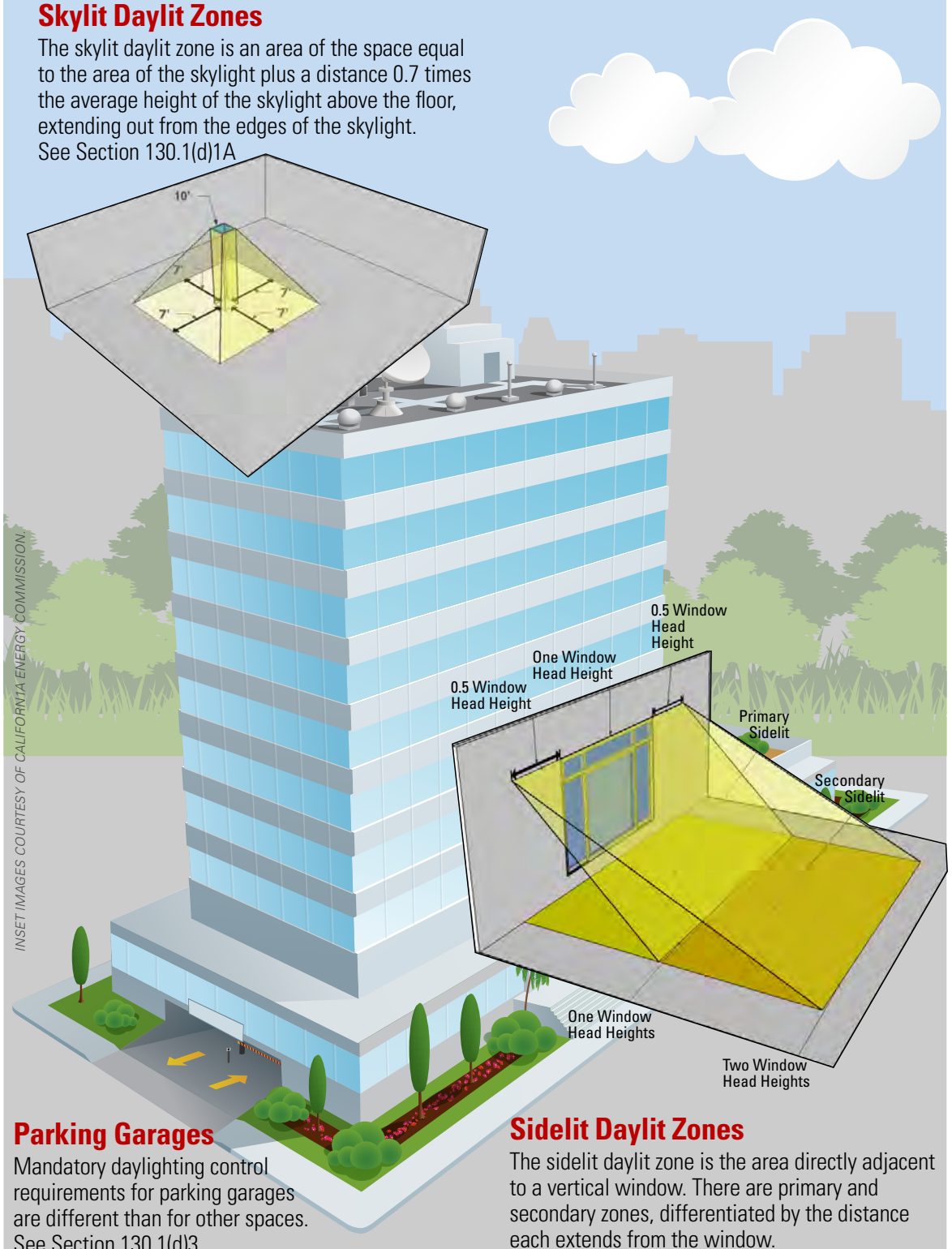
Nonresidential

Daylighting and Controls

Skylit Daylit Zones

The skylit daylit zone is an area of the space equal to the area of the skylight plus a distance 0.7 times the average height of the skylight above the floor, extending out from the edges of the skylight.
See Section 130.1(d)1A



INSET IMAGES COURTESY OF CALIFORN1A ENERGY COMMISSION.

Parking Garages

Mandatory daylighting control requirements for parking garages are different than for other spaces.
See Section 130.1(d)3.

Sidelit Daylit Zones

The sidelit daylit zone is the area directly adjacent to a vertical window. There are primary and secondary zones, differentiated by the distance each extends from the window.
See Sections 130.1(d)1B and 130.1(d)1C.

What is Daylighting?

Daylighting is the practice of placing windows or other openings and reflective surfaces so that during the day natural light provides effective internal lighting. Particular attention is given to daylighting while designing a building when the aim is to maximize visual comfort or to reduce energy use. A daylit zone is the floor area under skylights or next to windows. Types of daylit zones include Primary Sidelit, Secondary Sidelit, and Skylit.

