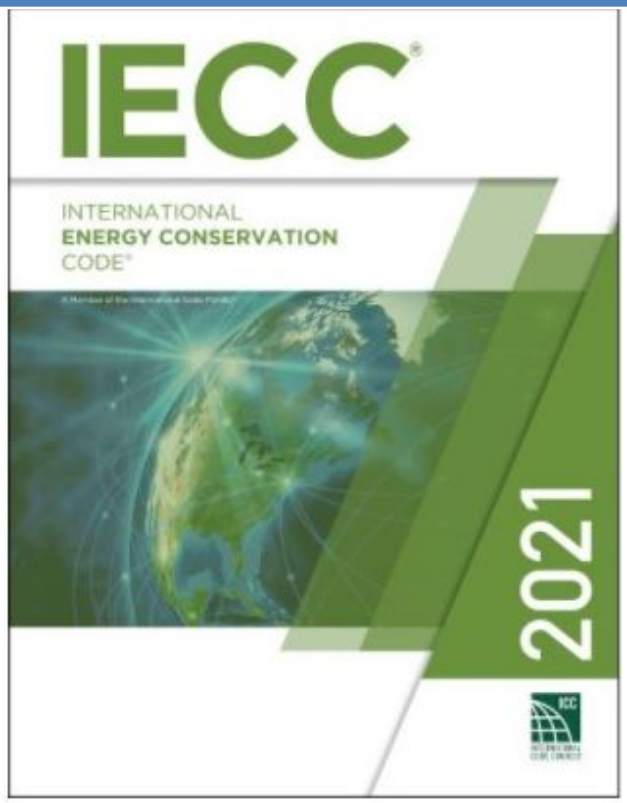
National Association of Home Builders

2021

International Energy Conservation Code Suggested Amendments



June 18, 2021

(rev. 1.0)

State and local HBAs should consider these amendments during the adoption of the 2021 International Energy Conservation Code to help maintain cost-effective and affordable code provisions. NAHB developed these amendments based on the outcome of the 2021 ICC Code Development Cycles.

Each amendment is shown in *legislative text* (underline and ~~strikethrough~~) and includes a supporting reason/s explaining why the jurisdiction should consider them. The analysis of energy savings and/or associated construction costs for many amendments are provided in a study published by Home Innovation Research Labs. The costs are estimated for a 2,600 square foot single-family house unless noted otherwise. Additional supporting documents and information are available on the NAHB website.

From the *Summary Table* on the next page, choose the amendment you are interested in and click on a link to view the content.

This document is available upon request in a "MS Word" format so that you can copy and or change any portion of the document to fit your precise needs. If you would like the word document sent to you or if you have questions, please contact:

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Summary Table

Click on the item to view the amendment.

E1. Wall R-Value/U-Factor Corrections (Climate Zones 4 & 5)

This amendment modifies the prescriptive wall insulation levels for above-grade framed walls from R-20+5 to R-20 and R-13+10 to R-13+5. It restores prescriptive options for walls with cavity-only insulation.

E2. Slab Edge R-Value Correction (Climate Zones 3, 4 & 5)

This amendment restores the requirement for slab edge insulation in Climate Zones 3, 4, and 5.

E3. Attic R-Value/U-Factor Corrections (Climate Zones 2 & 3)

This amendment restores the prescriptive attic insulation levels from R-49 to R-38.

E4. Attic R-Value/U-Factor Corrections (Climate Zones 4-8)

This amendment restores the prescriptive attic insulation levels from R-60 to R-49.

E5. Floor R-Value Correction for Ducts Located Inside Floor Cavity (Climate Zones 1 & 2)

This amendment removes the unnecessary requirement for R19 insulation at duct locations in floor cavities over unconditioned space.

E6. Exception for Testing Ducts Located Inside Conditioned Space

This amendment restores the exception to the requirement to test ducts and air handlers located in conditioned space.

E7. Mechanical Code Compliance for Ventilation Systems

This amendment removes the requirement for flow rate testing on mechanical ventilation systems.

E8. Interior Lighting Allowance and Design Option for Lighting Controls

This amendment restores a small 10% allowance for lighting sources and removes the requirement for occupancy sensors and dimmers.

E9. Resolving Conflict with Commercial Energy Code Exterior Lighting Requirements

This amendment removes the requirement for residential exterior lighting systems to comply with commercial lighting provisions.

E10. ERI Compliance Path – ERI Threshold Correction

This amendment restores the maximum energy rating index thresholds for all climate zones.

E11. ERI Compliance Path – 5% Penalty Correction

This amendment resolves a conflict with an additional 5% reduction in the ERI values.

E12. ERI Compliance Path – Design Options and Ventilation Correction

This amendment restores the design options for achieving target ERI.

E13. Additional Efficiency Package Options – Realignment to Minimum Code

This amendment removes the additional efficiency requirements that are beyond the base requirements of the prescriptive and performance paths.

E14. Air Barrier Location at Rim Joist – Clarification of Intent

This amendment clarifies the intent of the provision for an air barrier at the rim joist.

E15. Coordination of Requirements for Air-Sealed Outlet Boxes in Exterior Walls

This amendment coordinates the new prescriptive requirements for electrical and communication outlet boxes with the provisions of Table R402.4.1.1 for air barriers.

E16. ICC 700-2020 National Green Building Standard as a Compliance Path

This amendment lists ICC 700-2020 National Green Building Standard as a compliance path under Section R102.1.1 for above code programs in Chapter 1 of the IECC Residential Provisions.

E17. Air Leakage Rate Correction (Climate Zones 1-8)

This amendment modifies the requirements from 3 Air Changes per Hour (ACH) to 5 ACH in climate zones 3 through 8.

E18. Basement Wall R-Value/U-Factors Correction (Climate Zone 5)

This amendment reduces the basement wall insulation value requirements in Climate Zone 5, to a more reasonable R-Value/U-Factor based on cost-effectiveness criteria.

