Insulation

TECHNICAL BULLETIN #15

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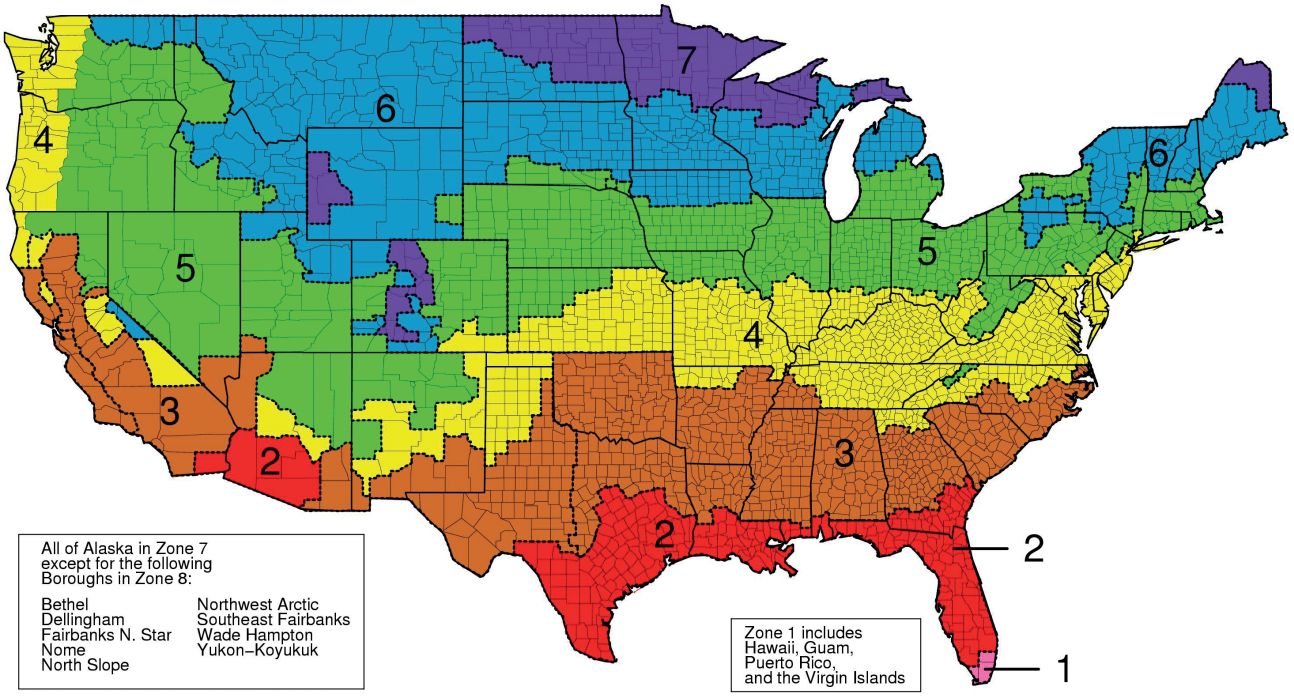
GreenGuard® IECC Reference Guide

2009 & 2012 VERSIONS



The 2009 International Energy Conservation Code (IECC) requires improved wall insulation in Climate Zones 5–7 and Marine 4. The 2012 IECC expands the requirement to include Climate Zones 3 and 4 and increases the requirements of the 2009 code. The Prescriptive Methods for meeting in the 2009 and 2012 IECC in these Climate Zones specify cavity wall insulation value plus exterior insulation. The amount of exterior insulation depends on Climate Zone and construction method as this Technical Bulletin will explain.

Adding a layer of continuous insulation (Ci) that covers all framing and sheathing meets the code requirements and reduces thermal breaks, raising the overall effective R–value of the wall system and significantly improving energy efficiency.

Follow these simple steps to determine compliance to the code.

1. **Find your climate zone on the above map.**
2. **Determine if your municipality is on the 2009 or 2012 IECC. The following website will help guide you: http://www.energycodes.gov/**
3. **Determine your construction method.**
   - **Full structural sheathing?**
   - **Direct to stud application of Ci?**
   - **Blend of structural corner bracing & direct to stud application of Ci?**
4. **Determine your below grade options. Consult your Kingspan Insulation representative to determine local solutions and common practices.**

2009 IECC

Zones 5, Marine 4 and 6 can utilize Ci under Table 402.1.1 (see below) using the Prescriptive method of compliance. Zones 7 and 8 can utilize Ci under the Total UA or Simulated Performance Alternative methods of code compliance.

