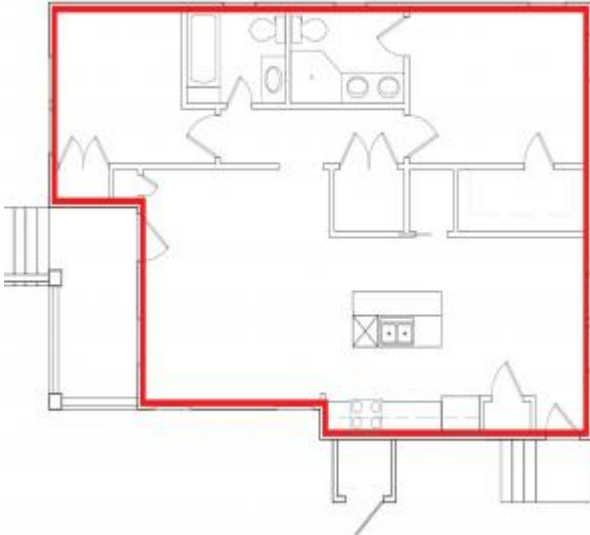


2009 IECC Code Level Insulation – ENERGY STAR Requirements

Last Updated: 05/09/2014

Scope



Install ceiling, wall, and foundation insulation that meets or exceeds the requirements of the most recent International Energy Conservation Code.

See the interactive map of 2009 IECC insulation levels by climate zone.

[See the interactive map of 2009 IECC insulation levels by climate zone.](#)

ENERGY STAR Certified Homes Notes:

ENERGY STAR Certified Homes requires that ceiling, wall, floor, and slab insulation levels meet or exceed those specified in the [2009 International Energy Conservation Code \(IECC\)](#) with some alternatives and exceptions. See the Compliance Tab for more details.

If the state or local residential building energy code requires higher insulation levels than those specified in the 2009 IECC, you must meet or exceed the locally mandated requirements. Some states have adopted the 2012 IECC. Visit the U.S. DOE [Building Energy Codes Program](#) to see what code has been adopted in your state. Some states and regions of the country have ENERGY STAR requirements that differ from the national requirements. Visit [ENERGY STAR's Regional Specifications](#).

ENERGY STAR Notes for Existing Homes:

Alternative to slab edge insulation, the thermal break is permitted to be created using \geq R-3 rigid insulation on top of an existing slab (e.g., in a home undergoing a gut rehabilitation). In such cases, up to 10% of the slab surface is permitted to not be insulated (e.g., for sleepers, for sill plates). Insulation installed on top of slab shall be covered by a durable floor surface (e.g., hardwood, tile, carpet).

DOE Zero Energy Ready Home Notes:

The U.S. Department of Energy Zero Energy Ready Home [National Program Requirements](#) requires homes to meet or exceed 2012 IECC insulation levels. See the guide [2012 IECC Code Level Insulation – DOE Zero Energy Ready Home Requirements](#) for more details.

Description

The ENERGY STAR Certified Homes (Ver 3, Rev 07) Thermal Enclosure System Rater Checklist, 2.1 Quality-Installed Insulation states

(2.1) Ceiling, wall, floor, and slab insulation levels shall comply with the following options:

- A. (2.1.1) Meet or exceed 2009 IECC levels OR
- B. (2.1.2) Achieve $\leq 133\%$ of the total UA resulting from the U-factors in 2009 IECC Table 402.1.3, excluding fenestration and per guidance in note "d" below, AND home shall achieve $\leq 50\%$ of the infiltration rate in Exhibit 1 of the National Program Requirements.

This guide describes methods for complying with both Option A and Option B, see below.

Option A

ENERGY STAR offers Option A as a prescriptive approach to meeting the insulation level requirements. Following Option A, insulation installed in the home must meet or exceed 2009 IECC R-values listed in the table below.

