

STANDARD

ANSI/ASHRAE/IES Standard 90.1-2016
(Supersedes ANSI/ASHRAE/IES Standard 90.1-2013)
Includes ANSI/ASHRAE/IES addenda listed in Appendix H

Energy Standard for Buildings Except Low-Rise Residential Buildings (I-P Edition)

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

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Energy Standard for Buildings Except Low-Rise Residential Buildings (I-P Edition)**

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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

Standard 90.1 was first published originally in 1975, and revised editions followed in 1980, 1989, and 1999 following ANSI and ASHRAE periodic maintenance procedures. In this way, the standard was publicly reviewed and published in its entirety each time. As energy prices and technology began changing more rapidly, the ASHRAE Board of Directors voted in 1999 to place the standard on continuous maintenance, which permitted the standard to be updated several times each year through publication of approved addenda. As of 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 for inclusion or reference in model building and energy codes. All approved addenda and errata are included in the new edition. This procedure allows users some certainty of the timing of publication.

The 2016 edition of the standard includes numerous energy-saving measures resulting from continuous maintenance proposals submitted by the public and from volunteers on the committee. The Project Committee welcomes suggestions for improvement, and users are encouraged to use the continuous maintenance proposal (CMP) form included in the back of this standard to submit recommended changes. The committee takes formal action on every CMP received.

More than 125 addenda to the 2013 edition of the standard were processed by the committee and approved by the ASHRAE and IES Boards of Directors and are incorporated into the 2016 edition. [Appendix H](#) gives brief descriptions and publication dates of these addenda. The 2016 edition also corrects all known typographical errors in the 2013 standard.

This new edition includes format changes to improve usability and readability:

- a. One-column format for easier reading*
- b. Exceptions separated, indented, and set apart with a smaller font size*
- c. Italicized defined terms*
- d. Changes to table formats to provide contrast between rows*

Additional structural changes include the following:

- a. A new Reference Standard Reproduction Annex 1 is provided at the end of the document. Section [5.1.4](#) now cites ASHRAE Standard 169 as the source for climatic data, and Annex 1 contains extracts of tables and figures from that standard for the reader's convenience.*
- b. Two new climate zones (0A/B) have been added to all prescriptive requirements tables.*

The most significant technical changes included are as follows:

- a. **Building Envelope***
 - 1. Mandatory provisions include the addition of envelope verification in support of reduced air infiltration and increased requirements for air leakage of overhead coiling doors.*
 - 2. Prescriptive requirements include increased stringency requirements for metal building roofs and walls, fenestration, and opaque doors. Requirements have been added for all assemblies for Climate Zone 0.*

3. *The clarity of the standard has been improved with regard to topics such as defining exterior walls, building orientation, fault assumptions for the effective R-value of air spaces, and calculation procedures for insulating metal building walls.*

b. Lighting

1. *Requirements for exterior and interior lighting power densities have been modified to reflect new lighting levels in the IES lighting handbook, which recognizes that LED technology is a common application in current lighting design and can provide additional energy savings.*
2. *Lighting control requirements have been modified to add additional controls in some space types and options to others to allow easier application of advanced controls.*

c. Mechanical

1. *Chilled-water plant metering. Large, electric-driven chilled-water plants are now required to be monitored for electric energy use and efficiency.*
2. *DOAS requirements. Dedicated outdoor air systems now include both efficiency and rating requirements for compliance.*
3. *Elevator efficiency. Requirements are introduced for designs to include both use category and efficiency class. While a minimum threshold is not listed, the first step is taken toward including minimum elevator efficiency requirement in a future standard.*
4. *Economizer diagnostics. The standard now requires that air-cooled DX cooling units with economizers have a monitoring system to determine that the air economizer is working properly.*

d. Energy Cost Budget (ECB) and Modeling. *Significant changes to the application of [Appendix G](#) are included as follows:*

1. *[Appendix G](#) now can be used as a path for compliance with the standard. Previously, [Appendix G](#) was used only to rate beyond-code performance of buildings. This new version of [Appendix G](#) can show compliance with the 2016 version of the standard in the following manner:*
 - (a) *The proposed design requires computation of a new metric, Performance Cost Index (PCI), and demonstration that it is less than that shown in [Table 4.2.1.1](#), based on building type and climate zone.*
 - (b) *The baseline design is now fixed at a certain level of performance, the stringency or baseline of which is expected not to change with subsequent versions of the standard. In this way, a building of any era can be rated using the same method.*
2. *Other modifications to [Appendix G](#) include changes to elevator, motor, and refrigeration baselines; changes to the baseline for existing building projects; and changes to specific opaque assemblies for the baseline envelope model. Modeling rule changes were made to heat pump auxiliary heat, economizer shutoff, lighting controls, humidification systems, cooling towers, and the simulation of preheat coils.*

Standard 90.1 is a fluid document. As technology evolves, the project committee is continually considering new changes and proposing addenda for public review. When addenda are approved, notices are published on the ASHRAE and IES websites. Users are encouraged to sign up for the free ASHRAE and IES Internet listserv for this standard to receive notice of all public reviews and approved and published addenda and errata.

The Chair and Vice-Chairs extend grateful thanks to the committee volunteers, public review commenters, and all involved in the open, consensus-based process.

1 Purpose

1.1

To establish the minimum *energy efficiency* requirements of *buildings* other than *low-rise residential buildings* for

- a. design, *construction*, and a plan for operation and maintenance; and
- b. utilization of on-site, renewable *energy* resources.

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2 Scope

2.1

This standard provides

- a. minimum *energy*-efficient requirements for the design and *construction*, and a plan for operation and maintenance of
 1. new *buildings* and their *systems*,
 2. new portions of *buildings* and their *systems*,
 3. new *systems* and *equipment* in *existing buildings*, and
 4. new *equipment* or *building systems* specifically identified in the standard that are part of industrial or manufacturing processesand
- b. criteria for determining compliance with these requirements.

2.2

The provisions of this standard do not apply to

- a. single-family houses, multifamily structures of three stories or fewer above *grade*, manufactured houses (mobile homes), and manufactured houses (modular) or
- b. *buildings* that use neither electricity nor *fossil fuel*.

2.3

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

2.4

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