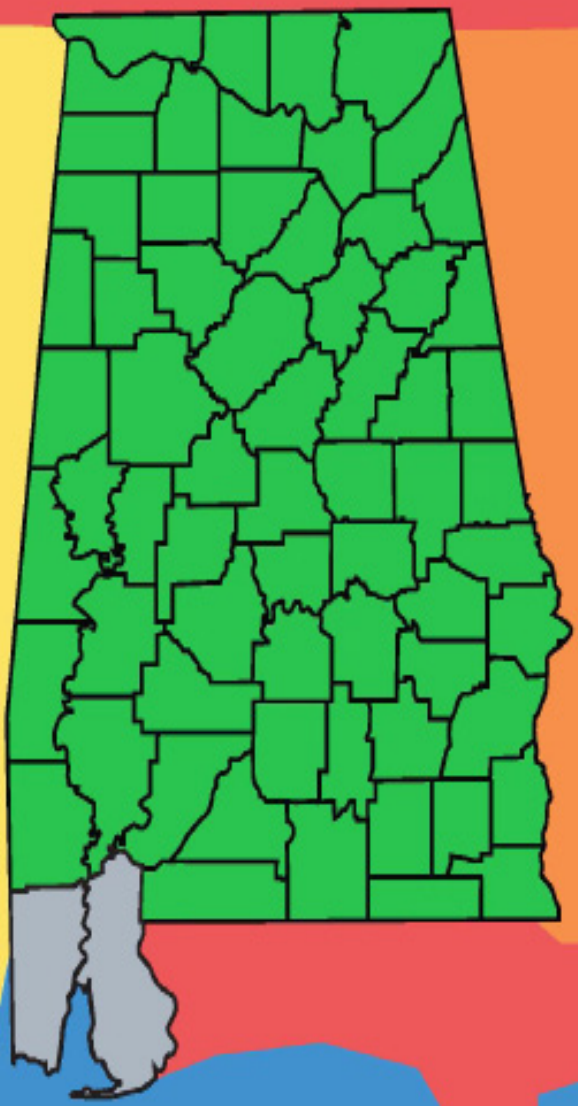
Alabama Residential Energy Code

FIELD GUIDE



2015 IECC® + 2016 ALABAMA

STATE SUPPLEMENTS & AMENDMENTS

This publication was developed by Southface Institute in partnership with the Alabama Department of Economic and Community Affairs (ADECA). It is intended to serve as a tool and support document for understanding the Albama Energy Code but does not replace or supercede the official Alabama State Energy Code, which can be accessed at www.adeca.alabama.gov.

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Alabama Residential Energy Code

FIELD GUIDE

2015 IECC® +
2016 Alabama Amendments

How to Use the Field Guide

This guide is intended to help explain the residential portion of the 2020 Alabama Energy Code and does not necessarily include all aspects and details. It is intended to serve as a tool and support document for understanding the Alabama Energy Code but does not replace or supercede the official Alabama State Energy Code, which can be accessed at www.adeca.alabama.gov.

This guide is organized by building component and attempts to compile all relevant information and key practices related to each component. Each entry includes references to all relevant sections of 2015 IECC, along with occasional references to the International Residential Code (IRC). Where applicable, each entry also provides summary details of requirements (such as R-values or U-factors) for each climate zone.

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Contents

Introduction 1
Insulation R-Values 4
Passing Grade Details 5
Slab Edge Insulation 7
Basement Wall Insulation 8
Crawl Space Wall Insulation 11
Crawl Space Vapor Retarder 12
Floor Insulation 13
Framed Wall Insulation 15
Mass Wall Insulation 18
Ceiling Insulation 19
Wind Wash Baffle and Air-Permeable Insulation Dam 22
Access Hatches and Doors 24
Attic Kneewalls 26
Fenestration U-Factor 29
Skylight U-Factor 30
Solar Heat Gain Coefficient (SHGC) Values
for Glazed Fenestration and Skylights 31
Fenestration Air Leakage 32
IC-Rated Recessed Lighting Fixtures (Sealing) 33
Air-Seal and Insulate Tubs and Showers 34
Air-Seal Window/Door Openings 36
Air-Seal Assemblies Separating Garage 37
Air-Seal Bottom and Top Plates 38
Air-Seal Seams in Exterior Air Barrier 40
Air-Seal Utility Penetrations 41
Air-Seal Dropped Soffit Ceilings and Chases 42
Air-Seal Rim/Band Joist Junctions 44
HVAC Piping Insulation 45
Hot Water Pipe Insulation 46
Service Hot Water Systems 47
Duct Insulation 48
Duct Sealing 49
Building Cavities May Not Be Used as Ducts or Plenums 51
Heating, Cooling, and Water-Heating Equipment 52
Heat Pump Controls 53
Rooms Containing Combustion Appliances 54
Mechanical Ventilation 56
Outdoor Intake/Exhaust Openings 58
Duct Tightness Testing 59
Blower Door Testing 60
Energy Code Compliance Certificate 62
Lighting 63
Wood-Burning Fireplaces 64

INTRODUCTION

Why the Energy Code Matters

The 2016 Alabama Energy Code is based primarily on the 2015 International Energy Conservation Code® (IECC) and the 2016 Alabama State Amendments. This upgraded code is important for all Alabamans. For those living in single-family buildings or low-rise multifamily residential buildings, the energy code helps ensure cost-efficient homes while also improving comfort and durability. For builders, it creates a level playing field while decreasing liability. For the environment, it reduces carbon and other emissions thanks to reduced energy production and usage.

Compliance Pathways

The IECC focuses heavily on the building thermal envelope (the air barrier plus insulation barrier that together contain the conditioned space). In addition, there are a few requirements pertaining to other systems such as ductwork and mechanical systems, as well as hot water piping. Items in the code are either mandatory (meaning they must be done and there is no trade-off) or prescriptive (meaning they represent the baseline, but could potentially be traded off). To comply with either the insulation R-value or the assembly U-factor for each building component, the builder should consult the prescriptive tables, available in 2015 IECC Chapter 4.

Compliance with the envelope requirements of the code is generally met using the prescriptive pathway. Under this approach, meeting (or exceeding) the "recipe" for each building component is the most straightforward means to demonstrating compliance. If the permit applicant satisfies the prescriptive code and meets all the mandatory requirements, energy code compliance is achieved.

When a house design varies from the prescriptive code, a trade-off must be employed. In Alabama, options include computer-based analyses such as the Simulated Performance Alternative and the brand new Energy Rating Index (ERI) option.

Trade-Off Approaches

Following is a summary of the various trade-off approaches. Important: no matter which trade-off compliance option is used, the "can't trade to zero" requirements of section 402.1.6 must be satisfied.

Simulated Performance Alternative: This annual computer simulation allows for trade-offs within the thermal envelope. This approach is more complex and usually requires a knowledgeable user with access to the software, such as a Home Energy Rating System (HERS) rater. If the proposed house design can be simulated and shown to be equal to or lower in annual energy cost when compared to a simulation of the same house built exactly to prescriptive code, the proposed design complies.

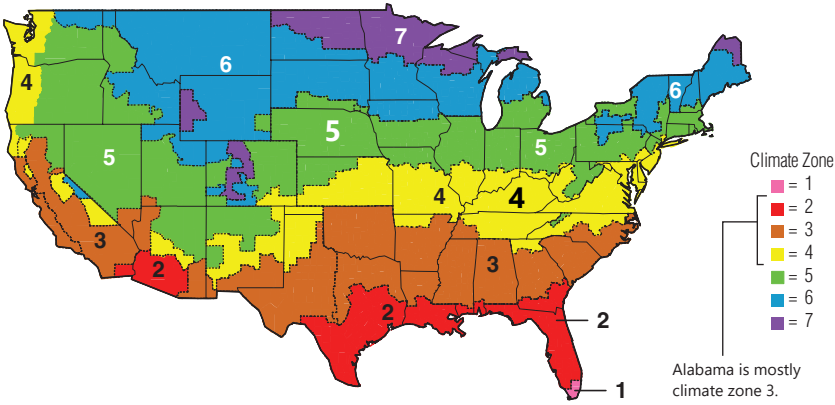
Energy Rating Index (ERI): Similar to a HERS rating, this compliance approach looks at all the energy used in the home, which means higher efficiency HVAC, water heating, and even appliances like refrigerators and dishwashers are accounted for. The computer analyzes all energy used

for heating, cooling, water heating, lights, appliances, and renewable energy systems in the proposed house and compares the energy usage to that of a home built to a baseline 2006 IECC level. This ratio creates an index wherein a lower number is more efficient and each index point represents a 1% difference compared to the reference home.

For example, an index of 100 means the home just meets the 2006 IECC reference home, while a home built to the 2009 IECC would likely be in the low-to-mid 80s (approximately 15–20% more efficient than the reference home). For energy code compliance, threshold index targets of **57** must be met for the proposed house in CZs 2-3.

Alabama Climate Zones by County

Nearly all Alabama counties are in Climate Zone (CZ) 3A, with the exception of Mobile and Baldwin counties, which are CZ2A. The letter indicates an area's moisture regime; the entire state of Alabama is designated as Regime A (moist); no areas fall in B (dry) or C (marine). Additionally, some counties are designated as A*, or warm-humid, as indicated in the table on the opposite page.



Climate Zone 3

Bibb
Blount
Calhoun
Chambers
Cherokee
Chilton
Clay
Cleburne
Colbert
Coosa
Cullman

DeKalb
Etowah
Fayette
Franklin
Greene
Hale
Jackson
Jefferson
Lamar
Lauderdale
Lawrence

Lee
Limestone
Madison
Marion
Marshall
Morgan
Pickens
Randolph
Shelby
St. Clair
Sumter

Talladega
Tallapoosa
Tuscaloosa
Walker
Winston

Climate Zone 3* moist-humid)

Autauga
Barbour
Bullock
Butler
Choctaw
Clarke
Coffee
Conecuh

Covington
Crenshaw
Dale
Dallas
Elmore
Escambia
Geneva
Henry

Houston
Lowndes
Macon
Marengo
Monroe
Montgomery
Perry
Pike

Russell
Washington
Wilcox

Climate Zone 2

Baldwin

Mobile

INSULATION R-VALUES

Code Section 303.1, 402.1.2, 402.2

Description

All insulation installed within the building thermal envelope must have a label indicating the R-value, or it must have a certificate verifying the type of insulation, the thickness, and installed R-value.

A certificate for blown insulation must provide the installed density, coverage, and number of bags of insulation.

- For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed must be listed on the certification.
- For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and R-value of installed thickness must be listed on the certification.
- For insulated siding, the R-value must be labeled on the product's package and listed on the certification. The insulation installer must sign, date, and post the certification in a conspicuous location on the job site.

Markers/rulers:

- The thickness of blown or sprayed roof/ceiling insulation (fiberglass or cellulose) must be written in inches on markers that are installed at least one for every 300 sq. ft. throughout the attic space.

Blown insulation rulers installed 1 per 300 sq. ft. facing attic access

- The markers must be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers not less than 1 inch in height. Each marker must face the attic access opening.
- SPF thickness and installed R-value must be listed on certification provided by the insulation installer.

Insulation material used in layers (e.g., framing cavity insulation) or continuous insulation is summed to compute the corresponding component R-value. For blown insulation, refer to the manufacturer's settled R-value.

Computed R-values do not include an R-value for other building materials or air films. Where insulated siding is used to meet prescriptive requirements, the manufacturer's labeled R-value for insulated siding is reduced by R-0.6.

PASSING GRADE DETAILS

Note: The following recommended practices are excerpted from Appendix RA of the 2020 Georgia Energy Code. They are included in this guide for informational purposes only in Alabama.

Wall and Ceiling Insulation Installation

Wall and ceiling insulation that makes up portions of the building thermal envelope shall be installed to Passing Grade quality.

Two criteria affect installed insulation grading: **voids/gaps** (in which no insulation is present in a portion of the overall insulated surface) and **compression/incomplete fill** (in which the insulation does not fully fill out or extend to the desired depth).

Voids/Gaps

Voids or gaps in the insulation are < 1% of overall component surface area (only occasional and very small gaps allowed for Passing Grade).