Table 1. Minimum Insulation Levels^a Adapted from 2009 IECC Table 402.1.1

Climate Zone	Ceiling R-Value	Wood Frame Wall R-Value ^b	Mass Wall ^c R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value ^d and Depth	Crawlspace ^e Wall R-Value
1	30	13	3/4	13	0	0	0
2	30	13	4/6	13	0	0	0
3	30	13	5/5	19	5/13 ^f	0	5/13
4 except Marine	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine	38	20/13+5 ^{b,c}	13/17	30 ^d	10/13	10, 2 ft	10/13
6	49	20/13+5 ^{b,c}	15/19	30 ^d	15/19	10, 4 ft	10/13
7 and 8	49	21	19/21	38 ^d	15/19	10, 4 ft	10/13

Source: Adapted 2009 IECC Table 402.1.1

a. R-values are minimums.

b. The first value is cavity insulation, the second value is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding.

c. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

d. Or insulation sufficient to fill the framing cavity, R-19 minimum.

e. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

f. Basement wall insulation is not required in warm-humid locations as defined by 2009 IECC Figure 301.1 and Table 301.1.

g. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.

Exceptions to Option A

ENERGY STAR includes some exceptions to these requirements, as outlined below. The exception for ceilings with attic spaces (from note b below) is included because the 2009 IECC assumes standard truss systems. The code allows a "credit" in the form of a reduced R-value requirement if insulation is allowed to be installed full height over the exterior wall plate line (e.g., raised heel truss). In ceilings without attic spaces (from note c below), the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, so the code sets the requirements for those spaces at R-30 but limits the area to which this reduced R-value can apply to 500 ft² or 20% of the total insulated ceiling area, whichever is less. Specifically, the exceptions are as follows and match footnote 3 in the [ENERGY STAR Qualified Homes Thermal Enclosure System Rater Checklist](#):

- a. Steel-frame ceilings, walls, and floors shall meet the insulation requirements of the 2009 IECC Table 402.2.5. In CZ 1 and 2, the continuous insulation requirements in this table shall be permitted to be reduced to R-3 for steel-frame wall assemblies with studs spaced at 24 inch on center. This exception shall not apply if the alternative calculations in "d" below are used;
- b. For ceilings with attic spaces, R-30 shall satisfy the requirement for R-38 and R-38 shall satisfy the requirement for R-49 wherever the full height of uncompressed insulation at the lower R-value extends over the wall top plate at the eaves. This exemption shall not apply if the alternative calculations in "d" are used;

- c. For ceilings without attic spaces, R-30 shall satisfy the requirement for any required value above R-30 if the design of the roof/ceiling assembly does not provide sufficient space for the required insulation value. This exemption shall be limited to 500 square feet or 20% of the total insulated ceiling area, whichever is less. This exemption shall not apply if the alternative calculations in "d" are used;
- d. [As described in Option B below] An alternative equivalent U-factor or total UA calculation may also be used to demonstrate compliance, as follows:
 - d.1. An assembly with a U-factor equal or less than specified in 2009 IECC Table 402.1.3 complies.
 - d.2 A total building thermal envelope UA that is less than or equal to the total UA resulting from the U-factors in Table 402.1.3 also complies. The insulation levels of all non-fenestration components (i.e., ceilings, walls, floors, and slabs) can be traded off using the UA approach under both the Prescriptive and the Performance Path. Note that fenestration products (i.e., windows, skylights, doors) shall not be included in this calculation. Also, note that while ceiling and slab insulation can be included in trade-off calculations, the R-value must meet or exceed the minimum values listed in Items 4.1 through 4.3 of the ENERGY STAR Checklist to provide an effective thermal break, regardless of the UA tradeoffs calculated. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The calculation for a steel-frame envelope assembly shall use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method.

Additional Information Related to Option A

Slab edge insulation is allowed to be cut at a 45-degree bevel cut to avoid bringing the insulation to the top of the slab edge so a carpet tack strip can be attached.

Option B

ENERGY STAR's Option B is similar to Option A, but it uses U-factors instead of R-values and allows some tradeoffs among the envelope components.

Calculating the Total Building Thermal Envelope UA (for Option B)

To use Option B for quality-installed insulation, the U-factor of each entire assembly (e.g., framed wall) must be equal to or less than the U-factor specified in Table 402.1.3 of the 2009 IECC (see Table 2 below). The entire assembly refers to framing, air films, insulation, etc., not just the insulation installed in the component as in Option A. Option B might be chosen instead of Option A if the home is using an innovative or less common construction technique such as log walls.

