BSR/ASHRAE/IES Addendum bx
to ANSI/ASHRAE/IES Standard 90.1-2016

Public Review Draft

Proposed Addendum bx to Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings

First Public Review (January 2019)
(Draft Shows Proposed Changes to Current Standard)

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research--technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE website, www.ashrae.org.

ASHRAE, 1791 Tullie Circle, NE, Atlanta GA 30329-2305

(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

Appendix A contains F-factors for heated slabs, but does not include combinations of perimeter insulation that has a different R-Value than the under-slab insulation. This addenda adds heated slab F-factors for multiple combinations of under-slab and perimeter insulation. These values were derived from a regression of the current heated slab F-factors for fully insulated, uninsulated, and 12" vertical perimeter insulation taken from Table A6.3.1 Assembly F-Factors for Slab-on-Grade Floors.

This proposal does not impact cost effective analysis as we are adding additional values to the appendix. Criteria has not changed.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by <u>underlining</u> (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 current standard 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 changes.]

Addendum bx to 90.1-2016

Modify the standard as follows (IP and SI Units)

A6 SLAB-ON-GRADE FLOORS

A6.1 General

For the purpose of Section A1.2, the base assembly is a slab *floor* of 6 in. concrete poured directly on to the earth, the bottom of the slab is at *grade* line, and soil conductivity is 0.75 Btu/h·ft·°F. In contrast to the *U-factor* for *floors*, the *F-factor* for *slab-ongrade floors* is expressed per linear foot of *building* perimeter. *F-factors* are provided for unheated slabs and for heated slabs. *Unheated slab-on-grade floors* do not have heating elements, and *heated slab-on-grade floors* do have heating elements within or beneath the slab. *F-factors* are provided for ~~three~~ <u>five</u> insulation configurations:

a. Horizontal Insulation: *Continuous insulation* is applied directly to the underside of the slab and extends inward horizontally from the perimeter for the distance specified, or *continuous insulation* is applied downward from the top of the slab and then extends horizontally to the interior or the exterior from the perimeter for the distance specified.
b. Vertical Insulation: *Continuous insulation* is applied directly to the slab exterior, extending downward from the top of the slab for the distance specified.
c. Fully Insulated Slab: *Continuous insulation* extends downward from the top of the slab and along the entire perimeter and completely covers the entire area under the slab.
<u>d. Under-Slab Insulation only: Insulation installed under the entire slab. The slab edge remains uninsulated.</u>

e. Uninsulated: Slabs without insulation under the slab and at the slab edge.

A6.2 Rated R-Value of Insulation for Slab-on-Grade Floors

A6.2.1

The *rated R-value of insulation* shall be installed around the perimeter of the *slab-ongrade floor* to the distance specified.

Exception to A6.2.1

For a monolithic *slab-on-grade floor*, the insulation shall extend from the top of the slab-on-*grade* to the bottom of the footing.

A6.2.2

Insulation installed inside the foundation *wall* shall extend downward from the top of the slab a minimum of the distance specified or to the top of the footing, whichever is less.

A6.2.3

Insulation installed outside the foundation *wall* shall extend from the top of the slab or downward to at least the bottom of the slab and then horizontally to a minimum of the distance specified. In all climates, the horizontal insulation extending outside of the foundation shall be covered by pavement or by soil a minimum of 10 in. thick.

A6.3 F-Factors for Slab-on-Grade Floors

A6.3.1

F-factors for *slab-on-grade floors* shall be taken from Table A6.3.1-1 or A6.3.1-2.

A6.3.2

These *F-factors* are acceptable for all *slab-on-grade floors*.