Compression/Incomplete Fill

- Compression/incomplete Fill for both air permeable insulation (e.g., fiberglass, cellulose) and air impermeable insulation (e.g., spray polyurethane foam) must be less than 1 inch in depth or less than 30% of the intended depth, whichever is more stringent. The allowable area of compression/incomplete fill must be less than 2% of the overall insulated surface to achieve a Passing Grade.
- Any compression/incomplete fill with a **depth** greater than the above specifications (up to 1" or 30% of the intended depth, whichever is more stringent) shall not achieve a Passing Grade.

Additional Wall Insulation Requirements

- All vertical air permeable insulation shall be installed in substantial contact with an air barrier on all six (6) sides. Exception: Unfinished basements, rim/band joist cavity insulation, and fireplaces (insulation shall be restrained to stay in place). For unfinished basements, air permeable insulation and associated framing in a framed cavity wall shall be installed less than ¼" from the basement wall surface.
- Attic knee walls shall be insulated to a total R-value of at least R-13 through any combination of cavity and continuous insulation. Air permeable insulation shall be installed with a fully sealed attic-side air barrier (e.g., OSB with seams caulked, rigid insulation with joints taped, etc.). Attic knee walls with air impermeable insulation shall not require an additional attic-side air barrier.

Note: The following are recommended best practices.

Underfloor Insulation Installation

Underfloor insulation that makes up portions of the building thermal envelope shall be installed to Passing Grade quality.

Two criteria affect installed insulation grading: voids/ gaps (in which no insulation is present in a portion of the overall insulated surface) and compression/incomplete fill (in which the insulation does not fully fill out or extend to the desired depth).

Voids/Gaps

- Voids or gaps in the insulation are minimal for Passing Grade (< 2% of overall component surface area).

Compression/Incomplete Fill

- Compression/incomplete Fill for both air permeable insulation (e.g., fiberglass, cellulose) and air impermeable insulation (e.g., spray polyurethane foam) must be less than 1 inch in depth or less than 30% of the intended depth, whichever is more stringent. The allowable area of compression/incomplete fill must be less than 10% of the overall insulated surface to achieve a Passing Grade.
- Any compression/incomplete fill with a **depth** greater than the above specifications (up to 1" or 30% of the intended depth, whichever is more stringent) shall not achieve a Passing Grade.
- Air-permeable underfloor insulation shall be permanently installed against the subfloor decking. Adequate insulation supports (e.g., wire staves) for air-permeable insulation shall be installed at least every 18-24".

Exception: The floor framing-cavity insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing where combined with insulation that meets or exceeds the minimum wood frame wall R-value and that extends from the bottom to the top of all perimeter floor framing members.

SLAB EDGE INSULATION

Code Section	402.1.2 (AL Amended)
Code Value	CZ2-3: *Slab edge insulation is not required.*

Description

- Slab insulation is not required per Table 402.1.2, Alabama Amendments.

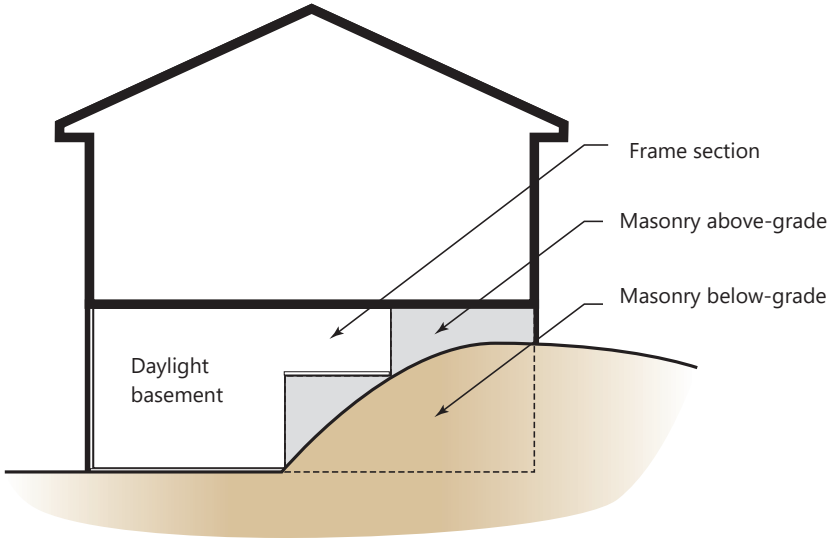
BASEMENT WALL INSULATION

Code Section	301.1, 303.2, 402.1.2, 402.1.4, 402.1.6 (AL amended), 402.2.7, 402.2.9, 402.4.1.1 (AL amended)
Code Value	CZ2 and CZ3*: R-0 CZ3: R-5 Continuous (interior or exterior); or R-13 Cavity (interior)

Description

- * Basement wall insulation is not required in CZ2 or warm-humid locations of CZ3. To find the appropriate Climate Zone, see the Figure R301.1 (Climate Zone Map).
- If insulation is installed on the exterior of the basement wall, code values listed above apply.
- A basement wall is at least 50% below grade.
- Insulation must be installed according to manufacturer's instructions.
- If installed on the exterior, code values listed above apply and insulation must have opaque, weather-resistant protective covering, which must cover exposed above-grade exterior insulation and extend at least 6 inches below grade.
- Basement wall insulation may also be applied in an interior wall cavity (R-13 for CZ3).
- Alternately, the floor over the basement may be air sealed and insulated (for an unconditioned basement only).
- Interior insulation must extend to the basement floor or to 10 feet, whichever is less.
- Indirectly conditioned basements must meet same requirements.

Basement Wall Insulation Details



Basement Wall Insulation Details, continued

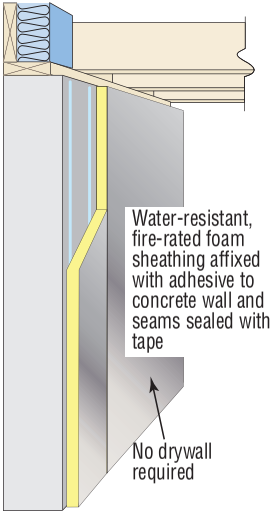
Insulation installed in full contact with wall.

INCORRECT (CZ3): Insulation not on concrete portion of basement wall.

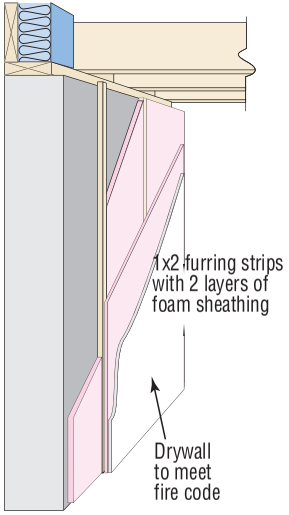
Insulated concrete form exceeds code by providing continuous insulation on interior and exterior of foundation.

Basement Wall Insulation Details, continued

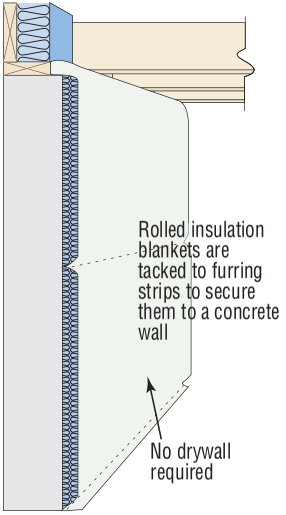
Important Note: A 3-inch inspection/view strip immediately below the floor joists must be provided for termite inspection. Diagrams on this page do not show this strip; see p.17 (Crawl Space) for illustration.



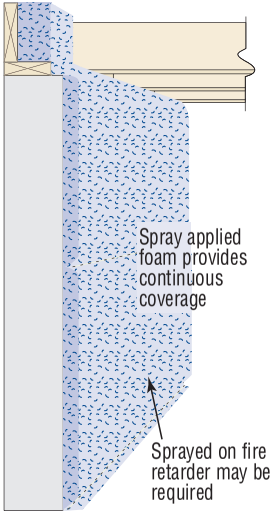
Fire-rated rigid foam board



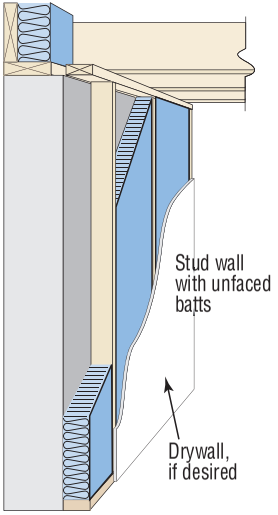
Rigid board with drywall



Blanket Batts



Spray applied foam



Batts in cavities

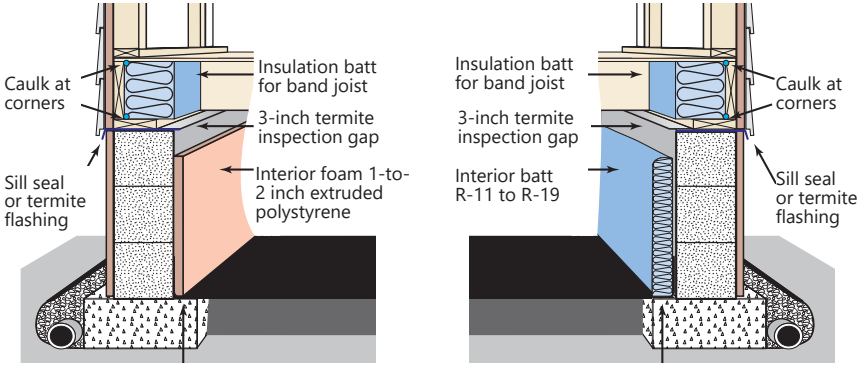
CRAWL SPACE WALL INSULATION

Code Section	303.2, 402.1.2, 402.1.4, 402.1.6 (AL amended), 402.2.11 (AL amended), 402.4.1.1 (AL amended), IRC408
Code Value	CZ2: R-0 CZ3: R-5 Continuous; R-13 Cavity

Description

- Closed (conditioned) crawlspaces may have the walls insulated instead of overhead floors if the crawlspace is not vented from the outside and the details of the IRC for unvented crawlspaces are met (e.g., conditioning the crawlspace via a supply duct or a dedicated dehumidifier).
- Floors above a ventilated (unconditioned) crawlspace must be insulated to R-13 in CZ2 and R-19 in CZ3.
- Insulation on the interior of unvented, conditioned crawlspace walls must be permanently fastened to the wall and extend downward from the bottom of the floor framing to within zero to 9 inches of finished grade.
- A 3-inch inspection/view strip immediately below the floor joists must be provided for termite inspection. An optional, removable (for inspection purposes) 3-inch "plug" of insulation may be inserted for a more complete insulation coverage.
- The band area of a conditioned crawlspace must be air sealed and insulated. It is strongly recommended that the band area be insulated with a removable insulation product to provide access for pest control inspection.
- See also "Crawl Space Vapor Retarder" and "Access Hatches and Doors."

Crawl Space Wall Insulation Diagram



CRAWL SPACE VAPOR RETARDER

Code Section 402.1.1, 402.2.11 (AL amended)

Description

- Exposed earth in an unvented crawl space must be covered by a continuous Class I vapor retarder in accordance with IBC or IRC.
- All joints of the vapor retarder must overlap by 6 inches and be sealed or taped. The edges must extend at least 6 inches up the stem wall and be attached to the stem wall.
- A Class I vapor retarder must be applied to the entire floor and run at least 6 inches up the walls of the crawl space and sealed to the walls. Any seams in the vapor retarder must have at least a 6-inch overlap and be sealed or taped. See Crawl Space Wall Insulation for diagram of vapor retarder sealing.

Notes: A Class I vapor retarder has a perm rating of less than 0.1 perm (such as 6-mil polyethylene). The IECC only requires a vapor retarder for unvented, conditioned crawlspaces, but the IRC requires a vapor retarder for both vented and unvented crawlspaces unless the crawlspace is “highly vented” (i.e., 1 sq. ft. of net free vent area per 150 sq. ft. of floor area).