Table 2. Equivalent U-Factors^a Adapted from 2009 IECC Table 402.1.3

Climate Zone	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor ^b	Floor U-Factor	Basement U-Factor	Crawlspace U-Factor ^c
1	0.035	0.082	0.197	0.064	0.360	0.477
2	0.035	0.082	0.165	0.064	0.360	0.477
3	0.035	0.082	0.141	0.047	0.091 ^c	0.136
4 except Marine	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine	0.030	0.057	0.082	0.033	0.059	0.065
6	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.026	0.057	0.057	0.028	0.050	0.065

Source: adapted from the 2009 IECC Table 402.1.3

a. U-factors for non-fenestration components to be obtained from measurement, calculation, or an approved source.

b. When more than 50% of the insulation is on the interior, the mass wall U-factors shall be a maximum of: Zone 1: 0.17, Zone 2: 0.14, Zone 3: 0.12, Zone 4 except Marine: 0.10, and the same as the frame wall U-factor in Marine Zone 4 and Zones 5-8.

c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.1 in the 2009 IECC.

Option B requires the total building thermal envelope UA (U-factor x area) excluding the fenestration components (windows, doors and skylights) to be calculated, and that total UA must be less than or equal to 133% of the total UA resulting from the U-factors in Table 2 (also excluding fenestration). This option allows you to trade off some of the insulation for ceilings, walls, and foundation assemblies as long as you achieve 50% better infiltration than required per [Exhibit 1 of the National Program Requirements](#).

The UA calculation must be done using a method consistent with the ASHRAE Handbook of Fundamentals and include the thermal bridging effects of framing materials (see below for different requirements for steel-frame assemblies). DOE's [REScheck software](#), meets these requirements and can be used to determine whether the home will achieve <= 133% of the total UA. To use REScheck for this purpose, follow these steps:

1. Select 2009 IECC from the Code menu.

2. Select the home's location and enter the conditioned floor area on the Project screen.
3. Enter only ceiling, wall, and foundation components on the Envelope screen. Do NOT enter windows, doors or skylights.
4. Review the REScheck compliance results. As long as you are no more than 33% worse than code, you have met the UA part of this requirement.

Steel-Frame Assemblies for Option B

The calculation for steel-frame envelope assemblies must use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method. There are online calculators to help with these methods. REScheck, as described above, can also be used for steel-frame assemblies.

Infiltration Rate Requirements for Option B

In order to use Option B, your envelope, exclusive of fenestration, must have a UA \leq 133% of the total UA as described above **AND** meet the infiltration rates of the last column in Table 3.

Table 3. Infiltration Rates as Adapted from the ENERGY STAR National Program Requirements

Climate Zone	Infiltration Rate, ACH50	\leq 50% Infiltration Rate, ACH50
1,2	6	\leq 3
3,4	5	\leq 2.5
5-7	4	\leq 2
8	3	\leq 1.5

In addition to these requirements, ENERGY STAR (Ver 3 Rev 07) requires that insulation be installed to RESNET Grade 1 quality as described in the guide [Insulation Installation \(RESNET Grade 1\)](#). ENERGY STAR requires that the insulation be fully aligned with (in continuous contact with) a complete air barrier as described in the guides under the [ENERGY STAR Thermal Enclosure Checklist item TES 3. Fully Aligned Air Barriers](#).

ENERGY STAR (VER 3 Rev 07) also requires that builders use construction techniques to reduce thermal bridging by providing a continuous layer of insulation that is uninterrupted by framing members at key house components including the attics, walls and slab edge. The techniques are described in the guides under the ENERGY STAR Thermal Enclosure Checklist item [TES 4. Reduced Thermal Bridging](#). Insulation levels associated with these requirements are listed in the ENERGY STAR (VER 3 Rev 07) Thermal Enclosure System Rater Checklist, excerpted here.

