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STREET LIGHTING SYSTEM DESIGN AND CONSTRUCTION MANUAL

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01	09/08/2021	Revision – Streetlight Program	LUMA-DS-DST-003-R01
02	06/09/2023	Revision – Distribution Standards	4401.001
03	10/09/2023	Revision – Distribution Standards	4401.001

STREET LIGHTING SYSTEM DESIGN AND CONSTRUCTION MANUAL REVISION LOG V03 - OCTOBER 9, 2010

Standard No.	Document No.	Previous Approval Date	Previous Version	Current Approval Date	Current Version	Changes
Theory	---	6/16/23	2	8/30/23	3	Modifications in different sections to resolve issues commented and recommended by legal and regulatory areas.
STL-1	4401.002	6/6/23	3	8/24/23	4	Modification in notes 6 and 10 to clarify materials and connections. Modifications in bill of materials.
STL-4	4401.007	6/5/2023	3	8/24/23	4	Modification in notes 6 and 10 to clarify materials and connections. Modifications in bill of materials.
STL-6	4401.011	6/8/23	3	8/24/23	4	Modification in notes 6 and 10 to clarify materials and connections. Modifications in bill of materials.
STL-10	4401.021	6/6/23	3	8/24/23	4	Modifications in drawings to add protection devices. Modifications in notes 3, 5 and 8 to add information and clarify materials. Modifications in bill of materials.
STL-11	4401.023	6/6/23	3	8/24/23	4	Modifications in notes 3 and 8 to add and clarify materials. Modifications in bill of materials.
STL-14	4401.036	6/5/23	3	8/24/23	4	Modifications in note 6 to clarify materials. Modification of bill of materials.
STL-16	4401.038	6/5/23	3	8/24/23	4	Modifications in backfill material in drawings.

STREET LIGHTING SYSTEM DESIGN AND CONSTRUCTION MANUAL REVISION LOG V02 – JUNE 16, 2023

Standard No.	Document No.	Previous Approval Date	Previous Version	Current Approval Date	Current Version	Changes
STL-1	4401.002	--	2	6/6/23	3	Merge of the following standards: STL-1, A-STL-1, STL-2, STL-9B and STL-21. Addition of a 12" x 12" service pedestal and PVC ducts. Modification to drawing to show grounding rod and fuse installation at service pedestal. A 2' tolerance was included for the installation height of the luminaire with respect to the final level of the street. Addition of arm connections details for different arm configurations. Addition of option to use 125 W luminaire as per design requirements. Revision of installation notes and bill of materials.
A-STL-1	4401.003	--	2	--	--	Merged with standard no. STL-1.
STL-2	4401.004	--	2	--	--	Merged with standard no. STL-1.
STL-3	4401.005	--	2	--	--	Standard no. STL-3 was removed because the 30’ pole is no longer in use.
A-STL-3	4401.006	--	2	--	--	Standard no. A-STL-3 was removed because the 30’ pole is no longer in use.
STL-4	4401.007	--	2	6/5/23	3	Merge of the following standards: STL-4, A-STL-4, STL-5, A-STL-5, STL-9B, STL-9C, A-STL-9C and STL-21. Addition of a 12" x 12" service pedestal and PVC ducts. Modification to drawing to show grounding rod and fuse installation at service pedestal. A 2' tolerance was included for the installation height of the luminaire with respect to the final level of the street. Addition of arm connections details for different arm configurations. Revision of installation notes and bill of materials.
A-STL-4	4401.008	--	2	--	--	Merged with standard no. STL-4.
STL-5	4401.009	--	2	--	--	Merged with standard no. STL-4.
A-STL-5	4401.010	--	2	--	--	Merged with standard no. STL-4.

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STL-6	4401.011	--	2	6/8/23	3	Merge of the following standards: STL-6, A-STL-6, STL-7, A-STL-7, STL-9B, STL-9C, A-STL-9C and STL-21. Addition of a 12" x 12" service pedestal and PVC ducts. Modification to drawing to show grounding rod and fuse installation at service pedestal. A 2' tolerance was included for the installation height of the luminaire with respect to the final level of the street. Addition of arm connections details for different arm configurations. Revision of installation notes and bill of materials.
A-STL-6	4401.012	--	2	--	--	Merged with standard no. STL-6.
STL-7	4401.013	--	2	--	--	Merged with standard no. STL-6.
A-STL-7	4401.014	--	2	--	--	Merged with standard no. STL-6.
STL-9A	4401.018	--	2	--	--	Standard no. STL-9A was removed because the breakaway coupling is no longer in use.
STL-9B	4401.019	--	2	--	--	Merged with standards no. STL-1, STL-4 and STL-6.
STL-9C	4401.020	--	2	--	--	Merged with standards no. STL-4 and STL-6.
A-STL-9C	4401.044	--	--	--	--	Merged with standards no. STL-4 and STL-6.
STL-10	4401.021	--	2	6/6/23	3	Merge of the following standards: STL-10, A-STL-10, STL-11A-1 and STL-11B-1. A 2' tolerance was included for the installation height of the luminaire with respect to the final level of the street. Addition of arm bracket installation details. Addition of option to use 125 W luminaire as per design requirements. Revision of installation notes and bill of materials.

STREET LIGHTING SYSTEM DESIGN AND CONSTRUCTION MANUAL REVISION LOG V02 – JUNE 16, 2023

Standard No.	Document No.	Previous Approval Date	Previous Version	Current Approval Date	Current Version	Changes
A-STL-10	4401.022	--	2	--	--	Merged with standard no. STL-10.
STL-11	4401.023	--	2	6/6/23	3	Merge of the following standards: STL-11, A-STL-11, STL-11A, A-STL-11A, STL-11A-1, STL-11B, A-STL-11B and STL-11B-1. Addition of a 12" x 12" service pedestal and PVC ducts. Modification to drawing to show fuse installation at service pedestal. A 2' tolerance was included for the installation height of the luminaire with respect to the final level of the street. Addition of arm bracket installation details. Revision of installation notes and bill of materials.
A-STL-11	4401.024	--	1	--	--	Merged with standard no. STL-11.
STL-11A	4401.025	--	1	--	--	Merged with standard no. STL-11.
A-STL-11A	4401.026	--	1	--	--	Merged with standard no. STL-11.
STL-11A-1	4401.027	--	1	--	--	Merged with standards no. STL-10 and STL-11.
STL-11B	4401.028	--	1	--	--	Merged with standard no. STL-11.
A-STL-11B	4401.029	--	1	--	--	Merged with standard no. STL-11.
STL-11B-1	4401.030	--	1	--	--	Merged with standards no. STL-10 and STL-11.
STL-14	4401.036	--	2	6/5/23	3	Merge of standards no. STL-14, STL-14-1 and A-STL-14-1. Addition of details for luminaire controller cabinet installation on pole. Revision of installation notes and bill of materials.
STL-14-1	4401.037	--	--	--	--	Merged with standard no. STL-14.
A-STL-14-1	4401.043	--	--	--	--	Merged with standard no. STL-14.
STL-16	4401.038	--	2	6/5/23	3	Merge of standards no. STL-16 and STL-17.

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Standard No.	Document No.	Previous Approval Date	Previous Version	Current Approval Date	Current Version	Changes
STL-17	4401.039	--	2	--	--	Merged with standard no. STL-16.
STL-18	4401.040	--	2	--	--	Diagrams were modified and included in the theory.
STL-19	4401.041	--	2	--	--	Diagrams were modified and included in the theory.
STL-20	4401.044	--	2	--	--	Diagrams were modified and included in the theory.
STL-21	4401.042	--	--	--	--	The information was included in standards no. STL-1, STL-4 and STL-6.
K-7	4301.092	12/20/21	3	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
K-7-1	4301.093	12/20/21	3	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
K-7-2	4301.094	12/20/21	3	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
K-7-3-1	4301.095	12/20/21	3	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
E-1-2-3	4301.083	12/20/21	3	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
E-2-1	4301.085	12/20/21	2	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
E-5	4301.086	12/20/21	2	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.

STREET LIGHTING SYSTEM DESIGN AND CONSTRUCTION MANUAL REVISION LOG V02 – JUNE 26, 2023

Standard No.	Document No.	Previous Approval Date	Previous Version	Current Approval Date	Current Version	Changes
F-1-3	4301.087	12/20/21	2	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
F-4-1	4301.089	12/20/21	2	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
F-4-2	4301.088	12/20/21	2	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
F5-1	4301.090	12/20/21	2	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.
F6-1	4301.091	12/20/21	2	--	--	Standard was removed from this Manual because it is part of the current Overhead Electrical Distribution System Manual.

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Acronyms and Abbreviations

Term	Definition
AA	Aluminum Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACT	Autoridad de Carreteras y Transportación (Highway and Transportation Authority)
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
BUG	Backlight, Uplight, and Glare
CCT	Correlated Color Temperature
CU	Utilization Coefficient
DRNA	Departamento de Recursos Naturales y Ambientales de Puerto Rico (Department of Natural and Environmental Resources)
DTOP	Departamento de Transportación y Obras Públicas (Department of Transportation and Public Works)
EPR	Ethylene Propylene Rubber
FD	Foot-candle design
FHWA	Federal Highway Administration
Gfc	Graphic Foot-candles
HPS	High-intensity Sodium Vapor
HS	House Side
ICT	Information and Communication Technologies
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society of North America
IL	Initial Lumens
JCA	Junta de Calidad Ambiental de Puerto Rico (Puerto Rico Environmental Quality Board) - This agency was consolidated with DRNA and ceased to exist.
JP	Junta de Planificación (Puerto Rico Planning Board)
kVA	Kilovolt Amperes
LCS	Luminaire Classification System

Term	Definition
LDD	Luminaire Dirt Depreciation Factor
LED	Light Emitting Diode
LF	Lamp Factor
LLD	Lamp Lumen Depreciation Factor
LLF	Light Loss Factor
LL	Luminaire Lumens
LUMA	LUMA Energy, LLC / LUMA Energy Servco, LLC
MF	Maintenance Factor
MH	Mounting Height
MHCF	Mounting Height Correction Factor
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NIST	National Institute of Standards and Technology
OGPe	Oficina de Gerencia de Permisos (Permits Management Office)
PLG	Public Lighting General rate
PPPE	Programa de Política Pública Energética (Energy Public Policy Program)
PREB	Puerto Rico Energy Bureau (Negociado de Energía de Puerto Rico)
PVC	Polyvinyl Chloride
SS	Street Side
STL	Street Lighting Standards
UBC	Uniform Building Code
UL	Utilized Lumens
W	Wattage
XLPE	Cross-linked Polyethylene

Definitions

Arrangement of the Lamps: Location of the luminaires; alternate or on one side of the roadway.

Coefficient of Utilization (CU): Ratio between the luminous flux (lumens) of a luminaire received on the road surface and that emitted directly by the luminaire.

Foot-Candle Design (FD): The average illumination level for the lighting system being designed.

Foot-Candles: A measurement of light intensity. One foot-candle is defined as enough light to saturate one square foot with one lumen of light.

Graphic Foot-candles (Gfc): Graphic foot-candles per 1,000 lumens.

House Side (HS): Illuminated section towards the back of the lamp, in the direction of the house.

Illumination Level: This is measured in foot-candles. Refers to the average lighting level required by design.

Initial Lumens (IL): Initial lamp lumens as set by the manufacturer.

Lamp Factor (LF): The ratio of the lumens specified by the manufacturer to the lumens of the test bulb.

Lamp Lumen Depreciation Factor (LLD): Factor used in lighting computations to relate the initial lamp illumination output with minimum anticipated output based on the lamp replacement program.

Light Emitting Diode (LED): A p-n junction semiconductor device that emits incoherent optical radiation when forward biased. The optical emission may be in the ultraviolet, visible, or infrared wavelength intervals.

Longitudinal Ratio: The distance along the street above the mounting height.

Luminaire Dirt Depreciation Factor (LDD): Reduction factor in lighting due to the accumulation of dirt in the luminaire refractor.

Luminaire: Device used to distribute, filter, or transform the light from the lamps, and which includes all the necessary parts to protect and connect the lamps to the power circuit.

Maintenance Factor (MF): Factor used to denote the rate of illumination in an area after a period of time and under conditions of temperature, voltage variation, accumulation of dirt, depreciation of the lamp, maintenance processes, and atmospheric conditions. LLD multiplied by LDD.

Mounting Height (MH): Vertical distance between the lamp and the pavement.

Mounting Height Correction Factor (MHCF): The correction factor used when the lamp height specified is different from the design criteria.

Overhang: Distance the lamp protrudes from the curb curve to the pavement.

Photo Control: Photosensitive device located in the upper part of the luminaire that translates the variations of incident light into corresponding variations (signals) of voltage or electrical currents. Its function is to turn on the luminaire at certain levels of light intensity.

Refractor: A glass apparatus used to modify the lumen flux distribution of a lamp using the process of refraction.

Spacing (S): Distance or separation between successive luminaires measured along the center line of the street.

Street Side (SS): Illuminated section from the luminaire to the other side of the street.

Transverse Ratio: The ratio of the transverse distance to the street or house over the mounting height.

Uniformity Ratio: The ratio of average illumination over minimum illumination.

Utilized Lumens (UL): Product of initial lumens by the coefficient of utilization.

Veiling luminance (Lv): A luminance superimposed on the retinal image which reduces its contrast. It is this veiling effect produced by bright sources or areas in the visual field that results in decreased visual performance and visibility.

Veiling Luminance Ratio: The IES method uses the maximum value of Veiling Luminance (Lv,max) divided by the Average Pavement Luminance (Lavg) as a measure of the disability glare produced by a lighting system.

PART I: OVERVIEW

1. Overview

1.1 LUMA's Authorities

Pursuant to the Puerto Rico Transmission and Distribution System Operation and Maintenance Agreement executed among LUMA Energy, LLC, LUMA Energy Servco, LLC (the latter two jointly "LUMA"), the Puerto Rico Electric Power Authority ("PREPA") and the Puerto Rico Public-Private Partnerships Authority dated as of June 22, 2020 ("T&D OMA"), LUMA is responsible, on behalf of or as agent of PREPA, for (i) providing management, operation, maintenance, repair, restoration and replacement and other related services for PREPA's transmission and distribution system and related facilities, equipment and other assets related to the transmission and distribution system ("T&D System"), in each case that are customary and appropriate for a utility transmission and distribution system service provider and (ii) establishing policies, programs and procedures with respect thereto (collectively, the "O&M Services"). LUMA is entitled to exercise all the rights and perform the responsibilities of PREPA in providing the O&M Services and have the autonomy and responsibility to operate and maintain the T&D System and establish the related plans, policies, procedures and programs with respect thereto. As part of the O&M Services, LUMA is responsible for all engineering activities related to the operation of the T&D System, including, analyses related to, and maintenance of records and standards for design and engineering, design standards, construction standards, system performance, system reliability, equipment ratings, and the improvement of existing, or development of additional/new, and the on-going maintenance of revisions to, all T&D System drawings, specifications, construction manuals, equipment diagrams and other technical documentation. Pursuant to these rights and responsibilities, LUMA has developed this "Street Lighting System Design and Construction Manual" (this Manual). This Manual supersedes any other technical documents or manuals issued by PREPA or LUMA prior to the effective date of this document. All actions taken by LUMA described in this document are taken on behalf of or as agent of PREPA pursuant to the T&D OMA.

1.2 Purpose

The purpose of this Manual is to provide updated requirements for the design and construction of the Street Lighting System (as defined in Section 1.4) as part of the effort to improve the resilience and to modernize the Puerto Rico electrical system.

1.3 Scope

This Manual establishes the requirements and methods for the design of street lighting systems and associated calculation prior to installation or replacement, as well as the construction of these systems, including the specific requirements for the system layout, geometry, and mounting, based on the required road and zone illumination levels and luminaire characteristics. Additionally, this Manual describes the street lighting design approval process and requirements.

1.4 Applicability

The requirements of this Manual apply to any street lighting system owned by PREPA or to be transferred to PREPA ("Street Lighting System"), except for Sections 2.2, 2.3 and 2.4, which apply to any other street lighting system to be connected to the PREPA T&D System. These systems are generally found in the following applications:

- In main streets, highways, and roadways that will benefit from the artificial lighting
- In areas where street lighting is required according to the guidelines and requirements of the JP and the OGPe
- In all projects that have associated street lighting requirements
- In those projects where it is safer, cheaper, more advantageous, or more aesthetically pleasing to use street lighting

Accordingly, this Manual applies to PREPA, LUMA and their contractors and any third parties that design or build a Street Lighting System with respect to such Street Lighting System. Special written approval from LUMA must be obtained for exceptions or deviations from the requirements in this Manual, set forth in Section 2.

1.5 Effectiveness

The requirements of this Manual will be effective as of the date of its publication for all new designs submitted for endorsement commencing on that date.

PART II: APPROVAL PROCESS AND GENERAL REQUIREMENTS

2. Procedure for Submitting Designs for Approval

All projects for new Street Lighting Systems or retrofit of existing Street Lighting Systems shall be first submitted for PPPE's approval with a descriptive memorandum of the project, the equipment to be used, and the luminaires' site plan. The PPPE will carry out the pertinent evaluation and determine whether to approve the transfer to PREPA of the new project (See Section 3).

All projects for new Street Lighting Systems or retrofits of existing Street Lighting Systems must be submitted to OGPe for LUMA's endorsement with a report attesting the compliance with the requirements of this Manual, Technical Bulletins in force and a certification of approval issued by the PPPE. As part of LUMA's evaluation of a project, LUMA reserves the right to require modifications or impose additional requirements or conditions, to ensure compliance with this Manual and other applicable laws, regulations, codes or standards. Any request for written approval of an exception or deviation to the standards or requirements in this Manual shall be submitted to the corresponding LUMA regional Distribution Engineering Department. The applicant will be required to follow the process established by LUMA for evaluation, endorsement, documentation, and inspection of projects.

2.1 Street Lighting Systems Transferred to PREPA

LUMA (on behalf of PREPA) will only accept the transfer of Street Lighting Systems to PREPA that are designed, specified, and built according to the requirements and standards set forth in this Manual. In addition, to accept the transfer to PREPA of a system, it must comply with the following:

- All materials and equipment installed as part of these systems must be:
  - LUMA approved
  - Coded in LUMA's materials list
- If any material or equipment does not meet the foregoing specifications, the approval of these changes must be requested from LUMA's Standards and Materials Department.
- Those Street Lighting Systems that are connected to the electrical distribution system of the project area do not require a meter for billing the electrical energy that the system consumes. The consumption of these systems will be billed to all customers in accordance with the applicable PREB approved rates.
- The design plans must specify the different components of the Street Lighting Systems.
- LUMA (on behalf of PREPA) will not accept the transfer to PREPA of special street lighting systems (as defined in Section 2.2).

2.2 Special Street Lighting Systems

Special street lighting systems are those that are not owned and will not be transferred to PREPA, that propose luminaires, poles, equipment, or accessories different from those that LUMA (on behalf of PREPA) acquires to install in PREPA's system, such as lampposts and ornamental posts, which are not specified in this Manual, and those systems whose integration into the Street Lighting System is not approved by PPPE.

- This special street lighting system is not transferred to PREPA but belongs to the owner of the project, be it the ACT or other government entity, the Municipality, an association of residents, a council of owners, or any other natural or legal person. These types of systems are considered private, but they are built for public service.
- The project owner is responsible for the operation, maintenance, and replacement of the components of the street lighting system from the delivery point.
- The installation of this type of street lighting system is not allowed on PREPA poles and structures of power lines.
- This type of street lighting system is generally connected to the electrical distribution system of the project and requires the installation of a meter to measure the electrical energy consumption for invoicing by LUMA. The meter installation shall comply with the applicable LUMA standards and requirements.
- In projects where it is impossible to install a meter, such as in the case of residential developments, the electrical energy is billed in accordance with the PLG tariff based on estimated consumption of kWh, which does not include the costs of operating, maintaining, or replacing the components of this system. In these cases, the delivery point of each lighting circuit or luminaire is the nearest transformer, distribution pole, or service pedestal.
- The project designer shall specify in the design plans the different components of the street lighting system and the provisions for measuring equipment at the delivery point defined by LUMA in the project evaluation letter.
- Conduits for the special street lighting system cannot be installed in the same trench as the PREPA conduits. They shall be separated from PREPA's conduits by a horizontal distance of 13".
- For luminaires requested by a customer to be installed on existing PREPA distribution poles, the customer will be charged a monthly fee for this service. Refer to current LUMA's Customer Experience Manual for applicable rate. LUMA provides the material, installation, operation, and maintenance for these luminaires.

