



**Addendum p
to ANSI/ASHRAE/IES Standard 90.2-2018**

Public Review Draft

Proposed Addendum p to Standard 90.2-2018, High-Performance Energy Design of Residential Buildings

**First Advisory Public Review (February 2024)
(Draft Shows Proposed Changes to Current Standard)**

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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 standard did not offer a prescriptive option in its 2018 publication because the SSPC believed and continues to believe that performance-based compliance saves money and allows markets in energy efficiency to develop, offering new and better ways of meeting a performance goal.

But we recognized that some jurisdictions and other users wanted a prescriptive option, and Appendices E and F offered optional (non-normative) advice on how to construct such options. The language of the recipe in Appendix E was normative because we wanted to assure that IF a user developed such an option, they did it in such a way that it did not water down the requirements of the normative standard.

Appendix F was an example of what the user could set forth if they wanted to comply with U.S. law on equipment efficiency.

The current publication of 90.2 makes a number of significant changes, most notably increasing the requirements for efficiency and renewable energy substantially along a path to Net Zero energy and Net Zero emissions. As a result, the recipe of the current Appendix E has become outdated. This new text updates the requirements to again assure consistency in energy performance and now also in carbon emissions performance compared to the normative text. It also attempts to do so in a cost-minimizing way.

This change would make Appendix F obsolete, as it no longer complies with the recipe. But developing a new example is problematic because of the variability of the role that renewable energy, both rooftop solar and off-site renewables, would, or should, throw into the mix. This adds a dimension or two to the optimization and is more of a research project than the SSPC could undertake. Thus, we propose the deletion of the Appendix, at least until a reasonable prescriptive option is offered and analyzed.

[Note to Reviewers: This addendum makes proposed changes to the current standard. 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 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 p to 90.2-2018

(This appendix 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.)

INFORMATIVE APPENDIX E

PROCEDURES FOR GENERATING PRESCRIPTIVE PATHS

Appendix provides a recipe for how to construct one or more prescriptive paths using a model. It provides an optional alternative to the performance-based requirements of the normative standard. This appendix itself is not mandatory.

E1. PRESCRIPTIVE COMPLIANCE GUIDES

Prescriptive compliance guides shall comply with this standard, including Section 6 and applicable requirements of Section 7, and shall be generated in accordance with either Section E1.1, Section E1.2, or Section E1.3. In all cases, prescriptive guidelines shall comply with the envelope provisions of the most recent version of the DOE Zero Energy Ready Homes program, and for fenestration, with the most recent Energy Star Most Efficient specification. Section 7.1.1 of the standard, and, where on-site power production is incorporated, prescriptive guidelines shall comply with Section 6.3.1 of the standard. Prescriptive compliance guides may be derived for the normative standard and for the Informative Net Zero options in Appendix J.

E1.1 Worst-Case Home Plan Guides. For a specific home plan to be constructed in a specific weather location, a set of prescriptive specifications may be developed such that under the worst-case home orientation the specified home plan will comply with the requirements of Section 6 of this standard. Homes conforming to this Worst-Case Home Plan Guide may be constructed at multiple sites in any orientation within the specific weather location.

E1.2 Local Area Prescriptive Guides. For a specific weather location, a prototype home configured in accordance with Section E1.2.1 shall be used to generate local area prescriptive guides for the specified weather location.

E1.2.1 Prototype Home Configuration (See Figure E-1.)

E1.2.1.1 The total *conditioned floor area* of the prototype shall be 2400 ft² (220 m²).

E1.2.1.2 The prototype shall have 1200 ft² (110 m²) of *conditioned floor area* on the first level and 1200 ft² (110 m²) of *conditioned floor area* on the second level, with a first-level floor to second-level ceiling height of 17 ft (5.2 m) (i.e., two 8 ft (2.4 m) high floor levels plus 1 ft high (0.3 m) interstitial floor structure).

E1.2.1.3 The prototype shall have a hip roof with composition shingles and a 5/12 roof pitch.

E1.2.1.4 The prototype shall have 3 *bedrooms*.

