Section 26 09 23

Lighting Control Devices

جامعة الملك عبدالله
للعلوم والتقنية
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Science and Technology

KAUST Standards

This standard will serve as specific engineering requirements in the design and construction of all KAUST facilities within KAUST vicinity to address electrical, civil/structural, integrated automation, plumbing, HVAC, fire suppression, electronic safety and security aspects.

The standard is a “live” and on-going document that is to be updated as the need arises. It is governed by KAUST procedure SAP-P-007-2015 and related forms for initiating updates and approving any waiver requests developed by E&PM.

SECTION 26 09 23 – LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
B. All related referenced codes and standards in this section correspond to IBC 2009 Edition.

1.2 SUMMARY

A. This Section includes the following lighting control devices:
   1. Time switches.
   2. Outdoor and indoor photoelectric switches.
   3. Indoor occupancy sensors.
   4. Lighting contactors.
   5. Emergency shunt relays.
B. Related Sections include the following:
   1. Division 26 Section "Architectural Lighting Control System" for low-voltage, manual and programmable lighting control systems.
   2. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.
B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Occupancy Sensors
   1. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.
   2. Submit a floor plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.
   3. Submit any interconnection diagrams per major subsystems showing proper wiring.
   4. Submit standard catalog literature, which includes performance specifications, coverage patterns, and physical dimensions of each unit.
   5. Fixture Compatibility: List of ballasts and lamp combinations compatible with occupancy sensors; by manufacturer and catalog number.
C. Shop Drawings: Show installation details for occupancy and light-level sensors.
D. Field quality-control test reports.
E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 – National Electrical Code - 2014 Edition, Article 100 by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

1.6 COORDINATION

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 system and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Outdoor areas and street lighting fixtures shall be controlled by a photocell or a timer.

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawing or a comparable product by one of the following:
   1. Lutron Electronics Co. Inc.
   2. Intermatic, Inc.
   3. Leviton Mfg. Company Inc.
   4. Lightolier Controls; a Genlyte Company.
   5. Square D; Schneider Electric.
   6. TORK.
   7. Watt Stopper (The).

C. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
   1. Contact Configuration: SPDT
   2. Contact Rating: 20-A ballast load, 220-V ac.
   3. Programs: 8 channels; each channel shall be individually programmable with 40 on-off operations per week, plus 4 seasonal schedules that modify the basic program and an annual holiday schedule that overrides the weekly operation on holidays.
   4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
   5. Astronomic Time: All channels.
   6. Battery Backup: For schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Lutron Electronics Co. Inc.
   2. Intermatic, Inc.
   3. Novitas, Inc.
   4. Square D; Schneider Electric.
   5. TORK.
   6. Watt Stopper (The).

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000- VA inductive to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
   1. Light-Level Monitoring Range: 10000 to 100000 lx, with an adjustment for turn-on and turn-off levels within that range and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
   2. Time Delay: 15-second minimum, to prevent false operation.
   3. Surge Protection: Metal-oxide varistor complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
   4. Mounting: Twist lock complying with IEEE C136.10 with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Lutron Electronics Co. Inc.
   2. Intermatic, Inc.
   3. Novitas, Inc.
   4. Square D; Schneider Electric.
   5. TORK.
   6. Watt Stopper (The).

B. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit with separate relay unit to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
   1. Sensor Output: Contacts rated to operate the associated relay complying with
   2. UL 773A. Sensor shall be powered from the relay unit.
   3. Relay Unit: Dry contacts rated for 20-A ballast load at 220-V ac, Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70 – National Electrical Code - 2014 Edition.
   4. Light-Level Monitoring Range: 108 to 2152 lx, with an adjustment for turn-on and turn-off levels within that range.
   5. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling with dead band adjustment.
   6. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.4 INDOOR OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   1. Lutron Electronics Co. Inc.
   2. Hubbell Lighting.
   3. Leviton Mfg. Company Inc.
   4. Novitas, Inc.
   5. Watt Stopper (The).
   6. Legrand

B. General Description: Wall or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 220-V ac, for 13-tungsten at 220-V ac, and for 1 hp at 220-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70 – National Electrical Code - 2014 Edition.
4. Mounting:
    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 13-mm knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 21.5 to 2152 lx; keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
    1. Detector Sensitivity: Detect occurrences of 150-mm minimum movement of any portion of a human body that presents a target of not less than 232 sq. cm.
    2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 93 sq. m when mounted on a 2440-mm- high ceiling.
    3. Detection Coverage (Corridor): Detect occupancy within 27.4 m when mounted on a 3-m- high ceiling.
D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
    1. Detector Sensitivity: Detect a person of average size and weight moving not less than 305 mm in either a horizontal or a vertical manner at an approximate speed of 305 mm/s.
    2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 56 sq. m when mounted on a 2440-mm high ceiling.
    3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 93 sq. m when mounted on a 2440-mm high ceiling.
    4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 186 sq. m when mounted on a 2440-mm high ceiling.
    5. Detection Coverage (Corridor): Detect occupancy anywhere within 27.4 m when mounted on a 3-m high ceiling in a corridor not wider than 4.3 m.
E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage.

Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 150-mm- minimum movement of any portion of a human body that presents a target of not less than 232 sq. cm, and detect a person of average size and weight moving not less than 305 mm in either a horizontal or a vertical manner at an approximate speed of 305 mm/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 93 sq. m when mounted on a 2440-mm high ceiling.

2.5 **LIGHTING CONTACTORS**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASCO Power Technologies, LP; a division of Emerson Electric Co.
   2. Eaton Electrical Inc.; Cutler-Hammer Products.
   3. GE Industrial Systems; Total Lighting Control.
   4. Square D; Schneider Electric.
   5. TORK.

B. Description: Electrically operated and mechanically held, combination type with non-fused disconnect, 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 total harmonic distortion 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, matching the NEMA type specified for the enclosure.

C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
   1. Monitoring: On-off status.
   2. Control: On-off operation.

2.6 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Lighting Control and Design, Inc.
   2. Wattstopper
   3. Bodine

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
   1. Coil Rating: 220-V.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low- Voltage Electrical Power Conductors and Cables."
C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low- Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. The Electrical Contractor shall provide all conduit, wire, connectors, hardware, and other incidental items necessary for properly functioning lighting control and occupancy sensors as described herein and shown on the plans.
B. It shall be the contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage of controlled areas per the manufacturer's recommendations. Room shall have 90 to 100 percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
C. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative at the Owner's facility to verify placement of sensors and installation criteria.
D. Proper judgement must be exercised in executing the installation 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. The contractor shall also provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.
E. Occupancy sensors shall be set at 12 minutes.

3.2 CONTACTOR INSTALLATION

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.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power
B. Conductors and Cables." Minimum conduit size shall be 13 mm.
C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems".
   1. Identify Controlled circuits in lighting contactors.
   2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Testing
   1. Upon completion of all line, load and interconnection wiring, and after all fixtures are installed and lamped, a qualified factory representative shall completely check the installation prior to energizing the system. Each installed occupancy sensor shall be tested in the test mode to see that lights turn off and on based on occupancy.
   2. At the time of checkout and testing, the Owner's Representative shall be thoroughly instructed in the proper operation of the system.

B. Operational Test: Verify operation of each lighting control device, and adjust time delays.

C. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section " Architectural Lighting Control System."

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division "General Requirements" Section "Demonstration and Training."

END OF SECTION 26 09 23