ANSI/ASHRAE/IESNA Addendum r to
ANSI/ASHRAE/IESNA Standard 90.1-2007

ASHRAE STANDARD

Energy Standard for Buildings Except Low-Rise Residential Buildings

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FOREWORD

This addendum changes Informative Appendix G Performance Rating Method into a Normative Appendix. Additionally, some language has been modified to make the Appendix Enforceable.

Note: The entire content of this Appendix changes from Informative to Normative.

Addendum r to 90.1-2007

Revise the Standard as follows (IP and SI units):

~~INFORMATIVE~~ <u>NORMATIVE</u> APPENDIX G PERFORMANCE RATING METHOD

G1. GENERAL

G1.1 Performance Rating Method Scope. This building performance rating method is a modification of the Energy Cost Budget (ECB) Method in Section 11 and is intended for use in rating the energy *efficiency* of building designs that exceed the requirements of this standard. This appendix does NOT offer an alternative compliance path for minimum standard compliance; that is the intent of Section 11, Energy Cost Budget Method.

Rather, this appendix is provided for those wishing to use the methodology developed for this standard to quantify performance that substantially exceeds the requirements of Standard 90.1. It ~~may be useful~~ <u>shall be used</u> for evaluating the performance of all <u>such</u> *proposed designs*, including *alterations* and *additions* to *existing buildings*, except designs with no mechanical systems.

G1.2 Performance Rating. This performance rating method requires conformance with the following provisions:

a. All requirements of 5.4, 6.4, 7.4, 8.4, 9.4, and 10.4 are met. These sections contain the mandatory provisions of the standard, and are prerequisites for this rating method.

b. The improved performance of the proposed building design is calculated in accordance with provisions of this appendix using the following formula:

Percentage improvement =
100 × (*Baseline building performance*
– *Proposed building performance*)/*Baseline building performance*

Notes:

1. Both the *proposed building performance* and the *baseline building performance* shall include all end-use load components, such as receptacle and process loads.
2. Neither the *proposed building performance* nor the *baseline building performance* are predictions of actual energy consumption or costs for the *proposed design* after construction. Actual experience will differ from these calculations due to variations such as occupancy, building operation and maintenance, weather, energy use not covered by this procedure, changes in energy rates between design of the building and occupancy, and the precision of the calculation tool.

G1.3 Trade-Off Limits. When the proposed modifications apply to less than the whole building, only parameters related to the systems to be modified shall be allowed to vary. Parameters relating to unmodified existing conditions or to future building components shall be identical for determining both the *baseline building performance* and the *proposed building performance*. Future building components shall meet the prescriptive requirements of Sections 5.5, 6.5, 7.5, 9.5, and 9.6.

G1.4 Documentation Requirements. Simulated performance shall be documented, and documentation shall be submitted to the rating authority. The information <u>shall be</u> submitted <u>in a report and</u> shall include the following:

a. <u>A brief description of the project, the key energy efficiency improvements, the simulation program used, the version of the simulation program, and the results of the energy analysis. This summary shall contain the c</u>~~C~~alculated values for the *baseline building performance*, the *proposed building performance*, and the percentage improvement.

<u>b. An overview of the project that includes: the number of stories (above and below grade), the typical floor size, the uses in the building (e.g., office, cafeteria, retail, parking, etc.), the gross area of each use, and whether each use is conditioned space.</u>

<u>c.</u> A list of the energy-related features that are included in the design and on which the performance rating is based. This list shall document all energy features that differ between the models used in the *baseline building performance* and *proposed building performance* calculations.

<u>d. A list showing compliance for the proposed design with all the requirements of 5.4, 6.4, 7.4, 8.4, 9.4, and 10.4 (mandatory provisions).</u>

<u>e. A list identifying those aspects of the proposed design that are less stringent than the requirements of 5.5, 6.5, 7.5, 9.5, and 9.6 (prescriptive provisions).</u>

<u>f. A table with a summary by end use of the energy cost savings in the proposed building performance.</u>

<u>g. A site plan showing all adjacent buildings and topography which may shade the proposed building (with estimated height or number of stories).</u>

<u>h. Building elevations and floor plans (schematic is acceptable).</u>

i. A diagram showing the thermal blocks used in the computer simulation.

j. An explanation of any significant modeling assumptions.

k. Back-up calculations and material to support data inputs (e.g., U-factors for envelope assemblies, NFRC ratings for fenestration, end-uses identified in 1. Design Model, paragraph (a), in Table G3.1).

~~e~~l. Input and output report(s) from the *simulation program* or compliance software including a breakdown of energy usage by at least the following components: lights, internal equipment loads, service water heating equipment, space heating equipment, space cooling and heat rejection equipment, fans, and other HVAC equipment (such as pumps). The output reports shall also show the amount of time any loads are not met by the HVAC system for both the *proposed design* and *baseline building design*.

m. Purchased energy rates used in the simulations.

~~d~~n. An explanation of any error messages noted in the *simulation program* output.

o. For any exceptional calculation method(s) employed, document the predicted energy savings by energy type, the energy cost savings, a narrative explaining the exceptional calculation method performed, and theoretical or empirical information supporting the accuracy of the method.

G2. SIMULATION GENERAL REQUIREMENTS

G2.1 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, and
c. the same energy rates.

G2.2 Simulation Program. The *simulation program* shall be a computer-based program for the analysis of energy consumption in buildings (a program such as, but not limited to, DOE-2, BLAST, or EnergyPlus). The *simulation program* shall include calculation methodologies for the building components being modeled. For components that cannot be modeled by the simulation program, the exceptional calculation methods requirements in Section G2.5 ~~may~~ shall be used.

G2.2.1 The *simulation program* shall be approved by the *rating authority* and shall, at a minimum, have the ability to explicitly model all of the following:

a. 8760 hours per year
b. hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation, defined separately for each day of the week and holidays
c. thermal mass effects
d. ten or more thermal zones
e. part-load performance curves for mechanical equipment
f. capacity and *efficiency* correction curves for mechanical heating and cooling equipment
g. air-side economizers with integrated control
h. *baseline building design* characteristics specified in Section G3

G2.2.2 The *simulation program* shall have the ability to either (1) directly determine the *proposed building performance* and *baseline building performance* or (2) produce hourly reports of energy use by an energy source suitable for determining the *proposed building performance* and *baseline building performance* using a separate calculation engine.

