

# Thermal Enclosure System



*ENERGY STAR® Qualified Homes*

## **THERMAL ENCLOSURE SYSTEM RATER CHECKLIST**

# Rater Checklist: Sections 1 thru 4



## ENERGY STAR Certified Homes, Version 3 (Rev. 07) Thermal Enclosure System Rater Checklist

Home Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

	Must Correct	Builder Verified <sup>1</sup>	Rater Verified	N/A
<b>1. High-Performance Fenestration</b>				
1.1 <i>Prescriptive Path:</i> Fenestration shall meet or exceed ENERGY STAR requirements <sup>2</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.2 <i>Performance Path:</i> Fenestration shall meet or exceed 2009 IECC requirements <sup>2</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>2. Quality-Installed Insulation</b>				
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 <sup>3,4,5</sup> <b>OR:</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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 Footnote 3d. <b>AND</b> home shall achieve $\leq 50\%$ of the infiltration rate in Exhibit 1 of the National Program Requirements <sup>4,5</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2 All ceiling, wall, floor, and slab insulation shall achieve RESNET-defined Grade I installation or, alternatively, Grade II for surfaces that contain a layer of continuous, air impermeable insulation $\geq R-3$ in Climate Zones 1 to 4, $\geq R-5$ in Climate Zones 5 to 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>3. Fully-Aligned Air Barriers</b>				
At each insulated location noted below, a complete air barrier shall be provided that is fully aligned with the insulation as follows:				
<ul style="list-style-type: none"> <li>• At interior or exterior surface of ceilings in Climate Zones 1-3; at interior surface of ceilings in Climate Zones 4-8. Also, include barrier at interior edge of attic eave in all climate zones using a wind baffle that extends to the full height of the insulation. Include a baffle in every bay or a tabbed baffle in each bay with a soffit vent that will also prevent wind washing of insulation in adjacent bays</li> <li>• At exterior surface of walls in all climate zones; and also at interior surface of walls for Climate Zones 4-8<sup>7</sup></li> <li>• At interior surface of floors in all climate zones, including supports to ensure permanent contact and blocking at exposed edge<sup>8,9</sup></li> </ul>				
<b>3.1 Walls<sup>10</sup></b>				
3.1.1 Walls behind showers and tubs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.2 Walls behind fireplaces	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.3 Attic knee walls <sup>11</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.4 Skylight shaft walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.5 Wall adjoining porch roof	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.6 Staircase walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.7 Double walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.8 Garage rim / band joist adjoining conditioned space	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.9 All other exterior walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>3.2 Floors</b>				
3.2.1 Floor above garage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.2 Cantilevered floor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.3 Floor above unconditioned basement or unconditioned crawlspace	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>3.3 Ceilings<sup>10</sup></b>				
3.3.1 Dropped ceiling / soffit below unconditioned attic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.2 All other ceilings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>4. Reduced Thermal Bridging</b>				
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: $\geq R-30$ <sup>12</sup>	<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 $\geq R-6$ at the depth specified by the 2009 IECC and aligned with thermal boundary of the walls <sup>4,5</sup>	<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: <sup>13</sup>				
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 <sup>14,15,16</sup> <b>OR:</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.2 Structural Insulated Panels (SIPs) <sup>17</sup> <b>OR:</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.3 Insulated Concrete Forms (ICFs) <sup>18</sup> <b>OR:</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4.4 Double-wall framing <sup>14,17</sup> <b>OR:</b>	<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 <sup>19</sup> <b>AND:</b>	<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) <sup>19</sup> <b>AND:</b>	<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 <sup>20</sup> <b>AND:</b>	<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 <sup>21</sup> <b>AND:</b>	<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 <sup>22</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# 1. High-Performance Fenestration



- Prescriptive Path
  - Meet or exceed Energy STAR requirements
- Performance Path
  - Meet or exceed 2009 IECC requirements

# Prescriptive Path



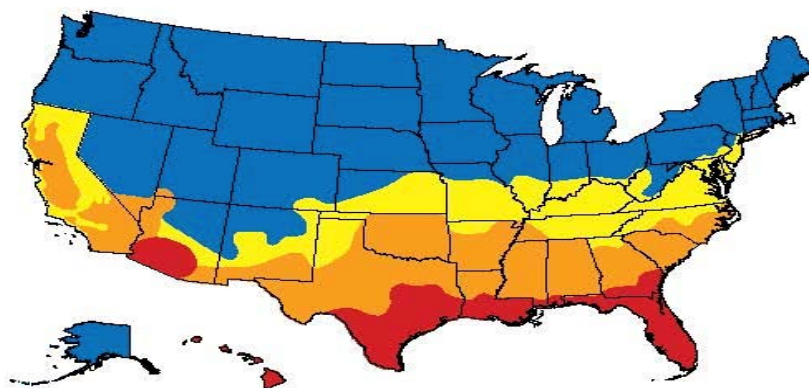
THERMAL ENCLOSURE SYSTEM RATER CHECKLIST		ENERGY STAR
1	HIGH-PERFORMANCE FENESTRATION	
1	PRESCRIPTIVE PATH	



A. Window does not meet ENERGY STAR requirements.



Window meets ENERGY STAR requirements.



