



© 2011, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (www.ashrae.org). All rights reserved. This publication may not be reproduced in whole or in part; may not be distributed in paper or digital form; and may not be posted in any form on the Internet without ASHRAE's expressed written permission. Inquires for use should be directed to publisher@ashrae.org.

ANSI/ASHRAE/IES Standard 90.1-2010 Applicability to Datacom

ANSI/ASHRAE/IESNA Standard-90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings, has been amended by the Standing Standard Project Committee (SSPC) to include data centers within the scope of the 2010 edition, following approval of Addendum aq. Addendum bu was also approved, which establishes specific criteria for data centers, including key exemptions for economizers. This white paper provides an overview of the portions of Standard 90.1-2010 that pertain to datacom HVAC and presents supplemental resources to better prepare the industry for potential future impacts.

EXECUTIVE SUMMARY

One of the functions of ASHRAE is to produce standards, through ASHRAE Standards Committees, for adoption in model codes. The purpose of ANSI/ASHRAE/IES Standard 90.1-2010, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, (ASHRAE 2010a) is to address minimum requirements for energy efficiency in buildings, including requirements for the building envelope, HVAC systems, service water heating, power, lighting, and other equipment. The scope covers new building construction as well as renovations or additions to existing buildings and systems. This standard is managed by the Standing Standard Project Committee (SPCC) 90.1, which meets regularly to maintain and update the document with addenda produced through internally generated proposals and externally generated continuous maintenance proposals (CMPs) and to address public review comments on published addenda. The standard is formally published on a three-year cycle, at which time all previously approved addenda are incorporated. Details of the SSPC process can be found [online](#).

ASHRAE Standards are written in legally enforceable language and developed in accordance with the ANSI standards process, which allows various federal, state, and municipal governments to adopt them into their model codes, mandates, and laws. As of 2011, some version of ANSI/ASHRAE/IES Standard 90.1 has been adopted by all fifty states and mandated by the DOE (2005). The International Code Council (ICC) also references Standard 90.1 in the International Energy Conserva-

tion Code (IECC). Prior to 2010, all building construction except residential and process cooling applications (i.e., datacom, etc.) were required to comply with this standard. With the 2010 version of Standard 90.1, requirements will become mandatory for compliance on datacom projects as soon as the standard is adopted and enforced by various authorities having jurisdiction (AHJs). In addition, it is likely that Standard 90.1-2010 will be adopted by the ICC during the 2012 update cycle for the ICC codes. The ICC codes are then adopted by the various states. The current adoption cycle for the ICC codes in each state can be viewed [online](#). Review of current energy code requirements in the relevant jurisdiction to determine whether Standard 90.1-2010 applies is highly recommended before beginning any new datacom project. (Note: Sometimes jurisdictions adopt slight variations to Standard 90.1 or have developed their own versions, which may vary from the original.) When Standard 90.1 is adopted, the AHJ will often require paperwork demonstrating compliance. This is usually documentation completed by the project licensed professional engineer indicating compliance with the various portions of Standard 90.1 that apply to the project, as well load calculations and modeling calculations if the performance path is used. The AHJ may then use this paperwork to issue the necessary project permits. The details of the permitting process and required paperwork vary from jurisdiction to jurisdiction, so it's important to obtain requirements early in the project either when building a new data center or renovating an existing data center with HVAC upgrades.

The three main components of Standard 90.1-2010 compliance are as follows:

1. Mandatory provisions—applies to all projects
2. Prescriptive (code minimum) *or* performance path (known as the Energy Cost Budget Method [ECB])—must comply with one *or* the other
3. Appendix G—exceeding 90.1 prescriptive requirements (generally used for LEED® certification; however, LEED for data centers is not available as of the publication of this paper)

The mandatory provisions for HVAC systems in Section 6, “Heating, Ventilating, and Air Conditioning,” include minimum requirements for HVAC equipment efficiencies, verification, and labeling (Section 6.4). The HVAC equipment efficiency tables in the Standard-90.1-2010 include many but not all types of HVAC systems used in computer rooms. Table 6.8.1k applies to HVAC equipment intended for computer rooms as rated by ANSI/ASHRAE Standard 127-2007, *Method of Testing for Rating Computer and Data Processing Room Unitary Air Conditioners* (ASHRAE 2007)—typical CRAC and CRAH HVAC equipment only. Other types of commercial HVAC equipment (air-handling units, rooftop units, chillers, heat exchangers, etc.) applied to data centers must meet the requirements of Tables 6.8.1A through 6.8.1J and their associated rating standards, as appropriate. Any HVAC equipment used in datacom applications that is not addressed by these tables and associated rating standards is exempt from mandatory equipment efficiency requirements. Examples of equipment that are exempt include all types of source cooling options (in the row, above the electronic equipment frames, on or in

cabinets, etc.), hybrid chillers, evaporative cooling and humidification solutions, absorption chillers, and other types of liquid cooling applications. ASHRAE Standard 127 is the rating standard used to establish performance rating requirements for HVAC systems intended for use in computer room applications. Standard 127 was first published in 1988, was revised in 2001 and 2007, and is being revised again for the 2013 update to Standard 90.1 to further address requirements of computer room air-conditioning equipment.

