Preparing Activity: NASA Superseding
UFGS-26 56 19.00 40 (May 2016)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
****

SECTION TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

SECTION 26 56 19.00 40

ROADWAY LIGHTING

05/20

PART 1 GENERAL

1.1 REFERENCES
1.2 DEFINITIONS
1.3 SUBMITTALS
1.4 QUALITY CONTROL
1.4.1 Regulatory Requirements
1.5 WARRANTY

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION
2.1.1 Design Requirements
2.1.1.1 Photometric Plan
2.1.2 Performance Requirements
2.2 EQUIPMENT
2.2.1 LED Luminaires
2.2.1.1 Thermal Management
2.2.1.2 Correlated Color Temperature
2.2.1.3 Finish
2.2.1.4 Mounting
2.2.1.5 Options
2.2.2 End-Mounted High-Intensity-Discharge (HID) Luminaires
2.2.3 Side-Mounted (HID) Luminaires
2.2.4 Side-Mounted Incandescent Luminaires
2.3 COMPONENTS
2.3.1 Luminaire [Power Supply Units (Drivers)] [and] [Ballasts]
2.3.1.1 LED Power Supply Units (Drivers)
2.3.1.2 Multiple-Circuit Ballasts
2.3.2 Lamps
2.3.2.1 (HID) Lamps
2.3.2.2 Low Pressure Sodium Lamps
2.3.2.3 Incandescent Lamps
2.3.3 Series Circuit Transformers

PART 3 EXECUTION

3.1 INSTALLATION
3.1.1 End-Mounted High-Intensity-Discharge (HID) Luminaires
3.1.2 Side-Mounted (HID) Luminaires
3.1.3 Side-Mounted Incandescent Luminaires
3.2 FIELD QUALITY CONTROL
3.2.1 Tests
3.3 CLOSEOUT ACTIVITIES

-- End of Section Table of Contents --

Preparing Activity: NASA

Superseding
UFGS-26 56 19.00 40 (May 2016)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023

SECTION 26 56 19.00 40

ROADWAY LIGHTING
05/20

NOTE: This guide specification covers the requirements for highway and roadway lighting luminaires.

Refer to ANSI/IES RP-8-18, "American National Standard Practice for Design and Maintenance of Roadway and Parking Facility Lighting," for IES recommended practices of roadway lighting fixtures.

Coordinate this section with UFGS Section 26 09 23.00 40 LIGHTING CONTROL DEVICES and Section 26 56 13.00 40 LIGHTING POLES AND STANDARDS.

Roadway-lighting standards and fixture details on drawings should describe, in plan and elevation, the type and kind of pole, bracket, luminaire, base, and foundation required for installation at the location indicated. Elevation details should indicate height of pole, bracket-spread length, luminaire, depth of foundation, anchor bolts, underground conduit connections, ground rods, and ground connections. Plan views should indicate foundation configuration, conduit stub-ups, base dimensions, and bolt circles. Foundation detail drawings should accurately describe the nature and properties of soil surrounding foundations for the support of lighting standards.

Foundations for installation of area, flood lighting, roadway lighting, and security lighting standards and fixtures in filled locations may require modification to resist horizontal movement without permanent set under stipulated wind loads.

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).
****

****
NOTE: TO DOWNLOAD UFGS GRAPHICS

Go to
http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/for
****

****
NOTE: The following sketches (Graphics) and are available in metric (SI) and U.S. Customary (IP) system dimensions. Sketch titles and style numbers are unchanged for both types. The metric values indicated are a conversion of U.S. Customary (IP) system dimensions.

Do not include list of sketches, or sketches themselves, in project specifications. Use luminaire sketches as details on drawings. If special features are required, do not modify sketches, but indicate these changes as notes in fixture schedule. The "XL" style numbers and dates should remain on the drawing details.

Sketch No.	Title
XL-01	LED Roadway Luminaire
XL-02	HID Induction Roadway Luminaire
XL-03	LED Area Luminaire
XL-04	HID Area Luminaire
XL-05	Induction Area Luminaire
XL-06	Low Pressure Sodium Area Luminaire
XL-07	HID High Mast Luminaire

NOTE: Do not include this index in project specification.
****

****
NOTE: Show the following information on the drawings or specify in the project specifications:

a. Luminaire schedule and indicate pertinent information; i.e., mounting, lamps, ballasts, and voltage.

