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

ASHRAE STANDARD

Energy Standard for Buildings Except Low-Rise Residential Buildings

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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

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FOREWORD

The control factors were selected based on published studies that document energy savings. The control factors are not as large as the documented savings. This way the overall energy performance of the building improves with the use of additional, not mandated controls. They generally cover office buildings, educational facilities, and retail stores. Control factors have been extended to other types of spaces when automatic, as opposed to when manually operated controls are employed, using the assumption that automated control systems give a similar performance irrespective of building type.

In addition, the control factors were coordinated with those used in the 2008 Title 24 language. The control factors in this proposal are in many instances slightly more conservative (smaller) than in Title 24.

The references that were used are the following:

1. *For personal control and manual dimming control:*
   - *Occupant Use of Manual Lighting Controls in Private Offices. IESNA Paper #34. Lighting Research Center, RPI.*
   - *Individual Lighting Control: Task Performance Mood & Illuminance: Lighting Research Center http://www.lrc.rpi.edu/resources/pdf/67-1999.pdf.*
   - *California Code of Regulations Title 24, Part 1 2008 Building Energy Efficiency Standards – 45-Day Language.*
   - *Dimming Controls for Lighting. PG&E. May 1997.*
2. *For multi-scene control with time scheduling:*
   - *California Code of Regulations Title 24, Part 1 2008 Building Energy Efficiency Standards – 45-Day Language.*
   - *Dimming Controls for Lighting. PG&E. May 1997.*
3. *For manual bi-level switching:*
   - *Lighting Controls Effectiveness Assessment. Final Report on Bi-level Lighting Study. ADM Associates for Heschong Mahone Group. May 2002.*
   - *Bi-Level Lighting Control Credits. PG&E. June 2002.*
   - *Demand Responsive Lighting: A Scoping Study. Jan 2007 LBL.*
4. *For automatic bi-level switching:*
   - *No specific references for the given applications are available in the public domain. The same control factors were used as in manual bi-level switching, but applications were extended to include spaces where manual control would likely not yield any benefits.*
5. *For daylighting control:*
   - *Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways. April 2005. Pacific Northwest National Lab for DOE.*
   - *Dimming Controls for Lighting. PG&E. May 1997.*
   - *Preliminary Results from An Advanced Lighting Controls Testbed.*
   - *Daylight Dividends Program; http://www.lrc.rpi.edu/programs/daylighting/dr_energyIssues.asp.*
   - *Daylighting Initiative – Lighting the Way. PG&E; http://www.pge.com/003_save_energy/003c_edu_train/pec/daylight/di_pubs/1487Gate_repaginated.pdf.*
   - *The Potential Simplified Concepts for Daylight Harvesting. Lighting Research Center; http://www.lrc.rpi.edu/programs/daylighting/pdf/simplifiedConcepts.pdf.*
   - *Daylighting in the NYTimes. Berkeley Labs. http://windows.lbl.gov/comm_perf/newyorktimes.htm.*
   - *Sidelighting Photocontrols Field Study. Heschong Mahone, 2003.*
   - *Draft Report Sidelighting – Daylighting Requirements for Sidelit Areas near Windows. July 2006, PG&E.*

Energy Impact:

The referenced studies show that energy savings from the use of manual dimming controls are in the range of 10%–80%. The proposed additional power allowances of 5% or 10%, depending on the application, give a net energy savings of at least the amount of the allowance, in many cases likely much more.

The referenced studies show that energy savings from the use of manual bi-level daylighting controls are in the range of 10%–21%. The proposed additional power allowances of 10% give a net energy savings in all but the worst performing cases, where the expected savings approximately equal the additional allowance.

The referenced studies show that energy savings from the use of automatic daylight dimming controls are in the range of 16%–70%. The proposed additional power allowances of 20% give a net energy savings in all but the worst performing cases, where the expected savings approximately equal the additional allowance.

Consistency with other standards:

The approach to encouraging the use of lighting controls in this proposal is the same as in Title 24. The proposed additional allowances are similar to those offered in Title 24, but not identical.

Addendum ac to Standard 90.1-2007

Add definitions to Section 3.2 as follows (I-P and SI units):

continuous daylight dimming: method of automatic lighting control using daylight *photosensors* where the lights are dimmed continuously or use at least four preset levels with at least a five-second fade between levels and where the control turns the lights off when sufficient daylight is available.

multi-level occupancy sensor: an occupancy sensor having an automatic OFF function that turns off all the lights, and either an automatic or a manually controlled ON function capable of activating between 30%–70% of the lighting power. After that event occurs, the device shall be capable of all of the following actions when manually called to do so by the occupant:

1. Activating alternate sets of lights.
2. Activating 100% of the lighting power.
3. Deactivating all lights.

primary sidelighted area: the total *primary sidelighted area* is the combined *primary sidelighted area* without double counting overlapping areas. The floor area for each *primary sidelighted area* is directly adjacent to vertical glazing below the ceiling with an area equal to the product of the *primary sidelighted area* width and the primary sidelighted area depth. See Figure 3.3.