Insulation and Fenestration Requirements by Component

Climate Zone	Fenestration U–factor[b]	Skylight U–factor[b]	Glazed Fenestration SHGC[b,e]	Ceiling R–value	Wood Frame Wall R–value	Mass Wall R–value	Floor R–value	Basement[c] Wall R–valwue	Slab[d] R–value & Depth	Crawl Space[c] Wall R–value
1	1.2	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4 / 6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5 / 8	19	5 / 13[f]	0	5 / 13
4 except Marine	0.35	0.60	NR	38	13	5 / 10	19	10 / 13	10.2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5[h]	13 / 17	30[g]	10 / 13	10.2 ft	10 / 13
6	0.35	0.60	NR	49	20 or 13 + 5[h]	15 / 19	30[g]	15 / 19	10.4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[g]	15 / 19	10.4 ft	10 / 13

a. R-values are minimums. U-factors and SHGC are maximums. R-19 bats compressed into a nominal 2 x 6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed R-value in addition to the full thickness R-value.

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. "15/19" means R-15 continuous insulation 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.

d. 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.

e. There are no SHGC requirements In the Marine Zone.

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

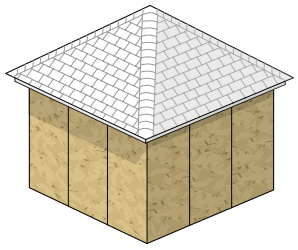
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. "13+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 exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

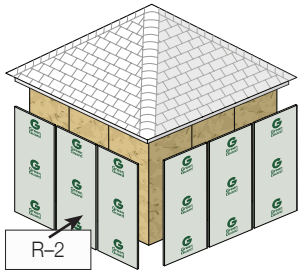
I. The second R-value applies when more than half the insulation is on the interior of the mass wall.

j. 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.

Walls Using Full Structural Sheathing



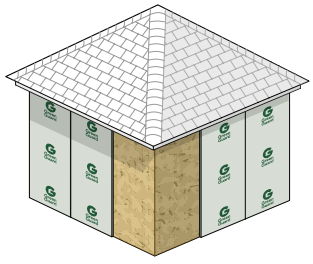
- Use R–13 cavity insulation between studs.
- Use R–2 *Kingspan* **GreenGuard®** Type IV XPS Insulation Board as sheathing over the structural sheathing.
- Apply *Kingspan* **GreenGuard®** Building Wrap over the XPS Insulation Board before installing windows, doors and cladding.



Code Language

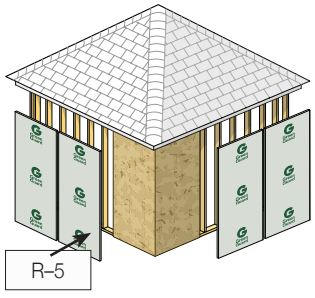
'13 + 5 means R–13 cavity insulation plus R–5 insulating sheathing….If structural sheathing covers more than 25% of the exterior, structural sheathing shall be supplemented with insulating sheathing of at least R–2.'

Walls with 25% or Less Structural Sheathing



- Use R–13 cavity insulation between studs.
- Use structural sheathing as specified to meet structural requirements.
- Use R–5 *Kingspan* **GreenGuard®** Type IV XPS Insulation Board over studs where no structural sheathing is used.
- Apply *Kingspan* **GreenGuard®** Building Wrap over the XPS Insulation Board before installing windows, doors and cladding.

Note: Although Ci is not required over the structural sheathing part of this wall, an aplication of R–2 insulating sheathing over these areas areas will copensate for the difference in thickness of the R–5 XPS (1 in.) and the structural sheathing (7/16 in.) to provide a level sheathing layer for exterior cladding.



Code Language

'13 + 5 means R–13 cavity insulation plus R–5 insulating sheathing….If structural sheathing covers 25% or less of the exterior, insulating sheathing is not required where structural sheathing is used.'

2012 IECC

Zones 3–8 can utilize Ci under Table 402.1.1 using the Prescriptive method of compliance.

