

ADDENDA

**ANSI/ASHRAE/IES Addendum bz to
ANSI/ASHRAE/IES Standard 90.1-2022**

Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings

Approved by ASHRAE and the American National Standards Institute on July 31, 2025; and by the Illuminating Engineering Society on July 2, 2025.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (<https://www.ashrae.org/continuous-maintenance>).

The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 180 Technology Parkway, Peachtree Corners, GA 30092. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

© 2025 ASHRAE

ISSN 1041-2336



ASHRAE Standard Project Committee 90.1

Cognizant TC: 7.6 Systems Energy Utilization

SPLS Liaison: Jennifer Isenbeck · ASHRAE Staff Liaison: Emily Toto · IES Liaison: Mark Lien

Richard Lord*, <i>Chair</i>	Benjamin Edwards	Nathan Kahre	Robert Ross*
Thomas Culp*, <i>Co-Vice Chair</i>	Kurt Fester	Maria Karpman*	Marty Salzberg*
Leonard Sciarra*, <i>Co-Vice Chair</i>	Francisco Flores	Andrew Klein	Christopher Schaffner
Rahul Athalye*	D. Andrew Fouss	Vladimir Kochkin*	Greg Schluterman
William Babbington	Phillip Gentry*	Toby Lau	Kelly Seeger*
John Bade*	Jason Glazer*	Chonghui Liu	Wayne Stoppelmoor*
Sean Beilman*	Melissa Goren*	Emily Lorenz	Matthew Swenka*
Daniel Bersohn	Skye Gruen	Samuel Mason*	Christian Taber*
Paula Cino*	Charles Haack*	Benjamin Meyer*	Steven Taylor*
Glen Clapper	David Handwork*	Julian Mills-Beale	Kevin Teakell
Ernest Conrad*	Armin Hauer	Nazme Mohsina	Douglas Tucker
Shannon Corcoran*	Rick Heiden	Frank Morrison*	Jason Vandever
Jay Crandell*	Gary Heikkinen	Michael Myer	Martha VanGeem*
Kelly Cunningham	Mark Heizer*	Frank Myers*	Michael Waite*
Brandon Damas*	David Herron*	Michael Patterson*	McHenry Wallace*
Hayley Davis	Mike Houston*	Timothy Peglow*	Theresa Weston
Thomas Deary*	Harold Jepsen*	Christopher Perry*	Jerry White*
Darryl Dixon	Greg Johnson*	Laura Petrillo-Groh	Jeffrey Whitelaw
Julie Donovan*	Zac Johnson	Patrick Riley	Jeremiah Williams
Craig Drumheller*	Duane Jonlin*	Michael Rosenberg*	
James Earley	Michael Jouaneh*	Steven Rosenstock*	

* Denotes members of voting status when the document was approved for publication

ASHRAE STANDARDS COMMITTEE 2024–2025

Douglas D. Fick, <i>Chair</i>	Jaap Hogeling	Kenneth A. Monroe	Paolo M. Tronville
Adrienne G. Thomle, <i>Vice Chair</i>	Jennifer A. Isenbeck	Daniel H. Nall	Douglas K. Tucker
Hoy R. Bohanon, Jr.	Satish N. Iyengar	Philip J. Naughton	William F. Walter
Kelley P. Cramm	Phillip A. Johnson	Kathleen Owen	David P. Yuill
Abdel K. Darwich	Paul A. Lindahl, Jr.	Gwelen Paliaga	Susanna S. Hanson, <i>BOD ExO</i>
Drake H. Erbe	Julie Majurin	Karl L. Peterman	Wade H. Conlan, <i>CO</i>
Patricia Graef	Lawrence C. Markel	Justin M. Prosser	
William M. Healy	Margaret M. Mathison	Christopher J. Seeton	

Ryan Shanley, *Senior Manager of Standards*

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus Standard developed under the auspices of ASHRAE. *Consensus* is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this Standard as an ANS, as “substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution.” Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Senior Manager of Standards of ASHRAE should be contacted for

- interpretation of the contents of this Standard,
- participation in the next review of the Standard,
- offering constructive criticism for improving the Standard, or
- permission to reprint portions of the Standard.

DISCLAIMER

ASHRAE uses its best efforts to promulgate Standards and Guidelines for the benefit of the public in light of available information and accepted industry practices. However, ASHRAE does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with ASHRAE's Standards or Guidelines or that any tests conducted under its Standards or Guidelines will be nonhazardous or free from risk.

ASHRAE INDUSTRIAL ADVERTISING POLICY ON STANDARDS

ASHRAE Standards and Guidelines are established to assist industry and the public by offering a uniform method of testing for rating purposes, by suggesting safe practices in designing and installing equipment, by providing proper definitions of this equipment, and by providing other information that may serve to guide the industry. The creation of ASHRAE Standards and Guidelines is determined by the need for them, and conformance to them is completely voluntary.

