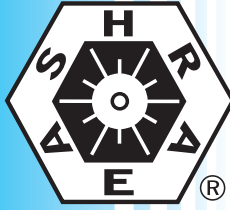


**ANSI/ASHRAE/IESNA Standard 90.1-2007**  
(Supersedes ANSI/ASHRAE/IESNA Standard 90.1-2004)  
Includes ANSI/ASHRAE/IESNA Addenda listed in Appendix F



# ASHRAE STANDARD

## Energy Standard for Buildings Except Low-Rise Residential Buildings

**I-P Edition**

See Appendix F for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the IESNA Board of Directors, and the American National Standards Institute.

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](mailto: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).

© Copyright 2007 ASHRAE, Inc.

ISSN 1041-2336

Jointly sponsored by



The  
LIGHTING  
AUTHORITY

Illuminating Engineering Society of North America  
[www.iesna.org](http://www.iesna.org)



[www.ansi.org](http://www.ansi.org)

**American Society of Heating, Refrigerating  
and Air-Conditioning Engineers, Inc.**

1791 Tullie Circle NE, Atlanta, GA 30329

[www.ashrae.org](http://www.ashrae.org)

**ASHRAE Standing Standard Project Committee 90.1**  
**Cognizant TC: TC 7.6, Systems Energy Utilization**  
**SPLS Liaisons: Hugh F. Crowther and Ross Montgomery**  
**ASHRAE Staff Liaison: Steven C. Ferguson**  
**IESNA Liaison: Rita M. Harrold**

Jerry W. White, Jr., <i>Chair</i> *	Jason J. Glazer*	Frank T. Morrison
James M. Calm, <i>Vice-Chair</i> *	S. Pekka Hakkarainen*	Frank Myers*
Michael Schwedler, <i>Vice-Chair</i> *	Katherine G. Hammack*	Ronald G. Nickson
Carol E. Marriott, <i>Vice-Chair</i>	Susanna S. Hanson	Jim A. Ranfone
Wagdy A.Y. Anis*	Richard V. Heinisch*	Eric E. Richman*
Anthony Arbore	Ned B. Heminger	Michael I. Rosenberg*
Karim Amrane*	Randall T. Higa*	Steven Rosenstock*
William P. Bahnfleth*	John F. Hogan*	Robert D. Ross*
Peter A. Baselici*	William G. Holy*	David A. Schaaf, Jr.*
Van D. Baxter*	Hyman M. Kaplan*	Leonard C. Sciarra*
Denise M. Beach	Larry Kouma*	Bipin Vadilal Shah*
Donald L. Beaty*	Ronald D. Kurtz*	Stephen V. Skalko*
Valerie L. Block	Samantha H. LaFleur	Frank A. Stanonik*
Donald M. Brundage*	Michael D. Lane*	Dennis Sczomak*
Ken Brendan*	Dean E. Lewis	Joseph K. Ting
Ernest A. Conrad	Richard Lord	Cedric S. Trueman*
Charles C. Cottrell*	Kenneth Luther*	Martha G. VanGeem
Roy Crane*	Ronald Majette*	Carl Wagus*
Joseph J. Deringer*	Itzhak H. Maor*	McHenry Wallace, Jr.*
Keith I. Emerson*	R. Christopher Mathis	Richard D. Watson*
Drake H. Erbe*	Merle F. McBride	David Weitz*
Thomas A. Farkas	Michael W. Mehl	Robin Wilson
Charles R. Foster, III	Harry P. Misuriello	Michael W. Woodford
Allan Fraser*	Louis J. Molinini	Donald R. Wulfinghoff
James A. Garrigus*	John Montgomery*	Stanley W. Zajac

*\*Denotes members of voting status when this standard was approved for publication.*

### ASHRAE STANDARDS COMMITTEE 2006–2007

David E. Knebel, *Chair*  
Stephen D. Kennedy, *Vice-Chair*  
Michael F. Beda  
Donald L. Brandt  
Steven T. Bushby  
Paul W. Cabot  
Hugh F. Crowther  
Samuel D. Cummings, Jr.  
Robert G. Doerr  
Roger L. Hedrick  
John F. Hogan  
Eli P. Howard, III  
Frank E. Jakob  
Jay A. Kohler

James D. Lutz  
Carol E. Marriott  
Merle F. McBride  
Mark P. Modera  
Ross D. Montgomery  
H. Michael Newman  
Stephen V. Santoro  
Lawrence J. Schoen  
Stephen V. Skalko  
Bodh R. Subherwal  
Jerry W. White, Jr.  
James E. Woods  
Richard D. Hermans, *BOD ExO*  
Hugh D. McMillan, III, *CO*

Claire B. Ramspeck, *Assistant Director of Technology for Standards and Special Projects*

---

### 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, or
- d. permission to reprint portions of the Standard.

### DISCLAIMER

ASHRAE uses its best efforts to promulgate Standards and Guidelines for the benefit of the public in light of available information and accepted industry practices. However, ASHRAE does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with ASHRAE's Standards or Guidelines or that any tests conducted under its Standards or Guidelines will be nonhazardous or free from risk.

### ASHRAE INDUSTRIAL ADVERTISING POLICY ON STANDARDS

ASHRAE Standards and Guidelines are established to assist industry and the public by offering a uniform method of testing for rating purposes, by suggesting safe practices in designing and installing equipment, by providing proper definitions of this equipment, and by providing other information that may serve to guide the industry. The creation of ASHRAE Standards and Guidelines is determined by the need for them, and conformance to them is completely voluntary.

