

READ THIS FIRST

Notice to the Design Engineer, this document is part of Facilities and Infrastructure standards for Electrical Systems. Designers are advised to NOT use this template (*.doc) document as part of any project contract documents. Designers shall use the Port of Seattle MasterSpec specifications from the following link:

<https://www.portseattle.org/page/guide-specifications>.

Designers shall edit the corresponding Port's MasterSpec specification to meet the F&I Electrical Standard outlined in this specification. Note that Port's MasterSpec specifications contain specifications and languages for both Aviation and Maritime Divisions. F&I Standards are strictly for Aviation Division, and any Maritime related specs or languages should be removed from the project specifications.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Time switches.
 - 2. Photoelectric switches.
 - 3. Standalone daylight-harvesting switching controls.
 - 4. Standalone daylight dimming sensors.
 - 5. Indoor occupancy/vacancy sensors.
 - 6. Lighting contactors.
 - 7. Emergency shunt relays.
- B. Lighting controls shall be provided to comply with Washington State Non-residential Energy Code at a minimum. STIA is a 24 hour facility and public spaces are exempt from automatic off controls.
- C. Vacancy sensors are required in all conference rooms with override capability. Such sensors shall be dual technology to decrease the number of false empty-room errors.
- D. Lighting in daylight zones will be dimmed, per WSEC.
- E. Related Requirements:
 - 1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy/vacancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy/vacancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
 - 2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Commissioning plan with test procedures.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Intermatic, Inc.
 - 2. Leviton Manufacturing Co., Inc.
 - 3. NSi Industries LLC; TORK Products.
- B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; programmable from 5 minutes to 24 hours.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 TIME CLOCKS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Intermatic
 - 2. NSi Industries LLC; Tork

3. Paragon
 4. F&I approved equal.
- B. Description: Multi-purpose microprocessor-based digital controller with astronomical settings.
1. Eight Channels
 2. 365-day advance single and block holiday scheduling
 3. Program entries made by mechanical pushbutton and acknowledgement of each entry into the unit.
 4. Remote timed override for each channel.
 5. Automatic daylight saving or standard time.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Intermatic, Inc.
 2. NSi Industries LLC; TORK Products.
 3. Paragon
 4. F&I approved equal.
- B. Description: Solid state, with 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. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: 1-5 fc on, 3-15 fc off, with an adjustment for turn-on and turn-off levels within that range.
 3. Time Delay: Up to two minutes, to prevent false operation.
 4. Surge Protection: Metal-oxide varistor.
 5. Cell: Cadmium Sulfide, epoxy coated.
 6. Contacts: closed between dusk and dawn.
 7. Temperature Range: -40° to 140°.
 8. Manual bypass switch shall be installed in parallel to the photocell. Provide keyed switch where location is accessible to the public.
 9. For outdoor lighting, provide 60 minute timed on override in accessible location unless fog detection or time clock is included in photoelectric controller.
 10. Enclosure: Heavy duty die-cast zinc, gasketed for maximum weather protection.
 11. Mounting: Typically conduit mounted.

2.4 DAYLIGHT-HARVESTING DIMMING CONTROLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Sensor Switch

2. Hubbell Building Automation, Inc.
 3. Leviton Mfg. Company Inc.
 4. Watt Stopper.
 5. Acuity Brands.
- B. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
1. Lighting control set point is based on two lighting conditions:
 - a. When no daylight is present (target level).
 - b. When significant daylight is present.
 2. System programming is done with two hand-held, remote-control tools.
 - a. Initial setup tool.
 - b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.
- C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
 3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70. Capable of controlling two separate zones of lighting based on input from single photosensor.
 4. Light-Level Sensor Set-Point Adjustment Range: 3-6000 fc.

2.5 INDOOR OCCUPANCY/VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Leviton Manufacturing Co., Inc.
 2. Lutron Electronics Co., Inc.
 3. Sensor Switch, Inc.
 4. Watt Stopper.
 5. Acuity Brands.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy/vacancy sensors with a separate power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated operation shall be as follows:
 - a. Occupancy Sensors: 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.

- b. Vacancy Sensors: Lights are turned on manually by occupant, and sensor turns them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 6. Indicator: LED status lights to show when motion is detected during testing and normal operation of sensor.
 7. Bypass Switch: Override the "on" function in case of sensor failure.
- C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. Trigger of either technology turns lights on. Both technologies must detect vacancy in order for lights to turn off.
 1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences walking motion and desktop motion.
 3. Detection Coverage: Provide sensor layout to ensure complete room coverage. Ceiling mounted sensors shall have 360° of coverage.
 4. Ceiling sensor shall be used in conjunction with manual wall switch. Verify compatibility of sensor and wall switch.
 5. Sensor shall be capable of manual on/auto off function.

