

**Scope:** Lighting system controls for interior and exterior applications

**Exceptions:** Continuously lit security and emergency areas; exit stairs, ramps, and passageways; emergency egress lighting normally off

**Alterations:** Lighting control, power and test requirements apply when ≥ 10% of the lighting system is replaced, or when the alteration increases the lighting power

**OCCUPANCY SENSOR REQUIREMENTS**

LUMINAIRE LEVEL LIGHTING CONTROLS  
INTERIOR & EXTERIOR LIGHTING CONTROLS

<p><b>Occupancy Sensor Controls C405.2.1</b></p> <ul style="list-style-type: none"> <li>Lights auto off within 20 minutes of occupants leaving</li> <li>Manual off control</li> </ul>	<p><b>Required for the Following Space Types</b></p> <ul style="list-style-type: none"> <li>Class/lecture/training</li> <li>Locker rooms</li> <li>Open plan offices</li> <li>Copy/print rooms</li> <li>Warehouses</li> <li>Storage rooms</li> <li>Enclosed offices</li> <li>Conference/meeting</li> <li>Spaces ≤ 300ft<sup>2</sup></li> <li>Restrooms</li> <li>Lounges/break rooms</li> <li>Corridors</li> </ul>	<p><b>Key Exceptions</b></p> <ul style="list-style-type: none"> <li>Specific Application Control luminaires of C405.2.5</li> </ul>
<p><b>Manual On or Partial Auto On C405.2.1.1.2</b></p> <ul style="list-style-type: none"> <li>Manual on or partial auto on to ≤ 50% power</li> </ul>	<p><b>Full Auto On Only Permitted for</b></p> <ul style="list-style-type: none"> <li>Corridors</li> <li>Stairways</li> <li>Interior Parking</li> <li>Lobbies</li> <li>Locker Rooms</li> <li>Library Stacks</li> <li>Restrooms</li> <li>Where manual on would endanger safety and security</li> </ul>	<p><b>Key Exceptions</b></p> <ul style="list-style-type: none"> <li>Where full auto on is permitted, Manual Controls, Manual On and Partial Auto On control is not required</li> </ul>
<p><b>Warehouse Aisle &amp; Open Areas C405.2.1.2</b></p> <ul style="list-style-type: none"> <li>Automatically reduce lighting ≥ 50% within 20 minutes of occupants leaving</li> <li>Auto off by occupancy sensor or timeswitch</li> <li>Manual control to turn lighting off</li> </ul>	<p><b>Each aisle independently controlled, cannot control lighting beyond aisles</b></p>	<p><b>Key Exceptions</b></p> <ul style="list-style-type: none"> <li>None</li> </ul>
<p><b>Occupancy Sensors in Open Office C405.2.1.3</b></p> <ul style="list-style-type: none"> <li>Control zones limited to no more than 600ft<sup>2</sup></li> <li>Auto On permitted in occupied zone, unoccupied zones auto on to not more than 20% lighting power</li> <li>Auto off or reduce general lighting in control zone to ≤ 20% lighting power within 20 minutes of occupants leaving control zone</li> <li>Auto off all control zones within 20 minutes of all occupants leaving the open plan office</li> </ul>		<p><b>Key Exceptions</b></p> <ul style="list-style-type: none"> <li>Where open offices are &lt; 300ft<sup>2</sup> comply with section C405.2.1.1</li> <li>All lighting may auto off with timeswitch</li> </ul>
<p><b>Occupancy Sensors in Corridors C405.2.1.4</b></p> <ul style="list-style-type: none"> <li>Uniformly reduce lighting not more than 50% lighting power within 20 minutes of occupants leaving</li> </ul>		<p><b>Key Exceptions</b></p> <ul style="list-style-type: none"> <li>Corridors with less than two footcandles at darkest point with all lighting on</li> </ul>

**TIMESWITCH REQUIREMENTS (where occupancy sensors not used)**

<p><b>Timeswitch Controls C405.2.2</b></p> <ul style="list-style-type: none"> <li>Auto off lighting when scheduled unoccupied</li> <li>Provide manual override &amp; light reduction control</li> <li>Override for ≤ 2 hours, control area ≤ 5,000ft<sup>2</sup></li> </ul>	<p><b>In Mall Concourses, Auditoriums, Sales Areas, Manufacturing Facilities, Sports Arenas</b></p> <p>Override permitted &gt; 2 hours with captive key switch Control area ≤ 20,000ft<sup>2</sup></p>	<p><b>Key Exceptions</b></p> <ul style="list-style-type: none"> <li>Specific Application Control luminaires of C405.2.5</li> <li>Where patient care is directly provided</li> <li>Where auto off endangers safety or security</li> <li>24/7 operations</li> <li>Shop and laboratory classrooms</li> </ul>
<p><b>Light Reduction Control C405.3</b></p> <ul style="list-style-type: none"> <li>Manual controls that uniformly dims or uses an intermediate control step, in addition to full on or off</li> </ul>	<p><b>Choose the following or another approved control method</b></p> <ul style="list-style-type: none"> <li>Continuously dim all luminaires ≤ 20% full power</li> <li>Reduce all luminaires between 30-70% full power</li> <li>Switch alternate luminaires to achieve between 30-70% full power</li> </ul>	<p><b>Key Exceptions</b></p> <ul style="list-style-type: none"> <li>One luminaire &lt; 60W or LPD &lt; 0.45W ft<sup>2</sup></li> <li>Daylight-responsive control zones</li> <li>Specific application controlled lighting C405.5</li> <li>The following space types:             <ul style="list-style-type: none"> <li>Corridors</li> <li>Elect/mech rooms</li> <li>Lobbies</li> </ul> </li> </ul>

