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ANSI/ASHRAE Standard 90.4-2025
Energy Standard for Data Centers

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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 Standard 90.4 was initiated to promote energy-efficient design of data centers, a rapidly expanding and energy-intensive category among buildings in the United States and worldwide. The primary goal and responsibility of Standing Standard Project Committee (SSPC) 90.4 is to publish a consensus standard that sets demanding but technologically feasible energy efficiency requirements for data centers on a consistent schedule. Since 2013, Standard 90.4 has been in a continuous state of development as a code-intended companion to ANSI/ASHRAE/IES Standard 90.1. Standard 90.4 still requires compliance with Standard 90.1 for the building envelope, service water heating, lighting, and other conventional building aspects. However, Standard 90.4 also addresses the much more specialized cooling and electrical systems in data centers, and requires designers to satisfy the appropriate compliance paths corresponding to their data center projects as delineated in Section 4. Compliance is based on meeting or exceeding two minimum efficiency values as defined in Sections 6 and 8: the mechanical load component (MLC) and the electrical loss component (ELC). For optimal utility, maximum values for MLC vary by indicated climate zone. However, data center computing equipment electrical loads are not a function of weather conditions so are not climate zone dependent. In the event that the design, and particularly the electrical or mechanical equipment involved in upgrades or renovations, cannot meet the MLC or ELC requirements in the standard, Section 11 allows trade-offs between the two components.

Informative Appendix E contains a summary of addenda to the 2022 edition of Standard 90.4 that have been incorporated into the 2025 edition. Key changes include the following:

a. Updated Purpose Statement: The purpose statement was updated in response to the following developments that SSPC 90.4 considers important both to its constituency and to the wider ASHRAE ecosystem:
   1. ASHRAE's recently declared positions on decarbonization of the built environment and the elimination of greenhouse gas (GHG) emissions from the built environment as essential elements in addressing climate change, inclusive of the harmonizing of its standards to respond to industry and member needs in these areas
   2. The advent and prioritization of energy and sustainability policy as a governance concern for many businesses and the corresponding goal-setting and reporting disciplines these organizations have established

   The updated purpose statement aims to provide alignment between Standard 90.4, ASHRAE's strategic plan, and contemporary industry needs. The primary purpose of Standard 90.4 heretofore is energy efficiency requirements, and this change expands the purpose statement to enable the future inclusion of resources and considerations beyond direct energy use that contribute to data center sustainability and decarbonization. These may ultimately define GHG emissions, environmental impact, water consumption, or other resources beyond energy.

b. Changes to Process Heat and Ventilation Definitions: Definitions in Section 3 and mandatory language in Section 6 have been modified to support the regulation of process heat and process ventilation. This subject matter was moved to Section 6 for clarity.

c. Refinements to UPS Segment and ELC Calculations: The UPS segment of the ELC calculation requires knowing three different load numbers. While those numbers have always been described in the examples in Informative Appendix C, they have not been clearly delineated in definitions, leading to confusion in the use of undefined terms. A definition for "UPS redundant capacity" has been added to Section 3 to clarify that UPS efficiency must be based on the total available capacity of the UPS, including its redundant capacity, even though that additional capacity is not intended to be used under normal operating conditions. Terminology throughout Section 8, "Power," as well as in the informative appendices, has also been updated to correspond with the revised terminology.

d. Updated Normative References: Normative references have been updated to reflect the use of more current versions of referenced material.

Standard 90.4 follows ASHRAE's continuous maintenance process, which allows changes to the standard to be made on a continuous basis through addenda to the existing standard. This process allows for frequent modifications to the standard to keep pace with rapidly changing technologies in the industry. In addition,

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the chairs of the committees responsible for both Standard 90.1 and Standard 90.4 meet with members of the ASHRAE Standards Committee to address any conflicts in scope between the two standards. It is the hope of the committee that knowledgeable people within the data center industry will continue to offer their talents to sustain and improve the quality and accuracy of the standard moving forward.

1. PURPOSE

The purpose of this standard is to establish minimum *energy efficiency* requirements for the design, *construction*, and planned operation and maintenance of *data centers*, and to balance those requirements with related factors affecting the environment. Factors to be evaluated include the following:

a. Nonrenewable *energy* consumption
b. Renewable *energy* consumption
c. Water consumption
d. Greenhouse gas emissions

2. SCOPE

2.1 This standard applies to

a. New *data centers*, or portions thereof, and their *systems*;
b. New *additions* to *data centers*, or portions thereof, and their *systems*; and
c. Modifications to *systems* and *equipment* in existing *data centers* or portions thereof.

2.2 The provisions of this standard do not apply to

a. *Telephone exchanges*,
b. *Essential facilities*, and
c. *Information technology equipment* (*ITE*).

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.

3. DEFINITIONS

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 differs from the defined term, the defined term still applies. These definitions are applicable to all sections of this standard except where specifically limited.

3.1.1 Coordination. Where terms are not defined in this standard but are defined in ANSI/ASHRAE/IES Standard 90.1, those terms shall have the meanings as assigned to them in ANSI/ASHRAE/IES Standard 90.1. Where terms are not defined in either document, they shall have their ordinary accepted meanings within the context in which they are used. Ordinarily accepted meanings shall be based on standard American English language usage as documented in an unabridged dictionary accepted by the *adopting authority*.

Informative Notes:

1. ANSI/ASHRAE/IES Standard 90.1 can be read for free online at www.ashrae.org/preview.
2. Only terms that appear in Section 3 of this standard are italicized throughout the document.

3.2 Definitions

addition: see ANSI/ASHRAE/IES Standard 90.1.

adopting authority: see ANSI/ASHRAE/IES Standard 90.1.

air, ambient: the air surrounding a *building* or *space*; the source of *outdoor air* brought into a *building*.

air, supply: air to be delivered by design to a *space*, composed of any combination of *outdoor air*, *recirculated air*, or air designed to move from another *space.*

alteration: see ANSI/ASHRAE/IES Standard 90.1.

annualized mechanical load component (annualized MLC): the result of dividing the sum of the annual process *cooling energy*, annual process *heating energy*, and annual process *ventilation energy* by the annual total *data center energy* as precisely defined by Equation 6.5.

authority having jurisdiction (AHJ): see ANSI/ASHRAE/IES Standard 90.1.

automatic: see ANSI/ASHRAE/IES Standard 90.1.

bin: the practice of organizing data points into closely similar groupings in order to simplify calculations. For Standard 90.4 *bin* requirements, see Section 6.5.2.

branch circuit: see ANSI/ASHRAE/IES Standard 90.1.

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