Sealing and Overlapping Vapor Retarder

Sealed and overlapped seams

Sealed and applied 6" up wall

FLOOR INSULATION

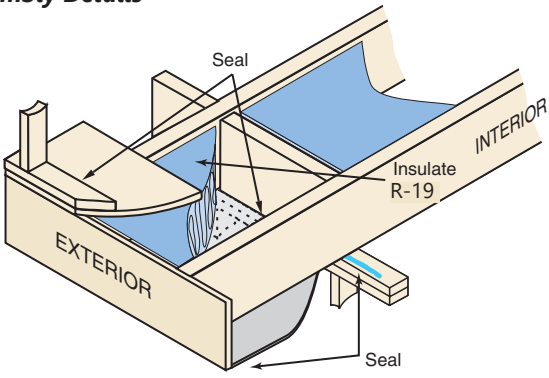
Code Section	303.2, 402.1.2, 402.1.4, 402.1.6 (AL amended), 402.2.6, 402.2.8
Code Value	CZ2: Wood: R-13 Steel*: R-19 in 2x6; R-19+R-6 in 2x8 or 2x10 CZ3: Wood: R-19 Steel*: R-19+R-6 in 2x6; R-19+R-12 in 2x8 or 2x10

*Cavity insulation R-value is listed first, followed by continuous insulation R-value.

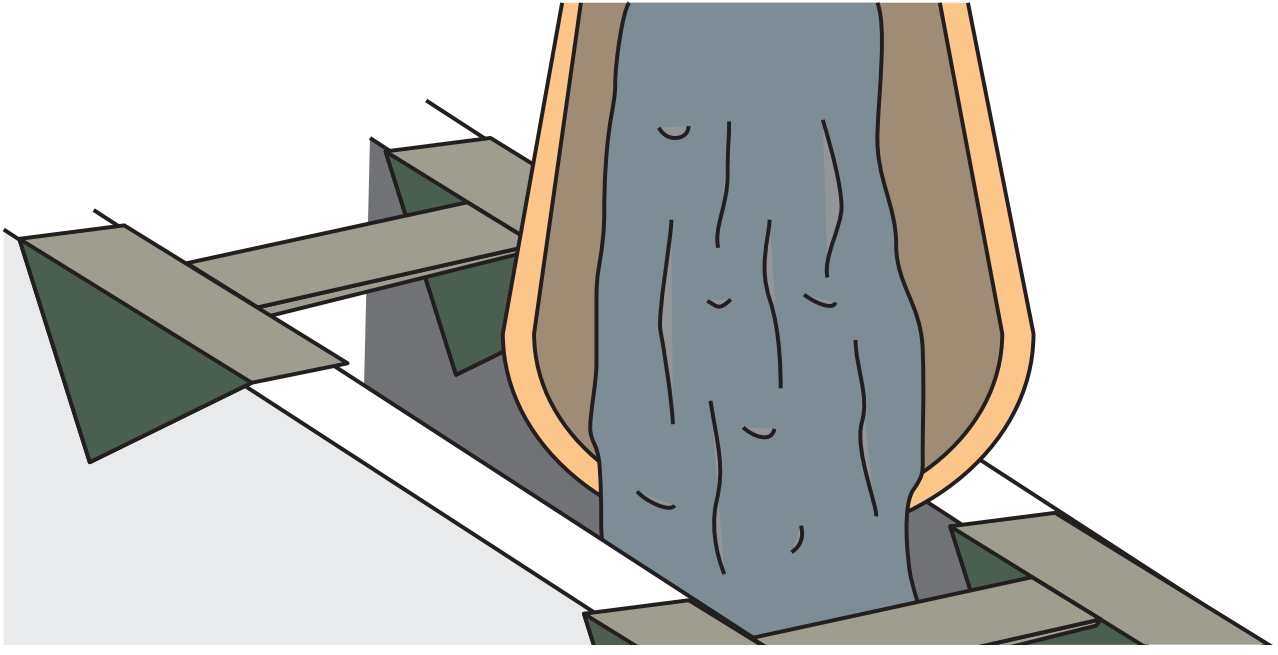
Description

- Floor insulation must be installed on any wood-framed, steel-framed, or raised concrete floor that is part of the building thermal envelope.
- Floor insulation must be installed in accordance with the manufacturer's installation instructions and in permanent continuous contact with the underside of the subfloor decking.
- As an exception, the floor framing-cavity insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing where combined with insulation that meets or exceeds the minimum wood-frame wall R-value in Table 402.1.2 and extends from the bottom to the top of all perimeter floor framing members.
- Cantilevered floors over the outdoors must be R-19, and the band area above the exterior wall must be blocked and air sealed.
- Vapor retarders are not required for floor insulation in CZs 2-3.

Floor Assembly Details



Floor Insulation Details, continued



FRAMED WALL INSULATION

Code Section	303.2, 402.1.2 (AL amended), 402.1.4, 402.1.5, 402.1.6 (AL amended), 402.2.5, 402.2.6, 402.2.13	
Code Value	CZ2:	Wood: R-13 Steel*: 16" o.c. R-13+4.2 or R-19+2.1; R-21+2.8; R-0+9.3; R-15+3.8; R-21+3.1; 24" o.c. R-0 + 9.3 or R-13 + 3.0 or R-15 + 2.4
	CZ3:	Wood: R-13 Steel*: 16”o.c. R-0 + 14.0 or R-13 + 8.9 or R-15 + 8.5 or R-19 + 7.8 or R-19 + 6.2 or R-21 + 7.5; 24” o.c. R-0 + 14.0 or R-13 + 7.7 or R-15 + 7.1 or R-19 + 6.3 or R-21 + 5.9

*Cavity insulation R-value is listed first, followed by continuous insulation R-value.

Description

- Insulation must be applied to wood-frame, steel-frame, and mass walls that are above grade and associated with the building thermal envelope.
- Mass walls are those of concrete block, concrete, ICFs, masonry cavity, brick (non-veneer), earth/adobe, and solid timber/logs. See "Mass Wall Insulation" for more details.
- Wall insulation must be installed in accordance with the manufacturer’s installation instructions, and all places in the wall that will accommodate insulation must be insulated.
- Insulation in sunroom walls (rooms thermally isolated from conditioned space) must meet these criteria.
- Vapor retarders are not required for wall insulation in CZs 2-3.

Wall Insulation Details

CORRECT: Batt in wood-framed cavity

INCORRECT: Unfilled cavity

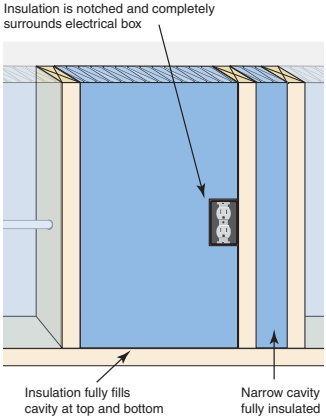
CORRECT: Full coverage/no compression

INCORRECT: Compression/poor coverage

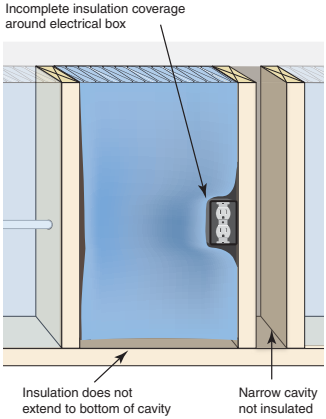
Wall Insulation key points

Voids / Gaps

Passing Grade

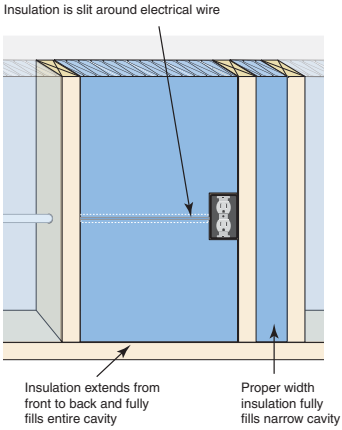


Unacceptable Installation

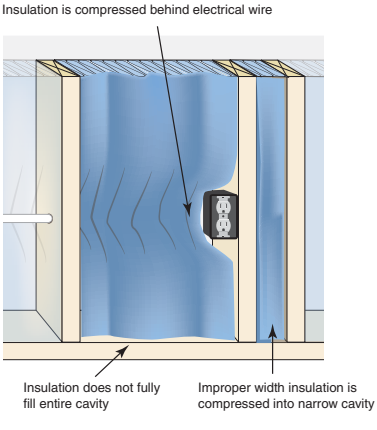


Compression / Incomplete Fill

Passing Grade



Unacceptable Installation



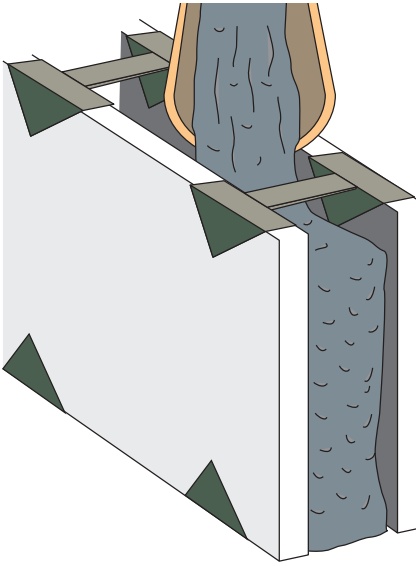
MASS WALL INSULATION

Code Section	303.2, 402.1.2, 402.1.4, 402.1.6 (AL amended), 402.2.5
Code Value	CZ2: R-4 exterior; R-6 interior CZ3: R-5 exterior; R-8 interior

Description

- Above-grade mass walls are those of concrete block, concrete, ICFs, masonry cavity, brick (non-veneer), earth/adobe, and solid timber/logs.
- An above-grade mass wall is one that is more than 50% above grade. If the wall is at least 50% below grade, see "Basement Wall Exterior Insulation" requirements.
- Mass wall insulation must be installed in accordance with the manufacturer's installation instructions.
- If more than half the insulation is on the interior, the mass wall interior insulation requirement applies.

Insulated Concrete Forms



Above-grade Insulated Concrete Forms (ICFs) are considered mass walls and typically greatly exceed prescriptive code R-values

CEILING INSULATION

Code Section	303.1.1, 303.1.1.1, 303.1.2, 303.2, 402.1.2, 402.1.4, 402.1.5, 402.1.6 (AL amended), 402.2.1 (AL amended), 402.2.2, 402.2.4, 402.2.6, 402.2.13
Code Value	CZ2: R-30 CZ3: R-30 *See 2015 IECC, Table R402.2.6 for equivalent R-values for steel components.

Description

- All insulation must be installed in accordance with the manufacturer's installation instructions.
- For blown-in attic insulation, rulers must be provided for every 300 sq.ft. of attic space and face the attic access. See "Insulation R-Values" for more details.
- Insulation in sunroom ceilings (rooms thermally isolated and enclosing conditioned space) must have R-19 minimum insulation installed.
- Access must be provided to attic equipment (such as HVAC equipment) that prevents any damage or compression to the installed insulation.
- See also"Wind Wash Baffles and Air Permeable Insulation Dams" and "Access Hatches and Doors" for more details, if applicable.
- Vapor retarders are not required for ceiling insulation in CZs 2 and 3.
- The minimum insulation value for ceilings with attic spaces is R-30
- For unvented attics where air-impermeable insulation is installed on the roofline, R-20 is deemed equivalent and meets the mandatory code minimum.