2.6 SWITCHBOX-MOUNTED OCCUPANCY/VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Leviton Manufacturing Co., Inc.
 2. Lutron Electronics Co., Inc.
 3. NSi Industries LLC; TORK Products.
 4. Sensor Switch, Inc.
 5. Watt Stopper.
 6. Acuity Brands.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy/vacancy sensor, suitable for mounting in a single gang switchbox.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, 800-W incandescent, and 1200-VA LED.

2.7 Wall-Switch Sensor:

- A. Range: 180-degree field of view, coverage shall be adequate for application.
- B. Sensing Technology: Dual technology.
- C. Switch Type: Field selectable for automatic on or manual on, with automatic off.
- D. Voltage: Match the circuit voltage.
- E. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.

2.8 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Corporation.
 - 2. General Electric Company;
 - 3. Square D.
- B. Description: Electrically operated and mechanically held, combination-type lighting contactors with nonfused 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 field convertible contacts with N.O. and N.C. indicators.
 - 5. Provide contactors in enclosure with mounting brackets.

2.9 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Lighting Control and Design.
 - 2. Watt Stopper.
 - 3. LVS
- 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: Voltage to match lighting circuit.

2.10 CONDUCTORS AND CABLES

- A. Comply with requirements in Section 260519 "Low Voltage Electrical Power Conductors and Cables" and with device manufacturer's requirements and recommendations.

PART 3 - INSTALLATION

3.1 SENSOR INSTALLATION

- 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. Comply with device manufacturer's recommendations for distance from HVAC equipment.
- 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 written instructions.
- C. Outdoor Photoelectric Cells shall be oriented north and shall be directed to avoid detection of artificial light source.
- D. Install lighting contactors in NEMA enclosure appropriate for location. Provide disconnecting means and overcurrent protection at contactor enclosures.
- E. Installation shall comply with sensor manufacturer's recommendations.

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.
- B. Mount contactors in NEMA enclosure rated for location.
- C. Installation shall comply with Seismic Zone 3 requirements.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions. Wires in enclosures shall be neatly arranged and protected from damage.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

- D. 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 Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy/vacancy sensors at each sensor.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections if required based on project scope.
- C. Perform the following calibration, tests and inspections:
- D. Occupancy/Vacancy Sensors:
 - 1. Visually check placement and aiming of sensors and LED activity.
 - 2. Verify that wiring type, technique, connections, and polarity are correct.
 - 3. Test sensor function:
 - a. Motion
 - 1) Set sensitivity to Minimum. Set time delay to Minimum. Verify OFF.
 - 2) Adjust sensitivity to desired setting. Verify ON with motion.
 - 3) Adjust time delay to desired setting. Walk-test room for sensitivity.
- E. Daylight Sensors
 - 1. Visually check placement and aiming of sensors and LED display.
 - 2. Verify that wiring type, technique, connections and polarity are correct.
 - 3. All room finishes and furniture must be installed prior to start-up, calibration and testing. If a desk or table is within the area viewed by the photocell, then the desk should be unpacked and the surface cleaned prior to final calibration.
 - 4. Any window treatment must be installed and operable prior to start-up. Blinds must be positioned as they would be under normal conditions.
 - 5. Do not calibrate dimming controls under overcast skies. Controls adjusted under these conditions are likely to over-dim the lights under sunny conditions.
 - 6. Calibrate and test sensor function:
 - a. Adjust deadband and cutoff levels based on project requirements.
 - b. Set light level to Minimum. Set sensitivity level to Minimum. Set time delay to Minimum. Verify OFF.
 - c. Adjust sensitivity to desired setting. Cover sensor lense. Verify ON.

- d. Adjust Light Level to desired setting.
- e. Adjust time delay to desired setting.

- F. Adjust sensors to meet project requirements. Replace damaged and malfunctioning controls and equipment.

- G. Lighting control devices will be considered defective if they do not pass tests and inspections.

- H. Prepare test and inspection reports. Include list of devices tested and indication of correct function. Note device settings for each device.

3.6 ADJUSTING

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

3.7 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."

- B. Engage a factory-authorized service representative to train Port maintenance personnel to adjust, operate, and maintain lighting control devices.

3.8 COMMISSIONING

- A. Provide controls commissioning according to Washington State Energy Code requirements.

END OF SECTION 260923

F&I STANDARD