**ADDITIONAL INTERIOR LIGHTING CONTROL REQUIREMENTS**

<b>Manual Controls C405.2.6</b> <ul style="list-style-type: none"> <li>Readily accessible to occupants</li> <li>Controlled lighting is visible from manual control device</li> </ul>	<b>Choose between switching or dimming manual controls</b>	<b>Key Exceptions</b> <ul style="list-style-type: none"> <li>When installed remotely, identify the area controlled and indicate the lighting's status</li> </ul>
<b>Daylight Responsive Control C405.2.4</b> <ul style="list-style-type: none"> <li><b>Sidelit:</b> Primary &amp; secondary daylight zones</li> <li><b>Toplit:</b> Single primary daylight zone</li> <li>Automatic continuous dimming of general lighting to <math>\leq 15\%</math> full power</li> <li>Configure to completely turn lighting off</li> <li>Authorized calibration in space with ready access</li> <li>Control sidelit independent of toplit zone</li> </ul>	<div style="background-color: #4CAF50; color: white; padding: 5px; font-weight: bold;">           Primary daylight zone lighting power &gt; 150W?            or primary and secondary daylight zone lighting &gt; 300W?         </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>YES</span> <span>NO</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="background-color: #4CAF50; color: white; padding: 5px; font-weight: bold;">Daylight Control Required</div> <div style="background-color: #4CAF50; color: white; padding: 5px; font-weight: bold;">Daylight Control Not Required</div> </div>	<b>Key Exceptions</b> <ul style="list-style-type: none"> <li>Healthcare facility direct patient care areas</li> <li>Retail sidelit zones on the first floor</li> <li>Where sidelight fenestration is &lt; 24ft<sup>2</sup></li> <li>Where obstructions block daylight</li> <li>Where visible transmittance is too low</li> <li>Where LPD is reduced by equation 4-9</li> <li>Where overhang projection factor too large</li> </ul>
<b>Specific Application Controls C405.2.5</b> <ul style="list-style-type: none"> <li>Manual control separate from general lighting</li> <li>Auto off by timeswitch or occupancy sensor</li> </ul>	<b>Required for the Following Lighting</b> <ul style="list-style-type: none"> <li>Display &amp; accent</li> <li>Supplemental task</li> <li>Food warming</li> <li>Under shelf/cabinet</li> <li>Lighting for sale/education</li> <li>Display cases</li> <li>Galleries/museums</li> <li>Added power lighting</li> </ul>	<b>Key Exceptions</b> <ul style="list-style-type: none"> <li>None</li> </ul>
<b>Medical/Dental Task Lighting C405.2.5.5</b> <ul style="list-style-type: none"> <li>When in addition to general lighting, provide with a manual control</li> </ul>	<b>Required for the Following Lighting</b> <ul style="list-style-type: none"> <li>Task lighting for medical purposes</li> <li>Task lighting for dental purposes</li> </ul>	<b>Key Exceptions</b> <ul style="list-style-type: none"> <li>None</li> </ul>
<b>Sleeping Units C405.2.5.2</b> <ul style="list-style-type: none"> <li>Auto off all permanent luminaires and switched receptacles within 20 minutes of occupants leaving</li> </ul>	<div style="background-color: #4CAF50; color: white; padding: 5px; font-weight: bold;">           Lighting power requirements may follow either:         </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="background-color: #4CAF50; color: white; padding: 5px; font-weight: bold;">Dwelling Unit Efficacy Requirements</div> <div style="background-color: #4CAF50; color: white; padding: 5px; font-weight: bold;">Interior lighting power allowance C405.3.2</div> </div>	<b>Key Exceptions</b> <ul style="list-style-type: none"> <li>Where lighting and switched receptacles are controlled by card key controls</li> <li>Spaces where direct patient care provided</li> </ul>
<b>Dwelling Units C405.1.1, C405.2.5.3</b> <ul style="list-style-type: none"> <li>Provide either occupancy sensor shut off control per C405.2.1.1 or light reduction control per C405.2.3.1</li> </ul>	<b>Required Lighting Efficacy</b> <ul style="list-style-type: none"> <li>No less than 90% of permanently installed lighting must have lamp efficacy <math>\geq 65</math> lm/W or luminaire efficacy <math>\geq 45</math> lm/W</li> </ul>	<b>Key Exceptions</b> <ul style="list-style-type: none"> <li>None</li> </ul>

