

## **SECTION 26 09 23**

### **LIGHTING CONTROL DEVICES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS:**

- A. The Conditions of the Contract and applicable requirements of Divisions 0 and 1 and Section 26 00 01, "Electrical General Provisions", govern this Section.

##### **1.2 DESCRIPTION OF WORK:**

- A. Work Included: The extent of occupancy sensor lighting control system work is as shown and scheduled, as indicated by the requirements of this Section, and as specified elsewhere in these Specifications.
- B. Types: The types of occupancy sensor lighting control systems required for the project include, but are not necessarily limited to the following:
  - 1. Ceiling-mounted infrared/ultrasonic sensors with relay control packs.
  - 2. All occupancy sensor lighting controls shall include auxiliary contacts to provide indication of room occupancy status to the BAS.
  - 3. Wall sensors are not allowed.

##### **1.3 QUALITY ASSURANCE:**

- A. Manufacturers: Provide products complying with these specifications and produced by one of the following:
  - 1. Hubbell.
  - 2. Sensor Switch.
  - 3. The Watt Stopper, Inc.
  - 4. Lutron.
- B. NEMA Standards: Sensors, components and installation shall comply with NEMA Guide Publication WD7-2000 – Occupancy Motion Sensors.
- C. UL Label: All lighting control system products shall be UL-labeled, individually and as a system for the specific applications utilized on this project.

##### **1.4 SUBMITTALS:**

- A. Shop Drawing submittals shall include, but not be limited to, the following:
  - 1. Submit manufacturer's product data on all occupancy sensor lighting control system components and accessories.
  - 2. Reflected ceiling plan drawings showing specific locations of occupancy sensors for lighting control, including lines delineating sensor effective range, with and without furniture system partitions, sensor type, sensor mounting and other pertinent data to allow evaluation of the proposed system.
  - 3. Wiring diagrams for occupancy sensors, related control units and override switches.

4. Additional information as required in Section 26 00 01, "Electrical General Provisions".

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Store occupancy sensor lighting control system components in a clean dry space.
- B. Handle occupancy sensor lighting control system components to avoid damage to components, enclosure, and finish.

**PART 2 - PRODUCTS**

2.1 INFRARED/ULTRASONIC CEILING OCCUPANCY SENSOR LIGHTING CONTROLS:

- A. General: Provide a complete and operable multi-technology, passive infrared and ultra-sonic occupancy sensor lighting control system in areas shown on the Drawings. Ceiling mounted sensors shall be designed to turn room lighting "on" immediately upon sensing a room occupant and to turn room lighting "off" if no room occupant is sensed for the entire period of the sensors off time delay, regardless of the shape of the room.
- B. System Components: Occupancy sensor lighting control shall include, but not be limited to, all required sensors, transformers, interface controls and relays, wiring and bypass switches.
- C. Sensors Requirements:
  - 1. Sensors shall be self-contained, crystal-controlled ultrasonic motion detectors and infrared motion detectors which provide volumetric coverage without gaps in coverage within the controlled areas.
  - 2. Sensors shall have built-in timing and load control driving circuitry. Housings shall be white impact resistant plastic.
  - 3. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction in coverage shall occur when air conditioning or heating fans are operating or if sensor has turned off due to not sensing motion.
  - 4. All sensors shall have easily accessible, user-adjustable controls for adjusting sensitivity of a sensor to its controlled area, and for adjusting "time to light off" delay. Time delay shall be made settable down to 5 minutes. Sensors must also include a time delay adjustment of one minute or less for sensor operation testing. Adjustment controls shall be recessed in order to limit tampering.
  - 5. An internal bypass "manual-on" switch shall be provided for each sensor for use in the event of sensor failure. When the bypass switch is activated, lighting shall remain constantly "on" and on/off control shall divert to wall switches until sensor is replaced. Override shall be accomplished without the use of unit specific or special tools. The bypass control shall also be recessed to limit tampering.
  - 6. Sensors operating frequency shall be crystal-controlled to within  $\pm 0.01\%$ , and all ultrasonic transducers must be protected from damage, to provide for long life and consistent and reliable performance.
  - 7. Sensors shall be available with different operating frequencies in order to allow for individual control of adjacent areas, as required.
  - 8. All sensors shall be provided with an indicator light to verify that motion is being detected and that the unit is operating.