2.3 Solar Street Lighting Systems

The design of solar luminaires with new technology allows the construction of an efficient lighting system. LUMA's conditions for installation of solar lights on roads, avenues, streets, etc. are the following:

- Installation of solar luminaires is not allowed on PREPA poles.
- The owner of the project is responsible for the cost of materials, equipment, and installation of the solar street lighting system.
- The owner of the project is responsible for the maintenance, operation, and replacement of the solar street lighting system.
- Solar street lighting systems will not be transferred to PREPA.
- The design of the solar street lighting system must comply with the following:
  - *Reglamento de Ordenación de la Infraestructura en el Espacio Público* (Planning Board Regulation No. 22 – Regulation 4861) from the JP, as may be amended or superseded.
  - Lighting design standards and criteria in effect established by IES.

- Applicable laws, regulations, and codes in effect at the time of installation as per the terms of effectiveness or applicability such laws, regulations or codes, including the specific municipal codes or ordinances.

2.4 Smart Street Lighting Systems

Smart street lighting systems comprehend the use of ICT based technologies and solutions to control, manage consumption, identify failures, improve the operation, extend equipment life, and reduce maintenance of the smart street lighting systems. LUMA's conditions for installation of private smart lighting systems are the following:

- Installation of smart street lighting system is not allowed on PREPA poles. The owner of the project is responsible for the cost of materials, equipment, and installation of the smart street lighting system.
- The owner of the project is responsible for the maintenance, operation, and replacement of the smart street lighting system.
- Smart street lighting systems will not be transferred to PREPA.
- Cybersecurity, privacy, and data governance best practices should be followed by all smart street lighting systems, particularly NIST Cybersecurity and Privacy Frameworks.
- The design of the smart street lighting system must comply with the following:
  - *Reglamento de Ordenación de la Infraestructura en el Espacio Público* (Planning Board Regulation No. 22 – Regulation 4861) from the JP, as may be amended or superseded.
  - Lighting design standards and criteria in effect established by the IES.
  - Applicable laws, regulations, and codes, including the specific municipal codes or ordinances.

3. General Requirements

New Street Lighting System projects or retrofits of existing Street Lighting Systems must comply with the requirements of this Manual and comply with the applicable standards, codes, and regulations in force. The street lighting design and calculations shall be submitted to the OGPe in the form of a report indicating accordance with LUMA standards, considering:

- Road classification recommended illuminance levels
- Intersections and pedestrian conflict areas recommended illuminance levels
- Requirements established in the R*eglamento para el Control y Prevención de la Contaminación Lumínica* (Regulation 8493) of the JCA (now administered by DRNA), as may be amended or superseded, in accordance with the applicable illumination zone.
- Luminaire distribution and uniformity requirements

The report will include, but not be limited to the final spacing between poles, information on the type of luminaire used, average illuminance results, uniformity ratio, and veiled luminance ratio.

3.1 Standards and Regulations

In addition to this Manual, projects for new Street Lighting Systems or retrofits of existing Street Lighting Systems shall comply with all applicable standards, codes, laws, and regulations in force applicable to the design and construction of the PREPA electrical system.

3.1.1 Roadway Lighting and Electrical Codes and Standards

All Street Lighting System design, materials and installations must be approved by LUMA and must be in strict accordance with the following applicable standards and guidelines in force, except where otherwise stated:

- American Association of State Highway and Transportation Officials (AASHTO)
- Illuminating Engineering Society of North America (IES).
- National Electrical Code (NEC)
- National Electrical Safety Code (NESC)
- Institute of Electrical and Electronics Engineers (IEEE)
- National Electrical Manufacturers Association (NEMA)
- American National Standards Institute (ANSI)
- National Institute of Standards and Technology (NIST)

In case of conflict, the more restrictive requirement shall prevail.

Refer to the Street Lighting System specifications of the materials and equipment approved by LUMA or contact LUMA Standards and Materials Department.

3.1.2 Codes, Laws, and Regulations

The design of Street Lighting Systems shall comply with all applicable federal, Commonwealth of Puerto Rico, and local codes, laws, and regulations in force, including, but not limited to:

- Joint Regulation for the Evaluation and Issuance of Permits Related to the Development, Use of Land and Business Operation (*Reglamento Conjunto para la Evaluación y Expedición de Permisos Relacionados con el Desarrollo, Uso de Terrenos y Operación de Negocios*) from the JP, in effect, as may be amended or superseded.
- *Reglamento de Ordenación de la Infraestructura en el Espacio Público* (Planning Board Regulation No. 22 – Regulation 4861), from the JP, as may be amended or superseded.
- *Reglamento para el Control y la Prevención de la Contaminación Lumínica,* (Regulation 8493) of the JCA (now administered by DRNA), as may be amended or superseded.

3.1.3 Safety Standards

The requirements in this Manual shall be in accordance with LUMA safety rules, the National Electrical Code (NEC), the National Electrical Safety Code (NESC), and applicable Puerto Rico Codes in force. Safety will take priority over all other requirements. If any specification or standard is considered inadequate or

incorrect from a safety point of view, it should be brought to the attention of LUMA for clarification or correction in the application of the specifications or standards.

All Street Lighting System installations shall comply with the NESC clearances requirements, as well as clearances requirements under the electrical distribution standards established or adopted by LUMA. The designer shall follow best practices to reduce hazards to the public with special attention to the proximity of live parts to adjacent buildings, vehicular traffic, and cabinet locations.

3.2 Street Lighting Equipment and Infrastructure

All equipment and infrastructure used to provide power to the Street Lighting System shall be in accordance with the requirements of the electrical distribution standards established or adopted by LUMA and shall be submitted to LUMA for approval.

The designs shall meet specifications from FHWA, IES, AASHTO, ACT, and DTOP.

3.2.1 Transformers

Whenever possible, Street Lighting Systems shall have dedicated transformers. These transformers shall comply with LUMA's specifications requirements for transformers and shall be the same type used in the distribution system. Consideration shall be given to minimizing street crossings in the installation of the transformers. Loads that exceed 75 kVA shall be connected to a three-phase system and be distributed in a balanced way amongst the three phases.

The maximum voltage drop allowed in Street Lighting Systems is 3%. The length of circuits, transformers capacity, luminaire voltage, conductor gauge, and luminaire type shall be selected so as to meet this requirement.

3.2.2 Cables

The following cables shall be used for Street Lighting System circuits:

- Stranded copper cable, 600 V, XHHW-2 with cross-linked polyethylene insulation (XLPE) with high heat resistance, water resistance for 90°C; minimum gauge #2 AWG.
- Stranded copper cable, 600 V, THWN-2 with thermoplastic, high heat resistant, water resistant, nylon jacket for 90°C; minimum gauge #12 AWG.

Alternate materials require LUMA's approval.

Underground cables shall be installed in PVC SCH-40 duct.

Refer to street lighting construction standards in Part IV of this Manual for more installation details.

3.2.3 Underground Street Lighting System

The underground Street Lighting System shall be protected by fuses of the appropriate capacity. Cables shall be installed in ducts approved by LUMA buried to a minimum of 24" deep. A 6" minimum wide red

underground cable identification hazard warning tape will be installed 12" below the final ground surface. Refer to standard no. STL-16 of this Manual for installation details.

3.2.4 Mounting Systems

All components of the Street Lighting System's mounting system, such as poles and arm brackets, shall be in accordance with LUMA material specifications, and standards described in this Manual.

3.2.5 Luminaires

To comply with Act No. 17-2019, all luminaires and lighting sources shall be converted to Light Emitting Diodes (LED). All LED luminaires must be compatible with a service voltage (120 V, 208 V, or 240 V), with integrated optics and electronics, and shall be in accordance with LUMA's luminaire specification requirements. LED luminaires shall be connected to 240 V circuits.

All luminaires shall be smart-ready, compatible with the mounting system standards and shall come with NEMA compliance 7-pin twist-lock type control receptacle installed at the factory.

3.2.6 Street Lighting Management and Control Systems

In freeways and expressways, an entire circuit of luminaires shall be controlled by a luminaires' controller. As default, an individual automatic "on" and "off" device (photo control) shall be used with a standard NEMA compliance, 7-pin twist-lock type control receptacle in each luminaires' controller. The photo control shall be installed facing north. A shorting cap shall be used on each LED luminaire to provide power.

3.3 Pole Joint Use (Third Party Attachments)

Installation of wireless cameras or antennas is allowed on Street Lighting System poles. Communication cables are not allowed between poles used exclusively for street lighting. The connection of communication equipment shall comply with the following technical requirements:

- Be connected to the 240 V circuit.
- Be interconnected from the nearest Street Lighting System service pedestal or pad mounted transformer available. An exposed riser shall be installed using a PVC SCH-80 duct, attached to the pole with stainless steel fixing bands.
- Drilling holes to poles is not allowed.
- Independent fuse circuit protection shall be installed for each equipment.
- Third party equipment shall be installed 42" minimum below the arm for LED luminaire.
- Communication equipment cabinets shall be installed up to 16' from finish grade to the cabinet's top.
- Evidence of the Pole Load Analysis (PLA), performed with a software application approved by LUMA, to determine if the structural integrity of poles is not compromised with its joint use.

3.4 Right-of-Way

PREPA's right-of-ways are subject to the requirements set forth in thePREPA's *Reglamento de Servidumbres para la Autoridad de Energía Eléctrica* (Regulation 7282), approved on December 13, 2005, Act 143 of June 20, 1971, as amended, and the Puerto Rico Civil Code of 2020, and other applicable laws and regulations governing public easements, as may be amended or superseded.

3.5 Street Lighting System Location

Street Lighting System poles will be installed in the planting area at a distance of no less than 1 foot (30.48 cm) from the outer edge of the curb. Any other locations shall be coordinated with LUMA and shall follow all requirements from the governmental authority having jurisdiction.

On urban roads, pole installation on sidewalks or planting areas shall be performed in compliance with the *Reglamento de Ordenación de la Infraestructura en el Espacio Público* (Planning Board Regulation No. 22 – Regulation 4861), as may be amended or superseded.

Street Lighting System poles shall be located where they do not interfere with driveways, garages, pad mounted transformers or pad mounted switching units. Street Lighting System poles shall not interfere with vehicular traffic and parking. Where parking is permitted, and sidewalks are present, new poles should consider pedestrian activities (car doors, wheelchair ramps, etc.).

The Street Lighting System can be installed on distribution poles when the distribution system is either overhead or semi-underground. Adequate spacing shall be considered for the LED luminaire, and the required minimum illuminance level shall be maintained. The maximum spacing will be a determining factor for the location of the poles in the distribution system.

3.6 Specific Requirements for Freeways, Expressways, and Major Roads

The standards and specifications for Street Lighting Systems on freeways, expressways, and major roads shall be governed by the following guidelines:

- It shall be a requirement for lighting design in freeways, expressways, and major roads that the circuits are controlled from a single point. An appropriate luminaires controller shall be installed for this purpose. The use of individual photo control shall not be allowed on freeways, expressways, and major roads.
- All luminaires shall include a control receptacle for photo control but shall have shorting caps installed.
- Breakaway bases approved by AASHTO for lighting poles shall be used.
- The guidelines established in standard no. STL-6 for the breakaway base shall be used in all cases when the lighting pole is not protected by a physical barrier, and standard no. STL-4 where there is a physical barrier.
- Any type of special lighting that is not part of the Street Lighting System will have the energy consumption metered and billed, and the maintenance of this special lighting will be the responsibility of the developer or project owner.

- The location of the lighting poles shall provide adequate distance to the existing transmission and distribution lines such that they are not impacted in the event of a collision with the lighting poles.
- Projects shall be designed considering projections and plans for the road in question. Input from the ACT, the DTOP, and the JP will be required for these designs.

PART III: DESIGN CRITERIA

The Street Lighting System shall follow the design criteria in this Part III in order to improve visibility, ensure the safety and well-being of pedestrians, cyclists, drivers (motorists and passengers), transit users, and surrounding residents; avoid light pollution, glare, or discomfort to the surrounding residents; and enhance night circulation on the streets, inhibit criminal actions and protect wildlife.

4. Road Classifications and Illumination Zones

The street lighting requirements vary based on the road classification and illumination zones.

4.1 Road Classifications

Road classification is based on certain parameters, such as its width, hierarchy, function, land use characteristics, whether the road is in an urban or rural area, and the volume of traffic. The following classifications considered in this Manual are based on IES standards in effect:

- Freeway: A divided major roadway with full control of access (no crossings at grade). This definition applies to toll as well as non-toll roads.
  - Freeway Class A: Roadways with greater visual complexity and high traffic volumes. Usually, this type of freeway will be found in major metropolitan areas in or near the central core and will operate through some of the early evening hours of darkness at or near design capacity.
  - Freeway Class B: All other divided roadways with full control of access.
- Expressway: A divided major roadway for through traffic with partial control of access and generally with interchanges at major crossroads. Expressways for noncommercial traffic within parks and park-like areas are generally known as parkways.
- Major: That part of the roadway system that serves as the principal network for through-traffic flow. The routes connect areas of principal traffic generation and important rural roadways leaving the city. These routes are often known as "arterials," "thoroughfares or preferentials." They are sometimes subdivided into primary and secondary; however, such distinctions are not necessary in roadway lighting.
- Collector: Roadways servicing traffic between major and local streets. These are streets used mainly for traffic movements within residential commercial and industrial areas. They do not handle long, through trips. Collector streets may be used for truck or bus movements and give direct service to abutting properties.
- Local: Local streets are used primarily for direct access to residential, commercial, industrial, or other abutting property. They make up a large percentage of the total street system but carry a small proportion of vehicular traffic.

The lighting design principles for each type of road, pedestrian conflict areas, and pavement classification are provided in Table 4 (Appendix A). Any deviations should be evaluated and approved by LUMA. The owner is responsible for defining the applicable road classification as per the definitions provided and

expected uses. LUMA is not responsible for validating the selected road classification on which the design is based.

4.2 Pedestrian Conflict Area Classifications

The following classifications considered in this standard are based on IES standards in effect:

- High - Areas with a significant number of pedestrians expected to be on sidewalks or crossing the streets during darkness.
- Medium - Areas with lesser number of pedestrians utilizing the streets at night.
- Low - Areas with very low volume of night pedestrian usage.

Lighting design principles for illuminance levels for intersections and pedestrian conflict areas are provided in Table 5 (Appendix A). For calculation purposes, cyclists will be considered to determine the flux of pedestrians in conflict areas.

4.3 Pavement Classification

Pavement classification describes the characteristic directional reflectance of each pavement. Reflection characteristics of each pavement will follow the descriptions provided in Table 1.

Table 1. Pavement Classification

Class	Q_0*	Description	Mode of Reflectance
R1	0.10	Portland cement concrete road surface. Asphalt road surface with a minimum of 12% of the aggregates composed of artificial brightener (e.g., Synopal) aggregates (e.g., labradorite, quartzite).	Mostly diffuse
R2	0.07	Asphalt road surface with aggregate composed of a minimum of 60% gravel [size greater than 0.4 in. (1cm)]. Asphalt road surface with 10% to 15% artificial brightener in aggregate mix. (Not normally used in North America.)	Mixed (diffuse and specular)
R3	0.07	Asphalt road surface (regular and carpet seal) with dark aggregates (e.g., trap rock, blast furnace slag); rough texture after some months of use. (Typical Highways).	Slightly specular
R4	0.08	Asphalt road surface with very smooth texture.	Mostly specular

**Q_0 representative means luminance coefficient.*

Source: ANSI/IES RP-08-18

4.4 Special Area Illumination

The *Reglamento para el Control y la Prevención de la Contaminación Lumínica* (Regulation 8493), enacted by the JCA (currently administered by DRNA) pursuant to Act No. 218-2008, known as the Act for the Control and Prevention of Light Pollution Program, requires the use of turtle friendly luminaires in zones where sea turtles nest and lay their eggs. If a project is proposed in a coastal zone, it is necessary to verify whether the requirements of this regulation (as may be amended or superseded) and Act No. 218-2008, as amended, apply to the project.

5. Luminaire Types and Classification

5.1 Light Distribution

The light distribution of luminaires directly influences the performance and efficiency of the system, on the safety and visibility of the streets, and on the quality of street/roadway lighting and surrounding environments. Proper light distribution can prevent glare (including incapacitating glare for drivers, cyclists, pedestrians, and transit users), trespass, and light pollution that may affect surrounding residents, including humans, fauna, and flora.

Figure 1 illustrates the most common light distribution types.

5.1.1 Longitudinal Light Distribution

The longitudinal light distribution range is divided into three groups:

- Short - Maximum spacing between luminaires is typically 4.5 times the mounting height.
- Medium - Maximum spacing between luminaires is typically 7.5 times the mounting height.
- Long - Maximum spacing between luminaires is typically 12 times the mounting height.

The longitudinal light distribution type approved for Street Lighting Systems is medium.

5.1.2 Transversal or Lateral Light Distribution

IES has established five types of lateral distribution:

- Type I – Applies to narrow streets
- Type II – Applies to medium width roads
- Type III – Applies to medium width roads
- Type IV – Normally applies when it is necessary to illuminate sides of building facades, walls or parking areas
- Type V – Applies to areas where light distribution needs to be in all directions

The transversal or lateral light distribution type approved for the Street Lighting Systems is Type II for Amber LED luminaire, Type II for 65 W LED luminaire, and Type III for 125 W LED luminaire.

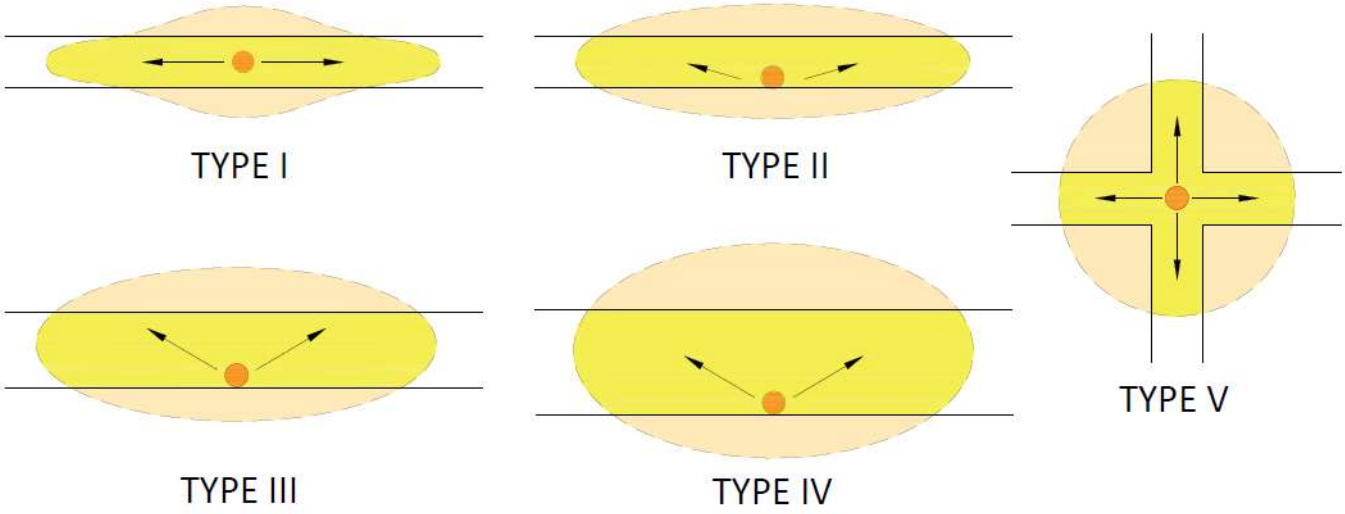


Figure 1 - Light Distribution Types

5.1.3 Luminaire Classification System (LCS) and BUG Ratings

The LCS defines categories of light distribution of a luminaire based on primary and secondary solid angles listed below:

- Forward light low secondary angle (FL)
- Forward light mid secondary angle (FM)
- Forward light high secondary angle (FH)
- Forward light very high secondary angle (FVH)
- Backlight low secondary angle (BL)
- Backlight mid secondary angle (BM)
- Backlight high secondary angle (BH)
- Backlight very high secondary angle (BVH)
- Uplight low secondary angle (UL)
- Uplight high secondary angle (UH)

Figure 2 contains a representation of LCS angles.