1. Type of luminaire;

2. Voltage, wattage, and frequency rating required;

3. Accessories required, such as photocell, time switches, auxiliary lamps, and house side shields;

4. Location of poles or standards;

5. Referenced sketch; and

6. Extent and location of the work to be accomplished and wiring and equipment necessary for a complete installation.

****

****

NOTE: Demolition work that involves disposal of fluorescent and HID lamps and ballasts requires the use of Section 02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY.

****

PART 1 GENERAL

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.

****

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.

ILLUMINATING ENGINEERING SOCIETY (IES)

ANSI/IES LM-79	(2019) Approved Method: Electrical and Photometric Measurements of Solid State Lighting Products
ANSI/IES LM-80	(2020) Approved Method: Measuring Luminous Flux and Color Maintenance of LED

	Packages, Arrays and Modules
ANSI/IES LS-1	(2020) Lighting Science: Nomenclature and Definitions for Illuminating Engineering
ANSI/IES RP-8	(2018; Addenda 1 2020; Errata 1-2 2021) Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2023) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI ANSLG C78.42	(2009; S 2022) For Electric Lamps: High-Pressure Sodium Lamps
ANSI C82.4	(2017; R 2022) Lamp Ballasts - Ballasts for High- Intensity-Discharge and Low-Pressure Sodium Lamps
ANSI C136.2	(2015) American National Standard for Roadway and Area Lighting Equipment: Luminaires Voltage Classification
ANSI C136.15	(2020) American National Standard for Roadway and Area Lighting Equipment - Luminaire Field Identification
NEMA ANSLG C82.9	(2010) American National Standard for Lamp Ballasts— High-Intensity Discharge and Low-Pressure Sodium Lamps— Definitions

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

21 CFR 1040	Performance Standards for Light-Emitting Products

1.2 DEFINITIONS

****
NOTE: Delete definitions that are not applicable to project.
****

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings are as defined in IEEE 100 and ANSI/IES LS-1.

[b. For HID, fluorescent, and induction luminaire light sources, "Average

Rated Life" is the time after which 50 percent of a large group of light sources will have failed and 50 percent will have survived under normal operating conditions.]

[c. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in ANSI/IES LM-80.]

1.3 SUBMITTALS

****

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.

****

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-01 Preconstruction Submittals

****

NOTE: Required for all area and roadway designs. Contractor to provide calculations to verify luminaires and design layout meet required illumination and photometric values of the design. This requirement has been added as a quality assurance step. Absolute photometry of LED luminaires provided by ANSI/IES LM-79 data should provide accurate values to assure contractor's luminaires meet the standards of the initial design.
****

Material, Equipment, and Fixture Lists; G[, [____]]

Equipment and Performance Data; G[, [____]]

Photometric Plan; G

Equipment; G

SD-02 Shop Drawings

Street-Lighting Luminaires; G[, [____]]

Installation Drawings; G[, [____]]

SD-03 Product Data

Street-Lighting Fixtures; G[, [____]]

Street-Lighting Luminaires; G[, [____]]

SD-06 Test Reports

Operational Tests

SD-07 Certificates

Lighting-Distribution Certificates

SD-11 Closeout Submittals

Warranty

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.

Submit Lighting-distribution certificates showing compliance with the following requirement: lighting-distribution curves for each type of fixture prepared, utilizing the fixture manufacturer's own facilities or

those of an independent nationally recognized laboratory, in accordance with the standard procedure developed by the Illuminating Engineering Society.

1.5 WARRANTY

Provide a [five][_____] year Limited Warranty on entire system, including finish.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide street-lighting fixtures, equipped with lamps. Furnish fixtures complete with wiring and mounting devices ready for installation at the locations indicated.

2.1.1 Design Requirements

Provide roadway luminaires conforming to the following standards:

a. Voltage classification, ANSI C136.2

b. Field identification marking, ANSI C136.15

2.1.1.1 Photometric Plan

For all luminaires, include computer-generated photometric analysis of the "designed to" values for the "end of useful life" of the luminaire installation using a light loss factor of [0.7] [_____]. Provide analysis with the following:

Horizontal illuminance measurements at finished grade, taken at a maximum of every 3 meters10 feet.