E1.2.1.5 The length of the prototype shall be 40.0 ft (12.0m), and the width of the prototype shall be 30.0 ft (9.00 m).

E1.2.1.6 The window area of the prototype shall be apportioned such that 35% of the total window area is located on each of the 40.0 ft (12.0 m) faces of the prototype, and 15% of the total window area is located on each of the 30.0 ft (9.00 m) faces of the prototype.

E1.2.1.7 A garage with 20.0 linear ft (6.00 m) of wall adjoining the *conditioned space* shall be located on one of the 40.0 ft (12.0 m) faces of the prototype.

E1.2.1.8 The area of vertical *fenestration* and the area of skylights, respectively, in the prototype shall be equal to the maximum area of each type of fenestration, separately, to be allowed in the prescriptive guide specifications.

E1.2.1.9 For jurisdictions in the United States, the heating and water heating equipment shall be heat pumps and 60-gallon heat pump water heaters with the efficiency required in 10 CFR Section 430. For other locations and other uses than energy codes they shall meet the most recent Energy Star Most Efficient specification.

E1.2.1.10 For jurisdictions in the United States, all other appliances and equipment, including light bulbs, shall be electric with the efficiency required in 10 CFR Section 430. For other locations and other uses than energy codes they shall meet the specifications of Energy Star Most Efficient, and plumbing fixtures shall meet the specifications in California Title 20 Water Efficiency Standards.

E1.2.1.11 The prototype home shall be equipped with a solar PV generating system that produces 5 kW and oriented within 90 degrees of South (in the Northern Hemisphere) or North (in the Southern Hemisphere) and shall have 7.5 kWh of storage.

E1.2.2 Determination of Prescriptive Guide Specifications. Unless the prescriptive guide specification includes requirements for orientation of *fenestration*, the prototype shall be simulated in accordance with this standard in the specified weather location for each of the four cardinal compass orientations facing north, east, south, and west. The worst-case Energy Rating Index (ERI) and CO₂e Rating Index (CRI) from these four prototype orientations shall comply with the requirements of Section 6 of this standard. Where the prescriptive guide specification includes requirements for *fenestration* orientation, these shall be minimally met in the simulations¹

¹ Where the prescriptive guide is intended to be orientation specific and, for example, require that no more than 5% of the total window areas face east and no more than 5% face west, with no less than 50% of the total window

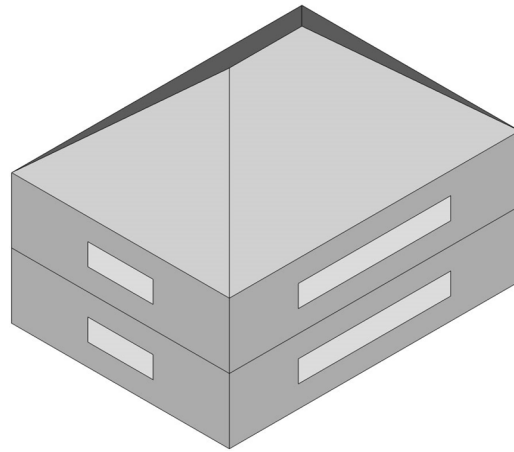


Figure E-1 Isometric schematic of prototype to be used for Sections E1.2 and E1.3 of this procedure.

Table E-1 Weather Locations

| Climate Zone | Weather Sites |
|--------------|---|
| 0 | Ho Chi Minh City, <u>Vietnam</u> Dubai, <u>UAE</u> |
| 1 | Miami, FL |
| 2 | Houston, TX Phoenix, AZ |
| 3 | Atlanta, GA El Paso, TX Los Angeles, CA |
| 4 | Philadelphia, PA Albuquerque, NM Seattle, WA |
| 5 | Chicago, IL |
| 6 | Minneapolis, MN |
| 7 | Duluth, MN |
| 8 | Fairbanks, AK |

E1.3 Climate Zone Prescriptive Guides. For a specific climate zone, a prototype home configured in accordance with Section E1.3.1 shall be used to generate climate zone prescriptive guides for the specified climate zone.

