

## SECTION 260923 - LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

#### 1. SUMMARY

##### A. Section Includes:

1. Outdoor, wireless photoelectric switches, solid state.
2. Outdoor, wireless smart-control sensors, flexible mounting.
3. Daylight-harvesting dimming controls.
4. Indoor occupancy and vacancy sensors.
5. Digital wall control stations.
6. Extreme-temperature, wireless occupancy sensors.
7. Outdoor motion sensors.
8. Lighting contactors.
9. Emergency shunt relay.
10. Conductors and cables.

##### B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

#### 2. ACTION SUBMITTALS

##### A. Product Data:

1. Outdoor, wireless photoelectric switches, solid state.
2. Outdoor, wireless smart-control sensors, flexible mounting.
3. Daylight-harvesting dimming controls.
4. Indoor occupancy and vacancy sensors.
5. Digital wall control stations.
6. Extreme-temperature, wireless occupancy sensors.
7. Outdoor motion sensors.
8. Lighting contactors.
9. Emergency shunt relay.
10. Conductors and cables.

- B. Shop Drawings:
  - 1. Provide installation details for the following:
    - a. Occupancy sensors.
    - b. Vacancy sensors.
  - 2. Interconnection diagrams indicating field-installed wiring.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Field quality-control reports.

### 3. INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's warranties.

### 4. WARRANTY

- A. Special Extended Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of lighting control software.
    - b. Faulty operation of lighting control devices.
    - c. **Insert failure modes.**
  - 2. Extended Warranty Period: **Insert number** year(s) from date of shipment.

## PART 2 - PRODUCTS

### 1. OUTDOOR, WIRELESS PHOTOELECTRIC SWITCHES, SOLID STATE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; rSBOR or comparable product by one of the following:
  - 1. Cooper Industries, Inc.
  - 2. Leviton Manufacturing Co., Inc.
  - 3. **Insert manufacturer's name.**

- B. Description: Solid state, with SPST dry contacts rated for **Specify Dry Contact Ratings**, to operate connected load, complying with UL 773, and compatible with CFL and LED lamps.
1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
  2. Light-Level Monitoring Range: 0.1.5 to 200 fc (1 to 2152 lx), with an adjustment for turn-on and turn-off levels within that range.
  3. Time Delay: Thirty-second minimum, to prevent false operation.
  4. Lightning Arrester: Air-gap type.
  5. Mounting: Directly to a 1/2 inch (16 mm) knockout.
  6. Failure Mode: Luminaire stays ON.

## 2. OUTDOOR, WIRELESS SMART-CONTROL SENSORS, FLEXIBLE MOUNTING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; rSBOR series or comparable product by one of the following:
1. Cooper Industries, Inc.
  2. Leviton Manufacturing Co., Inc.
  3. **Insert manufacturer's name.**
- B. Description: Digital sensor capable of motion- and daylight-based switching and dimming control of connected load complying with UL 916, UL 924, and compatible with CFL and LED lamps.
- C. General Requirements:
1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
  2. Capable of group control when paired with compatible devices in wireless network.
  3. Operating Voltage: Specify Voltage V(ac).
  4. Operating Temperature: Minus 40 to plus 149 deg F (Minus 40 to plus 65 deg C).
  5. Ingress Protection: IP66.
  6. Mounting: Direct to 1/2 inch (16 mm) knockout.

D. Features:

1. Mounting Height: **Specify Height.**
2. Motion Sensing Range: 360-degree field of view with a coverage area equal to[ twice] mounting height.
3. Motion Sensing Technology: PIR tuned for walking motion.
4. Light-Level Monitoring Range: 0.1 to 200 fc (1 to 2152 lx), with an adjustment for turn-on and turn-off levels within that range.
5. Wireless Communication:
  - a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
  - b. Security: AES-128 bit.
6. Power Monitoring: Output current monitoring with 3 percent accuracy and calculates power usage.

3. DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, lights are dimmed.

1. Lighting control set point is based on the following two lighting conditions:
  - a. When no daylight is present (target level).
  - b. When significant daylight is present.
2. System programming is done with integral push button or dedicated software package.

