# CONTENTS

## ANSI/ASHRAE/IES Standard 90.1-2022
## Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings (I-P Edition)



**NOTE**

**Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.**

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## FOREWORD

*The 2022 edition of Standard 90.1 incorporates more than 80 addenda to the 2019 edition and includes numerous energy-saving measures. Notable changes include the following:*

### *General*

- *The scope of the standard has been expanded to include sites as well as buildings, enabling regulation of energy use associated with the building but not in the building itself, such as exterior or parking lot lighting not connected to the building electric service. This also allows for equipment, such as photovoltaic (PV) equipment, located on site but not within the building.*
- *A new energy credits requirement (new Section 11) has been added that enables approximately 4% to 5% cost-effective energy savings through 33 different energy-saving measures. The number of required credits varies by building type and climate zone.*
- *A minimum prescriptive requirement for on-site renewable energy has been added. This requirement includes exceptions for small buildings, buildings with limited roof space, and other situations where PV installations would be problematic.*
- *It should be noted that, due to the addition of a new section and several appendices, the number or letter designations of several well-known sections and appendices have changed from those used in the 2019 and previous editions of the standard.*

### *Administration and Enforcement*

- *There were no major changes to administration and enforcement.*

### *Building Envelope*

- *A requirement was added to perform whole-building air-leakage testing and measurement on buildings less than 25,000 $ft^2$.*
- *Requirements were added that address the impacts of thermal bridges in building envelopes, with a new Informative Appendix K providing supplemental information on application.*
- *A solar reflectance requirement for walls was added for Climate Zone 0. This is similar to the requirements for high albedo roofs.*
- *Specific provisions were added to distinguish roof replacements from other types of alterations.*
- *A new reference was added for steel-framed walls to allow use of ANSI/AISI S250 for U-factor determination.*
- *Added a definition for insulated metal panels (IMPs).*
- *Normative Appendix A was reformatted to clarify the requirements for thermal performance calculations.*

### *Lighting and Power*

- *Reorganized Section 9, "Lighting," to be more consistent with the structure of other main sections of the standard.*
- *Updated installed interior lighting power allowances and minimum control requirements; added a power exception for the germicidal function in luminaires and sources; and removed exceptions for casinos and parking garage daylight transition zone lighting.*
- *Modified a number of lighting requirements to reflect greater use of higher efficiency LED products and revised lighting practices.*
- *Added requirements for indoor horticultural lighting in greenhouses and indoor grow buildings based on a new metric, photosynthetic photon efficacy (PPE), developed in ANSI/ASABE S640.*
- *Provided an additional interior lighting power allowance for video conferencing. Power allowances and controls have been moved to a table for ease of reference.*

### *Mechanical*

- *Introduced an optional Mechanical System Performance Path that allows HVAC system efficiency trade-offs based on a new metric, total system performance ratio (TSPR).*
- *Required condensing boilers for new construction in order to achieve 90% or greater efficiency for large boilers (1 to 10 million Btuh. The thermal efficiency requirements for high-capacity gas-fired service water-heating equipment were also increased.*
- *Established a minimum enthalpy recovery ratio for energy recovery systems and specified operational requirements to ensure proper economized performance.*
- *Revised demand control ventilation requirements to be based on climate zone and Standard 62.1 airflow requirements.*
- *Modified the minimum efficiency requirements for air-source heat pumps and introduced a new metric, $COP_{HR}$, for units that perform heat recovery during chiller operation.*
- *Added the minimum energy efficiency requirements (and new CFEI metric) for large-diameter ceiling fans from 10 CFR 430.*

### *Performance Rating Method (Appendix G)*

- *New requirements were added to limit trade-offs between the building envelope and other building systems.*
- *A new Informative Appendix I was added that provides information on how alternative performance metrics other than cost could be used with the Performance Rating Method. These alternative metrics include site energy, source energy, and carbon emissions, and would be useful to assess building performance against carbon emission goals or for similar types of comparison.*
- *A relaxation in stringency was added when using Normative Appendix G for retrofit projects consisting of substantial alterations.*

### *Both Performance-Based Compliance Paths (Section 12 [Energy Cost Budget Method] and Appendix G)*

- *Numerous changes were included to improve clarity and coordinate with revisions to other sections of the standard.*

### *New Normative Appendix J*

- *Contains performance curves that represent minimally compliant chiller performance for the budget and baseline building design and for proposed building designs when specific equipment performance is not known.*

## 1. PURPOSE

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

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

## 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* specifically identified in this standard that are part of a *site*,
   4. new *systems* and *equipment* in *existing buildings*, and
   5. new *equipment* or *building systems* specifically identified in this standard that are part of *process applications*

   and
b. criteria for determining compliance with these requirements.

**2.2** The provisions of this standard do not apply to

a. single-family houses and related incidental *structures*, 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* or *sites* shall be exempt.

**2.4** 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. When the tense or plurality of the term is different than the defined term, the definition still applies. These definitions are applicable to all sections of this standard, wherever *italicized*. Terms that are not italicized shall have their ordinarily accepted meanings within the context in which they are used. Ordinarily accepted meanings shall be based on 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*.

***addition:*** an extension or increase in *floor* area or height of a *building* outside of the *existing building envelope* or the *equipment* or *systems* to a *site*.

***adopting authority:*** the agency or agent that adopts this standard.

***air economizer:*** see *economizer, air*.

***air leakage:*** the uncontrolled airflow through the *building envelope* caused by pressure differences across the *building envelope* due to factors such as wind, inside and outside temperature differences, stack effect, and imbalance between supply and exhaust air *systems*. *Air leakage* can move inward (infiltration) or outward (exfiltration) through the *building envelope*.

***air system balancing:*** see *balancing, air system*.

***alteration:*** replacing or adding to *systems*, *equipment*, *structures*, or *building* assemblies; routine maintenance, *repair*, and service, or a change in the *building* or *structure* use classification or *space conditioning category* shall not constitute an *alteration*.

***annual fuel utilization efficiency (AFUE):*** an *efficiency* descriptor of the ratio of annual output *energy* to annual input *energy* as developed in accordance with the requirements of U.S. Department of Energy (DOE) 10 CFR Part 430.

***attic and other roofs:*** see *roof*.

***authority having jurisdiction:*** the agency or agent responsible for enforcing this standard.

***automatic* or *automatically:*** self-acting, operating by its own mechanism when actuated by some nonmanual influence, such as a change in current strength, pressure, temperature, or mechanical configuration.

***automatic control device:*** a device capable of *automatically* turning loads off and on without *manual* intervention.

***balancing, air system:*** adjusting airflow rates through air *distribution system* devices, such as fans and diffusers, by manually adjusting the position of dampers, splitter vanes, extractors, etc., or by using *automatic control devices* such as constant-air-volume or *variable-air-volume (VAV)* boxes.

***balancing, hydronic system:*** adjusting water flow rates through hydronic *distribution system* devices, such as *pumps* and coils, by manually adjusting the position valves or by using *automatic control devices* such as *automatic* flow control valves.

***ballast:*** a device used in conjunction with an electric-discharge *lamp* to cause the *lamp* to start and operate under the proper circuit conditions of voltage, current, wave form, electrode heat, etc.

***baseline building design:*** a computer representation of a hypothetical design based on the *proposed design*. This representation is used as the basis for calculating the *baseline building performance* for rating above-standard design or when using the *Performance Rating Method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.