REPI-26-21 (MODIFICATION)
(Delete and replace entire proposal to reconcile REPI-26, 34, and 36)

IECC®: SECTION 202 (New), TABLE R402.1.2, R402.2.9, R402.1.2, R402.1.3, R402.1.5

Proponents:

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2021 International Energy Conservation Code

Add new definition as follows:

R202 (N1101.6) DEFINITIONS

***F*-Factor (Thermal Transmittance).** The perimeter heat loss factor for slab-on-grade floors (Btu/h·ft·°F) [W/(m·K)].

Revise as follows:

R402.1.2 (N1102.1.2) 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 or *F*-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.

Revise as follows:

TABLE R402.1.2 (TABLE N1102.1.2)
MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

Portions of table not shown remain unchanged.

CLIMATE ZONE	SLAB F-FACTOR[g]	
	UNHEATED	HEATED
0	0.73	0.74
1	0.73	0.74
2	0.73	0.74
3	0.54	0.66
4 except Marine	0.51	0.66
5 and Marine 4	0.51	0.66
6	0.48	0.66
7 and 8	0.48	0.66

For SI: 1 foot = 304.8 mm.

a. Nonfenestration *U*-factors and *F*-factors shall be obtained from measurement, calculation or an approved source.

…

g. F-factors for slabs correspond to the R-values of Table R402.1.3 and the installation conditions of Section R402.2.9.1.

Revise as follows:

R402.1.3 (N1102.1.3) 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 or *F*-factor in Table R402.1.2

Revise as follows:

TABLE R402.1.3 (TABLE N1102.1.3)
INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Portions of table not shown remain unchanged.

CLIMATE ZONE	SLAB[d] R-VALUE & DEPTH	
	Unheated	Heated
0	0	R-5ci edge and R-5 full slab
1	0	R-5ci edge and R-5 full slab
2	0	R-5ci edge and R-5 full slab
3	10ci, 2 ft	R10ci, 2 ft and R-5 full slab
4 except Marine	10ci, 3 ~~4~~ ft	R10ci, 3 ft and R-5 full slab
5 and Marine 4	10ci, 3 ~~4~~ ft	R10ci, 3 ft and R-5 full slab
6	10ci, 4 ft	R10ci, 4 ft and R-5 full slab
7 and 8	10ci, 4 ft	R10ci, 4 ft and R-5 full slab

For SI: 1 foot = 304.8 mm.

NR = Not Required.
ci = continuous insulation.

d. Slab insulation shall be installed in accordance with Section R402.2.9.1. ~~R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab-edge insulation *R*-value for slabs, as indicated in the table. The slab-edge insulation for heated slabs shall not be required to extend below the slab.~~

Revise as follows:

R402.1.5 (N1102.1.5) ~~Total UA~~ Component performance alternative. Where the proposed total *building thermal envelope* thermal conductance ~~UA, the sum of *U*-factor times assembly area,~~ is less than or equal to the required total building thermal envelope conductance using ~~UA resulting from multiplying the *U*-~~factors in Table R402.1.2 ~~by the same assembly area as in the proposed *building*~~, the *building* shall be considered to be in compliance with Table R402.1.2. The ~~UA calculation~~ total thermal conductance shall be ~~performed~~ determined in accordance with Equation 4-1. Proposed *U*-factors and slab-on-grade *F*-factors shall be taken from ANSI/ASHRAE/IES Standard 90.1 Appendix A or determined using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. In addition to ~~UA~~ total thermal conductance compliance, the SHGC requirements of Table R402.1.2 and the maximum fenestration U-factors of Section R402.5 shall be met.

$(U_pA + F_pP) <= (U_r A + F_rP)$ (Equation 4-1)

where:

U_pA = the sum of proposed U-factors times the assembly areas of the proposed building.
F_pP = the sum of proposed F-factors times the slab-on-grade perimeter lengths of the proposed building.
U_rA = the sum of U-factors in Table R402.1.2 times the same assembly areas of the proposed building.
F_rP = the sum of F-factors in Table R402.1.2 times the same slab-on-grade perimeter lengths of the proposed building.