G2.2.3 The *simulation program* shall be capable of performing design load calculations to determine required HVAC equipment capacities and air and water flow rates in accordance with generally accepted engineering standards and handbooks (for example, *ASHRAE Handbook—Fundamentals*) for both the *proposed design* and *baseline building design*.

G2.2.4 The simulation program shall be tested according to ASHRAE Standard 140, and the results shall be furnished by the software provider.

G2.3 Climate Data. The *simulation program* shall perform the simulation using hourly values of climatic data, such as temperature and humidity from representative climatic data, for the site in which the *proposed design* is to be located. For cities or urban regions with several climatic data entries, and for locations where weather data are not available, the designer shall select available weather data that best represent the climate at the construction site. The selected weather data shall be approved by the *rating authority*.

G2.4 Energy Rates. Annual energy costs shall be determined using either actual rates for purchased energy or state average energy prices published by DOE's Energy Information Administration (EIA) for commercial building customers, but rates from different sources ~~may~~ shall not be mixed in the same project.

Informative Note: The above provision allows users to gain credit for features that yield load management benefits. Where such features are not present, users can simply use state average unit prices from EIA, which are updated annually and readily available on EIA's Web site (www.eia.doe.gov).

Exception: On-site renewable energy sources or site-recovered energy shall not be considered to be purchased energy and shall not be included in the *proposed building performance*. Where on-site renewable or site-recovered sources are used, the *baseline building performance* shall be based on the energy source used as the backup energy source or on the use of electricity if no backup energy source has been specified.

G2.5 Exceptional Calculation Methods. ~~Where no simulation program is available that adequately models a design, material, or device, the *rating authority* may approve an exceptional calculation method to demonstrate above-standard performance using this method. Applications for approval of an exceptional method shall include documentation of the calculations performed and theoretical and/or empirical information supporting the accuracy of the method.~~

When the *simulation program* does not model a design, material, or device of the proposed design, an Exceptional Calculation Method shall be used if approved by the *Rating Authority*. If there are multiple designs, materials or devices that the *simulation program* does not model, each shall be calculated separately and Exceptional Savings determined for each. At no time shall the total Exceptional Savings constitute more than one-half of the difference between the *baseline building performance* and the *proposed building performance*. All applications for approval of an exceptional method shall include:

a. step-by-step documentation of the Exceptional Calculation Method performed detailed enough to reproduce the results;
b. copies of all spreadsheets used to perform the calculations;
c. a sensitivity analysis of energy consumption when each of the input parameters is varied from half to double the value assumed;
d. the calculations shall be performed on a time step basis consistent with the simulation program used;
e. the *Performance Rating* calculated with and without the Exceptional Calculation Method;

G3. CALCULATION OF THE PROPOSED AND BASELINE BUILDING PERFORMANCE

G3.1 Building Performance Calculations. The simulation model for calculating the proposed and *baseline building performance* shall be developed in accordance with the requirements in Table G3.1.

G3.1.1 Baseline HVAC System Type and Description. HVAC systems in the *baseline building design* shall be based on usage, number of floors, conditioned floor area, and heating source as specified in Table G3.1.1A and shall conform with the system descriptions in Table G3.1.1B. For systems 1, 2, 3, and 4, each thermal block shall be modeled with its own HVAC system. For systems 5, 6, 7, and 8, each floor shall be modeled with a separate HVAC system. Floors with identical thermal blocks can be grouped for modeling purposes.

Exceptions:

a. Use additional system type(s) for nonpredominant conditions (i.e., residential/nonresidential or heating source) if those conditions apply to more than 20,000 ft^2 (1900 m^2) of conditioned floor area.
b. If the baseline HVAC system type is 5, 6, 7, or 8, use separate single-zone systems conforming with the requirements of System 3 or System 4 (depending on building heating source) for any spaces that have occupancy or process loads or schedules that differ significantly from the rest of the building. Peak thermal loads that differ by 10 Btu/h·ft^2 (31.2 W/m^2) or more from the average of other spaces served by the system or schedules that differ by more than 40 equivalent full-load hours per week from other spaces served by the system are considered to differ significantly. Examples where this exception may be applicable include, but are not limited to, computer server rooms, natatoriums, and continually occupied security areas.
c. If the baseline HVAC system type is 5, 6, 7, or 8, use separate single-zone systems conforming with the requirements of System 3 or System 4 (depending on building heat source) for any zones having special pressurization relationships, cross-contamination requirements, or code-required minimum circulation rates.
d. For laboratory spaces with a minimum of 5000 cfm (2400 L/s) of exhaust, use system type 5 or 7 that reduce the exhaust and makeup air volume to 50% of design values during unoccupied periods. For all-electric buildings, the heating shall be electric resistance.

TABLE G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance

No.	Proposed Building Performance	Baseline Building Performance
1. Design Model		
a.	The simulation model of the *proposed design* shall be consistent with the design documents, including proper accounting of fenestration and opaque envelope types and areas; interior lighting power and controls; HVAC system types, sizes, and controls; and service water heating systems and controls. All end-use load components within and associated with the building shall be modeled, including, but not limited to, exhaust fans, parking garage ventilation fans, snow-melt and freeze-protection equipment, facade lighting, swimming pool heaters and pumps, elevators and escalators, refrigeration, and cooking. Where the simulation program does not specifically model the functionality of the installed system, spreadsheets or other documentation of the assumptions shall be used to generate the power demand and operating schedule of the systems.	The *baseline building design* shall be modeled with the same number of floors and identical conditioned floor area as the *proposed design*.
b.	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, and temperature and humidity control setpoints and schedules shall be the same for *proposed* and *baseline building designs*.	
c.	When the *performance rating method* is applied to buildings in which energy-related features have not yet been designed (e.g., a lighting system), those yet-to-be-designed features shall be described in the *proposed design* exactly as they are defined in the *baseline building design*. Where the space classification for a space is not known, the space shall be categorized as an office space.	