Why?

Energy savings can be achieved from the reduced use of artificial lighting, either by simply installing fewer electric lights because daylight is present, or by installing controls to dim/switch electric lights automatically in response to the presence of daylight.

Relevant Code Sections

2016 California Building Energy Efficiency Standards, Title 24, Part 6:

- Section 130.1(d) – Automatic Daylighting Controls
- Section 140.3(c) – Minimum Daylighting Requirement for Large Enclosed Spaces
- Section 140.3(a)6 – Skylight Requirements
- Section 140.6(d) – Secondary Daylit Zone Control Requirements
- Section 141.0(b)2i – Alterations Requirements

Relevant Compliance Forms

- NRCC-ENV-04-E: Daylit Zone Worksheet
- NRCC-LTI-02-E: Indoor Lighting Controls Worksheet
- NRCI-LTI-01-E: Indoor Lighting
- NRCI-LTI-02-E: EMCS or Lighting Control System - Installation Certificate
- NRCA-LTI-03-A: Automatic daylighting Lighting Controls - Acceptance Test

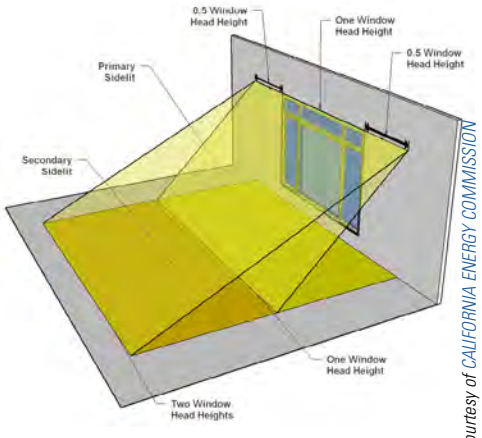
Control Requirements & Daylit Zones

The 2016 Title 24, Part 6 Building Energy Efficiency Standards (Energy Standards) contain daylighting control requirements that apply to many spaces. Mandatory daylighting controls are required for lighting that is in a daylit zone where the installed general lighting is 120 watts or greater and fenestration area is 24 ft^2 or greater. When using a Prescriptive compliance method, luminaires in the secondary sidelit zone must also have daylighting controls.

For lighting that requires daylighting controls, mandatory dimming controls that meet the specifications of Table 130.1-A are required. For example, linear fluorescent lamps greater than 13 Watts require either continuous dimming, stepped dimming down to a range of 20-40% on the lowest step, or switching lamps with a minimum of four lamps per luminaire.

Dimming Performance

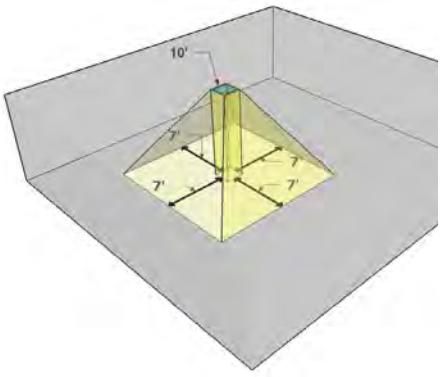
Installed daylighting controls must operate so that when the daylight received from the illuminance source (window or skylight) exceeds 150% of the design illuminance setpoint for electric lighting, the general lighting power must be reduced by a minimum of 65%. For example, if the illuminance setpoint in the space is 40 footcandles (fc), when the illuminance level from daylighting reaches 60 fc, the controls must dim the lights by at least 65%. When possible, controls that can automatically maintain illuminance levels at the set point at all times of the day are an even better solution.



Courtesy of CALIFORNIA ENERGY COMMISSION

The primary sidelit daylit zone is an area on a plan directly adjacent to each vertical glazing, one window head height deep into the area, and window width plus 0.5 times window head height wide on each side of the rough opening of the window.

The secondary sidelit daylit zone is the area on a plan directly adjacent to each vertical glazing, two window head heights deep into the area, and window width plus 0.5 times window head height wide on each side of the rough opening of the window.



Courtesy of CALIFORNIA ENERGY COMMISSION

The skylit daylit zone is an area of the space equal to the area of the skylight plus a distance 0.7 times the average height of the skylight above the floor, extending out from the edges of the skylight

Parking Garages

Mandatory daylighting control requirements for parking garages are different than for other spaces. For instance, parking garage daylight controls are mandatory for secondary sidelit zones, whereas this is not the case for interior areas of the building.

Parking garages that have a combined glazing or opening area of 36 square feet or greater must also comply with the daylighting control requirements of the Energy Standards, except when the combined general lighting power in the primary daylit zones is less than 60 watts. Daylighting controls are not required in parking garage daylight transition zones, which is a vehicular path intended to provide a transition between exterior and interior illumination levels and does not include parking areas.