- Northern
- North-Central
- South-Central
- Southern

## ENERGY STAR WINDOW SPECIFICATIONS

Climate Zone	U-Factor <sup>1</sup>	SHGC <sup>2</sup>
Northern Prescriptive	≤0.30	ANY
Northern Equivalent Energy Performance	≤0.31	≥0.35
North-Central	≤0.32	≤0.40
South-Central	≤0.35	≤0.30
Southern	≤0.60	≤0.27

## ENERGY STAR SKYLIGHT SPECIFICATIONS

Climate Zone	U-Factor <sup>1</sup>	SHGC <sup>2</sup>
Northern	≤0.55	ANY
North-Central	≤0.55	≤0.40
South-Central	≤0.57	≤0.30
Southern	≤0.70	≤0.30

## ENERGY STAR DOOR SPECIFICATIONS

Climate Zone	U-Factor <sup>1</sup>	SHGC <sup>2</sup>
Opaque	≤0.55	ANY
≤ 1/2 Lite	≤0.57	≤0.30
> 1/2 Lite	≤0.70	≤0.30

<sup>1</sup> Btu/h-ft<sup>2</sup>·°F

<sup>2</sup> Fraction of incident solar radiation

# Performance Path



**THERMAL ENCLOSURE SYSTEM RATER CHECKLIST**

**1 HIGH-PERFORMANCE FENESTRATION**

**2 PERFORMANCE PATH**




**A.** Window does not meet 2009 IECC requirements.



Window meets 2009 IECC requirements.

**2009 IECC WINDOW REQUIREMENTS**

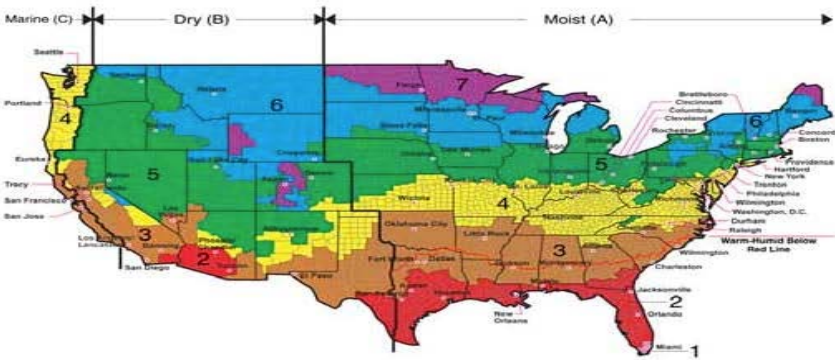
CLIMATE ZONE	U-FACTOR <sup>a</sup>	SHGC <sup>b,c</sup>
Zone 1	1.2	0.30
Zone 2	0.65 <sup>b</sup>	0.30
Zone 3	0.50 <sup>b</sup>	0.30
Zone 4	0.35	NR
Zone 5	0.35	NR
Zone 6	0.35	NR
Zone 7	0.35	NR

**2009 IECC SKYLIGHT REQUIREMENTS**

CLIMATE ZONE	U-FACTOR <sup>a</sup>	SHGC <sup>b,c</sup>
Zone 1	0.75	0.30
Zone 2	0.75	0.30
Zone 3	0.65	0.30
Zone 4	0.60	NR
Zone 5	0.60	NR
Zone 6	0.60	NR
Zone 7	0.60	NR

- a. U-factors and SHGC are maximums.
- b. For impact-rated fenestration complying with Section R301.2.1.2 of the International Residential Code or Section 1608.1.2 of the International Building Code, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.
- c. There are no SHGC requirements in the Marine Zone.

Interactive Map:  
<http://energycode.pnl.gov/EnergyCodeReqs/>



All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Delta Junction, Fairbanks, N. Star, Nome, North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk.  
 Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands.  
 Last Updated: 10/28/11



# 2. Quality Insulated Insulation



THERMAL ENCLOSURE SYSTEM RATER CHECKLIST	
2	QUALITY-INSTALLED INSULATION
1	INSULATION LEVELS: MEET OR EXCEED 2009 IECC LEVELS

**DETAIL 2.1** <sup>3, 4, 5, †</sup>

**Ceiling, wall, floor, and slab insulation levels shall meet or exceed 2009 IECC levels**

Install insulation in a home to meet or exceed the levels specified in the 2009 IECC and located on the back of this page.

A. Verify insulation meets standards by utilizing the guide below, looking at printed R-values on the insulation product or consulting the insulator.

† Footnotes located on page 49.

### COMMON INSULATION MATERIALS

MATERIAL	APPROX. R-VALUE PER INCH
Cellulose	R-3.5
Fiberglass (Batts)	R-3.5
Fiberglass (Blown)	R-3
Polyurethane Rigid Board	R-6.8
EPS Insulated Concrete Forms (ICF)	R-4.25
XPS Insulated Concrete Forms (ICF)	R-5.0
EPS Structurally Insulated Panels (SIP)	R-3.1
XPS Structurally Insulated Panels (SIP)	R-4.3
Spray Foam (Closed Cell)	R-6
Spray Foam (Open Cell)	R-3.6

Knowing the exterior boundary of the house is critical for everyone involved in aligning air barriers with insulation. The Rater should first gather all plans, elevations and sections of the house. By drawing a boundary around the exterior barrier, the Rater can see the difficult areas to insulate and better communicate the required actions in those areas with the insulator and subcontractors.

