**BSR/ASHRAE/IES Addendum am**
**to ANSI/ASHRAE/IES Standard 90.1-2022**

**Public Review Draft**

# Proposed Addendum AM to Standard 90.1-2022, Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings

**Second Public Review (November 2024)**
**(Draft Shows Proposed Independent Substantive Changes to Previous Public Review Draft)**

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**(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)**

# FOREWORD

*This independent substantive change (ISC) modifies the fenestration prescriptive criteria in Addendum AM in response to public comments. The U-factor requirements for skylights in conditioned spaces and semiheated spaces are adjusted in northern zones based upon information provided regarding technology breakpoints for commercial skylights. Note that even where skylight U-factors appear as an increase in this ISC relative to the first public review draft, these values are still an improvement relative to the 90.1-2022 standard. The U-factor for fixed vertical fenestration in zone 3 is lowered based upon alignment with the 2024 IECC as well as new cost information. The SHGC for residential spaces in zone 2 is restored back to 0.25 based upon concerns in multifamily spaces, which already generally have lower window area and solar aperture. The net changes for all of Addendum AM result in energy savings that are cost effective per ASHRAE cost effectiveness analysis with positive life cycle energy savings using an average heating and cooling scalar of 21.8 as well as engineering judgment to achieve consensus.*

***[Note to Reviewers: This public review draft makes proposed independent substantive changes to the previous public review draft. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the previous draft are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed substantive changes.]***

## Addendum am to 90.1-2022

*Modify Tables 5.5-2 through 5.5-6 as shown **(IP)**:*

**Table 5.5-2 Building Envelope Requirements for Climate Zone 2 (A,B)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| *Vertical Fenestration*, 0% to 40% of *Wall* | | | | | | | | | |
| *Fixed* | 0.45 | 0.23 | 1.10 (for all types) | 0.45 | ~~0.23~~0.25 | 1.10 (for all types) | 0.48 | NR (for all types) | NR (for all types) |
| *Operable* | 0.60 | 0.21 | | 0.60 | ~~0.21~~0.23 | | 0.62 | | |
| *Entrance door* | 0.77 | 0.21 | | 0.77 | ~~0.21~~0.23 | | 0.77 | | |
| *Skylight*, 0% to 3% of *Roof* | | | | | | | | | |
| All types | 0.65 | 0.30 | NR | 0.65 | 0.30 | NR | 0.75 | NR | NR |

**Table 5.5-3 Building Envelope Requirements for Climate Zone 3 (A,B,C)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| *Vertical Fenestration*, 0% to 40% of *Wall* | | | | | | | | | |
| *Fixed* | ~~0.42~~0.38 | 0.25 | 1.10 (for all types) | ~~0.42~~0.38 | 0.25 | 1.10 (for all types) | 0.48 | NR (for all types) | NR (for all types) |
| *Operable* | 0.54 | 0.23 | | 0.54 | 0.23 | | 0.62 | | |
| *Entrance door* | 0.68 | 0.23 | | 0.68 | 0.23 | | 0.77 | | |
| *Skylight*, 0% to 3% of *Roof* | | | | | | | | | |
| All types | 0.55 | 0.30 | NR | 0.55 | 0.30 | NR | 0.75 | NR | NR |

**Table 5.5-4 Building Envelope Requirements for Climate Zone 4 (A,B,C)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| *Vertical Fenestration*, 0% to 40% of *Wall* | | | | | | | | | |
| *Fixed* | 0.35 | 0.34 | 1.10 (for all types) | 0.35 | 0.34 | 1.10 (for all types) | 0.45 | NR (for all types) | NR (for all types) |
| *Operable* | 0.43 | 0.31 | | 0.43 | 0.31 | | 0.60 | | |
| *Entrance door* | 0.63 | 0.31 | | 0.63 | 0.31 | | 0.77 | | |
| *Skylight*, 0% to 3% of *Roof* | | | | | | | | | |
| All types | ~~0.49~~0.48 | 0.40 | NR | ~~0.49~~0.48 | 0.40 | NR | 0.65 | NR | NR |

**Table 5.5-5 Building Envelope Requirements for Climate Zone 5 (A,B,C)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U[c]** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U[c]** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| | | | | *Vertical Fenes ration*, 0% to 40% of *Wall* | | | | | |
| *Fixed* | 0.32 | 0.38 | 1.10 (for all types) | 0.32 | 0.38 | 1.10 (for all types) | 0.42 | NR (for all types) | NR (for all types) |
| *Operable* | 0.39 | 0.33 | | 0.39 | 0.33 | | 0.54 | | |
| *Entrance door* | 0.63 | 0.33 | | 0.63 | 0.33 | | 0.77 | | |
| | | | | *Skylight*, 0% to 3% of *Roof* | | | | | |
| All types | ~~0.46~~0.48 | 0.40 | NR | ~~0.46~~0.48 | 0.40 | NR | ~~0.55~~0.65 | NR | NR |

c. At *sites* located 4,000 feet or more above sea level, the assembly maximum *U-factor* is permitted to be increased by 0.02 BTU/hr x ft$^2$ x °F.