Exception: For Climate Zones 0, 1, and 2, the value of F_rP shall equal the value of F_pP

Revise as follows:

R402.2.9 (N1102.2.9) Slab-on-grade floors. Slab-on-grade floors with a floor surface within 24 ~~less than 12~~ inches (600 ~~305~~ mm) above or below grade shall be insulated in accordance with Table R402.1.3.

Exception: Slab-edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation.

Revise as follows:

R402.2.9.1 (N1102.2.9.1) Slab-on-grade floor insulation installation. Where installed, the slab edge *continuous insulation* shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the vertical distance provided in Table R402.1.3 , but need not exceed the footing depth in accordance with Section R403.1.4 of the *International Residential Code*. ~~the distance of the~~ Alternatively, a proposed design for slab insulation R-value and installation shall comply with Table R402.1.2, Section R402.1.5, or Section R405. ~~, as applicable, by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building.~~ Where a proposed design includes i~~I~~nsulation extending away from the building, it shall be protected by pavement or by not less than 10 inches (254 mm) of soil. ~~.~~ The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall*. Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Slab edge insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.

Revise as follows:

TABLE R405.4.2(1) (TABLE N1105.4.2(1))
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Foundations	Type: same as proposed.	As proposed
	Foundation wall or slab extension ~~area~~ above ~~and below~~ grade: 1 ft (30 cm) Foundation wall or slab extension below grade: same as proposed Foundation wall or slab perimeter length: same as proposed ~~and s~~Soil characteristics: same as proposed.	As proposed
	Foundation wall *U*-factor or slab *F*-factor: as specified in Table R402.1.2	

REASON STATEMENT (REVISED CONSENSUS PROPOSAL):

This revised consensus proposal combines the original REPI-26-21, REPI-34-21 and REPI-36-21 proposals based on the residential envelope subcommittee's direction to have proponents of REPI 26, 34, and 36 work on a proposal to reconcile differences in the three proposals. This proposal incorporates and coordinates the various changes in the three proposals for insulation of slab foundations. While most changes are formatting and editorial in nature, technical changes were made to unify the proposals with regard to the required F-factors (Table R402.1.2), the associated slab R-values (Table R402.1.3), and insulation installation requirements (Section R402.2.9.1). This was necessary because the location and placement of insulation on foundations affect the F-factors (thermal performance), not just the R-value and length or width of installation.

Finally, an exception was added to the Component Performance Alternative (Section R402.1.5) which restricts the use of slab insulation to make trade-offs for two reasons (note that currently the ability to use slab insulation to make trade-offs is not enabled in the code for any climate zone). First, slab insulation is not required for slab edges or perimeters in Climate Zones 0-2 and adding insulation to make a trade-off may overstate the actual trade-off value of the added slab insulation relative to the case with no insulation (e.g., ground and concrete thermal mass effects which are significant in warmer climates were not factored into the original development of F-factors) and their application in the performance (modeling) path is similarly affected. This may change with future research to better characterize heat transfer through slab on grade foundations. Second, Climate Zones 0-2 intersect with the "very heavy termite infestation" region and local rules often require an inspect strip (which alters the true F-factor) or, in some cases, prohibit the use of exterior insulation on the exposed edges of slabs.

Cost Impact: The code change proposal will decrease the cost of construction
The proposal better aligns R-values and insulation depths in Table R402.1.3 with typical footing depths for frost protect in the climate zones where perimeter edge insulation is required. For example, the insulation depth in CZ 4 and 5 are reduced from 4-feet to 3-feet. In addition, this proposal adds the ability to make trade-offs with slab insulation (F-factors) in the Component Performance Alternative (Section R402.1.5) – formerly the Total UA alternative – and in the performance (modeling) path of Section R405 (see changes to Table R405.4.2(1)).