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This User's Manual includes free online access to compliance forms for Chapters 5, 6, 7, 9, and 11 and Appendix G. These forms are provided to assist in understanding and documenting compliance with the Standard’s requirements. Visit www.ashrae.org/UM90.1-2019.

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Preface

General Information

Standard 90.1 User's Manual provides detailed instruction for the design of commercial and high-rise residential buildings to ensure their compliance with ANSI/ASHRAE/IES Standard 90.1-2019 (referred to in this manual as "Standard 90.1" or simply "the standard").

In addition, this user's manual

- offers information on the intent and application of Standard 90.1,
- illuminates the standard through the use of abundant sample calculations and examples,
- streamlines the process of showing compliance, and
- provides forms to demonstrate compliance.

This manual also instructs the user in the application of energy simulation programs used in conjunction with the Energy Cost Budget Method and Performance Rating Method of compliance with the standard. The Performance Rating Method is also used for calculating building energy performance ratings for certain building rating systems and incentive programs.

This manual is intended to be useful to numerous types of building professionals, including architects and engineers who must apply the standard to the design of their buildings, plan examiners and field inspectors who must enforce the standard in areas where it is adopted as code, general and specialty contractors who must construct buildings in compliance with the standard, and product manufacturers, state and local energy offices, policy groups, utilities, and others.

Δ Addenda

Standard 90.1 is a dynamic document undergoing continuous maintenance. Addenda, errata, and interpretations will be issued throughout its life. This edition of Standard 90.1 User's Manual is consistent with Standard 90.1-2019. Significant changes have been made to the standard since publication of the 2016 edition, including modifications by more than 88 addenda. In this manual, noteworthy changes are summarized at the start of each technical chapter and are indicated by a Δ in the relevant sections. In addition, Appendix I of the standard provides a detailed list of the addenda that define the differences between the 2016 and 2019 editions of the standard.

The ASHRAE and IES boards will approve additional addenda in the future that could revise the intent of the standard. Users should consult the ASHRAE website (www.ashrae.org/publicationupdates) or other sources to obtain the latest addenda.

When using this manual to comply with an energy code based on Standard 90.1, check whether any addenda have been incorporated into that code, and read those addenda carefully. Also, if one or more of the addenda or criteria of the standard are not incorporated into an energy code, be careful to apply the recommendations of this manual appropriately.

Official Interpretations of the Standard

Standing Standards Project Committee (SSPC) 90.1 provides official interpretations of the standard upon written request. Address requests for interpretations to Senior Manager of Standards, 180 Technology Parkway NW, Peachtree Corners, GA 30092, or e-mail standards.section@ashrae.org.

Requests for interpretations are forwarded to SSPC 90.1. That committee usually assigns the request to a subcommittee, which then reviews it and develops an interpretation. This interpretation is then voted on by the full committee. A common timeframe for a response is six to twelve months.

Standard 90.1 Organization

Numbering System

Standard 90.1 is divided into 11 sections. Sections 1, 2, 3, 4, and 12 are administrative:

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- Section 1, Purpose, states the purpose of the standard.
- Section 2, Scope, describes where the Standard applies and does not apply.
- Section 3, Definitions, Abbreviations, and Acronyms, provides definitions of terms that are used throughout the standard and a list of abbreviations, acronyms, and symbols.
- Section 4, Administration and Enforcement, gives an overview of the standard's compliance requirements, compliance documentation, materials and equipment labeling, and other administrative requirements.
- Section 12, Normative References, lists references and citations used in the Standard.

Sections 5 through 11 are the technical sections of the standard. Sections 5 through 10 contain the technical requirements for distinct components of the building's design, while Section 11 offers an alternative whole-building approach to complying with the standard:

- Section 5, Building Envelope, discusses building envelope, including building envelope components and installation and fenestration (glazing).
- Section 6, Heating, Ventilating, and Air Conditioning, covers HVAC systems, equipment, and controls.
- Section 7, Service Water Heating, addresses service water heating equipment and systems.
- Section 8, Power, applies to building power distribution systems.
- Section 9, Lighting, sets requirements for interior and exterior lighting systems and controls.
- Section 10, Other Equipment, covers permanently wired electric motors.
- Section 11, Energy Cost Budget Method, lays out the requirements for developing a computer model for the Energy Cost Budget (ECB) compliance method.