The *primary sidelighted area* width is the width of the window plus, on each side, the smallest of:

1. 2 ft (0.6 m), or
2. the distance to any 5 ft (1.5 m) or higher vertical obstruction.

The *primary sidelighted area* depth is the horizontal distance perpendicular to the glazing, which is the smaller of:

1. one window head height (head height is the distance from the floor to the top of the glazing), or
2. the distance to any 5 ft (1.5 m) or higher vertical obstruction.

sidelighting effective aperture: relationship of daylight transmitted through windows to the *primary sidelighted areas*. The *sidelighting effective aperture* is calculated according to the following formula:

$$\text{Sidelighting Effective Aperture} = \frac{\sum \text{Window Area} \times \text{Window VLT}}{\text{Area of Primary Sidelighted}}$$

where Window VLT is the visible light transmittance of windows as determined in accordance with Section 5.8.2.6.

secondary sidelighted area: the total *secondary sidelighted area* is the combined *secondary sidelighted area* without double counting overlapping areas. The floor area for each *secondary sidelighted area* is directly adjacent to a primary sidelighted area with an area equal to the product of the *secondary sidelighted area* width and the *secondary sidelighted area* depth. See Figure 3.4.

The *secondary sidelighted area* width is the width of the window plus, on each side, the smallest of:

1. 2 ft (0.6 m), or
2. the distance to any 5 ft (1.5 m) or higher vertical obstruction.

The *secondary sidelighted area* depth is the horizontal distance perpendicular to the glazing which begins at the edge of the *primary sidelighted area* depth and ends at the smaller of:

1. one window head height (head height is the distance from the floor to the top of the glazing), or
2. the distance to any 5 ft (1.5 m) or higher vertical obstruction.

If the adjacent *primary sidelighted area* ends at a 5 ft (1.5 m) or higher vertical obstruction or beyond the nearest edge of a neighboring *daylight area under skylight* or *primary sidelighted area*, there is no *secondary sidelighted area* beyond such obstruction or the edge of such areas.

Modify Section 9 as follows (I-P and SI units):

9.1.4 Luminaire Wattage. Luminaire wattage incorporated into the *installed interior lighting power* shall be determined in accordance with the following criteria:

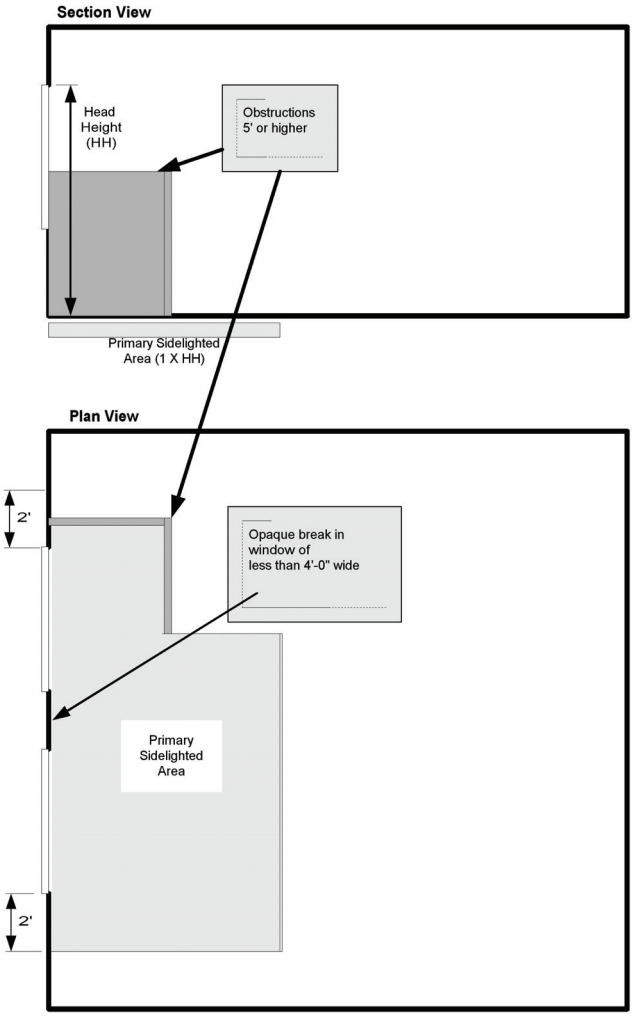

Figure 3.3 Computing the *primary sidelighted area*.