Minimum and maximum lux footcandle levels.

Average maintained lux footcandle level.

Maximum to minimum ratio.

2.1.2 Performance Requirements

Submit Equipment and performance data for highway and roadway lighting systems consisting of life test, system functional flows, safety features, mechanical automated details, automatic interlocks, and such features as electrical system protective device ratings.

2.2 EQUIPMENT

Submit Material, equipment, and fixture lists for highway and roadway lighting fixtures including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

Provide enclosed and gasketed vapor tight street-lighting luminaires in accordance with ANSI/IES RP-8 for Types I, II, III, IV, and V

lighting-distribution patterns.

****

NOTE: Select street-lighting luminaires, ballasts, and lamps from the following parts to suit project requirements.

Factors affecting the selection of luminaire types include the following:

Fixture efficiency is the percent of available lumens from the light source that emits from the fixture. The most efficient fixture should be selected commensurate with the other design requirements.

The spacing to mounting height ratio (S/MH) indicates how far apart the fixtures can be placed in relation to their mounting height. This ratio should be available in the fixture manufacturer's literature. A medium-to-wide distribution of light from the fixture should be selected. Fewer fixtures are required using the larger, more efficient light sources. Overlapping light patterns provide greater uniformity of illumination and increase light on vertical surfaces.

High power factor ballasts or drivers should be selected.

****

2.2.1 LED Luminaires

Provide luminaires that are UL [and DesignLights Consortium (DLC)]listed and are compliant with ANSI/IES LM-79 and ANSI/IES LM-80 with the following attributes:

a. Provide minimum IP 65 type housing. Provide LED light engines constructed of heavy-duty, die-cast aluminum, with external heat radiating fins.

b. Provide a driver housing constructed of extruded aluminum, with cast aluminum end covers and stainless steel fasteners; for easy access to the LED driver(s); allowing for cooler operation and longer driver life. Use one-piece gasketing throughout the fixture for weather-tight operation.

2.2.1.1 Thermal Management

****

NOTE: The L70 test determines the point in a LED's life when it reaches 70 percent of its initial output.

****

Provide LEDs that are determined to last a minimum of 75,000 hours in 25 degree C 77 degree F environments when driven at 530 mA.

2.2.1.2 Correlated Color Temperature

****

NOTE: Due to wildlife concerns, amber type luminaires may be requested for exterior applications. Phosphor converted amber technology provides greater lumen output and color rendition as it has a wide spectrum which contains blue light. Amber color with a wavelength higher than 560 nm, or "true chip amber", has a very narrow spectrum of light centered at 560 nm which outputs a dark orange, amber color at a lower lumen output and lower color rendition. For critical applications such as security gates or locations with hazardous operations, use phosphor converted amber. For all other locations with wildlife concerns, use true chip amber. For locations without wildlife concerns, use a non-amber color temperature.

****

Provide LED light engines that output [3000K] [4000K] [5000K] [Phosphor converted amber] [Amber color with a wavelength higher than 560 nm].

2.2.1.3 Finish

The finish is [textured and chemically pretreated through a multiple-stage washer, electrostatically applied, thermoset polyester powder coat finish, with a minimum of 3-5 millimeter [_____] inches thickness. The finish is oven-baked at 204.4 degrees C 400 degrees F to promote maximum adherence and finish hardness. Finish is guaranteed for five (5) years] [_____].

2.2.1.4 Mounting

[An adjustable knuckle slip that fits over a 6 centimeter [2-3/8 inch] [_____] Tenon, and allows for up to 90 degrees of vertical adjustment in 10 degree increments (minimum) from horizontal, as well as full side to side adjustment with the knuckle mount.][A round extruded aluminum, Bolt-On Arm with an in-pole nut plate. A Round Pole Plate Adaptor is required for mounting to round poles.][_____]

[2.2.1.5 Options

a. Photocell and Receptacle

[_____]

b. Photo receptacle

[_____]

c. Round pole plate adaptor

[_____]

][2.2.2 End-Mounted High-Intensity-Discharge (HID) Luminaires

Provide end-mounted HID luminaires with a horizontal lamp-burning position. Include with the luminaire; a hinged two- or three-piece housing, reflector, refractor, refractor holding ring, lamp holder, fuses,

fuseholders, terminal block, ballast, and lamp in a completely sealed optical system for end-mounting to street-lighting standards. Ensure wiring is concealed in street-lighting standards and luminaires.