**TRADES  
INSULATOR**

# Quality-Installed Insulation



- Ceiling, wall, floor and slab
  - Meet or exceed 2009 IECC levels
  - Achieve  $\leq 133\%$
- All ceiling, wall, floor and slab insulation shall achieve **RESNET**
  - Grade I installation or alternatively
  - Grade II for surfaces that contain layers of continuous air impermeable insulation
    - ✦  $\geq R-3$  in Climate Zones 1 to 4
    - ✦  $\geq R-5$  in Climate Zones 5 to 8

# Quality Insulated Insulation

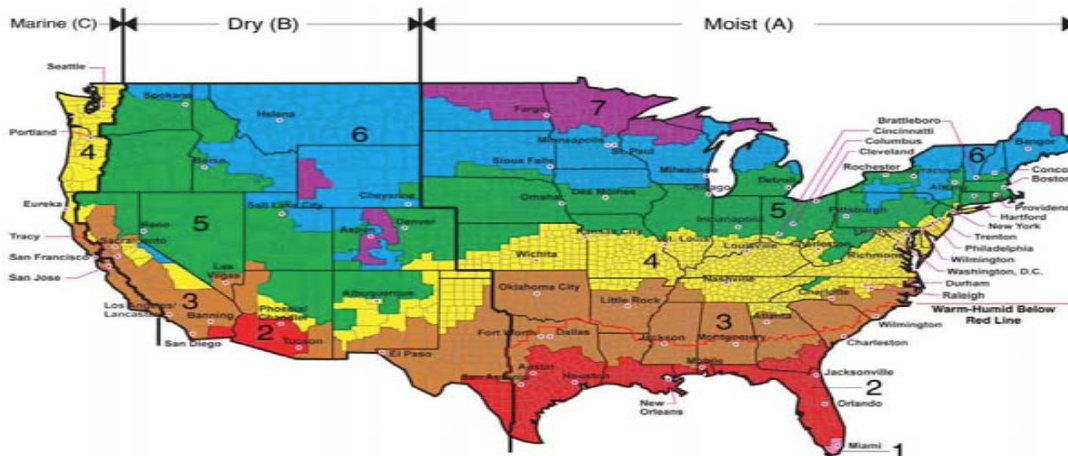
Meet or Exceed 2009 IECC Levels



THERMAL ENCLOSURE SYSTEM RATER CHECKLIST	
2	QUALITY-INSTALLED INSULATION
1	INSULATION LEVELS: MEET OR EXCEED 2009 IECC LEVELS

## 2009 IECC INSULATION REQUIREMENTS

CLIMATE ZONE	CEILING	FRAME WALL	MASS WALL <sup>c</sup>	FLOOR	BASEMENT WALL*	CRAWL SPACE WALL*
Zone 1	R-30	R-13	R-3	R-13	R-0	R-0
Zone 2	R-30	R-13	R-4	R-13	R-0	R-0
Zone 3	R-30	R-13	R-5	R-19	R-5/13 <sup>f</sup>	R-5/13
Zone 4	R-38	R-13	R-5	R-19	R-10/13	R-10/13
Zone 5	R-38	R-20 or R-13+R-5 <sup>b</sup>	R-13	R-30 <sup>d</sup>	R-10/13	R-10/13
Zone 6	R-49	R-20 or R-13+R-5 <sup>b</sup>	R-15	R-30 <sup>d</sup>	R-15/19	R-10/13
Zone 7	R-49	R-21	R-19	R-38 <sup>d</sup>	R-15/19	R-10/13



- R-Values are minimums.
- "R-13+R-5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulated sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of the exterior, structural sheathing shall be supplemented with insulation sheathing of at least R-2.
- The second R-value applies when more than half of the insulation is on the interior of the mass wall.
- Sufficient insulation to fill the cavity, R-19 minimum.
- "R-15/19" means R-15 continuous insulation sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "R-10/13" means R-10 continuous insulated sheathing or R-10 cavity insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
- Basement wall insulation is not required in warm-humid locations defined by Figure 301.1 and Table 301.1 of the IECC.

Interactive Map:  
<http://energycode.pnl.gov/EnergyCodeReqs/>

All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Delillingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk  
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 Last Updated: 10/28/11



# Quality Insulated Insulation

RESNET Grade I or Grade II Installation



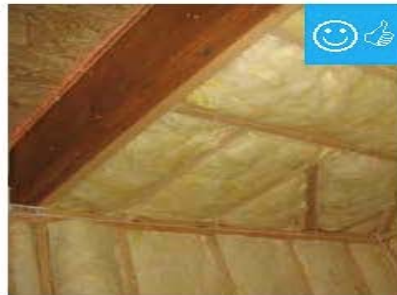
## THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

2 QUALITY-INSTALLED INSULATION

2 INSULATION: RESNET GRADE I OR GRADE II INSTALLATION



**A.** Insulation has misalignment, compression, and gaps.



RESNET Grade I installation of batt insulation.



**A.** Compression and misalignment because insulation is not split around wires.



Batt was properly split around wires to achieve RESNET Grade I.



**A.** Compression and misalignment because insulation is not split around plumbing.



RESNET Grade I installation of blown insulation.



**A.** Spray foam installed with voids.



RESNET Grade I installation of spray foam insulation.