Table 4. Excerpt of Thermal Bridging Requirements from ENERGY STAR (Ver 3 Rev 07) Thermal Enclosure System Rater Checklist

4. Reduced Thermal Bridging				
4.1 For insulated ceilings with attic space above (i.e., non-cathedralized), Grade I insulation extends to the inside face of the exterior wall below at these levels: CZ 1-5: \geq R-21; CZ 6-8: \geq R-30 ¹²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2 For slabs on grade in CZ 4 and higher, 100% of slab edge insulated to \geq R-5 at the depth specified by the 2009 IECC and aligned with thermal boundary of the walls ^{4,5}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.3 Insulation beneath attic platforms (e.g., HVAC platforms, walkways) \geq R-21 in CZ 1-5; \geq R-30 in CZ 6-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4 Reduced thermal bridging at above-grade walls separating conditioned from unconditioned space (rim / band joists exempted) using one of the following options: ¹³				
4.4.1 Continuous rigid insulation, insulated siding, or combination of the two; \geq R-3 in Climate Zones 1 to 4, \geq R-5 in Climate Zones 5 to 8 ^{14,15,16} , OR;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.2 Structural Insulated Panels (SIPs) ¹⁴ , OR;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.3 Insulated Concrete Forms (ICFs) ¹⁴ , OR;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.4 Double-wall framing ^{14,17} , OR;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5 Advanced framing, including all of the items below:				
4.4.5a All corners insulated \geq R-6 to edge ¹⁸ , AND;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5b All headers above windows & doors insulated \geq R-3 for 2x4 framing or equivalent cavity width, and \geq R-5 for all other assemblies (e.g., with 2x6 framing) ¹⁹ , AND;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5c Framing limited at all windows & doors to one pair of king studs, plus one pair of jack studs per window opening to support the header and sill ²⁰ , AND;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5d All interior / exterior wall intersections insulated to the same R-value as the rest of the exterior wall ²¹ , AND;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.5e Minimum stud spacing of 16 in. o.c. for 2x4 framing in all Climate Zones and, in Climate Zones 5 through 8, 24 in. o.c. for 2x6 framing ²²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If the state or local residential building energy code requires higher insulation levels than those specified in the 2009 IECC, you must meet or exceed the locally mandated requirements. Some states have adopted the 2012 IECC. EPA intends to implement a Version 3.1 in states that have adopted the 2012 IECC or an equivalent code. Specifically, EPA is proposing to enforce the Version 3.1 program requirements for homes permitted starting one year after state-level implementation of 2012 IECC or an equivalent code.

Visit the U.S. DOE [Building Energy Codes](#) Program to see what code has been adopted in your state. Some states and regions of the country have ENERGY STAR requirements that differ from the national requirements. Visit [ENERGY STAR's Regional Specifications](#) page for more information on those region-specific requirements.

Ensuring Success

For Option A, it is important to consult the insulation requirements of the 2009 International Energy Conservation Code (IECC) to ensure the R-value requirements are met or exceeded. A table of these R-value requirements is provided in the Description tab. Be sure to review the exceptions that ENERGY STAR provides for ceilings as these can affect the required insulation levels.

Option B relaxes overall insulation requirements for the ceiling, walls, and foundation components if infiltration rates are lowered by 50%. When calculating the total UA of the home, do NOT include doors, windows or skylights. Be sure to confirm that the home meets the improved infiltration rates provided in the table within the Description tab.

Climate

Climate-specific requirements are shown in the table below, and discussed further in the Description tab of this guide.

Minimum Insulation Levels^a Adapted from 2009 IECC Table 402.1.1

Climate Zone	Ceiling R-Value	Wood Frame Wall R-Value ^b	Mass Wall ^c R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value ^g and Depth	Crawlspace ^e Wall R-Value
1	30	13	3/4	13	0	0	0
2	30	13	4/6	13	0	0	0
3	30	13	5/5	19	5/13 ^f	0	5/13
4 except Marine	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine	38	20/13+5 ^{b,c}	13/17	30 ^d	10/13	10, 2 ft	10/13
6	49	20/13+5 ^{b,c}	15/19	30 ^d	15/19	10, 4 ft	10/13
7 and 8	49	21	19/21	38 ^d	15/19	10, 4 ft	10/13

Source: Adapted 2009 IECC Table 402.1.1

a. R-values are minimums.

b. The first value is cavity insulation, the second value is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding.

