Preparing Activity: NASA Superseding
UFGS-26 09 23.00 40 (August 2016)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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08/19

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SECTION 26 09 23.00 40

LIGHTING CONTROL DEVICES
08/19

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NOTE: This guide specification covers the requirements for photoconductive or other lighting control devices for use with interior or exterior lighting systems.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
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PART 1 GENERAL

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to work specified in this section.

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature

when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2023) National Electrical Safety Code
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

RCBEA GUIDE	(2004) NASA Reliability Centered Building and Equipment Acceptance Guide

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C136.10	(2017) Roadway and Area Lighting Equipment-Locking-Type Photocontrol Devices and Mating Receptacles--Physical and Electrical Interchangeability and Testing
NEMA ICS 1	(2022) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15	Radio Frequency Devices (47 CFR 15)

UNDERWRITERS LABORATORIES (UL)

UL 20	(2018; Reprint May 2023) UL Standard for Safety General-Use Snap Switches

UL 98	(2016; Reprint Jan 2022) UL Standard for Safety Enclosed and Dead-Front Switches
UL 773	(2016; Reprint Jul 2020) UL Standard for Safety Plug-In, Locking Type Photocontrols for Use with Area Lighting
UL 773A	(2016; Reprint Jun 2020) UL Standard for Safety Nonindustrial Photoelectric Switches for Lighting Control

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in the IEEE Stds Dictionary.

b. DALI: Digital Addressable Lighting Interface used to transmit data to and from lighting control system input devices, end devices, and control equipment.

1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting System Drawings; G[, [____]]

SD-03 Product Data

Installation Instructions; G[, [____]]

Dimming Ballast Controls; G[, [____]]

Light Level Sensor; G[, [____]]

Dimmer Switch; G[, [____]]

Lighting Contactor; G[, [____]]

Time Switch; G[, [____]]

Photocell Switch; G[, [____]]

Occupancy Sensors; G[, [____]]

SD-06 Test Reports

System Operation Tests

SD-10 Operation and Maintenance Data

Lighting Control System, Data Package 5

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Ensure equipment, materials, installation, and workmanship are in accordance with the mandatory and advisory provisions of NFPA 70, IEEE C2 unless more stringent requirements are specified or indicated.

1.4.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Provide products which have been in satisfactory commercial or industrial use for 2 years prior to bid opening. Ensure the 2-year period includes applications of equipment and materials under similar circumstances and of similar size. Ensure the

product has been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer.

1.4.3 Predictive Testing and Inspection Technology Requirements

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NOTE: The Predictive Testing and Inspection (PT&I) tests prescribed in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS are MANDATORY for all NASA assets and systems identified as Critical, Configured, or Mission Essential. If the system is non-critical, non-configured, and not mission essential, use sound engineering discretion to assess the value of adding these additional test and acceptance requirements. See Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS for additional information regarding cost feasibility of PT&I.

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This section contains systems and equipment components regulated by NASA's Reliability Centered Building and Equipment Acceptance Program. This program requires the use of Predictive Testing and Inspection (PT&I) technologies in conformance with RCBEA GUIDE to ensure building equipment and systems have been installed properly and contain no identifiable defects that shorten the design life of a system and its components. Satisfactory completion of all acceptance requirements is required to obtain Government approval and acceptance of the work.

Perform PT&I tests and provide submittals as specified in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit lighting system drawings showing luminaire configuration, control zones, and detection range of specified control devices. Ensure lighting system drawings include photometric calculations showing lighting levels in foot candles for all areas indicated. Ensure lighting calculations and photometric plans are created using industry standard light modeling software. Hand calculations will not be accepted.

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NOTE: Applies if simple non-centralized lighting control system using non-networkable control devices is required. This type of system is inexpensive but allows limited configurations and offers few if any remote capabilities.

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[a. Provide lighting control system of the non-centralized and non-addressable type that does not include any programmable devices. Control devices are of the line-voltage or low-voltage types and are used to create specific hard-wired control zones to turn lights on and off or to provide light dimming capabilities.]