Ceiling Insulation Details

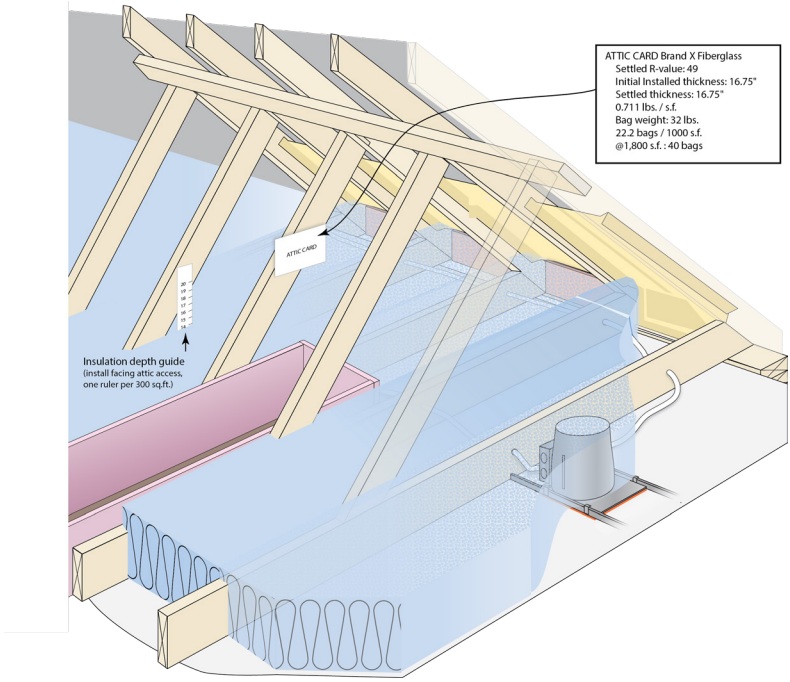
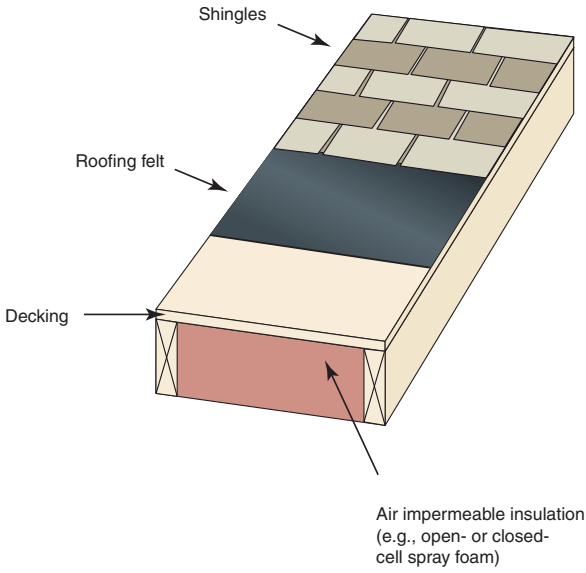


Diagram illustrates details of attic dams (at eaves and pull-down stairs), vent baffles at soffit, properly installed air-tight IC-Rated canned light fixture (sealed to drywall) and attic card and rulers to demonstrate consistent coverage of blown insulation.

Ceiling insulation ruler

Roofline Impermeable Insulation Assembly *(minimum R-20)*



Spray Foam Application

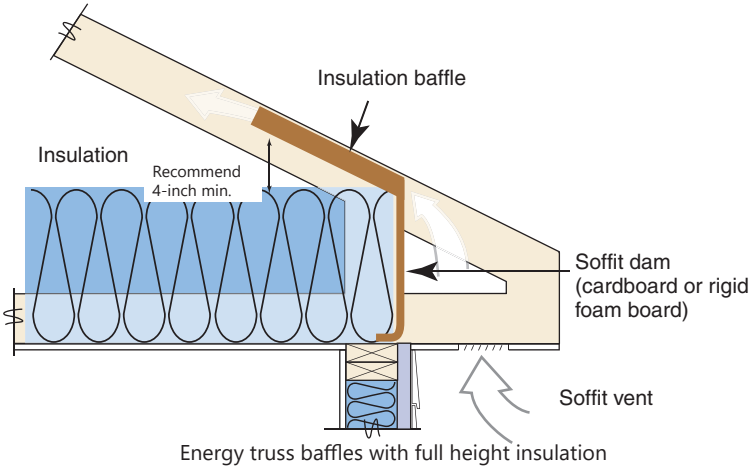
WIND WASH BAFFLE AND AIR-PERMEABLE INSULATION DAM

Code Section 402.2.3

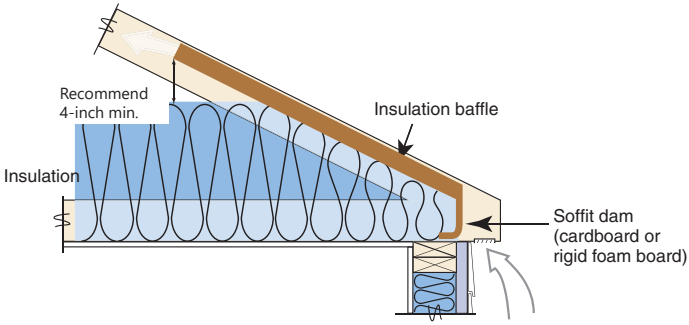
Description

- For air-permeable insulation (fiberglass or cellulose insulation) in vented attics, baffles must be installed adjacent to soffit and eave vents.
- The baffle must provide an opening equal to, or greater than, the opening of the soffit or eave vent.
- The baffle must extend over the top of the insulation.
- Any solid material such as cardboard or thin insulating sheathing is permissible as the baffle /insulation dam.

Baffle Installation



Baffle Installation, continued



Standard truss baffles with tapered insulation depth

Insulation Baffles

Baffles (pre-insulation) extended over top-plate

ACCESS HATCHES AND DOORS

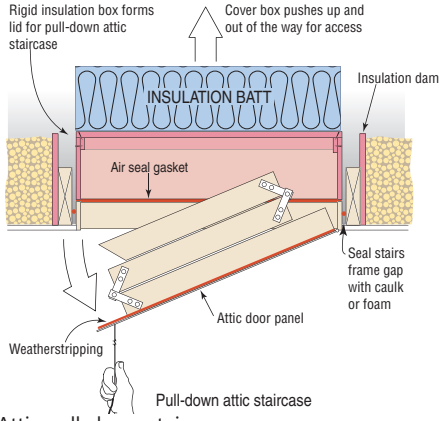
Code Section 402.2.4 (AL amended), 402.4.1, 402.4.1.1 (AL amended)

Code Value Hinged Vertical Door: R-5
Hatches/Scuttle-Hole Covers: R-19
Attic Pull-Down Stairs: R-5

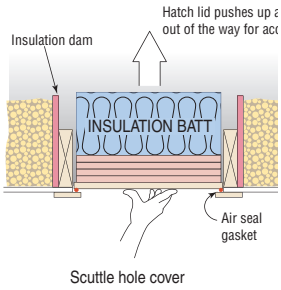
Description

- All accesses between conditioned and unconditioned space must be insulated and air-sealed (weather stripped).
- All pull-down attic stairs must have a maximum U-factor of U-0.20 with a minimum of 75% of the panel having R-5 insulation.
- A wood-framed or equivalent baffle or retainer is required where loosefill insulation is installed, such as around pull-down stairs in an insulated ceiling. The purpose is to prevent the loose-fill insulation from spilling into the living space when the attic access is opened and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

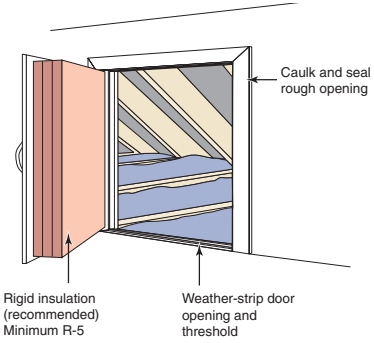
Hatches and Doors Diagram



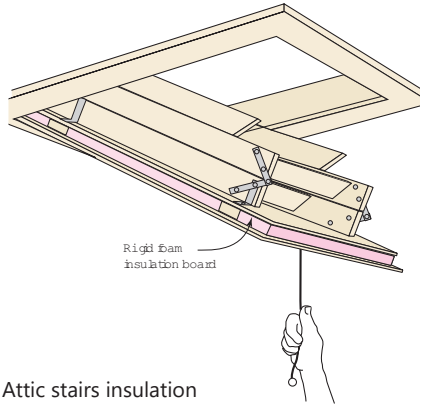
Attic pull-down stairs



Attic access hatch with batt insulation



Attic kneewall door



Attic stairs insulation

Hatches and Doors, continued

INCORRECT - This pull-down stairs needs air sealing in the rough opening.

This pull-down stairs features R-5 insulation in the door as well as an R-5 insulated cover box (either option will satisfy code).

ATTIC KNEEWALLS

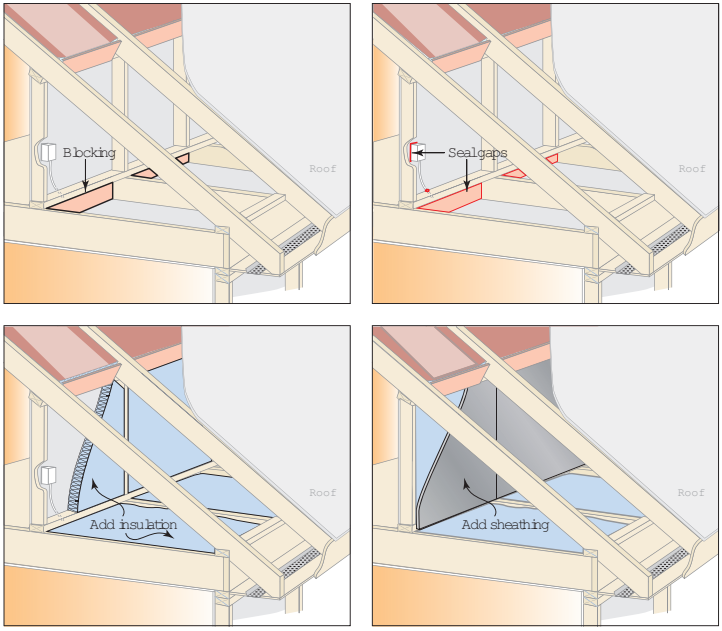
Code Section 402.4.1.1

Code Value CZs 2-3: R-13

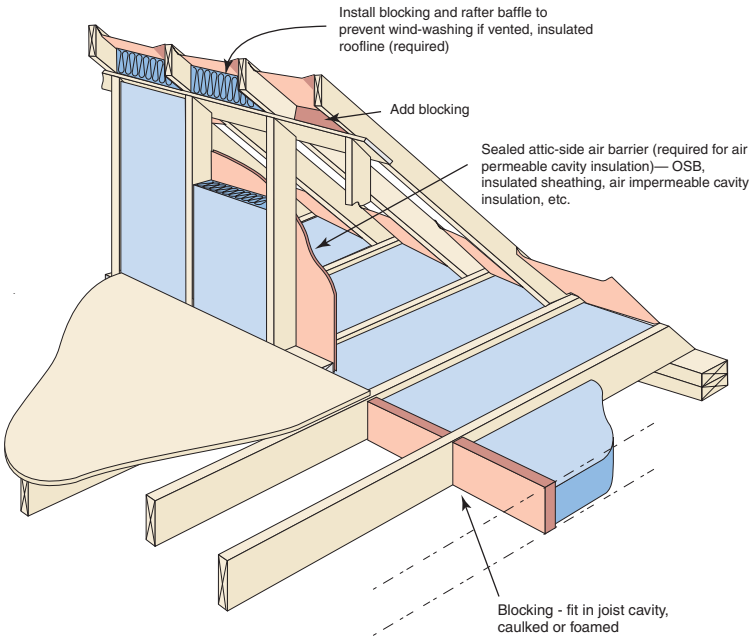
Description

- An attic kneewall is any vertical or near-vertical wall in the building envelope that has conditioned space on one side and attic space on the other side.
- All attic kneewalls must be insulated to at least R-13 and air-sealed.
- The attic side of the kneewall must have an attached air barrier (with all seams and edges sealed). The top and bottom of the kneewall stud cavity must be blocked and sealed to fully encapsulate insulation.
- Sprayed polyurethane foam in an attic kneewall serves as the air barrier.

Blocking and Sealing Attic Kneewalls



Kneewall Air-Sealing and Insulation Details



Blocking and Sealing Attic Kneewalls

INCORRECT: Unblocked joist cavity. Inspector is reaching through the unblocked joist cavity revealing a significant pathway for unconditioned attic air into the building envelope.

CORRECT: Blocked joist cavity/sealed attic-side air barrier

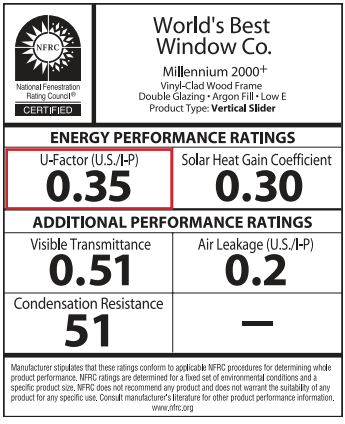
FENESTRATION U-FACTOR

Code Section	303.1.3, 402.1.2, 402.1.4, 402.1.5, 402.1.6, 402.3, 402.4.3, 402.5
Code Value	CZ2: U-0.35 CZ3: U-0.35

Description

- An area-weighted average can be used to satisfy the U-factor requirement.
- For the prescriptive approach only, up to 15 sq. ft. of the total glazed fenestration (including skylights) do not have to meet the specified U-factor in the code.
- Glazing must be labeled and certified to meet NFRC standards. If glazing is not NFRC certified, default values in Table 303 must be used, but these default values are poor and will not meet prescriptive requirements in the energy code.
- Under the prescriptive approach only, up to 24 sq. ft. of side-hinged door does not have to meet the specified U-factor in the code. This exemption does not apply to attic access doors.
- For enclosed, thermally isolated sunrooms, maximum 0.45 U-factor is allowed. New fenestrations separating sunrooms and conditioned space must meet code value(s) listed.