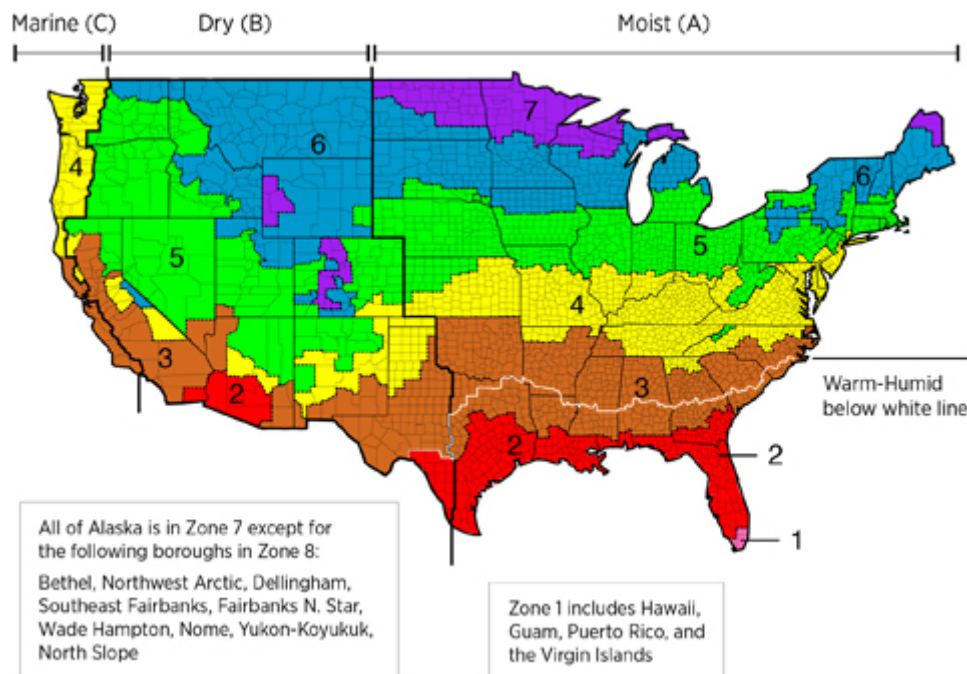
c. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

d. Or insulation sufficient to fill the framing cavity, R-19 minimum.

e. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

f. Basement wall insulation is not required in warm-humid locations as defined by 2009 IECC Figure 301.1 and Table 301.1.

g. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.



Training

Right and Wrong Images



Display Image: [ES TESRC 2.2 PG52_16b_102811.jpg](#)

Reference: [Thermal Enclosure System Rater Checklist Guidebook](#)

Author(s): EPA

Organization(s): EPA

Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.



Display Image: [ES TESRC 2.2 PG52_16b_102811.jpg](#)

Reference: [Thermal Enclosure System Rater Checklist Guidebook](#)

Author(s): EPA

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Display Image: [ES TESRC 2.2 PG52 16b 102811.jpg](#)

Reference: [Thermal Enclosure System Rater Checklist Guidebook](#)

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Organization(s): EPA

Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.



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Reference: [Thermal Enclosure System Rater Checklist Guidebook](#)

Author(s): EPA

Organization(s): EPA

Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.



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Reference: [Thermal Enclosure System Rater Checklist Guidebook](#)

Author(s): EPA

Organization(s): EPA

Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.



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Reference: [Thermal Enclosure System Rater Checklist Guidebook](#)

Author(s): EPA

Organization(s): EPA

Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.



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Reference: [Thermal Enclosure System Rater Checklist Guidebook](#)

Author(s): EPA

Organization(s): EPA

Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.



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Author(s): EPA

Organization(s): EPA

Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.



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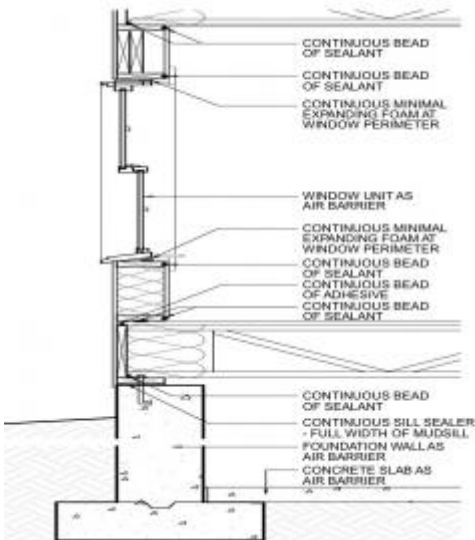
Reference: [Thermal Enclosure System Rater Checklist Guidebook](#)

Author(s): EPA

Organization(s): EPA

Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.

