

Special Specification 6447

Lighting Control Panel



1. DESCRIPTION

Furnish standalone lighting control panel using mechanically latched relays to control lighting and appliances for underground electric vault and electrical service building.

The item must meet Buy America requirements if applicable.

2. REFERENCE

Furnish materials and install in accordance with the following:

- Item 618, "Conduit,"
- Item 620, "Electrical Conductors,"
- Special Specification, "Control Voltage Electrical Power Cables,"
- Special Specification, "Tunnel Lighting."

3. MATERIAL

3.1. **System Description.** This section provides the material and operation requirements for each of the lighting Control Panel components.

3.1.1. **Sequence of Operations.** Ensure that input signal from field-mounted manual switches, or digital signal sources, open or close one or more lighting control relays in the lighting control panels. Ensure any combination of inputs are programmable to any number of control relays.

3.1.2. **Surge Protective Device.** Ensure devices used are either factory installed as an integral part of control components or field-mounted surge suppressors complying with UL 1449, SPD Type 2.

3.1.3. **Electrical Components.** Ensure devices and accessories are listed and labeled by a qualified testing agency and marked for intended location and application. Ensure devices comply with the following:

- 47 CFR 15, Subparts A and B, for Class A digital devices,
- UL 916, and
- UL 924 for emergency lighting control.

3.2. **Lighting Control Panel.** The lighting control panel is a single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit. Ensure the panel has a vertical barrier separating branch circuits from control wiring. Provide either 24 or 48 (two 24 relay cards) relays for the control panel as indicated by design drawing.

3.2.1. **Control Unit.** The panel control unit contains the power supply and electronic control for operating and monitoring individual relays. Provide equipment that operates as described below.

3.2.1.1. **Timing Unit.** Ensure the timing unit is equipped with the following:

- 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year,
- clock configurable for 12-hr. (A.M./P.M.) or 24-hr. format,
- four independent schedules, each having 24 time periods,
- schedule periods settable to the minute,

- day-of-week, day-of-month, day-of-year with one-time or repeating capability, and
 - 10 special date periods.
- 3.2.1.2. **Sequencing Control with Override.** Ensure the sequencing control operates as indicated below.
 - Unit must provide for automatic sequencing of on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
 - Sequencing control must operate relays one at a time, completing the operation of all connected relays in not more than 10 sec.
 - Override control must allow any relay connected to it to be switched on or off by network control signals.
- 3.2.2. **Nonvolatile memory.** Ensure the unit is equipped with nonvolatile memory, which must retain all setup configurations. Confirm that after a power failure, the controller automatically reboots and returns to normal system operation, including accurate time of day and date.
- 3.2.3. **Relays.** Provide electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Confirm short-circuit current rating is not less than 5 kA. Ensure control is three-wire, 24-V ac.
- 3.2.4. **Power Supply.** Confirm the power supply is NFPA 70, Class 2, sized for connected equipment, plus 20% spare capacity. Ensure the unit is powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays and is sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and photo sensors.
- 3.2.5. **Operator Interface.** Provide equipment for operator interface that includes the following:
 - integral alphanumeric keypad and digital display, and intuitive drop-down menus to assist in programming,
 - log and display relay on-time, and
 - connect relays to one or more time and sequencing schemes.
- 3.3. **Manual Switches and Plates.** Provide push-button switches that are modular, momentary contact, three wire, for operating one or more relays and to override automatic controls. Ensure switches provide the following indicators below.
 - Integral green LED pilot light to indicate when circuit is on.
 - Internal white LED locator light to illuminate when circuit is off.
- 3.4. **Field-mounted Signal Sources.** Ensure the control signal comes from the existing WonderWare lighting control software and Programmable Logic Controller (PLC) controller located in park control room at the existing park.
- 3.5. **Conductors and Cables.** Provide conductors and cables that meet the following requirements listed below.
 - Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG. Comply with requirements in Item 620, "Electrical Conductors."
 - Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG. Comply with requirements in Item 620, "Electrical Conductors."
 - Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No 14 AWG. Comply with requirements in in Item 620, "Electrical Conductors."
 - Twisted-Pair Data Cable: Category 6. Comply with Special Specification, "Ethernet Cables."

