



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

**Public Review Draft**

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

**First Public Review (December 2024)  
(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](http://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](http://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](http://www.ashrae.org).

The appearance of any technical data or editorial material in this public review document does not constitute endorsement, warranty, or guaranty by ASHRAE of any product, service, process, procedure, or design, and ASHRAE expressly disclaims such.

© 2024 ASHRAE. This draft is covered under ASHRAE copyright. Permission to reproduce or redistribute all or any part of this document must be obtained from the ASHRAE Manager of Standards, 180 Technology Parkway NW, Peachtree Corners, GA 30092. Phone: 404-636-8400, Ext. 1125. Fax: 404-321-5478. E-mail: [standards.section@ashrae.org](mailto:standards.section@ashrae.org).

**ASHRAE, 180 Technology Parkway NW, Peachtree Corners, GA 30092**

© 2024 ASHRAE

*This draft is covered under ASHRAE copyright. The appearance of any technical data or editorial material in this publication document does not constitute endorsement, warranty, or guaranty by ASHRAE of any product, service, process, procedure, design or the like and ASHRAE expressly disclaims such. Permission to republish or redistribute must be obtained from the MOS.*

**(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

*The Simplified Performance Rating Method is an alternative, streamlined path to model-based compliance for simple buildings. The intent is to encourage the adoption of building energy modeling and iterative analysis for buildings and systems that do not require the details and complexities of the Appendix G Performance Rating Method. This pathway allows simplified, generic zones rather than space-by-space modeling which requires the modification of some Performance Rating Method requirements. This also makes many requirements and exceptions null and not able to be applied in the same way. Complex HVAC systems are also beyond the scope of the Simplified Performance Rating Method pathway. For these reasons, the Simplified Performance Rating Method path excludes buildings with spaces or systems for which these simplifications would significantly influence the compliance result.*

*This adds an additional normative appendix to the standard which would provide an alternative whole building performance-based approach for simple buildings with the eventual goal of encouraging more buildings to comply using a performance-based approach. It includes a set of ‘partial prescriptive’ requirements, similar to the HVAC System Performance approach in Normative Appendix L, which requires compliance with prescriptive requirements that are critical to be met but cannot be analyzed using the simplified modeling approach.*

*[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 bj to 90.1-2022

---

### 4.2 Compliance

#### 4.2.1 Compliance Paths

**4.2.1.1 New Buildings.** New buildings shall comply with Section 4.2.2 through 4.2.5 and either the provisions of

- a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or
- b. Section 12, “Energy Cost Budget Method,” or
- c. Normative Appendix G, “*Performance Rating Method*” Or
- d. Normative Appendix X, “Simplified Performance Rating Method.”

When using Normative Appendix G or Normative Appendix X, the Performance Cost Index (PCI) of new buildings, additions to existing buildings, and/or alterations to existing buildings shall

be less than or equal to the Performance Cost Index Target ( $PCI_t$ ) when calculated in accordance with the following:

$$PCI_t = [BBUEC + (BPF \times BBREC) - PRE] / BBP$$

where

- PCI = Performance Cost Index calculated in accordance with Section G1.2.2
- BBUEC = baseline *building* unregulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *unregulated energy use*
- BPF = *building* performance factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1, use “All others.” Where a *building* has multiple *building* area types, the required BPF shall be equal to the area-weighted average of the *building* area types based on their *gross floor area*. Where a project includes an *existing building* and an *addition*, the required BPF shall be equal to the area-weighted average, based on the *gross floor area*, of the *existing building* BPF determined as described in Section 4.2.1.3 and the *addition* BPF from Table 4.2.1.1.
- BBREC = baseline *building* regulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *regulated energy use*
- PRE =  $PBP_{nre} - PBP_{pre}$
- PBP = *proposed building performance*, including the reduced, annual *purchased energy* cost associated with all *on-site renewable energy* generation systems
- $PBP_{nre}$  = *proposed building performance* without any credit for reduced annual *energy* costs from *on-site renewable energy* generation systems
- $PBP_{pre}$  = *proposed building performance*, excluding any *renewable energy system* in the *proposed design* and including an *on-site renewable energy system* that meets but does not exceed the requirements of Section 10.5.1.1 modeled following the requirements for a *budget building design* in Table 12.5.1, row 15
- BBP = *baseline building performance*

Regulated *energy* cost shall be calculated by multiplying the total *energy* cost by the ratio of *regulated energy use* to total *energy* use for each *fuel* type. Unregulated *energy* cost shall be calculated by subtracting regulated *energy* cost from total *energy* cost.