Sections 5 through 11 are further divided into thematic subsections, with each subsection number identifying its use. The numbering system for Sections 5 through 10 is organized as follows:

- x.1 General. This provides a general description of a particular section, including the scope and, in some instances, general requirements of the section.
- x.2 Compliance Paths. This provides a description of the process of complying with the section of the standard.
- x.3 Simple Buildings or Systems. This only exists for Section 6, but a placeholder is held for all the other sections in the event that a simple compliance approach is developed in the future.
- x.4 Mandatory Provisions. These are the mandatory minimum requirements that all projects must meet under all circumstances.
- x.5 Prescriptive Requirements. Provides additional requirements that only apply when the prescriptive method is used to show compliance. Only Sections 5, 6, 7, and 9 have prescriptive requirements.
- x.6 Alternative Compliance Path. This is an alternative approach to compliance. For the Building Envelope section, a procedure is included that permits trade-offs between all elements of the building envelope. For the Lighting section, a space-by-space method is provided for determining lighting power allowances.
- x.7 Submittals. Addresses information that needs to be provided by the designer to the building official, or by the contractor to the designer, to verify that the building complies with the standard.
- x.8 Product Information. Addresses product information, installation requirements, and equipment efficiency tables.

Section 11 follows a somewhat different numbering system because this section describes an alternative compliance method rather than requirements for specific components of the building's design.

In addition to the eleven primary sections, the standard contains a Foreword, nine appendices, and an annex. The Foreword provides a historical perspective on the development of the standard.

Appendices A, C, and G are normative appendices that are part of the standard. Appendices B, D, E, F, H, and I are informative and are not part of the standard. A brief description of each appendix follows:

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- Appendix A includes precalculated R-values, U-factors, C-factors, and F-factors for typical construction assemblies and calculation methods for atypical construction assemblies.
- Appendix B is retained for future use.
- Appendix C describes the methodology for the Building Envelope Trade-Off Option in Section 5.6.
- Appendix D is retained for future use.
- Appendix E contains informative references for the convenience of users of the standard and to acknowledge source documents.
- Appendix F includes an informative listing of minimum efficiency requirements established by the U.S. Department of Energy.
- Appendix G provides a normative description of the procedure for showing compliance or calculating building energy performance ratings using the Performance Rating Method.
- Appendix H provides informative guidance for verification, testing and commissioning. This information may be useful for achieving compliance with requirements for verification, testing, and commissioning included throughout the standard.
- Appendix I provides an informative listing of approved addenda. The approved addenda define the differences between the 2016 and 2019 editions of Standard 90.1.
- Annex 1 reproduces material from ASHRAE Standard 169, which defines the climate zones used throughout Standard 90.1.

Organization and Use of Standard 90.1 User's Manual

In general, the chapters of this user's manual follow the major sectional organization of the standard. To aid the user in correlating requirements of the standard with the explanations in the user's manual, all major headings in the manual contain section number references in parentheses. For example, a discussion of lighting control requirements in this user's manual begins with the heading "Lighting Control (9.4.1)." This allows the user to quickly refer to Section 9.4.1 of the standard, which gives the requirements for lighting control.

Each major section of the standard has a corresponding section in the user's manual, unless that section of the standard is so clear that no further explanation is required.

Compliance forms for Chapters 5, 6, 7, 9, 11, and Appendix G of the standard are available for download from ASHRAE's website at www.ashrae.org/UM90.1-2019. These forms are provided to assist in understanding and documenting compliance with the standard's requirements.

Unless directly footnoted or contained within the text, full citations for documents referred to in this manual are found in Standard 90.1, Section 12, "Normative References."

I-P and SI units

Standard 90.1-2019 is available in two editions, one using inch-pound (I-P) units and the other using the International System (SI). Throughout this manual, I-P numbers, equations, dimensions, and so forth are followed by the corresponding SI values in parenthesis, for example: 500 ft² (46 m²). Wherever possible, illustrations contain both I-P and SI units. Complex or lengthy tables and calculations are provided first in I-P units and then in SI units.

Resources, Data, and Analysis Tools

The following is a list of publications and tools that are necessary to apply the standard. Some of these items, as noted, are only applicable to specific sections of the standard:

- A current copy of Standard 90.1-2019 with errata and interpretations.
- Copies of any published addenda to Standard 90.1.
- An energy simulation program for the analysis of energy consumption in buildings if the ECB Method of Section 11 or the Performance Rating Method of Appendix G are to be used.
- *ASHRAE Handbook—Fundamentals*, which is referenced throughout the standard.

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- *ASHRAE Handbook—HVAC Systems and Equipment* and *ASHRAE Handbook—HVAC Applications*, which are referenced in Chapters 6 and 7 of the manual.
- ANSI/ASHRAE Standard 62.1-2013, *Ventilation for Acceptable Indoor Air Quality*, which is referenced in Section 6 of the standard.
- In addition to the project plans and specifications, manufacturer data may be required for lighting, motors, opaque envelope, fenestration, HVAC, control, and water heating systems and equipment.

NOTE: All compliance forms referenced in this user's manual, as well as any related spreadsheets and materials generated by the committee to assist in the use of the standard, are available for download at www.ashrae.org/UM90.1-2019.