****

NOTE: Applies if complex centralized lighting control system using addressable control devices is required. This type of system is more costly than the non-networkable type, but offers numerous options for configurations and remote capabilities. If this type of system is chosen, additional centralized control devices will need to be specified that conform to the same communication protocol as the end lighting control devices (such as DALI).

****

[b. Provide lighting control system of the centralized and addressable type that includes programmable devices. Control devices are of the digital low-voltage or wireless types and are used to create control zones which can be changed without affecting the wiring of the devices. Control zones are used to turn lights on and off or to provide light dimming capabilities.]

c. Lighting control system must comply with these specifications, all applicable construction document drawings, all applicable codes, and all local authorities having jurisdiction. Lighting control system equipment includes, but is not limited to, time control switches, manual and safety switches, dimming ballasts, light level sensors, incandescent dimmer switches, lighting contactors, photocell switches, and occupancy sensors.

2.1.1 System Requirements

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NOTE: Options apply if lighting control system is an addressable and networkable type.

****

a. The lighting control system and lighting end devices must revert to the on position in the event of a loss of power or control signal to the system or end devices.

[b. Lighting control zones consisting of one or more networked luminaires and lighting control devices must be capable of providing automatic control from sensors (occupancy and photocell) and manual control local switches.]

[c. Provide networked luminaires and lighting control devices that store programming in non-volatile memory such that following any loss of power the lighting control zones continue to operate according to the defined settings.]

2.2 COMPONENTS

2.2.1 Manual Switches

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NOTE: Use manual switches for control of the lighting system when controls are located in a space that is continuously supervised, such as a guardhouse, gatehouse, or watchtower.

****

Provide a switch mechanism consisting of a heavy-duty general-purpose precision snap-acting switch[, with NEMA ICS 6 Type [1] [4] enclosures,], single-pole, single-throw,[with a minimum rating of 1,000-watts incandescent-lamp load and 1,200-volt-amperes reactive for vapor-lamp load at rated voltage and frequency][suitable for operation on a [480Y/277] [208Y/120] [480] [277] [240] [120] volt, 60 Hz, [three-phase] [single-phase] system]. Provide with a selector switch having a minimum of three positions: ON, OFF, and AUTOMATIC. Use the automatic position when photoelectric or timer control is desired. Interface the selector switch with the lighting system magnetic contactor to control system activity.

Ensure switches conform to UL 98 as applicable. Provide a quick-make, quick-break type switch such that a screwdriver is required to open the switch door when the switch is on, with blades visible when the door is open. Coordinate terminal lugs with the wire size.

[2.2.2 Dimming Ballast Controls

Provide a single slide dimming ballast control dimmer with on-off control, compatible with the ballast. Control the ballast light output over the full dimming range. Provide a dimmer ballast control which is approved by the ballast manufacturer.

]2.2.3 Light Level Sensor
Wow a
Provide UL listed light level sensor capable of detecting changes in ambient lighting levels, with a dimming range of 20 percent to 100 percent, minimum. Ensure sensor is designed for use with dimming ballast and voltage system to which they are connected. Provide a sensor capable of controlling [40][_____] electronic dimming ballasts, minimum, with a sensor light level adjustable with a set level range from 100 to 1000 lux 10 to 100 foot-candles, minimum. Provide a sensor with a bypass function to electrically override the sensor control.

2.2.4 Incandescent Dimmer Switch

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NOTE: Do not specify central dimming systems with this specification.
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Provide a single-pole, [600][_____] watt, 120 volt ac, dimmer switch that conforms to UL 20. Ensure the switch is the full-range rotary on-off type with built-in electromagnetic interference filter.

2.2.5 Lighting Contactor

[Provide NEMA ICS 2,[electrically][mechanically] held contactor[with photocell input for outdoor locations], rated [_____] volts, [_____] amperes, and [_____] poles, with coils rated [_____] volts.][Rate contactor as indicated.] Provide in a NEMA[4][_____] enclosure conforming to NEMA ICS 6. Provide contactors with silver alloy double-break contacts [and coil clearing contacts for mechanically held contactor] requiring no arcing contacts.[Provide contactor with[hand-off-automatic][on-off] selector switch[.][, hermetically sealed.]]