Provide with cast aluminum upper housing with fixture-leveling pad, integral slip fitter, pipe stop, and clamps with provision for vertical adjustments of plus or minus 3 degrees for leveling purposes.

Provide a reflector formed from anodized sheet aluminum with a specular finish. Provide molded prismatic heat-resistant borosilicate glass refractor. Ensure the design generates the lighting-distribution pattern indicated. Ensure the refractor cover allows for expansion and contraction of the refractor for ambient temperature changes between 0 to 105 degrees F.

Provide a cast aluminum refractor holding ring and ballast cover which forms the lower housing. Equip lower housing with corrosion-resistant steel hinge and hinge pin, spring-loaded safety catch, and refractor latching mechanism.

][2.2.3 Side-Mounted (HID) Luminaires

Provide side-mounted (HID) luminaires with base-up vertical lamp-burning position. Include a universal head with built-in ballast, lamp, porcelain lamp holder, and reflector assembly in a completely sealed optical system for bracket mounting to street-lighting standards. Conceal wiring in street-lighting standards and luminaires.

Provide cast aluminum universal head with integral side-mounting slip fitter, pipe stop, and clamps with provisions for vertical adjustments of plus or minus 3 degrees for leveling purposes.

Include in reflector assembly a reflector, refractor, and clamping band. Form reflector from anodized sheet aluminum with a specular finish. Include molded prismatic heat-resistant borosilicate glass refractor designed to provide the lighting-distribution pattern indicated. Provide clamping band formed from sheet aluminum or corrosion-resistant steel.

Provide a complete assembly which latches the reflector directly to the universal head with aluminum or corrosion-resistant steel latches. Include a seating flange to provide a seal against moisture, dirt, and insects.

][2.2.4 Side-Mounted Incandescent Luminaires

Provide side-mounted incandescent-lamp luminaires with base-up vertical lamp-burning position including a universal head with lamp and porcelain lamp holders. Ensure the reflector assembly is in a completely sealed optical system suitable for bracket mounting to street-lighting standards.

Provide cast aluminum universal head with integral side-mounting slip fitter, pipe stop, and clamps with provision for vertical adjustments of plus or minus 3 degrees for leveling purposes.

Include in reflector assembly a reflector, refractor, and clamping band. Form reflector from anodized sheet aluminum with a specular finish. Provide a molded prismatic heat-resistant borosilicate glass refractor. Ensure the design generates the type of lighting-distribution pattern indicated. Form a clamping band from sheet aluminum or

corrosion-resistant steel to completely seal the joint between reflector and refractor.

Provide reflector assembly which latches directly to the universal bead with aluminum or corrosion-resistant steel latches, with latches and seating flange to provide a seal against moisture, dirt, and insects.

]2.3 COMPONENTS

2.3.1 Luminaire [Power Supply Units (Drivers)] [and] [Ballasts]

****

NOTE: Choose "Ballasts" for HID, LPS, fluorescent, and incandescent. Choose "Power Supply Units (Drivers)" for LED applications.

****

2.3.1.1 LED Power Supply Units (Drivers)

The LED drivers accept [120v thru 277v] [120v] [208v] [240v] [277v] [347v] [480], 50 Hz to 60 Hz input. Power factor of [greater than 90] [95] [_____] percent. Rated for [minus 40 C] [minus 40 F] [minus 18 thru 4 C] [0 thru 40 F] degrees operations.[Built-in 10 kV surge protector (minimum).]

[2.3.1.2 Multiple-Circuit Ballasts

****

NOTE: Select solid-state ballasts, if available and most efficient.

****

Multiple-circuit ballasts include a two-winding core-and-coil assembly with a saturated-iron regulating element and capacitors impregnated with an insulating material in accordance with ANSI C82.4 and NEMA ANSLG C82.9.

