012 IECC

- The IECC contains two separate sets of provisions.
  - **The IECC Residential Provisions apply to detached one- and two-family dwellings and multiple single- family dwellings as well as Group R-2, R-3 and R-4 buildings three stories or less in height.**

Section R202

Arrangement and format of the 2012 IECC

- The IECC contains two separate sets of provisions.
  - The IECC Residential Provisions apply to detached one- and two-family dwellings and multiple single- family dwellings as well as Group R-2, R-3 and R-4 buildings three stories or less in height.
  - **The IECC Commercial Provisions apply to all buildings that are not included in the definition of "Residential buildings".**

Section R202

Arrangement and format of the 2012 IECC

- IECC Commercial Provisions, are therefore, provisions for residential buildings four stories or greater in height.

Section R202

Objectives of the Code

- **To regulated energy efficiency in all of the following building systems :**

Objectives of the Code

- To regulated energy efficiency in all of the following building systems :
  - Building Envelope

Objectives of the Code

- To regulated energy efficiency in all of the following building systems :
  - Building Envelope
  - Mechanical Systems

Objectives of the Code

- To regulated energy efficiency in all of the following building systems :
  - Building Envelope
  - Mechanical Systems
  - Electrical Systems

Objectives of the Code

- To regulated energy efficiency in all of the following building systems :
  - Building Envelope
  - Mechanical Systems
  - Electrical Systems
  - Service Water Heating Systems

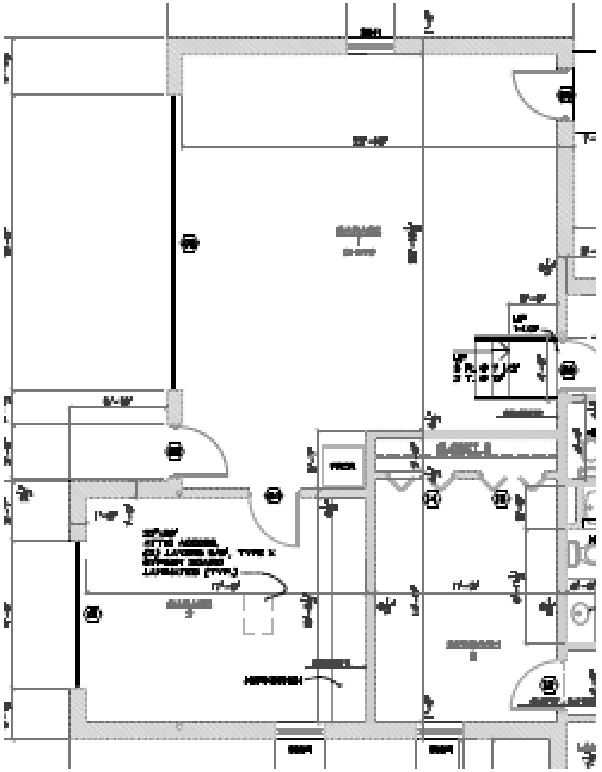
Code Compliance Process

Code Compliance Process

1. Determine if the project must comply with the IECC

1322.0100 Subpart 4B
"Low Energy Buildings"

- **Buildings designated as exempt include buildings that use less than 1 watt/ft^2 (10.7 W m^2) or 3.4 Btu/h ft^2 (10.7 W m^2) for space conditioning.**



1322.0100 Subpart 4B
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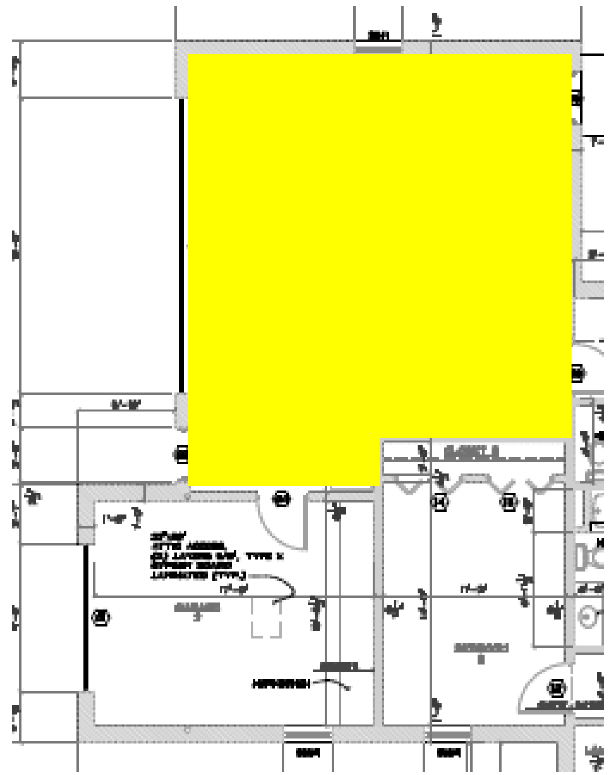
- **Buildings designated as exempt include buildings that use less than 1 watt/ft^2 (10.7 W m^2) or 3.4 Btu/h ft^2 (10.7 W m^2) for space conditioning.**
- **Buildings, or portions thereof, that are not conditioned are exempt from thermal envelope requirements.**
  - **Example: Garages (unless heated or cooled)**



Code Compliance Process

1. Determine if the project must comply with the IECC
2. Determine if the project is residential or commercial

(See definitions of Commercial & Residential buildings in either, Chapter 2 for the Residential Provisions, or Chapter 2 of the Commercial Provisions)

Code Compliance Process

1. Determine if the project must comply with the IECC
2. Determine if the project is residential or commercial
3. Compliance documentation submitted (see 1322.0103)

Code Compliance Process

1. Determine if the project must comply with the IECC
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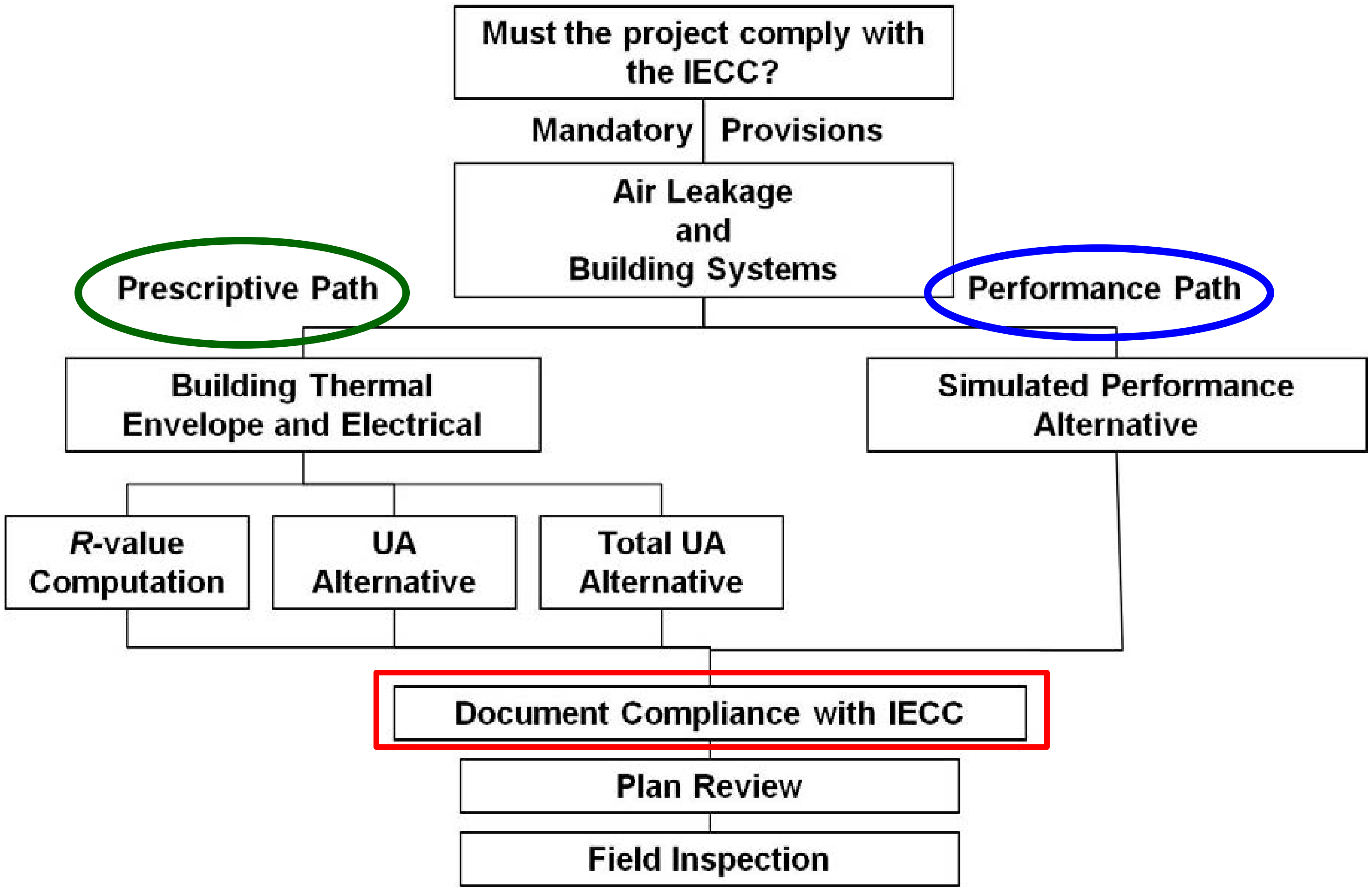
4. Plan reviewer then is to ensure the documentation is clearly identified and code compliant.

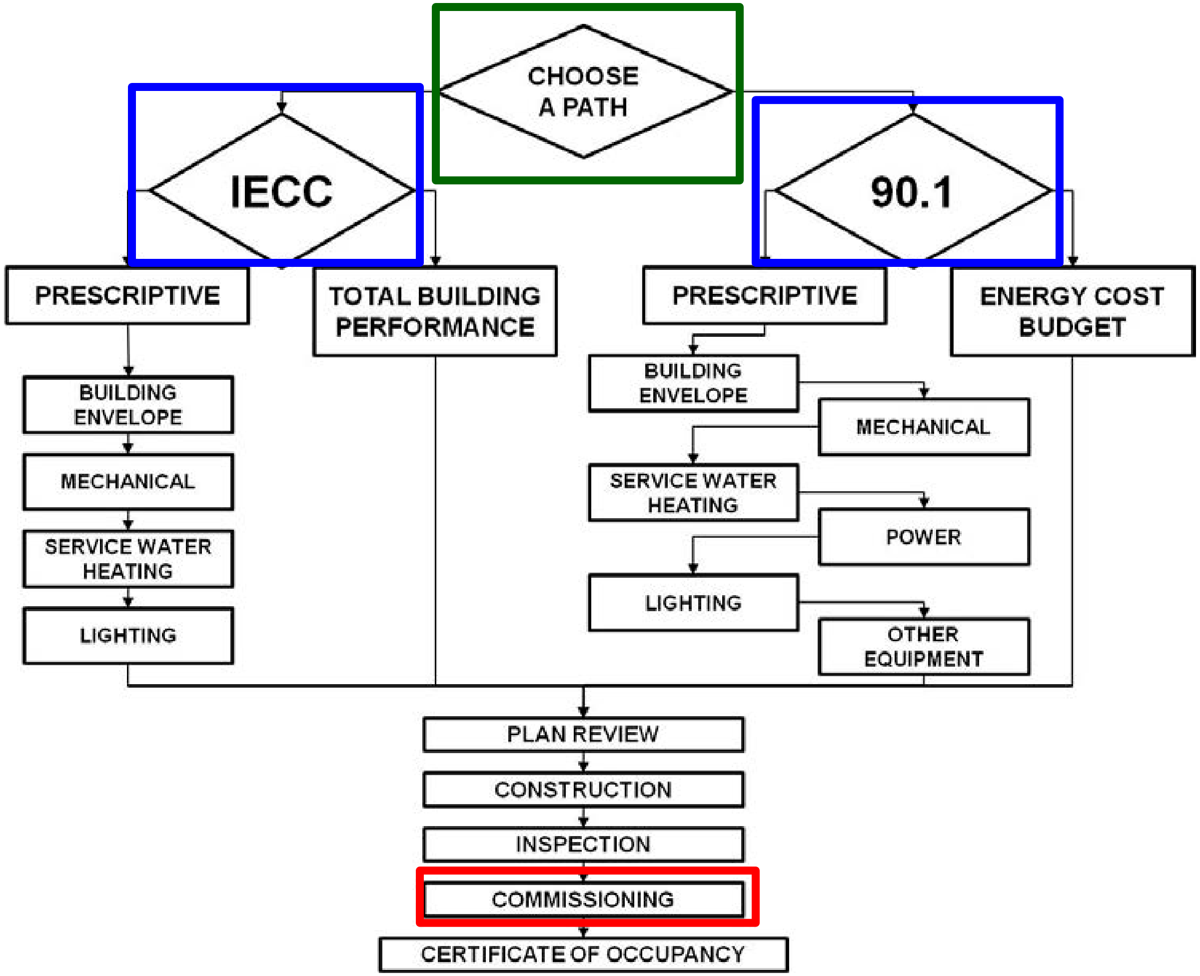
Code Compliance Process

1. Determine if the project must comply with the IECC
2. Determine if the project is residential or commercial
3. Compliance documentation submitted
4. Plan reviewer is to ensure the documentation is clearly identified and code compliant.
5. The field inspector is to confirm that energy-using features of the building's are installed per the approved plans and documentation

IECC Residential Compliance Process



IECC Commercial Compliance Process



1322.0015 Administration & Purpose

- **Changes Identical for both Commercial and Residential**

1322.0030 References to other Codes

- IBC
- IRC
- IFGC
- IMC
- Mn State plumbing Code
- 2014 NEC
- Others

- **The provisions apply to several different project types:**
    - **Newly conditioned space**

1322.0100 Subpart 2

- **Newly Conditioned Space – New Buildings**

- The provisions apply to several different project types:
    - **Newly conditioned space**
    - **New construction in existing buildings**

1322.0100 Subpart 3

Newly Conditioned Space – Previously Unconditioned

1322.0100 Subpart 3 item A Additions, alterations, renovations or repairs;

Additions, alterations, renovations or repairs;

- Additions, alterations, renovations, or repairs 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 portion(s) of the existing building or building system to comply with this code.

1322.0100

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- Additions, alterations, renovations, or repairs 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 portion(s) of the existing building or building system to comply with this code.
- Additions, alterations, renovations, or repairs shall not create an unsafe or hazardous condition or overload existing building systems.

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- An addition shall comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

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- **Additions, alterations, renovations, or repairs shall not create an unsafe or hazardous condition or overload existing building systems.**
- **An addition shall comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.**
- **Attic insulation shall not be installed unless accessible attic bypasses have been sealed.**

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- **An addition shall comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.**
- **Attic insulation shall not be installed unless accessible attic bypasses have been sealed.**
  - **An a*ttic bypass is any* air passageway between a conditioned space and an unconditioned attic.**

Additions, alterations, renovations or repairs; Exemptions are as follows:

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- The following need not comply provided the energy use of the building is not increased.

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- The following need not comply provided the energy use of the building is not increased.
  - Storm windows installed over existing ~~fenestration~~ windows.

Additions, alterations, renovations or repairs; Exemptions are as follows:

- **The following need not comply provided the energy use of the building is not increased.**
  - Storm windows installed over existing ~~fenestration~~ windows.
  - **Glass only replacements in existing sash and frame.**

Additions, alterations, renovations or repairs; Exemptions are as follows:

- **The following need not comply provided the energy use of the building is not increased.**
  - Storm windows installed over existing windows.
  - Glass only replacements in existing sash and frame.
  - **Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.**

Additions, alterations, renovations or repairs; Exemptions are as follows:

- **The following need not comply provided the energy use of the building is not increased.**
  - Storm windows installed over existing windows.
  - Glass only replacements in existing sash and frame.
  - Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
  - **Construction where existing roof, wall or floor cavity is not exposed.**

Additions, alterations, renovations or repairs; Exemptions are as follows:

- The following need not comply provided the energy use of the building is not increased.
- ~~Roofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~ Reroofing and residing.

Additions, alterations, renovations or repairs; Exemptions are as follows:

- The following need not comply provided the energy use of the building is not increased.
- Replacement of existing doors that separate conditioned space from the exterior (commercial language) “do not require the installation of a vestibule or revolving door; provided that an existing vestibule that separates a conditioned space from the exterior shall not be removed”

Additions, alterations, renovations or repairs; Exemptions are as follows:

- The following need not comply provided the energy use of the building is not increased.

- Alterations that replace less than 50 percent of the luminaires in a space, provided that the alterations do not increase the installed interior lighting power.

Additions, alterations, renovations or repairs; Exemptions are as follows:

- The following need not comply provided the energy use of the building is not increased.

- Alterations that replace only the bulb and ballast within the existing luminaires in a space, provided that the alteration does not increase the installed interior lighting power

Additions, alterations, renovations or repairs; Exemptions are as follows:

- The following need not comply provided the energy use of the building is not increased.
- Insulation R-value, air barrier, and vapor retarder requirements are not applicable to existing foundations, crawl space walls, and basements in existing dwellings or dwelling units when the alteration or repair requires a permit if the original dwelling's permit was issued before June 1, 2009.

1322.0100 Subpart 3 item C – Change in Occupancy/Use

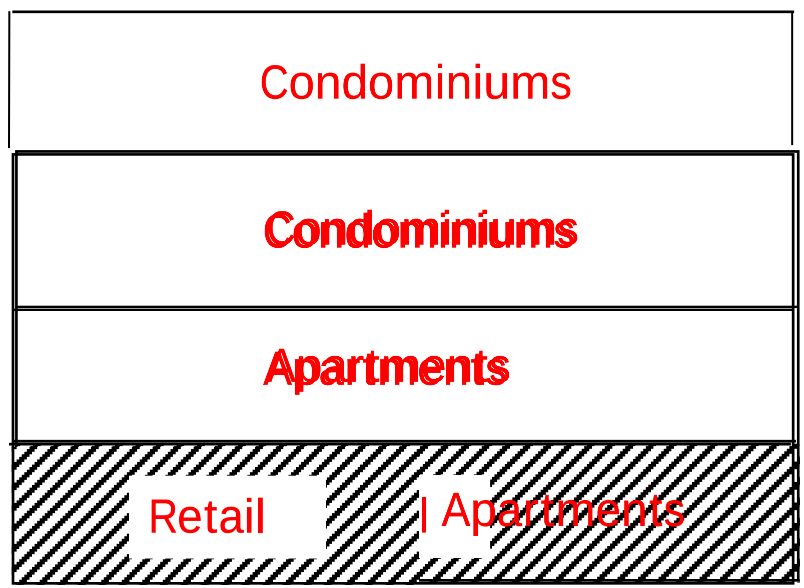
– Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code.

1322.0100 Subpart 3 item D - Mixed occupancy

- Where a building includes both residential and commercial occupancies, each occupancy shall be separately considered and meet the applicable provisions of ~~the IECC – Commercial and Residential Provisions~~ this chapter (1322) and chapter 1323

Mixed occupancy

- **Each occupancy shall be separately considered as residential or commercial**



Building is now 4 stories.
Commercial Provisions throughout

Residential

Residential

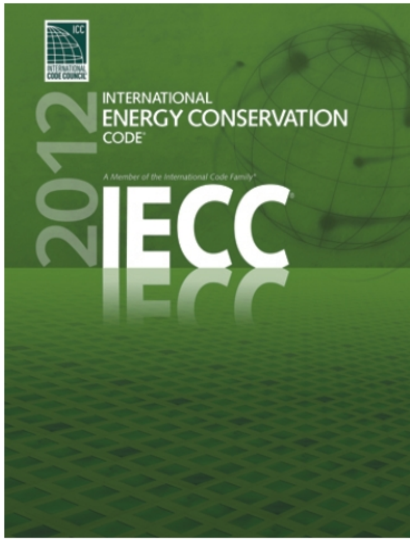
Commercial / Residential

Intent

- **Life safety, health and environmental requirements take precedence over energy provisions.**

1st

2nd



Definitions now included in the code.

- Accessible
- Readily Accessible
- Forced Air circulation
- Outdoor Air
- Exhaust air
- Code
- Air Conditioning System
- Furnace
- Manufacturers Installation Instructions
- Others

1322.0202 Definition of Approved

- **Approved** – "Approved" means **approval by the Building Official persuant to the State Building Code, by reason of inspection, investigation, or testing; acceptable principles; computer simulations; research reports; or testing performed by either a licensed engineer or by a locally or nationally recognized testing laboratory.**

Above code program

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- **Authority to approve "above code" program is vested in the code official.**

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- **Language does not guarantee alternative programs exceed the performance required by IECC.**

Above code program

- Authority to approve “above code” program is vested in the code official.
- Language does not guarantee alternative programs exceed the performance required by IECC.
- **Burden of proof to establish equivalency is on the applicant.**

Inspections

- **The code states:**

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  - **All construction is subject to inspection.**

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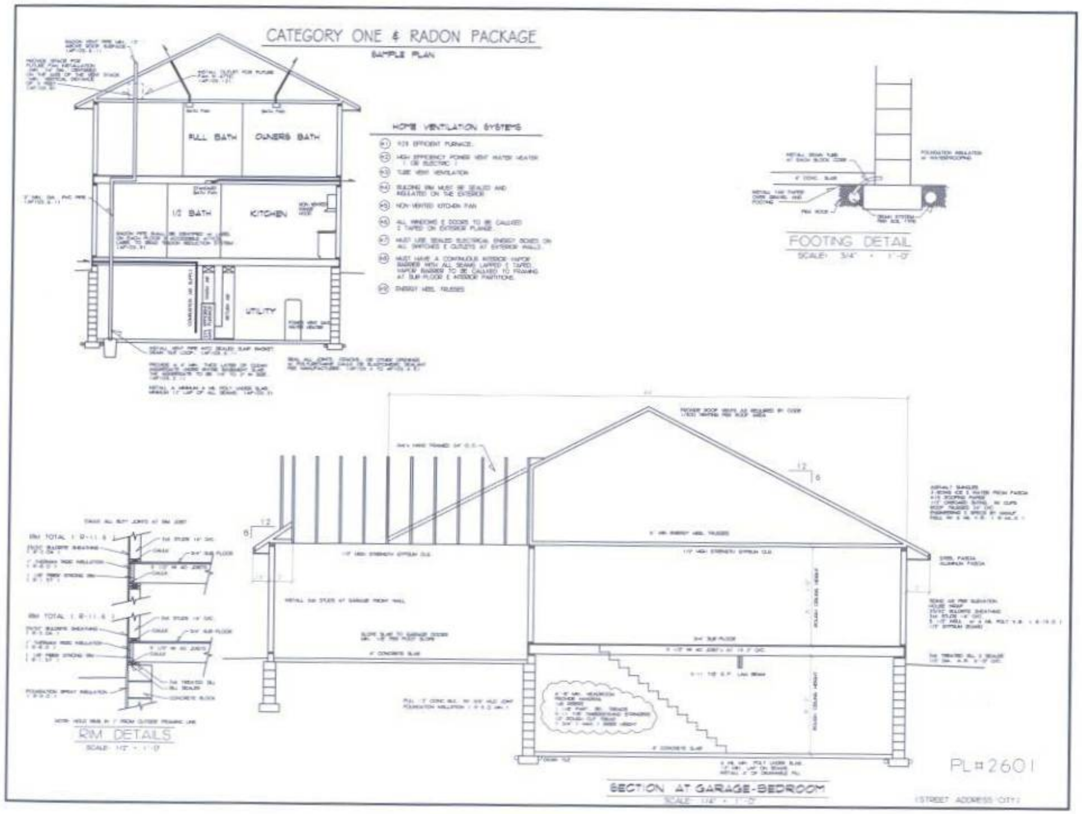
  - **A final inspection is required before occupancy.**

Inspections

- The code states:
  - All construction is subject to inspection.
  - Construction shall not be concealed without inspection approval.
  - A final inspection is required before occupancy.
  - **A building shall be reinspected when determined necessary by the code official.**

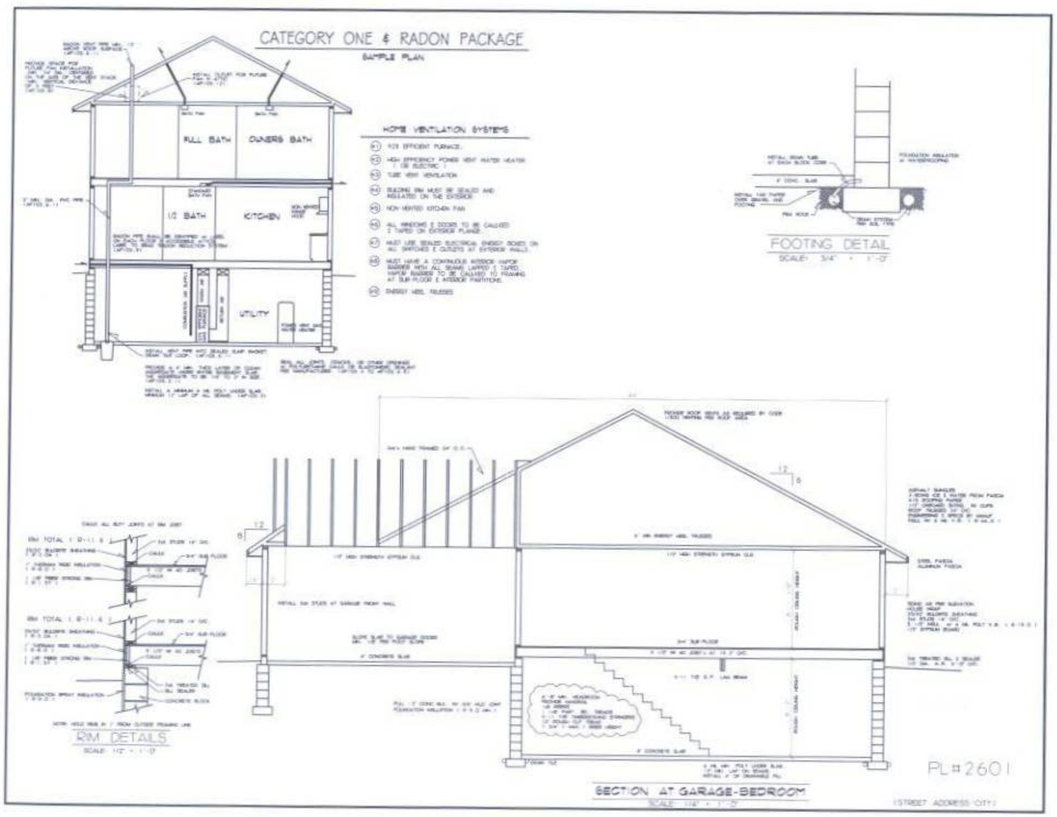
Information on Construction Documents 1322.0103

- **Level of efficiency used to demonstrate compliance with the code must be clearly identified.**



Information on Construction Documents

- Level of efficiency used to demonstrate compliance with the code must be clearly identified.
- **Complete set of building plans with efficiency requirements clearly labeled**



Information on Construction Documents

- Information can be presented in a number of ways:

Information on Construction Documents

- Information can be presented in a number of ways:
  - On the drawings.