Table A6.3.1-1 Assembly F-Factors for Slab-on-Grade Floors

Insulation Description	Rated R-Value of Insulation												
	~~R-0.0~~ R-3.5	R-5	R-7.5	R-10	R-15	R-20	R-25	R-30	R-35	R-40	R-45	R-50	R-55
Unheated Slabs													
~~None 0.73~~													
Uninsulated: 0.73													
No change to other unheated slab values													
Heated Slabs													
~~None~~ Uninsulated: 1.35	~~1.35~~												
12 in. horizontal		1.31	1.31	1.30	1.30								
24 in. horizontal		1.28	1.27	1.26	1.25								
36 in. horizontal		1.24	1.21	1.20	1.18								
48 in. horizontal		1.20	1.17	1.13	1.11								
12 in. vertical		1.06	1.02	1.00	0.98	0.968	0.964	0.961					
24 in. vertical		0.99	0.95	0.90	0.86	0.843	0.832	0.827					
36 in. vertical		0.95	0.89	0.84	0.79	0.762	0.747	0.740					
48 in. vertical		0.91	0.85	0.78	0.72	0.688	0.671	0.659					
Fully insulated slab		0.74	0.64	0.55	0.44	0.373	0.326	0.296	0.273	0.255	0.239	0.227	0.217
Under-slab insulation only	1.06	1.01	0.95	0.90	0.82	0.76							

Table A6.3.1-2 Assembly F-Factors for Fully Insulated Heated Slab-on-Grade Floors

Insulation Description	Rated R-Value of Edge Insulation							
	R-3.5	R-5	R-7.5	R-10	R-15	R-20	R-25	R-30
Heated Slabs								
R-3.5 under slab	0.81	0.78	0.74	0.71	0.69	0.671	0.670	0.669
R-5 under slab	0.77	0.74	0.69	0.66	0.62	0.602	0.602	0.601
R-7.5 under slab	0.71	0.67	0.64	0.60	0.58	0.566	0.564	0.563
R-10 under slab	0.66	0.62	0.58	0.55	0.51	0.496	0.494	0.493
R-15 under slab	0.57	0.54	0.50	0.47	0.45	0.433	0.432	0.431
R-20 under slab	0.51	0.48	0.44	0.41	0.39	0.371	0.370	0.369

Table A6.3.1-1 Assembly F-Factors for Slab-on-Grade Floors (SI)

Insulation Description	*Rated R-Value of Insulation*												
	~~R-0.0~~ R-0.6	R-0.9	R-1.3	R-1.8	R-2.6	R-3.5	R-4.4	R-5.3	R-6.2	R-7.0	R-7.9	R-8.8	R-9.7
Unheated Slabs													
~~None~~	~~1.26~~												
Uninsulated: 1.26													
No change to other unheated slab values													
Heated Slabs													
~~None~~	~~2.33~~												
Uninsulated: 2.33													
300 mm horizontal		2.27	2.26	2.26	2.25								
600 mm horizontal		2.21	2.19	2.18	2.16								
900 mm horizontal		2.14	2.10	2.07	2.04								
1200 mm horizontal		2.08	2.02	1.96	1.92								
300 mm vertical		1.84	1.76	1.73	1.70	1.67	1.67	1.66					
600 mm vertical		1.72	1.64	1.57	1.50	1.46	1.44	1.43					
900 mm vertical		1.64	1.54	1.45	1.36	1.32	1.29	1.28					
1200 mm vertical		1.57	1.47	1.35	1.25	1.19	1.16	1.14					
Fully insulated slab		1.28	1.11	0.95	0.76	0.65	0.56	0.51	0.47	0.44	0.41	0.39	0.38
Under-slab insulation only	1.83	1.75	1.64	1.56	1.42	1.32							

Table A6.3.1-2 Assembly F-Factors for Fully Insulated Heated Slab-on-Grade Floors (SI)

Insulation Description	Rated R-Value of Edge Insulation							
	R-0.6	R-0.9	R-1.3	R-1.8	R-2.6	R-3.5	R-4.4	R-5.3
Heated Slabs								
R-0.6 under slab	1.40	1.35	1.27	1.22	1.19	1.16	1.16	1.16
R-0.9 under slab	1.33	1.28	1.19	1.14	1.07	1.04	1.04	1.04
R-1.3 under slab	1.22	1.16	1.11	1.04	1.01	0.98	0.98	0.97
R-1.8 under slab	1.13	1.08	1.00	0.95	0.88	0.85	0.85	0.85
R-2.6 under slab	0.99	0.93	0.86	0.81	0.78	0.75	0.75	0.75
R-3.5 under slab	0.89	0.83	0.75	0.70	0.67	0.64	0.64	0.64