E19. Wall R-Value/U-Factors Corrections (Climate Zone 3)

This amendment reinstates the appropriate minimum wall assembly R-Values/U-Factors in climate zone 3.

E20. Wall R-Value/U-Factors Corrections (Climate Zones 6-8)

This amendment reinstates the appropriate minimum wall assembly R-Values/U-Factors in climate zone 6 based on cost effectiveness. This change is complementary to amendment E1.

E1. Wall R-Value/U-Factor Corrections (Climate Zones 4 & 5)

This amendment modifies the prescriptive wall insulation levels for above-grade framed walls from R-20+5 to R-20 and R-13+10 to R-13+5. It restores prescriptive options for walls with cavity-only insulation.

Revise as follows:

R402.1.2 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Table R402.1.2, based on the climate zone specified in Chapter 3. Assemblies shall have a U-factor equal to or less than that specified in Table R402.1.2. Fenestration shall have a U-Factor and glazed fenestration SHGC equal to or less than that specified in Table R402.1.2.

R402.1.3 R-value alternative. Assemblies with R-value of insulation materials equal to or greater than that specified in Table R402.1.3 shall be an alternative to the U-factor in Table R402.1.2.

TABLE R402.1.2

MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.026	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.026	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.024	0.060 ~~0.045~~	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.024	0.060 ~~0.045~~	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.024	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.024	0.045	0.057	0.028	0.050	0.055

Footnotes remain unchanged

TABLE R402.1.3

INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	49	13 or 0&10ci	4/6	13	0	0	0
3	.30	0.55	0.25	49	20 or 13&5ci[h] or 0 & 15ci[h]	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]

4 except Marine	.30	0.55	0.40	60	~~30 or~~ 20~~&5ci~~[h] or 13&5ci~~10~~[h] or ~~0 & 20ci~~[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	60	~~30 or~~ 20~~&5ci~~[h] or 13&5ci~~10~~[h] or ~~0 & 20ci~~[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci
6	0.30[i]	0.55	NR	60	30 or 20&5ci[h] or 13&10ci[h] or 0 & 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci
7 and 8	0.30[i]	0.55	NR	60	30 or 20&5ci[h] or 13&10ci[h] or 0 & 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci

Footnotes remain unchanged

Reason:

This amendment restores wall insulation values to the 2018 IECC. The requirement for added levels of continuous insulation is onerous and unjustified for the following reasons:

- It has a small impact on the energy use. Removing this requirement from the code will change energy use only by **$4.0** per month on average in **CZ 4** and **$5.3** per month on average in **CZ 5** for a 2,600 square foot single-family house.
- The added cost to consumer of constructing wall assemblies with exterior insulation is $4,970.
- Simple payback for the added level of insulation relative to the 2018 code is **103 years in CZ 4 and 78 years in CZ 5**.
- It leads to onerous installation requirements for cladding and fenestration over thick foam sheathing that are not commensurate with the small energy savings.
- Installing vinyl cladding directly over a thick layer of foam leads to challenges with ensuring that the nails are embedded into the framing and can impact resilience of the building during high wind events.
- The use of 20+5 assemblies limits interior vapor retarder options. Approved design is required for walls that use a Class I vapor retarder (e.g. sheet polyethylene).
- The net present value of the added continuous insulation over a 40-year useful life is negative – it costs much more than it saves over a 40-year period.
- The added continuous insulation results in a negative cash flow for the consumer throughout a 30-year mortgage – the consumer's total payment for the mortgage and energy bill is higher every month.

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E2. Slab Edge R-Value Correction (Climate Zones 3, 4 & 5)

This amendment restores the requirement for slab edge insulation in Climate Zones 3, 4, and 5.

Revise as follows:

R402.1.3 R-value alternative. Assemblies with R-value of insulation materials equal to or greater than that specified in Table R402.1.3 shall be an alternative to the U-factor in Table R402.1.2.

TABLE R402.1.3

INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	49	13 or 0&10ci	4/6	13	0	0	0
3	.30	0.55	0.25	49	20 or 13&5ci[h] or 0 & 15ci[h]	8/13	19	5ci or 13[f]	~~10ci, 2 ft~~ 0	5ci or 13[f]
4 except Marine	.30	0.55	0.40	60	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	8/13	19	10ci or 13	~~10ci, 4 ft~~ 10ci, 2 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	60	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	~~10ci, 4 ft~~ 10ci, 2 ft	15ci or 19 or 13 &5ci
6	0.30[i]	0.55	NR	60	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci
7 and 8	0.30[i]	0.55	NR	60	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci

Footnotes remain unchanged

Reason:

This amendment restores wall insulation values to the 2018 IECC. The requirement for added levels of slab insulation is onerous and unjustified for the following reasons:

- It has a small impact on the energy use: **$7.3 per month on average in CZ 3** and **$3.0 in CZ 4 & 5** for a 2,600 square foot single-family house.
- The added costs to consumer of installing slab insulation is $1,988 in CZ3 and $993 in CZ 4 & 5.
- This corresponds to a simple payback **of 23 years in CZ 3** and **28 years in CZ 4 & 5.**
- Large parts of CZ 3 overlap with the area with very heavy termite infestation probability in the states of South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas (refer to Figure R318.4 in 2021 IRC). The decision to add slab insulation in CZ 3 should be made by the building designer based on several factors and should not be a requirement. The remainder of CZ 3, all of CZ 4, and part of CZ 5 are designated as moderate to heavy probability of termite infestation.

- The net present value of the added continuous insulation over a 40-year useful life is negative – it costs much more than it saves over a 40-year period.
- The added continuous insulation results in a negative cash flow for the consumer throughout 30-year mortgage – the consumer's total payment for the mortgage and energy bill is higher every month.

