

Public Review Draft

Proposed Addendum ad to Standard 189.1-2023

Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings

First Public Review (February, 2026)
(Draft Shows Proposed Changes to Current Standard)

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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

Light emitting diode (LED) technology is a cost-effective high efficacy source for growing crops. The efficacy portion of this proposal is based on a review of the distribution of photosynthetic photon efficacies of LED horticultural lighting as reported in the DesignLights Consortium (DLC) database and keeping the green high-performance standard up to date with the efficacies available in the current market. ASHRAE 90.1-2022 Addendum BZ has also adopted a minimum luminaire photosynthetic photon efficacy of 2.5 $\mu\text{mol}/\text{J}$, 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 ASHRAE 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.

This proposal 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.

An added benefit of LED based light sources in addition to their efficacy is that almost all are dimmable which yields additional energy savings associated with controllability. Thus this proposal 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 ASHRAE 90.1 scalar ratio method.

Not for comment, but for background, the following are the definitions referenced in this section:

indoor grow space: a space, other than a *greenhouse*, used exclusively for horticultural production, cultivation, or maintenance.

greenhouse: a space with a skylight roof ratio of 50% or more above the growing area, used exclusively for horticultural production, cultivation, or maintenance by utilizing a sunlit environment, that is erected for a period of 180 days or more.

luminaire: a complete lighting unit consisting of *lamp(s)* or other light sources together with the housing designed to distribute the light, position and protect the light sources, and connect the light sources to the power supply.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open

for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum ad to 189.1-2023

Modify Section 3. DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

Definitions

daily light integral (DLI) : Cumulative photosynthetic photon flux density (PPFD) integrated over a 24-hour period in units of mol/m²·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 (μmol/s/W) (micromoles per joule [μmol/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 (μmol/m²/s), as defined by ANSI/ASABE S640.

Modify Section 7.3.6.1 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 2.4 2.5 μmol/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 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 4 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. Daily Light Integral (*DLI*) controls shall automatically dim supplemental electric lighting power in response to available *photosynthetic photon flux density (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 2 Additional Renewable Energy.