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# CONTENTS
## ANSI/ASHRAE/IES Standard 90.1-2025
## Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings
## (SI Edition)


| SECTION | PAGE |
|---|---|
| Foreword | 2 |
| 1 Purpose | 4 |
| 2 Scope | 4 |
| 3 Definitions, Abbreviations, and Acronyms | 4 |
| 4 Administration and Enforcement | 39 |
| 5 Building Envelope | 46 |
| 6 Heating, Ventilating, and Air Conditioning | 75 |
| 7 Service Water Heating | 161 |
| 8 Power | 174 |
| 9 Lighting | 178 |
| 10 Other Equipment | 205 |
| 11 Additional Efficiency Requirements | 219 |
| 12 Energy Cost Budget Method | 251 |
| 13 Normative References | 266 |
| Normative Appendix A: Rated R-Value of Insulation and Assembly U-Factor, C-Factor, and F-Factor Determinations | 273 |
| Informative Appendix B: (Retained for Future Use) | 326 |
| Normative Appendix C: Methodology for Building Envelope Trade-Off Option in Section 5.6 | 327 |
| Informative Appendix D: (Retained for Future Use) | 334 |
| Informative Appendix E: Informative References | 335 |
| Informative Appendix F: (Reserved for Future Use) | 338 |
| Normative Appendix G: Performance Rating Method | 339 |
| Informative Appendix H: Additional Guidance for Verification, Testing, and Commissioning | 384 |
| Informative Appendix I: Using Other Metrics in Conjunction with Appendix G Performance Rating Method when Approved by the Rating Authority | 392 |
| Normative Appendix J: Sets of Expanded Performance Data | 398 |
| Informative Appendix K: Informative Figures—Thermal Bridges | 405 |
| Normative Appendix L: Mechanical System Performance Rating Method | 410 |
| Informative Appendix M: Net Zero Operational Energy Emissions Performance Path | 431 |
| Informative Appendix N: Net Zero Operational Energy Emissions Prescriptive and Performance Paths | 437 |
| Informative Appendix O: Using End-Use Performance Factors in Conjunction with Appendix G Performance Rating Method When Approved by the Rating Authority | 471 |
| Informative Appendix P: Addenda Description | 475 |


Preview

**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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**(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

*ANSI/ASHRAE/IES Standard 90.1-2025 incorporates over 100 addenda approved since the publication of the 2022 edition. Collectively, these addenda achieve advanced energy efficiency levels, expand options for compliance, and create better alignment between Standard 90.1, industry practice, and related ASHRAE standards.*

*Following is a summary of the major developments that have occurred between 2022 and 2025, organized by topic area.*

### Organization and Structure

*Flowcharts at the beginning of each major section were updated to improve consistency and provide a better quick view of the processes described in writing. Climate zone tables are now located exclusively online, as are many of the tables utilized for compliance with informative appendices.*

### Enforcement and Compliance

*The standard replaces three terms—"code official," "building official," and "authority having jurisdiction"—with a single updated definition of "authority having jurisdiction." The committee also collaborated with SSPC 300 to improve the clarity of commissioning requirements throughout Sections 4 through 10.*

### Building Envelope

*Insulation levels for opaque elements (walls, roofs, and floors) and fenestration (windows and skylights) were updated to increase envelope stringency. These updates reflect commercially feasible construction.*

*Fenestration provisions were clarified to allow for performance impacts at high elevations; new requirements were included to address the proper installation of rigid insulation boards, particularly for assemblies located above the roof deck; and an updated methodology was introduced for calculating effective U-factors for steel-framed walls, and where continuous insulation is interrupted by cladding supports.*

### Mechanical

*Minimum efficiency requirements were increased for a wide range of equipment such that Standard 90.1 reflects the latest federal test procedures and industry rating standards for products that include unitary systems, water-source heat pumps, cooling towers, fans, and dedicated outdoor air systems. Included are new metrics for unitary products with the new IVEC cooling annualized metric and, for the first time, an annualized metric for heat pumps called IVHE (IVHE$_C$ for cold climates). These metrics go into effect in 2029. A new IEER metric was also added for water-source heat pumps.*

*A major update was made to integrate DOE regulated products throughout Section 6 and 7 tables, where appropriate. Moving this information to appear with 90.1 products (where it had previously appeared separately, in Appendix F), provides a more cohesive presentation for the user.*

*Fan power limits were tightened across most system types, with a new procedure for fan system power limits reinforcing the standard's emphasis on distribution system efficiency.*

*Pool heating provisions were revised to prioritize recovered and renewable heat sources before conventional heating methods are engaged.*

*New provisions were added for gas-fired heat pumps and gas-fired heat pump-water heaters to meet prescriptive requirements and qualify for energy credits.*

*Dehumidification and ventilation requirements were updated to align with recent changes to ANSI/ASHRAE Standard 62.1, ensuring energy efficiency while supporting updated indoor air quality targets.*

*Several addenda introduced changes to emphasize system-level efficiency measures rather than component-only improvements—for example, expanded requirements for energy recovery, updated economizer provisions (including targeted exceptions for specific healthcare applications), lower minimum VAV airflow turndown ratios to improve part-load operation in buildings considering occupied conditions, and new requirements for unoccupied setback controls in health care spaces.*