Insulation and Fenestration Requirements by Component

Climate Zone	Fenestration U–factor[b]	Skylight U–factor[b]	Glazed Fenestration SHGC[b,e]	Ceiling R–value	Wood Frame Wall R–value	Mass Wall R–value[i]	Floor R–value	Basement[c] Wall R–value	Slab[d] R–value & Depth	Crawl Space[c] Wall R–value
1	NR	0.75	0.25	30	13	3 / 4	13	0	0	0
2	0.40	0.75	0.25	38	13	4 / 6	13	0	0	0
3	0.35	0.65	0.25	38	20 or 13 + 5[h]	8 / 13	19	5 / 13[f]	0	5 / 13
4 except Marine	0.35	0.55	0.40	49	20 or 13 + 5[h]	8 / 13	19	10 / 13	10.2 ft	10 / 13
5 and Marine 4	0.32	0.55	NR	49	20 or 13 + 5[h]	13 / 17	30[g]	15 / 19	10.2 ft	15 / 19
6	0.32	0.55	NR	49	20 + 5 or 13 + 10[h]	15 / 20	30[g]	15 / 19	10.4 ft	15 / 19
7 and 8	0.32	0.55	NR	49	20 + 5 or 13 + 10[h]	19 / 21	38[g]	15 / 19	10.4 ft	15 / 19

a. R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table.

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. "$^{15}/_{19}$" means R-15 continuous insulation 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 insulation on the interior or exterior of the home. "$^{10}/_{13}$" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. 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 Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements In the Marine Zone.

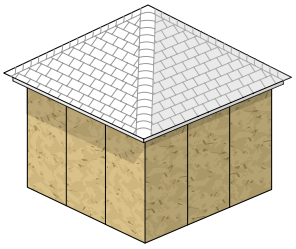
f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

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

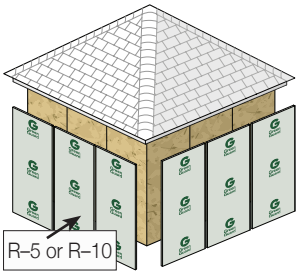
h. First value is cavity insulation, second is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be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

I. The second R-value applies when more than half the insulation is on the interior of the mass wall.

Walls Using Full Structural Sheathing

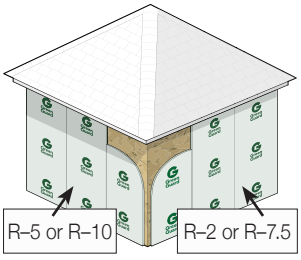


- Use R–13 cavity insulation between studs.
- In zones 3, 4, Marine 4 and 5. Use R–5 *Kingspan* **GreenGuard®** Type IV XPS Insulation Board over the structural sheathing.
- In zones 6, 7 and 8. Use R–10 *Kingspan* **GreenGuard®** Type IV XPS Insulation Board over the structural sheathing.
- Apply *Kingspan* **GreenGuard®** Building Wrap over the XPS Insulation Board before installing windows, doors and cladding.

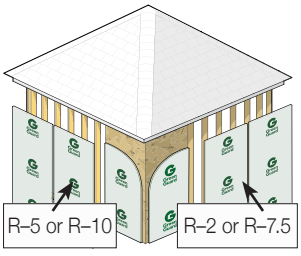


Code Language
'First value is cavity insulation. Second is continuous insulation, so 13 + 5 means R–13 cavity insulation plus R–5 continuous insulation.'

Walls with 40% or Less Structural Sheathing



- Use R–13 cavity insulation between studs.
- Use structural sheathing as specified to meet structural requirements.
- In zones 3, 4, Marine 4 and 5. Use R-5 *Kingspan* **GreenGuard®** Type IV XPS Insulation Board over studs where no structural sheathing is used. Use R–2 *Kingspan* **GreenGuard®** Type IV XPS Insulation Board over structural sheathing.
- In zones 6, 7 and 8. Use R–10 *Kingspan* **GreenGuard®** Type IV XPS Insulation Board over studs where no structural sheathing is used. Use R–7.5 (1½ in.) *Kingspan* **GreenGuard®** Type IV XPS Insulation Board over structural sheathing.
- Apply *Kingspan* **GreenGuard®** Building Wrap over the XPS Insulation Board before installing windows, doors and cladding.



Code Language
'If structural sheating covers 40% or less of the exterior, continuous insulation R–value shall be permitted to be reduced by no more than R–3 in the locations where structural sheathing is used
– to maintain a consistent total sheathing thickness.'