**Table 4.2.1.1 Building Performance Factor (BPF)**

Building Area Type	Climate Zone																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Multifamily	0.69	0.68	0.71	0.70	0.72	0.72	0.71	0.76	0.63	0.69	0.76	0.71	0.66	0.72	0.71	0.65	0.67	0.65	0.67
Healthcare/hospital	0.69	0.69	0.70	0.68	0.67	0.65	0.65	0.66	0.64	0.64	0.66	0.63	0.67	0.65	0.65	0.66	0.67	0.68	0.70
Hotel/motel	0.66	0.66	0.69	0.65	0.65	0.64	0.64	0.65	0.65	0.63	0.65	0.63	0.62	0.63	0.62	0.61	0.62	0.59	0.58
Office	0.54	0.54	0.53	0.52	0.52	0.52	0.50	0.54	0.48	0.48	0.53	0.48	0.49	0.52	0.48	0.48	0.49	0.46	0.48
Restaurant	0.62	0.59	0.57	0.57	0.57	0.53	0.57	0.53	0.51	0.55	0.54	0.54	0.57	0.56	0.55	0.59	0.58	0.61	0.64
Retail	0.51	0.49	0.48	0.48	0.44	0.43	0.43	0.43	0.44	0.42	0.43	0.46	0.43	0.42	0.47	0.43	0.43	0.41	0.44
School	0.52	0.57	0.57	0.56	0.52	0.53	0.52	0.49	0.50	0.46	0.47	0.47	0.47	0.46	0.46	0.46	0.44	0.45	0.45
Warehouse	0.26	0.26	0.22	0.25	0.21	0.22	0.25	0.21	0.19	0.25	0.22	0.22	0.28	0.24	0.22	0.31	0.28	0.29	0.32
All others	0.62	0.60	0.62	0.59	0.55	0.51	0.53	0.52	0.55	0.53	0.52	0.55	0.53	0.53	0.56	0.54	0.54	0.54	0.54

.....

**4.2.1.2 Additions to Existing Buildings.** *Additions to existing buildings* shall comply with the provisions of Section 4.2.2 through 4.2.5 and one of the following:

- a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or
- b. Section 12, “Energy Cost Budget Method,” or
- c. Normative Appendix G, “Performance Rating Method,” in accordance with Section 4.2.1.1. or
- d. Normative Appendix X, “Simplified Performance Rating Method.” in accordance with Section 4.2.1.1.

**4.2.1.2.1** When an *addition* to an *existing building* cannot comply by itself, trade-offs will be allowed by modification to one or more of the existing components of the *existing building*. Modeling of the modified components of the *existing building* and *addition* shall employ the procedures of Section 12-~~or~~ Normative Appendix G or Normative Appendix X; the *addition* shall not increase the *energy* consumption of the *existing building* plus the *addition* beyond the *energy* that would be consumed by the *existing building* plus the *addition* if the *addition* alone did comply.

**4.2.1.3 Alterations of Existing Building Assemblies, Systems, and Equipment.** *Alterations of existing building assemblies, systems, and equipment* shall comply with the provisions of Section 4.2.2 through 4.2.5 and one of the following:

- a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or
- b. Section 12, “Energy Cost Budget Method,” or
- c. Normative Appendix G, “Performance Rating Method,” in accordance with Section 4.2.1.1 with the following modifications:
  1. *Alterations* that meet the criteria in Section G3.1.4(a) shall use the BPF from Table 4.2.1.1 multiplied by 1.05.
  2. All other *alterations* modeled following Section G3.3 shall use BPF = 1
- d. Normative Appendix X, “Simplified Performance Rating Method” in accordance with Section 4.2.1.1. *Alterations* that meet the criteria in Section G3.1.4(a) shall use the BPF from Table 4.2.1.1 multiplied by 1.05.

**Exceptions to 4.2.1.3:** A *building* that has been specifically designated as historically significant by the *adopting authority* or is listed in The National Register of Historic Places or has been determined to be eligible for listing by the U.S. Secretary of the Interior need not comply with these requirements.

**4.2.1.4 New Sites and New Site Systems and Equipment.** *New sites* and *new site systems* and *equipment* shall comply with either the provisions of

- a. Sections 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; and 10, “Other Equipment,” or
- b. Section 12, “Energy Cost Budget Method.”

**All new text, has not been underlined**

## NORMATIVE APPENDIX X

### SIMPLIFIED PERFORMANCE RATING METHOD FOR SIMPLE BUILDINGS

#### X.1. GENERAL

**X.1.1 Scope.** This appendix offers an alternative path for minimum standard compliance in accordance with Section 4.2.1.1 when administered by a *building official*. It is also provided for those who wish to use this appendix to quantify performance that exceeds the requirements of this standard when administered by a *rating authority* and not seeking minimum standard compliance in accordance with Section 4.2.1.1. It shall be used for evaluating the performance of all such *proposed designs*, including *alterations* and *additions* to *existing buildings*, except designs with no mechanical systems. In the case where this appendix is administered solely by a *building official* to determine compliance with this standard in accordance with Section 4.2.1.1, all references to “*rating authority*” shall be replaced with “*building official*.”