TABLE G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance *(continued)*

No. Proposed Building Performance	Baseline Building Performance
2. Additions and Alterations	
It is acceptable to predict performance using building models that exclude parts of the *existing building* provided that all of the following conditions are met: a. Work to be performed in excluded parts of the building shall meet the requirements of Sections 5 through 10. b. Excluded parts of the building are served by HVAC systems that are entirely separate from those serving parts of the building that are included in the building model. c. Design space temperature and HVAC system operating setpoints and schedules on either side of the boundary between included and excluded parts of the building are essentially the same. d. If a declining block or similar utility rate is being used in the analysis and the excluded and included parts of the building are on the same utility meter, the rate shall reflect the utility block or rate for the building plus the *addition*.	Same as Proposed Design
3. Space Use Classification	
Usage shall be specified using the building type or space type lighting classifications in accordance with Section 9.5.1 or 9.6.1. The user shall specify the space use classifications using either the building type or space type categories but shall not combine the two types of categories. More than one building type category may be used in a building if it is a mixed-use facility. If space type categories are used, the user may simplify the placement of the various space types within the building model, provided that building-total areas for each space type are accurate.	Same as Proposed Design
4. Schedules	
Schedules capable of modeling hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, 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*. **HVAC Fan Schedules**. Schedules for HVAC fans that provide outdoor air for ventilation shall run continuously whenever spaces are occupied and shall be cycled on and off to meet heating and cooling loads during unoccupied hours. **Exceptions:** a. 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. b. HVAC fans shall remain on during occupied and unoccupied hours in spaces that have health and safety mandated minimum ventilation requirements during unoccupied hours.	Same as Proposed Design **Exception:** Schedules may be allowed to differ between *proposed design* and *baseline building design* when necessary to model nonstandard *efficiency* measures, provided that the revised schedules have the approval of the *rating authority*. Measures that may warrant use of different schedules include, but are not limited to, automatic lighting controls, automatic natural ventilation controls, automatic demand control ventilation controls, and ~~measures~~ automatic controls that reduce service water heating loads. In no case shall schedules differ where the controls are manual (e.g., manual operation of light switches or manual operation of windows).

TABLE G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance *(continued)*

No.	Proposed Building Performance	Baseline Building Performance

5. Building Envelope

Proposed Building Performance

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.

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

a. All uninsulated assemblies (e.g., projecting balconies, perimeter edges of intermediate floor slabs, concrete floor beams over parking garages, roof parapet) shall be separately modeled using either of the following techniques:
1. Separate model of each of these assemblies within the energy simulation model.
2. Separate calculation of the U-factor for each of these assemblies. The U-factors of these assemblies are then averaged with larger adjacent surfaces using an area-weighted average method. This average U-factor is modeled within the energy simulation model.
Any other envelope assembly that covers less than 5% of the total area of that assembly type (e.g., exterior walls) need not be separately described provided that it is similar to an assembly being modeled. If not separately described, the area of an envelope assembly shall be added to the area of an assembly of that same type with the same orientation and thermal properties.

b. Exterior surfaces whose azimuth orientation and tilt differ by less than 45 degrees and are otherwise the same may be described as either a single surface or by using multipliers.

c. For exterior roofs, the roof surface ~~may~~ shall be modeled with a reflectance of 0.45 if the reflectance of the *proposed design* roof is greater than 0.70 and its emittance is greater than 0.75 or has a minimum SRI of 82. Reflectance values shall be based on testing in accordance with ASTM C1549, ASTM E903, or ASTM E1918, and emittance values shall be based on testing in accordance with ASTM C1371 or ASTM E408, and SRI shall be based on ASTM E1980 calculated at medium wind speed. All other roof surfaces shall be modeled with a reflectance of 0.30.

d. Manual fenestration shading devices such as blinds or shades shall ~~not~~ be modeled or not modeled, the same as in the baseline. Automatically controlled fenestration shades or blinds ~~may~~ shall be modeled. Permanent shading devices such as fins, overhangs, and light shelves ~~may~~ shall be modeled.

Baseline Building Performance

Equivalent dimensions shall be assumed for each exterior envelope component type as in the *proposed design*; i.e., the total gross area of exterior walls shall be the same in the *proposed* and *baseline building designs*. The same shall be true for the areas of roofs, floors, and doors, and the exposed perimeters of concrete slabs on grade shall also be the same in the *proposed* and *baseline building designs*. The following additional requirements shall apply to the modeling of the *baseline building design*:

Exceptions:

a. **Orientation.** The *baseline building performance* shall be generated by simulating the building with its actual orientation and again after rotating the entire building 90, 180, and 270 degrees, then averaging the results. The building shall be modeled so that it does not shade itself.
   a. If it can be demonstrated to the satisfaction of the *Program Evaluator* that the building orientation is dictated by site considerations.
   b. Buildings where the vertical fenestration area on each orientation varies by less than 5%.

b. **Opaque Assemblies.** Opaque assemblies used for new buildings or *additions* shall conform with the following common, lightweight assembly types and shall match the appropriate assembly maximum U-factors in Tables 5.5-1 through 5.5-8:

• Roofs—Insulation entirely above deck
• *Above-grade walls*—Steel-framed
• Floors—Steel-joist
• Opaque door types shall match the proposed design and conform to the U-factor requirements from the same tables.
• Slab-on-grade floors shall match the F-factor for unheated slabs from the same tables.

Opaque assemblies used for *alterations* shall conform with Section 5.1.3.

c. **Vertical Fenestration.** Vertical fenestration areas for new buildings and *additions* shall equal that in the *proposed design* or 40% of gross above-grade wall area, whichever is smaller, and shall be distributed on each face of the building in the same proportions in the *proposed design*. Fenestration U-factors shall match the appropriate requirements in Tables 5.5-1 through 5.5-8 ~~for the applicable vertical glazing percentage for U_{fixed}~~. Fenestration SHGC shall match the appropriate requirements in Tables 5.5-1 through 5.5-8 ~~using the value for $SHGC_{all}$ for the applicable vertical glazing percentage~~. All vertical glazing ~~shall be modeled as fixed and~~ shall be assumed to be flush with the exterior wall, and no shading projections shall be modeled. Manual window shading devices such as blinds or shades are not required to ~~shall not~~ be modeled. The fenestration areas for envelope *alterations* shall reflect the limitations on area, U-factor, and SHGC as described in Section 5.1.3.

d. **Skylights and Glazed Smoke Vents.** Skylight area shall be equal to that in the proposed building design or 5% of the gross roof area that is part of the *building envelope*, whichever is smaller. If the skylight area of the proposed building design is greater than 5% of the gross roof area, baseline skylight area shall be decreased by an identical percentage in all roof components in which skylights are located to reach the 5% skylight-to-roof ratio. Skylight orientation and tilt shall be the same as in the proposed building design. Skylight U-factor and SHGC properties shall match the appropriate requirements in Tables 5.5-1 through 5.5-8.

e. **Roof albedo.** All roof surfaces shall be modeled with a reflectivity of 0.30.

f. **Existing Buildings.** For existing *building envelopes*, the *baseline building design* shall reflect existing conditions prior to any revisions that are part of the scope of work being evaluated.