E1.3.1 Prototype Home Configuration (See Figure E-1.)

E1.3.1.1 The total *conditioned floor area* of the prototype shall be 2400 ft² (220 m²).

E1.3.1.2 The prototype shall have 1200 ft² (110 m²) of *conditioned floor area* on the first level and 1200 ft² (110 m²) of *conditioned floor area* on the second level, with a first-level floor to second-level ceiling height of 17 ft (5.2 m) (i.e., two 8 ft (2.4 m) high floor levels plus 1 ft high (0.3 m) interstitial floor structure).

E1.3.1.3 The prototype shall have a hip roof with composition shingles and a 5/12 roof pitch.

area facing south with a specified structural overhang ratio, then the simulations qualifying the prescriptive guide must simulate the prototype using these exact features.

E1.3.1.4 The prototype shall have 3 *bedrooms*.

E1.3.1.5 The length of the prototype shall be 40.0 ft (12.0 m), and the width of the proto- type shall be 30.0 ft (9.00 m).

E1.3.1.6 The window area of the prototype shall be apportioned such that 35% of the total window area is located on each of the be 40.0 ft (12.0 m) faces of the prototype, and 15% of the total window area is located on each of the 30.0 ft (9.00 m) faces of the prototype.

E1.3.1.7 A garage with 20.0 linear ft (6.00 m) of wall adjoining the *conditioned space* shall be located on one of the be 40.0 ft (12.0 m) faces of the prototype.

E1.3.1.8 The area of vertical fenestration and the area of skylights, respectively, in the prototype shall be equal to the maximum area of each type of fenestration, separately, to be allowed in the Prescriptive Guide specifications.

E1.3.1.9 For jurisdictions in the United States, the heating and water heating equipment shall be heat pumps and 60-gallon heat pump water heaters with the efficiency required in 10 CFR Section 430. For other locations and other uses than energy codes they shall meet the most recent Energy Star Most Efficient specification.

E1.3.1.10 For jurisdictions in the United States, all other appliances and equipment, including light bulbs, shall be electric with the efficiency required in 10 CFR Section 430. For other locations and other uses than energy codes they shall meet the specifications of Energy Star Most Efficient, and plumbing fixtures shall meet the specifications in California Title 20 Water Efficiency Standards.

E1.3.1.11 The prototype home shall be equipped with a solar PV generating system that produces 5 kW and oriented within 90 degrees of South (in the Northern Hemisphere) or North (in the Southern Hemisphere) and shall have 7.5 kWh of storage.

E1.3.2 Weather Locations. To determine climate zone prescriptive guidelines, the prototype home shall be simulated in all of the appropriate weather locations shown in Table E-1 and the simulation results from the different weather locations averaged to determine the climate zone prescriptive guide specifications.

E1.3.3 Unless the Prescriptive Guide specification includes requirements for orientation of *fenestration*, the prototype shall be simulated in accordance with this standard in each of the specified weather locations for each of the four ~~or~~ cardinal compass orientations facing north, east, south, and west. The worst-case average ERI and CO₂e Rating Index (CRI) from these four prototype orientations shall comply with the requirements of Section 6 of this standard. Where the Prescriptive Guide specification includes requirements for *fenestration* orientation, these shall be minimally met in the simulations.

E2. COMPLIANCE GUIDE DOCUMENTS

All prescriptive compliance guides shall be documented in writing in accordance with Sections E2.1 through E2.5 of this Procedure.

E2.1 Conditioned Space Enclosures

E2.1.1 The compliance guide shall specify the minimum thermal performance criteria for all wall, floor, ceiling, *fenestration*, roof, attic, and foundation components of the *conditioned space* enclosure.

E2.1.2 The compliance guide shall specify the maximum air leakage criteria for the *conditioned space* enclosure.

E2.1.3 The compliance guide shall specify the maximum glazing area to *conditioned floor area* ratio, and where window orientation is specific to the prototype analysis, the guide shall specify the orientation and window-to-floor area ratios required to comply with the guide.

