ANSI/ASHRAE/IESNA Addenda ap, aq, ar, and av to
ANSI/ASHRAE/IESNA Standard 90.1-2004

ASHRAE STANDARD

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by the ASHRAE Standards Committee on January 27, 2007; by the ASHRAE Board of Directors on March 2, 2007; by IESNA on January 18, 2007; and by the American National Standards Institute on March 3, 2007.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, http://www.ashrae.org, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada).

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SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus standard developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Consensus is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

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.

The Manager of Standards of ASHRAE should be contacted for:

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard,
d. permission to reprint portions of the Standard.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This change clarifies the intent of the "sales area" space type and the appropriate application of the retail additional lighting power allowances. The inclusion of "sales area" in the common column confirms that sales areas can occur in many building types. The relocation of the reference note in the retail building type section confirms that the retail additional allowances are meant to be applied to sales areas regardless of what building type they exist in.

Note: *In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.*

Addendum ap to 90.1-2004 (I-P and SI Editions)

Make the following changes to the ***I-P Edition****.*

TABLE 9.6.1 (*continued*) Lighting Power Densities Using the Space-by-Space Method

Common Space Types[a]	LPD (W/ft^2)	Building Specific Space Types	LPD (W/ft^2)
Electrical/Mechanical	1.5	Bank/Office—Banking Activity Area	1.5
Workshop	1.9	Religious Buildings	
Sales Area [For accent lighting, see 9.6.2 (b)]	1.7	Worship Pulpit, Choir	2.4
		Fellowship Hall	0.9
		Retail ~~[For accent lighting, see 9.3.1.2.1(c)]~~	
		Sales Area [For accent lighting, see 9.6.2 (b)]	1.7
		Mall Concourse	1.7

The rest of the table remains unchanged.

Make the following changes to the ***SI edition****.*

TABLE 9.6.1 (*continued*) Lighting Power Densities Using the Space-by-Space Method

Common Space Types[a]	LPD (W/m^2)	Building Specific Space Types	LPD (W/m^2)
Electrical/Mechanical	16	Bank/Office—Banking Activity Area	16
Workshop	20	Religious Buildings	
Sales Area [For accent lighting, see 9.6.2 (b)]	18	Worship Pulpit, Choir	26
		Fellowship Hall	10
		Retail ~~[For accent lighting, see 9.3.1.2.1(c)]~~	
		Sales Area [For accent lighting, see 9.6.2 (b)]	18
		Mall Concourse	18

The rest of the table remains unchanged.

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FOREWORD

The latest edition of CTI Standard 201 is dated 2004. This edition made minor procedural changes facilitating certification as well as expanded the range of wet bulbs covered by the certification standard.

Expansion of the range of wet bulbs covered by the certification program allows manufacturers in more areas of the world to perform certification tests locally (*for example, a Dutch manufacturer can test locally at lower wet bulbs rather than ship their towers to the United States for testing*). *This change encourages more manufacturers to certify their cooling towers.*

The format of both standards should also be updated to match that used by the Cooling Technology Institute. Both of these CTI Standards in their current form remain compatible with their use in the 90.1 energy standard.

The dates shown are the most recent dates as of addendum ak. The current standard shows CTI ATC-105(97) and CTI STD-201(96).

Note: *In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.*

Addendum aq to 90.1-2004 (I-P and SI Editions)

Make the following changes to the ***I-P and SI editions****.*

12. NORMATIVE REFERENCES

Reference	Title
Cooling Technology Institute, 2611 FM 1960 West, Suite A-101, Houston, TX 77068-3730; P.O. Box 73383, Houston, TX 77273-3383	
CTI ATC-105–~~2000~~ (00)	Acceptance Test Code for Water Cooling Towers
CTI STD-201–~~2002~~ (04)	Standard for the Certification of Water-Cooling Tower Thermal Performance

The rest of the table remains unchanged.

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FOREWORD

The cost of the technology used to allow for the reduction in power of 30% at 50% air volume has improved and can be extended from 15 HP to 10 HP. The Mechanical Subcommittee has conducted an economic analysis for a typical VAV unit where motors of this size would be used. The savings at various static's would be:

- *0.40 in. water static kW-h savings = 4520 kWh reduction/yr*
- *1.0 in. water static kW-h savings = 5663 kWh reduction/yr*
- *1.5 in. water static kW-h savings = 6662 kWh reduction/yr*

Using industry cost data we found a payback of 0.6 years for a typical VAV application. A sensitivity study, with ±25% operating hours, changes the payback from 0.75 to 0.45 hours, which substantiates the change.

Also note that this change will align the requirements in 90.1-2004 with the IECC, which has already lowered the limit to motors 10 HP and higher.

