



**BSR/ASHRAE/IES Addendum I
to ANSI/ASHRAE/IES Standard 90.1-2025**

Public Review Draft

Proposed Addendum I to Standard 90.1-2025, Energy Standard for Sites and Buildings Except Low- Rise Residential Buildings

**First Publication Public Review (September 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

This addendum updates the horticultural lighting requirements in Section 9.4.3 to address both luminaire performance and lighting controls for greenhouse and indoor grow applications.

The addendum creates a distinction between horticultural lighting in greenhouses and horticultural lighting in indoor grow spaces because these applications have different operating characteristics. Greenhouse spaces can use available daylight to supplement crop lighting needs; therefore, the addendum requires controls that either combine automatic scheduling with daylight responsive dimming or use daily light integral (DLI) controls to modulate supplemental electric lighting based on daylight contribution and crop light targets. These controls are intended to reduce electric lighting when daylight is sufficient or when the user-specified DLI target has been achieved. Daily light integral (DLI) controls measure cumulative photosynthetic photon flux density (PPFD) integrated over a 24-hour period in units of $\text{mol}/\text{m}^2\cdot\text{day}$ as defined by ANSI/ASABE S640.

Indoor grow spaces generally rely on electric lighting as the primary or exclusive light source for plant growth. For these spaces, the addendum requires automatic scheduling dimming controls capable of providing multiple scheduled control levels each day, including dimmed operation and shutoff. The addendum also establishes control zone limits to ensure that large horticultural lighting loads are controlled with appropriate granularity.

This addendum only applies to commercial facilities with a minimum of 10 kW installed lighting power for horticultural lighting. The controls reduce the electric light in response to available daylight depending on the different control schemes.

This addendum is cost effective using the scalar ratio and standard energy prices. The technology required is currently used by the horticulture industry and has a ≤ 5 -year simple payback. The equipment has a lifetime of 15 years.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (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 1 to 90.1-2025

Add or modify definitions in Section 3.2 (I-P and SI):

[...]

critical circuit: the hydronic circuit that determines the minimum differential pressure that the pump must produce to

satisfy the zone loads (e.g., the circuit with the most-open valve). The critical circuit is the one with the highest pressure drop required to satisfy its load. At part-load conditions, the critical circuit can change based on zone loads.

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

DLI control: lighting control that automatically adjusts supplemental lighting to ensure crops receive a consistent target of total amount of light each day measured in units of $\text{mol}/\text{m}^2 \cdot \text{day}$ as defined by ANSI/ASABE S640.

daylight area: the floor area substantially illuminated by daylight.

[...]

photosensor: a device that detects the presence of visible light, infrared (IR) transmission, and/or ultraviolet (UV) energy.

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 ($\mu\text{mol}/\text{m}^2/\text{s}$), as defined by ANSI/ASABE S640.

physical renewable energy power purchase agreement: a contract for the purchase of renewable energy from a specific renewable energy generator to a purchaser of renewable energy.

[...]

Add or modify abbreviations in Section 3.3 (I-P and SI):

3.3 Abbreviations and Acronyms

[...]

<u>$\mu\text{mol}/\text{J}$</u>	<u>micromoles per joule</u>
Ψ	<i>psi-factor, thermal transmittance per unit length of a linear thermal bridge</i>
[...]	
DDC	<i>direct digital control</i>
<u>DLI</u>	<u>daily light integral</u>
DOAS	<i>dedicated outdoor air system</i>
[...]	
PPE	<u>photosynthetic photon efficacy</u>
<u>PPFD</u>	<u>photosynthetic photon flux of light, between 400 and 700 nm, per unit of surface area</u>
PRV	<i>power roof/wall ventilator</i>
[...]	

Modify Section 9.4.3 as follows (I-P and SI):

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

Greenhouse horticultural lighting shall be controlled in accordance with Section 9.4.3.2. Indoor grow horticultural lighting shall be controlled in accordance with Section 9.4.3.3.

9.4.3.1 Luminaires in greenhouses buildings and indoor grow spaces with at least 40 10 kW of connected load used for horticultural lighting shall have a luminaire photosynthetic photon efficacy of at least 2.5 $\mu\text{mol}/\text{J}$ when tested at the manufacturer-designed state with the highest power setting. Horticultural lighting in greenhouse spaces shall be

~~controlled by a device that automatically turns off the horticultural lighting at specific programmed times. Luminaires shall be capable of continuous dimming between 100% and 10% of full power in response to a control signal.~~

9.4.3.2 Greenhouse Lighting Control. ~~Luminaires in indoor grow spaces used for horticultural lighting shall have a luminaire photosynthetic photon efficacy of at least 2.5 $\mu\text{mol/J}$. Horticultural lighting in indoor grow spaces shall be controlled by a device that automatically turns off the horticultural lighting at specific programmed times. Horticultural lighting with 10 kW or more of connected load in greenhouses shall be controlled by an automatic scheduling control and a daylight responsive control in accordance with item (a) or shall be controlled by a daily light integral (DLI) control in accordance with item (b).~~

- a. ~~Automatic scheduling controls shall be capable of independently scheduling each control zone to turn horticultural lighting on or off four or more times daily. A control zone shall contain no more than 70 kW of lighting. Daylight responsive controls shall be capable of dimming horticultural lighting between 100% and 10% 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 horticultural lighting off. Automatic daylight responsive control devices shall separately control no more than 70 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.~~
- b. ~~DLI controls shall automatically dim horticultural lighting in response to available PPFD of daylight and the calculated DLI of combined daylight and electric light received by crops. The control system shall be capable of modulating horticultural lighting to achieve a user-specified DLI target. When a DLI target has been achieved, horticultural lighting shall turn 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 70 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.~~

Exception to 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 of at least 1.7 $\mu\text{mol/J}$.~~

9.4.3.3 Indoor Grow Spaces Lighting Control. ~~Horticultural lighting with 10 kW or more of connected load in indoor grow spaces shall be controlled by automatic scheduling dimming control. The control shall be capable of independently scheduling each control zone to not less than six different scheduled control levels per day. Scheduled control levels shall include dimming between 100% and 10% 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 20 kW of horticultural lighting.~~

13. NORMATIVE REFERENCES

References	Section
...	
<u>American Society of Agricultural and Biological Engineers (ASABE)</u> <u>2950 Niles Road Saint Joseph, MI 49085, United States</u> <u>www.asabe.org</u>	
<u>ANSI/ASABE</u> <u>S640-2017</u>	<u>Quantities and Units of Electromagnetic Radiation for Plants</u> <u>(Photosynthetic Organisms)</u> <u>3.2</u>

INFORMATIVE APPENDIX E

INFORMATIVE REFERENCES

This appendix contains informative references for the convenience of users of Standard 90.1 and to acknowledge source documents when appropriate. Some documents are also included in Section 13, “Normative References,” because there are other citations of those documents within the standard that are normative.

Address/Contact Information

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