GUAM POWER AUTHORITY
P.O. BOX 2977
AGANA, GUAM 96932

TRANSMISSION & DISTRIBUTION SPECIFICATION

SPECIFICATION NO. E-043

FOR

LIGHT EMMITTING DIODE (LED) STREET LIGHT LUMINAIRES

EFFECTIVE DATE: 11/4/24	ISSUED: GENERAL MANAGER	APPROVED:

LIGHT EMMITTING DIODE (LED) STREET LIGHT LUMINAIRES

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1.0 SCOPE

1.1 This specification covers GPA requirements for Network Lighting Controls, the Central Management System (Streetlight Monitoring Software), and Light Emitting Diode (LED) streetlight luminaires used to replace the existing High Pressure Sodium (HPS) lights for street lighting and private outdoor lighting.

1.2 The streetlights are intended for use in tropical weather conditions with a corrosive sea air atmosphere and subject to moderate to severe earthquakes.

2.0 APPLICABLE PUBLICATIONS

The equipment covered by this specification shall be designed, manufactured, assembled, and tested in accordance with the standards listed below:

2.1 IESNA (ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA)

LM-63-02 ANSI APPROVED STANDARD FILE FORMAT FOR ELECTRONIC TRANSFER OF PHOTOMETRIC DATA AND RELATED INFORMATION

LM-79-08 APPROVED METHOD FOR ELECTRICAL AND PHOTOMETRIC MEASUREMENTS OF SOLID STATE LIGHTING PRODUCTS

LM-80-08 APPROVED METHOD FOR MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

2.2 ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

C78.377 SPECIFICATIONS FOR THE CHROMATICITY OF SOLID STATE LIGHTING PRODUCTS

C82.SSL1 POWER SUPPLY

C82.77 HARMONIC EMISSION LIMITS – RELATED POWER QUALITY

C136.31-2010 FOR ROADWAY AND AREA LIGHTING EQUIPMENT – LUMINAIRE VIBRATION

C136.41 STANDARD RECEPTACLE

2.3 UL (UNDERWRITERS LABORATORIES) – Luminaires must be UL Listed. Vendor at time of bid must submit a copy of UL Certification.

UL 773 THE STANDARD FOR PLUG-IN TYPE PHOTOCONTROLS

UL 1598 THE STANDARD FOR SAFETY OF LUMINAIRES

UL 8750 THE STANDARD FOR SAFETY OF LIGHT EMITTING DIODE (LED) EQUIPMENT FOR USE IN LIGHTING PRODUCTS

2.4 IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

60929 AC AND/OR DC-SUPPLIED ELECTRONIC CONTROL GEAR FOR TUBULARFLUORESCENT LAMPS

62386 DIGITAL ADDRESSABLE LIGHTING INTERFACE

3.0 DEVIATIONS AND NON-CONFORMANCE REQUIREMENTS

3.1 All deviations from this specification must be specified in writing by the vendor and submitted as part of their bid submittal prior to bid opening. Failure to provide this information may be grounds for immediate bid rejection.

3.2 Deviations from this specification or changes in the material or design after the purchase order has been placed must be approved by the GPA Engineering department and acknowledged by a Purchase Order Amendment issued by GPA.

3.3 Units received with deviations or non-conformances that are not acknowledged per Section 3.1 are subject to rejection. The Supplier of rejected units is responsible for any corrective action including but not limited to materials, labor and transportation necessary to dispose of or make the units conform to the specification.

3.4 Notification of defective units discovered before or after installation that are believed to be inherent to manufacturing problems or workmanship shall be made and forwarded to the Supplier. The description of the item, documentation of the problem and the described information, disposition and/or follow-up (as appropriate) that GPA expects from the Supplier will be specified. The Supplier's response shall be made within thirty (30) days unless an extension is acknowledged and approved in writing by the GPA Manager of Engineering.

4.0 RATINGS

4.1 All photometric data must be collected via absolute photometry which tests the LED light when installed in the applicable luminaire. Ratings of the LED light shall be as specified in Table 1. Appendices A and B shall follow the requirements stated in Table 1.