TABLE G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance *(continued)*

No. Proposed Building Performance	Baseline Building Performance
6. Lighting	
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 lighting system has been designed, lighting power shall be determined in accordance with Sections 9.1.3 and 9.1.4. c. Where lighting neither exists nor is specified, lighting power shall be determined in accordance with the Building Area Method for the appropriate building type. d. Lighting system power shall include all lighting system components shown or provided for on the plans (including lamps and ballasts and task and furniture-mounted fixtures). **Exception:** For multifamily *dwelling units*, hotel/motel guest rooms, and other spaces in which lighting systems are connected via receptacles and are not shown or provided for on building plans, assume identical lighting power for the *proposed* and *baseline building designs* in the simulations. e. Lighting power for parking garages and building facades shall be modeled. f. Credit may be taken for the use of automatic controls for daylight utilization but only if their operation is either modeled directly in the building simulation or modeled in the building simulation through schedule adjustments determined by a separate daylighting analysis approved by the *rating authority.* g. For automatic lighting controls in addition to those required for minimum code compliance under Section 9.4.1, credit may be taken for automatically controlled systems by reducing the connected lighting power by the applicable percentages listed in Table G3.2. Alternatively, credit may be taken for these devices by modifying the lighting schedules used for the *proposed design*, provided that credible technical documentation for the modifications are provided to the *rating authority*.	Lighting power in the *baseline building design* shall be determined using the same categorization procedure (building area or space function) and categories as the *proposed design* with lighting power set equal to the maximum allowed for the corresponding method and category in Section 9.2. Lighting shall be modeled having the automatic and manual controls in Section 9.4. No additional automatic lighting controls (e.g., ~~programmable controls or~~ automatic controls for daylight utilization) shall be modeled in the *baseline building design*, as the lighting schedules used are understood to reflect the mandatory control requirements in this standard.
7. Thermal Blocks—HVAC Zones Designed	
Where HVAC zones are defined on HVAC design drawings, each HVAC zone shall be modeled as a separate *thermal block*. **Exception:** Different HVAC zones may be combined to create a single *thermal block* or identical *thermal blocks* to which multipliers are applied, provided that all of the following conditions are met: a. The space use classification is the same throughout the *thermal block*. b. All HVAC zones in the *thermal block* that are adjacent to glazed exterior walls face the same orientation or their orientations vary by less than 45 degrees. c. All of the zones are served by the same HVAC system or by the same kind of HVAC system.	Same as Proposed Design.
8. Thermal Blocks—HVAC Zones Not Designed	
Where the HVAC zones and systems have not yet been designed, *thermal blocks* shall be defined based on similar internal load densities, occupancy, lighting, thermal and space temperature schedules, and in combination with the following guidelines: a. Separate *thermal blocks* shall be assumed for interior and perimeter spaces. Interior spaces shall be those located greater than 15 ft (5 m) from an exterior wall. Perimeter spaces shall be those located within 15 ft (5 m) of an exterior wall. b. Separate *thermal blocks* shall be assumed for spaces adjacent to glazed exterior walls; a separate zone shall be provided for each orientation, except that orientations that differ by less than 45 degrees may be considered to be the same orientation. Each zone shall include all floor area that is 15 ft (5 m) or less from a glazed perimeter wall, except that floor area within15 ft (5 m) of glazed perimeter walls having more than one orientation shall be divided proportionately between zones. c. Separate *thermal blocks* shall be assumed for spaces having floors that are in contact with the ground or exposed to ambient conditions from zones that do not share these features. d. Separate *thermal blocks* shall be assumed for spaces having exterior ceiling or roof assemblies from zones that do not share these features.	Same as Proposed Design.
9. Thermal Blocks—Multifamily Residential Buildings	
Residential spaces shall be modeled using at least one *thermal block* per *dwelling unit*, except that those units facing the same orientations may be combined into one *thermal block*. Corner units and units with roof or floor loads shall only be combined with units sharing these features.	Same as Proposed Design.

TABLE G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance ***(continued)***