Information on Construction Documents

- **Information can be presented in a number of ways:**
  - On the drawings.
  - **On sections and in schedules.**

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- **Information can be presented in a number of ways:**
  - On the drawings.
  - On sections and in schedules.
  - **Through notes and callouts.**

Information on Construction Documents

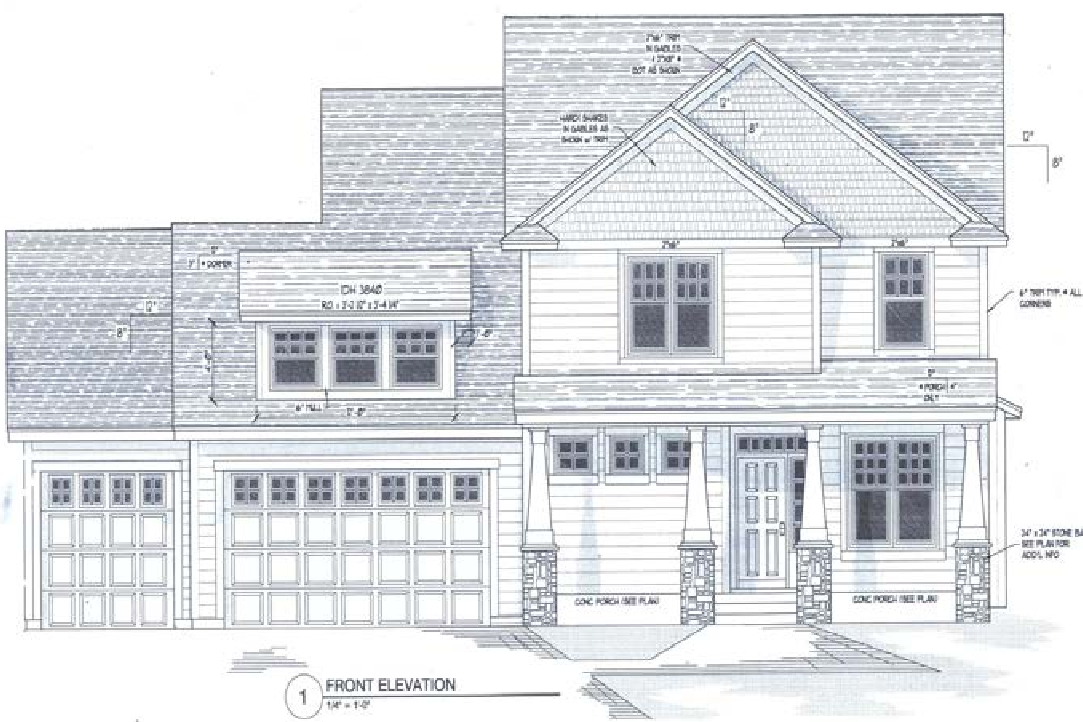
- **Information can be presented in a number of ways:**
  - On the drawings.
  - On sections and in schedules.
  - Through notes and callouts.
  - **Through supplementary worksheets or calculations.**

Information on Construction Documents

- **Information about the following systems, which can be presented in a number of ways, should be included on the plans:**
  - **Building envelope**
  - **Mechanical system**
  - **Lighting system**
  - **Service water heating system**

Examination of documents

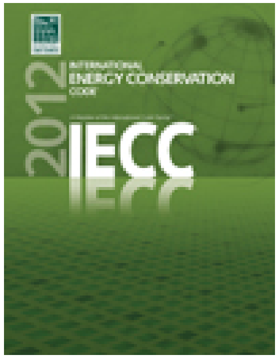
It is the plan reviewer's responsibility to verify that the energy code compliance documentation submitted with the plans is completed correctly and that the efficiency levels called out on the plans meet or exceed those provided by the code.



Examination of documents

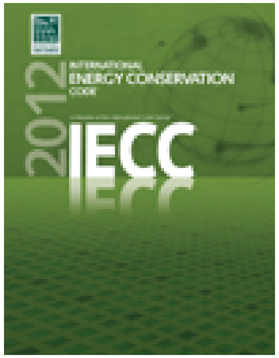
Plan reviewer's responsibility to verify that the energy code compliance documentation submitted with the plans is completed correctly and that the efficiency levels called out on the plans meet or exceed those provided by the code.

Field inspectors will use the approved plans and specifications as a reference for inspection.



Changes

- **Cold-climate builders: Will foam sheathing be needed?**



Changes

- Cold-climate builders: Will foam sheathing be needed?
- **Not necessarily….**

Insulation Requirements
Table R402.1.1

Insulation	Ceiling R-value		Wood frame R-value		Basement R-value		Crawl Space R-value	
Climate Zone	2009 Ch. 1322	2012 IECC	2009 Ch. 1322	2012 IECC	2009 Ch. 1322	2012 IECC	2009 Ch. 1322	2012 IECC
6	38	49	19 or 13 + 5	20, 13+5	5/10	15	5/10	15
7	44	49	19	21,	10	15	10	15

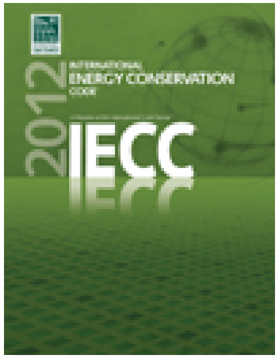
Footnote to Table R402.1.1

First value is cavity insulation, second is continuous insulation or insulated siding, so "20+5" or "13+10" means cavity insulation plus continuous insulation or insulated siding. *If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used* – to maintain a consistent total sheathing thickness.

What is Changing for basement insulation?

Insulation Requirements

Insulation	Ceiling R-value		Wood frame R-value		Basement R-value		Crawl Space R-value	
Climate Zone	2009 Ch. 1322	2012 IECC	2009 Ch. 1322	2012 IECC	2009 Ch. 1322	2012 IECC	2009 Ch. 1322	2012 IECC
6	38	49	19 or 13 + 5	20, 13+5	5/10	15	5/10	15
7	44	49	19	21,	10	15	10	15



- Cold-climate builders: Will foam sheathing be needed?
- **More efficient Fenestration products;**

Window Performance

Fenestration	Fenestration U-Factor		Skylight U-factor		Glazed Fenestration SHGC	
Climate Zone	2009 Ch. 1322	2012 IECC	2009 Ch. 1322	2012 IECC	2009 Ch. 1322	2012 IECC
6	0.35	0.32	0.60	0.55	N/A	N/A
7	0.35	0.32	0.60	0.55	N/A	N/A

NFRC
U-Factor, SHGC, VT & Air Leakage

NFRC
National Fenestration Rating Council
CERTIFIED

World's Best Window Co.

Millennium 2000+
Vinyl-Clad Wood Frame
Double Glazing • Argon Fill • Low E
Product Type: **Vertical Slider**

ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.34	**0.25**

ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance	Air Leakage (U.S./I-P)
0.41	**0.2**

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. Consult manufacturer's literature for other product performance information.
www.nfrc.org

NFRC PRODUCT CERTIFICATION PROGRAM

NFRC Label Certificate for Site-Built Products

World's Best Window Co.
Millennium 2000+

ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.35	0.32
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance	Air Leakage (U.S./I-P)
0.51	0.2

Project Location

Street Address: ________

City: ______ State: ____ Zip Code: ______

Project Name (Optional): ______ Designer (Optional): ______

Product Line Information

Operator Type (per Table 4-3 of NFRC 100) ______

Product Line ID No. ______ Individual Product ID No. ______

How many of this individual product ______ Location in building ______

Elevation drawing page ______ Fenestration (window & door) schedule page ______

Frame Material Supplier Company name: ______

City: ______ State: ____ Zip Code: ______

Street Address: ______

Contact: ______ Phone: ______ Fax: ______

Glazing Material Supplier Company name: ______

City: ______ State: ____ Zip Code: ______

Street Address: ______

Contact: ______ Phone: ______ Fax: ______

Glazing Contractor/Installer Comp. name: ______

City: ______ State: ____ Zip Code: ______

Street Address: ______

Contact: ______ Phone: ______ Fax: ______

Certification Authorization

Independent Certification & Inspection Agency (IA): ______

Date Certification Authorization Issued: ______

Materials, Systems, and Equipment

Default Glazed Fenestration *U*-Factor

TABLE 303.1.3(1)
DEFAULT GLAZED FENESTRATION *U*-FACTOR

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

Materials, Systems, and Equipment

Default Door *U*-Factors

TABLE 303.1.3(2)
DEFAULT DOOR *U*-FACTORS

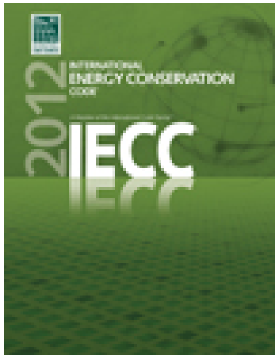
DOOR TYPE	*U*-FACTOR
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

Materials, Systems, and Equipment

Default Glazed Fenestration SHGC

TABLE 303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC

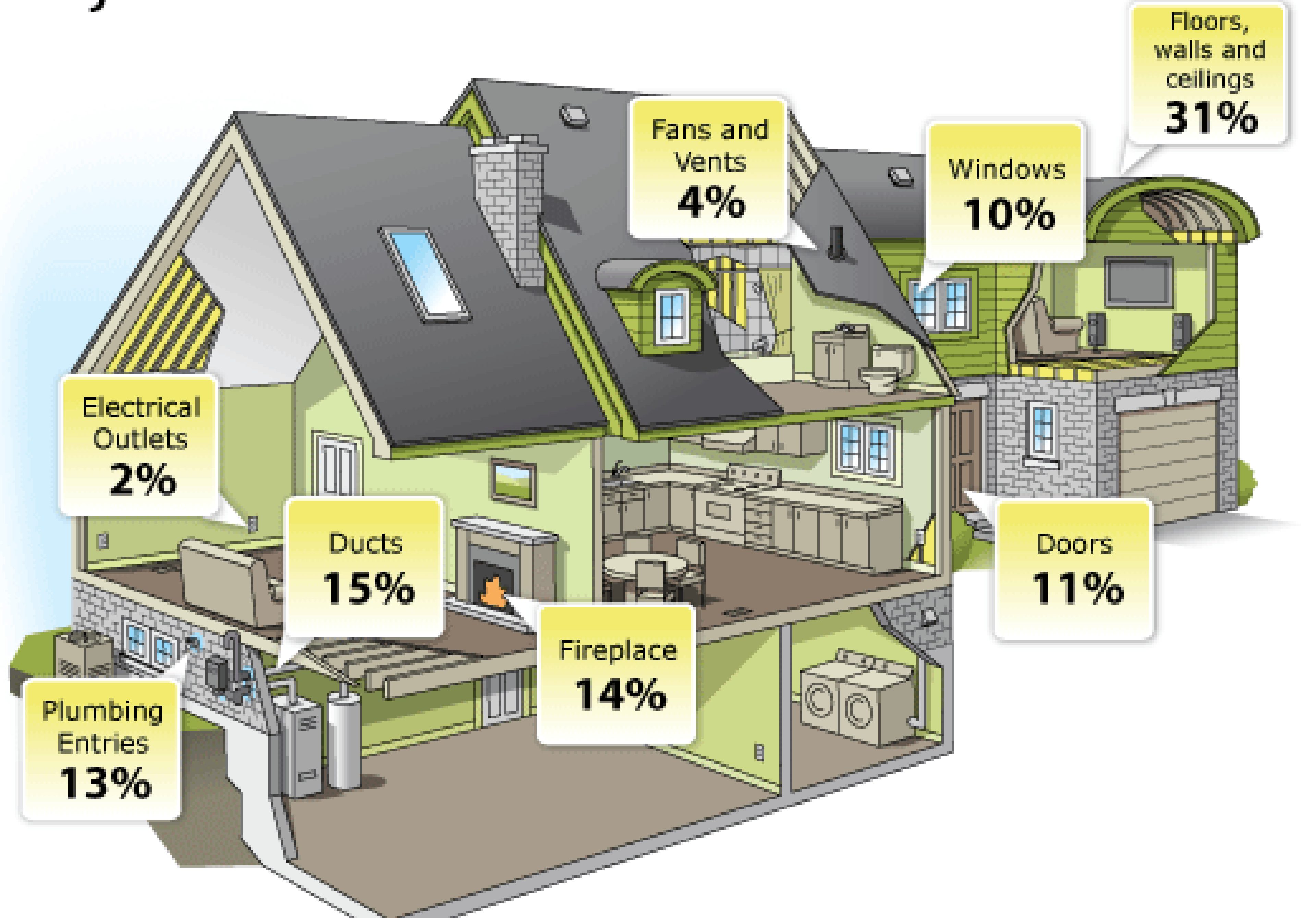
SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
0.8	0.7	0.7	0.6	0.6



R 402.4.1.2 Testing

- Cold-climate builders: will foam sheathing be needed?;
- More efficient Fenestration products;
- **Every new home will need to pass a blower door test to 3ACH$_{50}$;**

Major Sources of Air Leaks



Air leakage

New Homes must pass a Blower Door Test.

Air leakage

New Homes must pass a Blower Door Test.

Installa**tion.** Components of the building envelope and air barrier shall be installed in accordance with the thermal- and air-barrier table.

Air leakage

New Homes must pass a Blower Door Test.

***Installa*tion.** Components of the building envelope and air barrier shall be installed in accordance with the thermal- and air-barrier table.

Testing. The building/dwelling unit shall be tested/verified with a blower door as having **an air leakage rate not exceeding 3 ACH_{50}.**

-ACH_{50} means Air change per hour at a pressure differential of 50 Pascals (Pa)

R402.4.1.1 – Blower Door Testing

(Air Leakage Rate of 3 ACH$_{50}$ Required)

Use of a calibrated fan to depressurize the house…

1. Quantify air leakage of the building
2. Locate the sources of air leakage
3. Prioritize energy improvement dollars

Two Things Needed for Air to Flow

(Building Science 101)

Hole

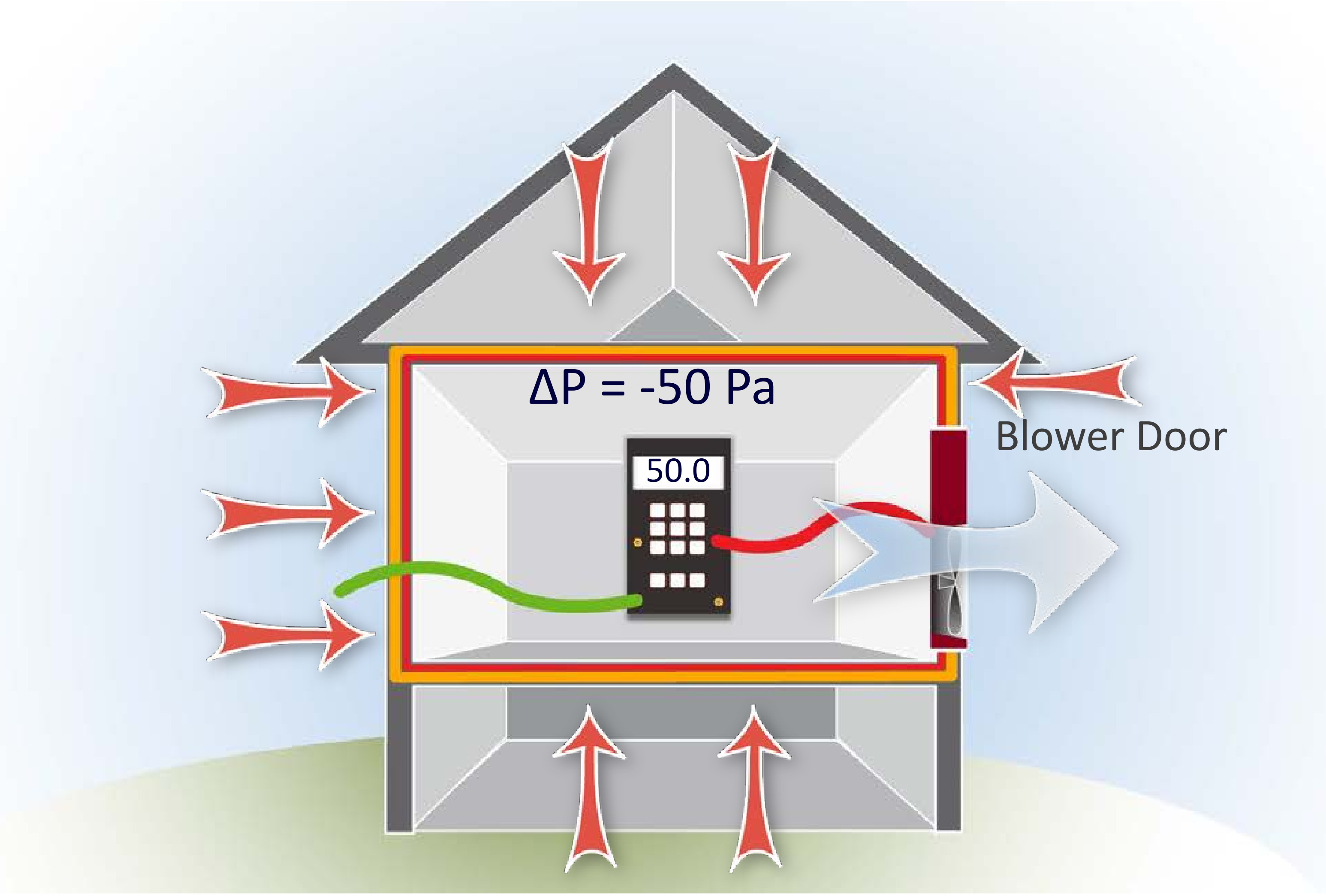
Pressure differential

Driving forces to cause air to flow:

- Mechanical (a fan)
- Wind *We have no control over wind!*
- Stack effect (convection)
- Reverse stack effect

We can control these

Blower Door Testing



Calculating ACH_{50}

$$ACH_{50} = (CFM_{50} \times 60 \text{ min/hour}) \div \text{Vol.}$$

- **Blower Door Flow Reading** = 2,550 cfm_{50}
- **House Volume** = 27,000 cu/ft
- **ACH_{50}** = (2,550 x 60) ÷ 27,000 = 5.7 ACH_{50}

(Multiply by 60 to convert from minutes to hours)

Approximate Leakage Area

16”

16”

Divide CFM_{50} by 10

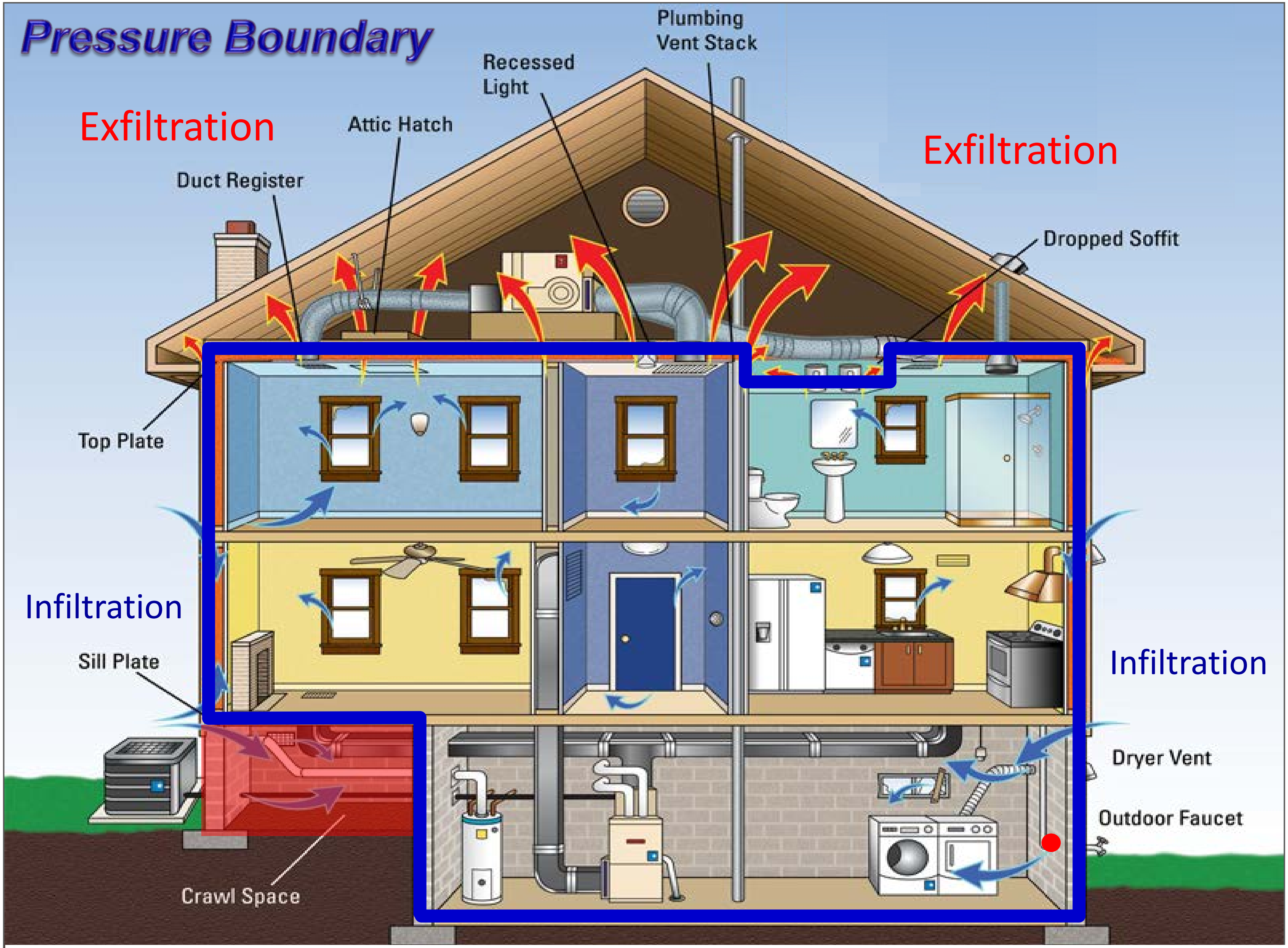
Then take Sq. Root

For example:

2,550 CFM_{50} ÷ 10 = 255 sq”

√ 255 = 16” x 16” hole

Like having a window open 24 / 7 in every season

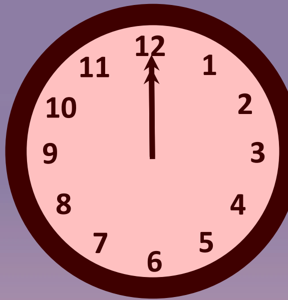


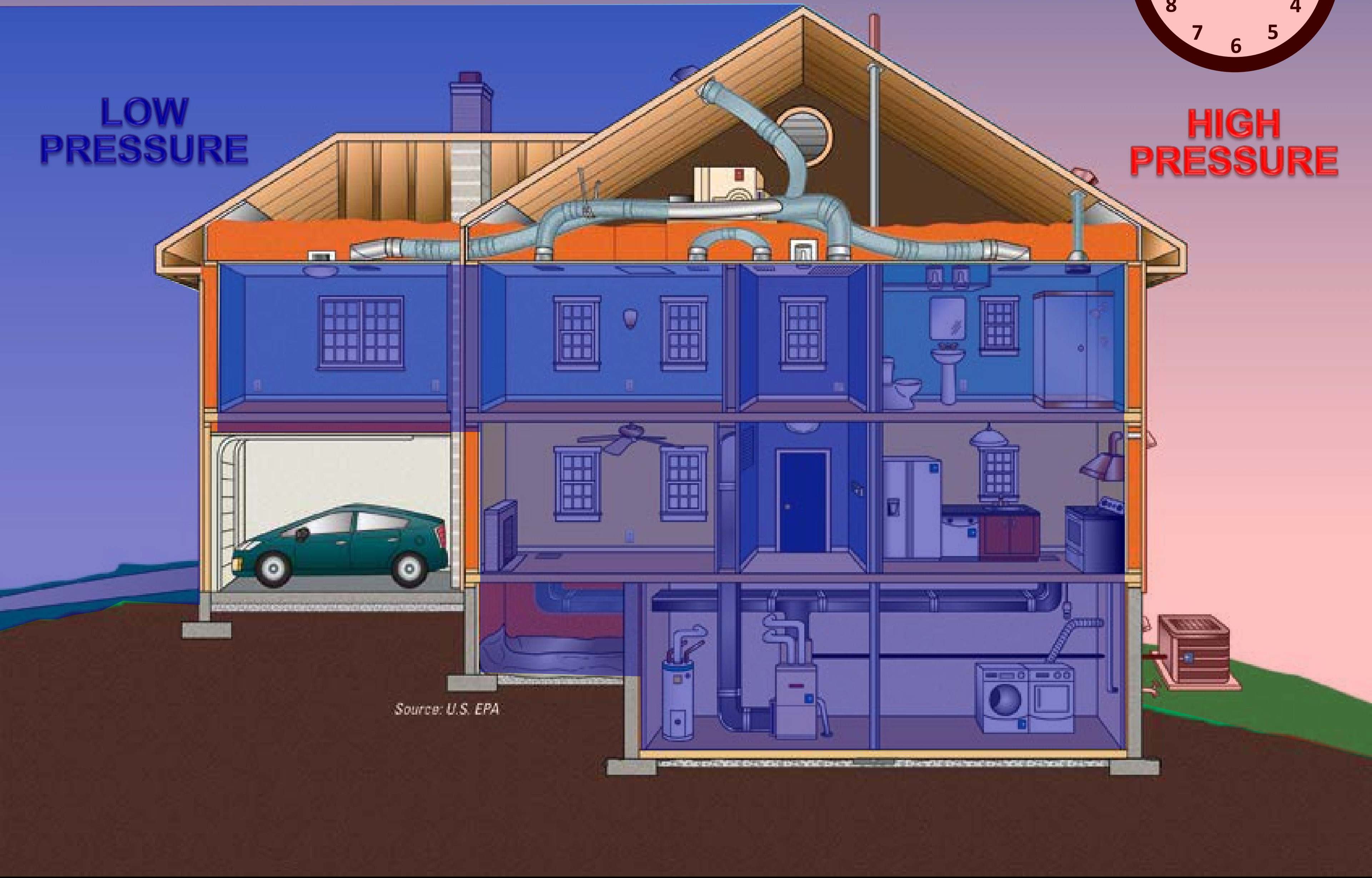
One cfm IN = one cfm OUT

50 Pa ≡ 20 mph wind

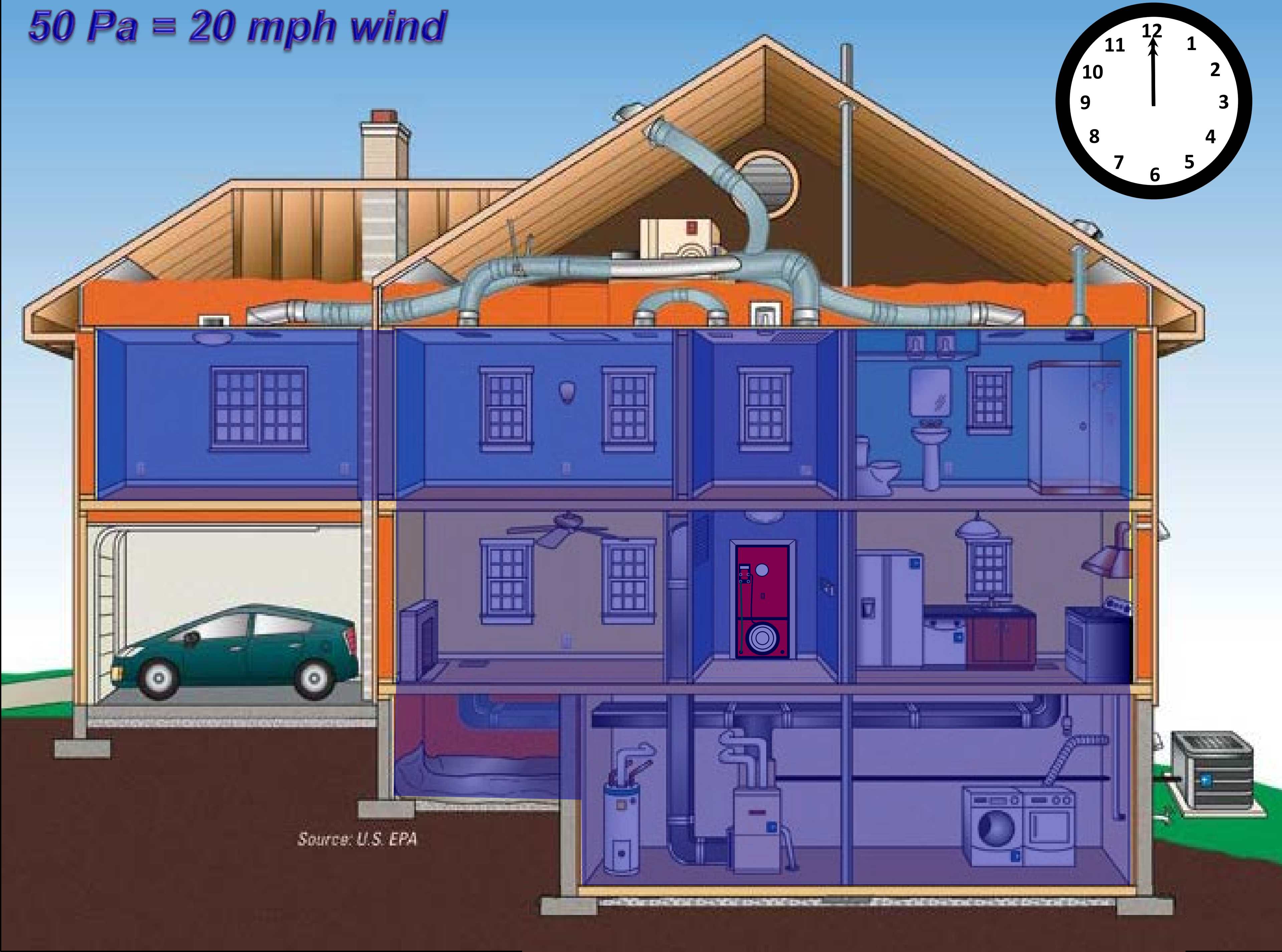
1 ACH_{50}

WIND PRESSURE





50 Pa = 20 mph wind

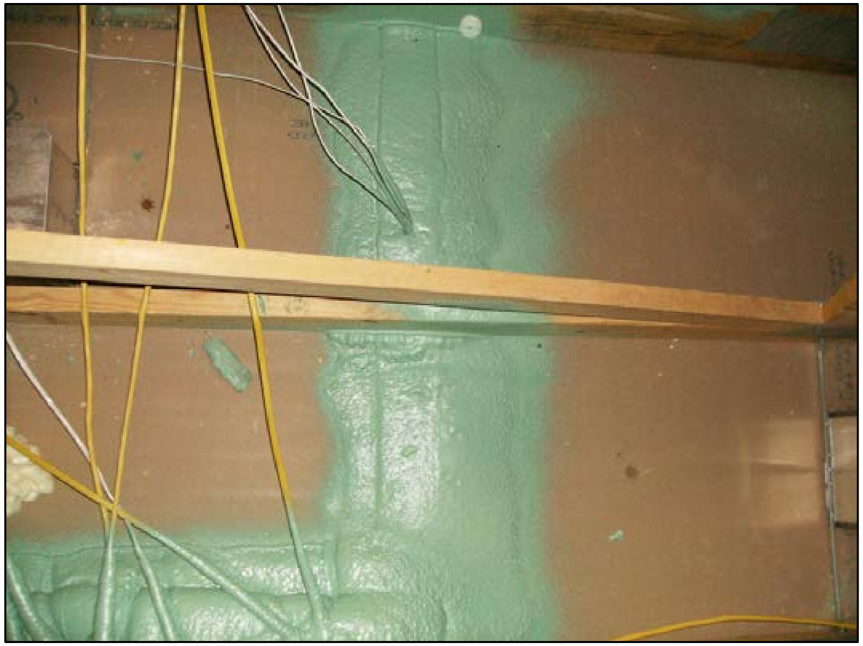


Gaps in Pressure Boundary

Why Do a Blower Door Test?