**ADDITIONAL CONTROL REQUIREMENTS**

<b>Exterior Lighting Controls C405.2.7</b> <ul style="list-style-type: none"> <li>Auto off when daylight available</li> <li>Façade &amp; landscape lights auto off up to one hour after business close to one hour before business open</li> <li>All other lighting reduce power <math>\geq 50\%</math> no later than midnight to 6 AM, one hour after closing to one hour before opening, or when no activity for &gt; 15 min</li> <li>Parking lot lights &gt; 78W with mounting heights <math>\leq 24</math>ft must reduce power <math>\geq 50\%</math> when no activity detected for &gt; 15 minutes. Control zone <math>\leq 1500</math>W</li> </ul>	<b>Key Exceptions</b> <ul style="list-style-type: none"> <li>Covered vehicle entrance/exits where required for eye adaptation</li> <li>Lighting controlled from within a dwelling unit</li> </ul>
<b>Parking Garage Lighting Controls C405.2.8</b> <ul style="list-style-type: none"> <li>Automatic lighting shut off by occupancy sensor control C405.2.1.1 or timeswitch control C405.2.2.1</li> <li>Automatically reduce lighting power <math>\geq 30\%</math> when no activity within 20 minutes, control zone <math>\leq 3,600</math>ft<sup>2</sup></li> <li>Covered vehicle entrances and exits with eye adaptation lighting, reduce lighting by <math>\geq 50\%</math> from sunset to sunrise</li> <li>Within 20ft of perimeter wall openings, automatically reduce lighting power <math>\leq 50\%</math> in response to daylight</li> </ul>	<b>Key Exceptions for Automatic Light Reduction</b> <ul style="list-style-type: none"> <li>In lighting zones with less than 1.5 FC at the darkest point</li> </ul> <b>Key Exceptions for Daylighting</b> <ul style="list-style-type: none"> <li>Where opening-to-wall ratio &lt; 40%</li> <li>Where distance from blocking obstruction is less than one half the obstruction height</li> <li>Where screens or architectural elements obstruct daylight entering the space</li> </ul>

ADDITIONAL CONTROL REQUIREMENTS CONT.

LUMINAIRE LEVEL LIGHTING CONTROLS  
INTERIOR & EXTERIOR LIGHTING CONTROLS

**Automatic Receptacle Control C405.11**

Applies to ≥ 50% of receptacles in enclosed offices, conference rooms, copy/print rooms, breakrooms, classrooms, individual workstations and ≥ 25% of feeders for modular furniture not on plans

- Auto off by either:
  1. Time schedule, ≤ 2 hour override, control area ≤ 5,000ft<sup>2</sup>
  2. Occupancy sensor with 20 minute off delay
  3. Automated signal that shall auto off receptacles within 20 minutes of occupants leaving
- Either top duplex receptacle controlled or controlled receptacle within 12 inches of uncontrolled receptacle
- Controlled receptacles permanently marked in accordance with NFPA 70
- Plug in controlled power strips and devices do not comply

**Key Exceptions**

- Equipment continuously operating 24/7
- Where auto control would endanger safety or security
- In a modular office workstation a controlled outlet may be mounted up to 72 inches from an uncontrolled outlet of the workstation

**Electrical Energy Monitoring C408.12**

- Measure, monitor, record and report electrical energy consumption
  - Record 15 min intervals minimum
  - Report at least hourly, daily, monthly, annually
  - Store energy data for ≥ 36 months
  - Graphically provided energy reports by end use
  - No more than 5% mix of end use energy category
- Measure and report separately for:**
- Total HVAC system
  - Interior lighting
  - Exterior lighting
  - Plug load
  - Process load
  - Operations and other miscellaneous loads

**Key Exceptions**

- Buildings < 25,000 ft<sup>2</sup>
- R-2 occupancy buildings
- Tenant spaces < 5,000 ft<sup>2</sup>

**Electrical Energy Monitoring C408.12**

Comply with one or more of the following to achieve 10 credits:

1. More efficient HVAC performance
2. Reduce LPD or efficacy requirements
3. Provide enhanced digital lighting controls
4. On-site renewable energy system
5. Dedicated outdoor air system
6. High efficiency service water heating
7. Enhanced envelope performance
8. Reduced air infiltration
9. Energy monitoring system
10. Fault detection and diagnostics
11. Efficient kitchen equipment

**Key Exceptions**

- Tenant spaces comply by achieving at least five credits
- Tenant spaces previously occupied and complying with the existing building requirements of section C501

**Lighting System Functional Testing C408.3**

- Before passing final inspection, the registered design professional or approved agency provides evidence that lighting controls have been tested, calibrated, adjusted, programmed, and in proper working condition
- Provide owner documents certifying lighting controls meet performance criteria within 90 days after certificate of occupancy

**Key Exceptions**

- None