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E3. Attic R-Value/U-Factor Corrections (Climate Zones 2 & 3)

This amendment restores the prescriptive attic insulation levels from R-49 to R-38.

Revise as follows:

R402.1.2 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Table R402.1.2, based on the climate zone specified in Chapter 3. Assemblies shall have a U-factor equal to or less than that specified in Table R402.1.2. Fenestration shall have a U-Factor and glazed fenestration SHGC equal to or less than that specified in Table R402.1.2.

R402.1.3 R-value alternative. Assemblies with R-value of insulation materials equal to or greater than that specified in Table R402.1.3 shall be an alternative to the U-factor in Table R402.1.2.

TABLE R402.1.2

MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.030 ~~0.026~~	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.030 ~~0.026~~	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.024	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.024	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.024	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.024	0.045	0.057	0.028	0.050	0.055

Footnotes remain unchanged

TABLE R402.1.3

INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	38 ~~49~~	13 or 0&10ci	4/6	13	0	0	0
3	.30	0.55	0.25	38 ~~49~~	20 or 13&5ci[h] or 0 & 15ci[h]	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]

4 except Marine	.30	0.55	0.40	60	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	60	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci
6	0.30[i]	0.55	NR	60	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci
7 and 8	0.30[i]	0.55	NR	60	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci

Footnotes remain unchanged

Reason:

This amendment restores attic insulation values to the 2018 IECC. The requirement for R49 is onerous and unjustified for the following reasons:

- It has a negligible impact on the energy use: **$0.67 per month on average in CZ 2** and **$0.92 per month on average in CZ 3** for a 2,600 square foot single-family house.
- The added costs to consumer of installing ceiling insulation is $1,366.
- This corresponds to a simple payback of **177 years in CZ 2** and **122 years in CZ 3**.
- Vaulted or cathedralized ceiling are very problematic when trying to achieve R- 49, which is about 16 inches thick. This would require a rafter at least 17" tall (which does not exist) or a prefabricated insulated panel (which represents a very small portion of the market). Developing an engineered solution for vaulted or cathedral ceilings would add substantial costs and that would make paybacks even longer.
- The net present value of the added continuous insulation over a 40-year useful life is negative – it costs much more than it saves over a 40-year period.
- The added continuous insulation results in a negative cash flow for the consumer throughout the 30-year mortgage – the consumer's total payment for the mortgage and energy bill is higher every month.

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E4. Attic R-Value/U-Factor Corrections (Climate Zones 4-8)

This amendment restores the prescriptive attic insulation levels from R-60 to R-49.

Revise as follows:

R402.1.2 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Table R402.1.2, based on the climate zone specified in Chapter 3. Assemblies shall have a U-factor equal to or less than that specified in Table R402.1.2. Fenestration shall have a U-Factor and glazed fenestration SHGC equal to or less than that specified in Table R402.1.2.

R402.1.3 R-value alternative. Assemblies with R-value of insulation materials equal to or greater than that specified in Table R402.1.3 shall be an alternative to the U-factor in Table R402.1.2.

TABLE R402.1.2

MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.026	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.026	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.026 ~~0.024~~	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.026 ~~0.024~~	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.026 ~~0.024~~	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.026 ~~0.024~~	0.045	0.057	0.028	0.050	0.055

Footnotes remain unchanged

TABLE R402.1.3

INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	49	13 or 0&10ci	4/6	13	0	0	0
3	.30	0.55	0.25	49	20 or 13&5ci[h] or 0 & 15ci[h]	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]

4 except Marine	.30	0.55	0.40	49 ~~60~~	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	49 ~~60~~	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci
6	0.30[i]	0.55	NR	49 ~~60~~	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci
7 and 8	0.30[i]	0.55	NR	49 ~~60~~	30 or 20& 5ci[h] or 13& 10ci[h] or 0& 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 &5ci

Footnotes remain unchanged

Reason:

This amendment restores attic insulation values to the 2018 IECC. The requirement for R60 is onerous and unjustified for the following reasons:

- It has a negligible impact on the annual energy use and unreasonable paybacks:

Climate Zone (CZ)	Average Monthly Savings	Simple Payback
CZ 4	$0.75 per month	152 years
CZ 5	$1.0 per month	118 years
CZ 6	$1.0 per month	105 years
CZ 7	$1.25 per month	90 years

- The added costs to consumer of installing ceiling insulation is $1,366.
- Higher levels of insulation are more challenging to implement in practice because the rafters or top chords limit the amount of insulation that can be placed around the perimeter, reducing the overall effectiveness of the requirement. This is particularly an issue in homes with smaller footprints or more complex roof configurations (hip roofs, dormers, etc.) where the perimeter attic insulation is a larger portion of the overall attic insulation.
- Vaulted or cathedral ceilings are very problematic when trying to achieve R-60, which is about 20 inches thick. This would require a rafter at least 21" tall (which does not exist) or a prefabricated insulated panel (which represents a very small portion of the market). Developing an engineered solution for vaulted or cathedral ceilings would add substantial costs and that would make paybacks even longer.
- The net present value of the added continuous insulation over a 40-year useful life is negative – it costs much more than it saves over a 40-year period.
- The added continuous insulation results in a negative cash flow for the consumer throughout the 30-year mortgage – the consumer's total payment for the mortgage and energy bill is higher every month.

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E5. Floor R-Value Correction for Ducts Located Inside Floor Cavity (Climate Zones 1 & 2)

This amendment removes the unnecessary requirement for R19 insulation at duct locations in floor cavities over unconditioned space.