NFRC Glazing Label (Highlighting U-Factor)



SKYLIGHT U-FACTOR

Code Section	303.1.3, 402.1.2 (AL Amended), 402.1.4 (AL Amended), 402.4.3, 402.5
Code Value	CZ2: U-0.55 CZ3: U-0.55

Description

- Glazing that is at least 15 degrees from vertical installed in the building envelope is subject to this requirement.
- For the prescriptive approach only, up to 15 sq. ft. of total glazed fenestration (including skylights) do not have to meet the specified U-factor.
- An area-weighted average can be used to satisfy the skylight U-factor requirement.
- Glazing must be labeled and certified as meeting NFRC standards. If not, default values in Table R303.1.3 must be used, but these default values are poor and will not meet the code's prescriptive requirements.
- For enclosed, thermally isolated sunrooms, maximum 0.7 U-factor is allowed.

Skylights

SOLAR HEAT GAIN COEFFICIENT (SHGC) VALUES FOR GLAZED FENESTRATION AND SKYLIGHTS

Code Section 303.1.3, 402.1.2 (AL Amended), 402.1.4 (AL Amended), 402.1.5, 402.3.2, 402.3.5

Code Value CZs 2-3, with no overhang present: SHGC 0.27 for S, E, W orientations; 0.33 for N orientation. If shaded by overhang, see **Table C402.4,** below.

Description

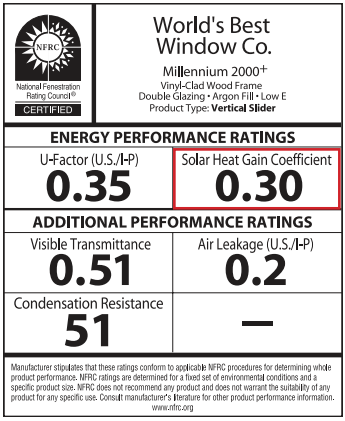
- An area-weighted average of fenestration products over 50 percent glazed can be used to satisfy the SHGC requirement.
- For the prescriptive approach only, up to 15 sq. ft. of glazed fenestration does not have to meet the specified SHGC requirement. Glazing must be labeled and certified as meeting NFRC standards.
- If glazing is not NFRC certified, default values in Table R303.1.3 must be used, but these default values are poor and will not meet prescriptive requirements.
- In CZs 2-3, skylights may be excluded from SHGC requirements if skylight SHGC does not exceed 0.30. (See Table R402.1.2, footnote B.)

Detail from Table C402.4

SHGC **CZ2-3**

Orientation	SEW	N
PF < 0.2	0.27	0.33
0.2 < PF < 0.5	0.30	0.37
PF > 0.5	0.40	0.40

NFRC Glazing Label (Highlighting SHGC)



FENESTRATION AIR LEAKAGE

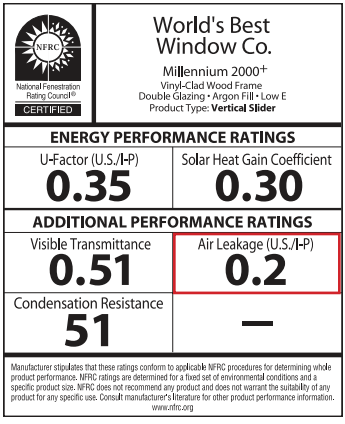
Code Section 402.4.3

Code Value Max 0.3 CFM/sq.ft.
(0.5 CFM/sq.ft. for swinging doors)

Description

- Each window, skylight, and sliding glass door must be tested to the referenced NFRC 400 or AAMA/WDMA/CSA standards and meet the required air-infiltration rate.
- Each window, skylight, and sliding glass door must have a manufacturer's label, seal, symbol, or other identifying mark indicating the test results or compliance with the code.
- Site-built windows, skylights, and doors are exempt from this requirement (but must comply with sealing requirements).

NFRC Glazing Label (Highlighting Air Leakage)



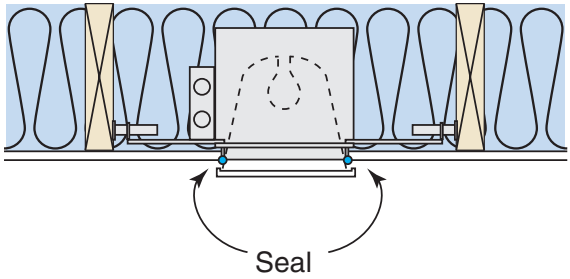
IC-RATED RECESSED LIGHTING FIXTURES (SEALING)

Code Section 402.4.1.1 (AL amended), 402.4.5

Description

- Recessed lighting fixtures inside the building thermal envelope must be sealed to limit air leakage between conditioned and unconditioned space.
- Fixtures must be IC-rated and labeled with an air leakage rate ≤ 2.0 CFM.
- Recessed fixtures must have a gasket or caulk between the housing and the interior finish.

Recessed Lighting Fixture Diagram



INCORRECT: Standard fixture

CORRECT: IC-rated and air-tight

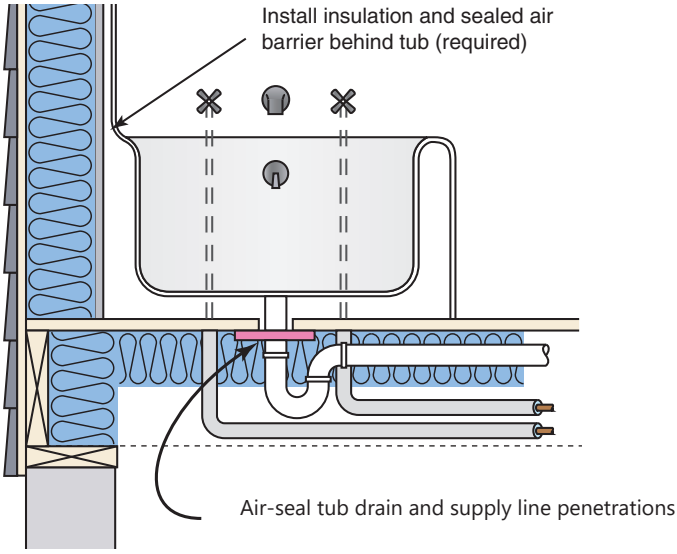
AIR-SEAL AND INSULATE TUBS AND SHOWERS

Code Section 402.1.2, 402.4.1, 402.4.1.1 (AL amended)

Description

- Insulation and a sealed air barrier must be installed between showers/ tubs on an insulated (usually exterior) wall.
- All plumbing penetrations must be appropriately air-sealed.

Tub Air-Sealing and Insulation Diagram



Air-Sealing Tubs and Showers

CORRECT: Air barrier and insulation behind tub

INCORRECT: Drain penetration open

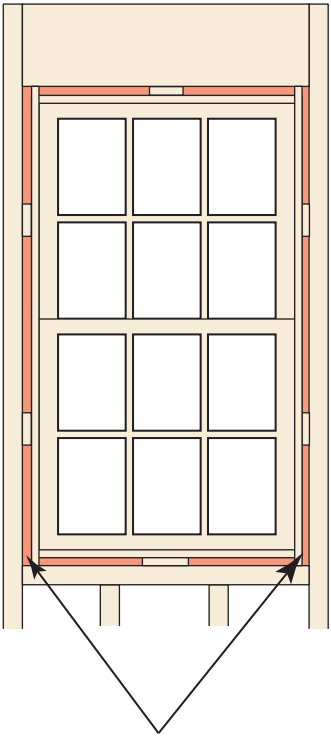
AIR-SEAL WINDOW/DOOR OPENINGS

Code Section 402.4.1, 402.4.1.1 (AL amended)

Description

Gaps between window/door jambs and framing must be sealed (e.g., with low expanding foam or backer rod). This includes skylights and attic access doors.

Air-Sealing Windows



Use backer rod or low expanding spray foam (appropriate for windows) to fill gaps between window/door and rough opening

Window air-sealing

Air-sealing with backer rod

Air-sealing with spray foam

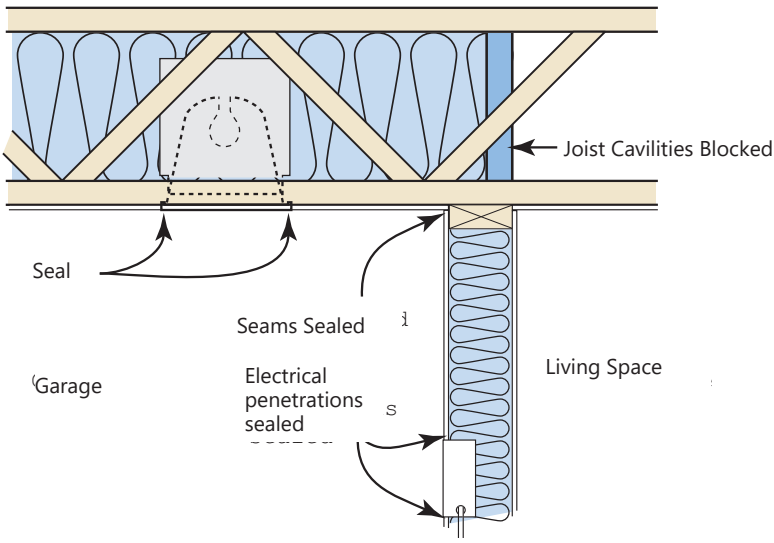
AIR-SEAL ASSEMBLIES SEPARATING GARAGE

Code Section 402.4.1, 402.4.1.1 (AL amended)

Description

Walls and ceilings separating the garage from conditioned space must be air-sealed as well as insulated. For example, all floor joists and penetrations above an attached garage must be blocked and sealed.

Air-Sealing Assembly for Garage



INCORRECT: Air bypass behind stairs

CORRECT: Joist cavities blocked

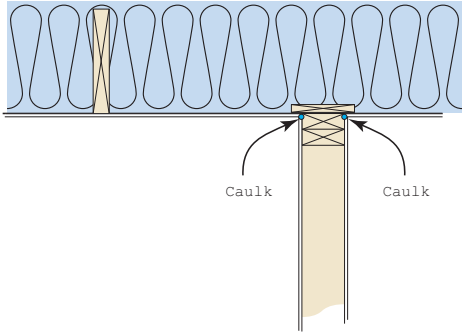
AIR-SEAL BOTTOM AND TOP PLATES

Code Section 402.4.1, 402.4.1.1 (AL amended)

Description

- Bottom plates of walls separating conditioned and unconditioned spaces must be sealed to subfloor or foundation using caulk, adhesive, or gasket material.
- All joints, seams, and penetrations must be sealed. For example, plumbing and electrical penetrations through plates must be caulked or foamed.
- Top plate must be sealed to drywall at all interfaces between unconditioned attic and wall. Sealant may be applied from attic side to joints between drywall and top plate.