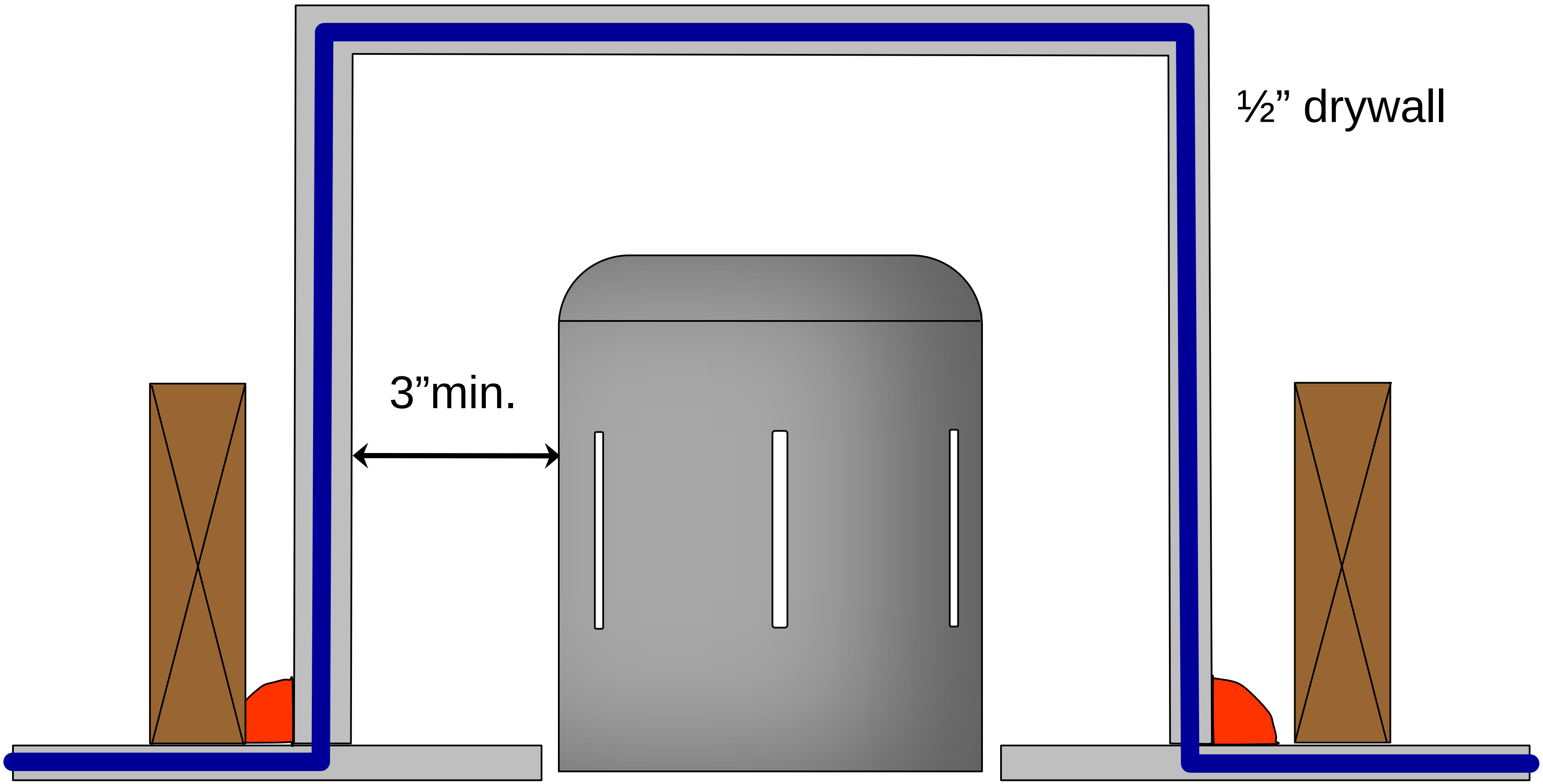
Sealed Top Plates & Short Knee Walls

Sealed and insulated short knee wall and top plates



Perfectly sealed top plates with 2-part spray foam

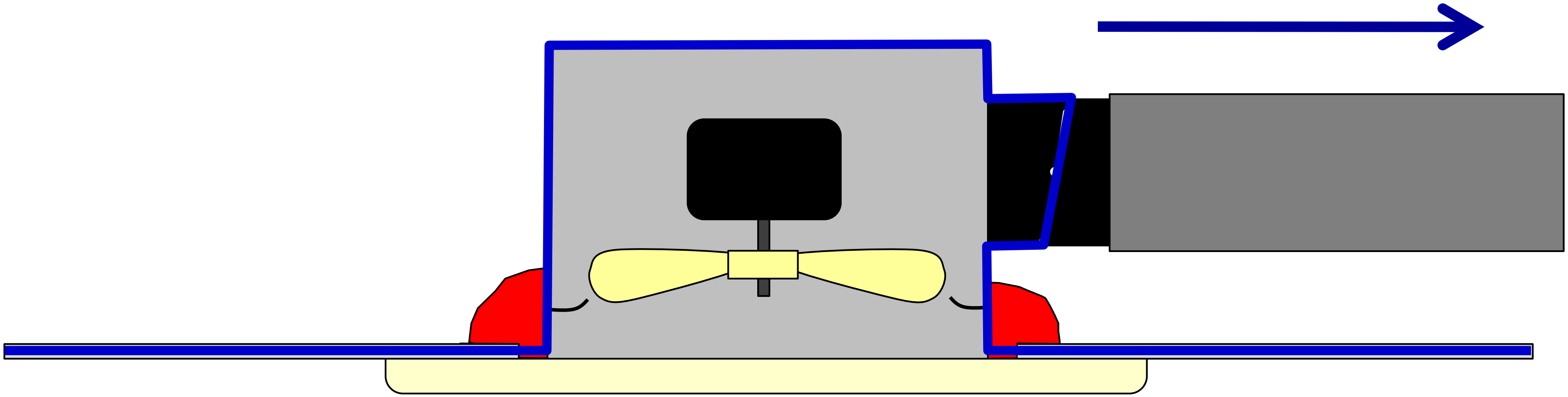
Non-IC Rated Recessed Light Fixture



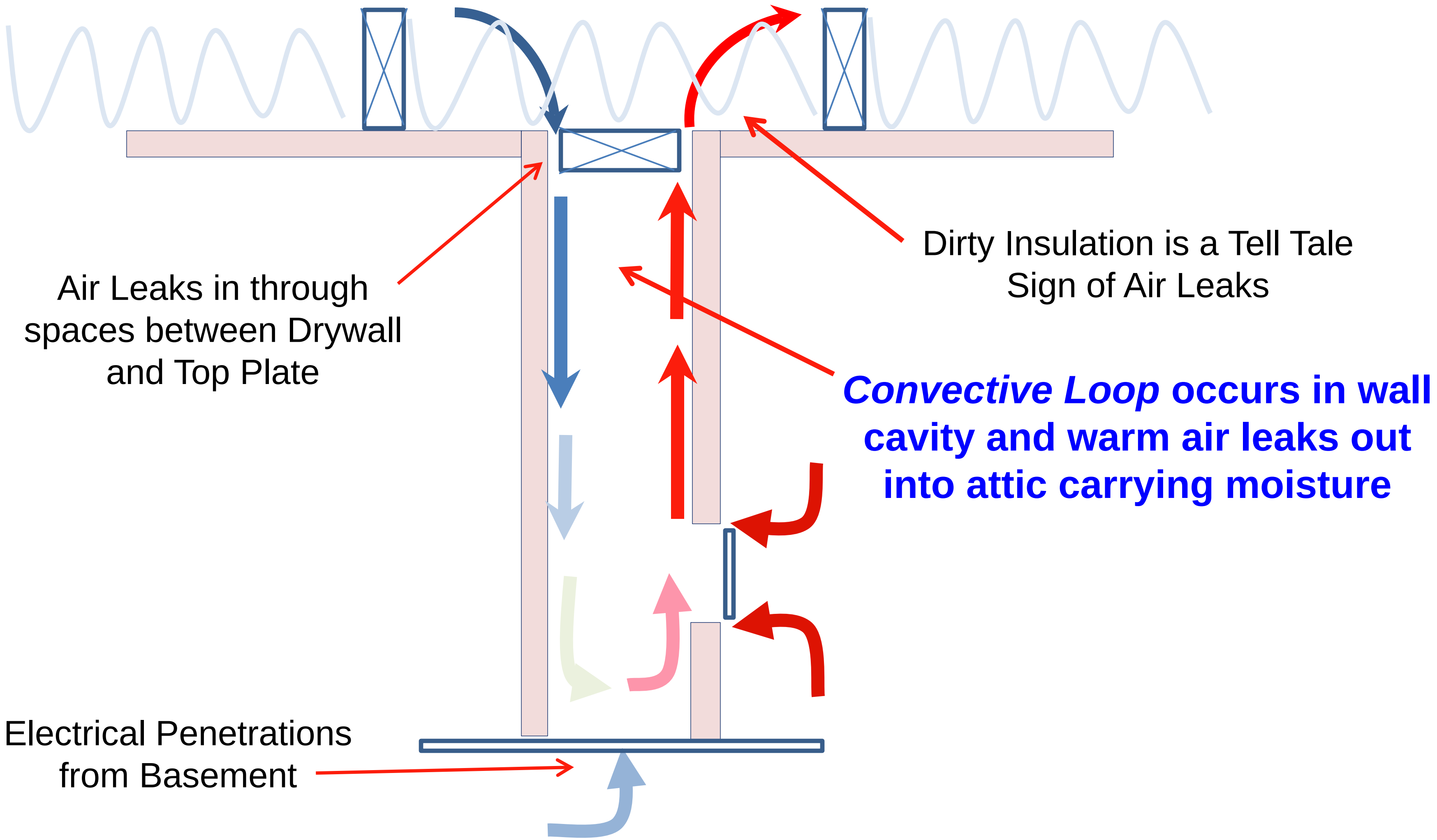
Incomplete pressure boundary

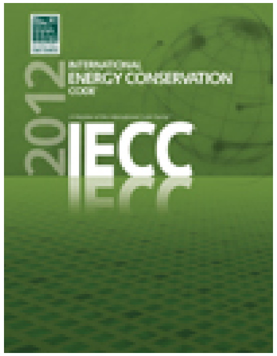
Why Do a Blower Door Test?

Continuity of Pressure Boundary, Exhaust Fans



Gaps in Pressure Boundary



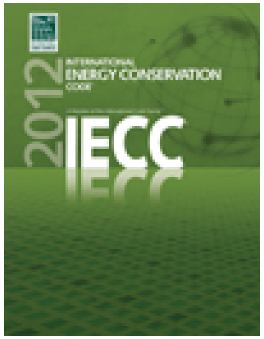


- Chapter 11 in IRC replaced by IECC-Residential(RE)
- Cold-climate builders: Will foam sheathing be needed;
- More efficient Fenestration products;
- Every new home will need to pass a blower door test to $3ACH_{50}$;(if Adopted
- Balanced Mechanical ventilation required for homes (if adopted)
- **New SHW pipe insulation and run-length requirements (R-3);**

R 403.4.4 Hot Water Pipe Insulation

- **Hot water piping will be insulated to at least R-3 as follows:**
  - Piping is larger than 3/4” in nominal diameter,
  - Piping serves more than one dwelling unit,
  - Piping runs from water heater to kitchen outlets,
  - Piping is located outside of conditioned space,
  - Piping runs from water heater to a distribution manifold,
  - Piping is located under a floor slab,
  - Piping is buried,
  - Supply and return piping is in recirculation systems other than demand recirculation systems,
  - **Piping run exceeds the following maximum run lengths:**

Nominal diameter of largest pipe diameter in run	3/8”	1/2"	3/4”	> 3/4"
Max run length	30 ft	20 ft	10 ft	5 ft



- Cold-climate builders: Get ready for mandatory foam sheathing;
- Better performing, more efficient windows;
- Every new home will need to pass a blower door test to 3ACH_{50};
- Balanced Mechanical ventilation required for homes
- New SHW pipe insulation and run-length requirements (R-3);
- **Increased stringency of duct leakage thresholds;**

R 403.2.2 Increased duct leakage stringency

Duct Sealing (Mandatory). All ducts are required to be tested for total duct leakage (tightness).

	Total Duct Leakage CFM25 per 100 ft^2 CFA	
Construction Phase	~~2009 IECC~~	2012 IECC
Post-Construction	~~12~~	4
Rough-in	~~6~~	4
Rough-in if air-handler not yet installed	~~4~~	3

Note: Duct Leakage is measured in cubic feet per minute (CFM) at a pressure of 25 Pascals for every 100 square feet of conditioned floor space (CFA)

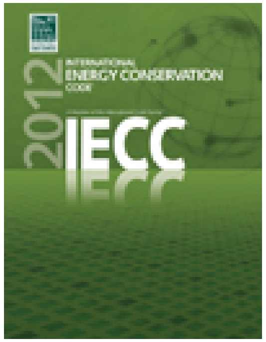
Increased duct leakage stringency

Duct Sealing (Mandatory). All ducts are required to be tested for total duct leakage (tightness).

Exception: The test is not required where the air handler and entire duct system are located within conditioned space.

Construction Phase	Total Duct Leakage CFM25 per 100 ft^2 CFA	
	~~2009 IECC~~	2012 IECC
Post-Construction	~~12~~	4
Rough-in	~~6~~	4
Rough-in if air-handler not yet installed	~~4~~	3

Note: Duct Leakage is measured in cubic feet per minute (CFM) at a pressure of 25 Pascals for every 100 square feet of conditioned floor space (CFA)

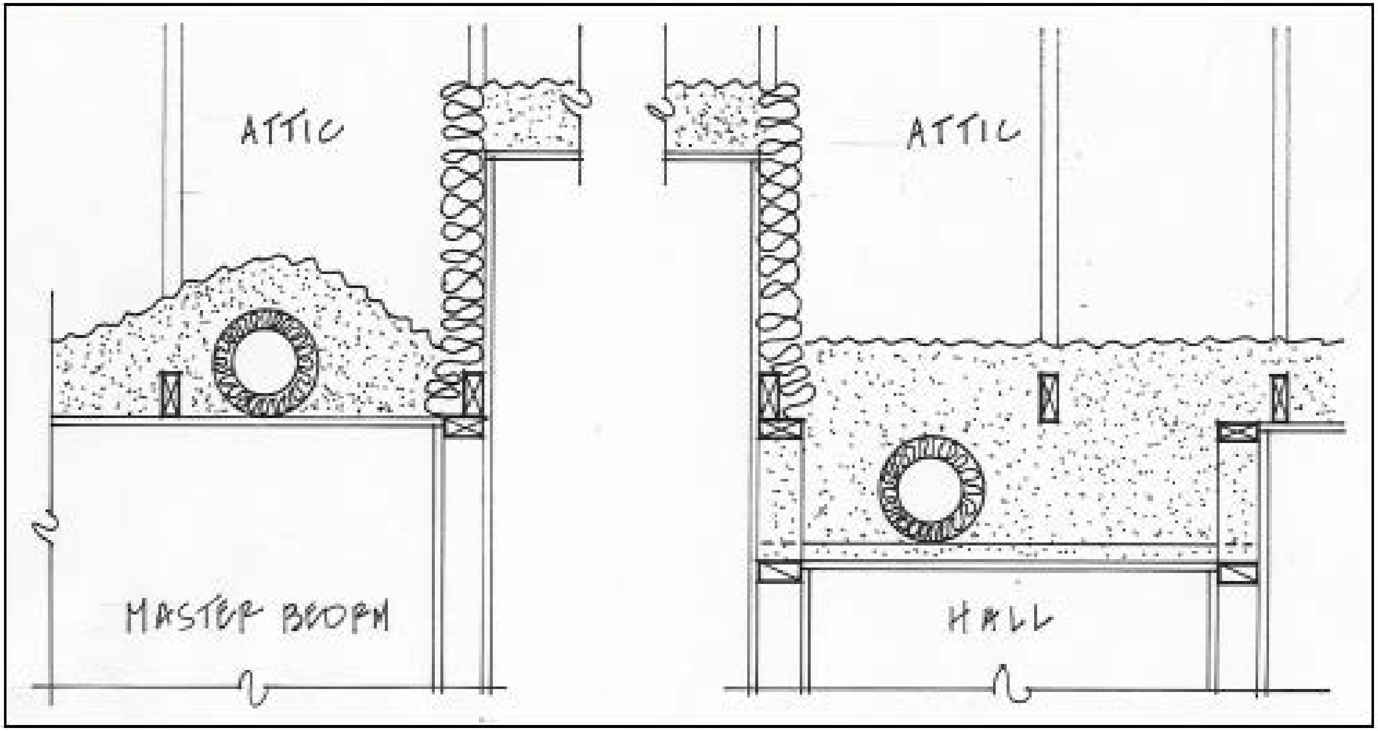


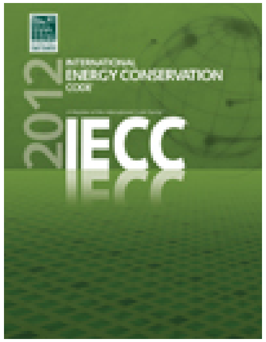
- Chapter 11 in IRC replaced by IECC-Residential(RE)
- Cold-climate builders: Get ready for mandatory foam sheathing;
- Better performing, more efficient windows;
- Every new home will need to pass a blower door test to $3ACH_{50}$;
- Balanced Mechanical ventilation required for homes
- New SHW pipe insulation and run-length requirements (R-3);
- Increased stringency of duct leakage thresholds;
- **Building cavities would no longer allowed for supply or return air; (R403.2.3)**

Ductwork Buried in Ceiling Insulation

- **Code Compliant Ceiling Insulation (R-Value, Depth, Density)?**

Figure 1. Two Buried Duct Installation Configurations

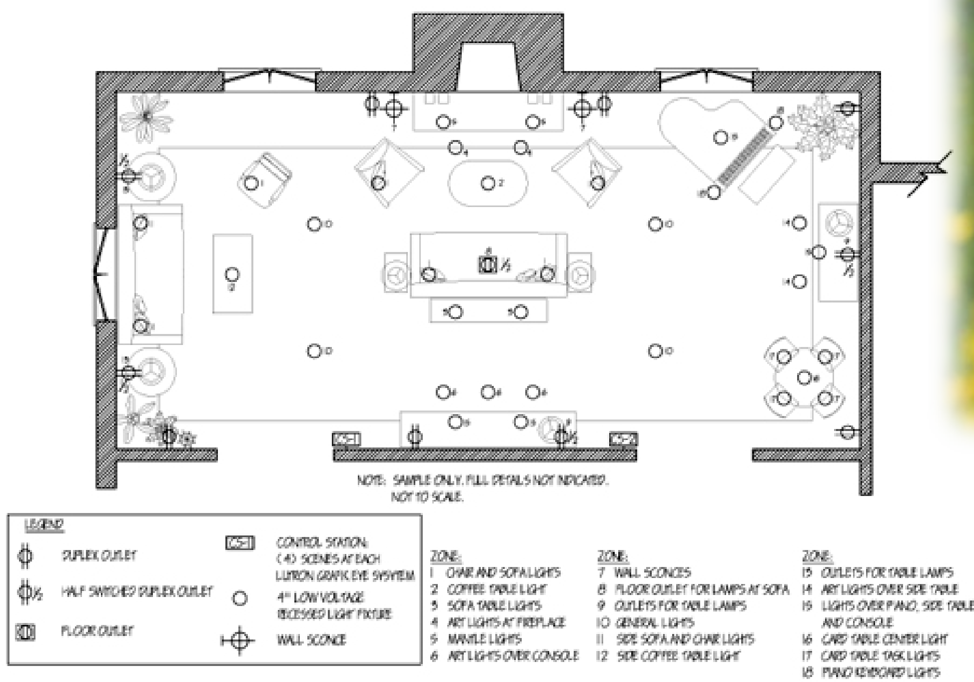




- Cold-climate builders: Get ready for mandatory foam sheathing;
- Better performing, more efficient windows;
- Every new home will need to pass a blower door test to $3ACH_{50}$;
- Balanced Mechanical ventilation required for homes
- New SHW pipe insulation and run-length requirements (R-3);
- Increased stringency of duct leakage thresholds;
- Building cavities no longer allowed for supply or return air;
- **Three of every four fixtures will need to be high-efficacy lamps (75%);**

R 404.1 Three of every four fixtures will need to be high-efficacy lamps

A minimum of 75% of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.



R402.2.12 Def'n – THERMAL ISOLATION (SUNROOMS)

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- **Sunrooms – One-story structure >40% glazed wall and roof area. Must meet insulation requirements of code or be *thermally isolated*.**

R402.2.12 Def'n – THERMAL ISOLATION (SUNROOMS)

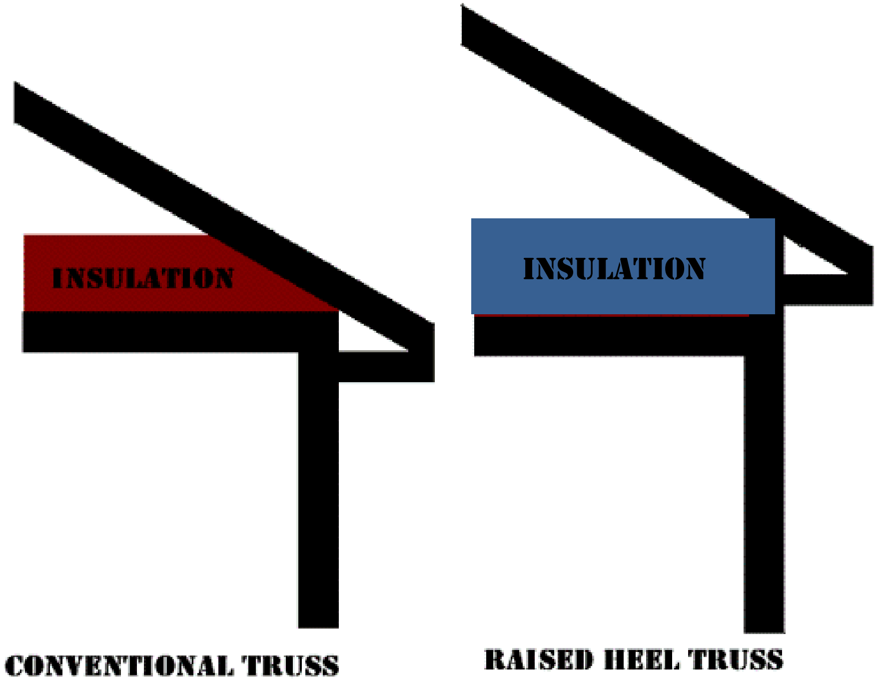
- **Sunrooms – One-story structure >40% glazed wall and roof area. Must meet insulation requirements of code or be *thermally isolated*.**

- **Physical and space conditioning separation from conditioned spaces. The conditioned spaces shall be controlled as separate zones for heating and cooling or conditioned by separate equipment.**

R402.2.1-Raised Truss Clarification

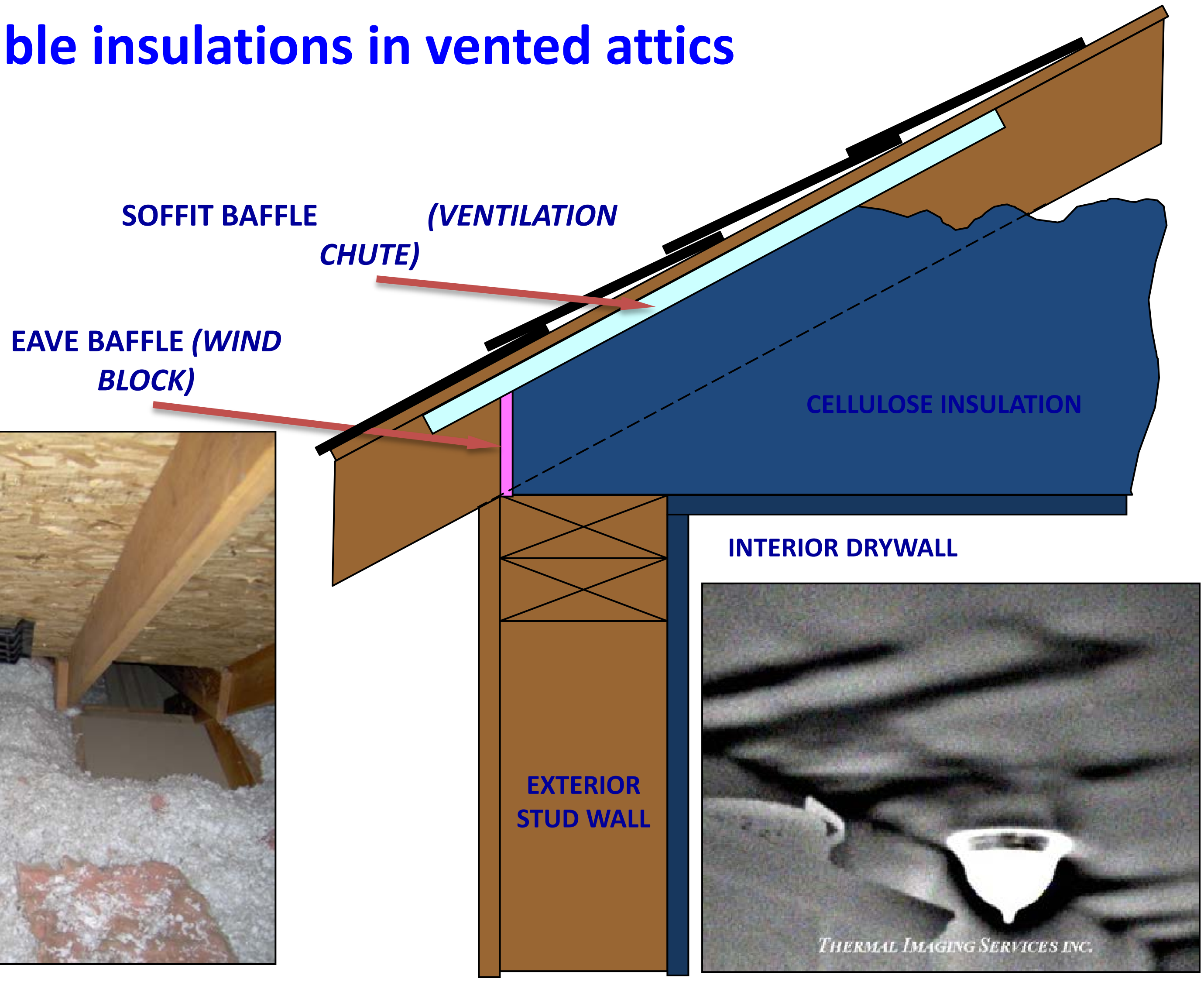
(R-Value Reduction Over Entire Attic Field)