Revise as follows:

R403.3.2 Ducts located in conditioned space. For ductwork to be considered inside a *conditioned space,* it shall comply with one of the following:

1. (Unchanged)
2. (Unchanged)

3. Ductwork in floor cavities located over unconditioned space shall comply with all of the following:

    3.1. A *continuous air barrier* installed between unconditioned space and the duct.

    3.2. Insulation installed in accordance with Section R402.2.7.

    3.3. A minimum ~~R-19~~ R-10 insulation installed in the cavity width separating the duct from unconditioned space.

Reason:

This provision was added in the 2021 IECC without any justification. Apparently, the requirement was copied by the proponent of the change from a drawing intended for CZ 3 applications where R-19 floor insulation is a requirement. There is no basis for having a separate requirement for insulation at duct locations in floor cavities. The modification aligns the requirement for ducts in floors with a similar requirement for ducts in exterior walls where ducts must be separated by R-10.

There are no energy savings associated with this change. This requirement can add cost for constructing a bulkhead to accommodate the added insulation in the floor. This change only affects CZs 1 and 2 because in CZ 3 the minimum floor insulation is R-19.

It is noted that the floor is required to include an air barrier in accordance with the code (see Table R402.4.1.1).

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E6. Exception for Testing Ducts Located Inside Conditioned Space

This amendment restores the exception to the requirement to test ducts and air handlers located in conditioned space.

Revise as follows:

R403.3.5 Duct testing. Ducts shall be pressure tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.

2. A duct air-leakage test shall not be required for ducts serving heating, cooling or ventilation systems that are not integrated with ducts serving heating or cooling systems.

Reason:

Testing ducts located inside conditioned space does not lead to energy savings because conditioned air remains within the building envelope. It is noted that ducts must be sealed in accordance with IECC Section R403.3.4 Sealing and be inspected to maximize air delivery effectiveness. The estimated testing cost to the consumer from this change is $247.

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E7. Mechanical Code Compliance for Ventilation Systems

This amendment removes the requirement for flow rate testing on mechanical ventilation systems.

Revise as follows:

~~**R403.6.3 Testing.**~~

~~Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected ventilation ducts. Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official.~~

> ~~**Exception:** Kitchen range hoods that are ducted to the outside with 6-inch (152 mm) or larger duct and not more than one 90-degree (1.57 rad) elbow or equivalent in the duct run.~~

Reason:

Ventilation systems should be installed in accordance with mechanical provisions of Chapters 15 and 16 of the IRC and the manufacturer's installation instructions. Where both are followed, good performance will be achieved without the need for testing and the associated cost. The focus should be on achieving compliance with the mechanical code provisions such as proper fan air flow rating, fan efficacy, maximum duct length, number of elbows, and duct sealing.

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E8. Interior Lighting Allowance and Design Option for Lighting Controls

This amendment restores a small 10% allowance for lighting sources and removes the requirement for occupancy sensors and dimmers.

Revise as follows:

R404.1 Lighting equipment. ~~All~~ Not less than 90 percent of the permanently installed lighting fixtures, excluding kitchen appliance lighting fixtures, shall contain only high-efficacy lighting sources.

~~**R404.2 Interior lighting controls.** Permanently installed lighting fixtures shall be controlled with either a dimmer, an occupant sensor control or other control that is installed or built into the fixture.~~

~~**Exception:** Lighting controls shall not be required for the following:~~

~~1. Bathrooms.~~

~~2. Hallways.~~

~~3. Exterior lighting fixtures.~~

~~4. Lighting designed for safety or security.~~

Reason:

A small 10% allowance for lighting sources that do not meet the new definition of High-Efficacy Lamps (70 lumens per watt) is restored to allow design flexibility.

The provision for interior lighting controls are removed for the following reasons:

- The language allows “other control” which can be a simple on/off switch;
- With the requirement for high-efficacy lamps, adding controls does not result in significant energy savings;
- Occupancy sensors can be disruptive to the occupant; and,
- Dimmers and sensors, which primarily address lifestyle preferences, should remain a design option.

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E9. Resolving Conflict with Commercial Energy Code Exterior Lighting Requirements

This amendment removes the requirement for residential exterior lighting systems to comply with commercial lighting provisions.

Revise as follows:

~~**R404.1.1 Exterior lighting.**~~

~~Connected exterior lighting for residential buildings shall comply with Section C405.4 of the International Energy Conservation Code—Commercial Provisions.~~

~~**Exceptions:**~~

1. ~~Detached one- and two-family dwellings.~~
2. ~~Townhouses.~~
3. ~~Solar-powered lamps not connected to any electrical service.~~
4. ~~Luminaires controlled by a motion sensor.~~
5. ~~Lamps and luminaires that comply with Section R404.1.~~

Reason:

Low-rise residential buildings should not be required to comply with complex lighting provisions of the commercial energy code that address a wide range of occupancies covered by the I-Codes. The IRC is a standalone code that was always intended to function independently of other I-codes. IRC Section R404.3 addresses Exterior Lighting Controls.

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E10. ERI Compliance Path – ERI Threshold Correction

This amendment restores the maximum energy rating index thresholds for all climate zones.

Revise as follows:

R406.5 ERI-based compliance.

Compliance based on an ERI analysis requires that the rated proposed design and confirmed built dwelling be shown to have an ERI less than or equal to the appropriate value indicated in Table R406.5 when compared to the ERI reference design.

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX
0-1	~~52~~ 57
2	~~52~~ 57
3	~~51~~ 57
4	~~54~~ 62
5	~~55~~ 61
6	~~54~~ 61
7	~~53~~ 58
8	~~53~~ 58

Reason:

This amendment restores the ERI thresholds to the 2018 IECC levels. There was no justification or cost analysis provided for this change during the 2021 IECC code development process. The 2018 thresholds have been substantiated through energy modeling to perform better than a typical code house using mechanical equipment with efficiencies above the federal minimums and remain valid code compliance targets.

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E11. ERI Compliance Path – 5% Penalty Correction

This amendment resolves a conflict with an additional 5% reduction in the ERI values.