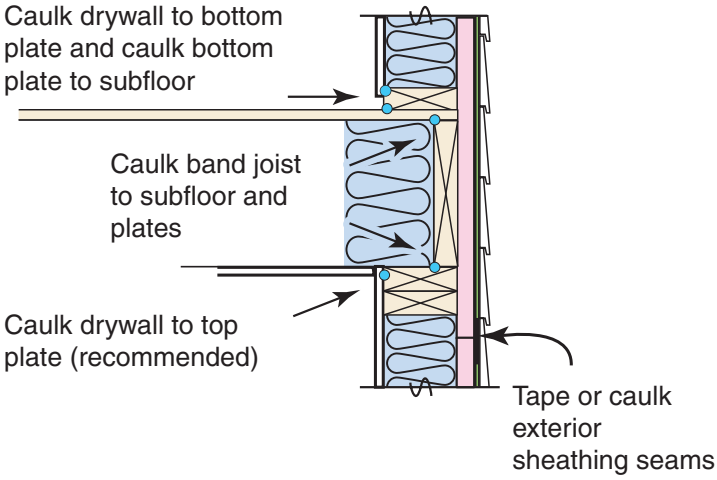
Air-Sealing Top/Bottom Plate

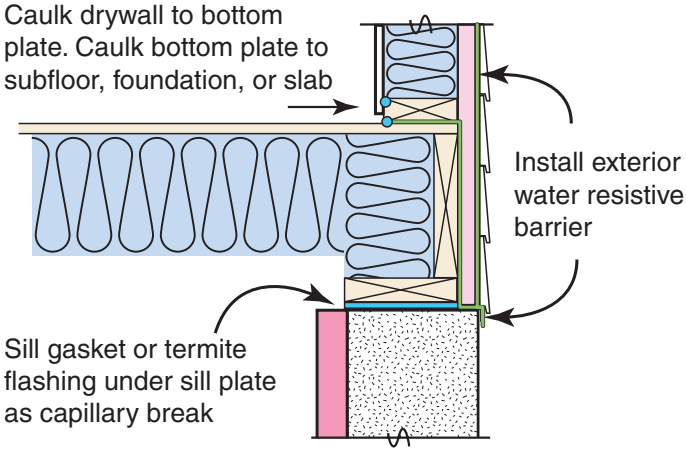


Bottom plate sealed to subfloor with caulk or gasket

Ceiling drywall sealed to top plate from attic side

Air-Sealing Top/Bottom Plate





AIR-SEAL SEAMS IN EXTERIOR AIR BARRIER

Code Section 402.4, 402.4.1, 402.4.1.1 (AL amended)

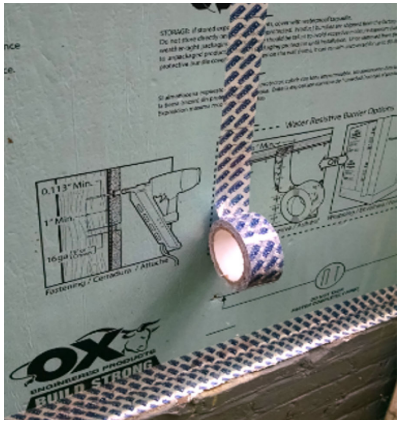
Description

- All joints, seams, and penetrations must be sealed. For example, gaps in exterior sheathing must be sealed with appropriate sealant. If house wrap is used as the air barrier, all edges, seams, and penetrations must be taped/sealed.

Sealing Sheathing or House Wrap

CORRECT: Tape seams in house wrap

CORRECT: Sealing exterior sheathing



Sheathing seams properly sealed

AIR-SEAL UTILITY PENETRATIONS

Code Section 402.4.1, 402.4.1.1 (AL amended)

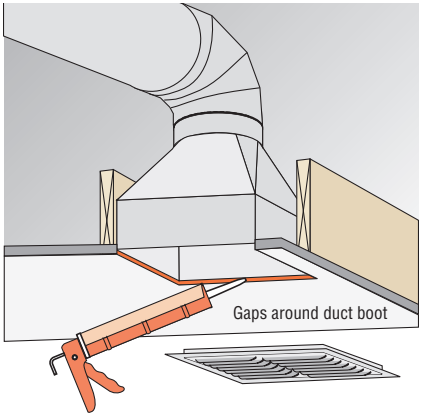
Description

- All utility penetrations in areas separating conditioned/unconditioned space must be air-sealed. This includes sealing all penetrations from plumbing, wiring, ductwork, exhaust fans, light fixtures, and electrical boxes through top and bottom plates, exterior sheathing, band and rim joists, insulated walls, insulated ceilings, and insulated subfloors.

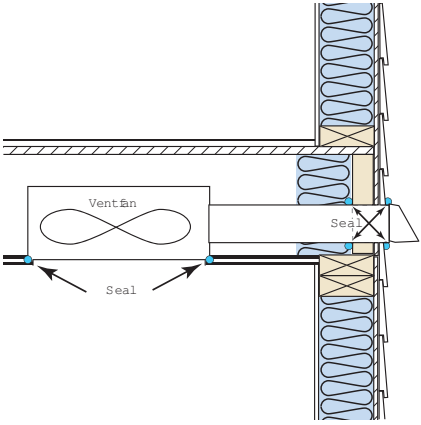
Air-Sealing Penetrations Details

INCORRECT: Unsealed sheathing penetration

CORRECT: Air-sealed utility penetrations



Duct boot penetration sealing



Band joist penetration sealing

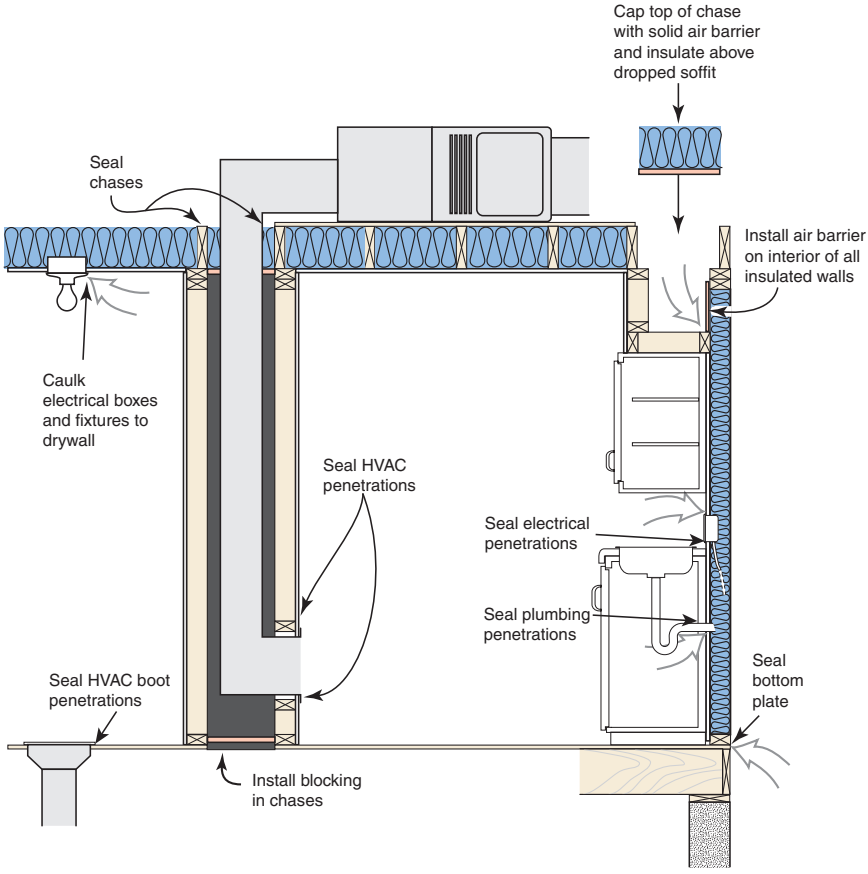
AIR-SEAL DROPPED SOFFIT CEILINGS AND CHASES

Code Section 402.4.1, 402.4.1.1 (AL amended)

Description

- Framed spaces connecting conditioned and unconditioned areas above and below a chase (e.g., attics, unconditioned basements, vented crawl spaces) must be air-sealed (e.g., with sheet material and proper sealant). These areas include chases for plumbing, ductwork, chimneys, and flues.
- Dropped ceilings or soffits between conditioned areas and the attic must also be air-sealed.

Proper Air-Sealing for Chases



Air-Seal Dropped Ceilings and Chases

INCORRECT: Unsealed chase

CORRECT: Well-sealed chase

INCORRECT: Improperly capped chase

CORRECT: Capped chase properly sealed

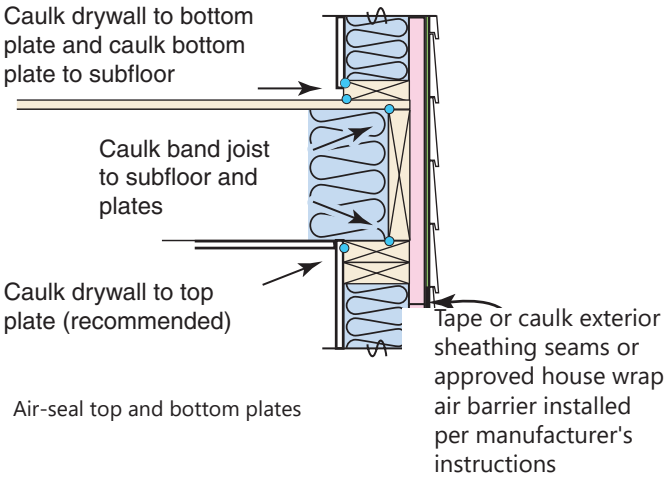
AIR-SEAL RIM/BAND JOIST JUNCTIONS

Code Section 402.4.1, 402.4.1.1 (AL amended)

Description

- All penetrations (e.g., from holes drilled for HVAC lines, plumbing lines, bathroom fans, exhaust fans, and electrical lines) through the rim/band joist between conditioned and unconditioned spaces must be sealed.
- Seal all seams in rim/band joist sheathing separating conditioned and unconditioned spaces between conditioned floors.
- Rim/band joist should be sealed to top plate, subfloor, and at butt joints (or at exterior sheathing).

Sealing Joist Penetrations



Air-seal top and bottom plates

HVAC PIPING INSULATION

Code Section	403.4, 403.4.1, IRC M1411.5
Code Value	R-3 (R-4 for suction lines)

Description

- Mechanical system piping capable of carrying fluids above 105°F or below 55°F must be insulated to a minimum of R-3. (Typically, a half-inch of insulation is equivalent to R-3.)
- Exposed piping insulation must be protected from the elements, including potential damage caused by UV from sunlight, wind, moisture, and home/yard maintenance. Adhesive tape is not permitted.

Note: IRC Section M-1411.5 requires R-4 for refrigerant suction lines.

HVAC Piping Insulation

HOT WATER PIPE INSULATION

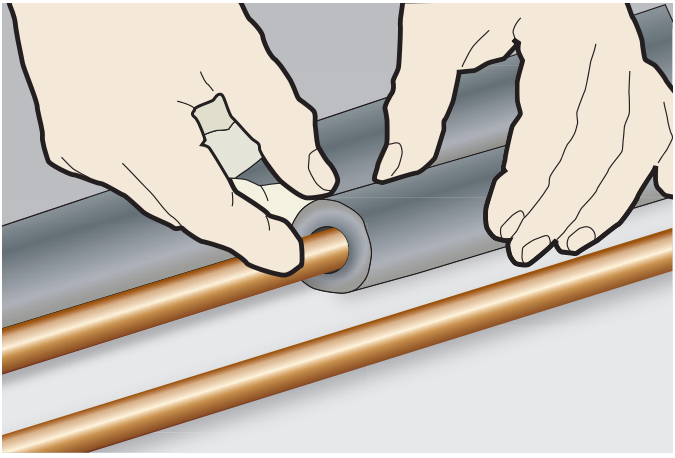
Code Section	403.5, 403.5.3
Code Value	R-3

Description

Meeting the prescriptive energy code requires hot water piping insulation of R-3 value or greater, applied to the following:

- Piping with nominal diameter of ¾-inch (19.1mm) and larger
- Piping that serves more than one dwelling unit
- Piping located outside the conditioned space
- Piping from the water heater to a distribution manifold
- Piping under a floor slab
- Buried piping
- Supply and return piping in recirculation systems (except demand recirculation systems)

Hot Water Pipe Insulation



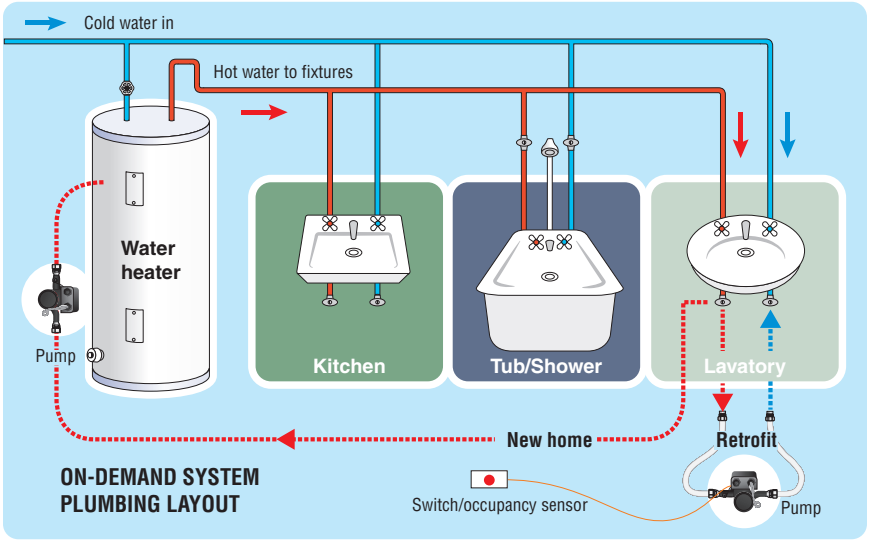
SERVICE HOT WATER SYSTEMS

Code Section 403.5, 403.5.1, 403.5.2

Description

- Heated water circulation systems must have a circulation pump. The return must be a dedicated return pipe or a cold water supply.
- Control should start based on identification for demand within the dwelling and automatically turn off when the water in the loop reaches desired temperature and there is no demand for hot water.
- Heat trace systems must comply with IEEE 515.1 or UL 515.
- A demand recirculation system has one or more recirculation pumps that pump water from a heated supply pipe back to the heated water source.
- Controls for a demand recirculation system start the pump upon receiving a signal or sensing the presence of a user or flow of hot/ tempered water to a fixture or appliance.
- Controls for demand recirculation systems must limit the temperature of water entering the cold water piping to 104ºF.
- Hot water piping insulation is prescriptively required for all recirculation systems (except demand-based controlled ones).