#### Informative Notes:

- a. To fully utilize the investment made to create a *building* energy model during the design process, the methodology described in ASHRAE Standard 209 should be considered.
- b. The *Simplified Performance Rating Method* is an alternative, streamlined path to model-based compliance for simple *buildings*. The intent is to encourage the adoption of *building* energy modeling and iterative analysis for *buildings* and *systems* that do not require the details and complexities of the Appendix G Performance Rating Method. This pathway allows simplified, generic zones rather than space-by-space modeling which requires the modification of some *Performance Rating Method* requirements. This also makes many requirements and exceptions null and not able to be applied in the same way. Complex HVAC *systems* are also beyond the scope of the *Simplified Performance Rating Method* pathway. For these reasons, the *Simplified Performance Rating Method* path excludes buildings with spaces or systems for which these simplifications would significantly influence the compliance result.

#### X.1.2 Simplified Performance Rating Method Applicability Criteria

The Simplified Performance Rating Method shall be used for office, retail, school, hotel and multifamily building types, which do not have the features excluded in the subsections below.

##### X.1.2.1 Excluded Areas

*Buildings* with the following areas are excluded from using the *Simplified Performance Rating Method*.

1. Commercial kitchens with total cooking capacity exceeding 100,000 Btu/h (29.28 kW)
2. Spaces with commercial refrigeration equipment exceeding 100 kW of power input.
3. Data centers and *computer rooms* with *equipment* power density exceeding 20 W/ft<sup>2</sup> (216 W/m<sup>2</sup>) of conditioned floor area and exceeding 10 kW of *equipment* load.
4. Laboratories with fume hoods
5. Locker rooms with more than 4 showers
6. Dining rooms associated with *commercial kitchens* with a total cooking capacity exceeding 100,000 Btu/h (29.28 kW)
7. Natatoriums or rooms with saunas

##### X.1.2.2 Excluded HVAC Systems

*Building* that are served by the following *HVAC systems* are excluded from using the *Simplified Performance Rating Method*:

1. Multi-zone *HVAC systems* except for systems that serve only zones with similar loads and schedules including the following:
  - a. Zones with the same space type or zones where peak internal loads differ by less than 10 Btu/h·ft<sup>2</sup> (31.5

W/m<sup>2</sup>) from the average of all the zones served by the multi-zone *system*.

- b. Zones which have schedules that differ by 40 or less equivalent full-load hours per week.
2. Multi-zone *systems* except DOAS *systems*.
3. On-site hydronic chilled water *systems*, and on-site hydronic hot water *systems* except for hydronic systems serving water loop heat pumps and PTACs.
4. *Systems* with underfloor air distribution.
5. *Systems* used for recovering heat on site, except for air-side energy recovery systems and heat recovery VRF systems.
6. Radiant cooling *systems*
7. Chilled beams
8. *Systems* with *humidistatic controls*
9. *Systems* meeting any of the exceptions to Section G3.2.2.5

**Informative Note:**

Buildings which want to take credit for a measure or system that is not credited through the *Simplified Performance Rating Method*, should instead use Appendix G, *Performance Rating Method*

**X.1.3 Mandatory Provisions.**

The *proposed design* shall comply with section G1.2.1 Mandatory Provisions.

**X.1.4 Partial Prescriptive Requirements.** *The proposed design using the Simplified Performance Rating Method shall meet the following prescriptive requirements:*

1. *Building envelope* shall meet the requirements of Section 5.5.5.
2. *Air economizers* shall meet the requirements of Sections 6.5.1.1.5 and 6.5.1.1.6.
3. *Variable-air-volume systems* shall meet requirements of Sections 6.5.3.2.2, 6.5.3.2.3, and 6.5.3.3.

**X.1.5 Performance Rating Calculation.**

The performance of the *proposed design* is calculated following section G1.2.2 Performance Rating Calculation.

**X.1.6 Submittals.**

**X.1.6.1 General** – Compliance documentation and supplemental information shall be submitted in accordance with Section 4.2.2 of this standard.

**X.1.6.2 Application Documentation.** Documentation mentioned in Section G1.3.2 shall be submitted to the *rating authority*.