E2.2 Equipment

E2.2.1 The compliance guide shall specify the minimum performance rating ~~by fuel type~~ for heating, cooling, and water heating equipment. It shall require that the primary systems equipment be electric and that the water heaters be larger than 55 gallons.

E2.2.2 The compliance guide shall specify the maximum air leakage rate to the outdoors of forced-air distribution systems, as measured at a pressure difference of 0.52 lb/ft² (25 Pa) (0.1 in. of water)

E2.2.3 The compliance guide shall specify the thermostat *controls* required.

E2.2.4 The compliance guide shall specify any hot-water system requirements that differ from the standard reference hot-water system configuration. Any requirements for recirculation systems and *controls*, maximum

pipng length, drain water heat recovery, or other hot-water system improvements shall be specified by the guide.

E2.2.5 The prototype home shall be equipped with a solar PV generating system that produces 5 kW and is oriented South (in the Northern Hemisphere) or North (in the Southern Hemisphere), or the equivalent in on-site or off-site energy in accordance with the provisions of 6.3 and shall have installed 7.5 kWh of storage.

~~E2.2.6~~ The compliance guide shall specify that mechanical *ventilation* shall be provided in accordance with the minimum requirements of ANSI/ASHRAE Standard 62.2 and all additional requirements in this standard.

E2.2.7 The compliance guide shall provide the electric vehicle charging equipment specified in Addendum k.

E2.3 Lighting and Appliances

E2.3.1 The compliance guide shall specify the lighting *efficacy* required to comply with the guide.

E2.3.2 The compliance guide shall specify the lighting *controls* required to comply with the guide.

E2.3.3 The compliance guide shall specify the minimum performance requirements for major appliances, including, at a minimum, refrigerators, clothes washers, clothes dryers, and dishwashers. (*Note:* This specification can be as simple as the standard versus Energy Star.)

E2.4 Applicability

E2.4.1 The compliance guide shall specify the weather location or climate zone(s) for which the guide is applicable.

E2.4.2 The compliance guide shall specify all circumstances, if any, for which the guide is not applicable within the applicable weather location or climate zone(s).

E2.5 Compliance. The compliance guide shall provide summary documentation of the ERI and CO₂e Rating Index (CRI) results of the simulation analysis showing that the compliance guide conforms to the requirements of Section E1.1, E1.2, or E1.3 of this procedure.

E6. REFERENCE STANDARDS

10 CFR Section 430 US Department of Energy Appliance Energy Conservation Standards, June 2024.
Energy Star Most Efficient specification.

https://www.energystar.gov/partner_resources/products_partner_resources/energy_star_most_efficient_2023_criteria

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INFORMATIVE APPENDIX F

EXAMPLE OF NAECA PRESCRIPTIVE PATH

F1. EXISTING BUILDING ENVELOPE

~~F1.1 Envelope components shall be in accordance with Table F-1.~~

~~F1.2 Fenestration. Fenestration shall be limited as follows:~~

- ~~a. Total vertical window area shall be limited to 15% of conditioned floor area.~~
- ~~b. Skylights are not allowed in this prescriptive path.~~

~~F1.3 Envelope leakage not to exceed 5 ACH₅₀ in Climate Zones 1 and 2, and 3 ACH₅₀ in Climate Zones 3 through 8.~~

F2. MECHANICAL SYSTEMS

~~F2.1 Heating, cooling, and water heating equipment efficiencies shall be in accordance with 10 CFR Section 430.~~

~~F2.2 Forced air distribution systems located entirely within the conditioned space with a substantially leak free air distribution system, where substantially leak free is defined as leakage to outdoors not exceeding 3 cfm₂₅ per 100 ft² (10 m²) of conditioned space.~~

~~F2.3 ANSI/ASHRAE Standard 62.2 compliant whole house mechanical ventilation systems.~~

F3. LIGHTING

~~F3.1 Lighting equipment efficacies shall be in accordance with Section 7.5.2. Use the required lighting controls in Section 7.5.2.~~