B. Wireless Ceiling-Mounted Dimming Controls:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; Model rCMS or comparable product by one of the following:
  - a. Cooper Industries, Inc.
  - b. Leviton Manufacturing Co., Inc.
  - c. **Insert manufacturer's name.**
2. Description: Solid-state, low-voltage, battery-powered, light-level sensor unit, with separate power pack mounted on luminaire, that detects changes in indoor lighting levels that are perceived by the eye, suitable for ceiling or surface mounting.
3. Operating Temperature: Specify Operating Temperature.
4. Maximum Humidity: 90 percent, non-condensing.
5. Sensor Output: Digital signal compatible with power pack.
6. Sensor Type: Closed loop.
7. Zone: Specify type.
8. Wireless Communication:
  - a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
  - b. Security: AES-128 bit.



C. Wireless Knockout-Mounted Dimming Controls:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; rLSXR series with automatic dimming or comparable product by one of the following:
  - a. Cooper Industries, Inc.
  - b. Leviton Manufacturing Co., Inc.
  - c. **Insert manufacturer's name.**
2. Description: Solid-state, low-voltage, light-level sensor unit, with separate power pack mounted on luminaire, that detects changes in indoor lighting levels that are perceived by the eye, suitable for mounting on luminaire or on any standard 1/2-inch (6-mm) knockout.
3. Operating Temperature: Specify Operating Temperature.
4. Maximum Humidity: 90 percent, non-condensing.
5. Sensor Output: Digital signal compatible with power pack.
6. Sensor Type: Closed loop.
7. Zone: Specify type.
8. Wireless Communication:
  - a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
  - b. Security: AES-128 bit.

D. Wireless, Battery-Powered, Ceiling-Mounted Dimming Controls:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; Model rCMSB or comparable product by one of the following:
  - a. Cooper Industries, Inc.
  - b. Leviton Manufacturing Co., Inc.
  - c. **Insert manufacturer's name.**
2. Solid-state, wireless, battery-powered, light-level sensor unit that detects changes in indoor lighting levels that are perceived by the eye, suitable for surface mounting.
3. Sensor Output: Wireless, digital signal compatible with power pack and other compatible sensors.
4. Power Source: Three replaceable, type AA lithium batteries.
5. Operating Temperature: Minus 40 to plus 140 deg F (Minus 40 to plus 60 deg C).
6. Wireless Communication:
  - a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
  - b. Security: AES-128 bit.

E. Power Pack:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; rPP20 D series or comparable product by sensor manufacturer.
2. Dry contacts Rating: **Specify Voltage** V(ac), 16 A tungsten, standard ballast electronic ballast and 1/2 hp at 120 V(ac) with integrated overcurrent protection for load side faults.
3. Relay Type: Latching.
4. Dimming Control Output: 100 mA, zero to 10 V(dc).
5. Compatible with digital addressable lighting interface.
6. Plenum rated.
7. Class 2 Power Supply: 15 V(dc), 40 mA power source for sensors.
8. Operating Temperature: **Specify Operating Temperature**.
9. Maximum Humidity: 90 percent, non-condensing.
10. Wireless Communication:
  - a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
  - b. Security: AES-128 bit.

#### 4. INDOOR OCCUPANCY AND VACANCY SENSORS

A. General Requirements for Sensors:

1. **Specify Mounting**-mounted, solid-state indoor **Specify Operating Mode** sensors.
2. **Specify Sensing Technology** technology.
3. Separate power pack.
4. **Specify wired vs wireless** connection to switch **Specify Network Requirements**.
5. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
6. Operation:
  - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - c. Combination Sensor: Unless otherwise indicated, sensor must be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
7. Sensor Output: Sensor is powered from the power pack.

8. Mounting:
    - a. Sensor: Suitable for mounting in any position in a standard device box or outlet box.
    - b. Relay: Externally mounted through a 1/2 inch (13 mm) knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  9. Bypass Switch: Override the "on" function in case of sensor failure.
  10. Automatic Light-Level Sensor: Adjustable from 0.1 to 200 fc (1 to 2152 lx); turn lights off when selected lighting level is present.
  11. Maximum Humidity: 90 percent, non-condensing.
- B. PIR Type, Wireless, Battery Powered, Ceiling Mounted: Detect occupants in coverage area by their heat and movement.
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; Model rCMSB series or comparable product by one of the following:
    - a. Cooper Industries, Inc.
    - b. Leviton Manufacturing Co., Inc.
    - c. **Insert manufacturer's name.**
  2. Detector Sensitivity: Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch (23 200 sq. mm).
  3. Detection Coverage (Low Mount): Detect occupancy anywhere within a circular area of 700 sq. ft. (65 sq. m) when mounted on a 108 inch (2740 mm) high ceiling.
  4. Sensor Output: Wireless, digital signal compatible with power pack and other compatible sensors.
  5. Power Source: Three replaceable, type AA lithium batteries.
  6. Operating Temperature: Minus 40 to plus 140 deg F (Minus 40 to plus 60 deg C).
- C. Dual-Technology Type, Wireless, Battery Powered, Ceiling Mounted: Detect occupants in coverage area using PIR and microphonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; Model rCMSB series with microphonics series or comparable product by one of the following:
    - a. Cooper Industries, Inc.
    - b. Leviton Manufacturing Co., Inc.
    - c. **Insert manufacturer's name.**
  2. Detector Sensitivity: Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch (23 200 sq. mm).