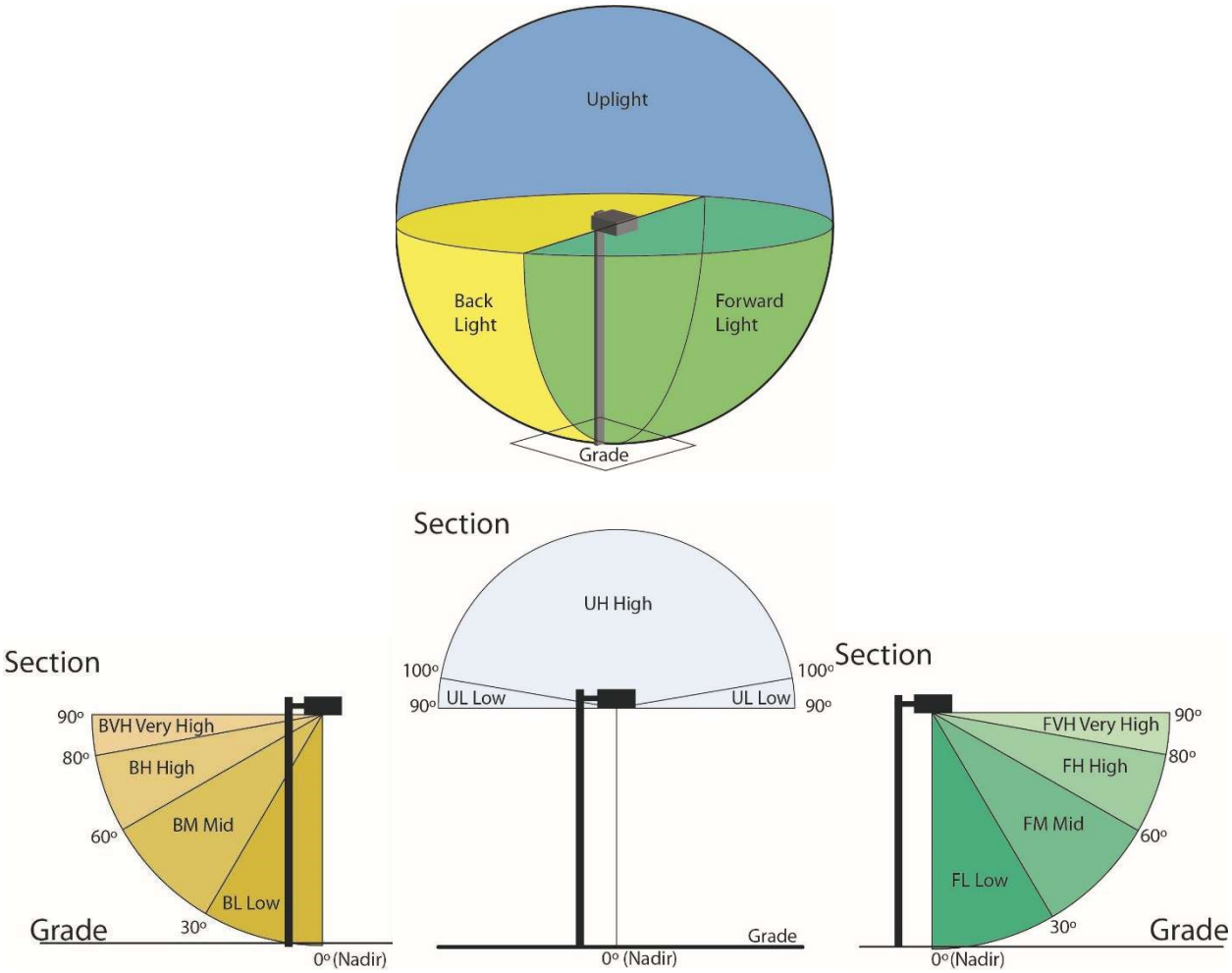


Figure 2 - Luminaire Classification System (LCS) Primary and Secondary Solid Angles

Source: © The Illuminating Engineering Society. Reprinted from ANSI/IES RP-8-18, Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting. New York: Illuminating Engineering Society, 2018.

The BUG Ratings are used to evaluate the luminaire optical performance in various backlight (B), uplight (U), and glare (G) zones by identifying the quantity of lumen output in each LCS secondary solid angle. The BUG ratings are based on ANSI/IES RP-08-18. The tables with BUG ratings values are included in Appendix B of this Manual for reference. The BUG rating values approved for the Street Lighting Systems are: B3(maximum)-U1(maximum)-G3(maximum), and uplight UL and UH ≤ 10 lumens.

6. LED Lamp and Luminaire Depreciation Factors

Light loss factor (LLF) is used in lighting calculations to simulate the lighting performance of the luminaire installed and operating based on certain conditions other than the initial condition (when installed).

LLF addresses the losses caused by the luminaire's exposure to dirt, lumen reduction over time, and other factors that contribute to reducing the emitted lighting to the streets, so that a minimum desired level of illuminance may be maintained in service. LLF is obtained by multiplying all the contributing factors for light losses, considering at least the luminaire's dirt depreciation factor (LDD) and the lamp lumen depreciation factor (LLD).

$$LLF = LDD \times LLD$$

LLF for LEDs are specific to each individual luminaire. Lumen depreciation and rated life can vary greatly between different models and manufacturers depending to luminaire design and thermal management.

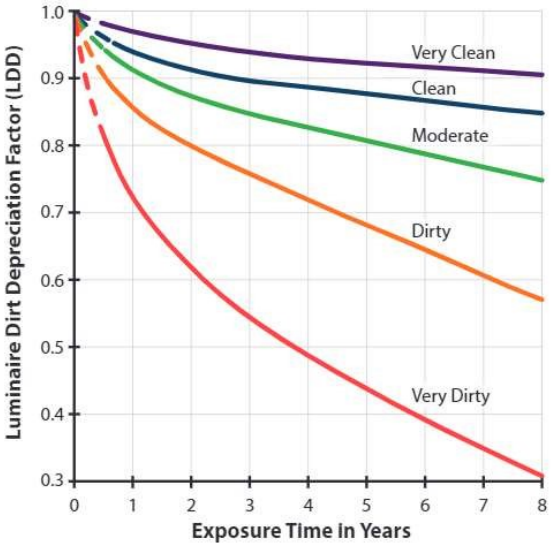
6.1 Lamp Lumen Depreciation Factor (LLD)

For LED luminaires, the light source is embedded in the luminaire. Consequently, there is no lamp replacement. The LED "Lamp" Lumen Depreciation (LLD) factor is determined by the rated lumen maintenance, based on the IES LM-80 standard's method. The LED lumen maintenance is an estimate based on when the LEDs within a luminaire are expected to lose a determined percentage of their initial light output. For the purpose of the light calculation, the default LED LLD considered will be 92% (LLD = 0.92).

6.2 Luminaire Dirt Depreciation Factor (LDD)

The LDD factor depends on the environment to which the luminaire will be exposed and the frequency of cleaning. Because the LED luminaires have a higher average system rated life, the cleaning and maintenance intervals considered are usually higher. For purposes of the light calculation, the default LED LDD considered will be 96% (LDD = 0.96). For streets with higher dirt exposure conditions, a shorter interval of the cleaning cycle should be considered.

Figure 3 contains the curves for the five contamination depreciation categories that are normally used according to the surrounding environment, as defined by IES.



Very clean – No nearby smoke or dust generating activities and a low ambient level. Light traffic. Generally limited to residential or rural areas. The ambient particulate levels are no more than 150 micrograms per cubic meter.

Clean – No nearby smoke or dust generating activities. Moderate to have traffic. The ambient particulate levels are no more than 300 micrograms per cubic meter.

Moderate – Moderate smoke or dust generating activities nearby. The ambient particulate levels are no more than 600 micrograms per cubic meter.

Dirty – Smoke or dust plumes generated by nearby activities may occasionally envelope the luminaires.

Very Dirty – As above, but the luminaires are commonly enveloped by smoke or dust plumes.

Figure 3 - Typical Luminaire Dirt Depreciation (LDD)

Source: © The Illuminating Engineering Society. Reprinted from ANSI/IES RP-8-18, Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting. New York: Illuminating Engineering Society, 2018.

6.3 Coefficient of Utilization

The coefficient of utilization (CU) is a value between 0 and 1 that indicates the proportion of lumens emitted by a luminaire that reached the primary target area (roads and bike lanes) and the immediate surrounding areas (sidewalks). A typical CU curve for luminaires is shown in Figure 4. Two curves are shown: House Side (HS) in blue and Street Side (SS) in red. SS is normally the needed curve for calculations.

Figure 4 - Example of a Typical Luminaire Coefficient of Utilization Curve

The coefficient of utilization (CU) of a given street is determined by dividing the street width by the luminaire mounting height, then referencing the resulting ratio on the CU graph abscissa (X-axis) and following this point upwards until it intersects the street side (SS) CU curve (in red) to identify the CU value of that street on the ordinance (Y-axis). The LED CU graph or the photometric graph (with the ISO foot-candle curves) shall be provided by the manufacturer for each luminaire within the IES LM-79 standard's report.

7. System Layout, Geometry and Mounting

The layout, geometry and mounting of Street Lighting Systems must ensure adequate lighting and visibility levels in the streets, including bicycle lanes, sidewalks, and pathways. A good arrangement of the Street Lighting Systems shall provide a high degree of uniformity, enhance contrast sensitivity, and avoid glare and lighting pollution. Additionally, pole and luminaire positioning should meet the recommended horizontal and vertical clearances, including special requirements for bicycle lanes, sidewalks, and pathways.

7.1 Pole and Luminaire Spacing

Luminaire spacing in a system is the distance in feet or meters between successive lighting units measured along the centerline of the street. According to the IES, pole height, arm length, and pole offset from the road can all influence a lighting calculation. The street lighting design shall define the optimal pole spacing along the streets based on the maximum pole spacing allowed by the luminaire type. The spacing must ensure even light distribution and uniformity.

Figure 5 shows one example of an evenly distributed pole array.

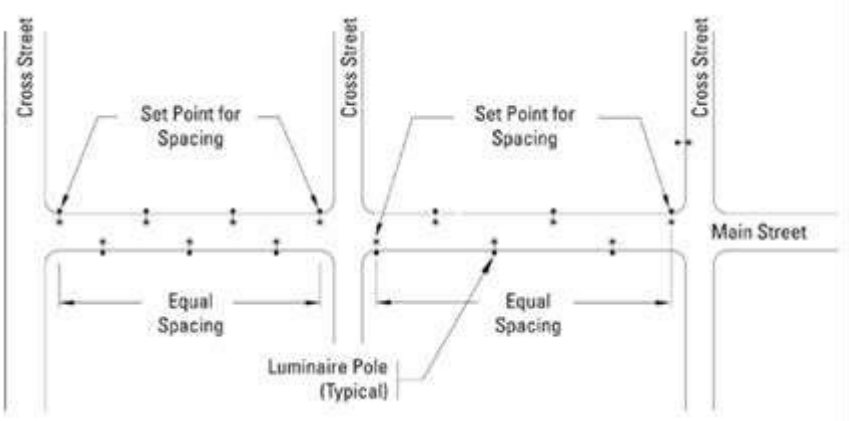


Figure 5 - Pole Spacing Example
Source: FHWA Lighting Handbook (2012)

The spacing selected for any given project (new installations or retrofit) shall be consistent with the illuminance level, uniformity ratio, BUG rating, luminaires' type, capacity and mounting height, road width and geometry, and pole arrangement.

7.2 Pole Arrangement

The types of pole arrangements can be one-sided (lateral), opposite (double-sided), staggered (alternate), median (central), or inside and outside (on curves). The pole arrangement shall ensure that the uniformity ratio (average ratio of the illuminance values over the minimum) will be maintained in all designs, as specified by LUMA. Figure 6 contains an illustration of typical pole arrangements.

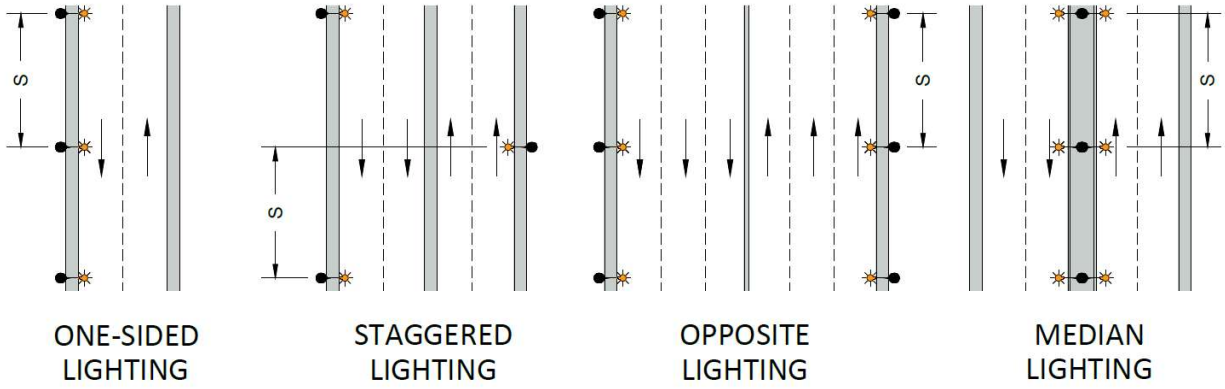
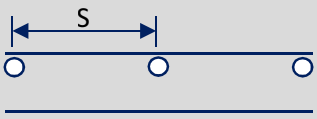
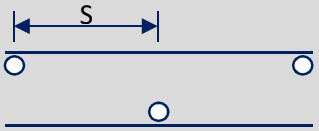
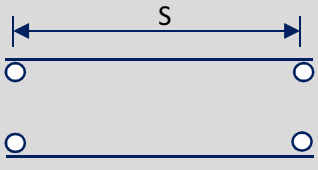


Figure 6 - Typical Pole Arrangements

7.2.1 Recommended Pole Arrangement

The recommended arrangement of poles with the luminaires in a given street is shown in Table 2 and is subject to applicable codes, laws and regulations, and considerations of aesthetics of the surroundings.

Table 2. Recommended Pole Arrangement

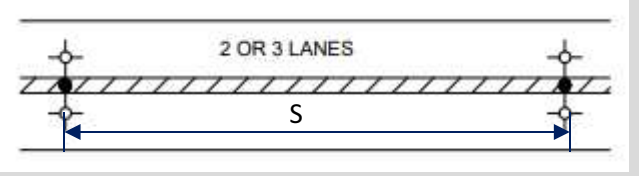
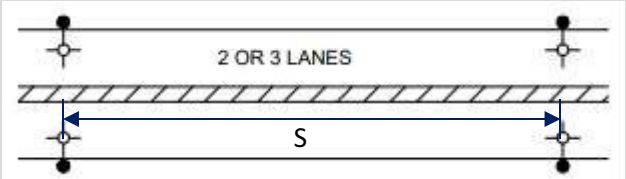
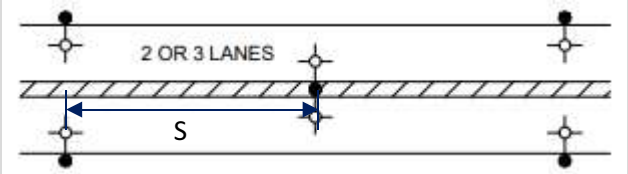
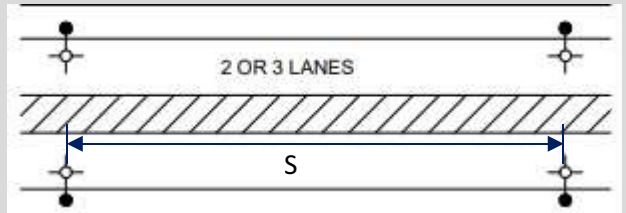
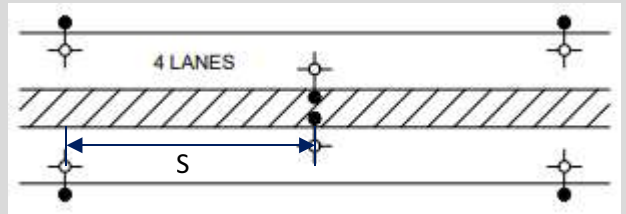
Street Width	Recommended Arrangement	Luminaire Arrangement Diagram
1 to 3 lanes	One-sided (Lateral)	
3 to 6 lanes	Staggered (Alternate)	
5 or more lanes	Opposite (Double-sided)	

Pole arrangements can vary from the recommended arrangements in Table 2. Requests for exceptions or deviations from these recommendations shall be submitted to LUMA for review and approval. The distance between poles will be determined by the luminaires' spacing as established in section 7.1.

7.2.2 Pole Arrangement in Roadways with Median

In large roadways with median barriers or strips that separate the two directions of travel, the recommended arrangement of poles with luminaries is shown in Table 3.

Table 3. Recommended Pole Arrangement for Roadways with Median

Median Width	Number of Lanes (Each Side)	Recommended Arrangement	Figure
Narrow	2 or 3	Median (economic option)	
Narrow	2 or 3	Opposite (better visibility, higher cost on poles and circuits)	
Narrow	2 or 3	Staggered (maximum visibility, expensive)	
Medium	2 or 3	Opposite	
Large	4 or more	Staggered (with individual poles in the median)	

Pole arrangements can vary from the recommended arrangements in Table 3. Requests for exceptions or deviations from these recommendations shall be submitted to LUMA for review and approval. The distance between poles will be determined by the luminaires' spacing as established in section 7.1.

7.2.3 Pole Arrangement on Curves

In sharp curves (with a radius of less than 2,000 ft.), the poles shall be positioned on the inside of the curve to reduce potential impacts from uncontrolled vehicles or in case of hazardous conditions, except where barriers are present. If the poles unavoidably need to be positioned on the outside of the curve, they should be positioned outside the overrun areas, as shown in Figure 7.

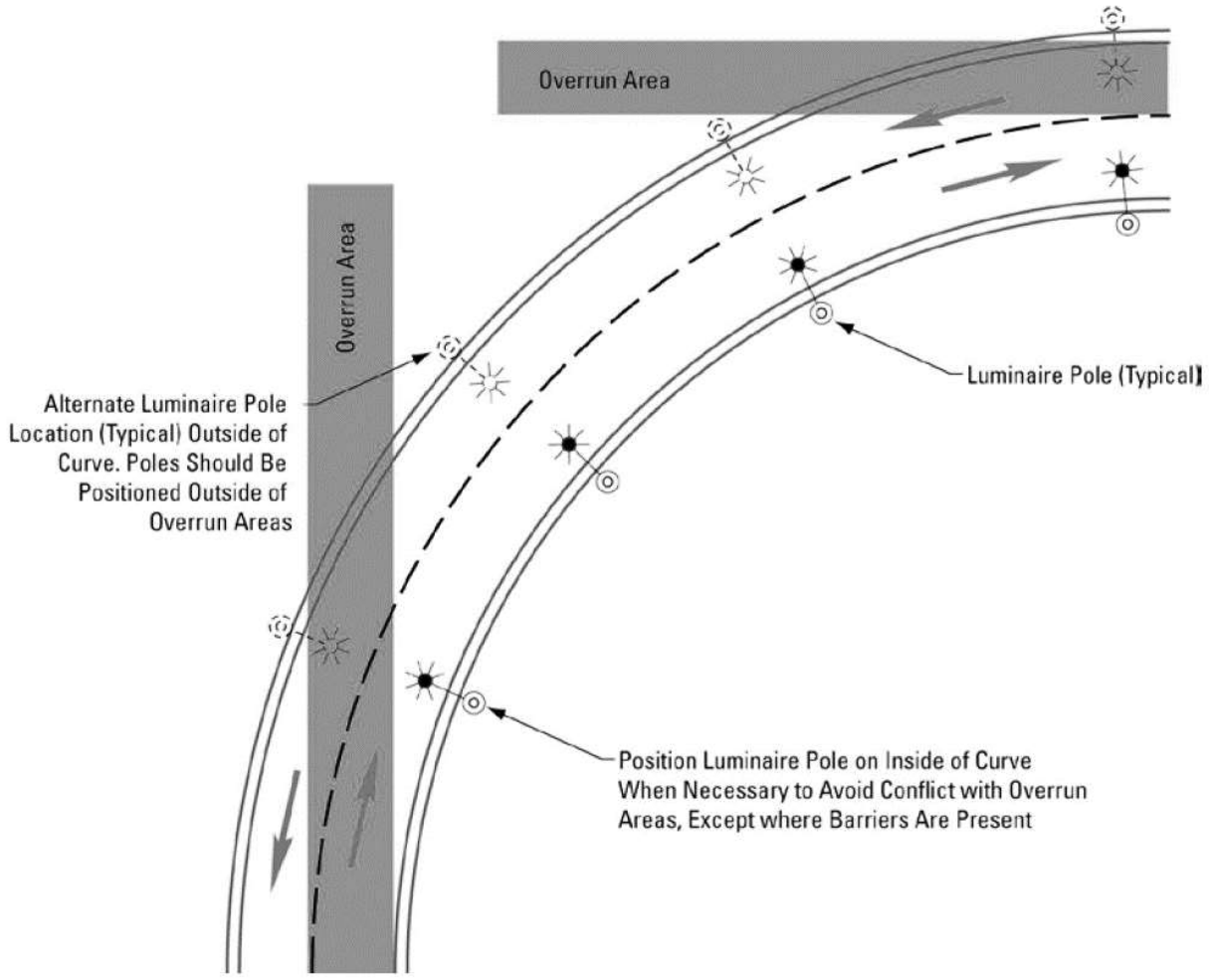


Figure 7 - Preferrable Pole Arrangement in Curves
Source: FHWA Lighting Handbook (2012)

In curves with a large radius horizontal curvature (2,000 ft. or greater), it is recommended that the poles be installed unilaterally on the outside of the curve to avoid driver disorientation. Other, more complex, and irregular intersections will be carefully studied to ensure effective lighting.