Revise as follows:

R401.2.5 Additional energy efficiency. This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. [No change]
2. [No change]
3. ~~For buildings complying with the Energy Rating Index alternative Section R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.~~

Reason:

This amendment removes the unjustified penalty on the ERI compliance path. The 2018 ERI threshold values in Table R406.5 were developed based on energy modeling including above-federal minimum equipment efficiencies to ensure that the home compliant with an ERI path is at least as efficient as a typical house built to the prescriptive provisions.

In addition, it's not clear from the language if the intent is 5% of the ERI threshold or 5% of energy performance (i.e., 5 ERI points).

The 5% penalty in combination with the 2021 IECC revised ERI thresholds results in ERI values close to the zero-energy ready levels listed in Appendix RC ZERO ENERGY RESIDENTIAL BUILDING PROVISIONS in the IECC. This level of performance is unprecedented and unjustified for minimum code provisions. According to RESNET, less than 7% of all rated dwelling units reached an ERI/HERS below 50 and only 1% of rated dwelling received an ERI/HERS below 45 in year 2020. Less than 25 percent of dwelling units constructed in the US obtain an ERI/HERS rating and these units are typically more energy efficient than the ones that do not seek the rating.

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E12. ERI Compliance Path – Design Options and Ventilation Correction

This amendment restores the design options for achieving target ERI.

Revise as follows:

R406.3 Building thermal envelope. ~~Building and portions thereof shall comply with Section R406.3.1 or R406.3.2.~~

~~R406.3.1 On-site renewables are not included. Where on-site renewable energy is not included for compliance using the ERI analysis of Section R406.4, t~~The proposed total building thermal envelope UA, which is sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.2 multiplied by 1.15 in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

$UA_{Proposed\ design} = 1.15 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

~~**R406.3.2 On-site renewables are included.** Where onsite renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.~~

R406.4 Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ICC 301 except for buildings covered by the International Residential Code, the ERI ~~reference design ventilation rate shall be in accordance with Equation 4-2~~ shall be permitted to be calculated using the minimum total air exchange rate for the rated home (Q_{tot}) and for the index adjustment factor in accordance with Equation 4.2.

~~Ventilation rate~~Qtot, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)] (Equation 4-2)

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the ERI reference design or the rated design. For compliance purposes, any reduction in energy use of the rated design associated with on-site renewable energy shall not exceed ~~5~~ 15 percent of the total energy use.

Reason:

This amendment restores the flexibility in design options for achieving ERI thresholds. The proposed modification maintains a consistent set of envelope requirements for the building independent of on-site generation. It also increases the allowance for the fraction of the overall energy use that can be met by on-site renewables from 5 to 15 percent. The 5% limit is a new requirement that did not exist in the previous energy code and is overly restrictive.

This amendment also fixes a problem that was introduced in the 2018 IRC by requiring the reference design ventilation rate be in accordance with the IRC ventilation rate. This change in 2018 IRC resulted in a significant increase in the calculated ERI scores for the building. That was never the intent of the original change as was acknowledged by the proponent, and it was the result of a lack of coordination of the proposal with the specific terms used in Standard 301. The amendment resolves the issues in accordance with the original intent by allowing the IRC ventilation rate to be used in calculating the ERI instead of changing the reference design building.

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E13. Additional Efficiency Package Options – Realignment to Minimum Code

This amendment removes the additional efficiency requirements that are beyond the base requirements of the prescriptive and performance paths.

Revise as follows:

~~**R401.2.5 Additional energy efficiency.** This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.~~

~~1. For buildings complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.~~

~~2. For buildings complying with Section R401.2.2, the building shall meet one of the following:~~

~~2.1. One of the additional efficiency package options in Section R408.2 shall be installed without including such measures in the proposed design under Section R405; or~~

~~2.2. The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.~~

Delete Section R408 in its entirety

~~**SECTION R408**~~

~~**ADDITIONAL EFFICIENCY PACKAGE OPTIONS**~~

Reason:

These provisions are new to the 2021 IECC in both content and approach to minimum code. The format of optional packages is carried over from green rating systems. Minimum energy code should remain at a minimum required level of efficiency and optional packages should remain in above-code green and energy efficiency programs.

The primary intent of the packages is to force designers to specify higher efficiency equipment. Minimum equipment efficiency levels are set by the Department of Energy (DOE). It is not the role of the energy code to circumvent the DOE process by grouping equipment with other optional design choices that are not reasonable alternatives (e.g., envelope measures with paybacks of over 100 years). Designers already specify higher efficiency equipment in many climates of the country where those choices are cost effective.

Specific comments on each of the efficiency packages recommended for deletion are provided below.

- ***Enhanced envelope performance (5% UA and SHGC)***
    - Energy savings from further increases in insulation levels are not commensurate with the costs. Estimated simple paybacks are in excess of 100 years and are not cost effective according to any metrics. The minimum energy codes are now at the levels where renewable generation at the utility scale is more cost effective than adding insulation to buildings.
- ***More efficient HVAC equipment performance (minimum 95 AFUE natural gas furnace and 16 SEER air conditioner, 10 HSPF/16 SEER airs source heat pump, or 3.5 COP ground source heat pump)***
    - Minimum equipment efficiency levels are set by DOE and should not be circumvent by energy codes.
    - 90+ AFUE furnaces are common practice in cold climates, but not a practical choice when combined with a 16 SEER AC in a heating dominated climate. Similarly, 95 AFUE may not be a practical choice in hot climates.

- The cost impact varies by climate zone and by fuel type as summarized in the table below. The cost impact is much more significant for electric homes.

Fuel Type	Climate Zone	First Cost
Gas	2-4	$1,317
	5-7	$1,494
Electric	2-4	$5,721
	5-7	$8,196

- Cost effectiveness for select options based on the fuel type used in the reference house for energy analysis is summarized in the table below. Whereas the simple paybacks are reasonable for a gas-fuel home, this option is not cost effective for an electric home where the investment does not justify the energy savings with paybacks approaching 50 years and corresponding to a negative net present value and cash flows.