Table 1. LED Ratings

	150W HPS Replacement LED	250W HPS Replacement LED
Input Voltage	120V	120V
Nominal Rating (Light + driver)	70 W max	100 W max
Burning Position	Horizontal	Horizontal
Off-state power	Zero	Zero
Power Factor	>0.9	>0.9
THD	<20%	<20%
Initial Lumens	6,400 lm min. at CCT	10,000 lm min. at CCT
CCT	3000K to 4000K	3000K to 4000K
CRI	> 70	> 70
Lamp Lumens per Watt	> 100 lm/W	> 100 lm/W
IES Classification	Type II, III or equivalent	Type II, III or equivalent
Shielding	Non-shielded	Non-shielded
Rated Life for outdoor temp of 25° C	50,000 Hours min.	50,000 Hours min.
Weight	<22 lbs	<22 lbs

5.0 REQUIRED DOCUMENTS

The required documents stated in this section are outlined in Appendices A and B for the respective lights. Appendices A and B must be filled out appropriately. Failure to do so may result in the disqualification of the proposed luminaires.

5.1 Luminaires must come with wiring diagrams and all necessary equipment and hardware for installation. Diagrams must show connection to terminal block. A picture of the luminaire showing the internal wire connections should be provided as well.

5.2 Streetlights must already be in production and not a prototype model. The vendor must submit documentation indicating production history.

5.3 The vendor shall furnish completed Appendices A and B as applicable providing manufacturer information, electrical information, photometric information, weight, and dimensions. The information provided in the appendices must be specific to the model proposed.

5.4 The vendor shall provide an LM-79-08 report.

5.5 The vendor shall provide certified laboratory test results to determine LED Streetlight nominal ratings and photometric data. The test reports shall be certified as true and correct by an independent testing firm and submitted to the Guam Power Authority prior to shipment of LED streetlights.

5.6 Provide isometric plots for each luminaire at 25 foot and 30 foot mounting heights similar to Figure 1 below.

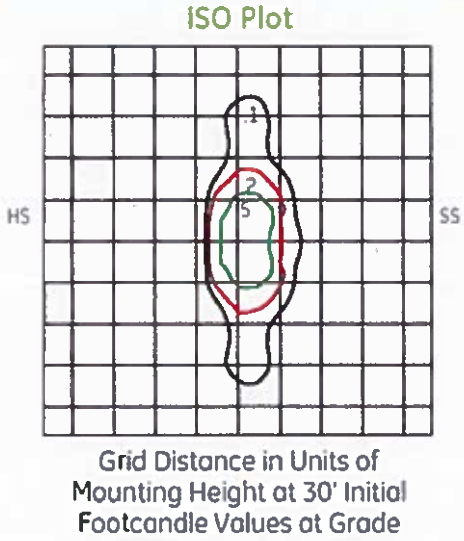

Figure 1. Isometric Plot

6.0 COST EVALUATION

6.1 During the bid evaluations, GPA will conduct a Cost evaluation to determine the equivalent cost for owning and operating the LED streetlight. The LED streetlight nominal power rating for the specified make, model, CCT, drive current, and IES classification will be utilized to calculate a projected GPA Total Cost of Ownership (TOC). The calculation is as follows:

Total Life Energy Cost	=	50,000 hours	x	*Energy Charge ($/kWh)	x	Nominal Power Rating (kW)

Total Cost of Ownership (TOC)	=	Initial Purchase Price	+	Total Life Energy Cost

*Note: As of October 1, 2015, the Energy Charge for GPA Rate Schedule "H" is $0.10784 per kWh. The Energy Charge will change as approved by the PUC.

6.2 The LED Streetlight with the lowest Total Cost of Ownership (TOC) shall be considered the lowest bid.

6.3 GPA will review actual certified test reports of nominal ratings and photometric data.

6.4 GPA will test streetlights upon delivery to GPA for verification of nominal power ratings. In the event actual power ratings are greater than specified during the bid, GPA may reject the LED Streetlights or reduce the supplier's contract amount. The price reduction shall be the difference between the TOC using the tested power rating and the TOC as calculated during the bid.