CAD



CAD FILE: [319&521 CAD 1-1 air seal lower wall 502002 GBA 1-31-12.dwg](#)

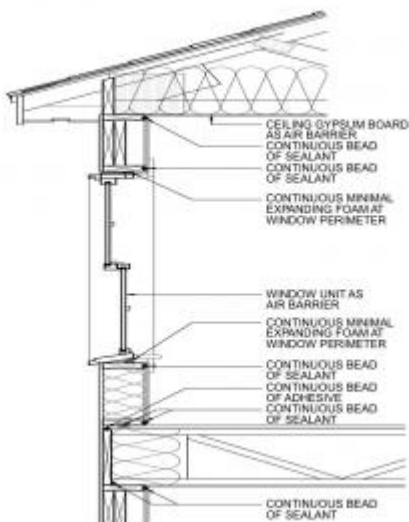
PDF: [319&521 CAD 1-1 air seal lower wall 502002 GBA 1-31-12.pdf](#)

Reference: [Building Plans for Advanced Framing](#)

Author(s): Green Building Advisor

Organization(s): Green Building Advisor

Website providing CAD files and drawings of advanced framing details.



CAD FILE: [319&522 CAD 1-1 air seal lower wall 5-02003 GBA 1-31-12.dwg](#)

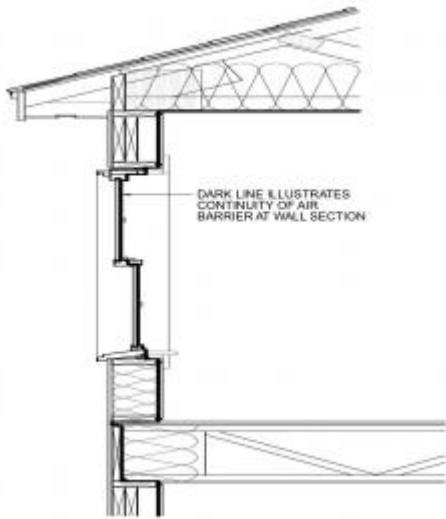
PDF: [319&522 CAD 1-1 air seal lower wall 5-02003 GBA 1-31-12.pdf](#)

Reference: [Building Plans for Advanced Framing](#)

Author(s): Green Building Advisor

Organization(s): Green Building Advisor

Website providing CAD files and drawings of advanced framing details.



CAD FILE: [319 CAD 1-1 Continuous air barrier upper wall 5-02001 GBA 1-31-12.dwg](#)

PDF: [319 CAD 1-1 Continuous air barrier upper wall 5-02001 GBA 1-31-12.pdf](#)

Reference: [Building Plans for Advanced Framing](#)

Author(s): Green Building Advisor

Organization(s): Green Building Advisor

Website providing CAD files and drawings of advanced framing details.

Compliance

[ENERGY STAR Version 3, \(Rev. 07\)](#)

ENERGY STAR for Homes requires that ceiling, wall, floor, and slab insulation levels meet or exceed those specified in the 2009 International Energy Conservation Code (IECC).

[See the interactive map of 2009 IECC insulation levels by climate zone.](#)

If the state or local residential building energy code requires higher insulation levels than those specified in the 2009 IECC, you must meet or exceed the locally mandated requirements. Some states have adopted the 2012 IECC. Visit the U.S. DOE [Building Energy Codes Program](#) to see what code has been adopted in each state. For states that have adopted the 2012 IECC or an equivalent code, EPA intends to implement the ENERGY STAR Certified Homes Version 3.1 [National Program Requirements](#) for homes permitted starting one year after state-level implementation of the 2012 IECC or an equivalent code. However, EPA will make a final determination of the implementation timeline on a state-by-state basis. Some states and regions of the country have ENERGY STAR requirements that differ from the national requirements. Visit ENERGY STAR's [Regional Specifications](#) page for more information on those region-specific requirements.