2.2.6 Time Switch

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NOTE: Do not always use photocells and time switches together. Use the following information as a guide:

1. Lights on/lights off by photocell: Street parking lots. Any facility or street that requires lighting after dark.

2. Lights on by photocell; lights off by time switch: Most administration facilities, commissaries, hobby shops, or clubs. Any facility that does not stay open all night.

3. Lights on/lights off by time switch: Service stations, snack bars, barracks, or officers' quarters. Facilities that are open to the public, or have personnel that report before daylight and after dark, but not continually through the night.

4. Other considerations: Time switches with a skip-a-day feature may be useful for facilities with a 5-day work week. (Program time switch to skip Saturday and Sunday.) For facilities that do not stay open all night, it may be desirable to have lighting at night for security. Consult area Engineering Field Division for local station policy and exceptions to these procedures.

****

Provide astronomic dial type or electronic type, arranged to turn "ON" at sunset and turn "OFF" at a predetermined time between 8:30 p.m. and 2:30 a.m. or at sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide a [_____] volts rated switch, having automatically wound spring mechanism or capacitor, to maintain accurate time for a minimum of 7 hours following power failure. Provide time switch with a manual on-off bypass switch. Surface mount the housing for the time switch, inside a NEMA [3R][_____] enclosure conforming to NEMA ICS 6.

2.2.7 Photocell Switch

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NOTE: Use silicon photocells for areas with very high temperatures or other extreme environmental conditions..

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Ensure photocell switches conform to UL 773 or UL 773A as applicable. Provide hermetically sealed photocells that use cadmium-sulfide or silicon diode type cells. Provide photocells that are rated at [_____] volts [ac, 60 Hz][dc] with[single-throw contacts][single pole double-throw (spdt) contacts for mechanically held contactors rated 1000 watts] and designed to fail to the ON position. Provide photocells that turn on at or below 32 lux 3 foot-candles and off at 43 to 107 lux 4 to 10 foot-candles. Provide time delay to prevent accidental switching from transient light sources.[Provide a directional lens in front of the cell to prevent

fixed light sources from creating a turnoff condition.]

Provide a photocell with the following:

[a. Integral to the luminaire, rated 1000W minimum.[Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition.]

][b. In a U.V. stabilized polycarbonate housing with swivel arm and adjustable window slide, rated 1800 VA, minimum.

][c. In a high-impact-resistant, noncorroding and nonconductive molded plastic housing with a locking-type receptacle conforming to ANSI C136.10, rated 1800 VA, minimum.

][d. In a cast weatherproof aluminum housing with adjustable window slide, rated 1800 VA, minimum.

]2.2.8 Occupancy Sensors

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NOTE: Occupancy sensors are useful in lighting control applications for private and open offices, restrooms, conference rooms, classrooms, utility areas, warehouses, and corridors. Additional design guidance can be found at the NAVFAC Criteria Office's website. See local energy codes to determine if power receptacles also need to be switched when not in use. Many occupancy sensors have additional contacts to connect receptacle relays.

Also, most occupancy sensor manufacturers offer design services for their products.
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NOTE: Typical sensor applications are:
Ultrasonic - Restrooms, Hallways
Infrared - Warehouses, Open Offices
Combination Sensor - Classrooms, Conference Rooms
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Provide UL listed occupancy sensor complying with FCC Part 15. Design occupancy sensors and power packs to operate on the voltage indicated. Provide sensors and power packs with circuitry that only allows load switching at or near zero current crossing of supply voltage, with mounting as indicated. Provide sensor with an LED occupant detection indicator, adjustable sensitivity, and adjustable delayed-off time range of 5 minutes to 15 minutes. Provide[ivory][white][color matching the adjacent wall plates] wall mounted sensors, and white ceiling mounted sensors. Provide ceiling mounted sensors with 6.28 rad 360 degree coverage unless otherwise indicated.

Provide sensors with:

[a. A crystal controlled ultrasonic sensor which does not cause detection interference between adjacent sensors.