Fuel Type	Climate Zone	Annual Energy Savings	Simple Payback
Electric	2	$118	**49 years**
	3	$122	**47 years**
Gas	4	$117	11 years
	5	$178	8 years
	6	$197	8 years
	7	$248	6 years

- ***Reduced energy use in service water-heating*** **(minimum 0.82 EF gas water heater, 2.0 EF electric water heater, or 0.4 solar fraction solar water heating system)**
  - Minimum equipment efficiency levels are set by DOE and should not be circumvent by energy codes
  - For electric homes, this practice would require a heat pump water heater (HPWH). HPWHs are not a good fit for certain applications such as installations within the building envelope because they release cold air into the living space (comfort issue in colder climates and smaller dwellings) and generate noise levels objectionable to occupants. HPWH have longer recovery times and require upsizing the tank and adding a mixing valve to accommodate hot water needs for medium or large households – the cost to the consumer for these types of water heaters with a larger tank is upward of $2,500.
  - The cost impact varies by climate zone as summarized in the table below. The cost impact is more significant for electric homes.

Fuel Type	Climate Zone	First Cost
Gas	All	$740
Electric	2-3 (50-gallon HPHW)	$1,331
	4-7 (80-gallon HPWH)	$2,503

- Cost effectiveness for select options based on the fuel type used in the reference house for energy analysis is summarized in the table below. Simple paybacks are more reasonable for electric homes in CZ 2 & 3 where the change is from a resistance water heater to a 50-gallon heat pump water heater. If an 80-gallon water heater is needed, the installed cost will nearly double and the paybacks will also increase. This option is not cost effective for gas homes where the investment does not justify the energy savings with paybacks exceeding 20 years and corresponding to a negative net present value and cash flow.

Fuel Type	Climate Zone	Annual Energy Savings	Simple Payback
Electric	2	$135	10 years
	3	$149	9 years
Gas	4	$36	21 years
	5	$31	24 years
	6	$27	27 years
	7	$9	89 years

- ***More efficient duct thermal distribution system*** **(100% of ducts and air handlers located entirely within the building thermal envelope, 100% ductless systems, or 100% duct system located in conditioned space as defined by Section R403.3.2)**
  - The location of ducts is governed by the house configuration and should remain a design choice.
  - For slab-on-grade homes where compliance with ducts in conditioned space is more challenging, construction costs are summarized for buried ducts below based on climate zone (R-8 vs R-13 minimum duct).

Climate Zone	Min Duct Insulation (Buried Ducts)	Cost
2-3	R-13	$4,125
4-7	R-8	$1,736

  - Cost effectiveness of this option for slab homes is summarized in the table below based on climate zone. This option is not cost effective where the investment does not justify the energy savings for most of the country with paybacks as high as 53 years (CZ 2). Corresponding net present value and cash flows are negative for climate zones 2 through 4.

Climate Zone	Annual Energy Savings	Simple Payback
2	$117	35 years
3	$78	53 years
4	$70	25 years
5	$110	16 years

6	$180	10 years
7	$221	8 years

- ***Air sealing (max 3.0 ACH50) and efficient ventilation (ERV or HRV: min 75% SRE; max 1.1 CFM/Watt*; shall not use recirculation as a defrost strategy; min 50% LRMT for ERV).**

  - The cost impact of this option varies by climate zone as summarized in the table below. The cost impact is more significant in Climate Zone 2 where the baseline requirement for building tightness is 5 ACH 50.

Climate Zone	First Cost
2	$4,591
3	$3,109
4-6	$3,206

  - Cost savings are very low for all climate zones ranging $1-3 per month on average in CZ 2-5 and about $5 in CZ 6. This option is not a cost-effective investment with simple paybacks ranging between 240 years and 54 years in CZ 2-6 as summarized in the table below. These investments result in negative net present value and cash flows for all climate zones.

Climate Zone	Annual Energy Savings	Simple Payback
2	$19	240 years
3	$14	226 years
4	$19	167 years
5	$33	97 years
6	$59	54 years

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E14. Air Barrier Location at Rim Joist – Clarification of Intent

This amendment clarifies the intent of the provision for an air barrier at the rim joist.

Revise as follows:

TABLE R402.4.1.1

AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA INSULATION	INSTALLATION CRITERIA
Rim joists	Rim joists shall include an ~~exterior~~ air barrier.[b] ~~The junctions of the rim board to the sill plate and the rim board and the subfloor shall be air sealed.~~	Rim joists shall be insulated so that the insulation maintains permanent contact with the exterior rim board.[b]

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Air barrier and insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason:

This amendment simplifies the provisions and allows the building designer the choice of selecting an air barrier based on the specific wall assembly design. Any air barrier at the rim will constitute an exterior air barrier because the rim is always located at the exterior of the structure. Having the additional word “exterior” can lead to misinterpretation that the air barrier always must be outboard of the rim joist’s exterior face. That was never the intent of the change that was approved for the 2021 IECC as evidenced by the supporting reason statement that was included by the proponent of the change.

Examples of acceptable air barrier options that meet the intent of the code include (not an exhaustive list):

- Sealing the entire rim joist from the interior with closed-cell spray foam;
- Sealing the rim joist boundaries and joints with caulk from the interior;
- Taping or sealing the joints on the on exterior face of the rim joist;
- Installing mechanically attached membrane (i.e., house wrap) taped at all seams and boundaries;
- Installing exterior rigid foam sheathing taped or sealed at all joints and boundaries;
- Installing a fluid-applied membrane on the exterior face of walls;
- Installing a peel-and-stick membrane on the exterior face of walls.

It is noted that a whole-building tightness test is required to verify the overall air tightness of the house.

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E15. Coordination of Requirements for Air-Sealed Outlet Boxes in Exterior Walls

This amendment coordinates the new prescriptive requirements for electrical and communication outlet boxes with the provisions of Table R402.4.1.1 for air barriers.