**X.1.6.3 Completion Requirements.** Completion requirements shall be consistent with the requirements mentioned in Section G1.3.3

**X.2. SIMULATION GENERAL REQUIREMENTS**

**X.2.1.1 Performance Calculations.** The proposed building performance and baseline building performance shall be calculated using the following:

- a. The same simulation program
- b. The same weather data
- c. The same *energy* rates

**X.2.1.2 Simulation Program.** The simulation program shall meet the requirements documented in Section G2.2, G2.3 and G2.4. The simulation tool shall automatically generate the baseline.

**X.2.1.3 Exceptional Calculation Methods.** Exceptional calculation methods or calculations outside of the software shall not be used to demonstrate compliance with the *Simplified Performance Rating Method*.

**X.3. CALCULATION OF THE PROPOSED DESIGN AND BASELINE BUILDING PERFORMANCE**

**X.3.1 Building Performance Calculations**

**X.3.1.1 Scope.** The simulation model for calculating the *proposed building performance* and *baseline building performance* for *new buildings*, *additions* and *alterations* which meet the requirements specified in G3.1.4(a) shall be developed in accordance with X3.2

### **X.3.2 Performance Calculations for New Buildings, Additions and Substantial Alterations**

#### **X.3.2.1 Design Model**

##### **X.3.2.1.1 Proposed Building Performance**

The simulation model of the *proposed design* shall be consistent with the design documents, except as specified below. End use components associated with equipment excluded from the scope of *Simplified Performance Rating Method* according to X.1.3 shall not be analyzed. The *simulation program* shall specifically model the functionality of the installed *systems*. Spreadsheets or other analytical approaches outside of the *simulation program* cannot be used to analyze a *system*. Simplification of building geometry is permitted, providing the following requirements are met-

- a. The *conditioned floor area* and volume of each block shall match the *proposed design* within 10 percent.
- b. The area of each exterior *building envelope* component from the Tables G3.4-1 through G3.4-8 is accounted for within 5 percent of the actual *proposed design*.
- c. The area of vertical fenestration and skylights is accounted for within 2 percent of the actual *proposed design*.
- d. The orientation of each component in (ii) and (iii) above is accounted for within 45 degrees of the actual *proposed design*.

All *conditioned spaces* in the *proposed design* shall be simulated as being both heated and cooled even if no heating or cooling *system* is to be installed.

**Exception:** *Spaces* designed with heating only *systems* serving storage rooms, stairwells, vestibules, electrical/mechanical rooms, and restrooms not exhausting or transferring air from mechanically cooled thermal zones in the *proposed design* shall not be modeled with *mechanical cooling*. Separate *thermal blocks* shall be created for portions of a building served by heated-only systems.

##### **X.3.2.1.2 Baseline Building Performance**

Same as *Performance Rating Method*, Table G3.1(a)

#### **X.3.2.2 HVAC Zones and Thermal Block**

##### **X.3.2.2.1 Proposed Building Performance**

- a. The minimum number of *thermal blocks* shall be specified based on the following:
  - i. A *thermal block* shall have only one *building area* type from Table G3.8.
  - ii. A separate *thermal block* shall be specified for non-predominant *building area* types within a *building* if its area is greater than 25% of the *gross floor area* of the entire *building* or 5,000 ft<sup>2</sup>( 465 m<sup>2</sup>) whichever is smaller.
  - iii. All of the HVAC zones within the *thermal block* shall be served by the same *HVAC system* or by the same type of *HVAC system*.
- b. Each floor in a *thermal block* shall be modeled as a single *hvac zone* per floor, as two perimeter zones or perimeter and core zones on each floor. If any façade in the *thermal block* is less than 30 feet (9.1m) in length, there shall only be a single *hvac zone* per floor. If any façade is less than 45 feet in length, then at least two perimeter zones of equal depth shall be modeled. Otherwise, each floor of the *thermal block* shall be modeled with perimeter and core zones. A perimeter zone shall be created extending from each façade to a depth of 15 feet. Where facades intersect, the zone boundary shall be formed by a 45-degree angle with the two facades, except when one of the façade lengths is less than 45 feet. The remaining area on each floor shall be modeled as a core zone with no exterior walls. Thermal zoning as per the design documents shall be allowed provided that the rules specified in Sections X.3.2.1 and X.3.2.7 are followed.
- c. Multifamily *building area* types shall be modeled with separate *thermal blocks* for *dwelling units* and common area when the common area is greater than 10% of the *thermal block*.
- d. A separate thermal zone does not need to be modeled for areas adjacent to *semiexterior walls* that separate *semiheated* space from *conditioned* space.
- e. Separate *thermal blocks* shall be created for portions of a building served by heated-only systems.

##### **X.3.2.2.2 Baseline Building Performance**

Same as *proposed design*.