### Lighting and Power

*Section 9, "Lighting," requirements were significantly restructured to clearly distinguish lighting power density limits from control requirements and update interior and exterior lighting power density values.*

*Revisions were made to the decorative and specialty lighting values to reflect widespread LED adoption. Exterior lighting zones were revised to align with current IES guidance. Control requirements were strength-*

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*ened through expanded daylight-responsive controls, updated occupancy provisions, and revised thresholds that trigger automatic control requirements.*

*In Section 8, "Power," new provisions were introduced for electric vehicle spaces, receptacle controls, and energy monitoring. Where direct digital control systems are installed, a requirement was added for data to be graphically displayed to encourage effective monitoring of building energy use.*

### Renewable Energy

*Renewable energy provisions were expanded and clarified, including higher minimum prescriptive on-site renewable capacity requirements based on an updated cost-effectiveness analysis, and the introduction of limited off-site renewable energy compliance options by climate zone.*

### Energy Credits

*The energy credit framework in Section 11 continues to evolve toward a more flexible, performance-oriented structure. New credits were added for system-level strategies, including use of the Mechanical System Performance Rating Method and thermal energy storage for both heating and cooling.*

*Additional revisions were made to the overall number of credits required by building type based on updated analyses that considered real-world performance factors.*

### Energy Cost Budget (ECB)

*The Energy Cost Budget compliance path was refined to improve consistency with prescriptive requirements. Updated modeling rules align envelope, mechanical, and lighting assumptions in the budget building more closely with current Sections 5, 6, and 9 requirements.*

*New requirements also specify that, where available, actual utility rates or contractual energy prices must be used instead of generic national averages.*

*Modeling of fan power in baseline systems was altered due to changes in equipment efficiency metrics and rating conventions.*

*Through multiple addenda, various changes were introduced to refine ECB requirements regarding building orientation, shading assumptions, and the treatment of renewable energy.*

### Appendix G—Performance Rating Method

*Appendix G received significant updates aimed at reinforcing its role as a stable, transparent performance baseline, while accommodating modern design approaches.*

*Baseline HVAC system definitions were expanded and refined, including new distinctions based on heating source and updated zoning and economizer rules.*

*Modeling requirements for elevators, dehumidification, ventilation, and purchased heating and cooling were revised to better reflect measured energy use and current international standards.*

*Simulation software requirements were updated to align with the latest version of ASHRAE Standard 140, and prior references to specific tools were replaced with performance-based qualification criteria.*

*Building performance factors were updated in consideration of the energy efficiency improvements that have been introduced since the last published standard.*

### Optional Appendices for Alternative Measures of Compliance

*Several informative appendices were added or expanded to support jurisdictions and project teams seeking alternatives to traditional energy-cost-based compliance for an emissions reduction approach. These include optional pathways focused on source energy, carbon emissions, end-use performance factors, and zero-emission building outcomes, using either prescriptive or performance-based approaches.*

*Appendix M provides a performance compliance pathway, based on Appendix G, which may be adopted by a jurisdiction or rating authority to achieve net zero operational energy emission (NZOEE) buildings. The performance pathway also includes building performance factors (BPFs) calculated on a site energy basis to ensure a minimum level of energy efficiency performance. The greenhouse gas emissions covered in Informative Appendix M include both on-site and upstream emissions associated with building energy usage; they do not include emissions associated with other building use operations, such as refrigerant leakage or water usage.*

*Appendix N provides a prescriptive compliance pathway that may be adopted by a jurisdiction or rating authority to achieve NZOEE buildings; it also incorporates the NZOEE performance path of Informative Appendix M. The prescriptive option is limited to buildings with common loads and standard, simple HVAC systems; compliance can be shown through emissions calculations or by meeting minimum renewable energy requirements. The greenhouse gas emissions covered in Informative Appendix N include both on-site and upstream emissions associated with building energy usage; they do not include emissions associated with other building use operations, such as refrigerant leakage or water usage.*

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*Informative Appendix O provides an optional approach for implementing Appendix G that is particularly useful for projects with atypical load profiles such as data centers. This appendix provides end-use-specific performance factors (EUPFs) that can be used in place of a single BPF, allowing compliance targets to reflect the distribution of energy end uses in a given project. While Appendix G continues to use energy cost as its compliance metric, the end-use performance factors are also provided for site energy, source energy, cost, and carbon emissions for jurisdictions that elect to apply them.*

## 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*;
b. criteria for controlling *systems* in the *building* or on the *site* that modify *energy* usage based on communication with *energy* suppliers to facilitate the use of low-emissions *energy* sources; and
c. 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.

Preview

## 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*.

***AC-coupled:*** electrical connections between electrical sources, electrical storage, and electrical loads using alternating current.

***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*.

***adiabatic fluid cooler, integral pad-type:*** a heat-rejection device consisting of a heat exchanger, an air moving device, integral pad-type adiabatic air-cooling system, and a structure. Water to the pads can be supplied as once-through or recirculated by a spray pump. Adiabatic heat-rejection devices with spray systems and no wetted media are not included in this definition, nor are adiabatic cooling systems field installed on the unit and supplied by anyone other than the *manufacturer* of the unit.

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