F4. ON-SITE POWER

~~Minimum on-site photovoltaic (PV) systems shall be installed in accordance with the Table F-2.~~

F5. APPLIANCES AND OTHER SYSTEMS

~~Energy Star 2015 major appliances for clothes washers, dishwashers, and refrigerators.~~

F6. REFERENCE STANDARDS

~~10 CFR Section 430 US Department of Energy Appliance Energy Conservation Standards, January 2017.~~

Table F 1 Maximum SHGC and U Factors (LP)

| Climate Zone | Maximum SHGC | Maximum U-Factors | | | | | | |
|-----------------|---------------------|-------------------|----------|-------------|------------|--------|----------------|------------------|
| | Glazed Fenestration | Fenestration | Ceilings | Frame Walls | Mass Walls | Floors | Basement Walls | Crawlspace Walls |
| 0 | 0.25 | 0.50 | 0.035 | 0.084 | 0.197 | 0.064 | 0.360 | 0.477 |
| 1 | 0.25 | 0.50 | 0.035 | 0.084 | 0.197 | 0.064 | 0.360 | 0.477 |
| 2 | 0.25 | 0.40 | 0.030 | 0.084 | 0.165 | 0.064 | 0.360 | 0.477 |
| 3 | 0.25 | 0.35 | 0.030 | 0.060 | 0.098 | 0.047 | 0.091 | 0.136 |
| 4 except Marine | 0.40 | 0.35 | 0.026 | 0.060 | 0.098 | 0.047 | 0.059 | 0.065 |
| Marine 4 and 5 | NR | 0.32 | 0.026 | 0.060 | 0.082 | 0.033 | 0.050 | 0.055 |
| 6 | NR | 0.32 | 0.026 | 0.045 | 0.060 | 0.033 | 0.050 | 0.055 |
| 7 | NR | 0.32 | 0.026 | 0.045 | 0.057 | 0.028 | 0.050 | 0.055 |
| 8 | NR | 0.32 | 0.026 | 0.045 | 0.057 | 0.028 | 0.050 | 0.055 |

Table F 1 Maximum SHGC and U Factors (SI)

| Climate Zone | Maximum SHGC | Maximum U-factors | | | | | | |
|-----------------|---------------------|-------------------|----------|-------------|------------|--------|----------------|------------------|
| | Glazed Fenestration | Fenestration | Ceilings | Frame Walls | Mass Walls | Floors | Basement Walls | Crawlspace Walls |
| 0 | 0.25 | 2.84 | 0.20 | 0.48 | 1.12 | 0.36 | 2.04 | 2.71 |
| 1 | 0.25 | 2.84 | 0.20 | 0.48 | 1.12 | 0.36 | 2.04 | 2.71 |
| 2 | 0.25 | 2.27 | 0.17 | 0.48 | 0.94 | 0.36 | 2.04 | 2.71 |
| 3 | 0.25 | 1.99 | 0.17 | 0.34 | 0.56 | 0.27 | 0.52 | 0.77 |
| 4 except Marine | 0.40 | 1.99 | 0.15 | 0.34 | 0.56 | 0.27 | 0.34 | 0.37 |
| Marine 4 and 5 | NR | 1.82 | 0.15 | 0.34 | 0.47 | 0.19 | 0.28 | 0.31 |
| 6 | NR | 1.82 | 0.15 | 0.26 | 0.34 | 0.19 | 0.28 | 0.31 |
| 7 | NR | 1.82 | 0.15 | 0.26 | 0.32 | 0.16 | 0.28 | 0.31 |
| 8 | NR | 1.82 | 0.15 | 0.26 | 0.32 | 0.16 | 0.28 | 0.31 |

Table F 2 On-Site Power Table

| Climate Zone | Photovoltaic Watts |
|--------------|--------------------|
| 0 | 1250 |
| 1 | 1250 |
| 2 | 1500 |
| 3 | 1500 |
| 4 | 1500 |

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| | |
|---|------|
| 5 | 2000 |
| 6 | 2250 |
| 7 | 2250 |
| 8 | 3500 |