9. Sensors shall be able to be wired in parallel to allow coverage of large areas.
  10. All ceiling sensors shall have pigtailed plenum cable connectors for installation in plenum ceiling spaces.
  11. Wall switches shall be provided with an override capability, for use in an emergency or during lamp changes, which shall be provided by a three position switch which allows selection of positive on, off, and automatic operation override switch to avoid excessive overrides to "on" to defeating energy savings.
  12. All ceiling sensors shall be low voltage, have a rugged solid state design, and be designed and manufactured specifically for control of lighting for energy conservation.
  13. All sensors shall be manufactured by the same company and shall be aesthetically compatible, i.e., from the same product line or generation of products.
  14. All ultrasonic sensors shall comply with the State of California Safety and Health Requirements. Decibel levels for ultrasonic sensors shall comply with the following California Energy Commission criteria for ultrasonic emissions. The manufacturer shall certify in writing that installed sensors comply with the specified standards.
  15. Sensors shall be suitable for NEC 725, Class 2 wiring and use plenum cable where approved.
  16. Sensors shall be suitable for use with electronic and energy saving ballasts.
- D. Sensors: Ceiling mounted dual technology occupancy sensors shall be Hubbell OMNI-DT series or an approved equal and shall be provided as noted on the drawings and as required to suit the applications on the project.
- E. Control/Switching Units: Control units shall be an integrated self-contained unit consisting internally of load switching control relay and a transformer to provide low-voltage power to a minimum of two sensors. Control unit relays and features shall be as follows:
1. Relay contacts shall have ratings of:
    - a. 10 amps - 120 volts AC tungsten.
    - b. 20 amps - 120 volts AC ballast.
    - c. 20 amps - 277 volts AC ballast.
  2. All occupancy sensor lighting controls shall include auxiliary contacts to provide indication of room occupancy status to the BAS.
  3. Relay contacts shall be isolated.
  4. Control units shall be UL-listed.
  5. Contactor, where indicated on the Drawings, shall provide control unit auxiliary relay to be interfaced with the Central Dimming and Lighting Control System specified hereinabove. Relay shall have contacts rated for pilot duty at 15 volts dc or 24 volts dc.
  6. Wiring between sensors and control units shall be three conductor, 18 AWG, stranded UL-classified, Teflon-jacketed and plenum-rated.
  7. Enclosures for control units shall be pressed steel, NEMA I construction with mounting and barriers to provide separation between line and low voltage wiring or standard 4" deep junction box with control unit mounting to coverplate with 1/2" KO. Boxes not located above accessible ceilings shall be painted to match finish color of mounting surface.

- F. Control/Switching Units: Control/Switching Units shall be Hubbell MP series or an approved equal and shall be provided as noted on the drawings and as required to suit the applications on the project.

2.2 INFRARED/ULTRASONIC WALL BOX OCCUPANCY SENSOR LIGHTING CONTROLS:

- A. General: Provide a complete and operable multi-technology, passive infrared and ultra-sonic wall box occupancy sensor lighting control system in areas shown on the Drawings. Sensors shall be designed to turn room lighting "on" immediately upon sensing a room occupant and shall turn room lighting "off" if no room occupant is sensed for the entire period of the sensors off time delay, regardless of the shape of the room.
- B. System Components: Occupancy sensor lighting control shall include, but not be limited to, all required sensors, transformers, interface controls and relays, wiring and bypass switches.
- C. Sensors Requirements:
1. Sensors shall be self-contained, crystal-controlled ultrasonic motion detectors and infrared motion detectors which provide volumetric coverage without gaps in coverage within the controlled areas.
  2. Sensors shall have built-in timing and load control driving circuitry. Housings shall be white impact resistant plastic.
  3. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction in coverage shall occur when air conditioning or heating fans are operating.
  4. All sensors shall have easily accessible, user-adjustable controls for adjusting sensitivity of a sensor to its controlled area, and for adjusting "time to light off" delay. Time delay shall be made settable down to 5 minutes. Sensors must also include a time delay adjustment of one minute or less for sensor operation testing. Adjustment controls shall be recessed in order to limit tampering.
  5. An internal bypass "manual-on" switch shall be provided for each sensor for use in the event of sensor failure. When the bypass switch is activated, lighting shall remain constantly "on" and on/off control shall divert to wall switches until sensor is replaced. Override shall be accomplished without the use of unit specific or special tools. The bypass control shall also be recessed to limit tampering.
  6. Sensors shall be filtered to ensure that sensors are insensitive to short wavelength infrared radiation such as that emitted by the sun.
  7. All sensors shall be provided with an indicator light to verify that motion is being detected and that the unit is operating.
  8. No wall sensors.
  9. Wall switch sensors which are "manual on" shall also be equipped with 10 second grace period after the unit turns itself off (due to lack of motion) during which a new motion will automatically turn lights on without the pushbutton having to be pressed, or be provided with an audible warning prior to turning off lights.
  10. Wall switches shall be provided with an override capability, for use in an emergency or during lamp changes, which shall be provided by a three position switch which allows selection of positive on, off, and automatic operation override switch to avoid excessive overrides to "on" to defeating energy savings.