7.3 Mounting

The arms for LED luminaires shall be installed in accordance with current LUMA standards. The length of the arm used shall be consistent with the overhang, road width, and type of light distribution of the luminaire. The overhang of the luminaire over the road constitutes an important factor in decreasing the amount of glare and providing a maximum degree of visibility for the driver. On roads with medium or light traffic, the overhang will be increased, depending on the width of the road. The appropriate mounting height for different types of luminaires will be in accordance with the standards included in this Manual.

7.3.1 Physical Surrounding Interference

Trees and other obstacles can compromise the lighting design because they can reduce the illuminance levels below the intended thresholds. It is important to consider tree location and species while spacing the lighting poles along the streets. To minimize conflict with trees and to best meet the requirements of a particular arborized street, the luminaires can be mounted on longer arms or have a lower mounting height. Alteration of the luminaire light distribution type, reduction of the light output or alteration of the pole spacing between luminaires may be required. If the luminaires use photo control, special maintenance and regular pruning of the foliage will be required. The design calculations must consider the appropriate mounting height and spacing to accommodate the interference of physical surroundings.

7.4 Bicycle Lanes, Sidewalks, and Pathway Illumination

The street lighting placement and luminaire spacing must consider the proper illumination of bicycle lanes, sidewalks, and pathways. LED luminaires have superior optical and light distribution control to avoid light trespass. This light distribution control potentially reduces light behind the luminaire, depending on the chosen BUG rating values, which can significantly impact sidewalk illumination and uniformity. Additionally, physical obstacles in the surroundings can interfere with the illuminance levels of these areas. Regular pruning of the foliage is required in arborized areas.

Supplementary lighting and pedestrian scale lighting installations may be required based on the volume of pedestrians. This type of lighting will never be transferred to PREPA.

7.5 Intersections and Crosswalks

Roadway intersections and crosswalks are predisposed to potential vehicle conflict or vehicle-pedestrian conflict. The crosswalks can be located in the middle of the block or at the intersection of two or more streets. The recommended positioning of the luminaire in the crosswalks is one-half (½) of the pole height before the crosswalk or intersection. There are six types of intersections, and the lighting criteria for each one is provided in Table 5 (Appendix A).

Figure 8 to Figure 11 show the determined preferred pole placement and luminaire arrangement for typical intersections.

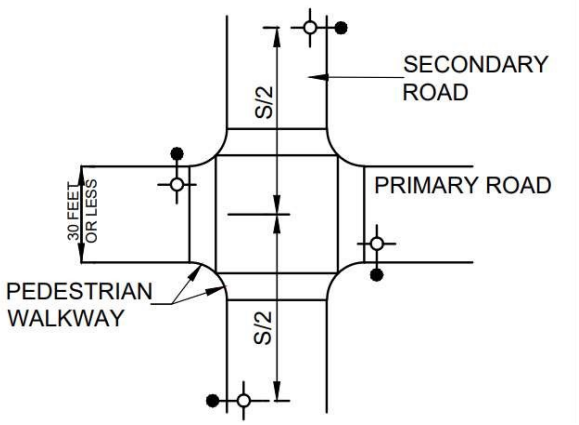


Figure 8 - Pole Placement and Luminaire Configuration for Right Angle Intersections

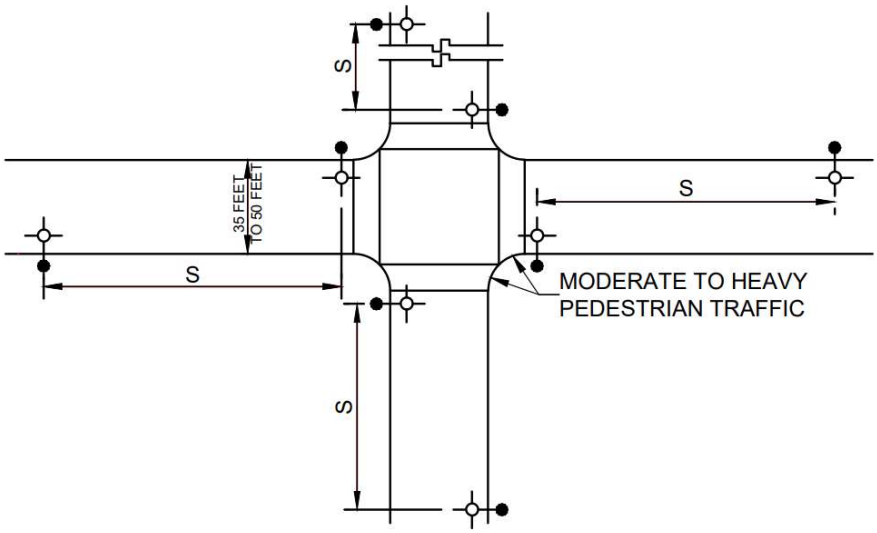


Figure 9 - Pole Placement and Luminaire Configuration for Right Angle Intersections with Higher Traffic

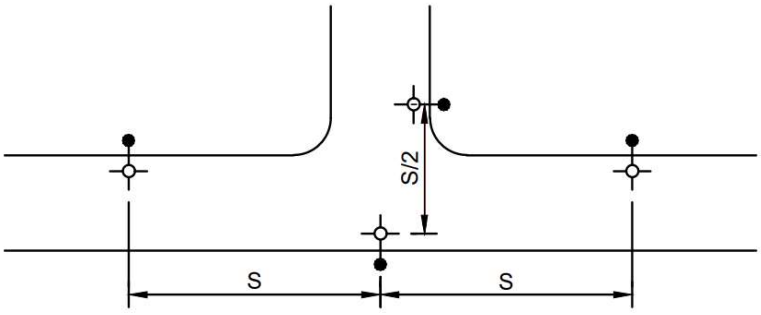


Figure 10 - Pole Placement and Luminaire Configuration for "T" Intersections

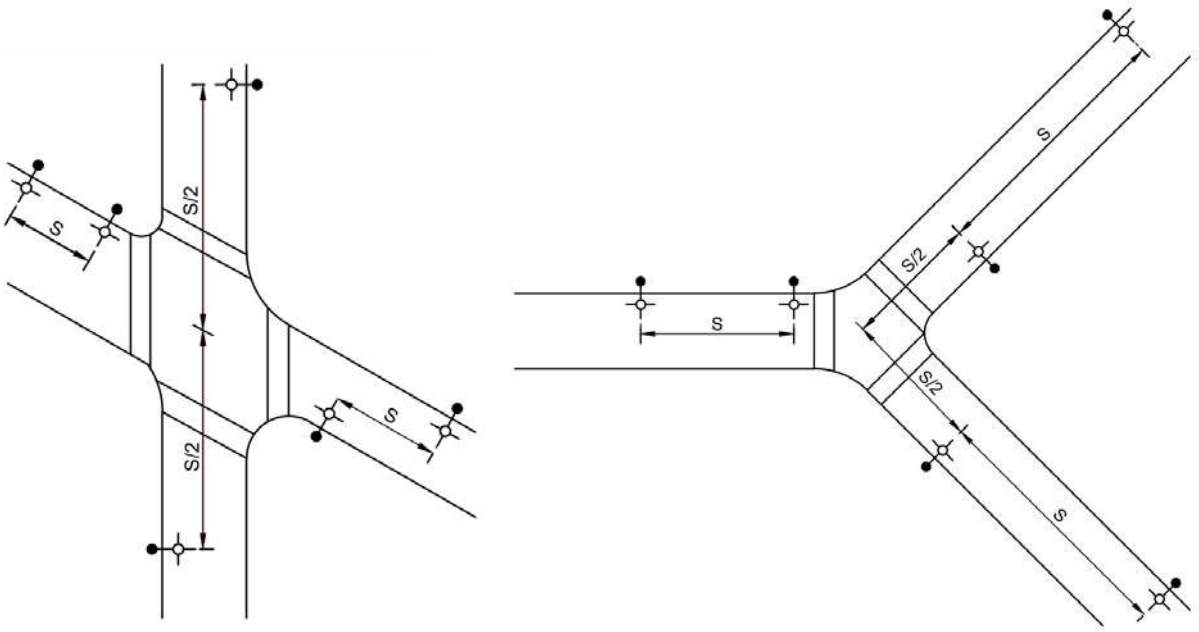


Figure 11 - Pole Placement and Luminaire Configuration for Diagonal and "Y" Intersections

PART IV: STREET LIGHTING SYSTEM STANDARDS

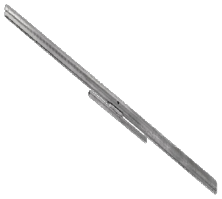
The following standards must be met for all new constructions, without deviation, to maintain the safety and reliability of the Street Lighting System. These standards include the bills of materials and construction details.

STREET LIGHTING STANDARDS INDEX		
STANDARD NO.	**DOCUMENT NO.**	**TITLE**
---	---	STREET LIGHTING SYSTEM MATERIAL LIST
STL-1	4401.002	OCTAGONAL CONCRETE POLE MOUNTING FOR 120/240 V LED LUMINAIRE
STL-4	4401.007	ALUMINUM POLE MOUNTING FOR 120/240 V, 125 W, LED LUMINAIRE
STL-6	4401.011	ALUMINUM POLE WITH BREAKAWAY BASE MOUNTING FOR 120/240 V, 125 W, LED LUMINAIRE
STL-10	4401.021	DISTRIBUTION POLE MOUNTING FOR OVERHEAD FED 120/240 V LED LUMINAIRE
STL-11	4401.023	DISTRIBUTION POLE MOUNTING FOR UNDERGROUND FED 120/240 V LED LUMINAIRE
STL-14	4401.036	100 A LUMINAIRES CONTROLLER
STL-16	4401.038	STREET LIGHTING CIRCUITS CONDUIT TRENCH CONSTRUCTION DETAIL

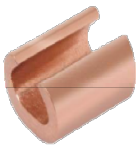
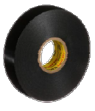
STREET LIGHTING SYSTEM MATERIAL LIST

ITEM NO.	GENERAL DESCRIPTION	SPECS DOC NO.	ASSET SUITE'S CATALOG NO.	WAREHOUSE ITEM	DETAILS	ILUSTRATIONS
0001	THROUGH BOLT Perno pasante	4350.072	54343	002-01483	⅝" DIAMETER, 8" L - HDG	
			82642	002-82642	⅝" DIAMETER, 10 " L - HDG	
			54344	002-01525	⅝" DIAMETER, 12" L - HDG	
			54345	002-01541	⅝" DIAMETER, 14" L - HDG	
			54346	002-01566	⅝" DIAMETER, 16" L - HDG	
			82411	002-82411	¾" DIAMETER, 8" L - HDG	
			82641	002-82641	¾" DIAMETER, 10" L - HDG	
			82412	002-82412	¾" DIAMETER, 12" L - HDG	
			59056	002-59056	¾" DIAMETER, 14" L - HDG	
			82413	002-82413	¾" DIAMETER, 16" L - HDG	
			82918	002-82918	½" DIAMETER, 8" L - HDG	
			82919	002-82919	½" DIAMETER, 10" L - HDG	
			82920	002-82920	½" DIAMETER, 12" L - HDG	
			82921	002-82921	½" DIAMETER, 14" L - HDG	
			82922	002-82922	½" DIAMETER, 16" L - HDG	
		4350.073	57697	002-13637	⅝" DIAMETER, 8" L - SS AND TDG	
			82643	002-82643	⅝" DIAMETER, 10" L - SS AND TDG	
			57698	002-13645	⅝" DIAMETER, 12" L - SS AND TDG	
			57700	002-13660	⅝" DIAMETER, 14" L - SS AND TDG	
			57701	002-13678	⅝" DIAMETER, 16" L - SS AND TDG	
			82405	002-82405	¾" DIAMETER, 8" L - SS AND TDG	
			82644	002-82644	¾" DIAMETER, 10" L - SS AND TDG	
			82406	002-82406	¾" DIAMETER, 12" L - SS AND TDG	
			82407	002-82407	¾" DIAMETER, 14" L - SS AND TDG	
			82408	002-82408	¾" DIAMETER, 16" L - SS AND TDG	
			82409	002-82409	¾" DIAMETER, 18" L - SS AND TDG	
			82410	002-82410	¾" DIAMETER, 20" L - SS AND TDG	
			82923	002-82923	½" DIAMETER, 10" L - SS AND TDG	
			82924	002-82924	½" DIAMETER, 16" L - SS AND TDG	
0002	FLAT SQUARE WASHER Arandela cuadrada plana	4350.120	57585	002-06946	2¼"x 2¼" x 3/16" HOLE 11/16" - HDG	
			82656	002-82656	2¼" x 2¼" x 3/16" HOLE 13/16" - HDG	
			57586	002-06961	4" x 4"x ¼" HOLE 11/16" - HDG	
			82657	002-82657	4" x 4"x ¼" HOLE ⅞" - HDG	
		4350.121	57703	002-13702	2¼"x 2¼" x 3/16" HOLE 11/16" - SS OR TDG	
			82660	002-82660	2¼" x 2¼" x 3/16" HOLE 13/16" - SS OR TDG	
			82661	002-82661	4" x 4"x ¼" HOLE 11/16" - SS OR TDG	
			82662	002-82662	4" x 4"x ¼" HOLE ⅞" - SS OR TDG	
	FLAT ROUND WASHER Arandela redonda	4350.111	82932	002-82932	½" - HDG	
		4350.112	84870	002-84870	⅜" - SS	
			30378	002-82041	½" - SS	
			83339	002-83339	⅝"" - SS	
			84533	002-84533	¾" - SS	
	SPLIT LOCK WASHER Arandela de seguridad partida	4350.109	82931	002-82931	½" - HDG	
		4350.110	82930	002-82930	½" - SS	
			84576	002-84576	¾" - SS	
			84869	002-84869	⅜" - SS	

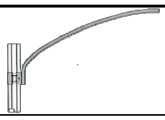
STREET LIGHTING SYSTEM MATERIAL LIST

ITEM NO.	GENERAL DESCRIPTION	SPECS DOC NO.	ASSET SUITE'S CATALOG NO.	WAREHOUSE ITEM	DETAILS	ILUSTRATIONS
0006	COMPRESSION SPLICES SINGLE SLEEVE FULL TENSION Conector de compresión de camisilla sencilla para tensión completa	4350.091	82678	002-82678	556.5 ACSR TO 556.5 ACSR, 652.4 AAAC	
			55430	002-04446	BARE COPPER CONDUCTOR #2	
			55892	002-09965	BARE COPPER CONDUCTOR 1/0	
			55893	002-09981	BARE COPPER CONDUCTOR 4/0	
			55838	002-13454	BARE COPPER CONDUCTOR 300 MCM	
	COMPRESSION SPLICES TWO SLEEVE FULL TENSION ACSR Conector de compresión de doble camisilla para tensión completa (ACSR)	4350.092	54260	002-08678	1/0 (6/1)	
			54261	002-08686	3/0 (6/1)	
			83031	002-83031	4/0 (6/1)	
			56679	002-09601	266.8 (26-7)	
			55995	002-11458	336.4 (18-1)	
			57692	002-13587	556.5 (24-7) MCM	
			83032	002-83032	795.0 (26-7)	
	COMPRESSION CONNECTORS FIGURE 3 SHAPE - ALUMINUM Conector de compresión tipo Figura 3 (AL)	4350.093	55897	002-10039	#6-#4, #6-#4 STRANDED, #6-#4, #6-#4 ACSR	
			54248	002-08363	#2-2/0, #6-#2 STRANDED, #2-1/0, #6-#2 ACSR	
			54249	002-08371	1/0-2/0, 1/0-2/0 STRANDED, 1/0, 1/0 ACSR	
			54250	002-08389	2/0-3/0, #2 STRANDED, 1/0-2/0, #2-#4 ACSR	
			56676	002-09569	4/0, 1/0-2/0 STRANDED, 3/0-4/0, 1/0-2/0 ACSR	
			83025	002-83025	2/0-3/0, 1/0-2/0 STRANDED, 2/0, #1-2/0 ACSR	
			83026	002-83026	4/0, #4-#2 STRANDED, 3/0-4/0, #4-#2 ACSR	
0006	COMPRESSION CONNECTORS FIGURE 6 SHAPE - ALUMINUM Conector de compresión tipo Figura 6 (AL)	4350.164	54253	002-08439	#6-#2 RUN, #14 SOL.-#8 TAP STRANDED AL/CU #6-#4 RUN, #14 SOL.-#8 TAP ACSR AL/CU	
			83028	002-83028	#1-3/0 RUN, #14 SOL - #8 TAP STRANDED AL/CU #2-3/0 RUN, #14 SOL - #8 ACSR AL/CU	
			83027	002-83027	3/0-4/0 RUN, #6-#3 TAP STRANDED AL/CU 3/0-4/0 RUN, #6-#3 TAP STRANDED AL/CU	
			54251	002-08413	3/0-4/0 RUN, 2/0-4/0 TAP STRANDED AL/CU 3/0-4/0 RUN, 3/0-4/0 TAP ACSR AL/CU	
			55917	002-10658	250-400 MCM RUN, 6 SOL.-2/0 TAP STRANDED AL/CU 266.8 (18/1)- 397.5 (18/1) RUN, #6-1/0 TAP ACSR	
			56704	002-10666	250 - 477 MCM RUN, 2/0-4/0 TAP STRANDED AL/CU 266.8 (18/1) - 397.5 (18/1) RUN, 2/0-4/0 TAP ACSR	
			56705	002-10674	250-400 MCM RUN, 250-400 MCM TAP STRANDED 266.8 (18/1)- 397.5 (18/1) RUN, 266.8 (18/1)- 397.5 (18/1) TAP ACSR	
			56710	002-10799	477-600 MCM RUN, 2/0-400 MCM TAP STRANDED AL/CU 397.5 (18/1)-556.5 (18-1) RUN, #6-1/0 TAP ACSR	
			56585	002-12217	600 - 800 MCM RUN, 2/0-400 MCM TAP STRANDED AL/CU 556.5 (18-1)- 795 (26/7) RUN, 2/0-397.5 (18/1) TAP ACSR	
			56586	002-12225	600 - 800 MCM RUN, 397.5-600 MCM TAP STRANDED AL/CU 556.5 (18-1)-795(26/7) RUN, 336.4 (26/7)-556.5 (18/1) TAP ACSR	
			56587	002-12233	600 - 954 MCM RUN, 600 - 954 MCM TAP STRANDED AL/CU 556.5 (18-1)-795 (26/7) RUN, 556.5 (18-1)-795 (26/7) TAP ACSR	
	COMPRESSION JUMPER SLEEVE SPLICES (ACSR & AAAC CONDUCTORS) Conector de compresión para empalme en puentes	4350.165	83690	002-83690	#6 (6/1)	
			83691	002-83691	#4 (6/1)	
			83034	002-83034	#2 (6/1) (7/1) ACSR	
			83035	002-83035	1/0 (6/1) ACSR	
			54365	002-09429	3/0 (6/1) ACSR	
			83632	002-09460	4/0 (6/1) ACSR	
			83633	002-09886	266.8 (26/7) ACSR	
			55450	002-05450	366.4 (18/1) ACSR	
			54366	002-09478	556.5 (24/7) ACSR, 652.4 (19) AAAC	
			83634	002-09502	795.0 (26/7) ACSR	