In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

This is a preview of "ANSI/ASHRAE/IESNA 90...". [Click here to purchase the full version from the ANSI store.](#)

## CONTENTS

### ANSI/ASHRAE/IESNA Standard 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings

SECTION	PAGE
Foreword.....	4
1 Purpose .....	4
2 Scope .....	4
3 Definitions, Abbreviations, and Acronyms .....	4
4 Administration and Enforcement.....	15
5 Building Envelope .....	17
6 Heating, Ventilating, and Air Conditioning .....	30
7 Service Water Heating.....	55
8 Power.....	58
9 Lighting .....	58
10 Other Equipment.....	64
11 Energy Cost Budget Method .....	65
12 Normative References .....	74
Normative Appendix A: Rated R-Value of Insulation and Assembly U-Factor, C-Factor, and F-Factor Determinations .....	76
Normative Appendix B: Building Envelope Climate Criteria .....	103
Normative Appendix C: Methodology for Building Envelope Trade-Off Option in Subsection 5.6 .....	114
Normative Appendix D: Climatic Data .....	123
Informative Appendix E: Informative References .....	168
Informative Appendix F: Addenda Description Information .....	170
Informative Appendix G: Performance Rating Method .....	173

#### NOTE

**When addenda, interpretations, or errata to this standard have been approved, they can be downloaded free of charge from the ASHRAE Web site at <http://www.ashrae.org>.**

© Copyright 2007 American Society of Heating,  
Refrigerating and Air-Conditioning Engineers, Inc.  
1791 Tullie Circle NE  
Atlanta, GA 30329  
[www.ashrae.org](http://www.ashrae.org)

All rights reserved.

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

## FOREWORD

The original Standard 90 was published in 1975 and revised editions were published in 1980, 1989, and 1999 using the ANSI and ASHRAE periodic maintenance procedures. Based upon these procedures, the entire standard was publicly reviewed and published in its entirety each time. As technology and energy prices began changing more rapidly, however, the ASHRAE Board of Directors voted in 1999 to place the standard on continuous maintenance, permitting the standard to be updated several times each year through the publication of approved addenda to the standard. Starting with the 2001 edition, the standard is now published in its entirety in the fall of every third year. This schedule allows the standard to be submitted and proposed by the deadline for inclusion or reference in model building and energy codes. All approved addenda and errata will be included in the new edition every three years. This procedure allows users to have some certainty about when new editions will be published.

This 2007 edition of the standard has several new features and includes changes resulting from the continuous maintenance proposals from the public. The committee welcomes suggestions for improving the standard. Users of the standard are encouraged and invited to use the continuous maintenance procedure to suggest changes. A form for submittal of a proposed change is included in the back of this standard. The committee will take formal action on every proposal received.

The project committee is continually considering changes and proposing addenda for public review. When addenda are approved, notices will be published on the ASHRAE and IESNA Web sites. Users are encouraged to sign up for the free ASHRAE and IESNA Internet Listserv for this standard to receive notice of all public reviews and approved and published addenda and errata.

This edition corrects all known typographical errors in the 2004 standard. It also includes the content of 31 addenda that were processed by the committee and approved by the ASHRAE and IESNA Boards of Directors. For brief descriptions and the publication dates of the addenda to 90.1-2004, see Appendix F.

## 1. PURPOSE

The purpose of this standard is to provide minimum requirements for the energy-efficient design of buildings except low-rise residential buildings.

## 2. SCOPE

2.1 This standard provides:

- a. minimum energy-efficient requirements for the design and construction of:

1. new buildings and their systems
  2. new portions of buildings and their systems
  3. new systems and equipment in existing buildings
- b. criteria for determining compliance with these requirements.
- 2.2 The provisions of this standard apply to:
- a. the envelope of buildings, provided that the enclosed spaces are
    1. heated by a heating system whose output capacity is greater than or equal to 3.4 Btu/h·ft<sup>2</sup> or
    2. cooled by a cooling system whose sensible output capacity is greater than or equal to 5 Btu/h·ft<sup>2</sup>, and
  - b. the following systems and equipment used in conjunction with buildings:
    1. heating, ventilating, and air conditioning,
    2. service water heating,
    3. electric power distribution and metering provisions,
    4. electric motors and belt drives, and
    5. lighting.

2.3 The provisions of this standard do not apply to

- a. single-family houses, multi-family structures of three stories or fewer above grade, manufactured houses (mobile homes), and manufactured houses (modular),
- b. buildings that do not use either electricity or fossil fuel, or
- c. equipment and portions of building systems that use energy primarily to provide for industrial, manufacturing, or commercial processes.

2.4 Where specifically noted in this standard, certain other buildings or elements of buildings shall be exempt.

2.5 This standard shall not be used to circumvent any safety, health, or environmental requirements.

## 3. DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

3.1 **General.** Certain terms, abbreviations, and acronyms are defined in this section for the purposes of this standard. These definitions are applicable to all sections of this standard. Terms that are not defined shall have their ordinarily accepted meanings within the context in which they are used. Ordinarily accepted meanings shall be based upon American standard English language usage as documented in an unabridged dictionary accepted by the *adopting authority*.

### 3.2 Definitions

**above-grade wall:** see *wall*.

**access hatch:** see *door*.