### X.3.2.3 Space use Classification

#### X.3.2.3.1 Proposed Building Performance

The *space* type classification for the *proposed design* shall be permitted to be specified in accordance with the *building* area types in Section 9.5.1 or in accordance with the *space* types identified in Table 9.5.2-1-1 or 9.5.2.1-2. Where a project wants to take credit for lighting controls beyond the mandatory requirements of Section 9.4.1, the *floor* area of each *space* type within each *thermal block* shall be specified in accordance with *space* types identified in Tables 9.5.2.1-1 or 9.5.2.1-2. Where no credit for additional lighting controls is being taken, *space* type lighting classification shall be specified in accordance with the *building* area types in Section 9.5.1

#### X.3.2.3.1 Baseline Building Performance

Same as *proposed design*.

### X.3.2.4 Schedules

#### X.3.2.4.1 Proposed Building Performance

Schedules capable of modeling hourly variations in occupancy, lighting power, miscellaneous *equipment* power, *thermostat set points*, and *HVAC system* operation shall be used. The schedules shall be typical of the proposed *building* type as determined by the designer and approved by the rating authority. When as-designed schedules are not known, default schedules, as specified in Appendix C shall be used. Zones within a *thermal block* that have differing hourly values for occupancy, lighting, equipment or HVAC schedules, shall aggregate schedules to a *thermal block* level as defined below.

- a. **Temperature Schedules.** When not known, temperature *set points* and schedules shall be based on *building* area types as specified in Section C3.5.4. When known, an area weighted average schedule shall be calculated for each *thermal block*, based on the area and the thermostat schedules of the zones within the *thermal block*. The *temperature control throttling range* shall be fixed at 2F and shall be the same for *proposed design* and *baseline building design*. *Thermal blocks* representing heated-only portions of a *building* area type shall use the as-designed heating-only schedule. When not known, they shall use the default heating setpoint schedules specified in Section C3.5.4.
- b. **HVAC System Fan Schedules.** Schedules for HVAC fans that provide *outdoor air* for *ventilation* shall be defined for each *thermal block* as the maximum inclusive schedule representing the earliest start hour and the latest end hour for all zones within the thermal block. When as-designed schedules are not known, default schedules, as specified in Appendix C shall be used. The *outdoor air* schedule shall be specified to provide outdoor air for ventilation when occupancy schedule fraction for the *thermal block* is >10%.

#### Exceptions:

- i. Where no heating and/or cooling system is to be installed, and a heating or cooling *system* is being simulated only to meet the requirements described in this table, heating and/or cooling *system* fans shall not be simulated as running continuously during occupied hours but shall be cycled on and off to meet heating and cooling loads during all hours.
- ii. Dedicated outdoor air supply fans shall stay off during unoccupied hours.
- c. **Lighting, Occupancy, Equipment Schedules:** Schedules for lighting, and *equipment* shall be defined for each *thermal block* as a load weighted average schedule. Schedules for occupancy shall be defined as a number of people weighted average schedule. When as-designed schedules are not known, default schedules, as specified in Appendix C shall be used.
- d. **SHW Schedules:** The schedules for SHW shall be defined for each *thermal block* as a SHW load weighted average schedule. When as-designed schedules are not known, then default schedules specified in COMNET<sup>1</sup> shall be used.

**Informative Note:** When permitted by the *rating authority*, Appendix C schedules and loads can be used as prescribed schedules.

---

<sup>1</sup><https://comnet.org/appendix-b-modeling-data>

#### X.3.2.4.2 Baseline Building Performance

Same as *proposed design*.

##### Exceptions:

1. *HVAC system* fan schedules may be allowed to differ when Section G3.2.1.2(a) applies.

#### X.3.2.5 Building Envelope

##### X.3.2.5.1 Proposed Building Performance

- a. All components of the *building envelope* in the *proposed design* shall be modeled as shown on architectural drawings or as built for *existing building envelopes*. All *opaque building envelope* components shall be modeled accounting for thermal mass effects.