No. Proposed Building Performance	Baseline Building Performance
10. HVAC Systems	
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 using actual component capacities and efficiencies. b. Where an HVAC system has been designed, 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. c. Where no heating system exists or no heating system has been specified, the heating system classification shall be assumed to be electric, and the system characteristics shall be identical to the system modeled in the *baseline building design*. d. Where no cooling system exists or no cooling system has been specified, the cooling system shall be identical to the system modeled in the *baseline building design*.	The HVAC system(s) in the *baseline building design* shall be of the type and description specified in Section G3.1.1, shall meet the general HVAC system requirements specified in Section G3.1.2, and shall meet any system-specific requirements in Section G3.1.3 that are applicable to the baseline HVAC system type(s).
11. Service Hot-Water Systems	
The service hot-water system type and all related performance parameters, such as equipment capacities and efficiencies, in the *proposed design* shall be determined as follows: a. Where a complete service hot-water system exists, the *proposed design* shall reflect the actual system type using actual component capacities and efficiencies. b. Where a service hot-water system has been specified, the service hot-water model shall be consistent with design documents. c. Where no service hot-water system exists or has been specified but the building will have service hot-water loads, a service hot-water system shall be modeled that matches the system in the *baseline building design* and serves the same hot-water loads. d. For buildings that will have no service hot-water loads, no service hot-water system shall be modeled.	The service hot-water system in the *baseline building design* shall use the same energy source as the corresponding system in the *proposed design* and shall conform with the following conditions: a. Where the complete service hot-water system exists, the *baseline building design* shall reflect the actual system type using the actual component capacities and efficiencies. b. Where a new service hot-water system has been specified, the system shall be sized according to the provisions of Section 7.4.1 and the equipment shall match the minimum *efficiency* requirements in Section 7.4.2. Where the energy source is electricity, the heating method shall be electrical resistance. c. Where no service hot-water system exists or has been specified but the building will have service hot-water loads, a service water system(s) using electrical-resistance heat and matching minimum *efficiency* requirements of Section 7.4.2 shall be assumed and modeled identically in the *proposed* and *baseline building designs*. d. For buildings that will have no service hot-water loads, no service hot-water heating shall be modeled. e. Where a combined system has been specified to meet both space heating and service water heating loads, the baseline building system shall use separate systems meeting the minimum *efficiency* requirements applicable to each system individually. f. For large, 24-hour-per-day facilities that meet the prescriptive criteria for use of condenser heat recovery systems described in Section 6.5.6.2, a system meeting the requirements of that section shall be included in the *baseline building design* regardless of the exceptions to Section 6.5.6.2. **Exception:** If a condenser heat recovery system meeting the requirements described in Section 6.5.6.2 cannot be modeled, the requirement for including such a system in the actual building shall be met as a prescriptive requirement in accordance with Section 6.5.6.2, and no heat-recovery system shall be included in the *proposed* or *baseline building designs*. g. Service hot-water energy consumption shall be calculated explicitly based upon the volume of service hot water required and the entering makeup water and the leaving service hot-water temperatures. Entering water temperatures shall be estimated based upon the location. Leaving temperatures shall be based upon the end-use requirements. h. Where recirculation pumps are used to ensure prompt availability of service hot water at the end use, the energy consumption of such pumps shall be calculated explicitly. i. Service water loads and usage shall be the same for both the *baseline building design* and the *proposed design* and shall be documented by the calculation procedures described in Section 7.4.1. **Exceptions:** 1. Service hot-water usage can be demonstrated to be reduced by documented water conservation measures that reduce the physical volume of service water required. Examples include low-flow shower heads. Such reduction shall be demonstrated by calculations. 2. Service hot-water energy consumption can be demonstrated to be reduced by reducing the required temperature of service mixed water, by increasing the temperature, or by increasing the temperature of the entering makeup water. Examples include alternative sanitizing technologies for dishwashing and heat recovery to entering makeup water. Such reduction shall be demonstrated by calculations.

TABLE G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance *(continued)*

No. Proposed Building Performance	Baseline Building Performance
	3. Service hot-water usage can be demonstrated to be reduced by reducing the hot fraction of mixed water to achieve required operational temperature. Examples include shower or laundry heat recovery to incoming cold-water supply, reducing the hot-water fraction required to meet required mixed-water temperature. Such reduction shall be demonstrated by calculations.
12. Receptacle and Other Loads	
Receptacle and process loads, such as those for office and other equipment, shall be estimated based on the building type or space type category and shall be assumed to be identical in the *proposed* and *baseline building designs*, except as specifically authorized by the *rating authority*. These loads shall be included in simulations of the building and shall be included when calculating the *baseline building performance* and *proposed building performance*.	Other systems, such as motors covered by Section 10, and miscellaneous loads shall be modeled as identical to those in the *proposed design* including schedules of operation and control of the equipment. Where there are specific *efficiency* requirements in Section 10, these systems or components shall be modeled as having the lowest *efficiency* allowed by those requirements.Where no efficiency requirements exist, power and energy rating or capacity of the equipment shall be identical between the *baseline building* and the *proposed design* with the following exception: variations of the power requirements, schedules, or control sequences of the equipment modeled in the *baseline building* from those in the *proposed design* ~~may~~ shall be allowed by the *rating authority* based upon documentation that the equipment installed in the *proposed design* represents a significant verifiable departure from documented conventional practice. The burden of this documentation is to demonstrate that accepted conventional practice would result in *baseline building* equipment different from that installed in the *proposed design*. Occupancy and occupancy schedules ~~may~~ shall not be changed.
13. Modeling Limitations to the Simulation Program If the simulation program cannot model a component or system included in the *proposed design* explicitly, substitute a thermodynamically similar component model that can approximate the expected performance of the component that cannot be modeled explicitly.	Same as Proposed Design.
14. Exterior Conditions a. **Shading by adjacent structures and terrain:** The effect that structures and significant vegetation or topographical features have on the amount of solar radiation being received by a structure shall be adequately reflected in the computer analysis. All elements whose effective height is greater than their distance from a proposed building and whose width facing the proposed building is greater than one-third that of the proposed building shall be accounted for in the analysis. If the computer program has a subroutine to simulate shading by adjacent structures, then this option shall be used. If the computer program does not have a subroutine to simulate shading by adjacent structures, then any portion of a structure that is shaded most of the time is allowed to be modeled as having a north-facing orientation. b. **Ground temperatures for below-grade wall and basement floor heat loss calculations:** It is acceptable to use either an annual average ground temperature or monthly average ground temperatures for calculation of heat loss through below-grade walls and basement floors. c. **Water main temperatures for service water heating calculations:** It is acceptable to use either an annual water main supply temperature or monthly average water main supply temperatures for calculating service water heating. If annual or monthly water main supply temperatures are not available from the local water utility, annual average ground temperatures may be used.	Same as Proposed Design.

G3.1.1.1 Purchased Heat. For systems using purchased hot water or steam, hot water or steam costs shall be based on actual utility rates, and on-site boilers shall not be modeled in the *baseline building design*.

G3.1.2 General *Baseline* HVAC System Requirements. HVAC systems in the *baseline building design* shall conform with the general provisions in this section.

G3.1.2.1 Equipment Efficiencies. All HVAC equipment in the *baseline building design* shall be modeled at the minimum *efficiency* levels, both part load and full load, in accordance with Section 6.4. Where *efficiency* ratings, such as EER and COP, include fan energy, the descriptor shall be broken down into its components so that supply fan energy can be modeled separately.

