MANDATORY MEASURES
INDOOR LIGHTING CONTROLS

(Reference: Sub-Chapter 4, Section 130)
MANDATORY LIGHTING CONTROLS

1. **Area Controls**: Manual controls that control lighting in each area separately

2. **Multi-level Controls**: Allow occupants to choose the appropriate light level for each area

3. **Shut-off Controls**: Automatically shuts off lighting or reduces light levels when illumination is not needed

4. **Automatic Daylighting Controls**: Adjust electric lighting in response to the presence of daylight

5. **Demand responsive controls**: Receive and *automatically* respond to demand response (DR) signals
MANUAL ON/OFF CONTROLS

An “area” is a space enclosed by ceiling-height partitions.

All lighting in each area must be controlled separately from luminaires in other areas by manual on/off lighting controls that are:

1. Readily accessible
2. Located in the same room or area as the lighting they control and with the lighting in view
3. Able to provide any required dimming or multi-level controls steps in addition to on/off
EGRESS LIGHTING

Up to 0.2 watts per square foot of lighting may remain on during occupied hours only for emergency egress. This lighting must be designated for emergency egress on building plans.

When controls are required to shut off all lighting in a building, this includes emergency egress lighting.
SEPARATELY CONTROLLED LIGHTING SYSTEMS

General lighting must be controlled separately from all other lighting systems in an area.

Display lighting must each be separately controlled on circuits of 20 amps or less. For example, window displays must be controlled separately from wall displays, which must also be controlled separately from case displays.

When using track lighting:
General, display, ornamental, and special effects lighting must be separately controlled.
PUBLIC RESTROOMS

Any public restroom with two or more stalls may use a manual switch that is not accessible to unauthorized personnel. All other lighting controls are still required.
For some **mixed-use buildings**, (e.g. high-rise residential, hotels, and motels) the common areas must comply with the [Nonresidential](#) Lighting Standards, while dwelling units must comply with the [Residential](#) Lighting Standards.
MULTI-LEVEL LIGHTING CONTROLS

Title 24 sets a minimum number of control steps and illuminance uniformity requirement for most major luminaire types in TABLE 130.1-A. These requirements are required in addition to any manual, daylight, shut-off or demand response controls.

These criteria apply only to general lighting for enclosed areas that:

• Are at least 100 square feet in size
• Have a connected lighting load over 0.5 watts per square foot
• Has more than one luminaire or more than two lamps
Each luminaire must meet every step of the multi-level control requirement. Controlling alternating luminaires or rows of luminaires does not meet this requirement.
### TABLE 130.1-A

**TABLE 130.1-A: MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS**

<table>
<thead>
<tr>
<th>LUMINAIRE TYPE</th>
<th>MINIMUM REQUIRED CONTROL STEPS (% of full rated power)</th>
<th>UNIFORM LEVEL OF ILLUMINANCE ACHIEVED BY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line-voltage sockets except GU-24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-voltage incandescent systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED luminaires &amp; LED source systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GU-24 rated for LED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GU-24 sockets rated for fluorescent &gt; 20W</td>
<td>Continuous dimming 10–100%</td>
<td></td>
</tr>
<tr>
<td>Pin-based compact fluorescent &gt; 20W²</td>
<td>Continuous dimming 20–100%</td>
<td></td>
</tr>
<tr>
<td>GU-24 sockets rated for fluorescent ≤ 20W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pin-based compact fluorescent ≤ 20W²</td>
<td>Minimum one step between 30–70%</td>
<td>Stepped dimming; or continuous dimming; or switching alternate lamps in a luminaire.</td>
</tr>
<tr>
<td>Linear &amp; U-bent fluorescent ≤ 13W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear &amp; U-bent fluorescent &gt; 13W</td>
<td>Minimum one step in each range:</td>
<td>Stepped dimming; or continuous dimming; or switching alternate lamps in each luminaire, having a minimum of four lamps per luminaire, illuminating the same area and in the same manner.</td>
</tr>
<tr>
<td></td>
<td>20–40% 50–70% 80–85% 100%</td>
<td></td>
</tr>
<tr>
<td>Track Lighting</td>
<td>Minimum one step between 30–70%</td>
<td>Stepped dimming; or continuous dimming; or separately switching circuits in a multi-circuit track with a minimum of two circuits.</td>
</tr>
<tr>
<td>HID &gt; 20W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induction &gt; 25W</td>
<td>Minimum one step between 50–70%</td>
<td>Stepped dimming; or continuous dimming; or switching alternate lamps in each luminaire, having a minimum of two lamps per luminaire, illuminating the same area and in the same manner.</td>
</tr>
<tr>
<td>Other light sources</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor.
2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps.