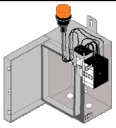
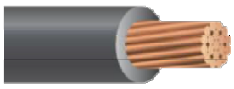
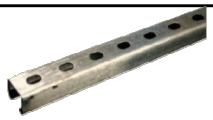
STREET LIGHTING SYSTEM MATERIAL LIST

ITEM NO.	GENERAL DESCRIPTION	SPECS DOC NO.	ASSET SUITE'S CATALOG NO.	WAREHOUSE ITEM	DETAILS	ILUSTRATIONS
0006	COMPRESSION C-SHAPE TYPE CONNECTORS - COPPER Conector de compresión tipo C - Cobre	4350.199	58181	002-03893	6 SOL. - 4 STR. RUN, 6 SOL. - 6 STR. TAP	
			55420	002-03919	6 SOL. - 4 STR. RUN, 6 SOL. - 4 STR. TAP	
			56167	002-08793	4 SOL. - 2 STR. RUN, 8 SOL. - 4 STR. TAP	
			54265	002-08785	2 SOL. - 2 STR. RUN, 2 SOL. - 2 STR. TAP	
			54369	002-09544	3/0 SOL. - 4/0 STR. RUN, 3/0 SOL. - 4 STR. TAP	
			83016	002-83016	8 SOL. - 8 STR. RUN, 10 SOL. - 8 STR. TAP	
			83017	002-83017	1/0 STR. - 2/0 STR. RUN, 8 SOL. - 2 STR. TAP	
			83018	002-83018	1/0 STR. - 2/0 SRT. RUN, 1/0 STR. - 2/0 STR. TAP	
			83019	002-83019	3/0 SOL. - 4/0 STR. RUN, 6 SOL. - 2 STR. TAP	
			83020	002-83020	3/0 SOL. - 4/0 STR. RUN, 1/0 STR. - 2/0 STR. TAP	
			83022	002-83022	4/0 - 500 MCM RUN, 4/0 - 500 MCM TAP	
			83023	002-83023	4/0 - 500 MCM, #2 - 250 MCM TAP	
			83024	002-83024	4/0 - 500 MCM, #6 SOL. - #6 STR. TAP	
	COMPRESSION CROSS GROUND GRID CONNECTOR Conector de compresión cruzado para sistema de conexión a tierra	4350.170	59063	002-14460	GROUND CROSS GRID CONNECTOR #2 AWG (STR) - 250 MCM	
			83499	002-83499	GROUND CROSS GRID CONNECTOR 250 MCM - 500 MCM	
	ALUMINUM PRIMARY T-TAP CONNECTOR Conector tipo T-Tap - Aluminio	4350.244	55977	002-11052	556.5 (24/7)	
			83030	002-83030	795 (26/7)	
0037	⅝" X 8' GROUND ROD Varilla para conexión a tierra ⅝" X 8'	4350.089	55365	002-02465	⅝" X 8' L	
	⅝" X 4' GROUND ROD Varilla para conexión a tierra ⅝" X 4'		83238	002-83238	⅝" X 4' L	
	THREADED COUPLING FOR COPPER GROUND ROD Unión con rosca para varilla de cobre para conexión a tierra		83223	002-83223	THREADED COUPLING FOR COPPER GROUND ROD	
	THREADED DRIVE HEAD FOR COPPER GROUND ROD Cabezal con rosca para varilla de cobre para conexión a tierra		83224	002-83224	THREADED DRIVE HEAD FOR COPPER GROUND ROD	
	UNTHREADED COUPLING FOR COPPER GROUND ROD Unión sin rosca para varilla de cobre para conexión a tierra		83239	002-83239	UNTHREADED COUPLING FOR COOPER GROUND ROD	
	UNTHREADED DRIVE HEAD FOR COPPER GROUND ROD Cabezal sin rosca para varilla de cobre para conexión a tierra		83240	002-83240	UNTHREADED DRIVE HEAD FOR COPPER GROUND ROD	
0066	CONNECTOR FOR ⅝" GROUND ROD Conector para varilla de ⅝" para conexión a tierra	4350.089	57693	002-13595	CONNECTOR FOR ⅝" GROUND ROD	
0077	VINYL INSULATING TAPE Cinta adhesiva de vinilo con aislación termoplástica para alto voltaje	4350.130	55005	038-01248	VINYL INSULATING TAPE 3/4" X 7 MILS RATED 600 V	
			82085	038-82085	VINYL INSULATING TAPE 2" X 8.5 MILS RATED 600 V	
0080	COPPER BARE CONDUCTOR Conductor de cobre sin cubierta	4350.055	82621	006-82621	#2 AWG	
			56082	006-01534	1/0 AWG	
			56081	006-01526	4/0 AWG	
			59361	006-01609	300 MCM	

STREET LIGHTING SYSTEM MATERIAL LIST

ITEM NO.	GENERAL DESCRIPTION	SPECS DOC NO.	ASSET SUITE'S CATALOG NO.	WAREHOUSE ITEM	DETAILS	ILUSTRATIONS
0182	FIXING BAND Banda de fijación	4350.038	14486	107-04344	BAND, ¾". X 0.025" X 200 FT/ROLL, 304 SS.	
			84298	107-84298	FIXING BAND INSTALLATION TOOL	
0183	BUCKLE FOR FIXING BAND Hebilla para banda de fijación		08023	107-03031	¾", ALUMINUM	
1001	OCTAGONAL CONCRETE POLE Poste octagonal de hormigón	4402.009	55936	026-00146	OCTAGONAL CONCRETE POLE FOR STREET LIGHTING 39'	
	ALUMINUM POLE Poste de aluminio	4402.005	56205	026-00609	ALUMINUM POLE WITH SHOE BASE FOR STREET LIGHTING 37' LONG	
1002	BREAKAWAY BASE Base separable	4402.008	56209	026-00658	TRANSFORMER BREAKAWAY BASE FOR ALUMINUM POLE 37' LONG	
1003	ARM FOR LED LUMINAIRE IN OCTAGONAL CONCRETE POLE Brazo para luminaria LED en poste octogonal de hormigón	4402.034	56148	028-00076	4' LONG SINGLE ARM FOR LED LUMINAIRE (OCTAGONAL CONCRETE POLE)	
		4402.016	56151	028-01082	12' LONG TRUSS ARM FOR LED LUMINAIRE (OCTAGONAL CONCRETE POLE)	
1004	ARM FOR LED LUMINAIRE IN ALUMINUM POLE Brazo para luminaria LED en poste de aluminio	4402.011	56199	026-00542	4' LONG SINGLE ARM FOR LED LUMINAIRE (ALUMINUM POLE)	
		4402.017	82609	026-82609	8' LONG SINGLE ARM FOR LED LUMINAIRE (ALUMINUM POLE)	
		4402.012	82610	026-82610	12' LONG TRUSS ARM FOR LED LUMINAIRE (ALUMINUM POLE)	
		4402.018	82611	026-82611	15' LONG TRUSS ARM FOR LED LUMINAIRE (ALUMINUM POLE)	
1005	ARM FOR LED LUMINAIRE IN SQUARE CONCRETE, GALVANIZED STEEL OR COMPOSITE POLE Brazo para luminaria LED en poste de hormigón cuadrado, acero galvanizado o de material compuesto	4402.034		028-00068	4' LONG SINGLE ARM FOR LED LUMINAIRE (SQUARE CONCRETE, GALVANIZED STEEL OR COMPOSITE POLE) 12" AND 16" HOLE SPACING	
			56150	028-00316	8' LONG SINGLE ARM FOR LED LUMINAIRE (SQUARE CONCRETE, GALVANIZED STEEL OR COMPOSITE POLE) 12" AND 16" HOLE SPACING	
1006	BRACKET FOR TRUSS ARM Soporte para brazo con refuerzo	4350.240	84846	002-84846	GALVANIZED STEEL, 13" FOR SQUARE CONCRETE POLES 45' TO 50'	
			84847	002-84847	GALVANIZED STEEL, 17" FOR SQUARE CONCRETE POLES 60' TO 65'	

STREET LIGHTING SYSTEM MATERIAL LIST

ITEM NO.	GENERAL DESCRIPTION	SPECS DOC NO.	ASSET SUITE'S CATALOG NO.	WAREHOUSE ITEM	DETAILS	ILUSTRATIONS
1007	LED LUMINAIRE Luminaria LED	4402.004	72355	028-72355	65 W LED LUMINAIRE TYPE II	
		4402.002	78110	028-78110	125 W LED LUMINAIRE TYPE III	
		4402.003	78119	028-78119	AMBER LED LUMINAIRE TYPE II	
1008	PHOTO CONTROL Fotocelda para control de iluminación	4402.001	78111	030-78111	PHOTOELECTRIC ELECTRONIC AUTO RANGE 105 - 305 VAC FOR LED LUMINAIRE	
1009	MIDGET FUSE HOLDER Portafusible	4350.200	54672	038-00729	FUSE HOLDER 600 V, SAME OR SIMILAR TO ELASTIMOLD	
1010	SHORTING CAP Tapón para continuación de circuito	4302.597	80074	030-80074	SHORTING CAP, TWIST LOCK AUTO RANGE 105 - 305 VAC	
1011	ALUMINUM POLE CONCRETE BASE SUPPORT Base en concreto para poste de aluminio	4402.035	84237	026-84237	CONCRETE DRILLED SHAFTS TO SUPPORT ALUMINUM POLE 37'	
1012	LUMINAIRES CONTROLLER Controlador de luminarias	4350.227	82824	030-82824	LUMINAIRES CONTROLLER	
2005	STRANDED COPPER CABLE, 600 V, XHHW-2 Cable de cobre trenzado, 600 V, XHHW-2	4350.054	56892	006-00833	#2 AWG CU, 600 V, XHHW-2	
			82622	006-82622	1/0 AWG CU, 600 V, XHHW-2	
			82623	006-82623	2/0 AWG CU, 600 V, XHHW-2	
			82753	006-82753	3/0 AWG CU, 600 V, XHHW-2	
			56891	006-00809	4/0 AWG CU, 600 V, XHHW-2	
			59358	006-01575	500 MCM CU, 600 V, XHHW-2	
2006	1⅝" STRUT CHANNEL Canal de puntal 1⅝"	4350.105	83135	038-83135	1⅝" X 1⅝" 12 GAUGE - HDG	
		4350.106	83136	038-83136	1⅝" X 1⅝" 12 GAUGE - SS	
2008	½" FULLY THREADED ROD Varilla rosca corrida ½"	4350.107	82933	002-82933	½" DIAMETER X 6' L - HDG	
		4350.108	82929	002-82929	½" DIAMETER X 6' L - SS	
2009	HEXAGONAL NUT Tuerca hexagonal	4350.113	82928	002-82928	½" DIAMETER - HDG	
		4350.114	82038	002-82038	½" DIAMETER - SS	
			84574	002-84574	⅝" DIAMETER - SS	
			84575	002-84575	¾"" DIAMETER - SS	
			84871	002-84871	⅜" DIAMETER - SS	
2012	BRONZE MALE SERVICE POST CONNECTOR Conector mecánico macho en bronce para conexión a tierra	4350.118	82925	002-82925	½" BRONZE MALE SERVICE POST CONNECTOR #2 AWG TO 1/0 AWG CU - BRZ	
			83411	002-83411	⅝" BRONZE MALE SERVICE POST CONNECTOR #1 AWG TO 350 MCM CU - BRZ	

STREET LIGHTING SYSTEM MATERIAL LIST

ITEM NO.	GENERAL DESCRIPTION	SPECS DOC NO.	ASSET SUITE'S CATALOG NO.	WAREHOUSE ITEM	DETAILS	ILUSTRATIONS
2014	DUCT SEALING COMPOUND Sellador de ductos	4350.190	48058	003-02935	DUCT SEALING COMPOUND	
2015	PADLOCK Candado	4350.191	54786	066-07303	1½ " PADLOCK	
			54787	066-07345	2½ " PADLOCK SIZE 15	
2039	PVC SCH-80 DUCT Tubo PVC SCH-80	4350.236	84893	038-84893	¾" - SCH-80	
			83314	038-83314	2" - SCH-80	
			83315	038-83315	3" - SCH-80	
			83316	038-83316	4" - SCH-80	
			83317	038-83317	6" - SCH-80	
2040	PVC SCH-40 DUCT Tubo PVC SCH-40	4350.235	83422	038-83422	¾" - SCH-40	
			83424	038-83424	1" - SCH-40	
			59318	038-01867	2" - SCH-40	
			83182	038-83182	3" - SCH-40	
			59311	038-01792	4" - SCH-40	
			56927	038-01727	6" - SCH-40	
			56920	038-01651	8" - SCH-40	
2041	90° PVC ELBOW Codo PVC 90°		83425	038-83425	¾" - SCH-40 - STANDARD RADIUS	
			83427	038-83427	1" - SCH-40 - STANDARD RADIUS	
			59319	038-01875	2" - SCH-40 - STANDARD RADIUS	
			82927	038-82927	3" - SCH-40 - STANDARD RADIUS	
			59312	038-01800	4" - SCH-40 - STANDARD RADIUS	
			56928	038-01735	6" - SCH-40 - STANDARD RADIUS	
			56921	038-01669	8" - SCH-40 - STANDARD RADIUS	
			84331	038-84331	2" - SCH-40 - SPECIAL RADIUS	
			84332	038-84332	3" - SCH-40 - SPECIAL RADIUS	
			84333	038-84333	4" - SCH-40 - SPECIAL RADIUS	
			84334	038-84334	6" - SCH-40 - SPECIAL RADIUS	
2043	PVC COUPLING Unión PVC		83428	038-83428	¾" - SCH-40	
			83429	038-83429	1" - SCH-40	
			58486	038-01909	2" - SCH-40	
			83198	038-83198	3" - SCH-40	
			59315	038-01834	4" - SCH-40	
			56931	038-01762	6" - SCH-40	
			56924	038-01693	8" - SCH-40	
2045	PVC END BELL Terminal tipo campana PVC		84894	038-84894	¾" - SCH-40	
			59321	038-01891	2" - SCH-40	
			83201	038-83201	3" - SCH-40	
			59314	038-01826	4" - SCH-40	
			56930	038-01750	6" - SCH-40	
			56923	038-01685	8" - SCH-40	
2048	HEX HEAD BOLT Tornillo con cabeza hexagonal	4350.209	83212	038-83212	½" DIAMETER X 2" L BOLT - SS	
			83218	038-83218	½" DIAMETER X 1½" L BOLT - SS	
			83413	038-83413	⅜" DIAMETER X 1" L BOLT - SS	
2049	A-2-4 BACKFILL MATERIAL Material de relleno A-2-4	4350.205	83207	038-83207	A-2-4 MATERIAL AS PER ASTM D3282, LATEST EDITION (CU.MT. OR m^3)	

STREET LIGHTING SYSTEM MATERIAL LIST

ITEM NO.	GENERAL DESCRIPTION	SPECS DOC NO.	ASSET SUITE'S CATALOG NO.	WAREHOUSE ITEM	DETAILS	ILUSTRATIONS
2050	#67 CRUSHED STONE OR GRAVEL Piedra triturada o gravilla #67	4350.223	83208	038-83208	¾" AND SMALLER CRUSHED STONE (CU. MT. OR m³)	
2055	READY MIX CONCRETE Concreto premezclado	4350.267	44668	038-44668	3000 PSI 4000 PSI	
2067	12" X 12" SERVICE PEDESTAL Pedestal de servicio 12" X 12"	4350.186	58494	038-01984	12" W X 12" L X 12" D STANDARD OPEN BOTTOM, TIER 15 UNDERGROUND SQUARE ENCLOSURE WITH TIER 15 COVER MADE OF PRECAST POLYMER CONCRETE	
2069	HAZARD WARNING TAPE Cinta de advertencia de peligro	4350.268	83464	072-83464	ELECTRICAL HAZARD WARNING TAPE	
2070	DUCT SPACER Espaciador/Separador de ductos	4350.235	58487	038-01917	2" x 3" - BASE	
			83210	038-83210	3" x 3" - BASE	
			59316	038-01842	4" x 3" - BASE	
			59309	038-01776	6" x 3" - BASE	
			56925	038-01701	8" x 3" - BASE	
			58488	038-01925	2" x 3" - INTERMEDIATE	
			83211	038-83211	3" x 3" - INTERMEDIATE	
			59317	038-01859	4" x 3" - INTERMEDIATE	
			59310	038-01784	6" x 3" - INTERMEDIATE	
			56926	038-01719	8" x 3" - INTERMEDIATE	
2086	STRANDED COPPER CABLE, 600 V, THHN / THWN-2 Cable de cobre trenzado, 600 V, THHN / THWN-2	4350.056	58516	040-00774	#12 AWG CU, 600 V, THHN, GREEN	
			54271	040-00931	#12 AWG CU, 600 V, THHN, WHITE	
			54270	040-00899	#12 AWG CU, 600 V, THHN, BLACK	
			54269	040-00873	#12 AWG CU, 600 V, THHN, RED	
			54268	040-00857	#12 AWG CU, 600 V, THHN, ORANGE	
			54267	040-00816	#12 AWGCU, 600 V, THHN, BLUE	
			54266	040-00790	#12 AWG CU, 600 V, THHN, YELLOW	
			54273	040-01293	#12 AWG CU, 600 V, THHN, BROWN	
			56897	006-01070	#10 AWG CU, 600 V, THHN, BLACK - SOLID	
			83458	006-83458	#10 AWG CU, 600 V, THHN, GREEN	
			83459	006-83459	#10 AWG CU, 600 V, THHN, WHITE	
			84642	006-84642	#10 AWG CU, 600 V, THHN, BLACK	
2102	STRUT CHANNEL NUT Tuerca del canal de puntal	4350.298	84270	002-84270	½" – 13 UNC (SPRING NUT)	
			84271	002-84271	⅜" – 16 UNC (SPRING NUT)	

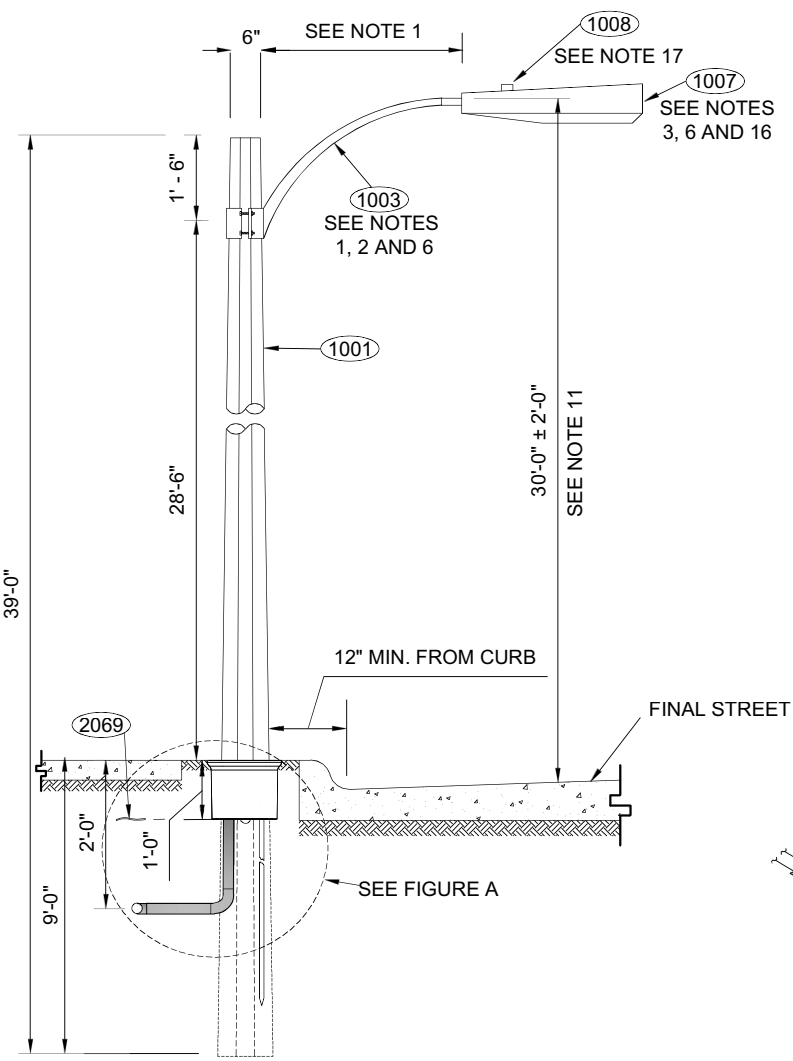
DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