][b. Infrared sensors with a daylight filter, and a fresnel lens that is applicable to the controlled space.

][c. Ultrasonic/Infrared Combination Sensor

[(1) Occupancy detection to turn lights on requires both ultrasonic and infrared sensor detection, such that the lights remain on if either the ultrasonic or infrared sensor detects movement. Provide infrared sensor with a lens selected for indicated usage and daylight filter to prevent short wavelength infrared interference. Provide crystal controlled ultrasonic sensor frequency.

]]d. Microwave and audiophonic sensors.

]PART 3 EXECUTION

3.1 INSTALLATION

Submit installation instructions for [light-sensitive] [occupancy sensitive] [motion sensitive] control devices in accordance with the manufacturer's recommended instructions for installation.

3.1.1 Photoconductive Control Devices

Install [photoconductive] [_____] control devices in accordance with the manufacturer's installation instructions.

3.1.2 Time Control Switches

Install switches with not less than four 6.4 mm 1/4 inch bolts. Do not use sheet metal screws.

3.1.3 Manual and Safety Switches

Coordinate terminal lugs with the wire size. Securely fasten switches to the supporting structure or wall using not less than four 6.4 mm 1/4 inch bolts. Do not use sheet metal screws.

3.1.4 Magnetic Contactors

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NOTE: Use mechanically held, electrically operated magnetic contactors to control operation of the lighting system circuits.

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Install magnetic contactors, mechanically held, electrically operated, conforming to NEMA ICS 1 and NEMA ICS 2, suitable for [480] [277] [240] [208] [120] volts, [single] [3] phase, 60 Hz, with coil voltage of [120] [277] [208] [240] volts. Provide contactors with maximum continuous ampere rating and number of poles as indicated on drawings. For contactors mounted indoors, provide enclosures conforming to NEMA ICS 6, Type 1. Provide each contactor with a spare, normally open auxiliary contact.

Coordinate terminal lugs with the wire size. Securely fasten switches to the supporting structure or wall using not less than four 6.4 mm 1/4 inch bolts. Do not use sheet metal screws.

3.2 EQUIPMENT IDENTIFICATION

3.2.1 Manufacturer's Nameplate

Provide each item of equipment with a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in an inconspicuous place; the nameplate of the distributing agent is not acceptable.

3.2.2 Labels

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NOTE: Labeling of lighting components is an inexpensive and effective method for helping facilities personnel properly operate and maintain the lighting systems. Use labels which are easy to read when standing next to the equipment, and durable to match the life of the equipment to which they are attached.
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Provide labeled control devices, clearly marked for operation of specific lighting functions according to type. Note the following devices characteristics in the format "Use Only [_____]."

Locate markings where readily visible to service personnel, but unseen from normal viewing angles when devices are in place.

3.3 FIELD QUALITY CONTROL

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NOTE: If the specified system is identified as critical, configured, or mission essential, use Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS to establish predictive and acceptance testing criteria, above and beyond that listed below.
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Perform PT&I tests and provide submittals as specified in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS.

Perform system operation tests in accordance with referenced standards in this section.

Demonstrate that photoconductive control devices operate satisfactorily in the presence of the Contracting Officer.

Measure and record foot-candle levels in areas indicated and compare to submitted photometric calculations.[Perform all lighting measurements in the presence of the Contracting Officer.]Take measurements in areas representing a minimum of [10%][20%][_____] relative sample[and as directed by the Contracting Officer]. Ensure measured lighting levels are within [5%][10%] of the calculated values. Where lighting levels are determined to be deficient contractor will modify system to bring lighting levels into compliance at no additional cost to the Government.

3.4 CLOSEOUT ACTIVITIES

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NOTE: Require O&M manuals for lighting control systems that use low voltage control circuits. Example: Light level sensors used with dimming ballast, occupancy, and motion sensors used with power packs.

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Submit operation and maintenance data, lighting control system, data package 5, in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein. Show information for all lighting fixtures, control modules, control zones, occupancy sensors, motion sensors, light level sensors, power packs, dimming ballasts, schematic diagrams and all interconnecting control wire, conduit, and associated hardware.

-- End of Section --