**Table 5.5-6 Building Envelope Requirements for Climate Zone 6 (A,B)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U[c]** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U[c]** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| | | | | *Vertical Fenestration*, 0% to 40% of *Wall* | | | | | |
| *Fixed* | 0.31 | 0.38 | 1.10 (for all types) | 0.31 | 0.38 | 1.10 (for all types) | 0.35 | NR (for all types) | NR (for all types) |
| *Operable* | 0.38 | 0.34 | | 0.38 | 0.34 | | 0.43 | | |
| *Entrance door* | 0.63 | 0.34 | | 0.63 | 0.34 | | 0.68 | | |
| | | | | *Skylight*, 0% to 3% of *Roof* | | | | | |
| All types | ~~0.45~~0.46 | 0.40 | NR | ~~0.45~~ 0.46 | 0.40 | NR | ~~0.55~~0.65 | NR | NR |

c. At *sites* located 4,000 feet or more above sea level, the assembly maximum *U-factor* is permitted to be increased by 0.02 BTU/hr x ft$^2$ x °F.

*Modify Tables 5.5-2 through 5.5-6 as shown **(SI)**:*

**Table 5.5-2 Building Envelope Requirements for Climate Zone 2 (A,B)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| | | | | *Vertical Fenestration*, 0% to 40% of *Wall* | | | | | |
| *Fixed* | 2.56 | 0.23 | 1.10 (for all types) | 2.56 | ~~0.23~~0.25 | 1.10 (for all types) | 2.72 | NR (for all types) | NR (for all types) |
| *Operable* | 3.41 | 0.21 | | 3.41 | ~~0.21~~0.23 | | 3.52 | | |
| *Entrance door* | 4.37 | 0.21 | | 4.37 | ~~0.25~~0.23 | | 4.37 | | |
| | | | | *Skylight*, 0% to 3% of *Roof* | | | | | |
| All types | 3.69 | 0.30 | NR | 3.69 | 0.30 | NR | 4.26 | NR | NR |

**Table 5.5-3 Building Envelope Requirements for Climate Zone 3 (A,B,C)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| | | | | *Vertical Fenestration*, 0% to 40% of *Wall* | | | | | |
| *Fixed* | ~~2.38~~2.16 | 0.25 | 1.10 (for all types) | ~~2.38~~2.16 | 0.25 | 1.10 (for all types) | 2.72 | NR (for all types) | NR (for all types) |
| *Operable* | 3.07 | 0.23 | | 3.07 | 0.23 | | 3.52 | | |
| *Entrance door* | 3.86 | 0.23 | | 3.86 | 0.23 | | 0.77 | | |
| | | | | *Skylight*, 0% to 3% of *Roof* | | | | | |
| All types | 3.12 | 0.30 | NR | 3.12 | 0.30 | NR | 4.26 | NR | NR |

**Table 5.5-4 Building Envelope Requirements for Climate Zone 4 (A,B,C)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| | | | | *Vertical Fenestration*, 0% to 40% of *Wall* | | | | | |
| *Fixed* | 1.99 | 0.34 | 1.10 (for all types) | 1.99 | 0.34 | 1.10 (for all types) | 2.55 | NR (for all types) | NR (for all types) |
| *Operable* | 2.44 | 0.31 | | 2.44 | 0.31 | | 3.41 | | |
| *Entrance door* | 3.58 | 0.31 | | 3.58 | 0.31 | | 4.37 | | |
| | | | | *Skylight*, 0% to 3% of *Roof* | | | | | |
| All types | ~~2.84~~2.78 | 0.40 | NR | ~~2.78~~2.72 | 0.40 | NR | ~~4.26~~3.69 | NR | NR |

**Table 5.5-5 Building Envelope Requirements for Climate Zone 5 (A,B,C)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U[c]** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U[c]** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| | | | | *Vertical Fenes ration*, 0% to 40% of *Wall* | | | | | |
| *Fixed* | 1.82 | 0.38 | 1.10 (for all types) | 1.82 | 0.38 | 1.10 (for all types) | 2.38 | NR (for all types) | NR (for all types) |
| *Operable* | 2.21 | 0.33 | | 2.21 | 0.33 | | 3.06 | | |
| *Entrance door* | 3.58 | 0.33 | | 3.58 | 0.33 | | 4.37 | | |
| | | | | *Skylight*, 0% to 3% of *Roof* | | | | | |
| All types | ~~2.84~~2.61 | 0.40 | NR | ~~2.61~~2.72 | 0.40 | NR | ~~3.12~~3.69 | NR | NR |

c. At *sites* located 1,200 m or more above sea level, the assembly maximum *U-factor* is permitted to be increased by 0.11 W/m$^2$K.

**Table 5.5-6 Building Envelope Requirements for Climate Zone 6 (A,B)***

| | Nonresidential | | | Residential | | | Semiheated | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fenestration** | **Assembly Max. U[c]** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U[c]** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** | **Assembly Max. U** | **Assembly Max. SHGC** | **Assembly Min. VT/SHGC** |
| | | | | *Vertical Fenestration*, 0% to 40% of *Wall* | | | | | |
| *Fixed* | 1.76 | 0.38 | 1.10 (for all types) | 1.76 | 0.38 | 1.10 (for all types) | 1.99 | NR (for all types) | NR (for all types) |
| *Operable* | 2.16 | 0.34 | | 2.16 | 0.34 | | 2.44 | | |
| *Entrance door* | 3.58 | 0.34 | | 0.63 | 0.34 | | 3.86 | | |
| | | | | *Skylight*, 0% to 3% of *Roof* | | | | | |
| All types | ~~2.67~~2.55 | 0.40 | NR | ~~2.55~~2.61 | 0.40 | NR | ~~3.12~~3.69 | NR | NR |

c. At *sites* located 1,200 m or more above sea level, the assembly maximum *U-factor* is permitted to be increased by 0.11 W/m$^2$K.