Revise as follows:

R402.4.6 Electrical and communication outlet boxes (air-sealed boxes).

~~Electrical and communication outlet boxes installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces.~~ Where air-sealed boxes are required by Table R402.4.1.1, ~~E~~ electrical and communication outlet boxes shall comply with all of the following:

1. be tested in accordance with NEMA OS 4, *Requirements for Air-Sealed Boxes for Electrical and Communication Applications*, ~~and shall~~
2. have an air leakage rate of not greater than 2.0 cubic feet per minute (0.944 L/s) at a pressure differential of 1.57 psf (75 Pa)~~. Electrical and communication outlet boxes~~ shall
3. be marked "NEMA OS 4" or "OS 4" in accordance with NEMA OS 4~~.~~, ~~Electrical and communication outlet boxes shall~~; and,
4. be installed per the manufacturer's instructions and with any supplied components required to achieve compliance with NEMA OS 4.

Reason:

Table R402.4.1.1 prescribes conditions where sealed boxes are required. This amendment coordinates the requirements of Table R402.4.1.1 with the new prescriptive provisions for electrical and communication outlet boxes installed in exterior building envelope and penetrating the primary air barrier. Where a continuous air barrier is located behind the outlet box (i.e., between the outlet box and the exterior), these additional prescriptive requirements do not apply.

The cost of compliance with these provisions for an average 2,600 sq.ft. house is estimated to add $369 to the consumer price of the house.

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E16. ICC 700-2020 National Green Building Standard as a Compliance Path

This amendment lists ICC 700-2020 National Green Building Standard as a compliance path under Section R102.1.1 for above code programs in Chapter 1 of the IECC Residential Provisions.

Revise as follows:

R102.1.1 Above code programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. *Buildings approved* in writing by such an energy-efficiency program shall be considered to be in compliance with this code where such buildings also meet the requirements identified in Table R405.2 and the building thermal envelope is greater than or equal to levels of efficiency and solar heat gain coefficients (SHGC) in Tables 402.1.1 and 402.1.3 of the 2009 *International Energy Conservation Code*.

> **R102.1.1.1 National Green Building Standard.** Buildings complying with ICC 700-2020 National Green Building Standard and achieving an equivalent energy performance as demonstrated by a third-party certification organization shall be deemed to exceed the energy efficiency required by this code.

Reason:

ICC 700-2020 National Green Building Standard (NGBS) is an ANSI-consensus standard for high performance residential buildings and a part of the ICC family of above-code specifications. Since its first publication in 2008, more than 300,000 residential units across the United States have been certified to the NGBS following a rigorous third-party compliance assurance process. NGBS provides the flexibility to achieve a range of performance levels. Jurisdictions adopting this amendment are expected to work with an NGBS certification organization to establish the appropriate energy performance level that corresponds to the energy code as adopted and amended by the jurisdiction. Home Innovation Research Labs is an example of an NGBS certification organization that administers a national compliance program (www.homeinnovation.com/green).

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The following amendments apply to provisions of the 2021 IECC that existed since an earlier edition of the code.

E17. Air Leakage Rate Correction (Climate Zones 1-8)

This amendment modifies the requirements from 3 Air Changes per Hour (ACH) to 5 ACH in climate zones 3 through 8.

Revise as follows:

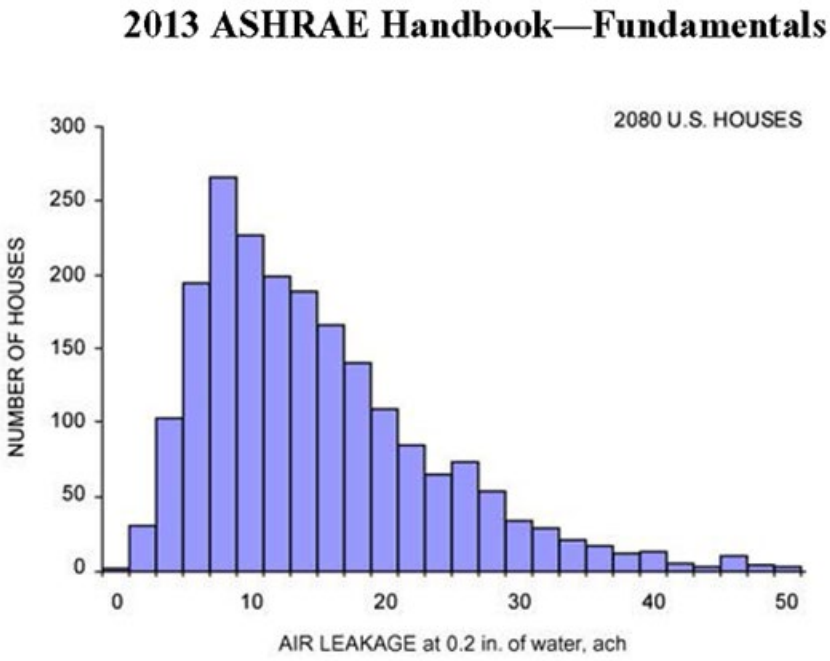
R402.4.1.3 Leakage rate. When complying with Section R401.2.1, the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour ~~in Climate Zones 0, 1 and 2, and 3.0 air changes per hour in Climate Zones 3 through 8,~~ when tested in accordance with Section R402.4.1.2.

Table R405.4.2 (1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be ~~*Climate Zones* 1 and 2:~~ 5 air changes per hour. ~~*Climate Zones* 3 through 8: 3 air changes per hour.~~ The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ where: CFA = conditioned floor area, ft^2 N_{br} = number of bedrooms	The measured air exchange rate[a]. The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed

Footnotes remain unchanged

Reason:
Building airtightness is an important part of an energy-efficient and comfortable house. However, 3 air changes (ACH) per hour at 50 Pascals is an extremely low target tightness, especially for smaller homes. The ASHRAE Handbook of Fundamentals shows that around 8% of U.S. homes achieve 3 ACH or less, 13% achieve 4 and less than 23% achieve 5. The proposed 5 ACH while still an aggressive tightness level will provide a tight, comfortable, energy-efficient home.