Hot water recirculation diagram



Hot water recirculation diagram showing optional return line (dashed)

DUCT INSULATION

Code Section	403.3.1
Code Value	Attic Supply/Return: R-8 (3" diameter or greater); R-6 (<3" diameter) Other Supply/Return: R-6 (3" diameter or greater); R-4.2 (<3" diameter)

Description

- R-value(s) apply to ducts that are outside the building thermal envelope. Ducts within conditioned space are not required to be insulated for energy code; however, insulating these ducts reduces the risk of condensation and is strongly recommended.
- Supply and return ducts in an unconditioned attic must be R-8. Other insulation requirements apply to supply and return ducts in unconditioned spaces outside the attic, such as an unconditioned basement or crawlspace.

R-8 Insulation of Attic Supply Duct

DUCT SEALING

Code Section 402.4.1.1, 403.3.2

Description

- The joints and seams of all ducts, air handlers, filter boxes, and building cavities used as return air ducts must be sealed with UL-181 tape, mastic or mastic tape, in accordance with IMC or IRC, as applicable.
- All duct connections must be mechanically fastened.

Note, exceptions to duct sealing with mastic include the following:

- Ducts sealed with spray polyurethane foam
- Ducts with a static pressure classification of <2" w.c. (500 Pa) that have continuously welded joints and seams, or locking-type joints and seams that are not snap-lock or button-lock. See 2015-IECC, R403.3.2.
- Inaccessible ductwork
- HVAC register boots that penetrate the thermal envelope should be sealed to the subfloor or drywall.

Best practice recommendations:

- Sealing joints and seams of all ducts, air handlers, and filter boxes with mastic or mastic tape that is at least 2mm in thickness (0.08inch), approximately the thickness of a nickel.
- Mastic should be installed at the inner liner of rigid metal and flexible duct (not the outer insulation jacket). Mastic on ductboard should be on the outer foil face.

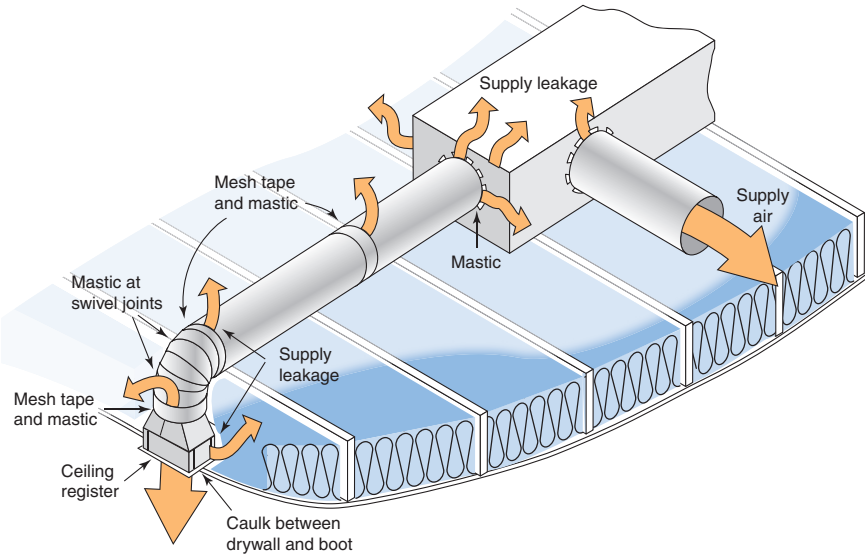
Duct Sealing: Best Practices

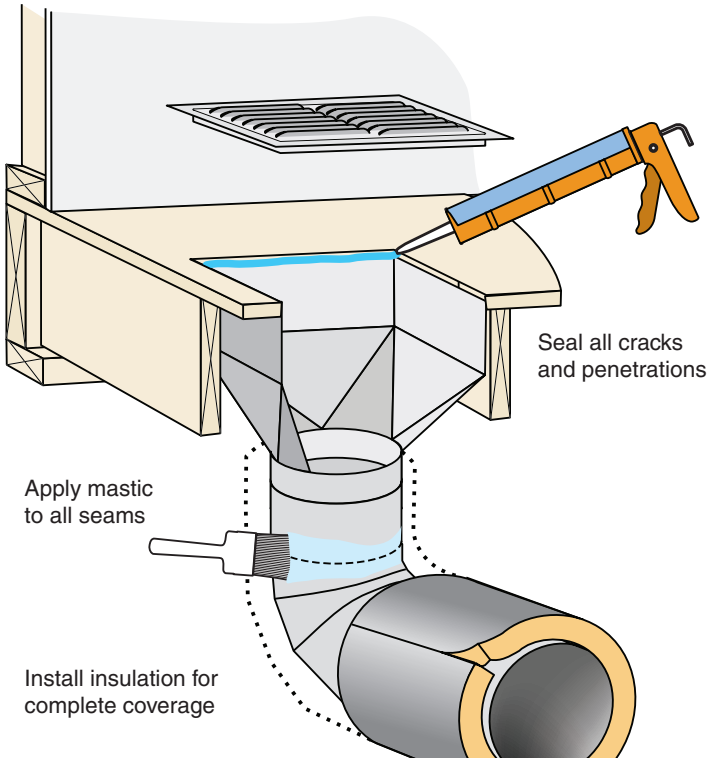
CORRECT: Mastic-sealed Joints

INCORRECT: UL-181 Tape without Mastic

INCORRECT: No Mastic

Duct Sealing: Best Practices





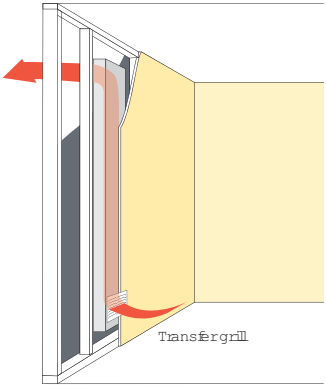
BUILDING CAVITIES MAY NOT BE USED AS DUCTS OR PLENUMS

Code Section 403.3.5

Description

- Unlined framing cavities may not be used as ducts or plenums.
- All supply and return ducts must be lined with metal, flex duct, ductboard, or other material approved in IRC Section M1601.

Correct/Incorrect Use of Building Cavity



CORRECT: Metal-lined cavity

INCORRECT: Unlined cavity as plenum

HEATING, COOLING, AND WATER-HEATING EQUIPMENT

Code Section 401.3, 403.7

Description

- Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.
- New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.
- For automatically modulating capacity heating and cooling equipment, the system shall be deemed to comply with appropriate portions of Manual S, provided the lowest output capacity of the equipment is less than the peak design load as determined by Manual J. This means oversizing of equipment is permitted for variable speed (capacity) equipment, provided it can automatically throttle to a lower output than the calculated design load.
- Information about the type and efficiencies of the heating, cooling, and water heating equipment must be located on the energy code compliance certificate located either on or near the electrical distribution panel or main air handler.

Certificate Sample

Compliance certificate affixed to electrical panel

HEAT PUMP CONTROLS

Code Section 403.1.2

Description

- Heat pumps must have controls that will prevent supplemental electric-resistance heat from operating when the heating load can be satisfied by the heat pump compressor.

Example of a control

ROOMS CONTAINING COMBUSTION APPLIANCES

Code Section 402.4.4

Description

- In CZ3 where combustion air ducts provide combustion air to open combustion fuel-burning appliances, the appliances and combustion air opening must be located outside the building thermal envelope or enclosed in a room and isolated from inside the thermal envelope.
- Such rooms must be sealed and insulated in accordance with the envelope requirements of Table R402.1.2, where the walls, floors and ceilings are no less than the basement wall R-value requirement.
- The door into the room must be fully gasketed, and any water lines and ducts in the room must be insulated in accordance with Section R403. The combustion air duct must be insulated to a minimum of R-8 where it passes through conditioned space.

Exceptions:

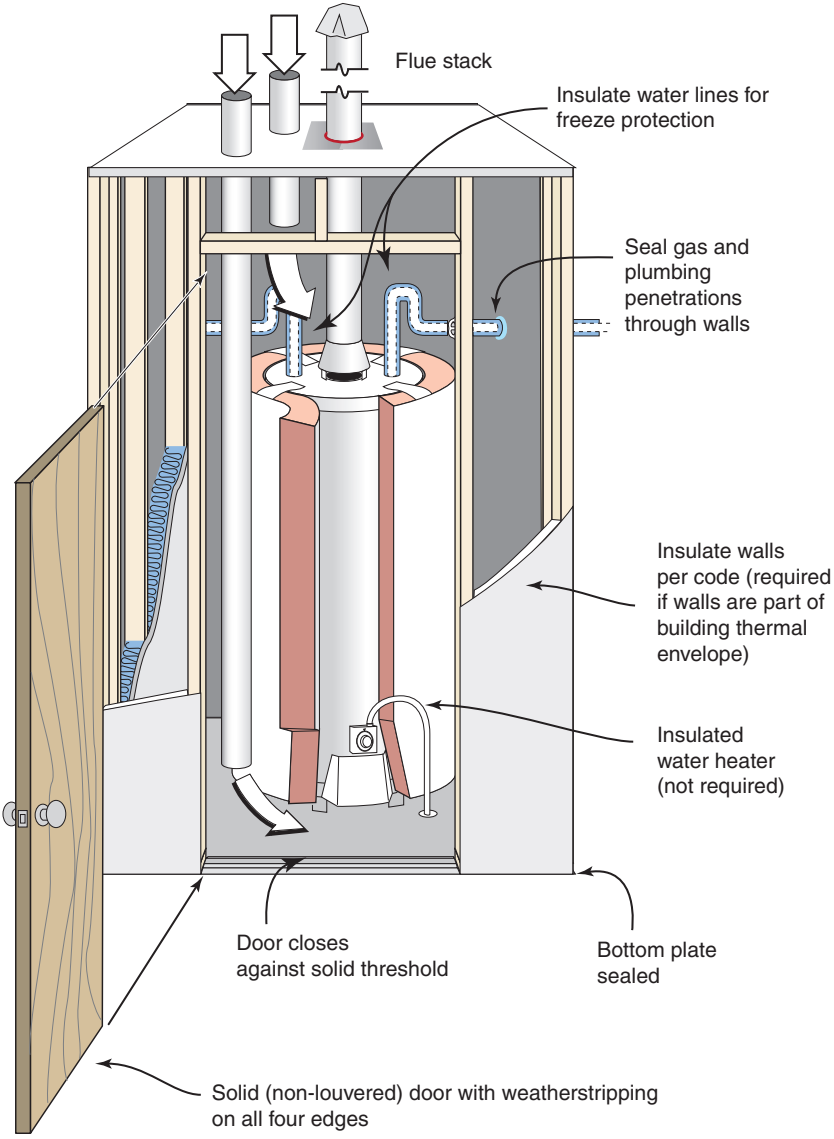
1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside
2. Fireplaces and stoves complying with Section R402.4.2 and Section R1006 of the IRC

Southface Recommended Practices:

- In tight homes, combustion air for fuel-burning appliances should not come from within the home (i.e., the occupant's air).
- Fuel-burning equipment should be located outside the building thermal envelope (such as a water heater in a garage) or either be direct vent (with intake and exhaust to the outdoors) or the equipment should be installed in a sealed "combustion closet" with combustion air provided from outdoors via "High/Low" vents as per the IRC.