The ENERGY STAR Thermal Enclosure System Rater Checklist (Ver 3, Rev 07) specifies

2.1 Ceiling, wall, floor and slab insulation levels shall comply with one of the following options:

2.1.1 Meet or exceed 2009 IECC levels,3,4,5 OR

2.1.2 Achieve $\leq 133\%$ of the total UA resulting from the U-factors in 2009 IECC Table 402.1.3, excluding fenestration and per guidance in note "d" below, AND home shall achieve $\leq 50\%$ of the infiltration rate in Exhibit 1 of the National Program Requirements.4,5 (See Table 3 in the Description tab of this guide).

(3) Insulation levels in a home shall meet or exceed the component insulation requirements in the 2009 IECC - Table 402.1.1. The following exceptions apply:

- a. Steel-frame ceilings, walls, and floors shall meet the insulation requirements of the 2009 IECC Table 402.2.5. In CZ 1 and 2, the continuous insulation requirements in this table shall be permitted to be reduced to R-3 for steel-frame wall assemblies with studs spaced at 24 inch on center. This exception shall not apply if the alternative calculations in "d" below are used;
- b. For ceilings with attic spaces, R-30 shall satisfy the requirement for R-38 and R-38 shall satisfy the requirement for R-49 wherever the full height of uncompressed insulation at the lower R-value extends over the wall top plate at the eaves. This exemption shall not apply if the alternative calculations in "d" are used;
- c. For ceilings without attic spaces, R-30 shall satisfy the requirement for any required value above R-30 if the design of the roof/ceiling assembly does not provide sufficient space for the required insulation value. This exemption shall be limited to 500 square feet or 20% of the total insulated ceiling area, whichever is less. This exemption shall not apply if the alternative calculations in "d" are used;
- d. An alternative equivalent U-factor or total UA calculation may also be used to demonstrate compliance, as follows: An assembly with a U-factor equal or less than specified in 2009 IECC Table 402.1.3 complies. A total building thermal envelope UA that is less than or equal to the total UA resulting from the U-factors in Table 402.1.3 also complies. The insulation levels of all non-fenestration components (i.e., ceilings, walls, floors, and slabs) can be traded off using the UA approach under both the Prescriptive and the Performance Path. Note that fenestration products (i.e., windows, skylights, doors) shall not be included in this calculation. Also, note that while ceiling and slab insulation can be included in trade-off calculations, the R-value must meet or exceed the minimum values listed in Items 4.1 through 4.3 of the ENERGY STAR Checklist to provide an effective thermal break, regardless of the UA tradeoffs calculated. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The calculation for a steel-frame envelope assembly shall use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method.

(4) Consistent with the 2009 IECC, slab edge insulation is only required for slab-on-grade floors with a floor surface less than 12 inches below grade. Slab insulation shall extend to the top of the slab to provide a complete thermal break. If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall.

(5) Where an insulated wall separates a garage, patio, porch, or other unconditioned space from the conditioned space of the house, slab insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab. Where specific details cannot meet this requirement, partners shall provide the detail to ENERGY STAR to request an exemption prior to the home's qualification. ENERGY STAR will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. [See a list of currently exempted details.](#)

Alternative to slab edge insulation, the thermal break is permitted to be created using \geq R-3 rigid insulation on top of an existing slab (e.g., in a home undergoing a gut rehabilitation). In such cases, up to 10% of the slab surface is permitted to not be insulated (e.g., for sleepers, for sill plates). Insulation installed on top of slab shall be covered by a durable floor surface (e.g., hardwood, tile, carpet).

[DOE Zero Energy Ready Home](#)

The U.S. Department of Energy Zero Energy Ready Home [National Program Requirements](#) specify as a mandatory requirement (Exhibit 1, #2.2) that, for all labeled homes, whether prescriptive or performance path, ceiling, wall, floor, and slab insulation shall meet or exceed 2012 IECC levels. See the guide [2012 IECC Code Level Insulation – DOE Zero Energy Ready Home Requirements](#) for more details.