## 3. Fully-Aligned Air Barriers



- Complete air barrier shall be provided that is fully aligned with insulation
  - Interior or exterior surface ceilings in Climate 1-3
  - Interior surface ceilings in Climate Zones 4-8
  - Barrier at interior edge of attic eave in all climate zones
    - ✦ Wind baffle that extend to the full height of insulation
  - Baffle in every bay or a tabbed baffle in each bay with soffit vent
    - ✦ Prevent wind washing of insulation in adjacent bays
  - Exterior surface of walls in all climate zones
  - Interior surface of walls in Climate Zones 4-8
  - Exterior surface of floor in all climate zones
    - ✦ Include supports to ensure permanent contact and blocking at exposed edge

# Fully-Aligned Air Barriers (cont.)



- Walls
  - Walls behind showers and tubs
  - Walls behind fireplaces
  - Attic knee walls
  - Skylight shaft walls
  - Wall adjoining porch roof
  - Staircase walls
  - Double walls
  - Garage rim / band joist adjoining conditioned space
  - All other exterior walls

# Walls



## THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

### 3 FULLY-ALIGNED AIR BARRIERS

#### 1 WALLS



#### DETAIL 3.1.1 <sup>6, 7, 10</sup>

##### Walls behind showers and tubs

- A. Install insulation without misalignments, compressions, gaps, or voids in all exterior wall cavities behind all tubs and showers.
- B. Back with a rigid air barrier or other supporting material to prevent insulation from sagging and create a continuous thermal barrier.\*
- C. Seal all seams, gaps, and holes of the air barrier with caulk or foam before tub/shower installation.

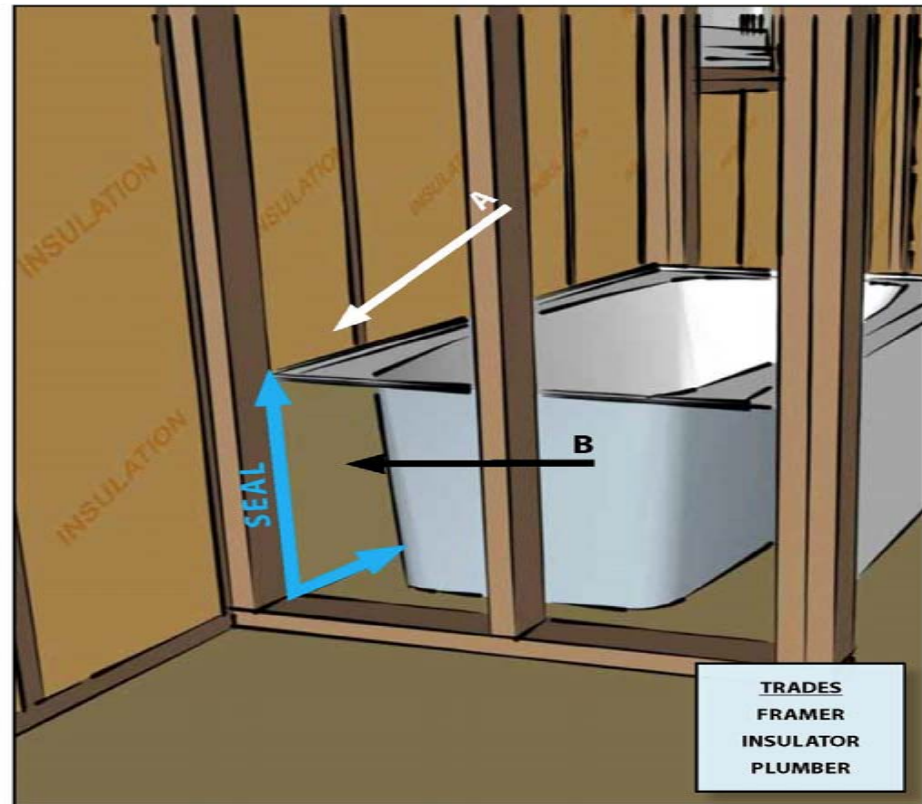
\* EPA recommends using a rigid air barrier, but it is not a requirement.

#### FOOTNOTES

6. For purposes of this checklist, an air barrier is defined as any durable solid material that blocks air flow between conditioned space and unconditioned space, including necessary sealing to block excessive air flow at edges and seams and adequate support to resist positive and negative pressures without displacement or damage. EPA recommends, but does not require, rigid air barriers. Open-cell or closed-cell foam shall have a finished thickness  $\geq 5.5$ " or 1.5", respectively, to qualify as an air barrier unless the manufacturer indicates otherwise. If flexible air barriers such as house wrap are used, they shall be fully sealed at all seams and edges and supported using fasteners with caps or heads  $\geq 1$ " diameter unless otherwise indicated by the manufacturer. Flexible air barriers shall not be made of kraft paper, paper-based products, or other materials that are easily torn. If polyethylene is used, its thickness shall be  $\geq 6$  mil.

7. EPA highly recommends, but does not require, inclusion of an interior air barrier at band joists in Climate Zone 4 through 8.

10. All insulated vertical surfaces are considered walls (e.g., exterior walls, knee walls) and must meet the air barrier requirements for walls. All insulated ceiling surfaces, regardless of slope (e.g., cathedral ceilings, tray ceilings, conditioned attic roof decks, flat ceilings, sloped ceilings), must meet the requirements for ceilings.