- **The R-38 for R-49 substitution is applied across the entire attic field (not just at the wall line-to-eave extension).**



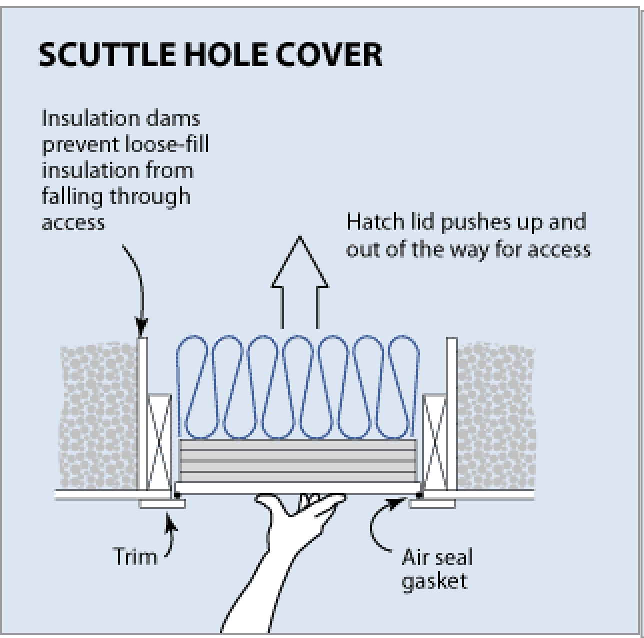
R 402.2.3-Eave Baffle

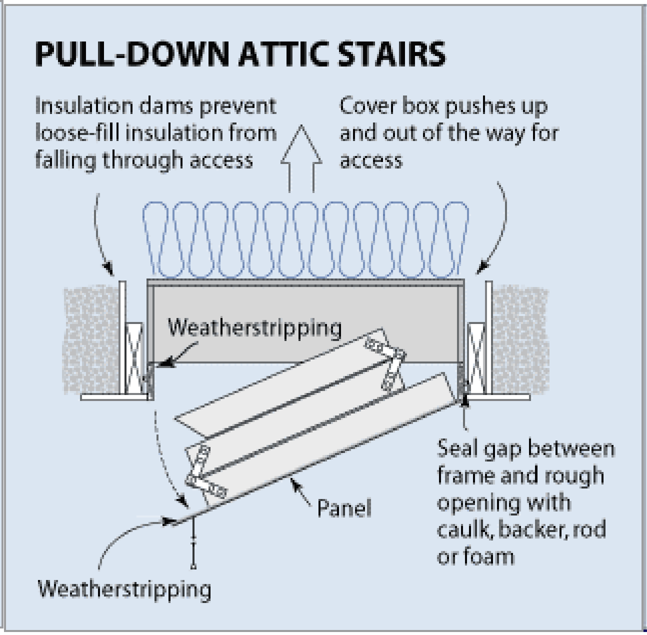
- **For air-permeable insulations in vented attics**

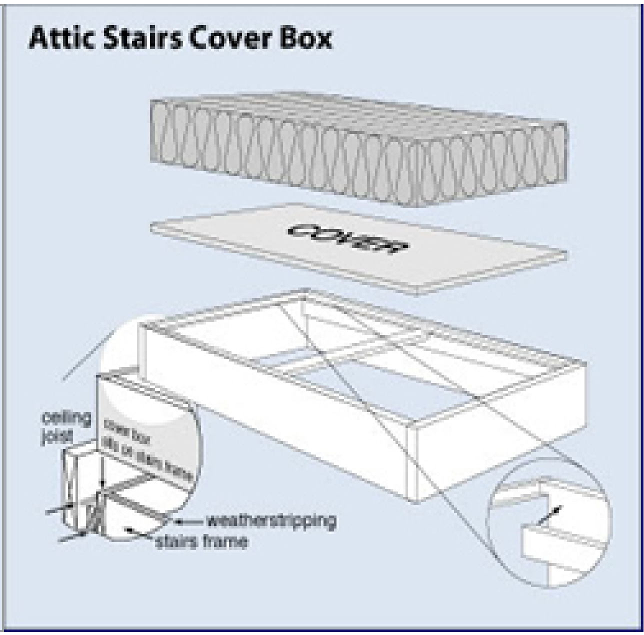


R402.2.4 - Attic Access Hatches

- **Attic access doors from conditioned to unconditioned spaces shall be weather-stripped and insulated. Insulation dam/baffling required.**







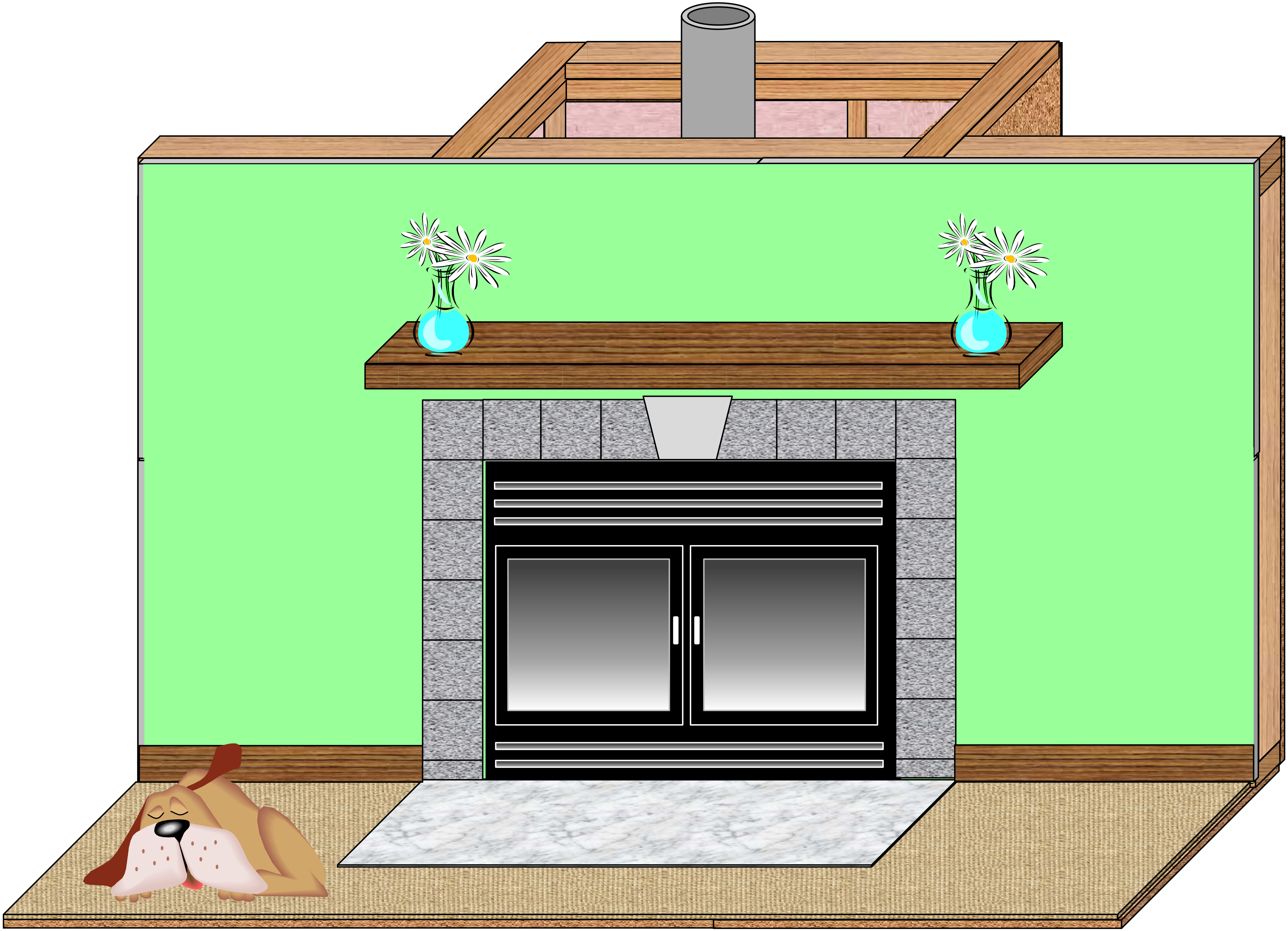
R 402.4.2 - Fireplaces.
New wood-burning fireplaces will have tight-fitting flue dampers and outdoor combustion air.

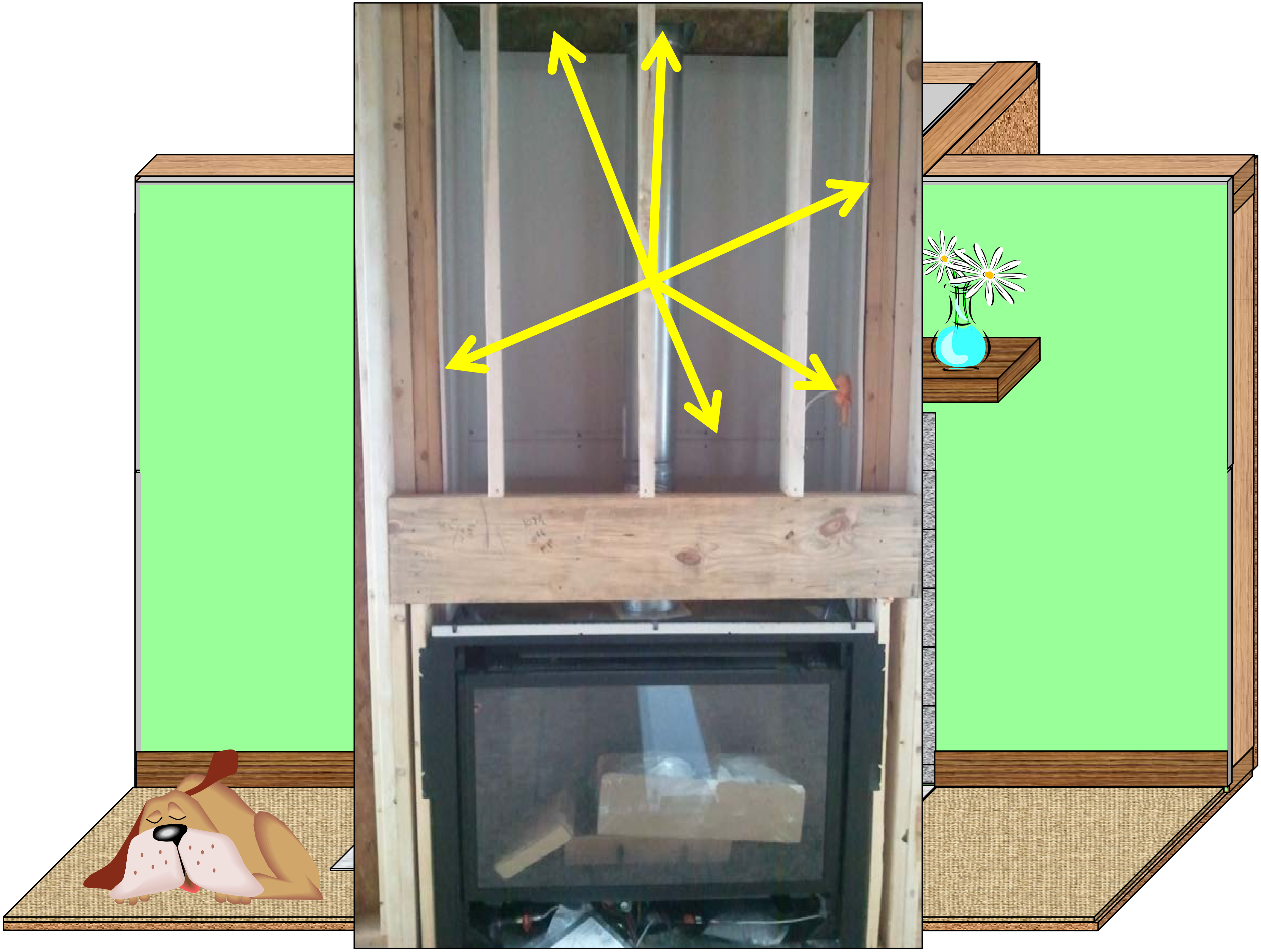
Fireplaces Table R402.4.1.1

TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	CRITERIA[a]
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. 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/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.
Rim joists	Rim joists shall be insulated and include the air barrier.
Floors (including above-garage and cantilevered floors)	Insulation shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier shall be installed at any exposed edge of insulation.
Crawl space walls	Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.
Narrow cavities	Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air tight, IC rated, and sealed to the drywall.
Plumbing and wiring	Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior wall	Exterior walls adjacent to showers and tubs shall be insulated and the air barrier installed separating them from the showers and tubs.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed.
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the sub-floor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors.

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.





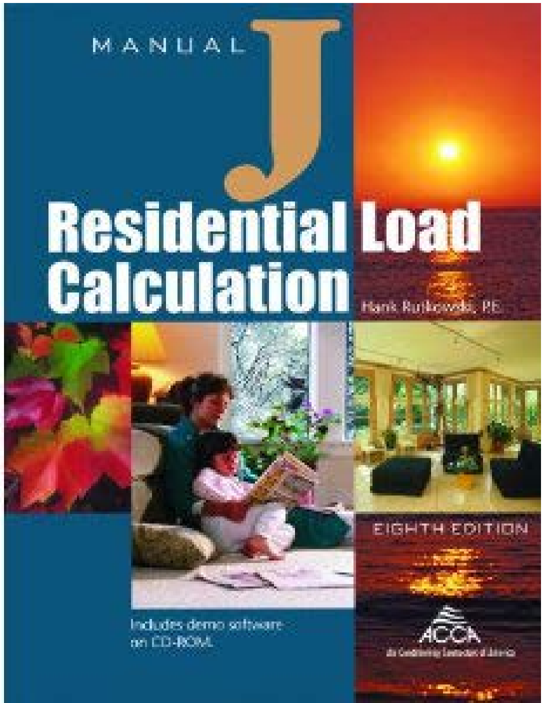
Calculating Heat Loss

And

Sizing The Mechanical Equipment

R 403.6 - Equipment Sizing ACCA Manual 'J', Manual 'S'

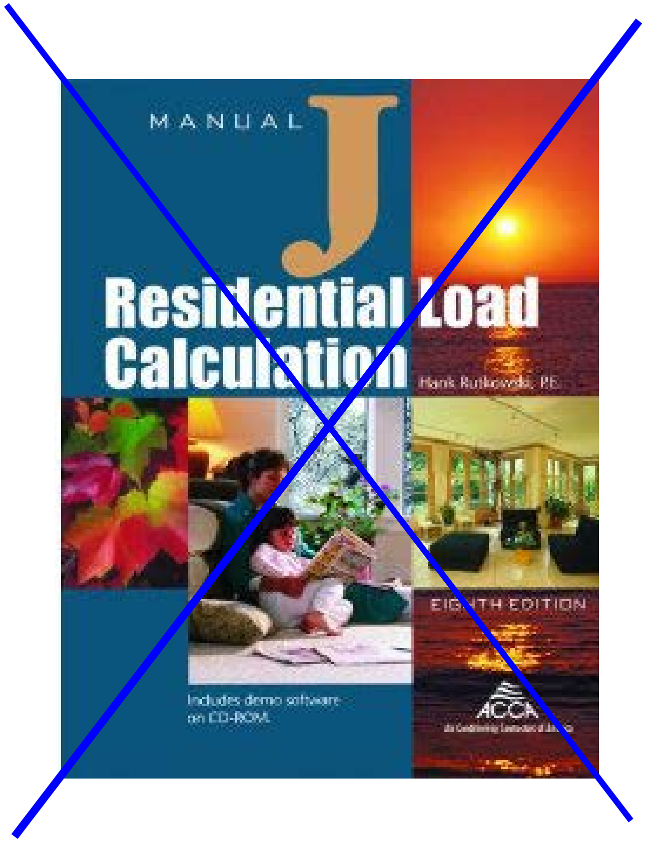
- **Heating and cooling equipment will be sized in accordance with ACCA *Manual S* based on building loads calculated in accordance with ACCA *Manual J*…**



Equipment Sizing

- Or Other accepted and established method for sizing

Ex. Q=UA (dT)



$Q = UA(dT)$

- **What exactly is this equation?.... and why do we need to understand it?**

Q = UA(dT)

- Q = what we are trying to define (Btu's lost Per hour)

$Q = UA(dT)$

- Q = what we are trying to define
- **U = the U-value of the wall**

$Q = UA(dT)$

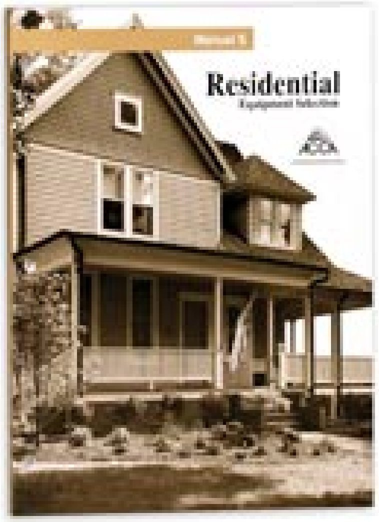
- Q = what we are trying to define
- U = the U-value of the wall
- **A = Area of the wall**

$Q = UA(dT)$

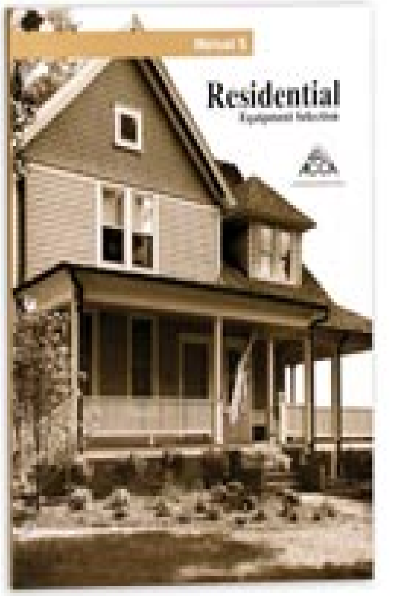
- Q = what we are trying to define
- U = the U-value of the wall
- A = Area of the wall
- **(dt) = Delta T or temperature difference…**

R403.6 - Mandatory Equipment Sizing ACCA Manual 'J', Manual 'S'

- *Manual J8th* is only used to calculate the residential heating and cooling loads.

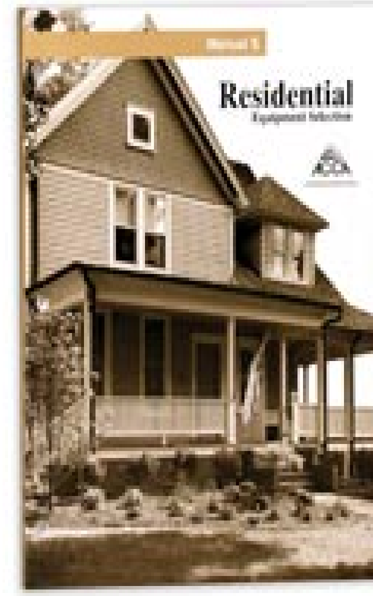


Equipment Sizing
ACCA Manual 'J', Manual 'S'



- *Manual J8th* is only used to calculate the residential heating and cooling loads.
- ***Manual J8th*** **guides HVAC designers to use ACCA *Manual S* to select equipment that is the right size.**

R 403.5.17 Equipment Sizing ACCA Manual 'J', Manual 'S'



- *Manual J8*th is only used to calculate the residential heating and cooling loads.
- *Manual J8*th guides HVAC designers to use ACCA *Manual S* to select equipment that is the right size (see§10-4 of *Manual S*).
- ***Manual S* sets equipment sizing limits, as summarized in Table 1.**

ACCA Manual S= Sizing of Equipment

Manual S Equipment Selection Sizing Limitations		
Equipment	**Sizing Limits**	**Reference**
Furnaces	100% - 140% of total heating load	Section 2-2
Boilers	100% - 140% of total heating load	Section 2-2
Air conditioners	115% of total cooling load*	Section 3-4
Heat pumps	115%[1] or 125%[2] of total cooling load*	Section 4-4
Supplemental heat (heat pumps)		
• Electric	Based on equipment balance point	Section 4-8
• Dual fuel	100% - 140% of total heating load	Section 6-8
Emergency Heat (heat pumps)	Based on local codes	Section 4-9

Manual S Input for Design Air Flow (*Manual D*)		
Mode of Operation	**Requirement**	**Reference**
• Heating	Temperature rise requirement	Section 2-6
• Cooling	Air flow associated with the selected equipment's capacity	Section 3-11

[1] Heat pumps in a *cooling* dominant climate are allowed to be 115% of the cooling load.
[2] Heat pumps in a *heating* dominant climate are allowed to be 125% of the cooling load.
* The size of the cooling equipment must be based on the same temperature and humidity conditions that were used to calculate the *Manual J* loads.

Equipment Sizing
Applying Manual S to a Heating

Equipment Sizing
Applying Manual S to a Heating

Example

Equipment Sizing
Applying Manual S to a Heating **Example**

- Select a furnace for a home with a **57,000 Btu/h output** heating requirement based on **Q=UA delta T or ACCA Manual J.**

Equipment Sizing
Applying Manual S to a Heating **Example**

- Select a furnace for a home with a **57,000 Btu/h** output heating requirement based on **Q=UA delta T or ACCA Manual J.**
- Furnace must deliver as least **57,000 Btu/h** to maintain the interior design temperature (T-1) in the home when the outdoor temperature (T-2) dips to design temp.

Changing Design Conditions

City	Summer Db/Wb ºF 1999	Summer Db/Wb ºF 2006	Winter Db ºF 1999	Winter Db ºF 2006
Albert Lea	87/72	**85/72**	-17	**-15**
Alexandria	88/72	**86/70**	-22	**-21**
Bemidji	85/69	**84/68**	-31	**-24**
Brainerd	87/71	**86/71**	-20	**-20**
Duluth	82/68	**81/67**	-21	**-20**
Faribault	88/72	**86/73**	-17	**-16**
Fergus Falls	88/72	**86/71**	-21	**-21**
Virginia	83/72		-25	
International Falls	83/68	**83/67**	-29	**-28**
Mankato	88/72	**86/72**	-17	**-15**
Minneapolis/St. Paul	89/73	**88/72**	-16	**-15**
Rochester	87/72	**85/72**	-17	**-17**
St. Cloud	**88/72**	**86/71**	-15	**-20**
Willmar	88/72	**85/71**	-15	**-20**
Winona	88/73	**88/74**	-14	**-13**

Equipment Sizing Applying Manual S to a Heating **Example**

- Select a furnace for a home with a **57,000 Btu/h** output heating requirement based on **Q=UA delta T or ACCA Manual J.**
- Furnace must deliver as least **57,000 Btu/h** to maintain the interior design temperature (T-1) in the home when the outdoor temperature (T-2) dips to design temp.
- ***Manual S* sets a sizing limit for furnaces using Table.**

Equipment Sizing
Applying Manual S to a Heating **Example**

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- *Manual S* sets a sizing limit for furnaces using Table.
- **Furnace shall have a capacity no larger than 140% of heating load.**
  - **(140% x 57,000 = 79,800 Btu/h)**
-

Equipment Sizing Applying Manual S to a Heating **Example**

- Select a furnace for a home with a **57,000 Btu/h** output heating requirement based on **Q=UA delta T or ACCA Manual J.**
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- Furnace shall have a capacity no larger than 140% of heating load.
  - (140% x 57,000 = 79,800 Btu/h)
- Based on home's load and sizing limitations, the furnace must produce a minimum of **57,000 Btu/h ≤ heating requirement for the home but can not produce more than ≤ 79,800 Btu/h**.

Equipment Sizing
Applying Manual S to a Cooling

Equipment Sizing
Applying Manual S to a Cooling

- Select an air conditioner for a home with the following *Manual J8th* cooling loads:

Equipment Sizing
Applying Manual S to a Cooling

- Select an air conditioner for a home with the following *Manual J8th* cooling loads:

  Sensible Cooling 22,000 Btu/h

Equipment Sizing
Applying Manual S to a Cooling

- Select an air conditioner for a home with the following *Manual J8th* cooling loads:

Sensible Cooling	22,000 Btu/h
Latent Cooling	**8,000 Btu/h**

Equipment Sizing
Applying Manual S to a Cooling

- Select an air conditioner for a home with the following *Manual J8th* cooling loads:

Sensible Cooling	22,000 Btu/h
Latent Cooling	8,000 Btu/h
Total Cooling	**30,000 Btu/h**

Equipment Sizing
Applying Manual S to a Cooling

- Select an air conditioner for a home with the following *Manual J8th* cooling loads:

Sensible Cooling	22,000 Btu/h
Latent Cooling	8,000 Btu/h
Total Cooling	**30,000 Btu/h**

- ***Manual S*** **sets a sizing limit for air conditioners using Table.**

Equipment Sizing
Applying Manual S to a Cooling

- Select an air conditioner for a home with the following *Manual J8th* cooling loads:

Sensible Cooling	22,000 Btu/h
Latent Cooling	8,000 Btu/h
Total Cooling	**30,000 Btu/h**

- *Manual S* sets a sizing limit for air conditioners using Table.
- **Air conditioner shall have a capacity no larger than 115% of total cooling load.**

Equipment Sizing
Applying Manual S to a Cooling

- Select an air conditioner for a home with the following *Manual J8th* cooling loads:

Sensible Cooling	22,000 Btu/h
Latent Cooling	8,000 Btu/h
Total Cooling	**30,000 Btu/h**

- *Manual S* sets a sizing limit for air conditioners using Table.
- **Air conditioner shall have a capacity no larger than 115% of total cooling load.**
  - **(115% x 30,000 = 34,500)**

Equipment Sizing
Applying Manual S to a Cooling

- Select an air conditioner for a home with the following *Manual J8th* cooling loads:

Sensible Cooling	22,000 Btu/h
Latent Cooling	8,000 Btu/h
Total Cooling	**30,000 Btu/h**

- *Manual S* sets a sizing limit for air conditioners using Table.
- Air conditioner shall have a capacity no larger than 115% of total cooling load.
  – (115% x 30,000 = 34,500)
- **Based on home's load and sizing limitations, air conditioner must produce 30,000 Btu/h ≤ cooling requirement ≤ 34,500 Btu/h.**

Heating and Cooling Systems and calculated heat loss requirements.

