RE37-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proponent: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	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	CRAWLSPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	~~NR~~ 0.40	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not 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: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "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. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. 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.

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. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

Reason: The purpose of this code change proposal is to improve occupant comfort, reduce peak demand and HVAC sizing, and reduce costs for homeowners by establishing a moderate SHGC requirement for fenestration in climate zone 5. While we believe that the vast majority of fenestration installed in climate zone 5 already meets or exceeds this level of efficiency, and the performance path already assumes this same level (a 0.40 SHGC) for climate zone 5, this proposal will encourage the use of fenestration with proven efficiency and comfort benefits.

Comfort – A window that combines both a low U-factor (which is already required for climate zone 5) with a low SHGC will help reduce the volatility of interior temperature swings and better maintain reasonable occupant comfort. According to the Efficient Windows Collaborative, based on an analysis completed by Lawrence Berkeley National Laboratory, windows with lower SHGCs reduce the amount of solar radiation passing through the glass, which will reduce the likelihood of discomfort of occupants. *See* https://www.efficientwindows.org/comfort.php. An uncomfortable occupant due to excessive solar gain through windows is more likely to adjust the thermostat to a cooler temperature over the course of the day in response, thereby increasing peak demand and energy use.

Although energy modeling software does not typically capture the likelihood of occupant response to discomfort, anyone who has lived or worked in

a building with excessive solar gain through fenestration, knows that this can lead occupants to adjust the thermostat. The energy impact of adjusting the thermostat is substantial. The following table shows the increased energy use that results from adjusting the thermostat down a single degree in a code-compliant house in each climate zone:

Increased Energy Use Resulting from Downward Thermostat Adjustment									
Measure	**Weighted**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
-1 Degree Cooling	3.0%	7.8%	5.3%	3.9%	2.6%	1.8%	1.4%	0.7%	0.4%

Obviously, if an uncomfortable occupant adjusts the thermostat 2 or 3 degrees, the impact will be far higher.

Peak Demand and HVAC Sizing Savings – Low-SHGC fenestration helps reduce both the home and utility peak electric demand, providing a range of benefits for homeowners and communities. Low-SHGC fenestration helps reduce the need for air conditioning during peak hours when electricity is more scarce and more expensive. Reduced cooling needs can allow for the installation of smaller cooling equipment, benefitting the homeowner by lowering costs at construction and every time the air conditioning unit is replaced. Reduced peak electric demand for each home will also help curb the overall increases in utility peak electric demand, reducing costs and negative environmental impacts associated with installing and operating peak electric generation. *See* U.S. Department of Energy, *Measure Guideline: Energy Efficient Window Performance and Selection*, at 49, *available at* https://www.nrel.gov/docs/fy13osti/55444.pdf.

Market Availability - Given the U-factor requirement in climate zone 5 (currently 0.30), the overwhelming majority of products being installed in this climate are already well under a 0.40 SHGC. Indeed, according to a 2015 U.S. DOE field study of homes in Pennsylvania (which had no SHGC requirement), 100% of the observed fenestration SHGC was below 0.40. In fact, the highest SHGC observed was 0.32. *See* https://www.energycodes.gov/compliance/energy-code-field-studies. While this study was limited to one state and a limited sample, we have seen no evidence that the circumstances are different in other climate zone 5 states. Given the ubiquity of low-SHGC fenestration in climate zone 5, we believe that this proposal will not significantly change, but merely recognize practices already implemented by homebuilders.

Bibliography: U.S. Department of Energy, *Measure Guideline: Energy Efficient Window Performance and Selection*, *available at* https://www.nrel.gov/docs/fy13osti/55444.pdf.
Energy Code Field Studies, U.S. Dep't of Energy, *available at* https://www.energycodes.gov/compliance/energy-code-field-studies.

Efficient Windows Collaborative, *Benefits: Improved Comfort*, *available at* https://www.efficientwindows.org/comfort.php.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
We believe that the vast majority of windows being installed in climate zone 5 already meet this SHGC level, and for any that do not, there are many standard products in the market that will meet it for no additional cost (the vast majority of windows that meet the U-factors specified for climate zone 5 already have a lower SHGC than 0.40; the lower SHGC typically comes with the lower U-factor). A lower SHGC may also provide the opportunity to reduce the size of the HVAC system, thereby reducing construction cost. As a result, any increased or decreased cost impact is dependent on specific circumstances and is uncertain.