Primary and secondary daylit zones can be controlled together. Daylighting controls for parking garages can be on/off, where other spaces require continuous or stepped dimming controls. Lighting in the primary and secondary daylit zones of parking garages must be completely turned off, when the space is fully daylit. For other space types multilevel dimming can be used with the dimmed lights consuming up to 35% of full power.

Daylighting Requirements for Large Enclosed Spaces

Requirements set forth in Section 140.3(c) establish large enclosed spaces with high ceilings must have a minimum amount of daylight available when using the Prescriptive compliance method. The requirements apply for buildings in climate zones 2 through 15 with a space that has:

1. Floor area greater than 5,000 ft^2 directly under a roof ***and***
2. Ceiling height (CH) greater than 15 ft ***and***
3. Have a general lighting system with a lighting power density equal to or greater than 0.5 W/ft^2

Buildings that meet all of the above criteria must have at least 75% of the floor area within skylit or primary sidelit daylit zones.

If skylights are used to meet the minimum daylighting requirement, per Section 140.3(a)6, the skylight area cannot comprise more than 5% of the gross roof area. However, if it is an atria area over 55 feet in height, the skylight area may make up 10% of the gross exterior roof area.

Careful sizing and placement of skylights will ensure proper daylit area coverage while minimizing the total skylight area and subsequent solar heat gain. For most spaces, a skylight area that is 3% to 4% of the gross roof area can provide necessary daylit area coverage, while limiting solar heat gain.

Forms: Which and When

During Design:

- NRCC-ENV-04-E: Daylit Zone Worksheet
- NRCC-LTI-02-E: Indoor Lighting Controls Worksheet

Why?: To show compliance with the energy code for minimum daylighting requirements for large enclosed spaces.

During Construction:

- NRCI-LTI-01-E: Indoor Lighting - Installation Certificate
  - Completed by the installing contractor and available for Inspector when onsite.
- NRCI-LTI-02-E: EMCS or Lighting Control System - Installation Certificate
  - Completed by the installing contractor and available for the Inspector when onsite
- NRCI-LTI-05-E: Power Adjustment Factors
  - (Optional) Completed if design claims compliance credit for dimming plus off daylighting controls
- NRCA-LTI-03-A: Automatic Daylighting Control - Acceptance Test

Why?: To verify the field installation meets or exceeds code

For More Information

Primary Documents

- Energy Standards Section 130.1(d) - Automatic Daylighting Controls:
  energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1301mandatoryindoorlightingcontrols.htm#dautomaticdaylightingcontrols.htm
- Energy Standards Section 140.3(c) - Minimum Daylighting Requirement for Large Enclosed Spaces
  energycodeace.com/site/custom/public/reference-ace-2016/Documents/section1403prescriptiverequirementsforbuildingenvelopes.htm
- Energy Standards Section 140.3(a)6 - Skylight Requirements:
  energycodeace.com/site/custom/public/reference-ace-2016/Documents/section1403prescriptiverequirementsforbuildingenvelopes.htm
- Energy Standards Section 140.6(d) - Secondary Daylit Zone Control Requirements:
  energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1406prescriptiverequirementsforindoorlighting.htm#dautomaticdaylightingcontrolsinsecondarydaylitzones.htm
- Energy Standards Section 141.0(b)2I - Alterations Requirements:
  energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/sec1410additionsalterationsrepairstoexistingbuildingsthatwillben.htm#balterations.htm
- Chapter 3.3 of the 2016 Nonresidential Compliance Manual:
  energy.ca.gov/2015publications/CEC-400-2015-033/chapters/chapter_03_building_envelope.pdf
- Chapter 5.4.4 of the 2016 Nonresidential Compliance Manual:
  energy.ca.gov/2015publications/CEC-400-2015-033/chapters/chapter_05_indoor_lighting.pdf
- Chapter 5.5 of the 2016 Nonresidential Compliance Manual:
  energy.ca.gov/2015publications/CEC-400-2015-033/chapters/chapter_05_indoor_lighting.pdf

California Energy Commission Information & Services

- Energy Standards Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
  energy.ca.gov/title24/orc/
  - The Energy Commission's main web portal for Energy Standards, including information, documents, and historical information

Additional Resources

- Energy Code Ace:
  EnergyCodeAce.com
  - An online "one-stop-shop" providing free resources and training to help appliance and building industry professionals decode and comply with Title 24, Part 6 and Title 20. The site is administered by California's investor-owned utilities.
    Of special interest: Fact Sheet for Nonresidential Lighting Mandatory Controls
    EnergyCodeAce.com/content/resources-fact-sheets/
    Please register with the site and select an industry role for your profile in order to receive messages about all our free offerings!

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