Lets calculate a simple Heat loss of a wall

Lets calculate a simple Heat loss of a wall

- **Here is a simple example of a wall and then the same wall with a window**

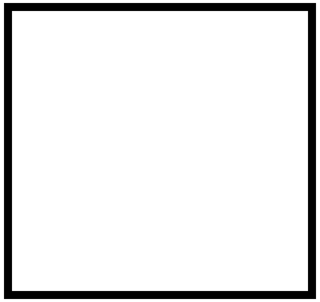
Lets calculate a simple Heat loss of a wall

- However here is a simple example of a wall and then the same wall with a window
- **Note the changes in heat loss with the window**

Q = UA(dT) = heat load assessment = defines equipment sizing.

Ex.

Using



Room is 10 x 10 x 10

Assuming a wall U=0.0526

(Conversion) R-19 = (1 divided by 19) = U

Lets look at just one wall

Lets look at just one wall

- **1 Wall that is 10’ tall and 10’ wide. Equals an Area (A) of 100 Sq. Ft**

Lets look at just one wall

- **1 Wall that is 10’ tall and 10’ wide. Equals an Area (A) of 100 Sq. Ft**
- **Btu’s per hour (Q) = 0.0526 (U) x 100Sq Ft. (A) x 90 (dT)**

Lets look at just one wall

- **1 Wall that is 10’ tall and 10’ wide. Equals an Area (A) of 100 Sq. Ft**
- **Btu’s per hour (Q) = 0.0526 (U) x 100Sq Ft. (A) x 90 (dT)**
- **Btu’s per wall for design loads = 474 Btu’s**

What is the total for the building in Heat Loss (Btu's)

- **Adding in all 4 walls at the exact same Btu's for each wall (4 x 474) would require a heating appliance capable of supplying a minimum of 1,896 Btu's**

What is the total for the building in Heat Loss (Btu's) when we add a 4 x 4 window meeting code to one wall?

- Wall #4 was 100 Sq. Ft. at .0526 U- Factor. Now it is only 84 Sq. Ft. at the .0526 U-Factor + 16 Square foot at a 0.35 U-Factor to accommodate the window

- **Wall 1 = .0526 x 100 x 90 = 474 Btu's**
- **Wall 2 = .0526 x 100 x 90 = 474 Btu's**
- **Wall 3 = .0526 x 100 x 90 = 474 Btu's**
- **Wall 4 = .0526 x 84 x 90 = 398 Btu's**
- **Window 1 In wall 4=**

  .35 x 16 x 90 = 504 Btu's

Total Btu's now are 2324 total Btu's

-1896 Wall w/out Window

Difference of 428 Btu's

This can make a big difference in heating and cooling appliances depending on Number of windows and their U-factors

Now its your turn

Grab the Plan you have

Lets do one together

Main Floor Walls

Main Floor Walls **(assuming 8’ in height with an R-value of 19 in the cavity)**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46**+28**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28**+22**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22**+8**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8**+1**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1**+10**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10**+7**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7**+13**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13**+29**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29**= 164 Lin. Ft. x 8’ wall height**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height **= 1312 Square foot of wall area**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area (additional 4’ added to walls- 12’ ceiling height)

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area (additional 4’ added to walls- 12’ ceiling height)

+ 8

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area (additional 4’ added to walls- 12’ ceiling height)

+ 8**+1**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area (additional 4’ added to walls- 12’ ceiling height)

+ 8+1**+10**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area (additional 4’ added to walls- 12’ ceiling height)

+ 8+1+10**+7**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area (additional 4’ added to walls- 12’ ceiling height)

\+ 8+1+10+7**= 26 Lin. Ft. x 4’ additional wall height**

Main Floor Walls (assuming 8' in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8' wall height = 1312 Square foot of wall area

Foyer area (additional 4' added to walls- 12' ceiling height)

\+ 8+1+10+7= 26 Lin. Ft. x 4' additional wall height **= 104 Square foot of wall area**

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area (additional 4’ added to walls- 12’ ceiling height)

\+ 8+1+10+7= 26 Lin. Ft. x 4’ additional wall height = 104 Square foot of wall area

Total square foot wall area (including window areas) = 1312 + 104 = = 1416 Square foot of wall area

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area (additional 4’ added to walls- 12’ ceiling height)

\+ 8+1+10+7= 26 Lin. Ft. x 4’ additional wall height = 104 Square foot of wall area

Total square foot wall area (including window areas) = 1312 + 104 = = 1416 Square foot of wall area

So if Q = UA(dT)

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

Foyer area (additional 4’ added to walls- 12’ ceiling height)

+ 8+1+10+7= 26 Lin. Ft. x 4’ additional wall height = 104 Square foot of wall area

Total square foot wall area (including window areas) = 1312 + 104 = = 1416 Square foot of wall area

So if Q = UA(dT)

Then Q = U of .0526 (1/R-value of 19) x A of 1416 (Sq Ft Wall area) x (dT) of 90 (Central Mn.) = BTU’s

Main Floor Walls (assuming 8’ in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8’ wall height = 1312 Square foot of wall area

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So if Q = UA(dT)

Then Q = U of .0526 (1/R-value of 19) x A of 1416 (Sq Ft Wall area) x (dT) of 90 (Central Mn.) = BTU’s

So Q = .0526 x 1416 x 90 = 6703.34 btu’s heat loss. (We always need to round up the .34 to next whole digit)

Main Floor Walls (assuming 8' in height with an R-value of 19 in the cavity)

46+28+22+8+1+10+7+13+29= 164 Lin. Ft. x 8' wall height = 1312 Square foot of wall area

Foyer area (additional 4' added to walls- 12' ceiling height)

+ 8+1+10+7= 26 Lin. Ft. x 4' additional wall height = 104 Square foot of wall area

Total square foot wall area (including window areas) = 1312 + 104 = = 1416 Square foot of wall area

So if Q = UA(dT)

Then Q = U of .0526 (1/R-value of 19) x A of 1416 (Sq Ft Wall area) x (dT) of 90 (Central Mn.) = BTU's

So Q = .0526 x 1416 x 90 = 6703.34 btu's heat loss. (We always need to round up the .34 to next whole digit)

So Q = 6,704 Btu's Heat loss for walls

Windows

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft	U Factor	(dT)	Btu's Heat Loss

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft	U Factor	(dT)	Btu's Heat Loss
Patio Dr. =					

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft	U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	**72 x 80 = 5760**				

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft	U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	**Divide by 144 = 40 Sq Ft**			

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	**x**	**.28**		

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	**x 90 =**	

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	**1008 Btu's**

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's

Kitchen Window

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	**30 x 36 = 1080**					

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	**Divide by 144 = 7.5 Sq Ft**				

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	**x**	**.29**		

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	**x 90 =**	

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	**196 Btu's**

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	**40 x 40 = 1600**	**Divide by 144 = 11.1 Sq ft**	**x**	**.30**	**x 90 =**	**300 Btu's**

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu’s Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu’s
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu’s
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu’s
Bedroom #3	**40 x 40 = 1600**	**Divide by 144 = 11.1 Sq ft**	**x**	**.30**	**x 90 =**	**300 Btu’s**

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	**50 x 40 = 2000**	**Divide by 144 = 13.9 Sq Ft**	**x**			

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	**50 x 40 = 2000**	**Divide by 144 = 13.9 Sq Ft**	**x**	**.31**	**x 90 =**	**388 Btu's**

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	**32 x 80 = 2560**	**Divide by 144 = 17.8 Sq Ft**				

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq Ft	**x**	**.60 (default)**		

Windows

Window or door unit	**Sq. Inches**	**Divided by 144= Sq Ft**		**U Factor**	**(dT)**	**Btu's Heat Loss**
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq Ft	x	.60 (default)	**x 90 =**	**962 Btu's**

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq Ft	x	.60 (default)	x 90 =	962 Btu's
Front Dr.	**48 x 80 = 3840**	**Divide by 144 = 26.7 Sq Ft**				

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq Ft	x	.60 (default)	x 90 =	962 Btu's
Front Dr.	48 x 80 = 3840	Divide by 144 = 26.7 Sq Ft	**x**	**.60 (default)**		

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
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Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq Ft	x	.60 (default)	x 90 =	962 Btu's
Front Dr.	48 x 80 = 3840	Divide by 144 = 26.7 Sq Ft	x	.60(default)	**x 90 =**	**1442 Btu's**

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq Ft	x	.60 (default)	x 90 =	962 Btu's
Front Dr.	48 x 80 = 3840	Divide by 144 = 26.7 Sq Ft	x	.60(default)	x 90 =	1442 Btu's
Living Rm.	**70 x 50 = 3500**	**Divide by 144 = 24.3 Sq Ft**	**x**	**.30**	**x 90 =**	**657 Btu's**

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq Ft	x	.60 (default)	x 90 =	962 Btu's
Front Dr.	48 x 80 = 3840	Divide by 144 = 26.7 Sq Ft	x	.60(default)	x 90 =	1442 Btu's
Living Rm.	70 x 50 = 3500	Divide by 144 = 24.3 Sq Ft	x	.30	x 90 =	657 Btu's
Totals		**151.6 Sq Ft**				

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq Ft	x	.60 (default)	x 90 =	962 Btu's
Front Dr.	48 x 80 = 3840	Divide by 144 = 26.7 Sq Ft	x	.60(default)	x 90 =	1442 Btu's
Living Rm.	70 x 50 = 3500	Divide by 144 = 24.3 Sq Ft	x	.30	x 90 =	657 Btu's
Totals		**151.6 Sq Ft**				**5253 Btu's**

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Patio Dr. =	72 x 80 = 5760	Divide by 144 = 40 Sq Ft	x	.28	x 90 =	1008 Btu's
Kitchen Window	30 x 36 = 1080	Divide by 144 = 7.5 Sq Ft	x	.29	x 90 =	196 Btu's
Bedroom #2	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Bedroom #3	40 x 40 = 1600	Divide by 144 = 11.1 Sq ft	x	.30	x 90 =	300 Btu's
Master B. R.	50 x 40 = 2000	Divide by 144 = 13.9 Sq Ft	x	**.31**	x 90 =	388 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq Ft	x	.60 (default)	x 90 =	962 Btu's
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Living Rm.	70 x 50 = 3500	Divide by 144 = 24.3 Sq Ft	x	.30	x 90 =	657 Btu's
Totals		**151.6 Sq Ft**				**5253 Btu's**

Note: Total Sq. Ft of window area 151.6 @ a U factor of .0526 needs to be subtracted from wall area Btu's So…

So If $Q = UA(dT)$ =

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Q = .0526 x 151.6 x 90 = 717.64 (Rounded up) = 718 Btus of heat loss So…

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Wall area Btu's = 6704

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Q = .0526 x 151.6 x 90 = 717.64 (Rounded up) = 718 Btus of heat loss So…

Wall area Btu's	= 6704
	+
Window Btu's	**= 5253**

So If Q = UA(dT) =

Q = .0526 x 151.6 x 90 = 717.64 (Rounded up) = 718 Btus of heat loss So…

Wall area Btu’s	= 6704
	+
Window Btu’s	= 5253
= Sub Total Btu’s	**= 11,957**

So If Q = UA(dT) =

Q = .0526 x 151.6 x 90 = 717.64 (Rounded up) = 718 Btus of heat loss

Wall area Btu's	= 6704
	+
Window Btu's	= 5253
= Sub Total Btu's	= 11,957
- Original window area figured as wall area.	**= 718**

So If Q = UA(dT) =

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Wall area Btu's		= 6704
		+
Window Btu's		= 5253
	= Sub Total Btu's	= 11,957
- Original window area figured as wall area.		= 718
Grand Total of Btu's of Walls including Windows		**= 11239**

Ceiling Heat Loss

Ceiling Heat Loss

(28 x 46)

Ceiling Heat Loss

(28 x 46) **+ (7 x 10)**

Ceiling Heat Loss

(28 x 46) + (7 x 10) **= 1358 Square foot of Ceiling Area**

Ceiling Heat Loss

(28 x 46) + (7 x 10) = 1358 Square foot of Ceiling Area **at a R-44 (.0227 U-factor) insulation on average, So…**

Ceiling Heat Loss

(28 x 46) + (7 x 10) = 1358 Square foot of Ceiling Area at a R-44 (.0227 U-factor) insulation on average, So…

If Q = UA(dT) then Q = .0227 x 1358 x 90 = 2774.39 or (rounding up) 2775 Btu's of Heat Loss through the ceiling.

Ceiling Heat Loss

(28 x 46) + (7 x 10) = 1358 Square foot of Ceiling Area at a R-44 (.0227 U-factor) insulation on average, So…

If Q = UA(dT) then Q = .0227 x 1358 x 90 = 2774.39 or (rounding up) 2775 Btu's of Heat Loss through the ceiling.

Slab On grade Basement floor

Ceiling Heat Loss

(28 x 46) + (7 x 10) = 1358 Square foot of Ceiling Area at a R-44 (.0227 U-factor) insulation on average, So…

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Slab On grade Basement floor

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Slab On grade Basement floor

(28 x 46) + (7 x 10) **= 1358 Square foot of floor Area**

Ceiling Heat Loss

(28 x 46) + (7 x 10) = 1358 Square foot of Ceiling Area at a R-44 (.0227 U-factor) insulation on average, So…

If Q = UA(dT) then Q = .0227 x 1358 x 90 = 2774.39 or (rounding up) 2775 Btu's of Heat Loss through the ceiling.

Slab On grade Basement floor

(28 x 46) + (7 x 10) = 1358 Square foot of floor Area **at a R-2 (.50 U-factor) insulation** ,

Ceiling Heat Loss

(28 x 46) + (7 x 10) = 1358 Square foot of Ceiling Area at a R-44 (.0227 U-factor) insulation on average, So…

If Q = UA(dT) then Q = .0227 x 1358 x 90 = 2774.39 or (rounding up) 2775 Btu's of Heat Loss through the ceiling.

Slab On grade Basement floor

(28 x 46) + (7 x 10) = 1358 Square foot of floor Area at a R-2 (.50 U-factor) insulation , **with a new (dT) of 15 So…**

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If Q = UA(dT) then Q = .0227 x 1358 x 90 = 2774.39 or (rounding up) 2775 Btu's of Heat Loss through the ceiling.

Slab On grade Basement floor

(28 x 46) + (7 x 10) = 1358 Square foot of floor Area at a R-2 (.50 U-factor) insulation , with a new (dT) of 15 So…

If Q = UA(dT) then Q = .50 x 1358 x 15 = 10,185 Btu's of Heat Loss through the floor.

Ceiling Heat Loss

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Adding them all up:

Ceiling Heat Loss

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Grand Total of Btu's of Walls including Windows = 11239

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	Grand Total of Btu's of Walls including Windows	**= 11239**
+	**Ceiling Heat Loss**	**= 2775**

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Adding them all up:

	Grand Total of Btu's of Walls including Windows	**= 11239**
+	**Ceiling Heat Loss**	**= 2775**
+	**Slab on Grade Heat Loss**	**= 10185**

Ceiling Heat Loss

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If Q = UA(dT) then Q = .0227 x 1358 x 90 = 2774.39 or (rounding up) 2775 Btu's of Heat Loss through the ceiling.

Slab On grade Basement floor

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Adding them all up:

	Grand Total of Btu's of Walls including Windows	**= 11239**
+	**Ceiling Heat Loss**	**= 2775**
+	**Slab on Grade Heat Loss**	**= 10185**

Total Heat Loss for Furnace sizing **=24199 BTU's**

So if this Building was our new Home, what is the <u>minimum</u> size the furnace would have to be in output rating?

So if this Building was our new Home, what is the minimum size the furnace would have to be in output rating?

And what is the <u>maximum</u> size in terms of Btu of output can the furnace be?

So if this Building was our new Home what is the Minimum size would the furnace have to be in output rating?

Total Heat loss of Building = 24,199 Btu's

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So the Minimum Btu's of Output allowed for the Furnace = 24,199

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So if this Building was our new Home what is the Minimum size would the furnace have to be in output rating?

Total Heat loss of Building = 24,199 Btu's

So the Minimum Btu's of Output allowed for the Furnace = 24,199

Calculating the Maximum Btu's =

24,199 x 1.40 = 33,878 Btu's

So if this Building was our new Home what is the Minimum size would the furnace have to be in output rating?

Total Heat loss of Building = 24,199 Btu's

So the Minimum Btu's of Output allowed for the Furnace = 24,199

Calculating the Maximum Btu's =

24,199 x 1.40 = 33,878 Btu's

So a properly sized furnace for this home output rating must be between

24,199 and 33,878 Btu's

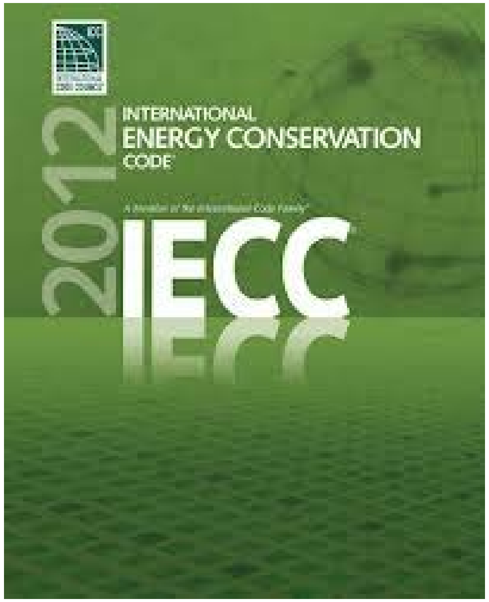
Residential Mechanical Provisions;
Minnesota Rules chapters
1322 & 1346

Code Books needed

Code Books needed

Code Books needed

Code Books needed



3- Types of air in any building

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- **Ventilation Air**

3- Types of air in any building

- Ventilation Air

- Make Up Air

3- Types of air in any building

- **Ventilation Air**
- **Make Up Air**
- **Combustion Air**

Quality Indoor air and Ventilation

QUALITY INDOOR AIR

Is quality indoor air a concern to the average homeowner or building occupant?

YES!

Quality indoor air is a concern to not only the occupants, but to builders, building officials and design professionals alike.

What do most homeowners do to address their own indoor air quality?

Liquid Gold
Favor
Pledge
Wood & Glass
Lemon
Endust
Old English
7.59
4.35
2.25
3.79
3.79
3.79
3.99
3.99
3.39
Glade
Wizard
Renuzit
After The Rain
Lysol
Antibacterial Action
Clorox
Citra
Air Purifier
cedar
1.49
1.49
1.49
1.19
1.49
4.25
4.25
4.25
3.89
5.65
Iron Out
Glade
PlugIns
3 Refills
Wizard
stick ups
Renuzit
Country Fields
After The Rain
Super Odor Killer
2.95
2.95
2.95
2.95
2.59
1.47
1.47
1.59
1.59
1.59
1.59
Clorox
PlugIns
Duet
2 in 1
Refill
Renuzit
OneTouch
Scotch Brite
3.19
3.19
3.25
2.17
2.17
3.25
3.25
4.29
4.29


PLUGINS
Double Strength
For Large Rooms
BOTANICAL GARDEN
Contains 1 Holder & 2 Fragrance Refills
NET WT. .34 OZ. (9.6g)
CAUTION: CONCENTRATE MAY IRRITATE. SEE CARTON CAUTION.
GLADE 01/01/01 PC
$3.19 PER EA
PLUG-INS 06/11/01 DC
$3.19 PER EA

Why do we need to be so concerned with quality indoor air today?

We never worried about it before.

INDOOR AIR QUALITY

The E.P.A. lists indoor air quality as the 4th largest environmental threat to our country.

People spend two-thirds of their lives in their homes and 90% of their life indoors.

Indoor air quality is very important for the health and well-being of building occupants and the building alike.

INDOOR AIR QUALITY

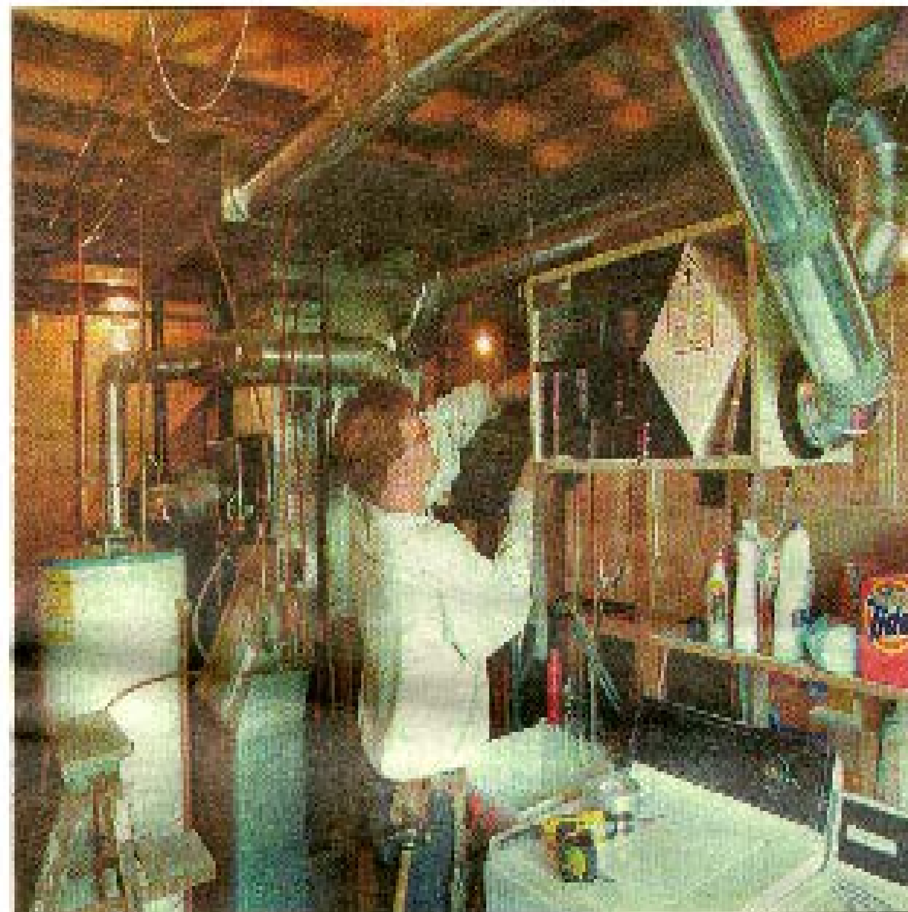
Poor indoor air quality can result in:

structural rot in walls, attics and around fenestration products...

…as well as a health concern for the occupants.

Houses must be built tight

and ventilated right



Things that have changed mechanically

Things that have changed mechanically

- **More mechanical equipment**

Things that have changed mechanically

- More mechanical equipment
- **Higher efficiency of that equipment**

Things that have changed mechanically

- More mechanical equipment
- Higher efficiency of that equipment
- **Required ventilation**

Lets Talk Ventilation

Improper Installations are the biggest issue

Residential Ventilation

Ventilation Systems-Overview

- Goals of Mechanical Ventilation
  - To maintain good indoor air quality
  - To control indoor moisture

Ventilation Systems-Overview

- **ASHRAE 62.1-2004**
  - **"Acceptable indoor air quality: air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction."**

Ventilation Systems

- When to Ventilate?
  - Primarily when the home is occupied
  - May need to continue after or purge before

- Where to Ventilate?
  - Ideally where the pollutants are concentrated
  - Remove point source pollutants immediately
  - Use general ventilation for disperse pollutants

Overview- What is Ventilation?

"The process of supplying air to or removing air from a space for the purpose of controlling air contaminant levels, humidity, or temperature within the space."

Overview- Ventilation Systems

- **Why** Ventilate?
  - People pollutants
    - human respiration, body odors
    - water vapor
  - Building pollutants
    - VOCs, Combustion gases, radon
    - water vapor
  - Activity pollutants
    - VOCs, odors
    - water vapor

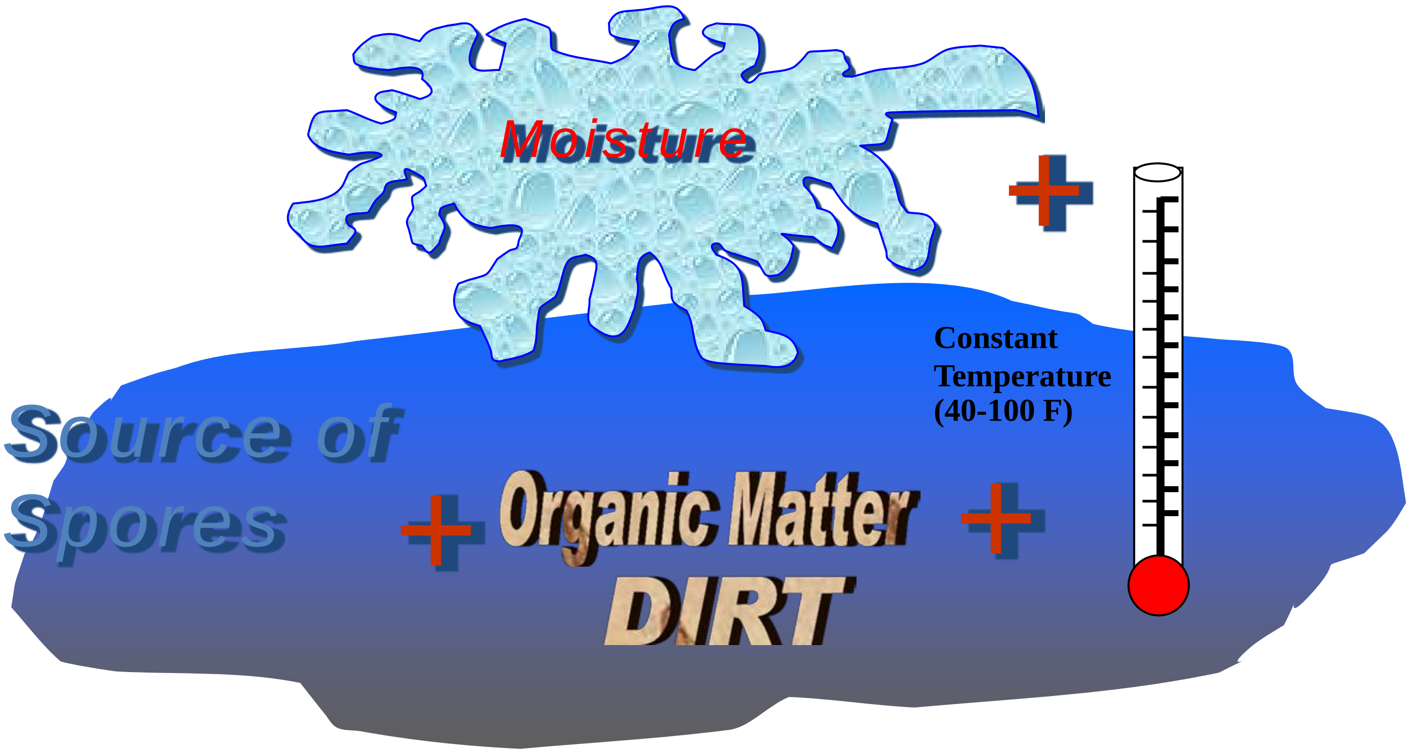
Overview-Ventilation Systems

- Types of Air Exchange in Houses
  - Infiltration/Exfiltration
  - Natural ventilation
  - Chimneys
  - Exhaust devices
  - Mechanical ventilation

Why Ventilate?