4. CONSTRUCTION

- 4.1. **Installation.** Install the lighting control panel in compliance with NECA1. Install cables in raceways to comply with requirements for raceways and boxes specified in Item 618, "Conduit." For wiring within the enclosures,

bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools. Install panels and accessories according to NECA 407. Mount top of trim 90 in. above finished floor unless otherwise indicated. Mount panel cabinet plumb and rigid without distortion of box. Perform startup service.

- 4.2. **Identification.** Identify system components, wiring, cabling, and terminals. Create a directory to indicate loads served by each relay. Use a PC or typewriter to create directory; handwritten directories are unacceptable. Label each lighting control panel with a nameplate.
- 4.3. **Field Quality Control.** Perform and provide documentation of acceptance testing. Tests include but are not limited to those listed in this section.
- 4.3.1. **Acceptance Testing.** Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers described below and low-voltage surge arrestors. Certify compliance with manufacturer's test parameters.

Following tests, correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

- 4.3.1.1. **Circuit-Breaker Tests.** Compare nameplate with Drawings and Specifications. Inspect physical and mechanical conditions. Inspect anchorage and alignment. Verify that the units are clean. Operate the circuit breaker to ensure smooth operation. Inspect bolted electrical connections for high resistance using one or more of the following methods:
- a low-resistance ohmmeter,
 - verify tightness of bolted electrical connections by calibrated torque wrench, and
 - thermographic survey.

Inspect operating mechanism, contacts, and arc chutes in unsealed units. Perform adjustments for final protective device settings according to the overcurrent protective device coordination study.

Perform insulation resistance tests for one minute on each pole, phase-to-phase, and phase-to-ground with the circuit breaker closed and across each pole using manufacturer's published data. Perform a contact/pole-resistance test. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential must be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration must be for one minute. Follow manufacturer's written instructions for solid-state units.

- 4.3.1.2. **Surge Arrestor Tests.** Compare nameplate with the Contract documents. Inspect physical and mechanical conditions. Inspect anchorage, alignment, grounding, and clearances. Verify that the units are clean. Inspect bolted electrical connections for high resistance using one or more of the following methods listed below.
- Low-resistance ohmmeter.
 - Verify tightness of bolted electrical connections by calibrated torque wrench.
 - Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

Perform an insulation-resistance test on each arrestor, phase terminal-to-ground using voltage according to manufacturer written instructions. Comply with requirements in Special Specification, "Grounding and Bonding for Electrical Systems" for grounding tests.

5. SUBMITTALS

- 5.1. **Product Data.** Submit product data for each type of product.
- 5.2. **Shop Drawings.** Provide shop drawings based on construction plans, using the same legend, symbols, and schedules, for each relay panel and related equipment that includes the following:

- dimensioned plans, elevations, sections, and details, showing tabulations of installed devices, equipment features, and ratings;
- detail enclosure types and details for types other than NEMA 250, Type 1;
- detail wiring partition configuration, current, and voltage ratings;
- short-circuit current rating of relays;
- address drawing for reflected ceiling plan and floor plans, showing connected luminaires, address for each luminaire, and luminaire groups;
- point list and data bus load, including a summary list of all control devices, sensors, ballasts, and other loads and also including percentage of rated connected load and device addresses; and
- wire termination diagrams and schedules that coordinate nomenclature and presentation with drawings and block diagram and that differentiate between manufacturer-installed and field-installed wiring.

6. MEASUREMENT

This Item will be measured by each Lighting Control Panel indicated in the plans, complete-in-place, connected, energized, tested and made fully operational.

7. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under, "Measurement" will be paid for at the unit price bid for "Lighting Control Panel." This price will be full compensation for all equipment described or required under this item; and for all furnishing all labor, equipment, tools, materials and incidentals necessary to complete the work.