G3.1.2.2 Equipment Capacities. The equipment capacities for the *baseline building design* shall be based on sizing runs for each orientation (per Table G3.1, No. 5a) and shall be oversized by 15% for cooling and 25% for heating, i.e., the ratio between the capacities used in the annual simulations and the capacities determined by the sizing runs shall be 1.15 for cooling and 1.25 for heating. Unmet load hours for the *proposed design* or *baseline building designs* shall not exceed 300 (of the 8760 hours simulated), and unmet load hours for the *proposed design* shall not exceed the number of unmet load hours for the *baseline building design* by more than 50.

TABLE G3.1.1A *Baseline* HVAC System Types (I-P)

Building Type	Fossil Fuel, Fossil/Electric Hybrid, and Purchased Heat	Electric and Other
Residential	System 1—PTAC	System 2—PTHP
Nonresidential and 3 Floors or Less and <25,000 ft^2	System 3—PSZ-AC	System 4—PSZ-HP
Nonresidential and 4 or 5 Floors and <25,000 ft^2 or 5 Floors or Less and 25,000 ft^2 to 150,000 ft^2	System 5—Packaged VAV w/ Reheat	System 6—Packaged VAV w/PFP Boxes
Nonresidential and More than 5 Floors or >150,000 ft^2	System 7—VAV w/Reheat	System 8—VAV w/PFP Boxes

Notes:
Residential building types include dormitory, hotel, motel, and multifamily. Residential space types include guest rooms, living quarters, private living space, and sleeping quarters. Other building and space types are considered nonresidential.
Where no heating system is to be provided or no heating energy source is specified, use the "Electric and Other" heating source classification.
Where attributes make a building eligible for more than one *baseline* system type, use the predominant condition to determine the system type for the entire building.
For laboratory spaces with a minimum of 5000 cfm of exhaust, use system type 5 or 7 and reduce the exhaust and makeup air volume to 50% of design values during unoccupied periods.
For all-electric buildings, the heating shall be electric resistance.

TABLE G3.1.1A *Baseline* System Types (SI)

Building Type	Fossil Fuel, Fossil/Electric Hybrid, and Purchased Heat	Electric and Other
Residential	System 1—PTAC	System 2—PTHP
Nonresidential and 3 Floors or Less and <2300 m^2	System 3—PSZ-AC	System 4—PSZ-HP
Nonresidential and 4 or 5 Floors and <2300 m^2 or 5 Floors or Less and 2300 m^2 to 13,800 m^2	System 5—Packaged VAV w/ Reheat	System 6—Packaged VAV w/PFP Boxes
Nonresidential and More than 5 Floors or >13,800 m^2	System 7—VAV w/Reheat	System 8—VAV w/PFP Boxes

Notes:
Residential building types include dormitory, hotel, motel, and multifamily. Residential space types include guest rooms, living quarters, private living space, and sleeping quarters. Other building and space types are considered nonresidential.
Where no heating system is to be provided or no heating energy source is specified, use the "Electric and Other" heating source classification.
Where attributes make a building eligible for more than one *baseline* system type, use the predominant condition to determine the system type for the entire building.
For laboratory spaces with a minimum of 2400 L/s of exhaust, use system type 5 or 7 and reduce the exhaust and makeup air volume to 50% of design values during unoccupied periods.
For all-electric buildings, the heating shall be electric resistance.
Except as noted in Exception (a) to Section G3.1.

TABLE G3.1.1B *Baseline* System Descriptions

System No.	System Type	Fan Control	Cooling Type	Heating Type
1. PTAC	Packaged terminal air conditioner	Constant volume	Direct expansion	Hot-water fossil fuel boiler
2. PTHP	Packaged terminal heat pump	Constant volume	Direct expansion	Electric heat pump
3. PSZ-AC	Packaged rooftop air conditioner	Constant volume	Direct expansion	Fossil fuel furnace
4. PSZ-HP	Packaged rooftop heat pump	Constant volume	Direct expansion	Electric heat pump
5. Packaged VAV with Reheat	Packaged rooftop VAV with reheat	VAV	Direct expansion	Hot-water fossil fuel boiler
6. Packaged VAV with PFP Boxes	~~Packaged rooftop~~ VAV with parallel fan-powered boxes and reheat	VAV	Direct expansion	Electric resistance
7. VAV with Reheat	Packaged rooftop VAV with reheat	VAV	Chilled water	Hot-water fossil fuel boiler
8. VAV with PFP Boxes	VAV with parallel fan-powered boxes and reheat	VAV	Chilled water	Electric resistance

If unmet load hours in the *proposed design* exceed the unmet load hours in the *baseline building* by more than 50, simulated capacities in the *baseline building* shall be decreased incrementally and the building resimulated until the unmet load hours are within 50 of the unmet load hours of the *proposed design*. If unmet load hours for the *proposed design* or *baseline building design* exceed 300, simulated capacities shall be increased incrementally, and the building with unmet loads resimulated until unmet load hours are reduced to 300 or less. Alternatively, unmet load hours exceeding these limits may be accepted at the discretion of the *rating authority* provided that sufficient justification is given indicating that the accuracy of the simulation is not significantly compromised by these unmet loads.

G3.1.2.2.1 Sizing Runs. Weather conditions used in sizing runs to determine *baseline* equipment capacities ~~may~~ shall be based either on hourly historical weather files containing typical peak conditions or on design days developed using 99.6% heating design temperatures and 1% dry-bulb and 1% wet-bulb cooling design temperatures.

G3.1.2.3 Preheat Coils. If the HVAC system in the *proposed design* has a preheat coil and a preheat coil can be modeled in the *baseline* system, the *baseline* system shall be modeled with a preheat coil controlled in the same manner as the *proposed design*.

G3.1.2.4 Fan System Operation. Supply and return fans shall operate continuously whenever spaces are occupied and shall be cycled to meet heating and cooling loads during unoccupied hours. If the supply fan is modeled as cycling and fan energy is included in the energy-efficiency rating of the equipment, fan energy shall not be modeled explicitly. Supply, return, and/or exhaust fans will remain on during occupied and unoccupied hours in spaces that have health and safety mandated minimum ventilation requirements during unoccupied hours.

G3.1.2.5 Ventilation. Minimum *outdoor air* ventilation rates shall be the same for the *proposed* and *baseline building designs.*

Exception: When modeling demand-control ventilation in the *proposed design* when its use is not required by Section 6.4.3.8.