# Walls



## THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

### 3 FULLY-ALIGNED AIR BARRIERS

#### 1 WALLS



#### DETAIL 3.1.4 <sup>6,7,10</sup>

##### Skylight shaft walls

- A. If non-rigid insulation is used, install a rigid air barrier to prevent insulation from sagging and create a continuous thermal barrier.\*
- B. Seal all seams, gaps, and holes of the air barrier with caulk or foam.
- C. Install the insulation without any misalignments, compressions, gaps, or voids so that it acts as both the air barrier and thermal boundary. *Examples include foam board, spray foam or dense pack insulation.*

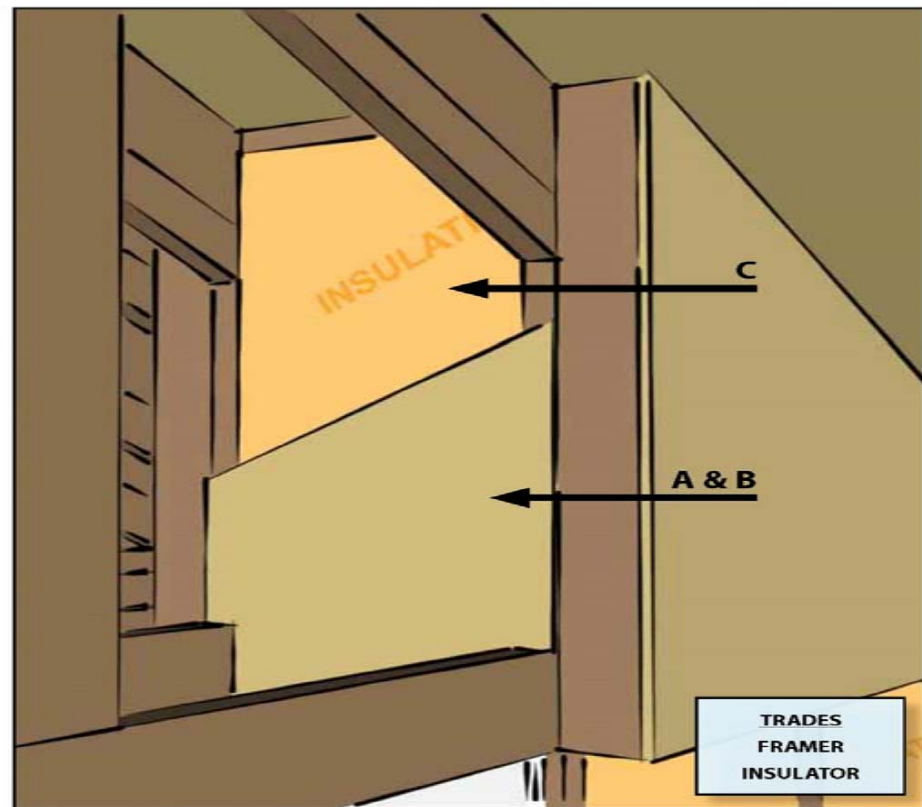
\* EPA highly recommends using a rigid air barrier, but it is not a requirement.

#### FOOTNOTES

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7. EPA highly recommends, but does not require, inclusion of an interior air barrier at band joists in Climate Zone 4 through 8.

10. All insulated vertical surfaces are considered walls (e.g., exterior walls, knee walls) and must meet the air barrier requirements for walls. All insulated ceiling surfaces, regardless of slope (e.g., cathedral ceilings, tray ceilings, conditioned attic roof decks, flat ceilings, sloped ceilings), must meet the requirements for ceilings.



TRADES  
FRAMER  
INSULATOR



# Walls



## THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

### 3 FULLY-ALIGNED AIR BARRIERS

#### 1 WALLS



#### DETAIL 3.1.8 <sup>6,7,10</sup>

##### Garage rim/band joist adjoining conditioned space

- A. Install a continuous rigid air barrier or other supporting material to separate the garage from the conditioned space.\*
- B. Seal all seams, gaps, and holes of the air barrier with caulk or foam and complete before installing the insulation.
- C. Install insulation without misalignments, compressions, gaps, or voids in all band joist cavities.

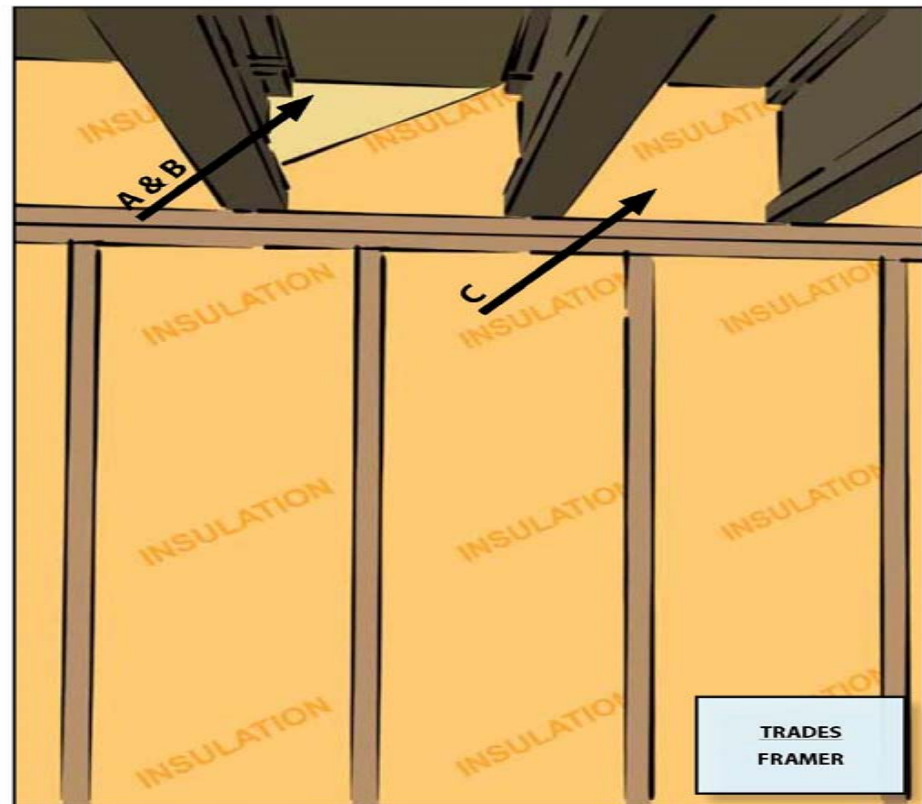
\* EPA highly recommends using a rigid air barrier, but it is not a requirement.

