



# INDOOR SHUT-OFF CONTROLS

Under the 2016 Building Energy Efficiency Standards

Depending on the scope of your indoor lighting project, there are up to five types of mandatory lighting controls required under the Energy Standards. Each type forms an important layer of control, and with the application of more layers comes increased energy savings.

One important type of lighting control required under the 2016 Energy Standards is shut-OFF control. Shut-OFF controls automatically shut off or reduce light output when a space is vacant or normally unoccupied. They are required for nearly all nonresidential lighting systems in newly constructed buildings, building additions and alterations.

## WHAT'S NEW UNDER THE 2016 ENERGY STANDARDS



### EMERGENCY AND EGRESS LIGHTING

Emergency lighting connected to emergency power or a backup and that operates only when normal power is absent is exempt from shut-OFF control requirements.

Up to 0.1 watts per square foot of lighting power is exempt from shut-OFF control requirements if it is designated for means of egress.



### OCCUPANCY SENSOR TIME-OUT

Occupancy sensor time-out limits have decreased from 30 minutes to 20 minutes.



### SPACES WITH MULTI-LEVEL CONTROLS

Clarifications regarding the specific occupancy control strategy required of certain areas have been added based on the area's multi-level lighting controls requirements per **Section 130.1(b)**.

Please watch the Energy Commission video series on Lighting Control Systems offered at the Energy Commission's Online Resource Center: [http://www.energy.ca.gov/title24/orc/lighting/2016\\_lighting.html](http://www.energy.ca.gov/title24/orc/lighting/2016_lighting.html) The 2016 Building Energy Efficiency Standards may be found at <http://www.energy.ca.gov/title24/2016standards/>.

## OVERVIEW

Shut-OFF controls include time-based control and occupancy-based control devices. Time-based shut-OFF controls include automatic time-switch controls, astronomical time-switch controls, multi-level astronomical time-switch controls and outdoor astronomical time-switch controls. Astronomical devices allow you to customize lighting operation schedules based on geographic location and time of the year.

Occupancy-based controls use sensors to detect the presence of people or moving objects. When a space is vacant, these controls reduce or extinguish lights to save energy. Devices include occupant sensors, motion sensors, vacancy sensors, partial-ON sensors and partial-OFF sensors.

### Requirements for All Space Types

All installed indoor lighting must be equipped with shut-OFF controls. The lighting system must be controlled by an occupant sensing control, automatic time-switch control, or other control capable of automatically shutting off all of the lighting when the space is typically unoccupied.

Separate shut-OFF controls are required for the lighting on each floor, other than lighting in stairwells, as well as each space enclosed by ceiling height partitions not exceeding 5,000 square feet. In malls, auditoriums, single tenant retail, industrial, convention centers, and arenas the control zone can be as large as 20,000 square feet.

Also, general, display, ornamental, and display case lighting must be controlled separately.

### EXCEPTIONS

- Lighting serving an area that is in continuous use, 24 hours per day, 365 days per year.
- Lighting that complies with the shut-OFF control requirements contained in [Section 130.1\(c\)5](#) or [7](#) of the Energy Standards.
- Lighting in electrical equipment rooms subject to article 110.26(D) of the California Electrical Code.
- Illumination provided by lighting equipment that is designed as emergency lighting, is connected to an emergency power source or battery supply, and is intended to function in emergency mode only when normal power is absent.
- Up to 0.1 watts per square foot of lighting in any area within a building may be continuously illuminated if it's designated for means of egress.



### Countdown Timer Switches

One type of common shut-OFF control is a countdown timer switch. Under the Energy Standards, these devices can only be used in a limited number of cases which include:

- Single-stall bathrooms and closets less than 70 square feet in size. The maximum time-out setting must be 10 minutes or less to comply with requirements.
- Server aisles, which are aisles of racks of Information Technology (IT) server equipment in dedicated server rooms. While networking equipment may also be housed on these racks, it is largely a room to manage server equipment. In these spaces, the maximum timeout setting must be 30 minutes or less.

### Automatic Time Switch Controls

When an automatic time-switch control is used to comply with the automatic shut-OFF requirements, the control is not responsive to the presence or absence of occupants. Therefore, when any control other than an occupant-sensing control is used to comply with the shut-OFF control requirements, the lighting control system must incorporate an override so occupants can still use the lighting. The time switch must allow the lighting to remain ON for no more than two hours when an override is initiated.

There are exceptions to the override time limit. In the following function areas, if a captive-key override is utilized, the override time may exceed two hours:

- Malls
- Auditoriums
- Single tenant retail spaces

- Industrial areas
- Arenas

Automatic time switch controls must also incorporate an automatic holiday shut-OFF feature that turns all the

lighting OFF for at least 24 hours, and then resumes the normally scheduled operation. However, this feature is not required for retail stores, restaurants, grocery stores, churches and theaters.

## REQUIREMENTS FOR PARTICULAR SPACES

### Offices, Multipurpose Rooms, Conference Rooms and Classrooms

Under the Energy Standards, occupancy sensors are required to shut off all the lighting in certain types of spaces:

- Offices 250 square feet or smaller
- Multipurpose rooms of less than 1,000 square feet
- Classrooms of any size
- Conference rooms of any size

In these spaces, the occupant sensing controls must function either as a partial-ON device or a vacancy sensor.