**Exceptions:** The following *building* elements are permitted to differ from architectural drawings:

- i. *Linear thermal bridge* and *point thermal bridge* shall not be modeled..
  - ii. Each uninsulated assembly not identified in Section 5.5.5 shall be modeled using the *U-factors* of uninsulated assemblies averaged with larger adjacent surfaces of the same *class of construction* using an area-weighted average method. This average *U-factor* is modeled within the *energy* simulation model.
  - iii. The exterior *roof* surface shall be modeled with a reflectance of 0.30 and a thermal *emittance* of 0.90.
  - iv. *Manual fenestration* shading devices, such as blinds or shades, shall not be modeled.
  - v. Automatically controlled fenestration shades or blinds shall not be modeled.
  - vi. Manually or *automatically* controlled dynamic glazing shall be modeled using the average of the minimum and maximum *SHGC* and *VT*.
  - vii. The above-grade wall surface shall be modeled with a solar reflectance of 0.25 and a thermal *emittance* of 0.90.
  - viii. Where different *building envelope* properties are present in a *thermal block*, those shall be modeled in the *proposed design* as specified in Section L2.2.2
- b. **Air Leakage.** To simulate *air leakage*, infiltration shall be modeled following the requirements specified in the *Performance Rating Method*, Table G3.1 (5) (b)
  - c. **Fenestration.** *Vertical fenestration* shall be permitted to be combined into a single window centered on each façade of each *HVAC Zone*. The height of the combined window shall be calculated as the difference of the area weighted averages of the sill height and head height, and the window shall be placed at the area weighted average sill height and horizontally centered. Where a façade includes *fenestration* with different *U-factor*, *SHGC*, or *VT*, and they are combined, those values for the single horizontally centered window shall be based on area weighted averages.
  - d. **Skylights.** *Skylights* shall be permitted to be combined into a single *skylight* centered on the *roof* of each *thermal block*. The aspect ratio of the *skylight* would be determined by the aspect ratio of the *roof*. Where a *roof* includes *skylights* with different *U-factor*, *SHGC*, or *VT*, and they are combined, those values for the single centered *skylight* shall be based on area weighted averages.
  - e. **Permanent shading devices.** When *vertical fenestration* is combined into a single window centered on each façade of each *HVAC zone*, permanent shading devices shall not be modeled. When *vertical fenestration* is not combined on a façade, permanent shading devices shall be modeled as-designed.
  - f. Opaque assemblies used for new buildings, existing buildings, or additions shall be based on material properties detailed in Appendix A, the ASHRAE Handbook of Fundamentals or as permitted by the rating authority.

##### X.3.2.5.1 Baseline Building Performance

Same as *Performance Rating Method*, Table G3.1(5).

#### X.3.2.6 Interior Lighting

##### X.3.2.6.1 Proposed Building Performance

Lighting power in the *proposed design* shall be determined as follows:

- a. Where a complete *lighting system* exists, the actual lighting power for each *thermal block* shall be used in the model.

- b. Where a complete *lighting system* has been designed and submitted with design documents, lighting power shall be specified for the entire thermal block. When *space* types within each *thermal block* are specified in accordance with Section X3.2.3,
  - the lighting power shall be determined in accordance with the Space-by-Space method and the *thermal block* shall be modeled with *space* area weighted average lighting power.
  - Retail display lighting may be included in the *proposed design* in accordance with Section 9.5.2.2(b),
- c. Where lighting neither exists nor is submitted with design documents, lighting power shall be determined in accordance with Table 9.5.1, *Building Area Method*.
- d. Exterior lighting power and lighting power for parking garages shall be modeled.
- e. For lighting controls, at a minimum, the *proposed design* shall contain the mandatory automatic lighting controls specified in Section 9.4.1 (e.g., automatic daylight responsive controls, occupancy sensors, programmable controls, etc.). No additional credit for lighting controls shall be given.
- f. *Automatic* daylighting responsive controls shall be modeled directly in the proposed design as follows.
  - i. For each *thermal block* available daylight shall control only the portion of lighting power in the *daylight area* of the *proposed design* subject to daylight responsive controls
  - ii. Daylight control shall be modeled as *continuous daylight dimming* such that when sufficient daylight is available at the corresponding photosensor, lighting power is reduced to maintain a minimum 50 fc (538.2 lux) for conditioned spaces and 30 fc (323 lux) for semiheated spaces. The minimum light output for the continuous daylight dimming shall be 6% of peak light output. Power input shall be modeled as 20% of lighting power at the minimum light output and scaled linearly to 100% of lighting power at peak light output.
  - iii. For each *daylight area* associated with *vertical fenestration*, the photosensor shall be modeled as located at the center of the largest window on the façade at a depth equal to the head height of the window and a height of 3 ft above the floor.
  - iv. For each *daylight area* associated with *skylights*, the photosensor shall be modeled as located at the center of the skylight and a height of 5 ft (1.52 m) above the floor.
- g. Other *automatic* lighting controls included in the *proposed design* shall be modeled as follows:
  - i. Where *space* types within each *thermal block* are not specified in accordance with Section X.3.2.3, the lighting schedule assumes the mandatory lighting controls are present, and no additional credit shall be given.
  - ii. Where *thermal blocks* are broken down by space types in accordance with Section X.3.2.3, an area weighted average reduction factor shall be calculated for the *thermal block* using the *occupancy sensor* reduction factors in Table G3.7 for the applicable *space* type with *automatic* lighting controls. The schedule reduction factor shall be applied to the lighting schedule of the *thermal block*. This reduction shall be taken only for lighting controlled by the *occupancy sensors*. Credit for other programmable lighting control in *buildings* less than 5000 ft<sup>2</sup> (464.5 ft<sup>2</sup>) can be taken by reducing the lighting schedule each hour by 10%.

