

**STANDARDS PRESENTATION**  
**TO**  
**CALIFORNIA OCCUPATIONAL SAFETY AND HEALTH STANDARDS BOARD**

TITLE 8, DIVISION 1, CHAPTER 4

Amend §3441 to read:

§3441. Operation of Agricultural Equipment.

\*\*\*\*

(g) All tractors, ~~or~~ self-propelled farm equipment, and trucks used between ~~an hour after~~ sunset ~~or an hour before~~ and sunrise shall be equipped with at least one headlight which shall be used to ~~that will~~ illuminate the area in front of the equipment at least 50 feet. There shall be at least one rear light which shall ~~to~~ illuminate equipment at the rear. Additional lighting shall be provided where the operation requires field adjustment or the operator's attention.

NOTE to Subsection (g): See Section 3449 for illumination requirements for working near agricultural equipment during hours of darkness.

(h) Adequate means of access shall be provided so that employees can safely reach the top of the load for manual loading or unloading of high loads.

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NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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Amend §3449 to read:

§3449. ~~Ladders (Repealed)~~-Outdoor Agricultural Operations During Hours of Darkness (Between Sunset and Sunrise).

(a) Illumination. Outdoor agricultural operations taking place between sunset and sunrise shall be illuminated at levels no less than the levels stated in Table 1. Illumination levels for task lighting shall be measured at the task/working surface, in the plane in which the task/work surface is present. Illumination levels for area lighting shall be measured at approximately 30 inches above the floor or other horizontal, vertical or sloped surface on or through which the employee walks, works or gains access to a work area.

Note: The illumination levels required in Table 1 may be provided by one or more light source (e.g. lamp mounted on equipment, vehicles, or personal hands free portable lighting) or a combination of methods.

(1) The employer shall provide and maintain hands-free portable personal lighting or area lighting or both to employees.

Table 1 – Illumination Levels

| <u>Foot-candles</u> | <u>Lux</u>    | <u>Operations, Areas or Tasks</u>   |
|---------------------|---------------|---|
| <u>0.09-0.19</u>    | <u>1-2</u>    | <u>Poultry harvesting or catching operations.</u>   |
| <u>3</u>            | <u>32.29</u>  | <u>Meeting area and meal/rest area.</u>   |
| <u>5</u>            | <u>53.82</u>  | <u>Outdoor agricultural operations except where otherwise specified in this table.</u><br><u>Pathways leading to and around restrooms and drinking water.</u><br><u>Inside restroom facilities.</u><br><u>Storage areas accessed by employees.</u>  |
| <u>10</u>           | <u>107.64</u> | <u>Intermittently exposed or exposed point of operation equipment, covered under Group 8. Points of Operation and Other Hazardous Parts of Machinery.</u><br><u>Operationally visible moving parts of machinery covered under Group 6. Power Transmission, Prime Movers, and Machine Parts of the General Industry Safety Orders.</u> |

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|           |               |  |
|-----------|---------------|--|
|           |               | <u>Task lighting for agricultural operations that involve the use of tools that can potentially cause cuts, lacerations, or punctures.</u> |
| <u>20</u> | <u>215.30</u> | <u>Task lighting for maintenance work on equipment.</u>  |

NOTES to Subsection (a):

NOTE 1: Area lighting should be set up in a manner that minimizes glare to the workers (selection of lamps, shielding, proper adjustment of the beam angle, glare avoidance screens).

NOTE 2: See Non-mandatory appendix for additional information regarding selecting light sources.

EXCEPTION to Subsection (a): In order to prevent glare while vehicles are traveling on farm roads, additional lighting installed to meet Table 1 does not need to be activated.

(b) Safety meetings. Supervisory employees shall conduct a safety meeting at the beginning of each shift to inform employees of the location of the restrooms, drinking water, designated break areas, nearby bodies of water, and high traffic areas.

NOTE to Subsection (b): Safety meetings are part of the implementation of Section 3203(a)(3).

(c) The employer shall provide and require workers to wear Class 2 high visibility garments meeting the requirements of Section 3380(e) and conforming to specifications of American National Standard for High-Visibility Safety Apparel and Accessories, (ANSI/ISEA) 107-2015, which is hereby incorporated by reference, for work activities between sunset and sunrise.

NOTE to Subsection (c): See Sections 3380, Personal Protective Devices and 3383(b), Body Protection.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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**Non-Mandatory Appendix to Section 3449**

This Appendix serves as a guide to employers in selecting light sources or lamps.