#### FOOTNOTES

6. For purposes of this checklist, an air barrier is defined as any durable solid material that blocks air flow between conditioned space and unconditioned space, including necessary sealing to block excessive air flow at edges and seams and adequate support to resist positive and negative pressures without displacement or damage. EPA recommends, but does not require, rigid air barriers. Open-cell or closed-cell foam shall have a finished thickness  $\geq 5.5"$  or  $1.5"$ , respectively, to qualify as an air barrier unless the manufacturer indicates otherwise. If flexible air barriers such as house wrap are used, they shall be fully sealed at all seams and edges and supported using fasteners with caps or heads  $\geq 1"$  diameter unless otherwise indicated by the manufacturer. Flexible air barriers shall not be made of kraft paper, paper-based products, or other materials that are easily torn. If polyethylene is used, its thickness shall be  $\geq 6$  mil.

7. EPA highly recommends, but does not require, inclusion of an interior air barrier at band joists in Climate Zone 4 through 8.

10. All insulated vertical surfaces are considered walls (e.g., exterior walls, knee walls) and must meet the air barrier requirements for walls. All insulated ceiling surfaces, regardless of slope (e.g., cathedral ceilings, tray ceilings, conditioned attic roof decks, flat ceilings, sloped ceilings), must meet the requirements for ceilings.



# Walls



## THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

### 3 FULLY-ALIGNED AIR BARRIERS

#### 1 WALLS



**A.** Air barrier is not continuous.



Continuous air barrier



**B.** Electrical box not air sealed.



Wiring penetrations properly air sealed.



**B.** Air barrier is air sealed.



Air barrier is air sealed.



**C.** Insulation is misaligned.



Insulation is properly installed.

# Fully-Aligned Air Barrier (cont.)



- **Floors**
  - Floor above garage
  - Cantilevered floor
  - Floor above unconditioned basement or unconditioned crawlspace
- **Ceilings**
  - Dropped ceiling / soffit below unconditioned attic
  - All other ceilings

# Floors



## THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

### 3 FULLY-ALIGNED AIR BARRIERS

### 2 FLOORS



- A.** No air barrier is present between the floor system and unconditioned space.



- Air barrier is present and installed between the floor system and unconditioned space.



- B.** Penetration through the floor is not air sealed.



- Penetrations through floor are air sealed.



- C.** Sub-floor insulation has gaps, compression, and misalignment.



- Sub-floor insulation is properly installed and supported.



- D.** Sub-floor insulation is not properly installed or supported.





# Ceilings



**THERMAL ENCLOSURE SYSTEM RATER CHECKLIST**

3	FULLY-ALIGNED AIR BARRIERS	
3	CEILING	



**A.** Wind baffle installation will not allow insulation over the top plate.



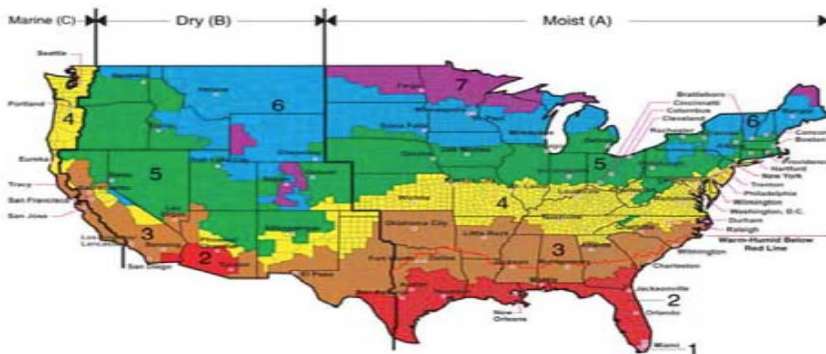
Wind baffle installation will allow proper insulation depth over the top plate.



**B.**



Wind baffle installation maintains necessary code clearance between baffle and roof deck.



All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Delta Junction, Fairbanks, N. Star, Nome, North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk.  
 Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands.  
 Last Updated: 10/28/11

## 2009 IECC INSULATION REQUIREMENTS

CLIMATE ZONE	CEILING
Zone 1	R-30
Zone 2	R-30
Zone 3	R-30
Zone 4	R-38
Zone 5	R-38
Zone 6	R-49
Zone 7	R-49

a. R-values are minimums.

Interactive Map:  
<http://energycode.pnl.gov/EnergyCodeReqs/>



## 4. Reduced Thermal Bridging



- Insulated ceiling with attic space above
- For slabs on grade in Climate Zone 4 and higher
- Insulation beneath attic platforms
- Reduce Thermal bridging at above-grade walls separating conditioned from unconditioned space
  - Choice in bridging
    - ✦ Rigid insulation
    - ✦ Structural Insulated Panels (SIPs)
    - ✦ Insulated Concrete Forms (ICFs)
    - ✦ Double-wall framing
    - ✦ Advanced framing

# Minimum Required Levels



## THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

4 REDUCED THERMAL BRIDGING

1 PERIMETER OF INSULATED CEILING MEETS REQUIRED LEVEL



### DETAIL 4.1 <sup>11</sup>

**For insulated ceilings with attic space above (i.e., non-cathedralized ceilings), uncompressed insulation extends to the inside face of the exterior wall below at the following levels: CZ 1 to 5:  $\geq$  R-21; CZ 6 to 8:  $\geq$  R-30**

- A. Install raised-heel trusses or equivalent framing method to allow the specified attic insulation R-value to be installed at the inside face of the exterior wall below (extending over the top plate).