6.5 A Band of Equivalence method will be used when evaluating the total cost for owning and operating each LED streetlight. LED Streetlights with a TOC that is within 5% of the LED streetlight with the lowest TOC will be considered equivalent. The LED streetlight with the lowest purchase price within this band shall be considered the lowest bid.

7.0 NAMEPLATE AND EXTERIOR WATTAGE LABEL

The manufacturer shall furnish with each luminaire a nameplate attached to the light. The nameplate shall include the following data:

a. Manufacturer's name
b. Catalog number
c. Lamp Type
d. Wattage
e. Voltage
f. Frequency
g. Connection diagram
h. Serial number – The serial number shall be specified in the as P.O. # - manufacturer #. Example: (Serial number: 27567-12345678)

Each light shall come with an exterior wattage label showing the light type i.e. "LED100". The wattage shown shall be based on the total power of the luminaire, LED plus driver.

8.0 COMPATIBILITY AND INSTALLATION

8.1 Luminaires shall be compatible with the existing NEMA standard 7-terminal twist lock type network lighting control device.

8.2 The Luminaire mounting bolts and tilt adjustment mechanism must be easily accessible. Full vertical clearance is necessary to allow the use of an impact gun.

8.3 Tilt adjustment mechanism must provide a minimum +/- 5 degree adjustment for leveling.

8.4 Luminaires must be compatible with 1-1/4" I.P.S (1-5/8" O.D.) to 2" O.D. mast arms.

8.5 The luminaire shall provide an effective method of preventing bird entrance to the luminaire.

8.6 Terminal blocks shall accept a two (2) wire 120VAC input ranging from #14 awg to #10 awg.

8.7 Terminal blocks shall accept no smaller than a #2 screwdriver.

8.8 Installation of the luminaire shall only require the use of a screwdriver and standard hex head sockets.

8.9 Termination of the light shall not require splicing and/or the use of wire nuts.

8.10 Terminations must be made on a terminal block in the luminaire. GPA's booms are pre-wired with #12 wires coming out of the boom.

9.0 NETWORKED LIGHTING CONTROL (NLC) AND STREETLIGHT MONITORING

9.1 The NLC shall be rated for voltages from 120 – 277 Volts.

9.2 The NLC shall have a maximum load rating of 6 amps.

9.3 The NLC shall be compatible with LED and HPS load types. Luminaire must be equipped with ANSI C136.41 standard receptacle.

9.4 The receptacle connection for the twist lock external NLC unit shall include rigid weatherproof electrical and mechanical connection.

9.5 The external NLC shall be an EEI-NEMA standard seven-terminal, polarized, twist lock type.

9.6 The NLC shall have a dimming protocol that complies with 0 – 10V (IEC 60929) and DALI (IEC62386) and be over the air (OTA) configurable.

9.7 The NLC's dimming method shall be power based and utilize continuous power feedback to eliminate driver dimming curve variability.

9.8 The NLC shall have a dimming ramping process in gradual steps every 6 seconds. (e.g. 100% to 20% = 102 seconds)

9.9 The NLC's dimming schedule shall be daily or weekly recurring with the ability to schedule a special event, in 1 minute increments with 1% resolution and be over the air configurable.

9.10 The NLC shall have offline storage that maintains time, day light savings, schedule, configuration parameters, accumulated energy and lamp on-time indefinitely if power is lost. Offline storage shall last for a minimum of 10 days.

9.11 The NLC shall sync to GPS time and continue to operate previously saved schedule if communication is lost and will automatically upload saved data to CMS when power is restored.

9.12 The NLC shall have on board technology for Supply Loss messaging.

9.13 The NLC shall have on board technology that can diagnose the health of the LED luminaire and provide this information main base of operations.

9.14 The NLC shall have onboard GPS with 3 meter accuracy to support automatic discovery of controllers.

9.15 The NLC's photo sensor is for local light detection; with GPS based astronomical Dawn/Dusk back up. The Dusk/ Dawn levels are 2.5 foot-candles (fc) for On and 3.9 foot-candles (fc) for Off. These shall be over the air configurable.

9.16 The NLC shall be compatible with the GPA's GridStream network, Landis + Gyr Command Center 7.1 MR3 or larger and Landis + Gyr Street Light management software.