3. Detection Coverage (Low Mount): Detect occupancy anywhere within a circular area of 700 sq. ft. (65 sq. m) when mounted on a 108 inch (2740 mm) high ceiling.
  4. Sensor Output: Wireless, digital signal compatible with power pack and other compatible sensors.
  5. Power Source: Three replaceable, type AA lithium batteries.
  6. Operating Temperature: Minus 40 to plus 140 deg F (Minus 40 to plus 60 deg C).
- D. Power Pack:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; rPP20 series or comparable product by sensor manufacturer.
  2. Dry contacts Rating: **Specify Voltage** V(ac), 16 A tungsten, standard ballast electronic ballast and 1/2 hp at 120 V(ac) with integrated overcurrent protection for load side faults.
  3. LED status lights to indicate load status.
  4. Plenum rated.
  5. Relay Type: Latching.
  6. Class 2 Power Supply: 15 V(dc), 40 mA power source for sensors.
  7. Operating Temperature: **Specify Operating Temperature**.
  8. Maximum Humidity: 90 percent, non-condensing.
  9. Wireless Communication:
    - a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
    - b. Security: AES-128 bit.

## 5. DIGITAL WALL CONTROL STATIONS

- A. Description: Manual controls for on/off, dimming and lighting scene selection compatible with Occupancy and Photosensor control power packs allowing user override of indoor electrical lighting levels.
- B. Wireless, Line Voltage Wall Controls:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; Model rPODLA or comparable product by one of the following:
    - a. Cooper Industries, Inc.
    - b. Leviton Manufacturing Co., Inc.
    - c. **Insert manufacturer's name**.
  2. Switch Configuration: Single pole.
  3. Operating Temperature: 32 to 140 deg F (Zero to 60 deg C).
  4. Supply Voltage: **Specify Voltage** V(ac).
  5. Maximum Humidity: 75 percent, non-condensing.



6. Switch Output: Wireless, digital signal compatible with power pack.
  7. Wireless Communication:
    - a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
    - b. Security: AES-128 bit.
  8. Color: **Enter switch color.**
- C. Wireless, Battery-Powered Wall Controls:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; Model rPODBA or comparable product by one of the following:
    - a. Cooper Industries, Inc.
    - b. Leviton Manufacturing Co., Inc.
    - c. **Insert manufacturer's name.**
  2. Switch Configuration: **Specify config.**
  3. Operating Temperature: Minus 40 to plus 140 deg F (Minus 40 to plus 60 deg C).
  4. Battery Type: Three, AAA lithium.
  5. Expected Battery Life: Ten years.
  6. Maximum Humidity: 75 percent, non-condensing.
  7. Switch Output: Wireless, digital signal compatible with power pack.
  8. Wireless Communication:
    - a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
    - b. Security: AES-128 bit.
  9. Color: **Enter switch color.**

## 6. EXTREME-TEMPERATURE, WIRELESS OCCUPANCY SENSORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; rSBOR or comparable product by one of the following:
1. Cooper Industries, Inc.
  2. Sensor Switch, Inc.
  3. **Insert manufacturer's name.**
- B. Description: Solid-state, extreme-temperature, wireless occupancy sensors.
1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended application in damp locations.
  2. Operation: Turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
  3. Operating Voltage: Specify Voltage V(ac).

