

**ANSI/ASHRAE/ICC/USGBC/IES Addendum ad to
ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2023**

Standard for the Design of High-Performance Green Buildings

**Except Low-Rise
Residential Buildings**

The Complete Technical Content of the International Green Construction Code®

Approved by ASHRAE and the American National Standards Institute on September 30, 2026; by the International Code Council on September 28, 2026; by the U.S. Green Building Council on September 4, 2026; and by the Illuminating Engineering Society on August 28, 2026.

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 (www.ashrae.org/continuous-maintenance).

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ISSN 1041-2336



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Cognizant TC: 2.8, Building Environmental Impacts and Sustainability

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

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FOREWORD

Light emitting diode (LED) technology is a cost-effective, high-efficacy source for growing crops. Addendum ad is based on a review of the distribution of photosynthetic photon efficacies of LED horticultural lighting as reported in the DesignLights Consortium (DLC) database. Its purpose is to keep the green high-performance standard up to date with the efficacies available in the current market. Addendum bz to ANSI/ASHRAE/IES Standard 90.1-2022 adopted a minimum luminaire photosynthetic photon efficacy of $2.5 \mu\text{mol/J}$, as this was found to be feasible and cost effective. This addendum updates the definition of “photosynthetic photon efficacy” to “luminaire photosynthetic photon efficacy” in alignment with Standard 90.1. Thus, the efficacy threshold is based on the light leaving the luminaire and accounts for luminaire optical efficiency and thermal management in addition to the efficacy of the light source.

Addendum ad is aligned with the standard metrics for rating horticultural luminaires such as that measurements of PPE are taken at the manufacturer-design state with the highest power consumption and that luminaires are capable of dimming in response to a line voltage, low voltage, or wireless signal.

In addition to their efficacy, another benefit of LED-based light sources is that almost all are dimmable, which yields additional energy savings associated with controllability. Thus, this addendum requires that horticultural lighting be dimmable and be controlled by dimming controls. In indoor grow spaces, the horticultural lighting is controlled by an automatic scheduled dimming control that is capable of dimming lighting according to a schedule in addition to turning the lights on and off. In greenhouses, lighting is controlled with a combination of a scheduling control and a daylighting control or a daily light integral control. These controls were found to be cost effective when evaluated using the Standard 90.1 scalar ratio method.

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 ad to Standard 189.1-2023

Modify Section 3.2 as follows.

3.2 Definitions

daily light integral (DLI): cumulative photosynthetic photon flux density (PPFD) integrated over a 24-hour period in units of $\text{mol/m}^2 \cdot \text{day}$ as defined by ANSI/ASABE S640.

horticultural lighting: ~~cord-and-plug or hard-wired~~ electric lighting used for photosynthesis in horticultural production, cultivation, or maintenance ~~with either cord and plug or hard-wired connections for electric power.~~

luminaire photosynthetic photon efficacy: photosynthetic photon flux of light between 400 and 700 nm emitted by a luminaire divided by its electrical input power, expressed in units of micromoles per second per watt ($\mu\text{mol/s/W}$) (micromoles per joule [$\mu\text{mol/J}$]) as defined by ANSI/ASABE S640.

photosynthetic photon flux density (PPFD): photosynthetic photon flux of light, between 400 and 700 nm, per unit of surface area, expressed in units of micromoles of photons per square meter per second ($\mu\text{mol/m}^2/\text{s}$) as defined by ANSI/ASABE S640.

Modify Section 7.3.6.1 as follows, and add new Sections 7.3.6.2 and 7.3.6.3.

7.3.6 Energy Systems for Horticulture

7.3.6.1 Horticultural Lighting Efficacy and Dimmability. Luminaires in indoor grow spaces and greenhouses used for horticultural lighting shall have a luminaire photosynthetic photon efficacy of not less than ~~2.1–2.5~~ $\mu\text{mol/J}$ when tested at the manufacturer-designed state with the highest power consumption. Luminaires shall be capable of continuous dimming between 100% and 20% of full power in response to a line voltage, low voltage, or wireless signal.

7.3.6.2 Indoor Grow Spaces Lighting Control Horticultural lighting in indoor grow spaces shall be controlled by an automatic scheduling dimming control. Such control shall be capable of scheduling control zones separately to six or more different scheduled control levels per day. Scheduled control levels shall include dimming between 100% and 20% of full power and lights turned off. Control zones shall be capable

of having an independent control schedule. Each space shall have one or more dedicated control zones. A control zone shall contain no more than 40 kW of lighting.

7.3.6.3 Greenhouse Lighting Control *Horticultural lighting in greenhouses shall be controlled by an automatic scheduling control and a daylight responsive control in accordance with items (a) and (b) or shall be controlled by a *daily light integral (DLI)* control in accordance with item (c).*

- a. Automatic scheduling controls shall be capable of scheduling independently each control zone to turn lights on or off four or more times daily. A control zone shall contain no more than 40 kW of lighting.
- b. Daylight responsive controls shall be capable of dimming lighting between 100% and 20% of full power in response to the available *photosynthetic photon flux density (PPFD)* of daylight. When the available *PPFD* of daylight received by crops is greater than the target *PPFD* for growing crops, the control shall turn lights off. Automatic daylight responsive control devices shall separately control no more than 40 kW per control zone. A single sensor shall be permitted to control more than one control zone, provided that the calibration settings for control zones are separately configured.
- c. *DLI* controls shall automatically dim supplemental electric lighting power in response to available *PPFD* of daylight and the calculated *DLI* of combined daylight and electric light received by the crops. The control system shall be capable of modulating supplemental electric light sources to achieve a user-specified *DLI* target. When a *DLI* target has been achieved, electric lighting shall be turned off. When a *DLI* target is not achieved, the control shall be permitted to compensate by modifying the next day's *DLI* target. The *DLI* control device shall control no more than that 40 kW per control zone. A single sensor shall be permitted to control more than one control zone, provided that the calibration settings for control zones are separately configured and the *DLI* is separately calculated per control zone.

Renumber Section 7.3.6.2.

7.3.6.4 ~~7.3.6.2~~ **Additional Renewable Energy.**

**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.

Standard 189.1 and the International Green Construction Code

Standard 189.1 serves as the complete technical content of the International Green Construction Code[®] (IgCC). The IgCC creates a regulatory framework for new and existing buildings, establishing minimum green requirements for buildings and complementing voluntary rating systems. For more information, visit www.iccsafe.org.

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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.

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