10.0 STREETLIGHT MANAGEMENT SOFTWARE

The Supplier shall provide a Streetlight Management Software that is compatible with the Networked Lighting Control and GPA's Command Center Network. The Software must also meet the requirements listed in Appendix D.

11.0 TRAINING AND IMPLEMENTATION SERVICES

The Supplier shall provide implementation services and proper training upon purchase of the Streetlight Management Software. Training shall be provided prior to turnover of the Central Management System to GPA.

12.0 QUALITY CONTROL

12.1 The Supplier shall have a quality control program to ensure compliance with the requirements of this specification. The program shall be documented and available for GPA's review if requested.

12.2 Documentation of the quality control program shall indicate where in the production and manufacturing process the quality checks are taken, describe the purpose of the checks, and describe the nature of the check, e.g. if check is visual only or if electrical or mechanical testing is used.

13.0 WARRANTY

All products shall come with a minimum five (5) year warranty on all parts and labor associated with the product. At time of bid, Vendor shall submit with his/her bid the contact information for warranty implementation complete with a copy of any forms required to fulfill warranty requirements.

14.0 PACKING AND SHIPPING

14.1 The equipment shall be placed and crated with suitable material to prevent damage and injury during shipment and handling operations.

14.2 The equipment shall be securely blocked to prevent shifting during transit.

14.3 Instructions for handling, shipping, packaging, and storing shall be provided by the manufacturer to prevent damage, loss, deterioration, and substitution of the luminaires.

Appendix A

150 Watt HPS replacement LED Streetlight Luminaire Information Sheet

NOTE: Please complete the product information and provide the required documents. Incomplete information shall be cause for rejection.

	Product Information		
1.	NEMA Standard 7-terminal twist lock type NLC receptacle or NLC supplied with light that is covered with the luminaire warranty.	Yes	No
2.	Mounting, Horizontal Tenon, 1-1/4"I.P.S (1-5/8" O.D.) to 2" O.D. I.P.S. pipe	Yes	No
3.	Voltage (120VAC)	Yes	No
4.	Frequency (60Hz)	Yes	No
5.	UL Listed	Yes	No
6.	Manufacturer's Name		
7.	Brand Name		
8.	**Model #** (Full detail with numbering logic sheet)		
9.	Weight (<22lbs)		
10.	Luminaire Wattage to include driver (<70W)		
11.	Luminaire leveling adjustment (degrees)		
12.	Initial Lumens (>6,400 lm)		
13.	Drive Current		
14.	Light Distribution		
15.	Correlated Color Temperature (CCT)		
16.	Color Rendering Index (CRI)		
17.	Specify tools required for entry; type and size		
18.	Specify tools require for mounting; type and size		
19.	Specify tools required for termination of wires; type and size		
20.	Applicable Accessories & Description (Provide Attachment if more space is needed)		

	Required Documents		
1.	Product Literature (Product sheet for only the specified luminaires showing the electrical, photometric, and physical characteristics of only the light specified in this appendix.)	Yes	No
2.	Warranty	Yes	No
3.	Isometric plots at 25 foot and 30 foot mounting heights as specified in section 5.7.	Yes	No
4.	Certified Laboratory Test Results of Nominal Ratings and Photometric Data	Yes	No
5.	Statement of compliance to current GPA Spec E-043	Yes	No

Appendix B

250 Watt HPS replacement LED Streetlight Luminaire Information Sheet

NOTE: Please complete the product information and provide the required documents. Incomplete information shall be cause for rejection.