#### **X.3.2.6.2 Baseline Building Performance**

- a. The *baseline building design* lighting power shall be determined in accordance with Table G3.8.
- b. Where retail display lighting is included in the *proposed design* in accordance with Section 9.5.2.2(b), the *baseline building design* retail display lighting additional power shall be equal to the limits established by Section 9.5.2.2(b) or same as proposed, whichever is less.
- c. Exterior lighting in areas that are designed to be illuminated and identified as “Tradable Surfaces” in Table G3.6 shall be modeled the baseline lighting power shown in Table G3.6. Other exterior lighting shall be modeled the same in *baseline building design* as in the *proposed design*.

#### **X.3.2.7 Heating, Ventilation and Air-Conditioning**

##### **X.3.2.7.1 Proposed Building Performance**

The HVAC *system* type and all related performance parameters in the *proposed design*, such as *equipment* capacities and efficiencies, shall be determined as follows:

- a. Where a complete *HVAC system* exists, the model shall reflect the actual *system* type and efficiencies. The component capacities shall be autosized by the *simulation program*.

- b. Where an *HVAC system* has been designed and submitted with design documents, the HVAC model shall be consistent with design documents. Mechanical *equipment* efficiencies shall be adjusted from actual *design conditions* to the standard rating conditions specified in Section 6.4.1 if required by the simulation model. The *proposed design HVAC system* shall be modeled using *manufacturers' full- and part-load data* for the *HVAC system* without fan power.
- c. Where no heating *system* exists or no heating *system* has been submitted with design documents, the *system* type shall be the same *system* as modeled in the *baseline building design* and shall comply with but not exceed the requirements of Section 6.
- d. Where no cooling *system* exists or no cooling *system* has been submitted with design documents, the cooling *system* type shall be the same as modeled in the *baseline building design* and shall comply with the requirements of Section 6.

**Exception:** *Thermal blocks* using baseline HVAC system types 9 and 10.

- e. Component capacities shall be determined through the *simulation program*. *Equipment* capacities for the *proposed design* shall be based on a sizing run and shall be oversized by 15% for cooling and 25% for heating. Plant capacities shall be based on coincident loads. Schedules for sizing runs shall be as designed when known. When not known, the schedules specified in Appendix C shall be used.
- f. Where multiple system components serve a block, average values weighted by the appropriate metric as described below shall be used.
  - i. Where multiple fan *systems* serve a single *thermal block*, fan power per unit airflow shall be based on weighted average using the design supply airflow (cfm).
  - ii. Where multiple cooling *systems* serve a single *thermal block*, *COP* shall be based on a weighted average using cooling capacity. DX coils shall be entered as multi-stage if more than 50% of coil capacity serving the *thermal block* is multi-stage with staged controls.
  - iii. Where multiple heating *systems* serve a single *thermal block*, thermal *efficiency* or heating *COP* shall be based on a weighted average using heating capacity.
  - iv. When multiple *system* types with and without economizers are combined, the maximum outside air fraction of the economizer for the combined *system* shall be based on the ratio of the design supply air of the *system(s)* with economizers and the total design supply air of all *systems* serving the *thermal block*.
  - v. When multiple *system* types with and without energy recovery ventilators are combined, sensible effectiveness and latent effectiveness of the combined *system* shall be based on a design outdoor air weighted average sensible and latent effectiveness of all the *systems* serving the *thermal block*. A value of 0 sensible and latent effectiveness would be assumed for systems without ERV. The combined *system* shall be modeled with bypass control if >50% of the design outdoor air supplied to the *thermal block* is supplied through *systems* with ERV with bypass control.
- g. Demand control ventilation shall be modeled as specified in Appendix L, Section L4.2.3(f).

#### **X.3.2.7.1 Baseline Building Performance**

*HVAC systems* in the *baseline building design* shall conform with the general provisions in this section.

- a. *Fossil fuel systems* shall be modeled using natural gas as their *fuel* source.
- b. For baseline *HVAC systems* 1,2,3,4, 9 and 10, each *HVAC zone* or *thermal block* shall be modeled with its own *HVAC system*. For Systems 5 and 6, each *floor* shall be modeled with a separate *HVAC system*.
- c. *HVAC systems* in the *baseline building design* shall be determined based on the climate zone and *building area* type as defined in Table X3.2.7-1 and shall conform with the baseline *system* descriptions in Table G3.1.1-4.
- d. Baseline *HVAC systems* shall meet the general *HVAC system* requirements specified in Section G3.2.2 and shall meet any *system-specific* requirements in Section G3.2.3 that are applicable to the baseline *HVAC system* types.
- e. *HVAC zones* designed with heating-only *systems* in the *proposed design* that do not exhaust or transfer air from mechanically cooled thermal zones shall use *system* type 9 or 10 in the *baseline building design*.

