

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1. SUMMARY

A. Section Includes:

1. Electronic dial-time switches.
2. Outdoor photoelectric switches, solid state, flexible mounting.
3. Daylight-harvesting dimming controls.
4. Indoor occupancy and vacancy sensors.
5. Switchbox-mounted occupancy sensors.
6. Digital wall control stations.
7. Extreme-temperature occupancy 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. Electronic dial-time switches.
2. Outdoor photoelectric switches, solid state, flexible mounting.
3. Daylight-harvesting dimming controls.
4. Indoor occupancy and vacancy sensors.
5. Switchbox-mounted occupancy sensors.
6. Digital wall control stations.
7. Extreme-temperature occupancy 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. ELECTRONIC TIME SWITCHES

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

- B. Electronic Time Switches: Solid state, programmable, with full-color, graphic display; complying with UL 917, which operates designated loads through compatible remote power pack.
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. Contact Configuration: SPST.
 3. Contact Type: Latching.
 4. Dimming Control Output: Zero to 10 V(dc)
 5. Programming:
 - a. 3.5-inch (900-mm), full-color, capacitive touch screen interface with proximity sensor for auto "wake-up."
 - b. Automatic and configurable adjustment for daylight saving.
 - c. Minimum 32 normal and holiday schedules programmable to occur on selected weekday(s) or within a selected date range.
 - d. Password-protected configuration.
 6. Circuitry: Allow connection of a compatible photoelectric relay as substitute for on-off function of a program **on selected channels**.
 7. Astronomic Time: **which channels** channels.
 8. Automatic daylight savings time changeover.
 9. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.
- C. Power Pack:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPP16 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.

2. OUTDOOR PHOTOELECTRIC SWITCHES, SOLID STATE, FLEXIBLE MOUNTING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nLO PC 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, low-voltage photocontrol that operates designated loads through compatible remote power pack.
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. Time Delay: Fifteen-second minimum, to prevent false operation.
 3. Surge Protection: Metal-oxide varistor.
 4. Mounting: Stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure **from same source and manufacturer as switch**.
 5. Failure Mode: Luminaire stays ON.
- C. Power Pack:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPP16 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.

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. Ceiling-Mounted Dimming Controls:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; Model nCM ADCX RJB or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. **Insert manufacturer's name**.

1. 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 ceiling or surface mounting.
 2. Operating Temperature: **Specify Operating Temperature**.
 3. Maximum Humidity: 90 percent, non-condensing.
 4. Sensor Output: Digital signal compatible with power pack.
 5. Sensor Type: Closed loop.
 6. Zone: **Specify type**.
- C. Recessed-Mounted Switching Controls:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nRM 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, light-level, low-voltage sensor unit, with separate power pack **mounted on luminaire**, that detects changes in indoor lighting levels that are perceived by the eye, suitable for recessed mounting within a standard junction box.
 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: **Specify Control**.
 7. Zone: **Specify type**.
- D. Power Pack:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPP16 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.

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.
9. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
10. Bypass Switch: Override the "on" function in case of sensor failure.
11. Automatic Light-Level Sensor: Adjustable from 0.1 to 200 fc (1 to 2152 lx); turn lights off when selected lighting level is present.
12. 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 (Standard Range): Detect occupancy anywhere in a circular area of 450 sq. ft. (41 sq. m) when mounted on a 108 inch (2740 mm) high ceiling.
 4. Detection Coverage (Extended Range): Detect occupancy anywhere in a circular area of 1800 sq. ft. (165 sq. m) when mounted on a 108 inch (2740 mm) high ceiling.
 5. Operating Temperature: **Specify Operating Temperature.**
- C. PIR Type, Wall 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.; nWV 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: Detect occupancy anywhere within a 120-degree pattern centered on the sensor over an area of 1600 sq. ft. (150 sq. m) when mounted 96 to 120 inch (2440 to 3000 mm) above finished floor.
 4. Operating Temperature: **Specify Operating Temperature.**
- D. Dual-Technology Type, Recessed 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.; nRM series with microphonics or comparable product by one of the following:
 - i. Cooper Industries, Inc.
 - ii. Leviton Manufacturing Co., Inc.
 - iii. **Insert manufacturer's name.**
 2. Sensitivity Adjustment: Separate for each sensing technology.
 3. 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), and detect a person of average size and weight moving not less than 12 inch (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inch/s (305 mm/s).