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E18. Basement Wall R-Value/U-Factors Correction (Climate Zone 5)

This amendment reduces the basement wall insulation value requirements in Climate Zone 5, to a more reasonable R-Value/U-Factor based on cost-effectiveness criteria.

Revise as follows:

TABLE R402.1.2

MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.026	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.026	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.024	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	NR	0.024	0.045	0.082	0.033	0.059 ~~0.050~~	0.055
6	0.30	0.55	NR	0.024	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.024	0.045	0.057	0.028	0.050	0.055

Footnotes remain unchanged

TABLE R402.1.3

INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0 + 10	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 + 10	3/4	13	0	0	0
2	0.40	0.65	0.25	49	13 or 0 + 10	4/6	13	0	0	0
3	.30	0.55	0.25	49	20 or 13 + 5ci or 0 + 15	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	13/17	30	10ci or 13 ~~15ci or 19 or 13 + 5ci~~	10ci, 4 ft	15ci or 19 or 13 + 5ci
6	0.30[i]	0.55	NR	60	20 + 5ci or 13 + 10ci or 0 + 20	15/20	30	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci
7 and 8	0.30[i]	0.55	NR	60	20 + 5ci or 13 + 10ci or 0 + 20	19/21	38	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci

Footnotes remain unchanged

Reason:

The prescriptive basement wall requirement increased from R-10 to R-15 in the 2012 IECC. Calculations used to justify the change were based on energy models with less sophisticated algorithms than Energy Plus, now DOE's preferred modeling software. When using Energy Plus, the energy savings in a 700-square-foot basement totaled $7 a year in Chicago (Climate Zone 5). The additional cost for this is conservatively estimated at $590. This makes the simple payback in excess of 84 years.

Climate Zone	Representative City	Basement Wall R-Value Change	Energy Savings	Incremental Cost	Simple Payback
5	Chicago, IL	R-10->R-15	$7/yr	$590 ($0.82/ft2)	84 years

The energy modeling was done using the Energy Plus simulation engine and BEopt version 1.4, Cost figures came from ASHRAE RP-1481.

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E19. Wall R-Value/U-Factors Corrections (Climate Zone 3)

This amendment reinstates the appropriate minimum wall assembly R-Values/U-Factors in climate zone 3.

Revise as follows:

TABLE R402.1.2

MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.026	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.026	0.084 ~~0.060~~	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.024	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	NR	0.024	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.024	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.024	0.045	0.057	0.028	0.050	0.055

Footnotes remain unchanged

TABLE R402.1.3

INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0 + 10	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 + 10	3/4	13	0	0	0
2	0.40	0.65	0.25	49	13 or 0 + 10	4/6	13	0	0	0
3	.30	0.55	0.25	49	~~20 or~~ 13 ~~+ 5ci or 0 + 15~~	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	13/17	30	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci
6	0.30[i]	0.55	NR	60	20 + 5ci or 13 + 10ci or 0 + 20	15/20	30	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci
7 and 8	0.30[i]	0.55	NR	60	20 + 5ci or 13 + 10ci or 0 + 20	19/21	38	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci

Footnotes remain unchanged

Reason:

Frame wall requirements of R-20 in Climate Zone 3 is not cost effective for the consumer.

Climate Zone	Representative City	Wall R-Value Change	Energy Savings	Incremental Cost	Simple Payback
3	Atlanta, GA	R-13->R-20	$50/yr	$1,199	24 years

The energy modeling was done using the Energy Plus simulation engine and BEopt version 1.4, Cost figures came from ASHRAE RP-1481. Not only is the payback extremely long, but for a consumer, there would be a negative cash flow based on the incremental cost and energy savings. The increase in the monthly mortgage would be $6.43 (@ 5%) and the average monthly energy savings would be $4.17 in Zone 3 causing the homeowner to pay more in additional monthly mortgage payments than the energy savings returns.

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E20. Wall R-Value/U-Factors Corrections (Climate Zones 6-8)

This amendment reinstates the appropriate minimum wall assembly R-Values/U-Factors in climate zone 6 based on cost effectiveness. This change is complementary to amendment E1.

Revise as follows:

TABLE R402.1.2

MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.026	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.026	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.024	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	NR	0.024	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.024	0.060 ~~0.045~~	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.024	0.045	0.057	0.028	0.050	0.055

Footnotes remain unchanged

TABLE R402.1.3

INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0 + 10	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 + 10	3/4	13	0	0	0
2	0.40	0.65	0.25	49	13 or 0 + 10	4/6	13	0	0	0
3	.30	0.55	0.25	49	20 or 13 + 5ci or 0 + 15	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	13/17	30	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci
6	0.30[i]	0.55	NR	60	20 ~~+ 5ci~~ or 13 + 5~~10~~ci or 0 + 15~~20~~	15/20	30	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci
7 and 8	0.30[i]	0.55	NR	60	20 + 5ci or 13 + 10ci or 0 + 20	19/21	38	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci

Footnotes remain unchanged

Reason:

The prescriptive wall requirement of R-20+R5 in climate zones 6 is not cost effective to the consumer. The additional cost for this is estimated at $1,819 for 1,016 square feet of wall. This makes the simple payback between of 55 years. This also will create a negative cash flow for the consumer in all cases.

Climate Zone	Representative City	Basement Wall R-Value Change	Energy Savings	Incremental Cost	Simple Payback
6	Minneapolis, MN	R-20->R-20+5	- $33/yr	$1,819 ($1.79/ft2)	55 years

The energy modeling was done using the Energy Plus simulation engine and BEopt version 1.4. Cost figures came from ASHRAE RP-1481.

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