### FOOTNOTES

11. The minimum designated R-values must be achieved regardless of the trade-offs determined using an equivalent U-factor or UA alternative calculation. Note that if the minimum designated values are used, they must be compensated with higher values elsewhere using an equivalent U-factor or UA alternative calculation in order to meet the overall insulation requirements of the 2009 IECC. Also, note that these requirements can be met by using any available strategy, such as a raised-heel truss, alternate framing that provides adequate space, and/or high-density insulation. In Climate Zones 1 through 3, one option that will work for most homes is to use 2x6 framing, an R-21 high-density batt, and a wind baffle that only requires 0.5" of clearance.



# Slab Edge Insulation



## THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

4 REDUCED THERMAL BRIDGING

2 SLAB EDGE INSULATION

### DETAIL 4.2<sup>4,5</sup>

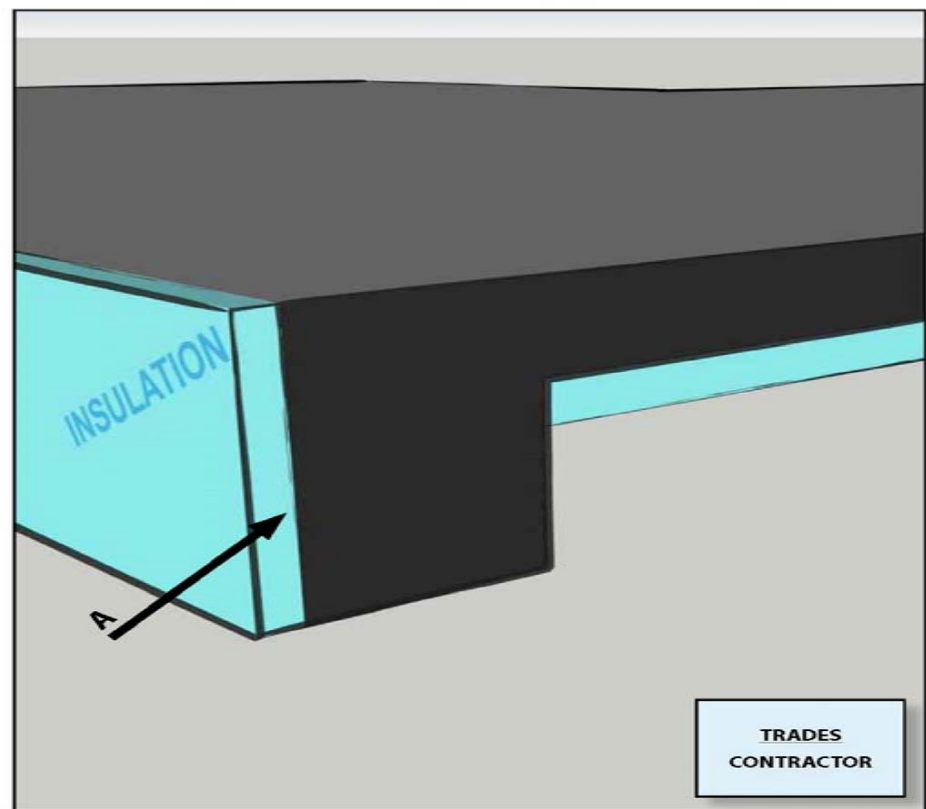
**For slabs on grade in CZ 4 and higher, 100% of slab edge insulated to  $\geq R-5$  at the depth specified by the 2009 IECC and aligned with thermal boundary of the walls**

- A. Install slab edge insulation to extend to the top of the slab so it provides a complete thermal break.

### FOOTNOTES

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 EPA to request an exemption prior to the home's qualification. EPA will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. A list of currently exempted details is available at: [www.energystar.gov/slabedge](http://www.energystar.gov/slabedge).







# Walls: Continuous Rigid Insulation



## THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

4 REDUCED THERMAL BRIDGING

4 WALLS: CONTINUOUS RIGID INSULATION



### DETAIL 4.4.1<sup>12,13,14,15 †</sup>

**Continuous rigid insulation, insulated siding, or i.e., 1 to 4 combination of the two;  $\geq R-3$  in Climate Zones 1 to 4,  $\geq R-5$  in Climate Zones 5 to 8<sup>\*†</sup>**

- A. If utilizing insulated siding that is not water-resistant barrier, install a water-resistant barrier before installing siding.
- B. If using steel studs, install continuous rigid insulation of  $\geq R-3$  in CZ 1 to 4 or  $\geq R-5$  in CZ 5 to 8. <sup>†</sup>
- C. Tape and seal all seams of continuous rigid insulation if it is being utilized as a water-resistant barrier.

<sup>\*</sup> Only one item of 4.4.1-4.4.5 must be installed to comply with ENERGY STAR. If the building utilizes steel framing, this requirement must be met.

<sup>†</sup> Footnotes located on page 95.