G3.1.2.6 Economizers. Outdoor air economizers shall not be included in *baseline* HVAC Systems 1 and 2. *Outdoor air* economizers shall be included in *baseline* HVAC Systems 3 through 8 based on climate as specified in Table G3.1.2.6A.

Exceptions: Economizers shall not be included for systems meeting one or more of the exceptions listed below.

a. Systems that include gas-phase air cleaning to meet the requirements of Section 6.1.2 in Standard 62.1. This exception shall be used only if the system in the *proposed design* does not match the *building design*.
b. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems. This exception shall only be used if the system in the *proposed design* does not use an economizer. If the exception is used, an economizer shall not be included in the *baseline building design.*

G3.1.2.7 Economizer High-Limit Shutoff. The high-limit shutoff shall be a dry-bulb switch with setpoint temperatures in accordance with the values in Table G3.1.2.6B.

G3.1.2.8 Design Airflow Rates. System design supply airflow rates for the *baseline building design* shall be based on a supply-air-to-room-air temperature difference of 20°F (11°C) or the required ventilation air or makeup air, whichever is greater. If return or relief fans are specified in the *proposed design*, the *baseline building design* shall also be modeled with fans serving the same functions and sized for the *baseline* system supply fan air quantity less the minimum *outdoor air*, or 90% of the supply fan air quantity, whichever is larger.

TABLE G3.1.2.6A Climate Conditions under which Economizers are Included for Baseline Systems 3 through 8

Climate Zone	Conditions
1a, 1b, 2a, 3a, 4a	N.R.
Others	Economizer Included

N.R. means that there is no conditioned building floor area for which economizers are included for the type of zone and climate.

TABLE G3.1.2.6B Economizer High-Limit Shutoff

Climate Zone	High-Limit Shutoff
1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8	75°F (24°C)
5a, 6a, 7a	70°F (21°C)
Others	65°F (18°C)

G3.1.2.9 System Fan Power. System fan electrical power for supply, return, exhaust, and relief (excluding power to fan-powered VAV boxes) shall be calculated using the following formulas:

For Systems 1 and 2,

$$P_{fan} = CFM_S \cdot 0.3 \ .$$

For systems 3 through 8,

$$P_{fan} = \text{bhp} \times 746 \ / \ \text{Fan Motor Efficiency}$$

where

P_{fan}	=	electric power to fan motor (watts)
bhp	=	brake horsepower of *baseline* fan motor from Table G3.1.2.9
Fan Motor Efficiency	=	the efficiency from Table 10.8 for the next motor size greater than the bhp using the enclosed motor at 1800 rpm.
CFM_S	=	the baseline system maximum design supply fan airflow rate in cfm (L/s)

G3.1.2.10 Exhaust Air Energy Recovery. Individual fan systems that have both a design supply air capacity of 5000 cfm (2400 L/s) or greater and have a minimum outdoor air supply of 70% or greater of the design supply air quantity shall have an energy recovery system with at least 50% recovery effectiveness. Fifty percent energy recovery effectiveness shall mean a change in the enthalpy of the *outdoor air* supply equal to 50% of the difference between the *outdoor air* and return air at design conditions. Provision shall be made to bypass or control the heat-recovery system to permit air economizer operation, where applicable.

TABLE G3.1.2.9 Baseline Fan Brake Horsepower

Baseline **Fan Motor Brake Horsepower**	
Constant Volume Systems 3–4	**Variable Volume Systems 5–8**
$CFM_s \cdot 0.00094 + A$	$CFM_s \cdot 0.00013 + A$

Where *A* is calculated according to Section 6.5.3.1.1 using the pressure drop adjustment from the proposed building design and the design flow rate of the baseline building system. Do not include pressure drop adjustments for evaporative coolers or heat recovery devices that are not required in the baseline building system by Section G3.1.2.10.

Exceptions: If any of these exceptions apply, exhaust air energy recovery shall not be included in the *baseline building design*:

a. Systems serving spaces that are not cooled and that are heated to less than 60°F (16°C).
b. Systems exhausting toxic, flammable, or corrosive fumes or paint or dust. This exception shall only be used if exhaust air energy recovery is not used in the *proposed design*.
c. Commercial kitchen hoods (grease) classified as Type 1 by NFPA 96. This exception shall only be used if exhaust air energy recovery is not used in the *proposed design*.
d. Heating systems in climate zones 1 through 3.
e. Cooling systems in climate zones 3c, 4c, 5b, 5c, 6b, 7, and 8.
f. Where the largest exhaust source is less than 75% of the design *outdoor airflow*. This exception shall only be used if exhaust air energy recovery is not used in the *proposed design*.
g. Systems requiring dehumidification that employ energy recovery in series with the cooling coil. This exception shall only be used if exhaust air energy recovery and series-style energy recovery coils are not used in the *proposed design.*
h. Systems serving laboratories with exhaust rates of 5000 cfm (2400 L/s) or greater.

G3.1.3 System-Specific Baseline HVAC System Requirements. *Baseline* HVAC systems shall conform with provisions in this section, where applicable, to the specified *baseline* system types as indicated in section headings.

G3.1.3.1 Heat Pumps (Systems 2 and 4). Electric air-source heat pumps shall be modeled with electric auxiliary heat. The systems shall be controlled with multistage space thermostats and an *outdoor air* thermostat wired to energize auxiliary heat only on the last thermostat stage and when outdoor air temperature is less than 40°F (4°C).

G3.1.3.2 Type and Number of Boilers (Systems 1, 5, and 7). The boiler plant shall use the same fuel as the *proposed design* and shall be natural draft, except as noted in Section G3.1.1.1. The *baseline building design* boiler plant shall be modeled as having a single boiler if the *baseline building design* plant serves a conditioned floor area of 15,000 ft^2 (1400 m^2) or less and as having two equally sized boilers for plants serving more than 15,000 ft^2 (1400 m^2). Boilers shall be staged as required by the load.

G3.1.3.3 Hot Water Supply Temperature (Systems 1, 5, and 7). Hot water design supply temperature shall be modeled as 180°F (82°C) and design return temperature as 130°F (54°C).