	Product Information		
1.	NEMA Standard 7-terminal twist lock type NLC receptacle or NLC supplied with light that is covered with the luminaire warranty.	Yes	No
2.	Mounting, Horizontal Tenon, 1-1/4"I.P.S (1-5/8" O.D.) to 2" O.D. I.P.S. pipe	Yes	No
3.	Voltage (120VAC)	Yes	No
4.	Frequency (60Hz)	Yes	No
5.	UL Listed	Yes	No
6.	Manufacturer's Name		
7.	Brand Name		
8.	**Model #** (Full detail with numbering logic sheet)		
9.	Weight (<22lbs)		
10.	Luminaire Wattage to include driver (<100W)		
11.	Luminaire leveling adjustment (degrees)		
12.	Initial Lumens (>10,000 lm)		
13.	Drive Current		
14.	Light Distribution		
15.	Correlated Color Temperature (CCT)		
16.	Color Rendering Index (CRI)		
17.	Specify tools required for entry; type and size		
18.	Specify tools require for mounting; type and size		
19.	Specify tools required for termination of wires; type and size		
20.	Applicable Accessories & Description (Provide Attachment if more space is needed)		

	Required Documents		
1.	Product Literature (Product sheet for only the specified luminaires showing the electrical, photometric, and physical characteristics of only the light specified in this appendix.)	Yes	No
2.	Warranty	Yes	No
3.	Isometric plots at 25 foot and 30 foot mounting heights as specified in section 5.7.	Yes	No
4.	Certified Laboratory Test Results of Nominal Ratings and Photometric Data	Yes	No
5.	Statement of compliance to current GPA Spec E-043	Yes	No

Appendix C

Networked Lighting Control and Streetlight Monitoring Information Sheet

NOTE: Please complete the product information and provide the required documents. Incomplete information shall be cause for rejection.

	Product Information		
1.	Voltage (120 – 277 Volts)	Yes	No
2.	Maximum Load Rating (6 amps)	Yes	No
3.	Compatible with LED and HPS load types	Yes	No
4.	NEMA Standard 7-terminal, polarized, twist lock type	Yes	No
5.	Dimming protocol compliant	Yes	No
6.	Supply Loss Messaging	Yes	No
7.	Compatibility with Landis + Gyr network, Command Center 7.1 MR3 or lager and Street Light management software	Yes	No
8.	Dimming method		
9.	Dimming Ramping Process		
10.	Dimming Schedule		
11.	Offline Storage features		
12.	Luminaire Health Monitoring		
13.	Onboard GPS features		
14.	Photo Sensor features		
18.			
19.			
20.			

	Required Documents		
1.	Product Literature (Product sheet for only the specified luminaires showing the electrical, photometric, and physical characteristics of only the light specified in this appendix.)	Yes	No
2.	Warranty	Yes	No
3.	Certified Laboratory Test Results	Yes	No
4.	Statement of compliance to current GPA Spec E-043	Yes	No

Appendix D

Central Management System (Street Light Management Software) Requirements

1.1 CMS FEATURE REQUIREMENTS

A. The Vendor shall disclose what features and functions are provided via a Graphical User Interface (GUI).
B. The Vendor shall disclose what features and functions are provided via a report or other mechanism.
C. The Vendor shall provide sample screen images of each GUI page or section.
D. The Vendor shall provide sample screen images depicting the following features and functions, as applicable:
    1. Map Data
    2. Satellite Image Data
    3. NLC location (i.e. GPS Lat/Long)
    4. NLC equipment type (i.e. NLC model, NLC serial number, luminaire type, sensor type)
    5. NLC and Gateway status (i.e. online, online reporting error, offline)
    6. System energy consumption (Daily over last prescribed time period – e.g. Daily for last 7 days)
E. The Central Management System shall be accessible to individual users only by username and password.
F. The Central Management System shall be capable of restricting user access to specific functions. At a minimum, these functions shall include the following:
    1. Creating and managing users and groups
    2. Configuration
    3. Monitoring
    4. Control
G. All asset data shall be stored on the Central Management System.
H. The Central Management System shall be capable of storing the following asset information for all NLCs:
    1. Pole number
    2. Pole type
    3. Pole GPS location
    4. Pole grouping
    5. Luminaire nominal input voltage
    6. Luminaire power requirement (wattage)
    7. Luminaire Target Power control (wattage) in the event user want the target operating power to be different than the luminaire wattage
    8. Luminaire installation date

9. Luminaire)
10. Utility billing account number

I. The Central Management System shall be capable of RETRIEVING and STORING all remote monitoring data.

1.2 LOGICAL FEATURES AND REQUIREMENTS

A. The Central Management System shall ensure secure communication between itself and all NLC by logically enabling security features inherent to the underlying communications protocols.
B. The Central Management System shall be capable of detecting communication failures between NLC and the Central Management System.
C. NLC firmware upgrades shall be deliverable over the Backhaul Communication Network.
D. The Central Management System shall be capable of remotely monitoring NLC performance, in order to identify and report any exception to normal NLC operation.