Combustion closet

Combustion air inlets
as per mechanical and/or fuel gas code



MECHANICAL VENTILATION

Code Section 403.6, 403.6.1, IRC M1507.3

Description

- Whole-house mechanical ventilation is required for all homes scoring < 5 ACH50 on the blower door test.
- Where required, the building must have ventilation that meets IRC or IMC, as applicable, ASHRAE 62.2-2016 standard, or any other approved standard. Ventilation may be provided in a manner that creates a positive, negative, or balanced pressure on the home. The amount of ventilation required is based on the IRC table M1507.3.3(1):

Table M1507.3.3(1) Continuous Whole-House Mechanical Ventilation System Airflow Rate Requirements

DWELLING UNIT FLOOR AREA (square feet)	NUMBER OF BEDROOMS				
	0-1	2-3	4-5	6-7	>7
	Airflow in CFM				
< 1,500	30	45	60	75	90
1,501 - 3,000	45	60	75	90	105
3,001 - 4,500	60	75	90	105	120
4,501 - 6,000	75	90	105	120	135
6,001 - 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

For SI: 1 square foot = 0.0929 m^2, 1 cubic foot per minute = 0.0004719 m^3/s.

- Intermittent ventilation may be utilized if the ventilation rate is increased in proportion to the fraction of runtime in a 4-hour segment (e.g., twice the ventilation rate for half the time, triple the ventilation for a third of the time, etc.).

Table M1507.3.3(2) Intermittent Whole House Mechanical Ventilation Rate Factors

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor[a]	4	3	2	1.5	1.3	1.0

Mechanical Ventilation, continued

- All outdoor intake and exhaust openings must have either gravity (self-closing) or automatic dampers that will close when the system associated with the air intake or exhaust is not functioning.
- Mechanical ventilation system fans shall meet the following efficacy requirements:

Fan Location	Air Flow Rate Minimum (CFM)	Min. Efficacy (CFM/Watt)	Air Flow Rate Min (CFM)
Range Hoods	Any	2.8 cfm/watt	Any
In-Line Fan	Any	2.8 cfm/watt	Any
Bathroom/ utility room	10	1.4 cfm/watt	<90
Bathroom/ utility room	90	2.8 cfm/watt	Any

- Where mechanical ventilation fans are integral to tested and listed HVAC equipment, they must be powered by an electronically commutated motor.

Note: To ensure that dampers close correctly, direction of airflow must be taken into account when installed.

Southface Recommended Practices:

- It is strongly recommended that ***all*** homes have an intentional ventilation system installed to reduce liability and the risk of poor indoor air quality (IAQ). Due to humidity concerns, exhaust-only whole-house ventilation strategies are discouraged; however, intermittent spot exhaust fans of 50 CFM in bathrooms and 100 CFM in kitchens are still required.

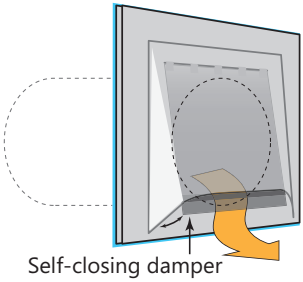
OUTDOOR INTAKE/EXHAUST OPENINGS

Code Section 403.6

Description

- All outdoor intake and exhaust openings must have either gravity (self-closing) or automatic dampers that will close when the system associated with the air intake or exhaust is not functioning.
- To ensure that dampers close correctly, direction of airflow must be taken into account when installed

Intake/Exhaust Openings



Motorized damper with ventilation controller

DUCT TIGHTNESS TESTING

Code Section	403.3.3, 403.3.4 (AL Amended)
Code Value	Rough-In Total Leakage (RIT) w/o air handler: ≤ 3%; Rough-In Total Leakage (RIT) w/ air handler: ≤ 4%; Post-Construction Total Leakage (PCT): < 4% Post-Construction Leakage to Outside (PCO): < 4%

Description

- The ducts and air handler must be tested for tightness if they are not located completely inside the conditioned spaces.
- Testing for duct tightness must be conducted by a certified Duct and Envelope Tightness (DET) verifier. The following tests are allowed: Rough-In Total Leakage (RIT) and Post-Construction (final) Total Leakage (PCT).
- The Post-Construction Leakage to Outside (PCO) test is no longer an option for energy code compliance.
- Duct testing results and other information about the test must be posted on the Energy Code Compliance Certificate.
- "4%" duct leakage means that a maximum of 4 CFM_{25} of measured duct leakage (at 25 Pascals) per 100 sq. ft. of conditioned floor area served by that system is acceptable.

Duct Testing

BLOWER DOOR TESTING

Code Section	402.4.1.2 (AL amended)
Code Value	Single family: <5 ACH_{50} where ACH_{50} = CFM_{50} x 60 / Volume

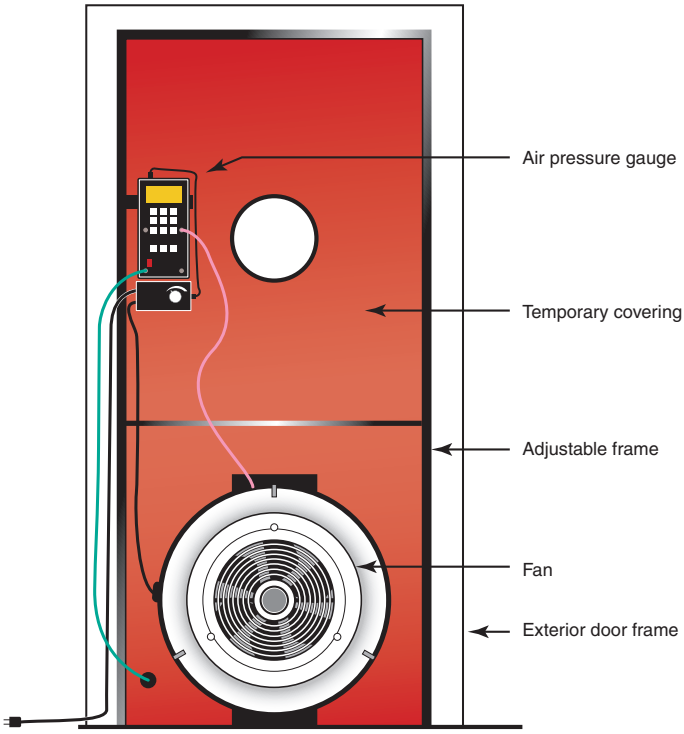
Description

- All new construction and full (gut) renovations that affect all aspects of the building thermal envelope must be tested for tightness with a blower door. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope have been sealed (usually at final).
- Testing for building envelope tightness must be conducted by a certified Duct and Envelope Tightness (DET) verifier.
- Details of the test results and test specifications should be made available on the Energy Code Compliance Certificate.

Correct testing procedure requires:

- Closing all exterior doors and windows
- Opening all interior doors (if installed)
- Ensuring all dampers are closed (but not sealed beyond normal operation)
- Closing and sealing all continuous HVAC ventilation
- Ensuring all HVAC registers are fully open

Blower Door Setup



Typical blower-door setup

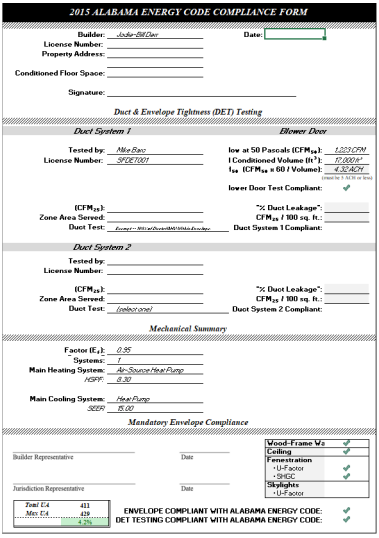
ENERGY CODE COMPLIANCE CERTIFICATE

Code Section 401.3

Description

- A permanent certificate must be completed by the builder or registered design professional and posted on or near the electrical distribution panel (such as a wall in the space where the panel is located, in a utility room, or in another approved location in the building). If located on an electrical panel, the certificate must not obstruct the visibility of the circuit directory or other required labels.
- Details for HVAC Manual J, S, and D calculations and mechanical ventilation (if required) must be completed and confirmed on the energy code compliance certificate.
- Where required by the code official, testing will be conducted by an approved third party. A written report of the test results must be signed by the party conducting the test and provided to the code official.

Compliance Certificate Example



2015 ALABAMA ENERGY CODE COMPLIANCE FORM

Builder: Jodar-Bill Dorr
Date:
License Number:
Property Address:
Conditioned Floor Space:
Signature:

Duct & Envelope Tightness (DET) Testing

Duct System 1

Tested by: Mike Banc
License Number: SPDET001
(CFM_{25}):
Zone Area Served:
Duct Test: (enter - Mixed/Duct/MM/Mid-Probe)

Blower Door

low at 50 Pascals (CFM_{50}): 1,223 CFM
l Conditioned Volume (ft^3): 17,000 ft^3
I_{50} (CFM_{50} x 60 / Volume): 4.32 ACH
(must be 7.0 ACH or less)
lower Door Test Compliant: ✓
"% Duct Leakage":
CFM_{25} / 100 sq. ft.:
Duct System 1 Compliant:

Duct System 2

Tested by:
License Number:
(CFM_{25}):
Zone Area Served:
Duct Test: (select one)
"% Duct Leakage":
CFM_{25} / 100 sq. ft.:
Duct System 2 Compliant:

Mechanical Summary

Factor (E_F): 0.95
Systems: 1
Main Heating System: Air-Source Heat Pump
HSPF: 8.30
Main Cooling System: Heat Pump
SEER: 15.00

Mandatory Envelope Compliance

Builder Representative
Date
Jurisdiction Representative
Date

Wood-Frame Wa	✓
Ceiling	✓
Fenestration	
• U-factor	✓
• SHGC	✓
Skylights	
• U-factor	

Total EA	411
Max EA	439
	4.2%

ENVELOPE COMPLIANT WITH ALABAMA ENERGY CODE: ✓
DET TESTING COMPLIANT WITH ALABAMA ENERGY CODE: ✓

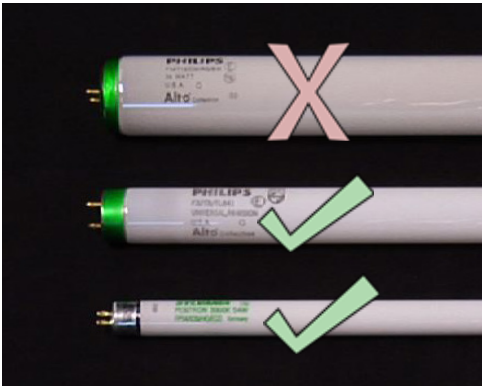
LIGHTING

Code Section 404.1 (AL amended)

Description

- At least 75 percent of lamps in permanently installed fixtures must be high-efficacy. Exception: low-voltage lighting.
- Definition of *high-efficacy lamps (Section R202):* Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, or lamps such as LED with a minimum efficacy of:
  1) 60 lumens per watt for lamps over 40 watts;
  2) 50 lumens per watt for lamps between 15 and 40 watts; and
  3) 40 lumens per watt for lamps of 15 watts or less.

Bulb Examples



WOOD-BURNING FIREPLACES

Code Section 402.4.2

Description

- New wood-burning fireplaces must have tight-fitting flue dampers or doors and outdoor combustion air. This combustion air should have a damper as per 402.4.1.2, which (along with the flue) should be closed during a blower door test.
- Where tight-fitting doors are used on factory built fireplaces listed and labeled in accordance with UL 127, the doors shall be tested and listed for the fireplace.
- Where tight-fitting doors are used on masonry fireplaces, the doors shall be listed and labeled in accordance with UL 907.