Provide ballasts which maintain correct lamp operation over a voltage-input range of plus or minus 13 percent of rated voltage. Include capacitors providing a power factor lamp load of not less than 95 percent.

Provide ballasts with a voltage rated for operation on 120- or 277-volt, single-phase, 60-hertz lighting-distribution systems as indicated.

Design ballasts for a minimum lamp starting temperature of minus 29 degrees C 20 degrees F and a maximum ambient temperature of 41 degrees C 105 degrees F.

][2.3.2 Lamps

Provide lamps, if used in a populated area, certified to be automatically self-extinguishing, conforming to 21 CFR 1040, Section 30.

****

NOTE: Select one of the following three paragraphs. Add watt requirements on the drawings.

****

[2.3.2.1 (HID) Lamps

Furnish compatible (HID) lamps and ballasts, as specified on drawings.

Provide high pressure sodium lamps in compliance with the following industry standards:

1,000 watts	ANSI ANSLG C78.42
400 watts	ANSI ANSLG C78.42
150 watts	ANSI ANSLG C78.42
70 watts	ANSI ANSLG C78.42

][2.3.2.2 Low Pressure Sodium Lamps

Provide lamps certified by manufacturer as meeting the requirements defined by the drawings.

][2.3.2.3 Incandescent Lamps

Provide the following incandescent lamps:

a. General-purpose incandescent lamps - clear or inside frosted.

b. Lamps with wattage ratings up to and including 300 watts- medium brass screw bases.

c. Lamps with wattage ratings in excess of 300 watts- mogul brass screw bases.

Provide special-purpose lamps, including PAR and R lamps as follows:

a. PAR lamps - clear molded heat-resistant hard-glass bulbs with parabolic aluminized inner-bulb wall reflectors for spotlighting or floodlighting applications.

b. R lamps - clear soft blown-glass bulbs with silver-deposited, inner-bulb wall reflector for spotlighting or floodlighting applications.

Provide lamps designed for operation on 120-volt, 60-hertz circuits unless otherwise specified.

]][2.3.3 Series Circuit Transformers

Provide series transformers with a two-winding core-and-coil assembly designed for connection to constant-current supply circuits in accordance with NEMA ANSLG C82.9.

Design the primary winding of the transformer for connection to 6.6-or 20-ampere constant-current street-lighting circuits, providing the proper starting voltage and operating current for the lamp indicated.

Design transformers for a maximum ambient temperature of 41 degrees C 105 degrees F.

]PART 3 EXECUTION

3.1 INSTALLATION

Submit installation drawings for the highway and roadway lighting

systems. Indicate on drawings overall physical features, dimensions, ratings, service requirements, and weight of equipment.

Install a street-lighting fixture at each location indicated, with lamps of the designated type, voltage, and wattage in each fixture.

[Install new lamps immediately prior to completion of the project. Install lamps with the light center at the focal point of the reflector and in the proper burning position.

][3.1.1 End-Mounted High-Intensity-Discharge (HID) Luminaires

Conceal wiring in street-lighting standards and luminaires. Mount porcelain lamp holder on an adjustable supporting bracket that permits vertical and horizontal positioning of the lamp. Ensure the upper housing overlaps the lower housing with a heat-resistant gasket providing a seal against moisture, dirt, and insects.

][3.1.2 Side-Mounted (HID) Luminaires

Conceal wiring in street-lighting standards and luminaires. Install clamping band to completely seal the joint between reflector and refractor against moisture, dirt, and insects.

][3.1.3 Side-Mounted Incandescent Luminaires

Conceal wiring in street-lighting standards and luminaires. Install clamping band to completely seal the joint between reflector and refractor against moisture, dirt, and insects.

]3.2 FIELD QUALITY CONTROL

3.2.1 Tests

Perform Operational Tests in accordance with referenced standards within this section[, in the presence of the Contracting Officer].

Perform demonstration to verify street lighting operates satisfactorily in the presence of the Contracting Officer, after sunset.

3.3 CLOSEOUT ACTIVITIES

No less than [30] days prior to project close out, submit the fixtures warranty to the Contracting Officer.

-- End of Section --