Partial-ON occupant sensors must be capable of automatically activating between 50-70 percent of the controlled lighting when an occupant is detected. When using a vacancy sensor, all the lighting must be manually turned on by the occupant.

In these spaces, if multi-level lighting controls are not required, the occupant sensing controls must function either as a standard occupant sensor; a partial-ON occupant sensor, or a vacancy sensor. A standard occupancy sensor automatically turns all the lights on when a space is occupied and off when it's vacant.

In addition, regardless of the occupancy control type, manual ON/OFF controls must always be available to occupants.

### Warehouses, Libraries, Corridors and Stairwells

Full or partial-OFF occupancy controls are required in aisle ways and open areas in warehouses. Partial-OFF controls automatically extinguish a portion of the lighting in a space when it becomes vacant. Systems may be set to automatically turn that lighting back on when occupants enter, or it may be set for manual ON control. Lighting in each aisle way must be independently controlled, and occupancy controls must automatically reduce lighting power by at least 50 percent when the area is vacant. Occupancy controls should not control lighting beyond the aisle way.

### EXCEPTIONS

- Areas with lighting power of 80 percent or less of that allowed under the Area Category Method - occupant sensing controls can reduce the lighting power by as little as 40 percent.
- Areas with metal halide lighting or high pressure sodium lighting in warehouses - occupant sensing controls can reduce lighting power by as little as 40 percent.

Lighting in library book stack aisles 10 feet or longer that are accessible from only one end or aisles 20 feet or longer that are accessible from both ends, must also be controlled by full or partial-OFF occupancy controls. The controls must automatically reduce lighting power by at least 50 percent when the areas are unoccupied.

Lighting in corridors and stairwells must also be controlled by occupant sensing controls that separately reduce the lighting power in each space by at least 50 percent when the space is unoccupied. The occupant sensing controls must be capable of automatically turning the lighting fully ON only in the separately controlled space, and must be automatically activated from all designated paths of egress.

In addition to this requirement, lighting in these areas must be equipped with a control capable of automatically shutting OFF all lighting when the space is typically unoccupied per Section 130.1(c)1



CONTROL EXAMPLE COURTESY OF ENLIGHTENED

## Hotels, Motels and High-Rise Residential Buildings

Lighting in stairwells and common area corridors that provide access to guestrooms and dwelling units of high-rise residential buildings and hotel/motels must use partial-OFF occupancy controls. Lighting in these spaces must be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied.

The occupant sensing controls must be capable of automatically turning the lighting fully ON only in the separately controlled space, and must be automatically activated from all designed paths of egress. For corridors and stairwells with an installed lighting power that is 80 percent or less of that allowed under the Area Category Method, the minimum required reduction is reduced to 40 percent.

Hotel and motel guest rooms must use captive card key controls, occupancy controls, or other automatic controls that turn lighting off within 30 minutes of the room being vacated. A single, high-efficacy luminaire located within six feet of the guest room

door is exempt from these requirements provided it is separately switched from the other lighting in the room.

## Parking Garages

In parking garages, parking areas, loading and unloading areas, general lighting must be controlled by occupant sensing controls having at least one control step between 20 percent and 50 percent of design lighting power. Metal halide luminaires with a lamp plus ballast mean system efficacy of greater than 75 lumens per watt must provide least one control step between 20 percent and 60 percent of design lighting power. No more than 500 watts of lighting power can be controlled in a single zone.

In addition, the occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designated paths of egress.

Parking areas on the roof of a parking structure are classified as outdoor hardscape and must comply with the applicable provisions in [Section 130.2](#).

## PRESCRIPTIVE REQUIREMENTS

In addition to the mandatory requirements for shut-OFF controls, there are several prescriptive requirements related to the devices.

First, certain types of lighting are excluded from lighting power density calculations under the prescriptive compliance approach. This means, for these applications, lighting systems can use as much power as is needed for the task. One of these exceptions is dependent on the use of a vacancy sensor. Lighting intended for hair, makeup and costume preparation in performing arts facility dressing rooms is excluded from LPD calculations if it is separately switched from the general lighting and is controlled by a vacancy sensor.

Second, the use of occupancy sensors in large open plan offices qualifies for a power adjustment factor (PAF) if certain requirements are met. Under the prescriptive compliance approach, voluntary use of certain lighting controls that go beyond mandatory requirements, can give designers and building owners some flexibility to install additional lighting in a space. In large, open plan offices, the use of occupancy sensors for general lighting above workstations is one such case.

To qualify for this PAF, occupancy sensors must

1. Be installed in an open plan office area greater than 250 square feet
2. Be installed in an open plan office area that contains workstations
3. Control only the general lighting or certain types of furniture mounted luminaires defined under [Section 140.6\(a\)2C](#) of the Energy Standards
4. Be installed and configured in such a way that they are not triggered by movement outside the controlled area.

When all these conditions are met, the system qualifies for a PAF between 0.2 and 0.4, depending on the size of the occupancy sensor control zone. Details are provided in [Table 140.6-A](#) of the Energy Standards.