OCTAGONAL CONCRETE POLE MOUNTING
FOR 120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO. STL-1 VERSION 4
DOCUMENT NO. 4401.002
PAGE 1 OF 4 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000



PROFILE VIEW

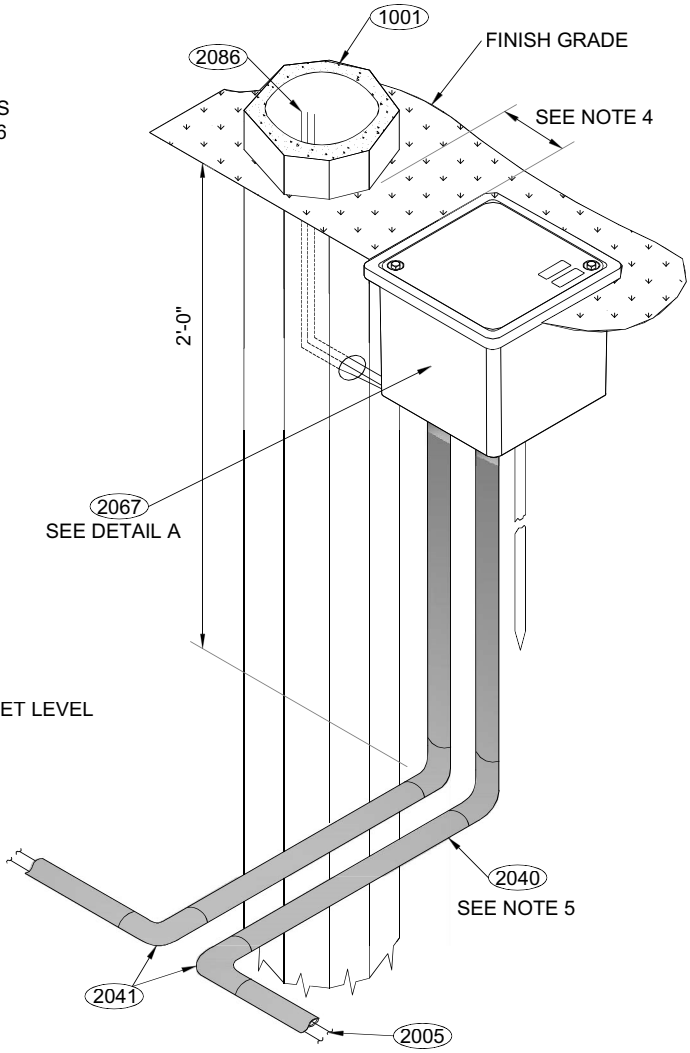
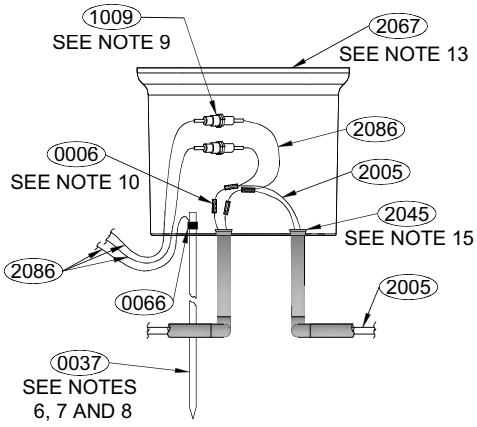


FIGURE A
UNDERGROUND CABLE ENTRY AT
THE POLE CABLE OPENING



DETAIL A
LUMINAIRE FUSE CONNECTION

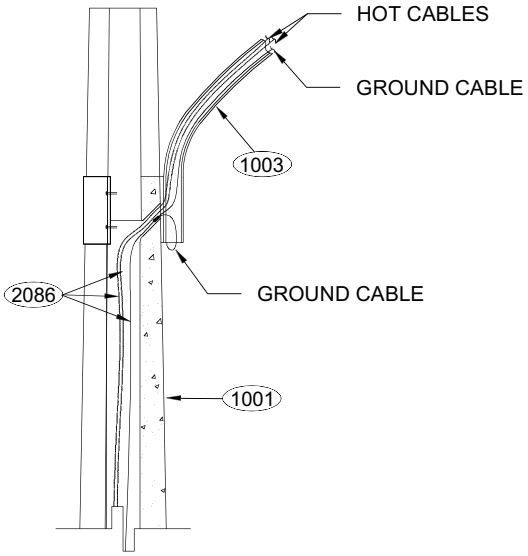
DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

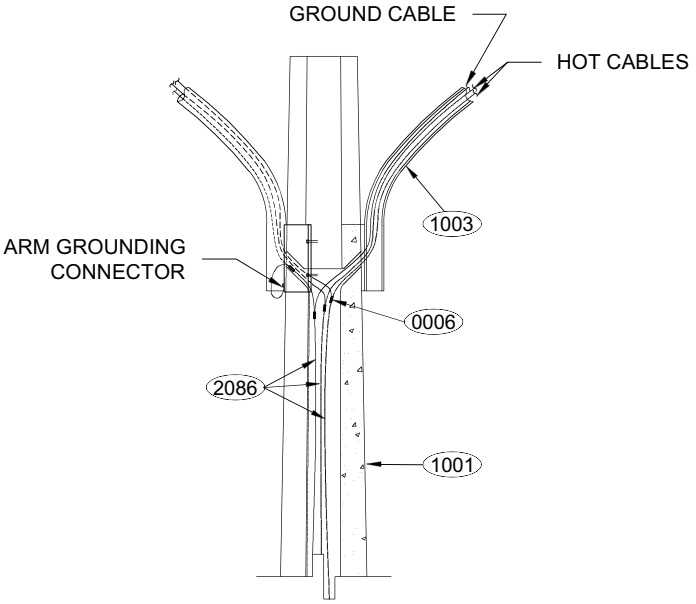
TITLE:

OCTAGONAL CONCRETE POLE MOUNTING
FOR 120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

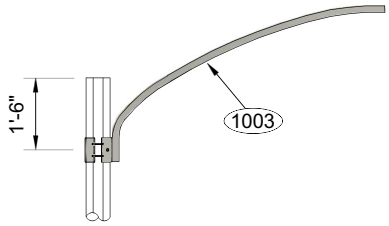
STANDARD NO.	STL-1 VERSION 4
DOCUMENT NO.	4401.002
PAGE	2 OF 4 DATE AUG 24, 2023
SUBMITTED	LUIS R. SOTO LIC. 11658
REVIEWED	IVETTE D. SANCHEZ LIC. 13837
APPROVED	RICARDO CASTRO LIC. 12135
DIGITIZED	EMILIO CUADRADO LIC. 3000



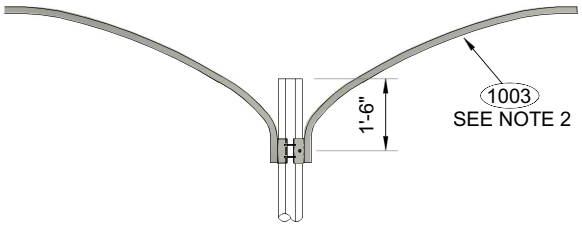
DETAIL B
ARM CONNECTION FOR SINGLE INSTALLATION



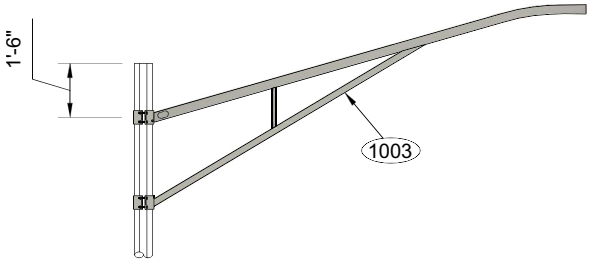
DETAIL C
ARM CONNECTION FOR DOUBLE INSTALLATION



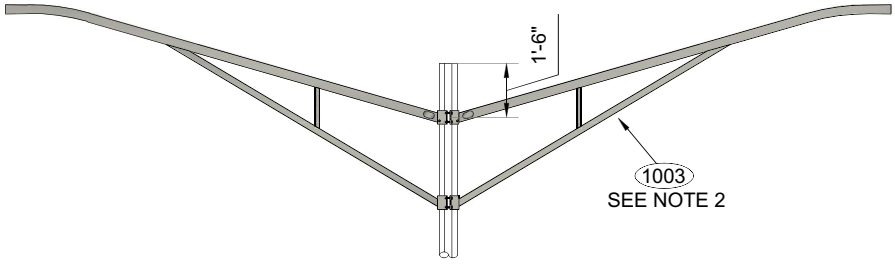
DETAIL D
4' LONG SINGLE ARM
SINGLE INSTALLATION



DETAIL E
4' LONG SINGLE ARM
DOUBLE INSTALLATION



DETAIL F
12' LONG TRUSS ARM
SINGLE INSTALLATION



DETAIL G
12' LONG TRUSS ARM
DOUBLE INSTALLATION

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

OCTAGONAL CONCRETE POLE MOUNTING FOR 120 / 240 V LED LUMINAIRE MAXIMUM VOLTAGE: 240 V NOTES

STANDARD NO. STL-1 VERSION 4
DOCUMENT NO. 4401.002
PAGE 3 OF 4 DATE AUG 24, 2023

SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

NOTES:

1. ARMS FOR LED LUMINAIRES IN OCTAGONAL CONCRETE POLES (ITEM 1003) CAN BE 4' LONG SINGLE ARM OR 12' LONG TRUSS ARM.
2. FOR DOUBLE ARMS INSTALLATION, LED LUMINAIRES SHALL BE CONNECTED THROUGH THE ARMS AT THE TOP OF THE POLE USING COMPRESSION CONNECTORS (ITEM 0006). REFER TO DETAIL C.
3. LED LUMINAIRES CAN BE 65 W OR 125 W ACCORDING TO THE DESIGN, CONNECTED TO 240 V CIRCUIT.
4. SERVICE PEDESTAL (ITEM 2067) SHALL BE INSTALLED BETWEEN 1' TO 2' FROM POLE IN THE PLANTING AREA. IT SHALL BE INSTALLED FLUSH WITH THE FINISH GRADE.
5. FOR STREET LIGHTING CIRCUITS, A PVC SCH-40 DUCT (ITEM 2040) WITH MINIMUM DIAMETER OF ¾" WILL BE USED FOR #12 AWG CABLES, AND 2" DIAMETER PVC SCH-40 DUCT FOR CABLES OF GAUGE NOT LARGER THAN 4/0 AWG. PVC SCH-40 DUCT FOR STREET LIGHTING CIRCUITS SHALL BE INSTALLED 24" DEEP. HAZARD WARNING TAPE (ITEM 2069) SHALL BE INSTALLED 12" BELOW THE FINISH GRADE.
6. GROUND ROD SHALL BE ON THE SERVICE PEDESTAL IN EACH STREET LIGHTING POLE. ENSURE GROUND CONNECTION AT SERVICE PEDESTAL, ARM FOR LED LUMINAIRE AND LED LUMINAIRE.
7. STRUCTURE'S FOOTING RESISTANCE TO GROUND SHALL BE BETWEEN 5 AND 10 OHMS OR LESS. USE ADDITIONAL RODS AS NECESSARY WITH THE DESIGNING ENGINEER GUIDANCE.
8. GROUND RODS WITH A MINIMUM LENGTH OF 8' SHALL BE USED FOR THE GROUNDING SYSTEM. TWO OR MORE SECTIONS OF 4' LONG GROUND RODS JOINED TOGETHER CAN ALSO BE USED.
9. EACH LIGHTING POLE SHALL BE FUSED WITH A 10 A MIDGET TYPE FUSE ON THE NEAREST SERVICE PEDESTAL. MIDGET FUSE HOLDER MAXIMUM RATING SHALL BE 30 A.
10. COMPRESSION CONNECTORS SHALL BE COVERED WITH A FEW LAYERS OF VINYL INSULATING TAPE (ITEM 0077).
11. LED LUMINARIES SHALL BE INSTALLED AT 28' TO 32' MOUNTING HEIGHT FROM FINAL STREET LEVEL.
12. INSTALLATION OF WIRELESS CAMERAS OR ANTENNAS IS ALLOWED ON STREET LIGHTING POLES. THIS EQUIPMENT CONNECTION SHALL BE TO THE 240 V CIRCUIT. THEY SHALL BE INTERCONNECTED FROM THE NEAREST STREET LIGHTING SERVICE PEDESTAL OR PAD MOUNTED TRANSFORMER AVAILABLE. AN EXPOSED RISER SHALL BE INSTALLED USING A PVC SCH-80 DUCT, ATTACHED TO THE POLE WITH STAINLESS STEEL FIXING BANDS. DRILLING HOLES IS NOT ALLOWED. AN INDEPENDENT FUSE CIRCUIT PROTECTION SHALL BE INSTALLED FOR EACH EQUIPMENT. THIS EQUIPMENT SHALL BE INSTALLED 42" MINIMUM BELOW THE ARM FOR LED LUMINAIRE.
13. EXCAVATION SHALL BE APPROXIMATELY 6" DEEPER THAN THE DEPTH OF THE SERVICE PEDESTAL. #67 CLEAN CRUSHED STONE OR GRAVEL WITH A MINIMUM THICKNESS OF 6" SHALL BE PLACED FOR DRAINAGE. THIS MATERIAL SHALL BE UNIFORMLY GRADED AND SIZED FROM ¾" DOWN TO FINE PARTICLES. IT SHALL BE FREE FROM SOFT AND DISINTEGRATED PIECES, CLAY, ORGANIC OR OTHER DELETERIOUS MATTER. THE PEDESTAL SHALL BE INSTALLED ENSURING THAT THE TOP COVER IS AT FINISH GRADE. IT SHALL BE FILLED WITH SOIL AROUND THE SERVICE PEDESTAL AND COMPACTED.
14. AFTER INSTALLATION OF ALL CABLES IS COMPLETED, DUCTS SHALL BE SEALED WITH A DUCT SEALING COMPOUND (ITEM 2014).
15. DUCTS SHALL HAVE A PVC END BELL (ITEM 2045) TO PROVIDE A SMOOTH SAFE CABLE ENTRY.
16. AMBER LED LUMINARIE (ITEM 1007) SHALL BE USED TO REDUCE LIGHT POLLUTION IN SPECIAL AREAS OR BEACHES WHERE SEA TURTLES NESTS.
17. FOR LIGHTING CIRCUITS IN MAIN ROADS OR HIGHWAYS, A LUMINAIRES CONTROLLER (ITEM 1012) IS REQUIRED. USE OF A SHORTING CAP (ITEM 1010) ON EACH LED LUMINAIRE TO PROVIDE POWER. IN CASES WHEN A LUMINAIRES CONTROLLER IS NOT INSTALLED A PHOTO CONTROL (ITEM 1008), FACING NORTH, IS REQUIRED IN EACH LED LUMINAIRE. FOR DETAILED INSTALLATION, REFER TO STANDARD NO. STL-14.
18. FOR STREET LIGHTING CIRCUITS CONDUIT TRENCH CONSTRUCTION DETAIL, REFER TO STANDARD NO. STL-16.

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

OCTAGONAL CONCRETE POLE MOUNTING
FOR 120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V
BILL OF MATERIAL

STANDARD NO. STL-1 VERSION 4
DOCUMENT NO. 4401.002
PAGE 4 OF 4 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

MATERIALS			
NO.	GENERAL DESCRIPTION	WAREHOUSE ITEM	QTY.
0006	COMPRESSION SPLICES AND CONNECTORS	VARIES	AS REQ.
0037	5/8" GROUND ROD	VARIES	AS REQ.
0066	CONNECTOR FOR 5/8" GROUND ROD	002-13595	1
0077	VINYL INSULATING TAPE	VARIES	AS REQ.
1001	OCTAGONAL CONCRETE POLE	026-00146	1
1003	ARM FOR LED LUMINAIRE IN OCTAGONAL CONCRETE POLE	VARIES	AS REQ.
1007	LED LUMINAIRE	VARIES	AS REQ.
1008	PHOTO CONTROL	030-78111	AS REQ.
1009	MIDGET FUSE HOLDER	038-00729	2
1010	SHORTING CAP	030-80074	AS REQ.
1012	LUMINAIRES CONTROLLER	030-82824	AS REQ.
2005	STRANDED COPPER CABLE, 600 V, XHHW-2	VARIES	AS REQ.
2014	DUCT SEALING COMPOUND	003-02935	AS REQ.
2040	PVC SCH-40 DUCT	VARIES	AS REQ.
2041	90° PVC ELBOW	VARIES	AS REQ.
2043	PVC COUPLING	VARIES	AS REQ.
2045	PVC END BELL	VARIES	AS REQ.
2050	#67 CRUSHED STONE OR GRAVEL	038-83208	AS REQ.
2067	12" X 12" SERVICE PEDESTAL	038-01984	1
2069	HAZARD WARNING TAPE	072-83464	AS REQ.
2086	STRANDED COPPER CABLE, 600 V, THHN / THWN-2	VARIES	AS REQ.