11. All sensors shall be manufactured by the same company and shall be aesthetically compatible, i.e., from the same product line or generation of products.
12. Sensors shall incorporate a Fresnel lens or similar device to allow full range energy collection over the entire "field of view" of the sensor.
13. Sensors shall be suitable for NEC 725, Class 2 wiring and use plenum cable where approved.
14. Sensors shall be suitable for use with electronic and energy saving ballasts.
15. All occupancy sensor lighting controls shall include auxiliary contacts to provide indication of room occupancy status to the BAS.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION OF OCCUPANCY SENSOR LIGHTING CONTROLS:**

- A. General: Install occupancy sensor lighting controls as required and where indicated, in accordance with manufacturer's written instructions and project shop drawings, applicable requirements of NEC, and recognized industry practices to ensure that products serve intended function.
- B. Sensor Design and Layout:
  1. It shall be the equipment manufacturers/contractors' responsibility to provide the quantity of motion sensors required for complete and proper volumetric coverage without gaps within the range of coverage of controlled areas. Rooms shall have 100% volumetric coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room. The locations and quantities of sensors shown on the Drawings are diagrammatic and indicate only rooms which are to be provided with sensors. The equipment manufacturer/ contractor shall provide additional sensors if required to properly and completely cover the respective room. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. Where conflicts occur additional sensor shall be provided.
  2. Exact locations of control unit hardware boxes shall be based on observing good installation practice and shall be coordinated with other elements of the reflected ceiling plan. Control unit hardware shall be fully concealed.
- C. Box Condition: Install low voltage lighting control devices only in electrical boxes which are clean, free from excess building materials, debris, and similar matter.
- D. Wiring:
  1. All branch circuit wiring shall be installed in an approved raceway.
  2. Low voltage wiring shall be installed in an approved raceway where concealed in inaccessible locations or exposed. Where low voltage wiring is concealed in accessible ceiling plenums, it may at the Contractor's option, be routed without a raceway using air plenum rated multi-conductor cable. All control wiring shall be minimum 18 gauge stranded copper.
  3. All low voltage wiring shall be color coded and identified or tagged at terminals to assist with future maintenance.

- E. Sensor Testing and Adjustment: At the time each sensor is installed, it shall be adjusted as follows:
1. Sensitivity shall be adjusted for proper detection of motion appropriate to the usage of the room.
  2. Set time delay at approximately 15 minutes after setting in 30 second test to verify sensor/control unit operation.
  3. Check indicator light of each sensor to verify that motion is being detected in the range desired.
  4. Sensor operating frequencies shall be selected to select interference with other units in the vicinity, as required.
  5. Ensure that there are no obstructions which could block proper sensor coverage, thereby minimizing the sensor detection zone.
  6. Occupancy sensors may be affected by various conditions in the room. It may be necessary for the Contractor to make adjustments, change the location or type of sensor to obtain proper operation in a specific room, or to add additional sensors. The Contractor/equipment manufacturer shall have final responsibility for proper operation and coverage of the system in each room and should therefore make labor allowance for such changes and adjustments. The Contractor is also responsible for acquiring approval from Engineer for any changes or deviations from project specifications.
- F. Bypass Switches: Install line voltage bypass switches in room line voltage wiring for all rooms with ceiling mounted sensors and control/switching units where shown on drawings. Switches shall be series wired with control/switching units to provide positive off control and function as standard on/off switches if the occupancy sensor fails and is bypassed.
- G. Demonstration: Upon completion of testing and adjustment, the Contractor shall demonstrate operation of the system to representatives of the Owner and Engineer.
- H. Training: The Contractors shall instruct the Owner's personnel in proper maintenance, adjustment and operation of the occupancy sensor lighting controls.
- I. Operating and Maintenance Manuals: Complete operating, maintenance, and adjustment instructions and other information necessary for proper operation of the occupancy sensor lighting controls shall be included as part of the project operating and maintenance manuals.
- J. As-built Drawings: Project As-built Drawings shall show the location and wiring configuration of all occupancy sensors and control units.
- K. Warranty: Provide a 5 year parts and one year labor warranty on the ceiling occupancy sensor lighting controls. Warranty coverage shall begin at the time of Project Completion.
- L. Identification: Refer to Section 26 05 53, "Identification for Electrical Systems", for applicable painting, nameplates and labeling requirements.

**END OF SECTION 26 09 23**