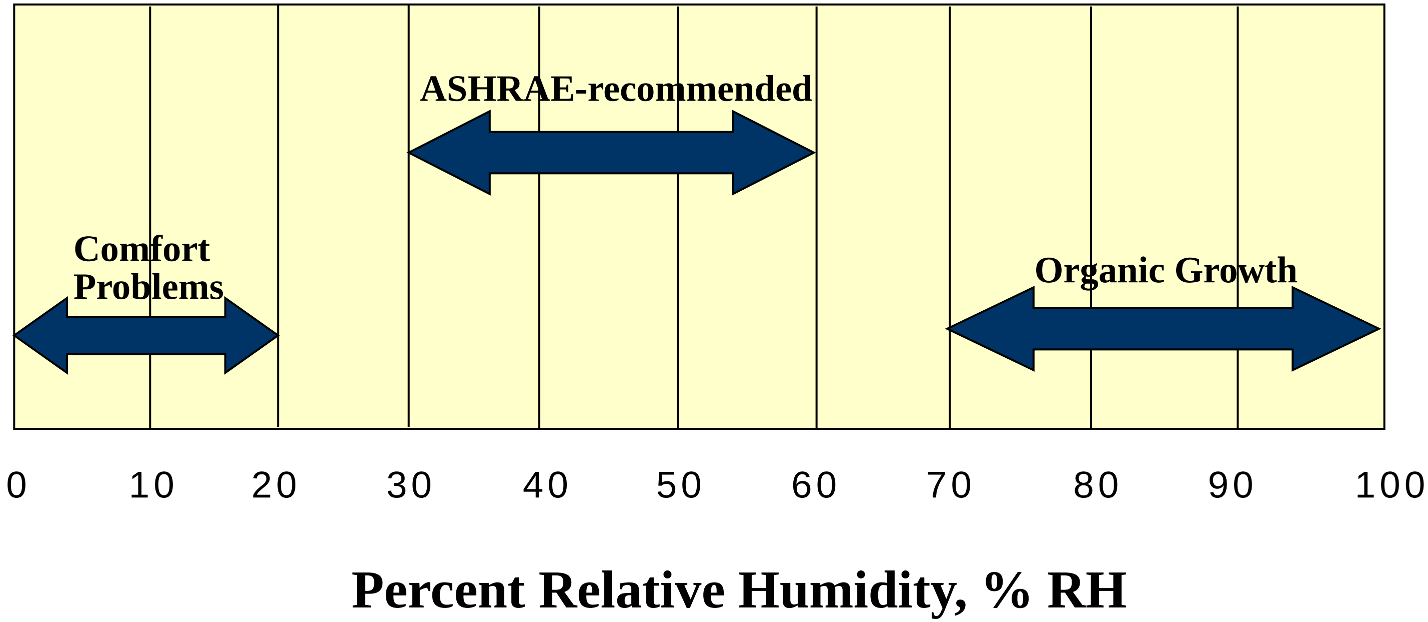
IAQ Solutions - HUMIDITY CONTROL

Why Manage Humidity?



Prerequisites for Microbial Growth

OVERVIEW- HUMIDITY CONTROL



Overview- Ventilation Systems

- **How Much** to Ventilate, considering:?
  - Moisture generation rates
    - people
    - building
  - Other pollutants
    - type of pollutant
    - source strength
  - Occupant sensitivity
  - Continuous ventilation

Ventilation Air

Comes out of the Energy Code
Section R403.5

1322.202
Definition of Mechanical Ventilation

- Mechanical Ventilation is the mechanical process of supplying conditioned or unconditioned air to, or removing it from, any space

Ventilation Air

- **How Much to Ventilate?**

- **Chapter 1322: Total ventilation rate:** "…shall provide sufficient outdoor air = total ventilation rate average, for each one hour period in accordance with **Table R403.5.2, or…**

Table R 403.5.2

Total and continuous ventilation rates (in CFM)

	Number of Bedrooms					
	1	2	3	4	5	6[2]
Conditioned space[1] (in sq. ft.)	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous
1000 – 1500	60/40	75/40	90/45	105/53	120/60	135/68
1501 – 2000	70/40	85/43	100/50	115/58	130/65	145/73
2001 – 2500	80/40	95/48	110/55	125/63	140/70	155/78
2501 – 3000	90/45	105/53	120/60	135/68	150/75	165/83
3001 – 3500	100/50	115/58	130/65	145/73	160/80	175/88
3501 – 4000	110/55	125/63	140/70	155/78	170/85	185/93
4001 – 4500	120/60	135/68	150/75	165/83	180/90	195/98
4501 – 5000	130/65	145/73	160/80	175/88	190/95	205/103
5001 – 5500	140/70	155/78	170/85	185/93	200/100	215/108
5501 – 6000[2]	150/75	165/83	180/90	195/98	210/105	225/113

Ventilation Air

- **Equation R403.5.2**
- **Total ventilation rate (CFM) = (0.02 x square feet of conditioned space) + (15 x (number of bedrooms +1)).**
  - **Includes the basement but excludes conditioned crawl spaces.**
  - **Subsript 2 in the table states "If conditioned space exceeds 6000 Sq. Ft or there are more than 6 bedrooms, use the equations"**

Ventilation Air

– **Example 1:**
  - **2300 square feet** of conditioned space house
    – Conditioned space = “An area, room or space being heated or cooled by any equipment or appliance.”
  - **3 bedrooms**

Ventilation Air

– **Example 1:**
  - **2300 square feet** of conditioned space house
    – Conditioned space = "An area, room or space being heated or cooled by any equipment or appliance."
  - **3 bedrooms**

- .02 x square feet of conditioned space = .02 x 2300 = 46 CFM
- Number of bedrooms (3) + 1 = 4
- 15 x 4 = 60 CFM
- Total ventilation rate (CFM) = 46 CFM + 60 CFM = **106 CFM**

Table R 403.5.2

Total and continuous ventilation rates (in CFM)

	Number of Bedrooms					
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Conditioned space[1] (in sq. ft.)	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous
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1501 – 2000	70/40	85/43	100/50	115/58	130/65	145/73
2001 – 2500	80/40	95/48	110/55	125/63	140/70	155/78
2501 – 3000	90/45	105/53	120/60	135/68	150/75	165/83
3001 – 3500	100/50	115/58	130/65	145/73	160/80	175/88
3501 – 4000	110/55	125/63	140/70	155/78	170/85	185/93
4001 – 4500	120/60	135/68	150/75	165/83	180/90	195/98
4501 – 5000	130/65	145/73	160/80	175/88	190/95	205/103
5001 – 5500	140/70	155/78	170/85	185/93	200/100	215/108
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1501 – 2000	70/40	85/43	100/50	115/58	130/65	145/73
2001 – 2500	80/40	95/48	110/55	125/63	140/70	155/78
2501 – 3000	90/45	105/53	120/60	135/68	150/75	165/83
3001 – 3500	100/50	115/58	130/65	145/73	160/80	175/88
3501 – 4000	110/55	125/63	140/70	155/78	170/85	185/93
4001 – 4500	120/60	135/68	150/75	165/83	180/90	195/98
4501 – 5000	130/65	145/73	160/80	175/88	190/95	205/103
5001 – 5500	140/70	155/78	170/85	185/93	200/100	215/108
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2501 – 3000	90/45	105/53	120/60	135/68	150/75	165/83
3001 – 3500	100/50	115/58	130/65	145/73	160/80	175/88
3501 – 4000	110/55	125/63	140/70	155/78	170/85	185/93
4001 – 4500	120/60	135/68	150/75	165/83	180/90	195/98
4501 – 5000	130/65	145/73	160/80	175/88	190/95	205/103
5001 – 5500	140/70	155/78	170/85	185/93	200/100	215/108
5501 – 6000[2]	150/75	165/83	180/90	195/98	210/105	225/113

Ventilation Air

- **Continuous Ventilation:**
  - **R403.5.3: "… a minimum of 50% of the total** ventilation rate, **but not less than 40 CFM,** on a continuous rate average for each one hour period in accordance with Table R403.5.2 or Equation 403.5.2
  - **Equation R403.5.3**: **Continuous** ventilation (CFM)= total ventilation rate /2.

Table R 403.5.2

Total and continuous ventilation rates (in CFM)

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1000 – 1500	60/40	75/40	90/45	105/53	120/60	135/68
1501 – 2000	70/40	85/43	100/50	115/58	130/65	145/73
2001 – 2500	80/40	95/48	110/55	125/63	140/70	155/78
2501 – 3000	90/45	105/53	120/60	135/68	150/75	165/83
3001 – 3500	100/50	115/58	130/65	145/73	160/80	175/88
3501 – 4000	110/55	125/63	140/70	155/78	170/85	185/93
4001 – 4500	120/60	135/68	150/75	165/83	180/90	195/98
4501 – 5000	130/65	145/73	160/80	175/88	190/95	205/103
5001 – 5500	140/70	155/78	170/85	185/93	200/100	215/108
5501 – 6000[2]	150/75	165/83	180/90	195/98	210/105	225/113

Ventilation System Requirements

- **Exhaust Only Systems (no longer Allowed)**

Ventilation System Requirements

- Exhaust Only Systems (no longer Allowed)

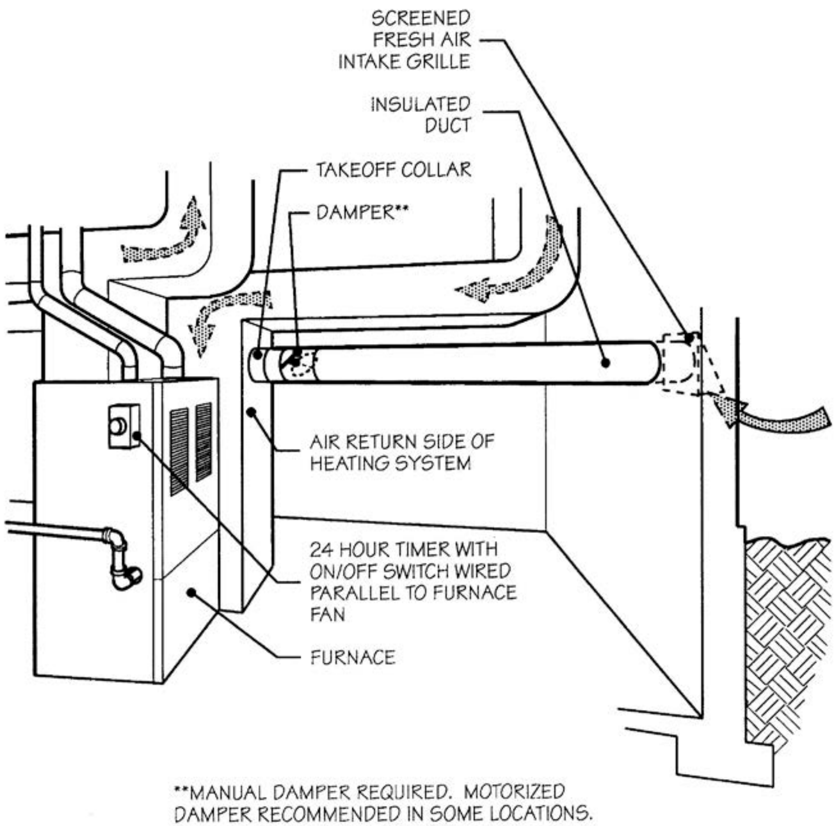
- “Balanced Systems” a ventilation system in which the air intake is within 10% of the exhaust output.

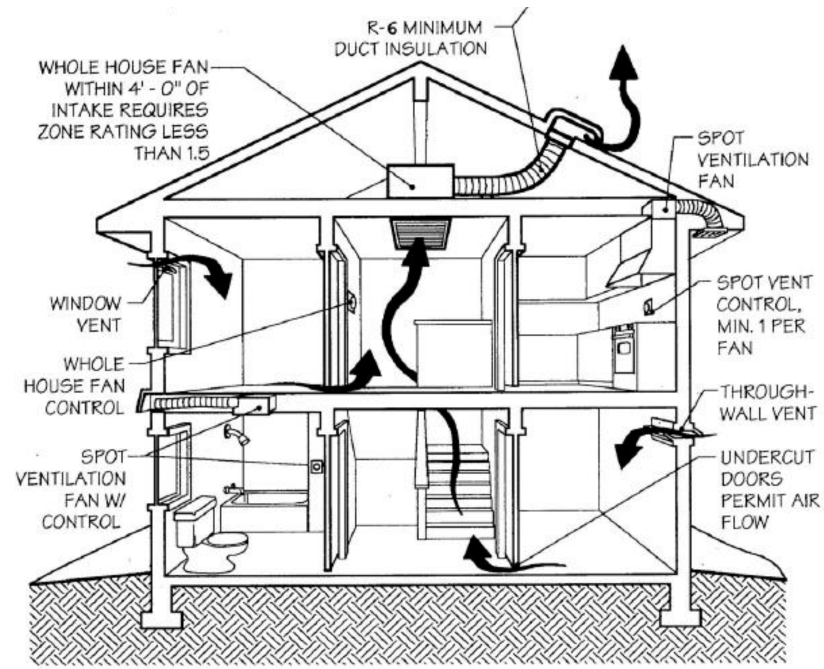
Ventilation System Requirements

- **Exhaust Only Systems (no longer Allowed)**

- **"Balanced Systems" a ventilation system in which the air intake is within 10% of the exhaust output.**
  - HRV/ERV
  - An intake and exhaust fan linked together to operate equally

Balanced Ventilation System



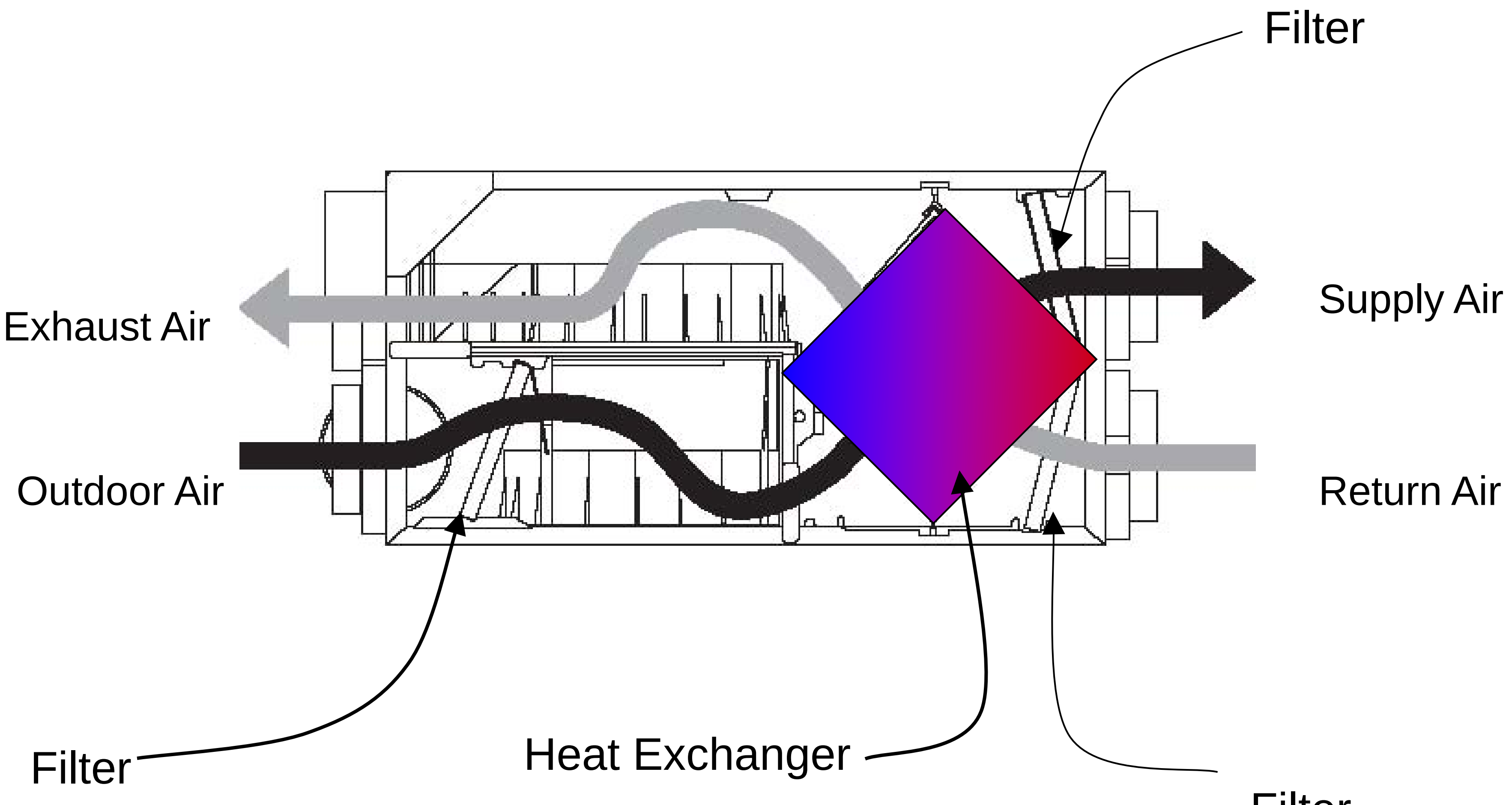


Definition of Heat Recovery Ventilator (HRV)

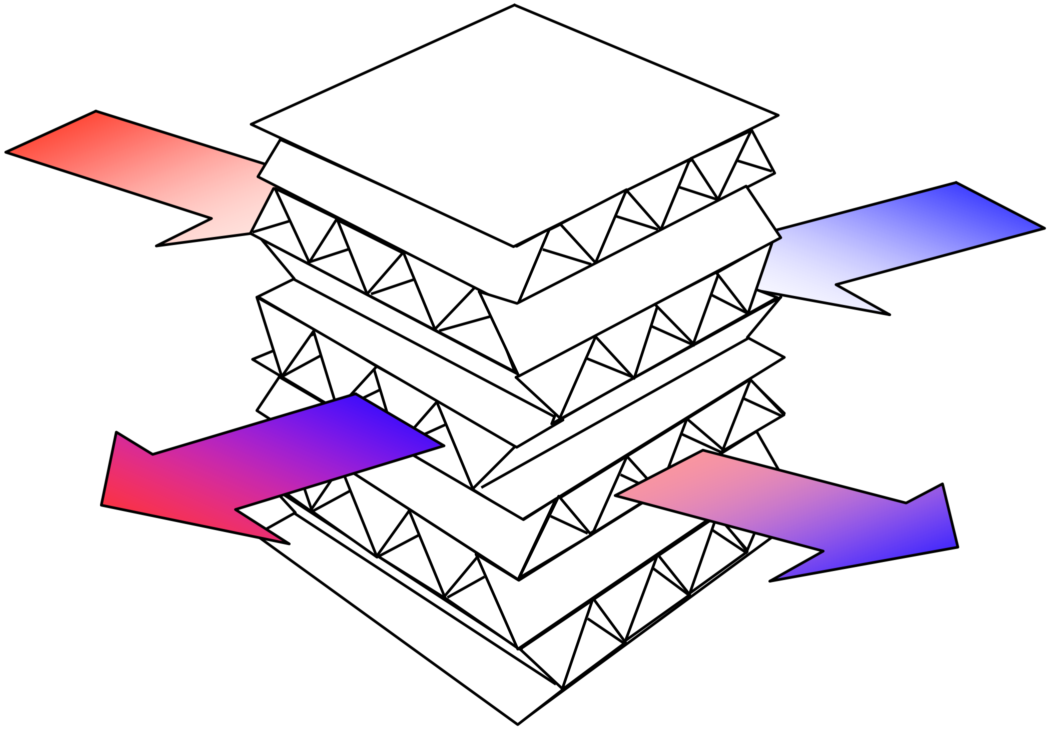
- A device or combination of devices applied to transfer energy from the exhaust air stream for use within the dwelling

Heat Recovery Ventilator

Heat Recovery Ventilator

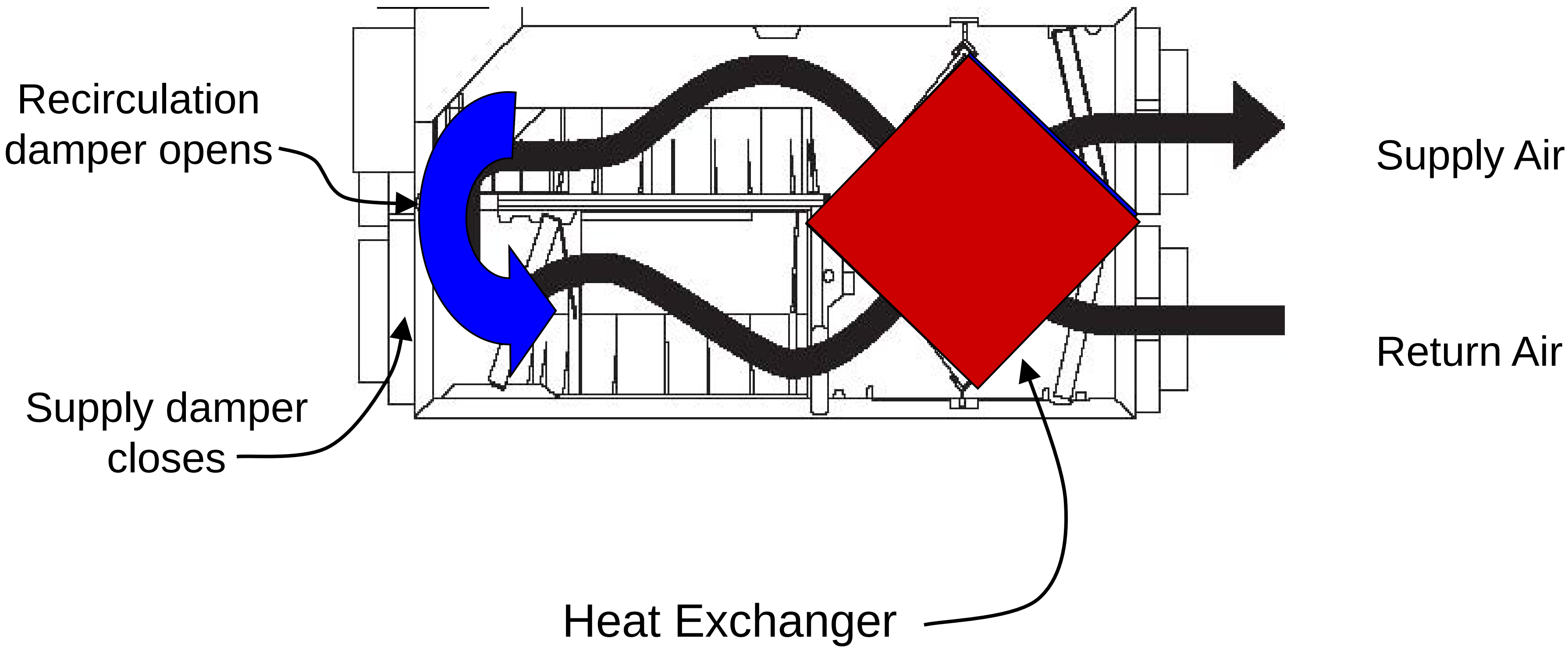


Heat Recovery Ventilator



1. Transfers heat by conduction

HRV Defrost Operation

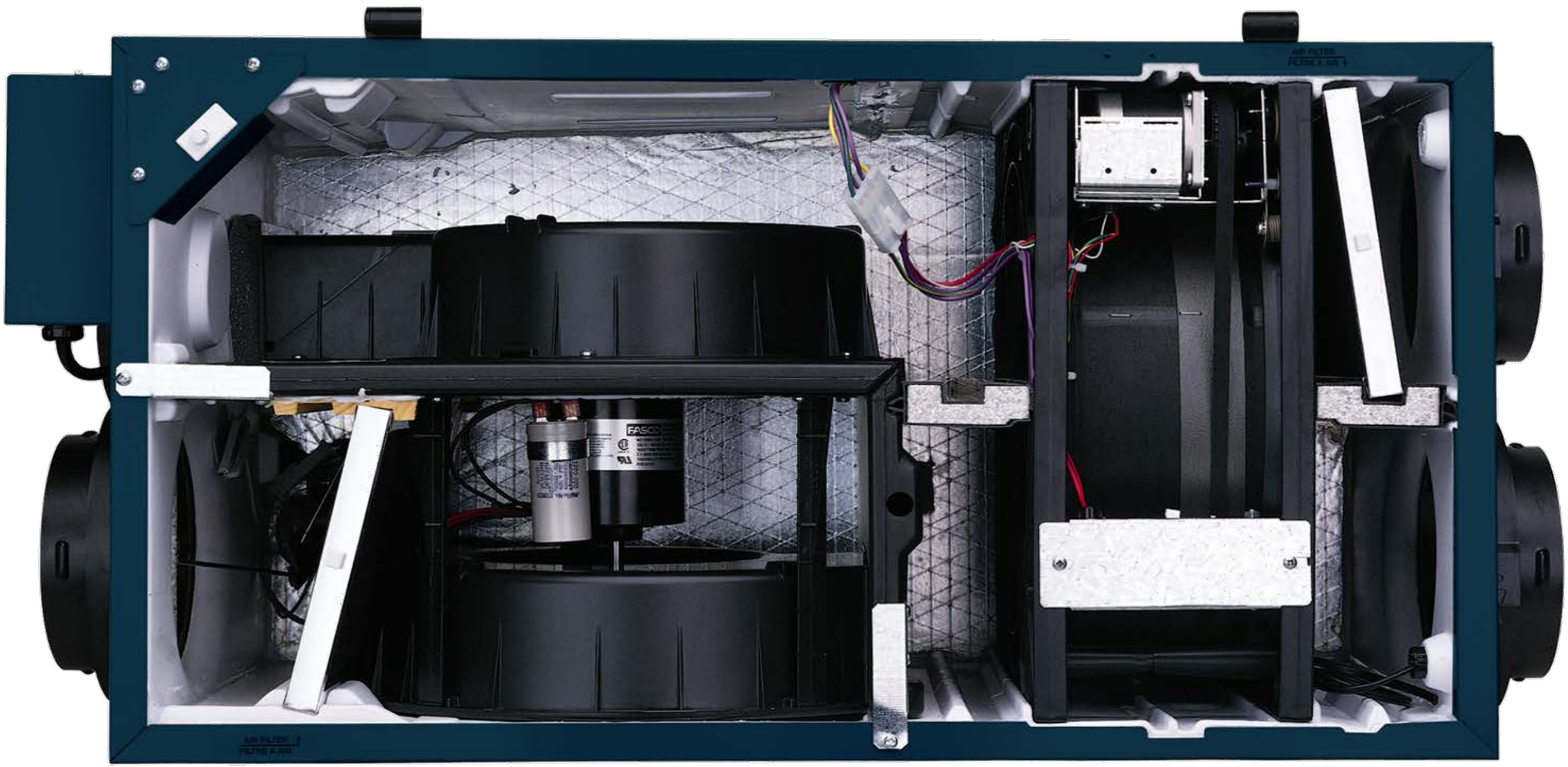


Definition of Energy Recovery Ventilator (ERV)

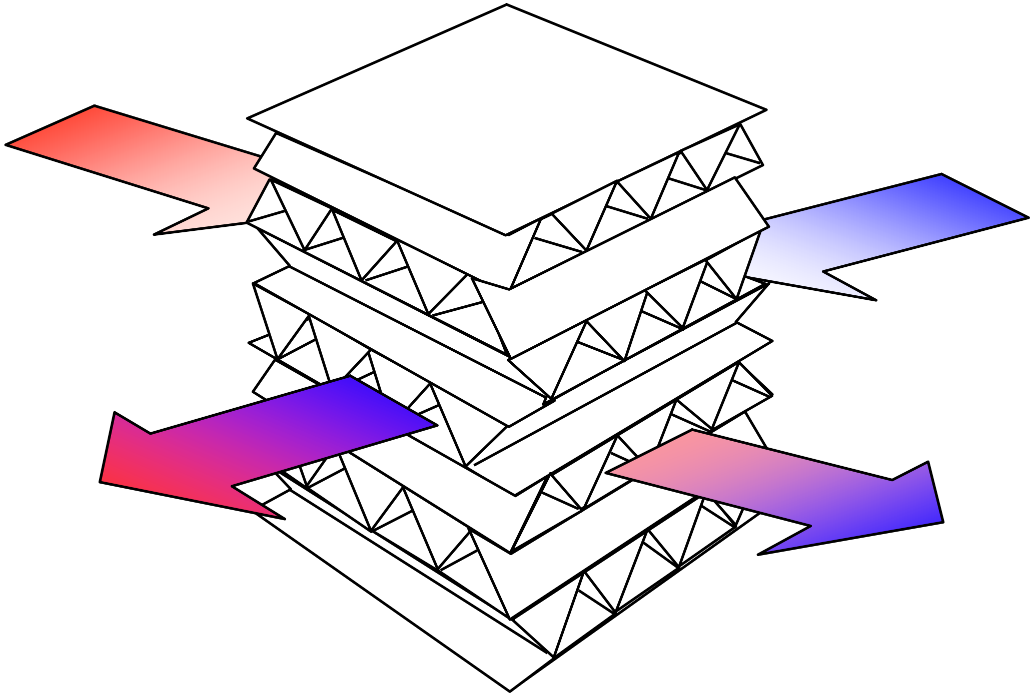
- **A device or combination of devices applied to transfer energy and moisture from the exhaust air stream for use within the dwelling.**

Balanced Ventilation

Energy Recovery Ventilator



Energy Recovery Ventilator



1. Transfers heat by conduction

2. Transfers humidity using *hygroscopic* resin

Make Up Air

Make Up Air

- **How about any Makeup air required? 1346.0501.**

Make-Up Air

Current Code

- Mn Rule 1346 currently in tables 501 calculate Make-up air.