Special Notes

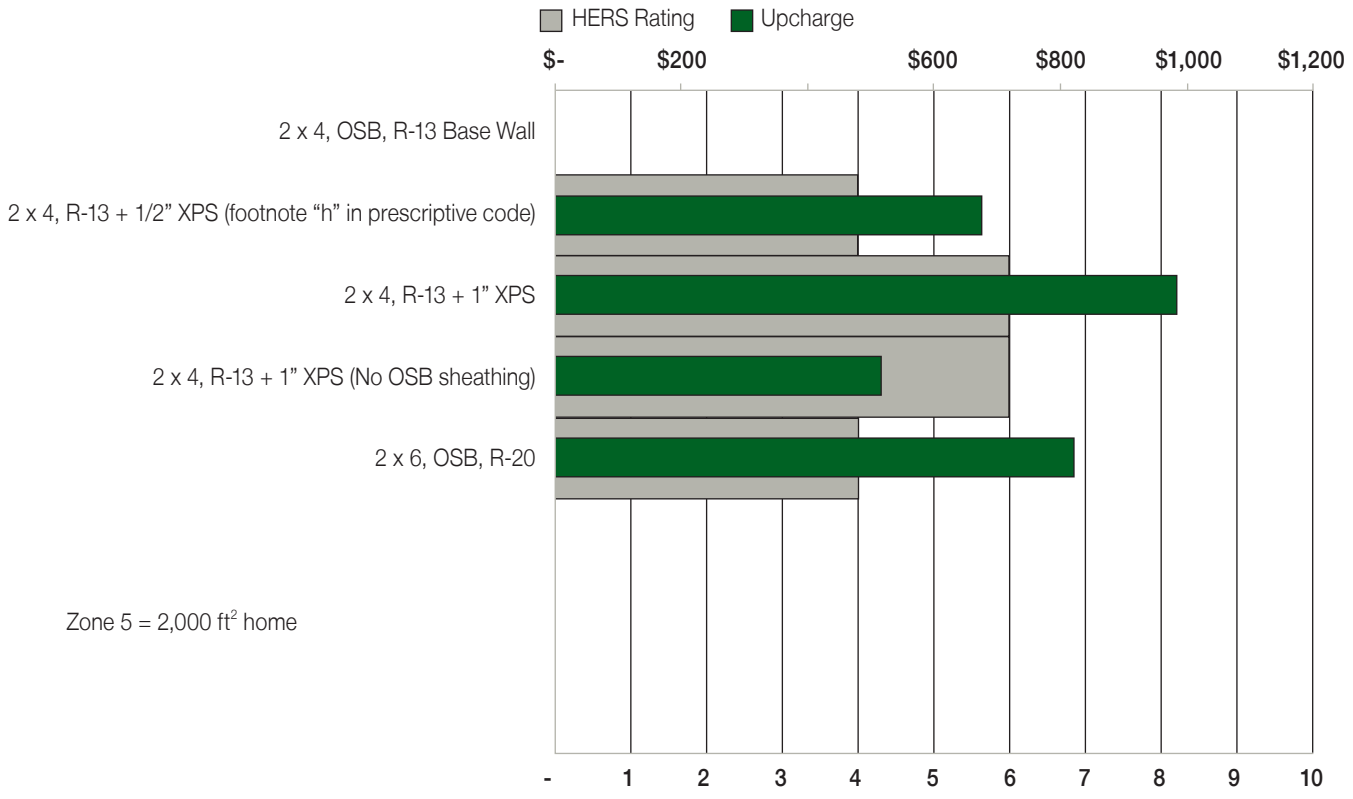
1. In the 2009 & 2012 IECC (section 402.1.2) the R–value of air films are not allowed. This includes any 'system' R–value calculations for radiant barriers.

   402.1.2 R–value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing shall be summed to compute the component R–value. The manufacturer's settled R–value shall be used for blown insulation. Computed R–values shall not include an R–value for other building materials or air films.

2. The 2009 and 2012 IECC specifically require air barriers. The requirement varies from state to state but may include mandated use of an air barrier material (building wrap) or a system (caulk and foam) package. Consult your Kingspan Insulation representative for further details.

3. Cost and performance of alternatives. Based on a study of a 2,000 ft^2 home located in Climate Zone 5, continuous insulation (Ci) approaches deliver higher performance at lower cost than a 2 x 6 / R20 wall option.

HERS Rating Improvement in Walls with Continuous Insulation



Continuous insulation (Ci) results in increased energy efficiency is illustrated by the increased HERS rating. Ci limits thermal bridging and moves the dew point toward the exterior of the wall cavity reducing energy loss and potential for condensation within the wall cavity.

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