In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

(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 objections on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

Addendum bz updates the definition of photosynthetic photon efficacy (PPE) to luminaire photosynthetic photon efficacy (PPE), so there is an even playing field for all products. The rating of all products will take into account the optical efficiency of the luminaire and the thermal impacts of luminaire design. The remainder of the definition is aligned with the metric developed by the American Society of Agricultural and Biological Engineers (ASABE) for the ANSI/ASABE S640 standard. This luminaire PPE definition is aligned with the Design Lights Consortium Draft Horticultural Technical Requirements V4.0, which are luminaire based not lamp based.

This addendum increases the minimum allowed luminaire photosynthetic photon efficacy (PPE) to 2.5 $\mu\text{mol/J}$. This is a 31% increase over the 1.9 $\mu\text{mol/J}$ minimum efficacy currently required for indoor grow spaces and a 47% increase over the 1.7 $\mu\text{mol/J}$ minimum efficacy currently required for greenhouses but is still near the bottom (22nd percentile) of lighting efficacies in the DesignLights Consortium's database of horticultural LED lighting products. This addendum is similar to prior proposals targeting large light source lighting such as outdoor lighting and warehouse lighting, where lower lighting power density values in ANSI/ASHRAE/IES Standard 90.1 and other energy codes resulted in selection of LED light sources with higher first costs but with cost-effective simple paybacks that save energy and reduce greenhouse gas emissions.

A cost-effectiveness analysis was completed, and this addendum meets the ASHRAE/IES Standard 90.1 scalar threshold for cost-effectiveness for the development of the 2025 standard. With the social cost of carbon, this addendum would be more cost-effective.

Informative Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~striking through~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum bz to Standard 90.1-2022

Modify Section 3.2 as shown (I-P and SI).

3.2 Definitions

[...]

luminaire photosynthetic photon efficacy (~~PPE~~): photosynthetic photon flux emitted by a ~~light source~~ luminaire between 400 and 700 nm divided by its electrical input power, expressed in units of micromoles per joule as defined by ANSI/ASABE S640-2017.

[...]

Modify Section 9.4.3 and subsections as shown (I-P and SI).

9.4.3 Horticultural Lighting. Greenhouse horticultural lighting shall follow the requirements of Section 9.4.4.1 ~~9.4.3.1~~. Indoor grow horticultural lighting shall follow the requirements of Section ~~9.4.4.2~~ 9.4.3.2.

9.4.3.1 Luminaires in greenhouses with at least 40 kW of connected load for horticultural lighting shall have a luminaire photosynthetic photon efficacy (~~PPE~~) of at least ~~1.72.5~~ $\mu\text{mol/J}$ for ~~integrated, non-serviceable luminaires, or a PPE of at least 1.7 $\mu\text{mol/J}$ for lamps in luminaires with removable or serviceable lamps~~. Horticultural lighting in greenhouse spaces shall be controlled by a device that automatically turns off the horticultural lighting at specific programmed times.

9.4.3.2 Luminaires in indoor grow spaces used for horticultural lighting shall have a luminaire photosynthetic photon efficacy (~~PPE~~) of at least ~~1.92.5~~ $\mu\text{mol/J}$ for ~~integrated, non-serviceable luminaires, or a PPE of at least 1.9 $\mu\text{mol/J}$ for lamps in luminaires with removable or serviceable lamps~~. Horticultural lighting in indoor grow spaces shall be controlled by a device that automatically turns off the horticultural lighting at specific programmed times.

Exception to ~~9.4.4.2~~ 9.4.3.2: Indoor grow buildings with less than 40 kW of connected load for horticultural lighting shall have a luminaire photosynthetic photon efficacy (~~PPE~~) of at least 1.7 $\mu\text{mol/J}$ for ~~integrated, non-serviceable luminaires, or a PPE of at least 1.7 $\mu\text{mol/J}$ for lamps in luminaires with removable or serviceable lamps~~.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

ASHRAE · 180 Technology Parkway · Peachtree Corners, GA 30092 · www.ashrae.org

About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

To stay current with this and other ASHRAE Standards and Guidelines, visit www.ashrae.org/standards, and connect on LinkedIn, Facebook, Twitter, and YouTube.

Visit the ASHRAE Bookstore

ASHRAE offers its Standards and Guidelines in print, as immediately downloadable PDFs, and via ASHRAE Digital Collections, which provides online access with automatic updates as well as historical versions of publications. Selected Standards and Guidelines are also offered in redline versions that indicate the changes made between the active Standard or Guideline and its previous edition. For more information, visit the Standards and Guidelines section of the ASHRAE Bookstore at www.ashrae.org/bookstore.

IMPORTANT NOTICES ABOUT THIS STANDARD

To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit www.ashrae.org/standards to download them free of charge.

Addenda, errata, and interpretations for ASHRAE Standards and Guidelines are no longer distributed with copies of the Standards and Guidelines. ASHRAE provides these addenda, errata, and interpretations only in electronic form to promote more sustainable use of resources.