Make-Up Air

Current Code

- Mn Rule 1346 currently in tables 501 calculates Make-up air.

New Code

- **The tables have been updated**

Make-Up Air

Current Code

- Mn Rule 1346 currently in tables 501 calculates Make-up air.

New Code

- **The tables have been updated**
  - **Exhaust only systems were removed from the table. (balanced only)**

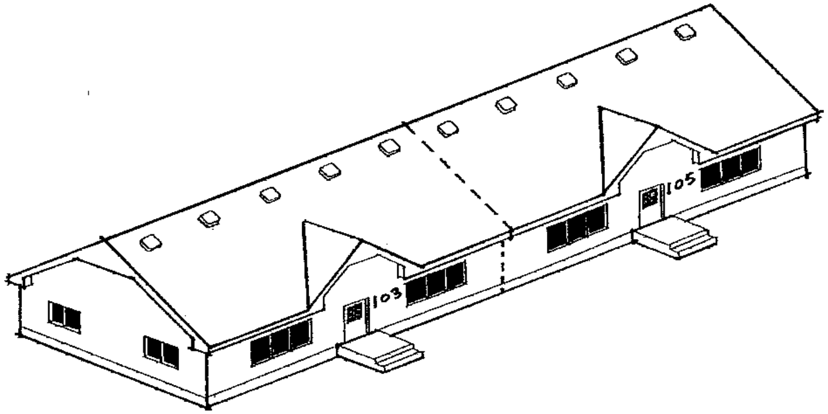
Make-Up Air

Current Code

- Mn Rule 1346 currently in tables 501 calculates Make-up air.

New Code

- **The tables have been updated**
  - **Exhaust only systems were removed from the table. (balanced only)**
  - **“Dwellings” are now “Dwelling Units”**



Make-Up Air

Current Code

- Mn Rule 1346 currently in tables 501 calculates Make-up air.

New Code

- **The tables have been updated**
  - **Exhaust only systems were removed from the table. (balanced only)**
  - **“Dwellings” are now “Dwelling Units”**
  - **Clarifications of wording in in heading of the fourth column to add the words “appliances that are” To clarify the intent of the column.**

Make Up Air

Example

Minnesota Mechanical Code 1346.0501

*Determine **Makeup Air** Requirements for the following:*

- Size of new house: **2,000 sq. ft. (including basement)**
- Average ceiling height: 8 ft.
- Number of bedrooms: 3
- Ventilation type: **Heat recovery ventilator (HRV)**
- Type of gas water heater: 40,000 Btu/hr. **power vent**
- Type of gas furnace: 60,000 Btu/hr. **direct vent**
- Type of gas fireplace: 30,000 Btu/hr. **direct vent**
- Kitchen exhaust fan: **250 cfm (exhausts to the outside)**
- Next largest exhaust fan: **70 cfm**

Minnesota Mechanical Code

- **It's a NEW house, so…. The makeup air shall be…**

Minnesota Mechanical Code

- **It's a NEW house, so…. The makeup air shall be…**

- ***Step 1**: Makeup Air Requirements shall be determined using **Table 501.4.1** and…*

Minnesota Mechanical Code

- **It's a NEW house, so…. The makeup air shall be…**

- ***Step 1****: Makeup Air Requirements shall be determined using* ***Table 501.4.1*** *and…*

- ***Step 2****: Supplied in accordance with* ***Table 501.4.2***

Table 501.4.1 **Procedure to Determine Makeup Air Quantity for Exhaust Equipment in Dwellings Units**

	One or multiple power vent or direct vent appliances or no combustion appliances[A]	One or multiple fan-assisted appliances and power vent or direct vent appliances[B]	One atmospherically vented gas or oil appliance or one solid fuel appliance[C]	Multiple appliances that are atmospherically vented gas or oil appliances or solid fuel appliances (cfm)
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf) (including unfinished basements)				
Estimated House Infiltration (cfm): [1a x 1b]				
2. Exhaust Capacity				
~~a) continuous exhaust-only ventilation system (cfm) (not applicable to balanced ventilation systems such as HRV)~~				
b) clothes dryer (cfm)	135	135	135	135
c) 80% of largest exhaust rating (cfm) (not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust)				
d) 80% of next largest exhaust rating (cfm) (not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust)	Not Applicable			
Total Exhaust Capacity (cfm): [2a + 2b + 2c + 2d]				
3. Makeup Air Requirement				
a) Total Exhaust Capacity (from above)				
b) Estimated House Infiltration (from above)				
Makeup Air Quantity (cfm): [3a - 3b] (if value is negative, no makeup air is needed)				

4. For Makeup Air Opening Sizing, refer to Table → M501.4.2

Table 501.4.1 Procedure to Determine Makeup Air Quantity for Exhaust Equipment in Dwellings Units

	One or multiple power vent or direct vent appliances or no combustion appliances[A]	One or multiple fan-assisted appliances and power vent or direct vent appliances[B]	One atmospherically vented gas or oil appliance or one solid fuel appliance[C]	Multiple appliances that are atmospherically vented gas or oil appliances or solid fuel appliances (cfm)
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf) (including unfinished basements)	2,000			
Estimated House Infiltration (cfm): [1a x 1b]	300			
2. Exhaust Capacity				
~~a) continuous exhaust-only ventilation system (cfm) (not applicable to balanced ventilation systems such as HRV)~~ XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	0			
b) clothes dryer (cfm)	135	135	135	135
c) 80% of largest exhaust rating (cfm) (not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust)	200			
d) 80% of next largest exhaust rating (cfm) (not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust)	Not Applicable			
Total Exhaust Capacity (cfm): [2a + 2b + 2c + 2d]	335			
3. Makeup Air Requirement				
a) Total Exhaust Capacity (from above)	335			
b) Estimated House Infiltration (from above)	300			
Makeup Air Quantity (cfm): [3a - 3b] (if value is negative, no makeup air is needed)	35			

4. For Makeup Air Opening Sizing, refer to Table → M501.4.2

Table 501.4.2

Makeup Air Opening Sizing Table for New and Existing Dwellings Units

Type of opening or system	One or multiple power vent or direct vent appliances or no combustion appliances[A] (cfm)	One or multiple fan-assisted appliances and power vent or direct vent appliances[B] (cfm)	One atmospherically vented gas or oil appliance or one solid fuel appliance[C] (cfm)	Multiple appliances that are atmospherically vented gas or oil appliances or solid fuel appliances (cfm)	Passive makeup air opening duct diameter[E,F,G] (inches)
Passive Opening	1-36	1-22	1-15	1-9	3
Passive Opening	37-66	23-41	16-28	10-17	4
Passive Opening	67-109	42-66	29-46	18-28	5
Passive Opening	110-163	67-100	47-69	29-42	6
Passive Opening	164-232	101-143	70-99	43-61	7
Passive Opening	233-317	144-195	100-135	62-83	8
Passive Opening with Motorized Damper	318-419	196-258	136-179	84-110	9
Passive Opening with Motorized Damper	420-539	259-332	180-230	111-142	10
Passive Opening with Motorized Damper	540-679	333-419	231-290	143-179	11
Powered Makeup Air[H]	>679	>419	>290	>179	Not Applicable

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil appliances or if there are no combustion appliances.

B. Use this column if there is one fan-assisted appliance per venting system. Other than atmospherically vented appliances may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil appliance per venting system or one solid fuel appliance.

D. Use this column if there are multiple atmospherically vented gas or oil appliances using a common vent or if there are atmospherically vented gas or oil appliances and solid fuel appliance(s).

E. An equivalent length of 100 feet of round smooth metal duct is assumed. Subtract 40 feet for the exterior hood and 10 feet for each 90 degree elbow to determine the remaining length of straight duct allowable.

F. If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

G. Barometric dampers are prohibited in passive makeup air openings when any atmospherically vented appliance is installed.

H. Powered makeup air shall be electrically interlocked with the largest exhaust system.

Combustion Air

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method
(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combution appliace information:

Furnace/Boiler:
____ Draft Hood (Not fan Assisted) ____ Fan Assisted & Power Vent ____ Direct Vent Input: _______Btu/hr

Water Heater:
____ Draft Hood (Not fan Assisted) ____ Fan Assisted & Power Vent ____ Direct Vent Input: _______Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings. CAS volume:_____ft³

Step 3: Determine air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES) Input: _______Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV) TRV: _______ ft³

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to STEP 5.

4b. Known Air Infiltration Rate (KAIR) Method

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) Input: _______Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) RVFA: _______ ft³

Total Btu/hr input of all non-fan-assisted appliances Input: _______Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) RVNFA: _____ ft³

Total Required Volume (TRV) = RVFA + RVNFA TRV = _______ + _______ = _______ ft³

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to STEP 5.

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) Ratio = ___ / ___ = ___

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio RF = 1 - _____ = _______

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) Input: _______Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided*** by 3000 Btu/hr per in² CAOA = _____ /3000 Btu/hr per in² = _______ in²

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF Minimum CAOA = ______ x _______ = _______ in²

Step 9: Calculate Combustion Air Opening Diameter (CAOD)

CAOD = 1.13 ***multiplied by the square root of*** Minimum CAOA CAOD = 1.13 x $\sqrt{\text{Minimum CAOA}}$ = _______ in

[1]If desired, ACH can be determined using ASHRAE calculation or blower door test. Follow procedures in Section 304.

Additional Mechanical Changes

Definitions

Current Code Requirements

- **IMC section 202**
- Extra Heavy-Duty Cooking Appliances
- Heavy-Duty Cooking Appliances
- Medium-Duty Cooking Appliances
- Light Duty Cooking Appliances

Definitions

Current Code Requirements

- IMC section 202
- Extra Heavy-Duty Cooking Appliances
- Heavy-Duty Cooking Appliances
- Medium-Duty Cooking Appliances
- Light duty Cooking Applainces

- **Deleting the existing definitions in favor of the classifications as listed in ASHRAE Standard 154**
- **(See Next Slide)**

Example of ASHRAE 154

IMC Table 507.2.1

Appliance Description	Size	Type I Hoods			
		Light Duty	Medium Duty	Heavy Duty	Extra-Heavy Duty
Braising pan/tilting skillet, electric	All	●	-	-	-
Oven, rotisserie, electric and gas	All	●	-	-	-
Oven, combi, electric and gas	All	●	-	-	-
Oven, convection, full-size, electric and gas	All	●	-	-	-
Oven, convection, half-size, electric and gas (protein cooking)	All	●	-	-	-
Oven, deck, electric and gas	All	●	-	-	-
Oven, mini-revolving rack, electric and gas	All	●	-	-	-
Oven, rapid cook, electric	All	●	-	-	-
Oven, rotisserie, electric and gas	All	●	-	-	-
Range, discrete element, electric (with or without oven)	All	●	-	-	-
Salamander, electric and gas	All	●	-	-	-
Braising pan/tilting skillet, gas	All	-	●	-	-
Broiler, chain conveyor, electric	All	-	●	-	-
Broiler, electric, under-fired	All	-	●	-	-
Conveyor oven, electric	6 kW or larger	-	●	-	-
Conveyor oven, gas	All	-	●	-	-
Fryer, doughnut, electric and gas	All	-	●	-	-
Fryer, kettle, electric and gas	All	-	●	-	-
Fryer, open deep-fat, electric and gas	All	-	●	-	-
Fryer, pressure, electric and gas	All	-	●	-	-
Griddle, double-sided, electric and gas	All	-	●	-	-
Griddle, flat, electric and gas	All	-	●	-	-
Range, cook-top, induction	All	-	●	-	-
Range, open-burner, gas (with or without oven)	All	-	●	-	-
Range, hot top, electric and gas	All	-	●	-	-
Broiler, chain conveyor, gas	All	-	-	●	-
Broiler, electric and gas, over-fired (upright)	All	-	-	●	-
Broiler, gas, under-fired	All	-	-	●	-
Range, wok, gas and electric	All	-	-	●	-
Appliances using solid fuel (wood, charcoal, briquettes, and mesquite) to provide all or part of the heat source for cooking Exception: Appliances complying with Section 14.3.4 of NFPA Standard 96	All	-	-	-	●

Example of ASHRAE 154

IMC Table 507.2.2

Appliance Description	Size	Hood Not Required[a,b]	Type II Hoods[a]	
			Light Duty	Medium Duty
Cabinet, holding, electric	All	●	-	-
Cabinet, proofing, electric	All	●	-	-
Cheese-melter, electric	All	●	-	-
Coffee maker, electric	All	●	-	-
Cooktop, induction, electric	All	●	-	-
Dishwasher, under-counter, electric	All	●	-	-
Dishwasher, powered sink, electric	All	●		
Drawer Warmer, 2 drawer, electric	All	●	-	-
Egg cooker, electric	All	●	-	-
Espresso machine, electric	All	●	-	-
Grill, panini, electric	All	●	-	-
Hot dog cooker, electric	All	●	-	-
Hot plate, countertop, electric	All	●	-	-
Ovens, conveyor, electric	< 6 kW	●		
Ovens, microwave, electric	All	●		
Ovens, warming, electric	All	●	-	-
Popcorn machine, electric	All	●	-	-
Rethermalizer, electric	All	●	-	-
Rice cooker, electric	All	●	-	-
Steam table, electric	All	●	-	-
Steamers, bun, electric	All	●	-	-
Steamer, compartment atmospheric, countertop, electric	All	●		
Steamer, compartment pressurized, countertop, electric	All	●		
Table, hot food, electric	All	●		
Toaster, electric	All	●	-	-
Waffle Iron, electric	All	●	-	-
Cheese-melter, gas	All	-	●	-
Dishwasher, conveyor rack, chemical sanitizing	All	-	●	-
Dishwasher, conveyor rack, hot water sanitizing	All	-	●	-
Dishwasher, door-type rack, chemical sanitizing	All	-	●	-
Dishwasher, door-type rack, hot water sanitizing	All	-	●	-
Kettle, steam jacketed, tabletop, electric, gas and direct steam	< 20 gallons	-	●	-
Oven, convection, half-size, electric and gas (non- protein cooking)	All		●	
Pasta cooker, electric	All	-	●	-
Rethermalizer, gas	All	-	●	-
Rice cooker, gas	All	-	●	-
Steamer, atmospheric, gas	All		●	
Steamer, pressurized, gas	All		●	
Steamer, atmospheric, floor-mounted, electric	All		●	
Steamer, pressurized, floor-mounted, electric	All		●	
Kettle, steam-jacketed floor mounted, electric, gas and direct steam	< 20 gallons	-	●	
Pasta cooker, gas	All	-	-	●
Smoker, electric and gas, pressurized	All	-	-	●
Steam-jacketed kettle, floor mounted, electric and gas	20 gallons or larger	-	-	●

Definitions

Current Code Requirements

- IMC section 202
- Exhaust system. An assembly of connected ducts,….., and radon exhaust systems through which air is conducted…..

Definitions

Current Code Requirements

- IMC section 202
- Exhaust system. An assembly of connected ducts,….., and radon exhaust systems through which air is conducted…..

New Code Requirements

- IMC section 202
- Exhaust system. An assembly of connected ducts,….., and ~~radon~~ subslab soil exhaust systems through which air is conducted…..

Ventilation

Current Code Requirements

- 1346.0401
- Scope. This chapter shall govern the ventilation of spaces within a building intended to be occupied.

Ventilation

Current Code Requirements

- 1346.0401
- Scope. This chapter shall govern the ventilation of spaces within a building intended to be occupied.

New Code Requirements

- IMC 0401.1
- Provides an **exception** for Residential building complying with the ventilation requirements in MN Rule 1322.

Opening Locations

Current Code Requirements

- IMC 1346.0401.4
- Opening location
  - Intake openings
  - Exhaust openings
  - Venting system terminations

Opening locations

Current Code Requirements

- IMC 1346.0401.4
- Opening location
  - Intake openings
  - Exhaust openings
  - Venting system terminations

New Code Requirements

- IMC 1346.0401.4 **as amended and reworded for clarity**

Opening Locations

Current Code Requirements

- IMC 1346.0401.4
- Opening location
  - Intake openings
  - Exhaust openings
  - Venting system terminations

New Code Requirements

- IMC 1346.0401.4
- ~~**Opening location**~~
  - ~~**Intake openings**~~ **use 2012 IMC 401.4 as amended**

Opening locations

Current Code Requirements

- IMC 1346.0401.4
- Opening location
  - Intake openings
  - Exhaust openings
  - Venting system terminations

New Code Requirements

- IMC 1346.0401.4
- ~~Opening location~~
  - ~~Intake openings~~ use 2012 IMC 401.4 as amended
  - **~~Exhaust openings~~ use 2012 Chapter 5**

Opening locations

Current Code Requirements

- IMC 1346.0401.4
- Opening location
  - Intake openings
  - Exhaust openings
  - Venting system terminations

New Code Requirements

- IMC 1346.0401.4
- ~~Opening location~~
  - ~~Intake openings~~ use 2012 IMC 401.4
  - ~~Exhaust openings~~ use 2012 Chapter 5
  - **~~Venting system terminations~~ use IMC Chapter 8 and IFGC Chapter 5.**

Mechanical Ventilation

Current Code Requirements

- IMC 1346.0403.1
- Mechanical Ventilation
- ASHRAE standard 62.1

Mechanical Ventilation

Current Code Requirements

- IMC 1346.0403.1
- Mechanical Ventilation
- ASHRAE standard 62.1

New Code Requirements

- IMC 1346.0403.1
- ~~ASHRAE standard 62.1~~
- Use 2012 IMC section 403
- Includes ASHRAE 62.1 tables.

Enclosed parking garages

Current Code Requirements

- IMC 1346.0404.1
- Enclosed parking garages
- Includes….. shall provide a minimum of .75 cfm/Ft^2 and mechanical systems not be required to operated continuously where the system is arranged to operate automatically upon detection of CO 25 ppm.

Enclosed parking garages

Current Code Requirements

- IMC 1346.0404.1
- Enclosed parking garages
- Includes….. shall provide a minimum of .75 cfm/Ft^2 and mechanical systems not be required to operated continuously where the system is arranged to operate automatically upon detection of CO 25 ppm.

New Code Requirements

- IMC 1346.0404.1
- Mechanical ventilation systems shall operate automatically upon detection of certain gas concentrations
  - For those vehicles that emit CO, **must** have a CO system that automatically triggers mechanical system if it hits 25 ppm CO
  - For those vehicle that emit NO2 shall have a NO2 device that automatically triggers mechanical system if it hits 3ppm NO2

Also, Mechanical ventilation system shall be **capable** of minimum exhaust rate of .75 cfm/ FT^2. (IMC 404.2)

Motor Vehicle Repair Garages

Current Code Requirements

- IMC 1346.0404.2
- Motor vehicle repair garages.

Motor Vehicle Repair Garages

Current Code Requirements

- IMC 1346.0404.2
- Motor vehicle repair garages.

New Code Requirements

- IMC 1346.0404.2
- ~~Motor vehicle repair garages.~~
- Use 2012 section 502.14 which says use IMC 403
- We deleted 1346.0403 so we now use the 2012 IMC section 403.

Enclosed Parking Garages/Ventilation

Current Code Requirements

- IMC 1346.0404.3
- Occupied spaces accessory to public garages.

Enclosed Parking Garages/Ventilation

Current Code Requirements

- IMC 1346.0404.3
- Occupied spaces accessory to public garages.

New Code Requirements

- IMC 1346.0404.3
- Adds ‘elevator lobbies” to the list of occupied spaces.
- E.g. waiting rooms, ticket booths, etc.

Source Capture

Current Code Requirements

- IMC 1346.0502.14 (motor vehicle repair)
- 3 exceptions
  - Electronic powered
  - One and two family dwellings
  - Where engines are operated inside the building only for the duration necessary to move them in and out of the building.

Source Capture

Current Code Requirements

- IMC 1346.0502.14 (motor vehicle repair)
- 3 exceptions
  - Electronically powered
  - One and two family dwellings
  - Where engines are operated inside the building only for the duration necessary to move them in and out of the building.

New Code Requirements

- IMC 1346.0502.14
- Includes 3 exceptions and adds a 4th exception
- 4th exception includes a source capture system is not required for any engine repair stall having an **exhaust pipe extension duct < 10 feet** in length, connected directly to the motor vehicle exhaust system and discharging directly to the OUTSIDE of the building.

Reference to other rules

Current Code Requirements

- IMC 1346.0506.3 and IMC 1346.0507.5
- Refer to the Minnesota Food Code, Minnesota Rules, chapter 4626, for additional requirements for commercial kitchen hoods licensed and inspected by the Department of Ag, Health, or other local authorities that conduct food inspections.

Reference to other rules

Current Code Requirements

- IMC 1346.0506.3 and IMC 1346.0507.5
- Refer to the Minnesota Food Code, Minnesota Rules, chapter 4626, for additional requirements for commercial kitchen hoods licensed and inspected by the Department of Ag, Health, or other local authorities that conduct food inspections.

New Code Requirements

- 1346.506.3 and IMC 1346.0507.5
- ~~Refer to the Minnesota Food Code, Minnesota Rules, chapter 4626, for additional requirements for commercial kitchen hoods licensed and inspected by the Department of Ag, Health, or other local authorities that conduct food inspections.~~
- Also, takes out the year of the particular standards in order to reference Chapter 15.

Duct Testing/NFPA 96

Current Code

- IMC 1346.0506.3
- NFPA 96 -2008
- 506.3.1-506.3.12.3 deleted and replaced with NFPA 96-2008 sections 5.1.1 and 7.5.2 with amendments.

Duct Testing/NFPA 96
Type I hoods

Current Code

- IMC 1346.0506.3
- NFPA 96 -2008
- 506.3.1-506.3.12.3 deleted and replaced with NFPA 96-2008 sections 5.1.1 and 7.5.2 with amendments.

New Code

- Updates NFPA 96 to 2011
- Sections 506.3.1-506.3.2.4 are deleted and replaced with chapters 1-10 and 12-15 of NFPA 96 2011
- Section 506.3.2.5 (Grease Duct Leakage Performance Test) has been added to the code including leakage tests utilizing one of the following test methods.
  - Light test,
  - Air test,
  - water test
  - or equivalent
- Sections 506.3.3-506.3.13.3 are deleted in their entirety

Type II hoods

Current Code

- 1346.0506.4.2 # 3 Ducts and plenums serving **Type II** hoods…..
- Horizontal ducts exceeding 75 feet in length shall slope not less than one unit vertical in 12 units horizontal

Type II hoods

Current Code

- 1346.0506.4.2 # 3 Ducts and plenums serving **Type II** hoods…..
- Horizontal ducts exceeding 75 feet in length shall slope not less than one unit vertical in 12 units horizontal

New Code

- 1346.0506.4.2 #3 **Type II** terminations….
- ~~Horizontal ducts exceeding 75 feet in length shall slope not less than one unit vertical in 12 units horizontal~~

Type I & Type II hoods

Current Code Requirements

- IMC 1346.0507.2
- A type I or type II hood shall be installed at or above all commercial cooking appliances in accordance with sections 507.2.1 (Type I) and 507.2.2 (Type II).

Type I & Type II hoods

Current Code Requirements

- IMC 1346.0507.2
- A type I or type II hood shall be installed at or above all commercial cooking appliances in accordance with sections 507.2.1 (Type I) and 507.2.2 (Type II).

New Code Requirements

- IMC 1346.0507.2
- A type I or type II hood shall be installed at or above all commercial cooking appliances in accordance with **ASHRAE standard 154**.

Commercial kitchen Air

Current Code Requirements

- IMC 1346.0508.1
- A minimum of 80 % of the makeup air shall be supplied into the space where the exhaust hood is located.

Commercial kitchen Air

Current Code Requirements

- IMC 1346.0508.1
- A minimum of 80 % of the makeup air shall be supplied into the space where the exhaust hood is located.

New Code Requirements

- IMC 1346.508.1
- ~~A minimum of 80 % of the makeup air shall be supplied into the space where the exhaust hood is located.~~

Sub slab soil exhaust

Current Code Requirements

- IMC Section 512.1
- General. When a subslab soil exhaust system is provided, the duct shall conform to the requirements of this section.

Sub slab soil exhaust

Current Code Requirements

- IMC Section 512.1
- General. When a subslab soil exhaust system is provided, the duct shall conform to the requirements of this section.

New Code Requirements

- IMC section 512.1
- General. When a subslab soil exhaust system is provided, the duct shall conform to the requirements of this section.
- **Added an exception: For radon gas control in residential occupancies, see Minnesota Rules, parts 1303.2400 to 1303.2403.**

Duct Gage

Current Code Requirements

- IMC Table 603.4
- Round ducts and exposed rectangular ducts
  - 14”and less = 30 gage galv.
  - Over 14” =28 gage galv.
- Exposed rectangular ducts
  - 14” or less = 28 gage galv.
  - Over 14” = 26 gage galv.

Duct Gage

Current Code Requirements

- IMC Table 603.4
- Round ducts and exposed rectangular ducts
  - 14”and less = 30 gage galv.
  - Over 14” =28 gage galv.
- Exposed rectangular ducts
  - 14” or less = 28 gage galv.
  - Over 14” = 26 gage galv.

New Code Requirements

- 2012 IMC table 603.4
- Introduced 3 conditions for round ducts and exposed rectangular ducts
  - < 14” = 28 gage galv.
  - 16”and 18” = 26 gage galv
  - 20” and over = 24 gage galv
- Exposed rectangular ducts did not change gage for galvanized.
- **The amendment simply keeps the EXISTING gage table.**

English to metric

Current Code Requirements

- IMC 1346.0603.4.1 Elbows.
- 1000 feet per minute
- SI equivalent 76.2 m/**min**

English to metric

Current Code Requirements

- IMC 1346.0603.4.1 Elbows.
- 1000 feet per minute
- SI equivalent 76.2 m/**min**

New Code Requirements

- 2012 IMC Table 603.4.**2**
- 1000 feet per minute
- SI equivalent ~~**76.2**~~ **5m/sec**

Duct sealing

Current Code Requirements

- IMC 1346.0603.9
- Table shows “DUCT SEALING”
  - Location
  - Design Static Pressure
  - Minimum required sealing

Duct sealing

Current Code Requirements

- IMC 1346.0603.9
- Table shows "DUCT SEALING"
  - Location
  - Design Static Pressure
  - Minimum required sealing

New Code Requirements

- 2012 IMC 603.9
- Existing amendment, with table, is deleted. Use 2012 IMC section 603.9- with an amendment.
- **Amendment**: Pressure-sensitive tape shall not be used as the primary sealant on ducts, unless it has been certified to comply with UL-181A or UL-181B by a nationally recognized lab and used in accordance with that certification.

Duct insulation

Current Code Requirements

- IMC 1346.0604.1
- Table for Minimum Required Duct Insulation

- E.g. Attics, garages, and ventilated crawl spaces are required to have R-8 and Vapor retarder.

Duct insulaton

Current Code Requirements

- IMC 1346.0604.1
- Table for Minimum Required Duct Insulation
- E.g. Attics, garages, and ventilated crawl spaces are required to have R-8 and Vapor retarder.

New Code Requirements

- 2012 IMC 1346.0604.1
- General
- "Duct insulation shall conform to the requirements in Minnesota Rules, chapter 1322 or 1323, as applicable.
- Also, R values reflect IECC
- Rescheck/Comcheck?