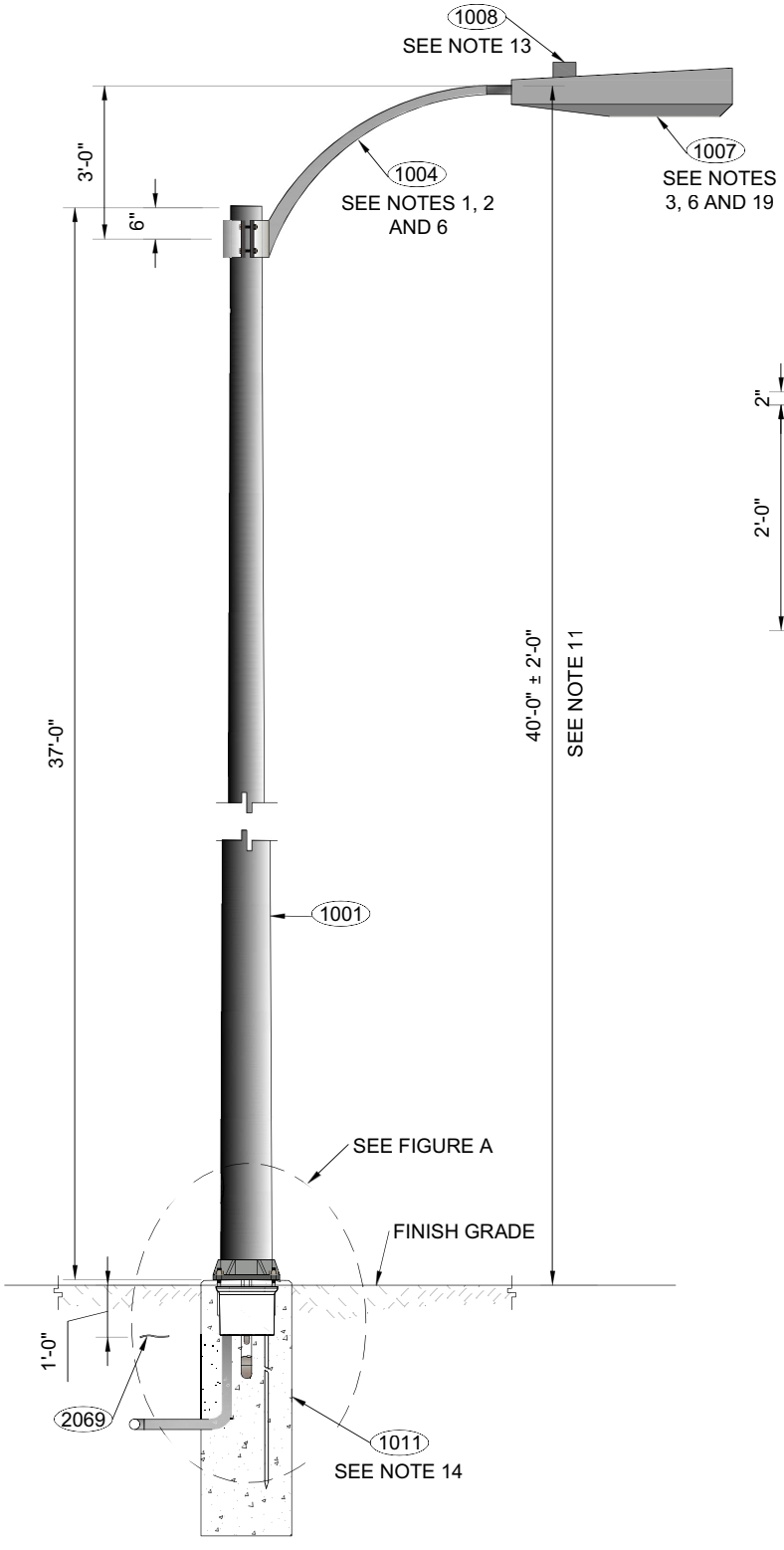
DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

ALUMINUM POLE MOUNTING
FOR 120 / 240 V, 125 W, LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO.	STL-4 VERSION 4
DOCUMENT NO.	4401.007
PAGE	1 OF 4 DATE AUG 24, 2023
SUBMITTED	LUIS R. SOTO LIC. 11658
REVIEWED	IVETTE D. SANCHEZ LIC. 13837
APPROVED	RICARDO CASTRO LIC. 12135
DIGITIZED	EMILIO CUADRADO LIC. 3000



PROFILE VIEW

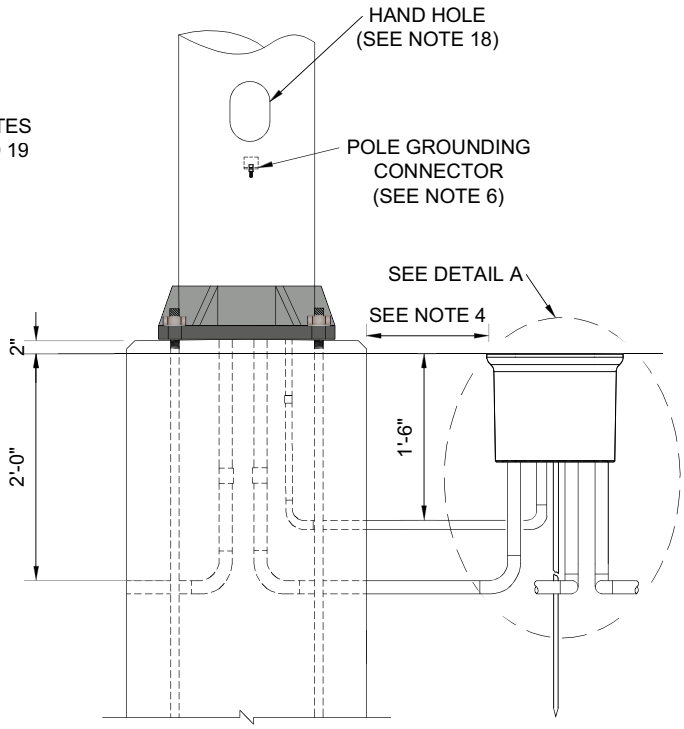
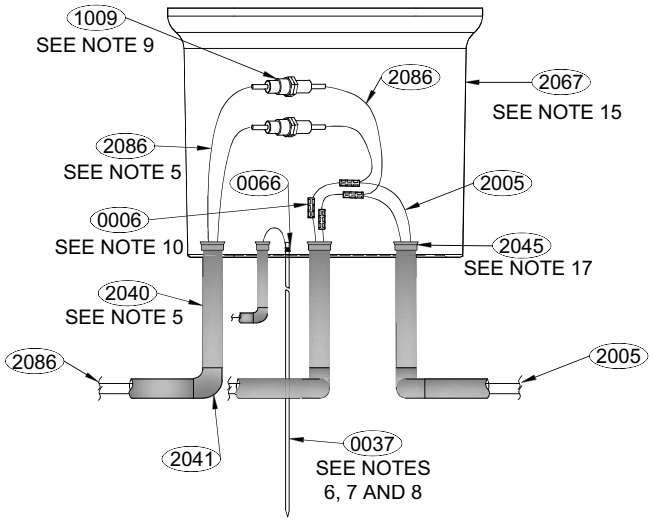


FIGURE A
UNDERGROUND CABLE ENTRY AT THE
CONCRETE BASE SUPPORT CABLE OPENING



DETAIL A
LUMINAIRE FUSE CONNECTION

DISTRIBUTION ENGINEERING

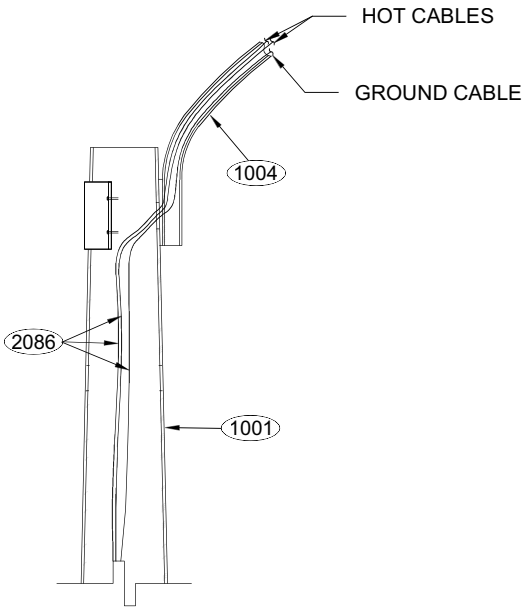
STREET LIGHTING STANDARDS

TITLE:

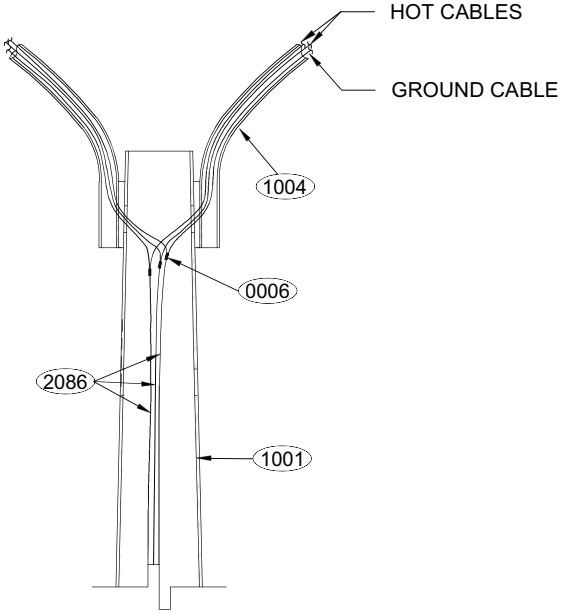
ALUMINUM POLE MOUNTING
FOR 120 / 240 V, 125 W, LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO. STL-4 VERSION 4
DOCUMENT NO. 4401.007
PAGE 2 OF 4 DATE AUG 24, 2023

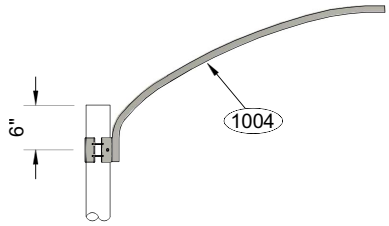
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000



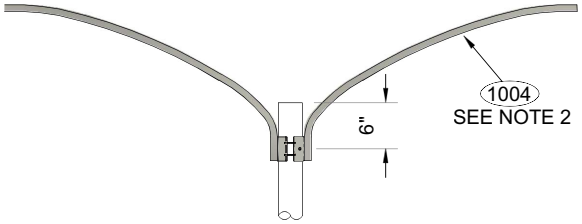
DETAIL B
ARM CONNECTION FOR SINGLE INSTALLATION



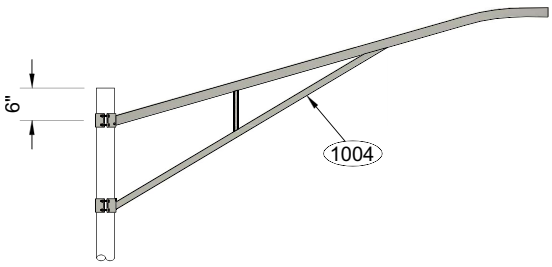
DETAIL C
ARM CONNECTION FOR DOUBLE INSTALLATION



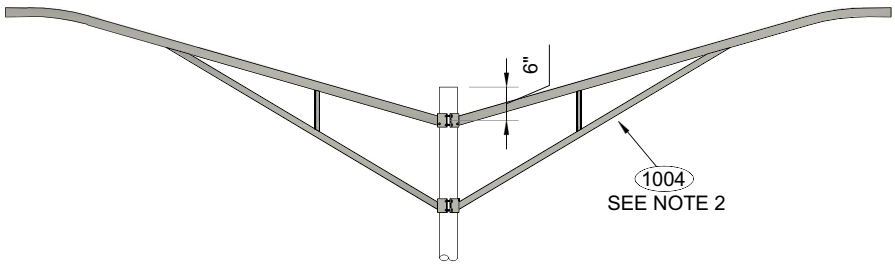
DETAIL D
4' AND 8' LONG SINGLE ARM
SINGLE INSTALLATION



DETAIL E
4' AND 8' LONG SINGLE ARM
DOUBLE INSTALLATION



DETAIL F
12' AND 15' LONG TRUSS
ARM SINGLE INSTALLATION



DETAIL G
12' AND 15' LONG TRUSS
ARM DOUBLE INSTALLATION

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

ALUMINUM POLE MOUNTING
FOR 120 / 240 V, 125 W, LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V
NOTES

STANDARD NO. STL-4 VERSION 4
DOCUMENT NO. 4401.007
PAGE 3 OF 4 DATE AUG 24, 2023

SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

NOTES:

1. ARMS FOR LED LUMINAIRES IN ALUMINUM POLES (ITEM 1004) CAN BE 4' OR 8' LONG SINGLE ARM OR 12' OR 15' LONG TRUSS ARM.
2. FOR DOUBLE ARMS INSTALLATION, LED LUMINAIRES SHALL BE CONNECTED THROUGH THE ARMS AT THE TOP OF THE POLE USING COMPRESSION CONNECTORS (ITEM 0006). REFER TO DETAIL C.
3. LED LUMINAIRES SHALL BE CONNECTED TO 240 V CIRCUIT, 125 W.
4. SERVICE PEDESTAL (ITEM 2067) SHALL BE INSTALLED BETWEEN 1' TO 2' FROM POLE CONCRETE BASE IN THE PLANTING AREA. IT SHALL BE INSTALLED FLUSH WITH THE FINISH GRADE.
5. FOR STREET LIGHTING CIRCUITS, A PVC SCH-40 DUCT (ITEM 2040) WITH MINIMUM DIAMETER OF ¾" WILL BE USED FOR #12 AWG CABLES, AND 2" DIAMETER PVC SCH-40 DUCT FOR CABLES OF GAUGE NOT LARGER THAN 4/0 AWG. PVC SCH-40 DUCT FOR STREET LIGHTING CIRCUITS SHALL BE INSTALLED 24" DEEP. HAZARD WARNING TAPE (ITEM 2069) SHALL BE INSTALLED 12" BELOW THE FINISH GRADE. DUCT FOR GROUNDING CABLE SHALL BE 18" DEEP.
6. GROUND ROD SHALL BE ON THE SERVICE PEDESTAL IN EACH STREET LIGHTING POLE. ENSURE GROUND CONNECTION AT SERVICE PEDESTAL, ALUMINUM POLE, ARM FOR LED LUMINAIRE AND LED LUMINAIRE.
7. STRUCTURE'S FOOTING RESISTANCE TO GROUND SHALL BE BETWEEN 5 AND 10 OHMS OR LESS. USE ADDITIONAL RODS AS NECESSARY WITH THE DESIGNING ENGINEER GUIDANCE.
8. GROUND RODS WITH A MINIMUM LENGTH OF 8' SHALL BE USED FOR THE GROUNDING SYSTEM. TWO OR MORE SECTIONS OF 4' LONG GROUND RODS JOINED TOGETHER CAN ALSO BE USED.
9. EACH LIGHTING POLE SHALL BE FUSED WITH A 10 A MIDGET TYPE FUSE ON THE NEAREST SERVICE PEDESTAL. MIDGET FUSE HOLDER MAXIMUM RATING SHALL BE 30 A.
10. COMPRESSION CONNECTORS SHALL BE COVERED WITH A FEW LAYERS OF VINYL INSULATING TAPE (ITEM 0077).
11. LED LUMINARIES SHALL BE INSTALLED AT 38' TO 42' MOUNTING HEIGHT FROM FINAL STREET LEVEL.
12. INSTALLATION OF WIRELESS CAMERAS OR ANTENNAS IS ALLOWED ON STREET LIGHTING POLES. THIS EQUIPMENT CONNECTION SHALL BE TO THE 240 V CIRCUIT. THEY SHALL BE INTERCONNECTED FROM THE NEAREST STREET LIGHTING SERVICE PEDESTAL OR PAD MOUNTED TRANSFORMER AVAILABLE. AN EXPOSED RISER SHALL BE INSTALLED USING A PVC SCH-80 DUCT, ATTACHED TO THE POLE WITH STAINLESS STAINLESS STEEL FIXING BANDS. DRILLING HOLES IS NOT ALLOWED. AN INDEPENDENT FUSE CIRCUIT PROTECTION SHALL BE INSTALLED FOR EACH EQUIPMENT. THIS EQUIPMENT SHALL BE INSTALLED 42" MINIMUM BELOW THE ARM FOR LED LUMINAIRE.
13. FOR LIGHTING CIRCUITS IN MAIN ROADS OR HIGHWAYS, A LUMINAIRES CONTROLLER (ITEM 1012) IS REQUIRED. USE OF A SHORTING CAP (ITEM 1010) ON EACH LED LUMINAIRE TO PROVIDE POWER. IN CASES WHEN A LUMINAIRES CONTROLLER IS NOT INSTALLED A PHOTO CONTROL (ITEM 1008), FACING NORTH, IS REQUIRED IN EACH LED LUMINAIRE. FOR DETAILED INSTALLATION, REFER TO STANDARD NO. STL-14.
14. ALUMINUM POLE CONCRETE BASE SUPPORT (ITEM 1011) SHALL BE INSTALLED 7'-4" DEEP, LEVELED. IT IS REQUIRED TO LEAVE 2" OVER THE FINISH GRADE. FOR INSTALLATION OF THE CONCRETE BASE:
    A. LEVEL AND COMPACT EVENLY THE EXCAVATION BOTTOM.
    B. FILL 6" WITH #67 CRUSHED STONE OR GRAVEL (ITEM 2050) AND LEVEL IT.
    C. INSTALL THE CONCRETE BASE SUPPORT AND LEVEL IT.
    D. THE EXCAVATION SHALL BE FILLED WITH SATURATED CLEAN SAND.
15. EXCAVATION SHALL BE APPROXIMATELY 6" DEEPER THAN THE DEPTH OF THE SERVICE PEDESTAL. #67 CLEAN CRUSHED STONE OR GRAVEL WITH A MINIMUM THICKNESS OF 6" SHALL BE PLACED FOR DRAINAGE. THIS MATERIAL SHALL BE UNIFORMLY GRADED AND SIZED FROM ¾" DOWN TO FINE PARTICLES. IT SHALL BE FREE FROM SOFT AND DISINTEGRATED PIECES, CLAY, ORGANIC OR OTHER DELETERIOUS MATTER. THE PEDESTAL SHALL BE INSTALLED ENSURING THAT THE TOP COVER IS AT FINISH GRADE. IT SHALL BE FILLED WITH SOIL AROUND THE SERVICE PEDESTAL AND COMPACTED.
16. AFTER INSTALLATION OF ALL CABLES IS COMPLETED, DUCTS SHALL BE SEALED WITH A DUCT SEALING COMPOUND (ITEM 2014).
17. DUCTS SHALL HAVE A PVC END BELL (ITEM 2045) TO PROVIDE A SMOOTH SAFE CABLE ENTRY.
18. HAND HOLE OPENING MUST FACE THE OPPOSITE SIDE TO TRANSIT.
19. FOR STREET LIGHTING CIRCUITS CONDUIT TRENCH CONSTRUCTION DETAIL, REFER TO STANDARD NO. STL-16.

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

ALUMINUM POLE MOUNTING
FOR 120 / 240 V, 125 W, LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V
BILL OF MATERIAL

STANDARD NO. STL-4 VERSION 4
DOCUMENT NO. 4401.007
PAGE 4 OF 4 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

MATERIALS			
NO.	GENERAL DESCRIPTION	WAREHOUSE ITEM	QTY.
0006	COMPRESSION SPLICES AND CONNECTORS	VARIES	AS REQ.
0037	5/8" GROUND ROD	VARIES	AS REQ.
0066	CONNECTOR FOR 5/8" GROUND ROD	002-13595	1
0077	VINYL INSULATING TAPE	VARIES	AS REQ.
1001	ALUMINUM POLE	026-00609	1
1004	ARM FOR LED LUMINAIRE IN ALUMINUM POLE	VARIES	AS REQ.
1007	LED LUMINAIRE	028-78110	AS REQ.
1008	PHOTO CONTROL	030-78111	AS REQ.
1009	MIDGET FUSE HOLDER	038-00729	2
1010	SHORTING CAP	030-80074	AS REQ.
1011	ALUMINUM POLE CONCRETE BASE SUPPORT	026-84237	1
1012	LUMINAIRES CONTROLLER	030-82824	AS REQ.
2005	STRANDED COPPER CABLE, 600 V, XHHW-2	VARIES	AS REQ.
2014	DUCT SEALING COMPOUND	003-02935	AS REQ.
2040	PVC SCH-40 DUCT	VARIES	AS REQ.
2041	90° PVC ELBOW	VARIES	AS REQ.
2043	PVC COUPLING	VARIES	AS REQ.
2045	PVC END BELL	VARIES	AS REQ.
2050	#67 CRUSHED STONE OR GRAVEL	038-83208	AS REQ.
2067	12" X 12" SERVICE PEDESTAL	038-01984	1
2069	HAZARD WARNING TAPE	072-83464	AS REQ.
2086	STRANDED COPPER CABLE, 600 V, THHN / THWN-2	VARIES	AS REQ.