1.3 FUNCTIONAL FEATURES AND REQUIREMENTS

A. The Central Management System shall be capable of RETRIEVING and STORING the following online NLC parameters:
   1. NLC status (Online, Offline, Warnings, Errors)
   2. Luminaire status (ON, OFF, Dimmed State, Warnings, Errors)
   3. Input voltage (RMS) in ON state
   4. Input current (mA) in ON state
   5. Input true power (W) in ON state
   6. Input power factor in ON state
   7. Cumulative ON state time (minutes)
   8. Cumulative energy consumption (kWh)
   9. Load profile energy consumption with a user defined interval of 5, 15, or 60 minutes
B. The Central Management System shall be capable of programming the Reporting Frequency of online NLC parameters for ALL NLCs.
C. The Central Management System shall be capable of defining Luminaire groups.
D. The Central Management System shall be capable of Manual Control, whereby the ON/OFF and DIMMED state of a single Luminaire or group of Luminaires is modified in response to commands created by the Central Management System.
E. The Central Management System shall be capable of creating programs for Scheduled Control, whereby the ON/OFF and DIMMED state of a single Luminaire or a group of Luminaires is modified according to a predefined schedule.

F. The Central Management System shall be capable of creating programs for Scheduled Control containing a minimum of 8 times/events per day).
G. The Central Management System shall be capable of creating programs for Scheduled Control that is either time-based, whereby NLCs modify Luminaire operation when a specific time in the schedule occurs, or event-based, whereby NLCs modify Luminaire operation when the next event in the schedule occurs.
H. The Central Management System shall be capable of creating programs for time-based Scheduled Control that are defined on a weekly recurring basis.
I. The Central Management System shall be capable of creating programs for event-based Scheduled Control that are defined according to inputs from sensors or commands from the Central Management System.
J. The Central Management System shall be capable of creating programs for Dynamic Control, whereby the ON/OFF and DIMMED state of a single Luminaire or a group of Luminaires is modified in response to dynamic inputs from sensors or commands from the Central Management System.
K. The Central Management System shall be capable of creating commands and programs for True Input Power Control, whereby the Luminaire DIMMED state is actuated to achieve to a desired true input power (percent relative watts).
L. The Central Management System shall be capable of creating commands and programs to select the dimming protocol (eg. DALI, 1-10V etc.) of the network lighting NLC.
M. The Central Management System shall be capable of creating commands and programs for Targeted Input Power Control, whereby the Luminaire DIMMED state is actuated to achieve to a desired true input power (watts) without the user having to understand or compensate for manufacturer-specific driver dimming curve across deployed luminaires.
N. The Central Management System shall be capable of creating commands and programs for Constant Light Output Control, whereby the Luminaire DIMMED state is automatically actuated to achieve a maintained constant light output (lumens) over time by compensating for Luminaire lumen depreciation without the user having to manually adjust CLO settings over the life of the luminaire.
O. The Central Management System shall be capable of creating programs for ensuring that a maximum Luminaire true input power (watts) is never exceeded.
P. The Central Management System shall be capable of creating pre-defined asset reports.
Q. The Central Management System shall be capable of comparing all reported NLC parameters with optional pre-defined maximum and minimum thresholds, and generating error messages in real-time (based on reported data availability) for any condition that violates a specified threshold a specified number (1 or more) of times.
R. The Central Management System shall be capable of creating Remote Monitoring reports based on a schedule.

S. The Central Management System shall be capable of creating pre-defined Remote Monitoring reports containing:
   1. Instances of communication loss between NLC and the Central Management System
   2. NLCs with error conditions sorted by error type
   3. Energy Consumption Data for individual Luminaires and/or groups of Luminaires

T. The Central Management System shall be capable generating Notifications, whereby specified Remote Monitoring reports are sent to assigned users and/or user groups via email