G3.1.3.4 Hot Water Supply Temperature Reset (Systems 1, 5, and 7). Hot water supply temperature shall be reset based on outdoor dry-bulb temperature using the following schedule: 180°F (82°C) at 20°F (–7°C) and below, 150°F (66°C) at 50°F (10°C) and above, and ramped linearly between 180°F (82°C) and 150°F (66°C) at temperatures between 20°F (–7°C) and 50°F (10°C).

G3.1.3.5 Hot Water Pumps (Systems 1, 5, and 7). The *baseline building design* hot water pump power shall be 19 W/gpm (301 kW/1000 L/s). The pumping system shall be modeled as primary-only with continuous variable flow. Hot water systems serving 120,000 ft^2 (11,148 m^2) or more shall be modeled with variable-speed drives, and systems serving less than 120,000 ft^2 (11,148 m^2) shall be modeled as riding the pump curve.

G3.1.3.6 Piping Losses (Systems 1, 5, 7, and 8). Piping losses shall not be modeled in either the *proposed* or *baseline building designs* for hot water, chilled water, or steam piping.

G3.1.3.7 Type and Number of Chillers (Systems 7 and 8). Electric chillers shall be used in the *baseline building design* regardless of the cooling energy source, e.g., direct-fired absorption, absorption from purchased steam, or purchased chilled water. The *baseline building design's* chiller plant shall be modeled with chillers having the number and type as indicated in Table G3.1.3.7 as a function of building peak cooling load.

G3.1.3.8 Chilled-Water Design Supply Temperature (Systems 7 and 8). Chilled-water design supply temperature shall be modeled at 44°F (6.7°C) and return water temperature at 56°F (13°C).

G3.1.3.9 Chilled-Water Supply Temperature Reset (Systems 7 and 8). Chilled-water supply temperature shall be reset based on outdoor dry-bulb temperature using the following schedule: 44°F (7°C) at 80°F (27°C) and above, 54°F (12°C) at 60°F (16°C) and below, and ramped linearly between 44°F (7°C) and 54°F (12°C) at temperatures between 80°F (27°C) and 60°F (16°C).

G3.1.3.10 Chilled-Water Pumps (Systems 7 and 8). The *baseline building design* pump power shall be 22 W/gpm (349 kW/1000 L/s). Chilled-water systems with a cooling capacity of 300 tons (11,148m^2) or more shall be modeled as primary/secondary systems with variable-speed drives on the secondary pumping loop. Chilled-water pumps in systems serving less than 300 tons (11,148m^2) cooling capacity shall be modeled as a primary/secondary systems with secondary pump riding the pump curve.

TABLE G3.1.3.7 Type and Number of Chillers

Building Peak Cooling Load	Number and Type of Chiller(s)
≤300 tons (11,148 m^2)	1 water-cooled screw chiller
>300 tons (11,148 m^2), <600 tons (22,296 m^2)	2 water-cooled screw chillers sized equally
≥<600 tons (22,296 m^2)	2 water-cooled centrifugal chillers minimum with chillers added so that no chiller is larger than 800 tons (2813 kW), all sized equally

TABLE G3.1.3.15 Part-Load Performance for VAV Fan Systems

Method 1—Part-Load Fan Power Data	
Fan Part-Load Ratio	**Fraction of Full-Load Power**
0.00	0.00
0.10	0.03
0.20	0.07
0.30	0.13
0.40	0.21
0.50	0.30
0.60	0.41
0.70	0.54
0.80	0.68
0.90	0.83
1.00	1.00

Method 2—Part-Load Fan Power Equation

$$P_{fan} = 0.0013 + 0.1470 \times PLR_{fan} + 0.9506 \times (PLR_{fan})^2 - 0.0998 \times (PLR_{fan})^3$$

where

P_{fan} = fraction of full-load fan power and

PLR_{fan} = fan part-load ratio (current cfm/design cfm).

G3.1.3.11 Heat Rejection (Systems 7 and 8). The heat rejection device shall be an axial fan cooling tower with two-speed fans. Condenser water design supply temperature shall be 85°F (29°C) or 10°F (5.6°C) approaching design wet-bulb temperature, whichever is lower, with a design temperature rise of 10°F (5.6°C). The tower shall be controlled to maintain a 70°F (21°C) leaving water temperature where weather permits, floating up to leaving water temperature at design conditions. The *baseline building design* condenser-water pump power shall be 19 W/gpm (310 kW/1000 L/s). Each chiller shall be modeled with separate condenser water and chilled-water pumps interlocked to operate with the associated chiller.

TABLE G3.2 Power Adjustment Percentages for Automatic Lighting Controls

Automatic Control Device(s)	Non-24-h and ≤ 5000 ft^2 (460 m^2)	All Other
1. Programmable timing control	10%	0%
2. Occupancy sensor	15%	10%
3. Occupancy sensor and programmable timing control	15%	10%

Note: These credits are only allowed where the control is not required by Section 9.4. The 5000 ft^2 (460 m^2)condition pertains to the total conditioned floor area of the building.

G3.1.3.12 Supply Air Temperature Reset (Systems 5 through 8). The air temperature for cooling shall be reset higher by 5°F (2.3°C) under the minimum cooling load conditions.

G3.1.3.13 VAV Minimum Flow Setpoints (Systems 5 and 7). Minimum volume setpoints for VAV reheat boxes shall be 0.4 cfm/ft^2 (2.15 L/s·m^2) of floor area served or the minimum ventilation rate, whichever is larger.

G3.1.3.14 Fan Power (Systems 6 and 8). Fans in parallel VAV fan-powered boxes shall be sized for 50% of the peak design primary air (from the VAV air-handling unit) flow rate and shall be modeled with 03.35 W/cfm (0.74 W per L/s) fan power. Minimum volume setpoints for fan-powered boxes shall be equal to 30% of peak design primary airflow rate or the rate required to meet the minimum outdoor air ventilation requirement, whichever is larger. The supply air temperature setpoint shall be constant at the design condition.

G3.1.3.15 VAV Fan Part-Load Performance (Systems 5 through 8). VAV system supply fans shall have variable-speed drives, and their part-load performance characteristics shall be modeled using either Method 1 or Method 2 specified in Table G3.1.3.15.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.