4. Integral dry contacts rated for 800 W at 120 V(ac), 1200 W at 277 V(ac), 1000 W at 208 V(ac), 1500 W at 347 V(ac), 1200 W at 240 V(ac), and 2160 W at 480 V(ac) or 1/4 HP.
  5. Operating Temperature: Minus 40 to plus 149 deg F (Minus 40 to plus 65 deg C).
  6. Mounting: Direct to 1/2 inch (16 mm) knockout.
  7. Wireless Communication:
    - a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
    - b. Security: AES-128 bit.
- C. Detector Technology: PIR. Ceiling mounted; detect occupants in coverage area by their heat and movement.
1. Detector Sensitivity: Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch (23 200 sq. mm).
  2. Detection Coverage: Detect occupancy anywhere in a circular area 60 ft. (18.2 m) in diameter when mounted 10 ft. (3 m) high.

## 7. OUTDOOR MOTION SENSORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; rSBOR or comparable product by one of the following:
1. Cooper Industries, Inc.
  2. Leviton Manufacturing Co., Inc.
  3. **Insert manufacturer's name.**
- B. Description: Solid-state outdoor motion sensors.
1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application, and must comply with California Title 24.
  2. PIR type, weatherproof. Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch (23 200 sq. mm). Comply with UL 773A.
  3. Switch Rating: **Specify Rating** or 1/4 hp.
  4. Detector Coverage:
    - a. Mounting Height: **Specify Height.**
    - b. Standard Range: 270-degree field of view, with a minimum coverage area of 314 sq. ft. (21 sq. m).
  5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 0.1 to 200 fc (1 to 2150 lx). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.

6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
9. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as "raintight" in accordance with UL 773A.

## 8. LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. ABB, Electrification Business.
  2. Eaton.
  3. Square D; Schneider Electric USA.
  4. **Insert manufacturer's name.**
- B. Description: Electrically operated and **Specify Operation** held, combination-type lighting contactors with **Specify Connection**, complying with NEMA ICS 2 and UL 508.
  1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
  2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  3. Enclosure: Comply with NEMA 250.
  4. Provide with control and pilot devices as **Specify Specification**, matching the NEMA type specified for the enclosure.
- C. Interface with DDC System for HVAC: Provide hardware interface to enable the DDC system for HVAC to monitor and control lighting contactors.
  1. Monitoring: On-off status, **Insert monitoring point.**
  2. Control: On-off operation, **Insert control point.**

## 9. EMERGENCY SHUNT RELAY

- A. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; PP16 SHUNT or comparable product by one of the following:
  1. Lighting Control and Design.
  2. WattStopper; Legrand North America, LLC.
  3. **Insert manufacturer's name.**



- B. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
  - 1. Input Rating: 120 to 277 V.
  - 2. Output Rating: 277 V(ac), 50/60 Hz, 16 A tungsten, standard ballast, electronic ballast, or general purpose; 120 V(ac), 50/60 Hz, 1/2 HP motor load.
  - 3. Mounting: 1/2-inch (12-mm) knockout on box or fixture.

## 10. CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than Specify Wire gauge AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than Specify Wire gauge AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

## PART 3 - EXECUTION

### 1. EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 2. INSTALLATION OF SENSORS

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's instructions.

### 3. INSTALLATION OF CONTACTORS

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

### 4. INSTALLATION OF WIRING

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's instructions.
- C. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

### 5. IDENTIFICATION

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

### 6. FIELD QUALITY CONTROL

- A. Field tests must be witnessed by Specify witnesses.
- B. Tests and Inspections:
  - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- A. Nonconforming Work:
  - 1. Lighting control devices will be considered defective if they do not pass tests and inspections.
  - 2. Remove and replace defective units and retest.
- B. Prepare test and inspection reports.
- C. Manufacturer Services:
  - 1. Engage factory-authorized service representative to Specify representative's role field tests and inspections.

## 7. ADJUSTING

- A. Occupancy Adjustments: When requested within **Insert number** months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to **Insert number** visits to Project during other-than-normal occupancy hours for this purpose.
  - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
  - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
  - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

## 8. MAINTENANCE

- A. Software and Firmware Service Agreement:
  - 1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement include software support for **Insert number** years.
  - 2. Upgrade Service: At Substantial Completion, update software and firmware to latest version. Install and program software upgrades that become available within **Insert number** years from date of Substantial Completion. Verify upgrading software includes operating system and new or revised licenses for using software.
    - a. Upgrade Notice: No fewer than **Insert number** days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.
  - 3. Upgrade Reports: Prepare written report after each update, documenting upgrades installed.

END OF SECTION 260923