**Wattage**

Wattage is a unit of power, amount of electricity the light bulb will consume. Use a light bulb that is appropriate for the light fixture. Do not use a light bulb that exceeds the maximum wattage on your fixture.

**Quantity of Light or Brightness**

Lumens is a unit of luminous flux, a measure of the quantity of visible light emitted by a source.

**Beam angle, beam radius, and target distance from the fixture**

Different lamps have different beam angles, from a narrow beam for spot lighting to very wide angle for flood lighting. The brightest output is usually located at the center of the beam. It is important to match the beam angle, beam radius, and target distance to the application of use.

**Photopic, Scotopic and Mesopic Vision**

Photopic vision-human colour vision under normal lighting conditions during the day.

Scotopic vision-visual perception in dim light “night vision”. Scotopic vision is more sensitive to blue light.

Mesopic vision-combination of photopic and scotopic vision which takes into account the combination of the higher total sensitivity of the rod cells in the eye for blue range, with the colour perception of the cone cells.

Light sources with a higher S/P ratio are better for night vision because their spectral distribution includes more blue and green light. A higher S/P ratio translates to a higher visually effective lux. A ratio higher than 1 means that the lamp is producing more scotopic lumens than photopic lumens.

General Scotopic/Photopic Ratios of Commercially Available Light Sources

| <b><u>Light Source</u></b>       | <b><u>S/P ratio</u></b> |
|----------------------------------|-------------------------|
| <u>Incandescent</u>              | <u>1.36</u>             |
| <u>Fluorescent (3500K)</u>       | <u>1.36</u>             |
| <u>Fluorescent (5000K)</u>       | <u>1.97</u>             |
| <u>Metal Halide (warm white)</u> | <u>1.20</u>             |

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|--------------------------------|-------------|
| <u>Metal Halide (daylight)</u> | <u>2.40</u> |
| <u>High Pressure Sodium</u>    | <u>0.65</u> |
| <u>Low Pressure Sodium</u>     | <u>0.25</u> |
| <u>LED (3500K)</u>             | <u>1.39</u> |
| <u>LED (6000K)</u>             | <u>2.18</u> |

Source: Lighting Industry Association Technical Statement, Issue 1 - 05/2013

(3) Formula to Convert Photopic Readings to Visually Effective Lux

For Ambient Lighting:

$$\text{Lux from photopic light meter} * (S/P)^{.78} = \text{Visually Effective Lux}$$

Task Lighting:

$$\text{Lux from photopic light meter} * (S/P) = \text{Visually Effective Lux}$$

**Color Rendering Index**

The color rendering index (CRI) is a measure of light source’s ability to show object colors “realistically” or “naturally” compared to a familiar reference source, either incandescent light or daylight. The maximum value of CRI index is 100.

A lamp with a high CRI would aid in distinguishing between different surfaces. CRI may be of critical importance to harvesting operations.

| <u>Light source</u>                            | <u>CRI</u> |
|--|------------|
| <u>Low-pressure sodium (LPS/SOX)</u>           | <u>-44</u> |
| <u>Clear mercury-vapor</u>                     | <u>17</u>  |
| <u>High-pressure sodium (HPS/SON)</u>          | <u>24</u>  |
| <u>Coated mercury-vapor</u>                    | <u>49</u>  |
| <u>Halophosphate warm-white fluorescent</u>    | <u>51</u>  |
| <u>Halophosphate cool-white fluorescent</u>    | <u>64</u>  |
| <u>Tri-phosphor warm-white fluorescent</u>     | <u>73</u>  |
| <u>Halophosphate cool-daylight fluorescent</u> | <u>76</u>  |

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|   |            |
|---|------------|
| <u>"White" SON</u>                          | <u>82</u>  |
| <u>Standard LED Lamp</u>                    | <u>83</u>  |
| <u>Quartz metal halide</u>                  | <u>85</u>  |
| <u>Tri-phosphor cool-white fluorescent</u>  | <u>89</u>  |
| <u>High CRI LED Lamp (Blue LED)</u>         | <u>95</u>  |
| <u>Ceramic discharge metal-halide lamp</u>  | <u>96</u>  |
| <u>Ultra High CRI LED Lamp (Violet LED)</u> | <u>99</u>  |
| <u>Incandescent/halogen bulb</u>            | <u>100</u> |

Source: [https://en.wikipedia.org/wiki/Color\\_rendering\\_index](https://en.wikipedia.org/wiki/Color_rendering_index)

**Life expectancy of the Light Sources**

Compare life expectancies between different light sources. Typically incandescent light bulbs have the shortest life span. LEDs have the longest and fluorescent bulbs are in between.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.