PRESCRIPTIVE REQUIREMENTS AND PATH

The prescriptive requirements are often referred to as “code minimum” requirements, and they are the most common path taken to demonstrate compliance with a standard. Section 6.5 of Standard 90.1-2010 outlines prescriptive requirements for economizers (air or water), fan power limitations, humidification/dehumidification, variable-air-volume (VAV) fan control, and various others. Several important exemptions to economizers for datacom are noted in Section 6.5.1.j and 6.5.1.k, respectively, as follows (ASHRAE 2010a):

- j. *Systems primarily serving computer rooms* where:
 1. the total design cooling load of all *computer rooms* in the building is less than 3,000,000 Btu/h and the building in which they are located is not served by a centralized chilled water plant, or
 2. the room total design cooling load is less than 600,000 Btu/h and the building in which they are located is served by a centralized chilled water plant, or
 3. the local water authority does not allow cooling towers, or
 4. less than 600,000 Btu/h of *computer room cooling equipment* capacity is being added to an existing building.

- k. *Dedicated systems for computer rooms* where a minimum of 75% of the design load serves:
 1. those *spaces* classified as an *essential* facility, or
 2. those *spaces* having a *mechanical cooling* design of Tier IV as defined by ANSI/TIA-942, or
 3. those *spaces* classified under NFPA 70 Article 708—Critical Operations Power Systems (COPS), or
 4. those *spaces* where core clearing and settlement services are performed such that their failure to settle pending financial transactions could present systemic risk as described in “The Interagency Paper on Sound Practices to Strengthen the Resilience of the US Financial System, April 7, 2003”

Air-side or waterside economizers are prescriptively required for all other datacom applications that don’t meet the above exemptions.

These exemptions were submitted by TC9.9 to recognize and provide for the critical importance of the mission served by datacom applications and the potential for unintended consequences that accompany enforcement of prescriptive requirements. All four definitions in Section 6.5.1k are required because different portions of the datacom industry utilize different codes.

Two companion documents are available with Standard 90.1:

- *90.1 User's Manual* (2010b)
- Formal interpretations of Standard 90.1 (ASHRAE 2011)

The user's manual is intended to guide the user in the application of the standard and to provide deeper insight. The manual is not considered part of the standard and, therefore, is not legally enforceable by the AHJ. The formal interpretations, however, are considered part of the standard and are legally enforceable by the AHJ. Formal interpretations may be submitted by anyone to gain further clarification on any part of the standard. These interpretations are voted on by the SSPC and formally posted on the [ASHRAE Web site](#).

Participation to recommend changes to Standard 90.1 is open to the public. Proposals for change can be submitted via a CMP directly to SSPC 90.1. Alternatively, proposals may be submitted to TC9.9, which has an established liaison with 90.1, as well as an informal workgroup for submitting new proposals for change to Standard 90.1. TC9.9 members can sign up to receive the latest addenda to Standard 90.1 on the ASHRAE [Standards Activity Web page](#). The references section of this paper includes numerous resources for more details and insights into this topic. In addition, TC9.9 has established a [new section](#) on its Web site filled with useful links and documents to help membership participate in shaping future versions of Standard 90.1 and in understanding these new requirements that impact our industry.

SUMMARY

Datacom HVAC is now included within the scope of Standard 90.1-2010. Within this revised standard are prescriptive requirements for economizers, minimum equipment efficiencies, and other related prescriptive energy efficiency measures for datacom HVAC. There are some exceptions for “mission critical” applications, as defined earlier in this paper, in recognition that mission must come first for many datacom applications. Beyond these few exemptions, the performance path (ECB method) must be pursued to demonstrate superior savings approaches through alternative and innovative energy-efficiency measures. Although the software tools currently available provide limited capability for modeling innovative solutions necessary to demonstrate compliance with the standard, work is underway to include a “nonmodeling” alternative compliance method in Section 6.6, such as *power usage effectiveness* (PUE), which will provide a more effective means of ensuring energy efficiency through innovative and holistic approaches without potential for unintended consequences that may compromise the mission.

REFERENCES

- ASHRAE. 2007. ANSI/ASHRAE Standard-127, *Method of Testing for Rating Computer and Data Processing Room Unitary Air Conditioner*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- ASHRAE. 2009. Gaseous and particulate contamination guidelines for data centers. ASHRAE TC.9 white paper. Atlanta: American Society of Heating,

- Refrigerating and Air-Conditioning Engineers. http://tc99.ashraetcs.org/documents/ASHRAE_Contamination_Whitepaper_30_July_2009.pdf.
- ASHRAE. 2010a. ANSI/ASHRAE/IES Standard-90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- ASHRAE. 2010b. *90.1 User's Manual*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- ASHRAE. 2011. Interpretations for Standard 90.1-2010. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Atlanta, GA. <http://www.ashrae.org/technology/page/interpretationsstd90-1-2010>.
- DOE. 2005. Energy Policy Act (EPAct) of 2005. Federal Energy Management Program, U.S. Department of Energy, Washington, DC. <http://www.ferc.gov/legal/fed-sta/ene-pol-act.asp>.
- Quirk, D. 2011. Navigating ASHRAE Standard 90.1-2010 Requirements for Economizers in Datacom. *ASHRAE Transactions* 117(2):18–25.
- Quirk, D., and V. Sorell. 2010. Economizers in datacom—Risk mission vs. reward environment? *ASHRAE Transactions* 116(2):70–81.