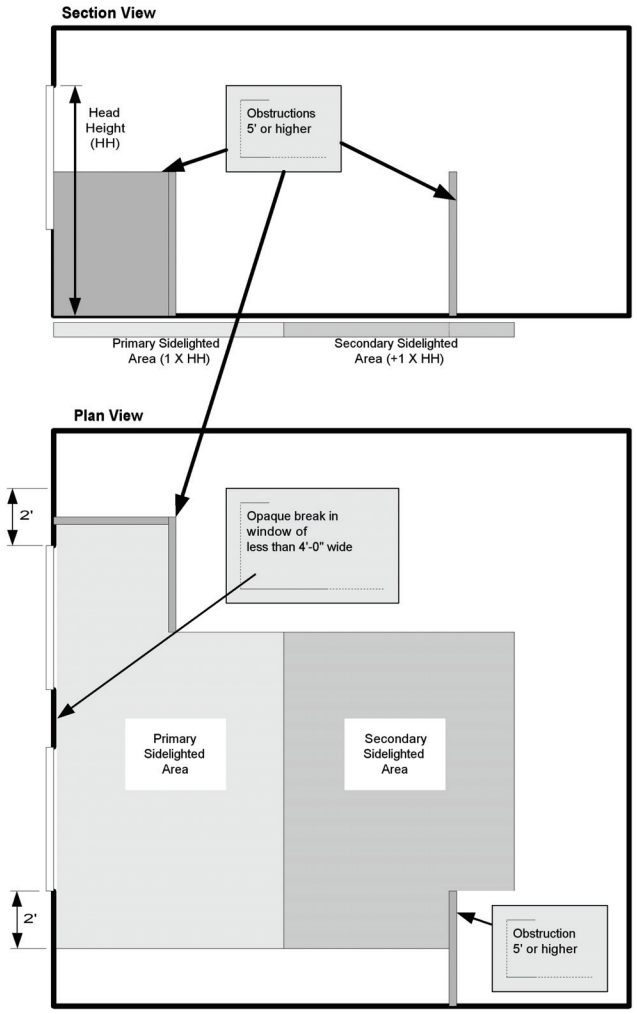

Figure 3.4 Computing the *secondary sidelighted area*.

a. The wattage of incandescent or tungsten-halogen luminaires with medium screw base sockets and not containing permanently installed ballasts shall be the maximum labeled wattage of the luminaire.

b. The wattage of luminaires with permanently installed or remote ballasts or *transformer*s shall be the operating input wattage of the maximum lamp/auxiliary combination based on values from the auxiliary *manufacturers'* literature or recognized testing laboratories or shall be the maximum labeled wattage of the luminaire.

Exception to 9.1.4b: Lighting power calculations for ballasts with adjustable ballast factors shall be based on the ballast factor that will be used in the space provided that the ballast factor is not user changeable.

9.6.2 Additional Interior Lighting Power. When using the Space-by-Space Method, an increase in the *interior lighting power allowance* is allowed for specific lighting functions. Additional power shall be allowed only if the specified lighting is installed and automatically controlled, separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified *luminaires* and shall not be used for any other purpose, unless otherwise indicated. An increase in the *interior lighting power allowance* is permitted in the following cases:

c. For space types identified in Table 9.6.2, when additional controls are used as indicated, provided that all mandatory controls are used according to Section 9.4, the additional lighting power, to be used anywhere in the building, is calculated as follows:

Additional Interior Lighting Power Allowance = Lighting Power Under Control × Control Factor;

where

Lighting Power Under Control = the total wattage of all lighting fixtures that are controlled in the given space using the control method indicated

Control Factor = the value given in Table 9.6.2 for the corresponding space type and control method.

TABLE 9.6.2 Control Factors Used in Calculating Additional Interior Lighting Power Allowance*

Additional Control Method (in Addition to Mandatory Requirements).	Space Type: Open Office, Private Office	Conference Room, Meeting Room, Classroom (Lecture/ Training)	Retail Sales Area	Lobby, Atrium, Dining Area, Corridors/ Stairways, Gym Pool, Mall Concourse, Parking Garage
Manual, continuous dimming control or Programmable multi-level dimming control	0.05	0.10†	0.10	0
Programmable multi-level dimming control using programmable time scheduling	0.05	0.10*	0.10	0.10
Multi-level occupancy sensors	0.05	0.05	0	0
Automatic bi-level or multi-level switching in *primary sidelighted areas* when *sidelighting effective aperture* is greater than 0.15		0	0.10	0
Automatic bi-level or multi-level switching in *primary sidelighted areas* when *sidelighting effective aperture* is greater than 0.15 and when *primary sidelighted area* is less than 1000 ft^2			0.10	
Automatic *continuous daylight dimming* in *primary sidelighted areas* when *sidelighting effective aperture* is greater than 0.15 and when *primary sidelighted area* is less than 1000ft^2			0.20	
Automatic *continuous daylight dimming* in *primary sidelighted areas* when *sidelighting effective aperture* is greater than 0.15 and when *primary sidelighted area* is greater than 1000 ft^2			0.10	
Automatic *continuous daylight dimming* in *secondary sidelighted areas* when *sidelighting effective aperture* is greater than 0.3			0.10	
Automatic *continuous daylight dimming* in *daylighted areas under skylights* when the total of those areas is less than 4,000 sq.ft. and when *skylight effective aperture* is greater than 0.01			0.20	
Automatic *continuous daylight dimming* in *daylighted areas under skylights* when the total of those areas is greater than 4,000 sq.ft. and when *skylight effective aperture* is greater than 0.01			0.10	

* (Only one control factor per controlled space may be used. Any manual controls must be user accessible.)
† These control factors may only be used if the requirements of section 9.4.1.2 are met using an occupancy sensor.

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.