The study also indicates that there may be a possibility of lowering the fan power limitation requirement, and further studies are being considered by the Mechanical Subcommittee.

***Note:** In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.*

Addendum ar to 90.1-2004 (I-P and SI Editions)

*Make the following change to the **I-P edition**.*

6.5.3.2.1 Part-Load Fan Power Limitation. Individual VAV fans with motors ~~15~~ 10 hp and larger shall meet one of the following:

*Make the following change to the **SI edition**.*

6.5.3.2.1 Part-Load Fan Power Limitation. Individual VAV fans with motors ~~11~~ 7.5 kW and larger shall meet one of the following:

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FOREWORD

Exception (b) to Section 5.5.4.4.1 allows users to take credit for overhangs toward compliance with the maximum SHGC requirements. The table of credits was developed based on an opaque overhang, with guidance as to partially opaque overhangs. This addendum provides clarification on how the credits will apply to louvered overhangs.

Note: *In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.*

Addendum av to 90.1-2004 (I-P and SI Editions)

Revise as follows for ***I-P and SI versions****.*

5.5.4.4 Fenestration Solar Heat Gain Coefficient (SHGC).

5.5.4.4.1 SHGC of Vertical Fenestration. *Vertical fenestration* shall have an *SHGC* not greater than that specified for "all" orientations in Tables 5.5-1 through 5.5-8 for the appropriate total *vertical fenestration area*.

Exceptions to 5.5.4.4.1:

(a) In latitudes greater than 10 degrees, the *SHGC* for *north-oriented vertical fenestration* shall be calculated separately and shall not be greater than that specified in Tables 5.5-1 through 5.5-8 for *north-oriented fenestration*. When this exception is used, the *fenestration area* used in selecting the criteria shall be calculated separately for *north-oriented* and all other-oriented *fenestration*.

Note to *adopting authority*: If the project is in the southern hemisphere, change north to south and June 21 to December 22.

(b) For demonstrating compliance for *vertical fenestration,* shaded by opaque permanent projections that will last as long as the building itself, the *SHGC* in the proposed building shall be reduced by using the multipliers in Table 5.5.4.4.1. Permanent projections consisting of open louvers shall be considered to provide shading, provided that no sun penetrates the louvers during the peak sun angle on June 21.

(c) For demonstrating compliance for *vertical fenestration* shaded by partially opaque permanent projections (e.g., framing with glass or perforated metal) that will last as long as the building itself, the *projection factor* shall be reduced by multiplying it by a factor O_s derived as follows:

$$O_s = (A_i \cdot O_i) + (A_f \cdot O_f)$$

where

O_s = percent opacity of the shading device

A_i = percent of the area of the shading device that is a partially opaque infill

O_i = percent opacity of the infill; for glass = (100% – T_s) where T_s is the solar transmittance as determined in accordance with NFRC 300; for perforated or decorative metal panels, O_i = percentage of solid material

A_f = percent of the area of the shading device that represents the framing members

O_f = percent opacity of the framing members; if solid, then 100%

And then the *SHGC* in the proposed building shall be reduced by using the multipliers in Table 5.5.4.4.1 for each *fenestration* product.

(d) *Vertical fenestration* that is located on the street side of the street-level story only, provided that

1. the street side of the street-level story does not exceed 20 ft in height,
2. the *fenestration* has a continuous overhang with a weighted average *projection factor* greater than 0.5, and
3. the *fenestration area* for the street side of the street-level story is less than 75% of the *gross wall area* for the street side of the street-level story.

When this exception is utilized, separate calculations shall be performed for these sections of the *building envelope,* and these values shall not be averaged with any others for compliance purposes. No credit shall be given here or elsewhere in the building for not fully utilizing the *fenestration area* allowed.

TABLE 5.5.4.4.1
SHGC Multipliers for Permanent Projections

Projection Factor	SHGC Multiplier (All Other Orientations)	SHGC Multiplier (North-Oriented)
0–0.10	1.00	1.00
> 0.10-0.20	0.91	0.95
> 0.20-0.30	0.82	0.91
> 0.30-0.40	0.74	0.87
> 0.40-0.50	0.67	0.84
> 0.50-0.60	0.61	0.81
> 0.60-0.70	0.56	0.78
> 0.70-0.80	0.51	0.76
> 0.80-0.90	0.47	0.75
> 0.90-1.00	0.44	0.73

5.5.4.4.2 SHGC of Skylights. *Skylights* shall have an *SHGC* not greater than that specified for "all" orientations in Tables 5.5-1 through 5.5-8 for the appropriate total *skylight area*.

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.