**NOTE:** Multi-level controls must not override the functionality of other controls required for compliance.
AUTOMATIC SHUT-OFF CONTROLS

Automatic shut-off controls turn off the lights when a space is unoccupied. All lighting must be controlled by one or more of the following:

1. Occupant sensing control
2. Automatic time-switch
3. Building Energy Management System
4. Other control capable of automatically shutting off all lights for vacant periods
AUTOMATIC SHUT-OFF CONTROLS

Space parameters
Each room needs to be separately controlled. A single control may not monitor more than 5,000 square feet of floor area (20,000 square feet in malls and single-tenant retail spaces).

Applications
The following types of lighting must be separately controlled:
1. General
2. Display
3. Ornamental
4. Display case
AUTOMATIC SHUT-OFF CONTROLS

Countdown timer switches are usable only in:
1. Single-stall bathrooms smaller than 70 square feet
2. Closets smaller than 70 square feet
3. Lighting in severe rooms smaller than 500 square feet

If time-based controls are used, occupants there after hours must be able to activate lighting as needed:
- Manual switch
- Temporary override
- Occupancy-based control
AUTOMATIC SHUT-OFF CONTROLS

Adaptive controls in secondary spaces

Controls for lighting in the following spaces must be capable of partially reducing lighting power during hours of operation in addition to providing full shut-off functionality when the building is vacant.
AUTOMATIC SHUT-OFF CONTROLS

Warehouse aisles and open areas

1. Each aisle must be independently controlled
2. Minimum automatic 50% reduction in lighting power when vacant
AUTOMATIC SHUT-OFF CONTROLS

Corridors and stairwells

1. Sensors/controls should be activated from all potential entrances
2. Minimum automatic 50% reduction in lighting power when vacant
AUTOMATIC SHUT-OFF CONTROLS

Spaces that are exempt from automatic shut-off controls requirements:

1. Buildings with lighting in continuous use 24 hours per day, 365 days per year
2. Areas where partial on/off controls are required instead of shut-off controls (ex: stairwells and corridors)
3. Electrical equipment rooms
4. Emergency egress lighting
AUTOMATIC DAYLIGHTING CONTROLS

Automatic daylight controls adjust electric lighting power when daylight is available.

**Automatic daylighting controls are required for luminaires that:**

1. Provide general lighting
2. Are at least half in a skylit or sidelit area
3. Are in an area where the total installed general lighting power exceeds 120 watts
4. Are located in an area which has more than 24 square feet of glazing
AUTOMATIC DAYLIGHTING CONTROLS

Automatic daylighting controls requirements:

1. If the controlled lighting has a lighting power density greater than 0.3 watts per square foot, controls must provide multi-level lighting in accordance with Table 130.1-A.

2. The combined illuminance from the controlled lighting and daylight must be at least as much as would be provided by the controlled lighting when no daylight is present.

3. When the light received from daylight is more than 150% of the design illuminance of the general lighting system at full power, the general lighting power in that space must be reduced by at least 65%.
When the demand for electricity threatens to exceed supply, the power grid becomes less stable and the risk of outages increases.

Demand response (DR) programs allow end users to temporarily reduce their electricity use in response to a notice or automated signal sent from a utility, independent system operator (ISOs) or other power provider.

This flexibility in what time power is consumed helps reduce peak demand and maintain grid stability. Currently, participating customers also receive financial incentives.
How DR Works

In traditional, non-automated DR programs, a local service provider sends notification of a pending DR event to facility managers, via e-mail, phone call or text message, requesting a reduction in electricity consumption for a limited period of time.

Automated demand response (ADR) programs make use of energy management technologies and controls to respond to DR events quickly. The provider issues an automated DR signal to energy management control systems enrolled in ADR programs. The systems then automatically respond by reducing electricity use according to pre-programmed load shed strategies.
DEMAND RESPONSE

Lighting is extremely well-suited to DR

1. Peak demand periods typically coincide with daylight hours (noon to 5 p.m., particularly during summer months)
2. Research indicates illuminance levels can be reduced by as much as 20% without impacting end-user comfort.
3. Light levels can be immediately restored when DR events end

Buildings larger than 10,000 square feet must be capable of responding to a DR signal by reducing building lighting power at least 15% while maintaining the uniformity requirements of Table 130.1-A.

Spaces that use less than 0.5 watts per square foot and non-habitable spaces, such as storage closets, are exempt from demand response requirements and cannot be counted towards compliance.
SUMMARY OF MANDATORY LIGHTING CONTROLS

DISCUSSION: What types of controls will retail spaces typically require?

1. Manual switches (what needs to be switched separately?)
2. Automatic shut-off controls (where are they required?)
3. Automatic daylighting controls (which lighting systems must comply?)
4. Demand responsive controls (how large does a building need to be?)
CHECK YOUR UNDERSTANDING: DEMAND RESPONSE

An 18,000 square foot building is being constructed that will contain ten retail tenant spaces that are 1,000 square feet each. Do these tenant spaces need to comply with demand response signals?