Duct Penetrations

Current Code Requirements

- IMC 607.6 dealing with Damper requirements for horizontal assemblies
- IMC section 607.6.1 (ref: IBC 717.6.1)
- Through penetrations
  - 1 exception with 5 conditions
  - E.g. The duct shall be contained and located within the cavity of a wall and shall be constructed of steel not less than 0.019 inch……

Duct Penetratons

Current Code Requirements

- IMC 607.6 dealing with Damper requirements for horizontal assemblies
- IMC section 607.6.1 (ref: IBC 717.6.1)
- Through penetrations
  - 1 exception with 5 conditions
  - E.g. The duct shall be contained and located within the cavity of a wall and shall be constructed of steel not less than 0.019 inch……

New Code Requirements

- 2012 IMC 1346.0607.6.1
- Ref IBC 1305.0717.6.1
- Amendments
  - Penetrates a fire-resistance-rated **FLOOR OR** floor/ceiling assembly…
  - Now 2 exceptions.
  - Exisiting exception remains and is re-numbered/lettered.
  - Second exception deals with I-2 and I-3 occupancies, that connects not more than 2 stories, a duct is permitted without a shaft enclosure protection, PROVIDED a listed smoke/fire damper is installed at the floor line.

Boiler sizes and who inspects them

Current Code Requirements

- IMC Chapter 10 Boilers
- DLI deals with:
- A. Boilers
  - 100,000 BTU's for steam
  - 500,000 BTU's for hot water supply
  - 750,000 BTU's for hot water heating boilers
- B. High pressure piping for boilers.
  - Steam systems operating at or below 15psi, or
  - Hot water or other heating medium operating at or below 30psi and 250 F.

New Code Requirements

- **1001.1** Exceptions: same as current exceptions as they relate to use
- **1001.2 states** "Anyone who installs a boiler must ensure that **the boiler is inspected by DLI before placed in operation** IF BTU/hr values exceed: 100,000, 500,000, and 750,000 BTU/HR (same BTU's as existing)
- ***Look for DLI Sticker of Inspection***

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  - 750,000 BTU's for hot water heating boilers
- B. High pressure piping for boilers.
  - Steam systems operating at or below 15psi, or
  - Hot water or other heating medium operating at or below 30psi and 250 F.

New Code Requirements

- Boilers utilizing fuel gas systems with Btu/hr inputs that are rated at or below items as already seen in the current code Section, shall comply with section 631 of the 2012 **IFGC**.
- **exceptions (3):**
  - **Residential (5-Families or less)**
  - **Direct jurisdiction of the USA**
  - **Agricultural/horticultural purposes.**

Boiler sizes and who inspects them

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  - 750,000 BTU's for hot water heating boilers
- B. High pressure piping for boilers.
  - Steam systems operating at or below 15psi, or
  - Hot water or other heating medium operating at or below 30psi and 250 F.

New Code Requirements

- **1001.3**
- The owner of a pressure vessel must ensure that the pressure vessel is inspected **by an insurance company** authorized to do business in MN **or DLI– every 2 years.**
- Subpart 3 exceptions:
  - Same as subpart 2

Boiler Installation

Current Code Requirements

- IMC Chapter 10 Boilers
- Section 1004.2 Installation
- Boilers shall have all controls set, adjust, and testing by the installer in accordance with amended IMC Chapter 16.

Boiler Installation

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- IMC Chapter 10 Boilers
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New Code Requirements

- IMC Chapter 10 Boilers
- Section 1004.2 Installation
- Boilers shall have all controls set, adjust, and testing by the installer in accordance with ~~amended IMC Chapter 16.~~ **Minnesota rules, parts 1346.1601 to 1346.1606.**

Safety Relief Valves

Current Code Requirements

- IMC Chapter 10 Boilers
- Section 1346.1006.4 Approval of safety and safety relief valves.
- Safety and safety relief valves shall have a manual method of lifting the seat, without endangering the operator, to ensure proper mechanical operation.

Safety Relief Valves

Current Code Requirements

- IMC Chapter 10 Boilers
- Section 1346.1006.4 Approval of safety and safety relief valves.
- Safety and safety relief valves shall have a manual method of lifting the seat, without endangering the operator, to ensure proper mechanical operation.

New Code Requirements

- IMC Chapter 10 Boilers
- Section 1346.1006.4 Approval of safety and safety relief valves.
- Safety and safety relief valves shall have a manual method of ~~lifting the seat~~ **to test the valve**, without endangering the operator, to ensure proper mechanical operation **of the valve.**

Low water cutoff

Current Code Requirements

- Chapter 10 Boilers
- Section 1346.1007 Boiler low water cutoff
- #1 An automatically fired hot water boiler or group of boilers piped together having a rated input of 400,000 Btu/hr or above shall be equipped **with an automatic low-water fuel cutoff to stop the combustion operation when the water level drops below the lowest safe permissible water level** established by the manufacturer.

New Code Requirements

- Chapter 10 Boilers
- Section **1346.1007**
- #1 An automatically fired hot water boiler or group of boilers piped together having a rated input of 400,000 Btu/hr or above shall be equipped with an automatic low-water fuel cutoff to stop the combustion operation ~~when~~ **BEFORE the water level drops below the lowest safe permissible water level** established by the manufacturer.

Boiler testing

Current Code Requirements

- IMC Chapter 10 Boilers
- Section 1346.1011- Tests
- Upon completion of the assembly and installation of boilers and pressure vessels, acceptance test shall be conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code.

Boiler testing

Current Code Requirements

- IMC Chapter 10 Boilers
- Section 1346.1011- Tests
- Upon completion of the assembly and installation of boilers and pressure vessels, acceptance test shall be conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code.

New Code Requirements

- IMC Chapter 10 Boilers
- Section 1346.1011- Tests
- Upon completion of the assembly and installation of boilers and pressure vessels, acceptance test shall be conducted in accordance with the requirements of the ~~ASME Boiler and Pressure Vessel Code.~~ **Minnesota Statutes, sections 326B.958 and 326B.966**

Refrigeration

Current Code Requirements

- IMC Chapter 11 Refrigeration
- Section 1101.1 Scope
- “This chapter shall govern…”
- No exceptions

Refrigeration

Current Code Requirements

- IMC Chapter 11 Refrigeration
- Section 1101.1 Scope
- “This chapter shall govern…”
- No exceptions

New Code Requirements

- IMC Chapter 11 Refrigeration
- Section 1101.1 Scope
- “This chapter shall govern…”
- Now there is an exception
  - **Exception: For all ammonia refrigeration systems, refer to Minnesota Rules, chapter 5230.**

Reference Standards

Current Code Requirements

- IMC Chapter 15
- Reference Standards
- Examples of referenced standards include:
  - NFPA 96-2008
  - NFPA 85-2007
  - NFPA 45-2004

New Code Requirements

- IMC Chapter 15
- Reference Standards
- The same Examples of referenced standards include:
  - NFPA 96-~~2008~~ 2014
  - NFPA 85-~~2007~~ 2011
  - NFPA 45-~~2004~~ 2011
  - Etc.
- **Also, the 2012 IMC Chapter 15 adopted some of 1346.1500 adopted standards (e.g. ASHRAE 15) that were not adopted in the 2006 edition.**

IMC

Current Code Requirements

- 2006 IMC
- Need to explain 2006 vs 2012 definitions (Chapter 2) of equipment vs appliance.
- **2006** definition includes
  - **Appliance**. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.
  - **Equipment.** All piping, ducts, vents, control devices and other components of systems other than appliances which are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

New Code Requirements

- **2012** IMC definition includes:
- Appliance. Same as 2006
- Equipment. Same as 2006.

IFGC

Current Code Requirements

- IFGC
- Need to explain 2006 vs 2012 definitions (Chapter 2) of equipment vs appliance.
- **2006** definition includes
  - **Appliance** (equipment). Any apparatus or equipment that utilizes gas as a fuel or raw material to produce light, heat, power, refrigeration or air conditioning.
  - **Equipment** . See “appliance.”

New Code Requirements

- IFGC
- **2012** IFGC definition includes:
- **Appliance**. Any apparatus or device that utilizes a fuel or raw material to produce light, heat, power, refrigeration or air conditioning.
- **Equipment**. Apparatus and devices other than appliances.

IFGC

Current Code Requirements

- 2006 IFGC
- 1346.**5101** subpart 1
- 101 Scope. The Minnesota Fuel Gas Code shall apply to the installation of fuel gas piping systems, fuel gas utilization equipment, gaseous hydrogen systems, and related accessories in accordance with this part.

New Code Requirements

- 2012 IFGC
- 1346.5101
- Subpart 1. Scope. ~~The Minnesota Fuel Gas Code~~ **This code** shall apply to the installation of fuel gas piping systems, fuel gas ~~utilization equipment~~ **appliances**, gaseous hydrogen systems, and related accessories in accordance with this ~~part~~ **code**.

IFGC- Definitions

Current Code Requirements

- 2006 IFGC
- Chapter 2 . Definitions
- **Approved.** Acceptable to the code official or other authority having jurisdiction.

New Code Requirements

- 2012 IFGC
- 1346.5202. Definitions
- Approved**. "Approved" means approval by the building official, pursuant to the Minnesota State Building Code, by reason of: inspection, investigation, or testing; accepted principles; computer simulations; research reports; or testing performed by either a licensed engineer or by a locally or nationally recognized testing laboratory.**

IFGC- Definitions

Current Code Requirements

- 2012 IFGC
- Chapter 2. Definitions
- Code. These regulations, subsequent amendments thereto or any emergency rule or regulation that the administrative authority having jurisdiction has lawfully adopted.

New Code Requirements

- 2012 IFGC
- 1346.5202. Definitions
- Code. **For purposes of parts 1346.5050 to 1346.6014, "the code" or "this code" means the portion of this rule that adopts the 2012 International Fuel Gas Code, with amendments.**

IFGC- Definitions

Current Code Requirements

- 2006 IFGC
- 1346.5202. Definitions
- Gas piping system. Both Medium and High Pressure
- "…exceeding five (5) psig"
- "…exceeding twenty (20) psig"

New Code Requirements

- 2012 IFGC
- 1346.5202. Definitions
- Gas piping system. Both Medium and High Pressure
- "…exceeding ~~**five**~~ **(5)** psig"
- "…exceeding ~~**twenty**~~ **(20)** psig"

Prohibited locations

Current Code Requirements

- 2006 IFGC
- Chapter 3.
- Section 303.3 Prohibited Locations
- Exception 3
  - "A single wall-mounted unvented room heater is installed…."
- Exception 4
  - "A single wall-mounted unvented room heater is installed…."

New Code Requirements

- 2012 IFGC
- 1346.5303
- ~~**Exception 3 and exception 4**~~
- Because….
- **1346.0901.5 Unvented heaters and appliances**
- **1346.5621 Unvented Room heaters**

Equipment/Appliance

Current Code Requirements

- 2006 IFGC
- 1346.5304.1
- Subpart 1
- Subpart 1. **Section 304.1.** IFGC Section304 is amended by adding language to the end of the first paragraph to read as follows:
- Exception 3
  - Equipment
  - E.g. Replacement equipment has.....

New Code Requirements

- 2012
- 1346.5304
- Subpart 1
- Subpart 1. **Section 304.1.** IFGC Section304 is amended by adding language to the end of the first paragraph **and additional exceptions** to read as follows:
- Exception 3
  - E.g. Replacement ~~equipment~~ **appliance** has.....

Two Opening Method

Current Code Requirements

- 2006 IFGC
- Section 304.6.1 **Two-permanent-openings method** (Outdoor combustion air).
- Figures 304.6.1 (1) and 304.6.1 (2) show "All air from outdoors through ventilated attic (see section 304.6.1- both tables).

New Code Requirements

- 2012 IFGC
- **304.6.1 is deleted in it's entirety.**
  - The figures depict air coming/going into the attic which is in direct **violation with existing 1346.5304.11** (Combustion air ducts) #5 that says "Ducts shall not terminate in an attic space."
  - **Will use 304.6.2 "One permanent-opening method"**

Access to…

Current Code Requirements

- 2006 IFGC
- 1346.5306.5
- Exception: A portable ladder may be used for dwellings, replacement **equipment** on existing buildings…..

New Code Requirements

- 2012 IFGC
- 1346.5306.5
- Exception: A portable ladder may be used for dwellings, replacement equipment **and appliances** on existing buildings…..

Metallic piping joints & fittings

Current Code Requirements

- 2006 IFGC
- Chapter 4 section 403.10.1
- **Pipe joints**. Pipe joints shall be threaded, flanged, brazed or welded. Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1,000 F. Brazing alloys shall not contain more than 0.05-percent phosphorus.

New Code Requirements

- 2012 IFGC
- 1345.5403.1
- Pipe joints. Pipe joints shall be threaded, flanged, brazed, welded, **or made with press-connect fitting complying ANSI LC-4.** Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1,000 F. Brazing alloys shall on contain more than 0.05-percent phosphorus.

Other Piping

Current Code Requirements

- 2006 IFGC
- 1346.5404.4 Piping through foundation wall.
- Underground piping shall not be installed below grade through the outer foundation or basement wall of a building. If necessary due to structural conditions, underground piping may be installed with prior approval from the building official.

New Code Requirements

- 2012 IFGC
- **1346.5404.6** (using the 2012 IFGC section title and number) **Underground penetrations prohibited.**
- The amended amendment now reads, Gas piping shall not penetrate building foundation walls at any point below grade. **Gas piping shall enter and exit a building at a point above grade and the annular space between the** pipe and the wall shall be sealed. If necessary due to structural conditions, underground piping may be installed with prior approval from the building official**.**

Other Piping (cont…)

Current Code Requirements

- 2006 IFGC
- 1346.5404.6 Piping in solid floors.
- **Piping in solid floors.** Piping in solid
- floors shall be laid in channels in the floor and covered in a manner that will allow access to the piping with a minimum amount of damage to the building. Where such piping is subject to exposure to excessive moisture or corrosive substances, the piping shall be protected in an approved manner. If necessary due to structural conditions, piping may be installed in other locations with prior approval from the building official.

New Code Requirements

- 2012 IFGC
- 1346.5404.**8** (using the 2012 IFGC section title and number) **Piping in solid floors**
- "…the piping shall be protected in an approved manner**. As an alternative to installation in channels, the piping shall be installed in a conduit of Schedule 40 steel, wrought iron, PVC, or ABS pipe in accordance with IFGC section 404.8.1 or 404.8.2**. **If necessary due to structural conditions…"**

Other piping

Current Code Requirements

- 2006 IFGC
- 1346.5404.11
- Piping underground beneath buildings.

New Code Requirements

- 2012 IFGC
- 1346.5404.~~11~~ **14**
- Piping underground beneath buildings.
- **Words are the same** as existing 1346.5404.11 except for: **Protection against corrosion moved from 404.8 to 404.11**.

Equipment / Appliance

Current Code Requirements

- 2006 IFGC
- 1346.5406.1.2 Alterations, repairs, and additions
- 1346.5408.4 Sediment trap
- 1346.5409.1.4 Main Shutoff valve
- 1346.5501.8 Equipment not required to be vented.
- 1346.5503 Venting of Equipment
- 1346.5503.5.5 Size of Chimneys
- 1346.5503.7.9 Size of single-wall metal pipe

New Code Requirements

- 2012 IFGC
- 1346.5406.1.2 added **or appliance**
- 1346.5408.4 added **appliance**
- 1346.5409.1.4 ~~equipment~~ **appliance**
- 1346.5501.8 ~~Equipment~~ **Appliance**
- 1346.5503 ~~Equipment~~ **Appliance**
- 1346.5503.5.5 ~~equipment~~ **appliance**
- 1346.5503.7.9 ~~equipment~~ **appliance**

Liner System sizing

Current Code Requirements

- 2006 IFGC
- 1346.5504.2.7 Liner system sizing.
- References various tables including table:
  - "… Corrugated metallic liner systems install with bends or **offsets** shall have their maximum capacity further reduced in accordance with IFGC Section **504.3…"**
  - **2006 book references vent offsets in 504.2.3 (which is correct; not 504.3)**
  - 504.2 (3)
  - 504.2 (4)
  - Both existing tables **do not** reference a row now seen in 2012 as 'Maximum Inter Area of Chimney (square inches)'

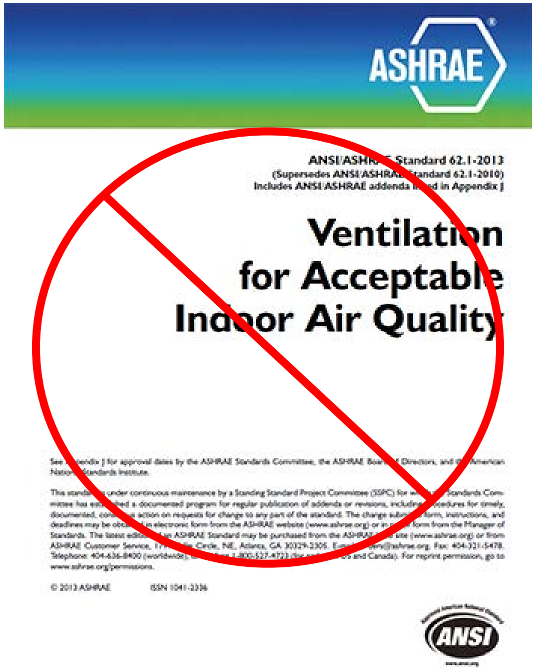
New Code Requirements

- 2012 IFGC
- 1346.5507.2.7
- So, 504.3 is titled 'Application of multiple appliance vent Tables 504.3(1) through 504.3(7).'
- In both the 2006 and 2013 IFGC the vent offset section is **504.2.3** which is now the new number in 1346.5504.2.7.
- 2012 IFGC tables 504.2(3) and (4) have a new row that says 'maximum internal are of chimney.' It states **Seven times the listed appliance categorized vent area, flue collar, area, or draft hood outlet area.** This conflicts with 1346.5503.6.9.1 –Category I appliances
  .

Brief introduction to Changes for commercial buildings

Code Books needed

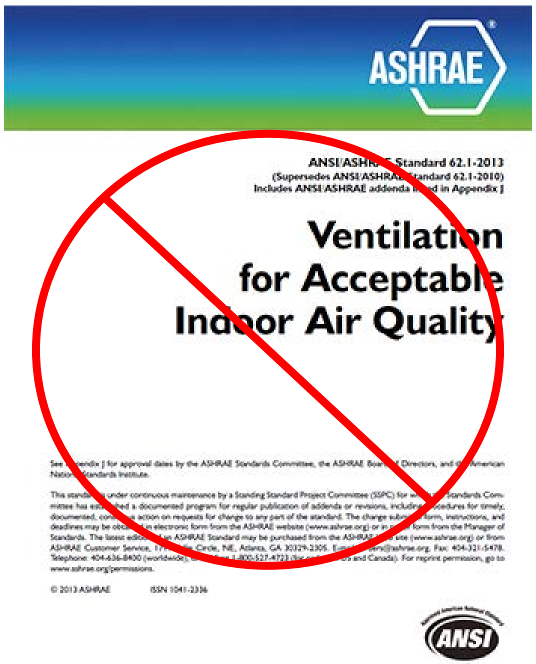
Current Code



- **ASHRAE Standard 62.1 will no longer be used**

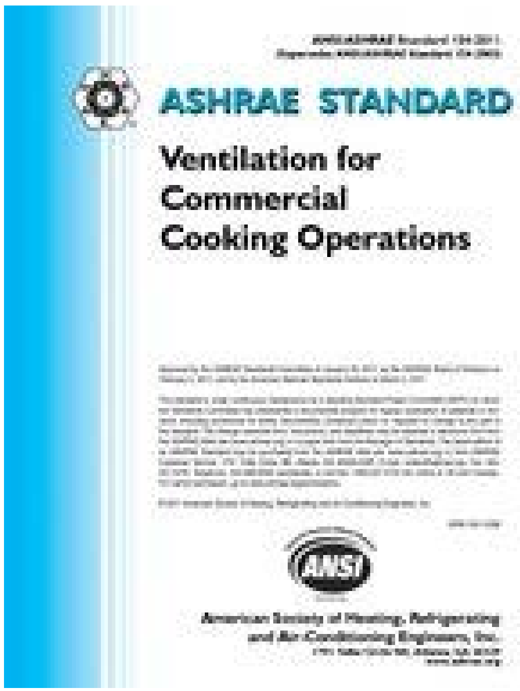
Code Books needed

Current Code



- ASHRAE Standard 62.1 will no longer be used

New Code



- ASHRAE Standard 154 will now be used

1323
Air Barrier

Current Code

- ASHRAE 90.1-2004
  - Section 5.4.3 Air leakage
    - Envelope Sealing 5.4.3.1
    - Fenestration and Doors 5.4.3.2
- MN Amended 5.4.3.1 and 5.4.3.2 to 1323.0543
  - **Building envelope air sealing.**
    - The building envelope shall contain an **air barrier** consisting of……..

New Code

- 2012 IECC section 402.4
  - Air barrier now has a definition in Chapter 2.
  - C402.4 Air barrier has:
    - C402.4.1 Air barrier. **A continuous air barrier shall be provided throughout the building envelope.**
    - C402.4.1.1 Air barrier construction
    - C402.4.1.2 Air barrier **COMPLIANCE** Options
      - **Materials**
      - **Assemblies**
      - Etc.
- ASHRAE 90.1-2010
  - 5.4.3 Air Leakage (same as 2004) BUT has sections:
    - 5.4.3.1 Continuous Air Barrier (**defined** in Chpt 2) (similar to C402.4.1)
    - 90.1-2010 , 5.4.3.1 now includes **design, Installation, Materials, Assemblies**, etc.

1323
Heat/Cool Load Calculations

Current Code

- 90.1-2004 ASHRAE section 6.4.2 Load Calculations "…engineering standards and handbooks acceptable to the adopting authority"
- MN Amended 6.4.2 to 1323.0642 **Load Calculations**
  - "…in accordance with MMC Chapter 1346.
  - **2006 IMC section 312**
    - **ASHRAE Fundamentals or**
    - **Chapter 3 IECC.**

New Code

- 2012 IECC
  - Section C403.2.1 (amended)
  - Keeps the **ANSI/ASHRAE/ACCA Standard 183-2007**.
  - Eliminates the alternative IECC section 3 computation procedure.
- 2010-90.1 ASHRAE
  - Section 6.4.2
  - ANSI/ASHRAE/ACCA **Standard 183-2007**
  - Except Low-Rise Residential buildings.

1323
Q = UA (dT), or BTU’s = U x Area x (T1-T2)

Current Code

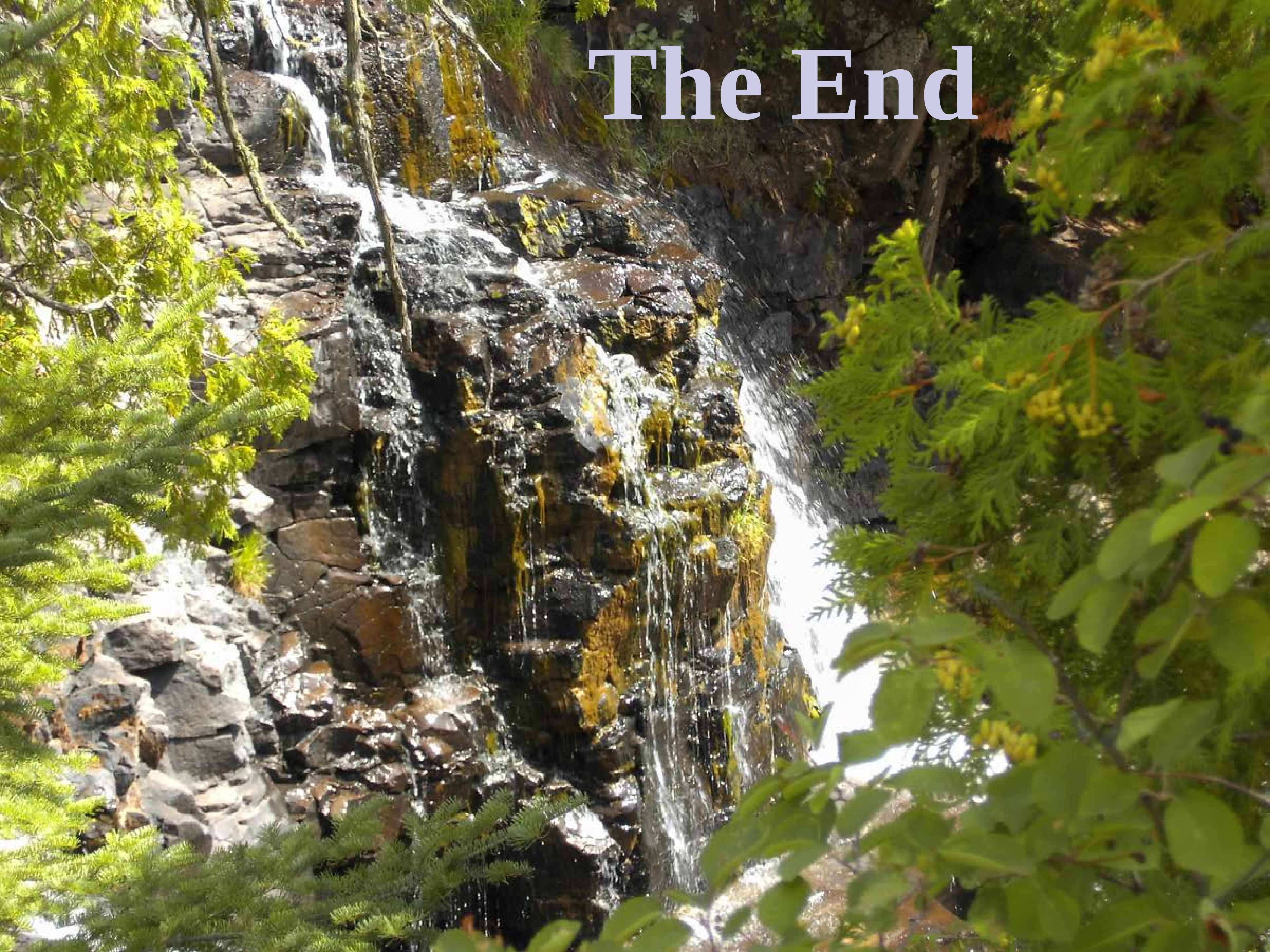
- Heat load calculations 1323.0642
  - MMC 1346
  - Outdoor design conditions table 6.4.2.1 gives **outdoor (T2)** design conditions Neither MN Rule 1346 or MN Rule 1323 provides specific **indoor** design conditions, **except,**
  - 2006 IMC section 309.1 “interior spaces intended for human occupancy shall be provided with active or passive space-heating systems capable of maintaining a minimum **indoor (T1)** temperature of 68 F at 3 feet above floor on the design heating day.

New Code

- 2012 IECC section C302
  - C302.1. Interior desing conditions. “The **interior (T1)** design temperatures used for heating and cooling load calculations shall be a **maximum of 72 F for heating** and a **minimum of 75 F for cooling.”**
  - IECC section C403.2.1 (Amended) “…. And by using the design parameters specified in Table C403.2.1 **(T2)** which gives the outdoor Temps by City (same as today).
- 2010 90.1 ASHRAE

Changing Design Conditions

City	Summer Db/Wb ºF 1999	Summer Db/Wb ºF 2006	Winter Db ºF 1999	Winter Db ºF 2006
Albert Lea	87/72	**85/72**	-17	**-15**
Alexandria	88/72	**86/70**	-22	**-21**
Bemidji	85/69	**84/68**	-31	**-24**
Brainerd	87/71	**86/71**	-20	**-20**
Duluth	82/68	**81/67**	-21	**-20**
Faribault	88/72	**86/73**	-17	**-16**
Fergus Falls	88/72	**86/71**	-21	**-21**
Virginia	83/72		-25	
International Falls	83/68	**83/67**	-29	**-28**
Mankato	88/72	**86/72**	-17	**-15**
Minneapolis/St. Paul	89/73	**88/72**	-16	**-15**
Rochester	87/72	**85/72**	-17	**-17**
St. Cloud	**88/72**	**86/71**	-15	**-20**
Willmar	88/72	**85/71**	-15	**-20**
Winona	88/73	**88/74**	-14	**-13**


The End

Please Remain Seated while we hand out Certificates

Thanks for attending