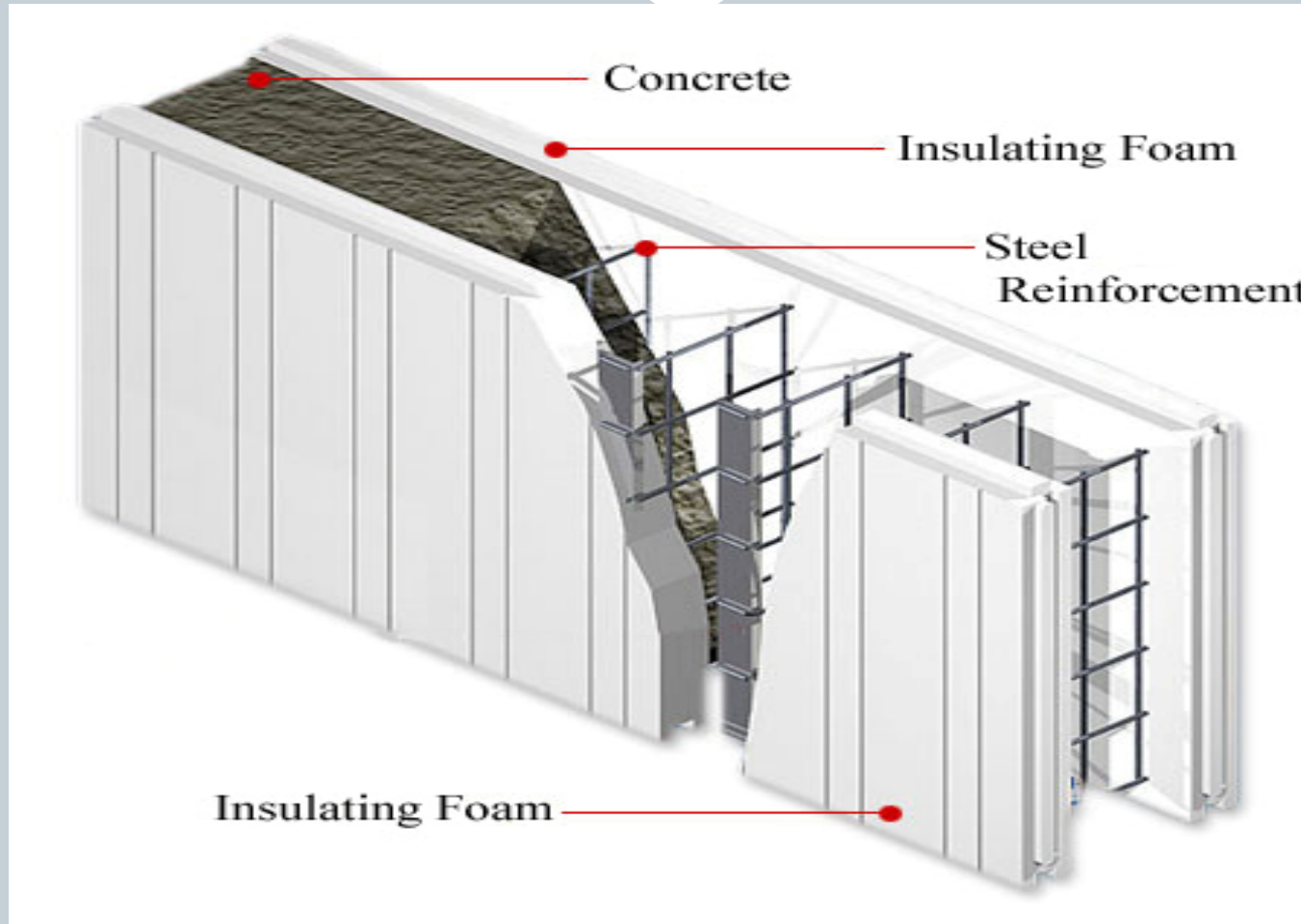




# Walls: Structural Insulated Panels (SIPs)



# Walls: Insulated Concrete Forms (ICFs)



# Walls: Double-Wall Framing



# Walls: Advanced Framing

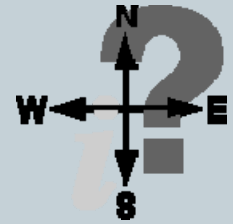


# Resources



## Important Websites:

- ❑ [www.ruralhome.org](http://www.ruralhome.org)
- ❑ [www.energystar.gov](http://www.energystar.gov)
- ❑ <http://www.epa.gov/watersense>
- ❑ [www.usgbc.com](http://www.usgbc.com)
- ❑ <http://greenhomeguide.com/program/leed-for-homes>

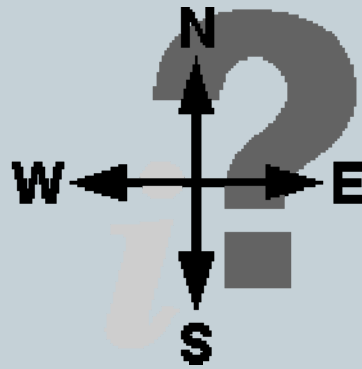


## YouTube Videos:

- <http://youtu.be/SvuXT1NQGis>
  - Attic Air-Sealing: Part 1, Evaluation (GreenHomes America)
- <http://youtu.be/cJViGzGmn7I>
  - Swiftsure Energy Duct Testing



# QUESTIONS



# CONTACT



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# Wrap Up



Materials from today's webinar  
and the recording will be available  
on HAC's website.

[www.ruralhome.org](http://www.ruralhome.org)