4. Detection Coverage (Standard Range): Detect occupancy anywhere within a circular area of 450 sq. ft. (41 sq. m) when mounted on a 108 inch (2740 mm) high ceiling.
 5. Detection Coverage (Extended Range): Detect occupancy anywhere within a circular area of 1800 sq. ft. (165 sq. m) when mounted on a 108 inch (2740 mm) high ceiling.
 6. Operating Temperature: **Specify Operating Temperature.**
 7. Maximum Humidity: 90 percent, non-condensing.
- E. Dual-Technology Type, Wall 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.
- a. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nWV series with microphonics or comparable product by one of the following:
 - i. Cooper Industries, Inc.
 - ii. Leviton Manufacturing Co., Inc.
 - iii. **Insert manufacturer's name.**
 - b. Sensitivity Adjustment: Separate for each sensing technology.
 - c. 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), and detect a person of average size and weight moving not less than 12 inch (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inch/s (305 mm/s).
 - d. Detection Coverage: Detect occupancy anywhere within a 120-degree pattern centered on the sensor over an area of 1600 sq. ft. (150 sq. m) when mounted 96 to 120 inch (2440 to 3000 mm) above finished floor.
 - e. Operating Temperature: **Specify Operating Temperature.**
 - f. Maximum Humidity: 90 percent, non-condensing.
- F. 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. SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nWSXA series or comparable product by one of the following:
 - 1. Cooper Industries, Inc.
 - 2. Sensor Switch, Inc.
 - 3. **Insert manufacturer's name.**
- B. General Requirements for Sensors: Low-voltage, automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired low-voltage connection.
 - 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. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 3. Operating Ambient Conditions: Dry interior conditions, 32 to 140 deg F (0 to 60 deg C).
 - 4. Separate power pack.
 - 5. Programmable "off" time-delay selector at up to 30 minutes.
 - 6. Field Adjustable Control Mode:
 - a. Auto On / Auto Off (Fully Automatic).
 - b. Manual On (initial state) to Override On (with expiration timer).
 - c. Auto On (initial state) to Override On (with expiration timer).
 - d. Manual On / Automatic Off (Semi-Automatic).
 - e. Manual On (initial state) to Fully Automatic.
 - f. Predictive Off Switch (returns zone to auto-on unless person remained in room after an off switch press).
 - 7. Maximum Humidity: 90 percent, non-condensing.
- C. Wall-Switch Sensor Tag WS1:
 - 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2025 sq. ft. (188 sq. m).
 - 2. Sensing Technology: **Specify Sensing Tech.**
 - 3. Switch Type: **Specify Switch Type.**
 - 4. Capable of controlling load in three-way application.
 - 5. Input Voltage: **Specify Voltage** V(ac).

6. Output Rating: Specify Output tungsten, standard ballast, electronic ballast or 1/2 hp.
7. Low-Voltage Output Rating: 0 to 10 V(dc), 50 mA.
8. Ambient-Light Override: Programmable, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lx). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
9. Operating Temperature: **Specify Operating Temperature.**
10. Color: **Enter switch color.**
11. Faceplate: Color matched to switch.

D. Wall-Switch Sensor Tag WS2:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft. (196 sq. m).
2. Sensing Technology: Dual technology - PIR and microphonic.
3. Switch Type: **Specify Switch Type.**
4. Capable of controlling load in three-way application.
5. Voltage: 15 to 24 V(dc), 3 mA, Class 2.
6. Ambient-Light Override: Programmable, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lx). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Operating Temperature: **Specify Operating Temperature.**
8. Color: **Enter switch color.**
9. Faceplate: Color matched to switch.

E. Power Pack:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; **Specify type** 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: **Enter switch color.**
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.

8. 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. Wired, Digital Wall Controls:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; Model nPODMA 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: **Specify Operating Temperature.**
 - 4. Maximum Humidity: 90 percent, non-condensing.
 - 5. Switch Output: Digital signal compatible with power pack.
 - 6. Wiring: Two RJ-45 ports for Category 5e, UTP wiring to power pack.
 - 7. Color: **Enter switch color.**

9. EXTREME-TEMPERATURE OCCUPANCY SENSORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nCM LT or comparable product by one of the following:
 - 1. Cooper Industries, Inc.
 - 2. Sensor Switch, Inc.
 - 3. **Insert manufacturer's name.**
- B. Description: Ceiling-mounted, solid-state, extreme-temperature occupancy sensors with a separate power pack.
 - 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 Ambient Conditions: From minus 4 to plus 140 deg F (minus 20 to plus 60 deg C).

1. Sensor Output: Specify Signal.
 2. Mounting: Single-Gang or Octagonal Box, Surface Mount.
 3. Automatic Light-Level Sensor: Adjustable from 0.1 to 200 fc (1 to 2150 lx); keep lighting off when selected lighting level is present.
- 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 (Room): Detect occupancy anywhere in a circular area of 700 sq. ft. (65 sq. m) when mounted on a 108 inch (2740 mm) high ceiling.
 3. Detection Coverage (High Bay): Detect occupancy within 30 ft. (9.1 m) when mounted on a 45 ft. (13.7 m) high ceiling.
- D. Power Pack:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPP16 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: Minus 4 to plus 122 deg F (Minus 20 to plus 50 deg C).
 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.

8. LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. ABB, Electrification Business.
 - b. Eaton.
 - c. Square D; Schneider Electric USA.
 - d. **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**.

18. 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.

18. 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.

- A. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.
- B. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

5. INSTALLATION OF WIRING

- 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.
- C. 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.
- D. Prepare test and inspection reports.
- E. 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

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