[2009 IECC](#)

Building thermal envelope components to meet or exceed the values in Table 402.1.1 Insulation and Fenestration Requirements By Component. Section 402.2.1 Ceilings with attic spaces, R-30 satisfies the requirement for R-38 in the ceiling wherever insulation achieves its full height over the wall top plate at the eaves and is uncompressed. Similarly, R-38 can satisfy an R-49 wherever insulation achieves its full height over the wall top plate at the eaves and is uncompressed. Section 402.2.2 Ceilings without attic spaces, R-30 satisfies the requirement for any required value above R-30 if the design of the roof/ceiling assembly does not provide sufficient space for the required insulation value. This exemption is limited to 500 sq. ft. or 20% of the total insulated ceiling area, whichever is less. Section 402.2.8 Slab-on-grade floors, slabs less than 12 inches below grade to be insulated per Table 402.1.1 with insulation extending downward from top of the slab on inside or outside of the foundation wall. Below-grade insulation to extend the distance in Table 402.1.1. Insulation extending away from the building to be protected by pavement or at least 10 inches of soil. The top insulation edge may be cut at a 45-degree angle away from the exterior wall. Slab insulation isn't required in areas of very heavy termite infestation, with approval of code official.*

[2012 IECC](#)

Building thermal envelope components to meet or exceed the values in Table R402.1.1 Insulation and Fenestration Requirements By Component. Section R402.2.1 Ceilings with attic spaces, R-30 satisfies the requirement for R-38 in the ceiling wherever insulation achieves its full height over the wall top plate at the eaves and is uncompressed. Similarly, R-38 can satisfy an R-49 wherever insulation achieves its full height over the wall top plate at the eaves and is uncompressed. Section R402.2.2 Ceilings without attic spaces, R-30 satisfies the requirement for any required value above R-30 if the design of the roof/ceiling assembly does not provide sufficient space for the required insulation value. This exemption is limited to 500 sq. ft. or 20% of the total insulated ceiling area, whichever is less. Section R402.2.9 Slab-on-grade floors, slabs less than 12 inches below grade to be insulated per Table 402.1.1 with insulation extending downward from top of the slab on inside or outside of the foundation wall. Below-grade insulation to extend the distance in Table 402.1.1. Insulation extending away from the building to be protected by pavement or at least 10 inches of soil. The top insulation edge may be cut at a 45-degree angle away from the exterior wall. Slab insulation isn't required in areas of very heavy termite infestation, with approval of code official.*

*Due to copyright restrictions, exact code text is not provided. For specific code text, refer to the applicable code.

More Info.

Case Studies

1. [DOE Zero Energy Ready Home Case Study e2 Homes Winter Park, Florida \[2-page summary version\]](#)
(845 KB)
Author(s): PNNL
Organization(s): PNNL
Publication Date: January, 2013
Case study about the first certified DOE Zero Energy Ready Home—the “Wilson Residence” in Winter Park, Florida.
2. [DOE Zero Energy Ready Home Case Study: e2 Homes, Winter Park, Florida](#)
(1 MB)
Author(s): PNNL
Organization(s): PNNL
Publication Date: January, 2013
Case study about the first certified DOE Zero Energy Ready Home—the “Wilson Residence” in Winter Park, Florida.

References and Resources*

1. [Building America Best Practices Series Volume 17: Insulation, A Guide for Contractors to Share with Homeowners](#)
Author(s): Baechler, Adams, Hefty, Gilbride, Love
Organization(s): PNNL, ORNL
Publication Date: May, 2012
Guide to help contractors and homeowners identify ways to make homes more comfortable, more energy efficient, and healthier to live in.
2. [DOE Zero Energy Ready Home National Program Requirements](#)
Author(s): DOE
Organization(s): DOE
Publication Date: April, 2014
Standard requirements for DOE's Zero Energy Ready Home national program certification.
3. [ENERGY STAR Certified Homes, Version 3 \(Rev. 07\) Inspection Checklist for National Program Requirements](#)
Author(s): EPA
Organization(s): EPA
Publication Date: June, 2013
Standard document containing the rater checklists and national program requirements for ENERGY STAR Certified Homes, Version 3 (Rev. 7).
4. [Thermal Enclosure System Rater Checklist Guidebook](#)
Author(s): EPA
Organization(s): EPA
Publication Date: October, 2011
Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.

*Publication dates are shown for formal documents. Dates are not shown for non-dated media. Access dates for referenced, non-dated media, such as web sites, are shown in the measure guide text.

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