#### **X.3.2.8 Water Heating**

##### **X.3.2.8.1 Proposed Building Performance**

The *service water-heating system* type and all related performance parameters, such as efficiencies, in the *proposed design* shall be determined as follows:

- a. Where a complete *service water-heating system* exists, the *proposed design* shall reflect the actual *system type*. The following simplifications shall be made:
  - i. When multiple *service water heating systems* of the same type serve a single Building Area Type, a single SHW system shall be simulated using the as-designed capacity weighted average *efficiency*.
  - ii. When multiple SHW systems of different types serve a single Building Area Type, a single SHW system shall be simulated for each type using the as-designed capacity weighted average *efficiency*.
  - iii. If multiple SHW system types serve a single *building area type*, the total autosized capacity shall be split between each SHW System within the *building area type* in proportion to the size of those systems as-designed.
- b. The service water heating system capacity shall be sized in according to Section 7.4.1 for each *building area type*, based on the service water heating system loads defined in COMNET<sup>2</sup>.
- c. Where a service water-heating system has been designed and submitted with design documents, the service water-heating system type shall be consistent with design documents and modeled as specified in (a).
- d. Where no *service water-heating system* exists or has been designed and submitted with design documents but the *building* will have *service water-heating loads*, a *service water-heating system* shall be modeled that matches the *system type* in the *baseline building design*, serves the same *water-heating loads*, and shall comply with but not exceed the requirements of Section 7.
- e. For *buildings* that will have no *service water-heating loads*, no *service water-heating system* shall be modeled.
- f. Piping losses shall not be modeled.

#### **X.3.2.8.1 Baseline Building Performance**

Same as the *Performance Rating Method*, Table G3.1 (11)

#### **X.3.2.9 Receptacle and Other Loads**

##### **X.3.2.9.1 Proposed Building Performance**

Receptacle and *process loads*, for the *Simplified Performance Rating Method*, shall be defined as a weighted average equipment power density for the entire *thermal block*. When the equipment power is not known, it shall be based on the default values defined in Appendix C. Additional credit for receptacle control installed in spaces not required by Section 8.4.2 shall not be given through the *Simplified Performance Rating Method* approach.

##### **X.3.2.9.1 Baseline Building Performance**

Same as *proposed design*.

#### **X.3.2.10 On-Site Renewable Energy**

##### **X.3.2.10.1 Proposed Building Performance**

*On-site renewable energy* in the *proposed building performance* shall be determined as follows:

- a. Where a complete *system* providing *on-site renewable energy* exists, the model shall reflect the actual *system type* using actual component capacities and efficiencies.
- b. Where a *system* providing *on-site renewable energy* has been designed, the *system* model shall be consistent with design documents.
- c. Where no system exists or is specified to provide on-site renewable energy, no system shall be modeled.

##### **X.3.2.10.1 Baseline Building Performance**

*On-site renewable energy* shall not be included in the *baseline building performance*.

#### **X.3.2.11 Exterior Conditions**

---

<sup>2</sup> <https://comnet.org/appendix-b-modeling-data>

**X.3.2.11.1 Proposed Building Performance**

Same as *Performance Rating Method*, Table G3.1(14)

**X.3.2.11.1 Baseline Building Performance**

Same as *proposed design*.

**X.3.2.12 Distribution Transformers**

Distribution transformers shall not be modeled for the *Simplified Performance Rating Method* approach.

**X.3.2.13 Elevators**

Elevators shall not be modeled when using *Simplified Performance Rating Method*

**X.3.2.14 Refrigeration**

Refrigeration equipment shall not be modeled when using *Simplified Performance Rating Method*.

**Table X3.2.7-1 Baseline HVAC System Types for the Simplified Performance Rating Method**

Building Type	Size	Baseline Building System Type	
		Cool Climates (3b, 3c, and 4-8)	Warm Climates (0 to 3A)
Residential	Any size	<i>System 1</i> PTAC	<i>System 2</i> PTHP
Heated-only Storage		<i>System 9</i> - Heating and Ventilation	<i>System 10</i> - Heating and Ventilation
All Other	< 4 Floors	<i>System 3</i> PSZ-AC	<i>System 4</i> PSZ-HP
	≥ 4 Floors	<i>System 5</i> - Packaged <i>VAV</i> with <i>reheat</i>	<i>System 6</i> - Packaged <i>VAV</i> with PFP boxes