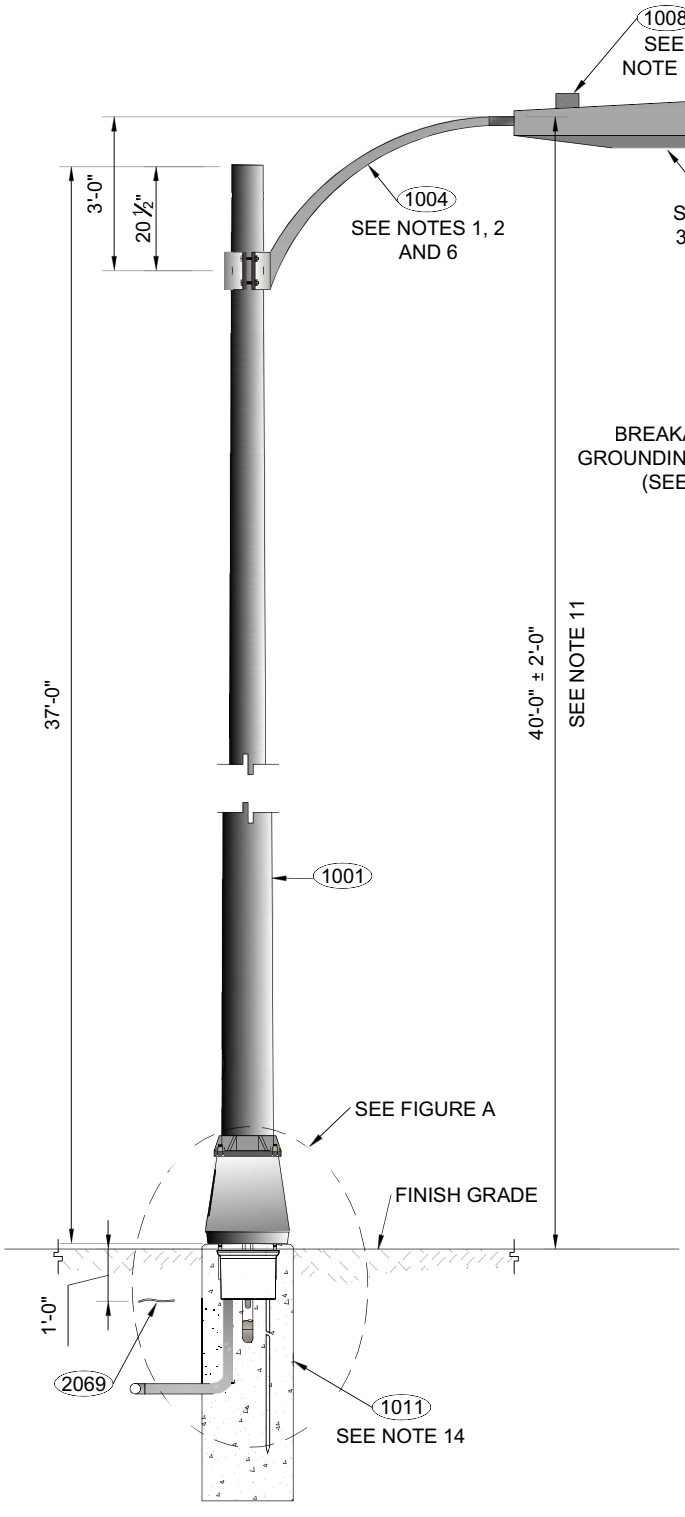
DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

ALUMINUM POLE WITH BREAKAWAY BASE MOUNTING
FOR 120 / 240 V, 125 W, LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO.	STL-6 VERSION 4
DOCUMENT NO.	4401.011
PAGE	1 OF 4 DATE AUG 24, 2023
SUBMITTED	LUIS R. SOTO LIC. 11658
REVIEWED	IVETTE D. SANCHEZ LIC. 13837
APPROVED	RICARDO CASTRO LIC. 12135
DIGITIZED	EMILIO CUADRADO LIC. 3000



PROFILE VIEW

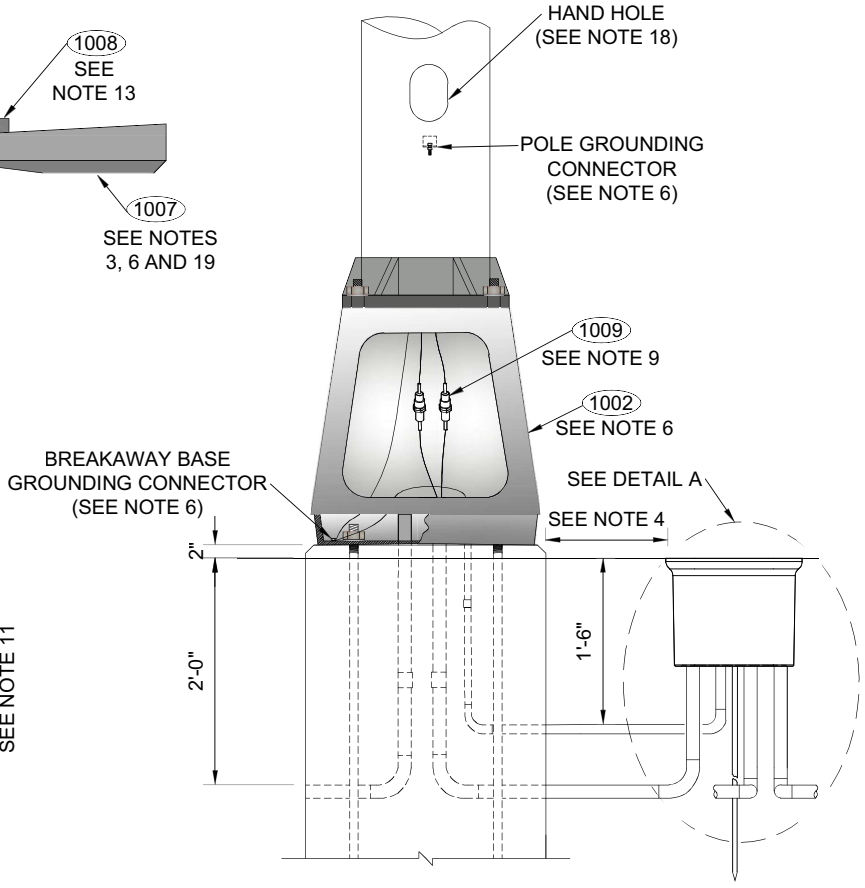
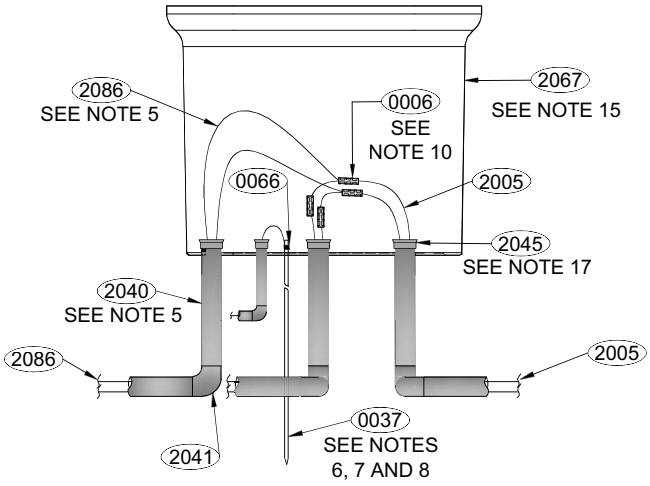


FIGURE A
UNDERGROUND CABLE ENTRY AT THE
CONCRETE BASE SUPPORT CABLE OPENING



DETAIL A
LUMINAIRE FUSE CONNECTION

DISTRIBUTION ENGINEERING

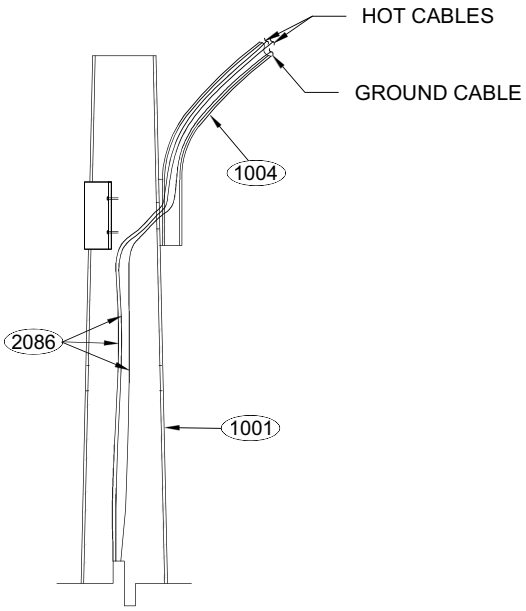
STREET LIGHTING STANDARDS

TITLE:

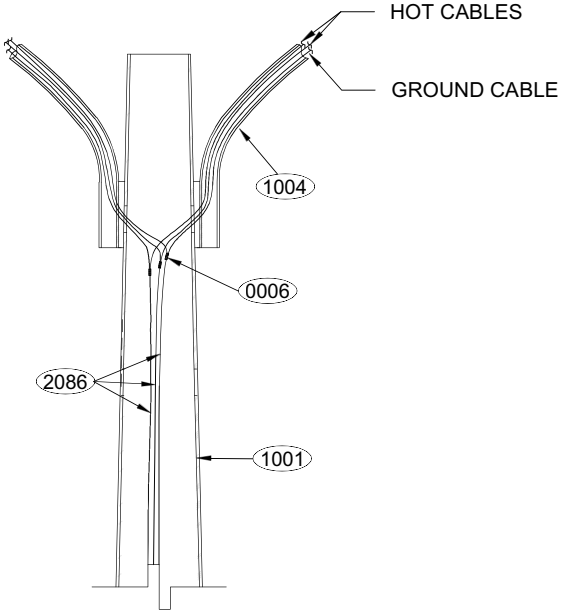
ALUMINUM POLE WITH BREAKAWAY BASE MOUNTING
FOR 120 / 240 V, 125 W, LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO. STL-6 VERSION 4
DOCUMENT NO. 4401.011
PAGE 2 OF 4 DATE AUG 24, 2023

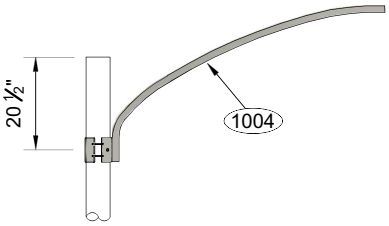
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000



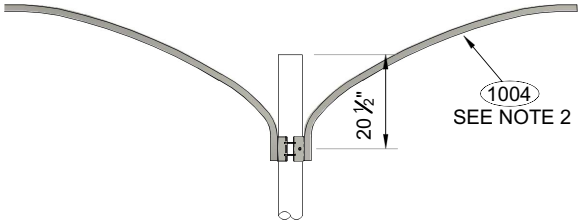
DETAIL B
ARM CONNECTION FOR SINGLE INSTALLATION



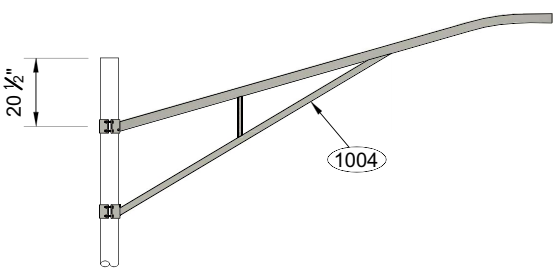
DETAIL C
ARM CONNECTION FOR DOUBLE INSTALLATION



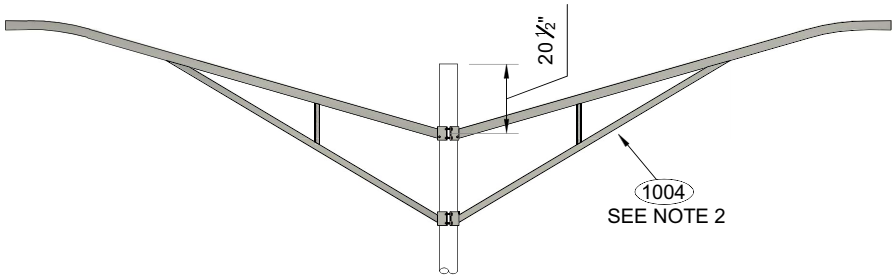
DETAIL D
4' AND 8' LONG SINGLE ARM
SINGLE INSTALLATION



DETAIL E
4' AND 8' LONG SINGLE ARM
DOUBLE INSTALLATION



DETAIL F
12' AND 15' LONG TRUSS
ARM SINGLE INSTALLATION



DETAIL G
12' AND 15' LONG TRUSS
ARM DOUBLE INSTALLATION

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

ALUMINUM POLE WITH BREAKAWAY BASE MOUNTING FOR 120 / 240 V, 125 W, LED LUMINAIRE MAXIMUM VOLTAGE: 240 V NOTES

STANDARD NO.	STL-6 VERSION 4
DOCUMENT NO.	4401.011
PAGE	3 OF 4 DATE AUG 24, 2023
SUBMITTED	LUIS R. SOTO LIC. 11658
REVIEWED	IVETTE D. SANCHEZ LIC. 13837
APPROVED	RICARDO CASTRO LIC. 12135
DIGITIZED	EMILIO CUADRADO LIC. 3000

NOTES:

1. ARMS FOR LED LUMINAIRES IN ALUMINUM POLES (ITEM 1004) CAN BE 4' OR 8' LONG SINGLE ARM OR 12' OR 15' LONG TRUSS ARM.
2. FOR DOUBLE ARMS INSTALLATION, LED LUMINAIRES SHALL BE CONNECTED THROUGH THE ARMS AT THE TOP OF THE POLE USING COMPRESSION CONNECTORS (ITEM 0006). REFER TO DETAIL C.
3. LED LUMINAIRES SHALL BE CONNECTED TO 240 V CIRCUIT, 125 W.
4. SERVICE PEDESTAL (ITEM 2067) SHALL BE INSTALLED BETWEEN 1' TO 2' FROM POLE CONCRETE BASE IN THE PLANTING AREA. IT SHALL BE INSTALLED FLUSH WITH THE FINISH GRADE.
5. FOR STREET LIGHTING CIRCUITS, A PVC SCH-40 DUCT (ITEM 2040) WITH MINIMUM DIAMETER OF ¾" WILL BE USED FOR #12 AWG CABLES, AND 2" DIAMETER PVC SCH-40 DUCT FOR CABLES OF GAUGE NOT LARGER THAN 4/0 AWG. PVC SCH-40 DUCT FOR STREET LIGHTING CIRCUITS SHALL BE INSTALLED 24" DEEP. HAZARD WARNING TAPE (ITEM 2069) SHALL BE INSTALLED 12" BELOW THE FINISH GRADE. DUCT FOR GROUNDING CABLE SHALL BE 18" DEEP.
6. GROUND ROD SHALL BE ON THE SERVICE PEDESTAL IN EACH STREET LIGHTING POLE. ENSURE GROUND CONNECTION AT SERVICE PEDESTAL, BREAKAWAY BASE, ALUMINUM POLE, ARM FOR LED LUMINAIRE AND LED LUMINAIRE.
7. STRUCTURE'S FOOTING RESISTANCE TO GROUND SHALL BE BETWEEN 5 AND 10 OHMS OR LESS. USE ADDITIONAL RODS AS NECESSARY WITH THE DESIGNING ENGINEER GUIDANCE.
8. GROUND RODS WITH A MINIMUM LENGTH OF 8' SHALL BE USED FOR THE GROUNDING SYSTEM. TWO OR MORE SECTIONS OF 4' LONG GROUND RODS JOINED TOGETHER CAN ALSO BE USED.
9. EACH LIGHTING POLE SHALL BE FUSED WITH A 10 A MIDGET TYPE FUSE ON THE BREAKAWAY BASE. MIDGET FUSE HOLDER MAXIMUM RATING SHALL BE 30 A.
10. COMPRESSION CONNECTORS SHALL BE COVERED WITH A FEW LAYERS OF VINYL INSULATING TAPE (ITEM 0077).
11. LED LUMINARIES SHALL BE INSTALLED AT 38' TO 42' MOUNTING HEIGHT FROM FINAL STREET LEVEL.
12. INSTALLATION OF WIRELESS CAMERAS OR ANTENNAS IS ALLOWED ON STREET LIGHTING POLES. THIS EQUIPMENT CONNECTION SHALL BE TO THE 240 V CIRCUIT. THEY SHALL BE INTERCONNECTED FROM THE NEAREST STREET LIGHTING SERVICE PEDESTAL OR PAD MOUNTED TRANSFORMER AVAILABLE. AN EXPOSED RISER SHALL BE INSTALLED USING A PVC SCH-80 DUCT, ATTACHED TO THE POLE WITH STAINLESS STAINLESS STEEL FIXING BANDS. DRILLING HOLES IS NOT ALLOWED. AN INDEPENDENT FUSE CIRCUIT PROTECTION SHALL BE INSTALLED FOR EACH EQUIPMENT. THIS EQUIPMENT SHALL BE INSTALLED 42" MINIMUM BELOW THE ARM FOR LED LUMINAIRE.
13. FOR LIGHTING CIRCUITS IN MAIN ROADS OR HIGHWAYS, A LUMINAIRES CONTROLLER (ITEM 1012) IS REQUIRED. USE OF A SHORTING CAP (ITEM 1010) ON EACH LED LUMINAIRE TO PROVIDE POWER. IN CASES WHEN A LUMINAIRES CONTROLLER IS NOT INSTALLED A PHOTO CONTROL (ITEM 1008), FACING NORTH, IS REQUIRED IN EACH LED LUMINAIRE. FOR DETAILED INSTALLATION, REFER TO STANDARD NO. STL-14.
14. ALUMINUM POLE CONCRETE BASE SUPPORT (ITEM 1011) SHALL BE INSTALLED 7'-4" DEEP, LEVELED. IT IS REQUIRED TO LEAVE 2" OVER THE FINISH GRADE. FOR INSTALLATION OF THE CONCRETE BASE:
    A. LEVEL AND COMPACT EVENLY THE EXCAVATION BOTTOM.
    B. FILL 6" WITH #67 CRUSHED STONE OR GRAVEL (ITEM 2050) AND LEVEL IT.
    C. INSTALL THE CONCRETE BASE SUPPORT AND LEVEL IT.
    D. THE EXCAVATION SHALL BE FILLED WITH SATURATED CLEAN SAND.
15. EXCAVATION SHALL BE APPROXIMATELY 6" DEEPER THAN THE DEPTH OF THE SERVICE PEDESTAL. #67 CLEAN CRUSHED STONE OR GRAVEL WITH A MINIMUM THICKNESS OF 6" SHALL BE PLACED FOR DRAINAGE. THIS MATERIAL SHALL BE UNIFORMLY GRADED AND SIZED FROM ¾" DOWN TO FINE PARTICLES. IT SHALL BE FREE FROM SOFT AND DISINTEGRATED PIECES, CLAY, ORGANIC OR OTHER DELETERIOUS MATTER. THE PEDESTAL SHALL BE INSTALLED ENSURING THAT THE TOP COVER IS AT FINISH GRADE. IT SHALL BE FILLED WITH SOIL AROUND THE SERVICE PEDESTAL AND COMPACTED.
16. AFTER INSTALLATION OF ALL CABLES IS COMPLETED, DUCTS SHALL BE SEALED WITH A DUCT SEALING COMPOUND (ITEM 2014).
17. DUCTS SHALL HAVE A PVC END BELL (ITEM 2045) TO PROVIDE A SMOOTH SAFE CABLE ENTRY.
18. HAND HOLE OPENING MUST FACE THE OPPOSITE SIDE TO TRANSIT.
19. FOR STREET LIGHTING CIRCUITS CONDUIT TRENCH CONSTRUCTION DETAIL, REFER TO STANDARD NO. STL-16.
20. THIS STANDARD WILL BE USED IN ALL CASES WHEN AN ALUMINUM LIGHTING POLE IS NOT PROTECTED BY A PHYSICAL BARRIER.

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

ALUMINUM POLE WITH BREAKAWAY BASE MOUNTING
FOR 120 / 240 V, 125 W, LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V
BILL OF MATERIAL

STANDARD NO. STL-6 VERSION 4
DOCUMENT NO. 4401.011
PAGE 4 OF 4 DATE AUG 24, 2023

SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

MATERIALS			
NO.	GENERAL DESCRIPTION	WAREHOUSE ITEM	QTY.
0006	COMPRESSION SPLICES AND CONNECTORS	VARIES	AS REQ.
0037	⅝" GROUND ROD	VARIES	AS REQ.
0066	CONNECTOR FOR ⅝" GROUND ROD	002-13595	1
0077	VINYL INSULATING TAPE	VARIES	AS REQ.
1001	ALUMINUM POLE	026-00609	1
1002	BREAKAWAY BASE	026-00658	1
1004	ARM FOR LED LUMINAIRE IN ALUMINUM POLE	VARIES	AS REQ.
1007	LED LUMINAIRE	028-78110	AS REQ.
1008	PHOTO CONTROL	030-78111	AS REQ.
1009	MIDGET FUSE HOLDER	038-00729	2
1010	SHORTING CAP	030-80074	AS REQ.
1011	ALUMINUM POLE CONCRETE BASE SUPPORT	026-84237	1
1012	LUMINAIRES CONTROLLER	030-82824	AS REQ.
2005	STRANDED COPPER CABLE, 600 V, XHHW-2	VARIES	AS REQ.
2014	DUCT SEALING COMPOUND	003-02935	AS REQ.
2040	PVC SCH-40 DUCT	VARIES	AS REQ.
2041	90° PVC ELBOW	VARIES	AS REQ.
2043	PVC COUPLING	VARIES	AS REQ.
2045	PVC END BELL	VARIES	AS REQ.
2050	#67 CRUSHED STONE OR GRAVEL	038-83208	AS REQ.
2067	12" X 12" SERVICE PEDESTAL	038-01984	1
2069	HAZARD WARNING TAPE	072-83464	AS REQ.
2086	STRANDED COPPER CABLE, 600 V, THHN / THWN-2	VARIES	AS REQ.

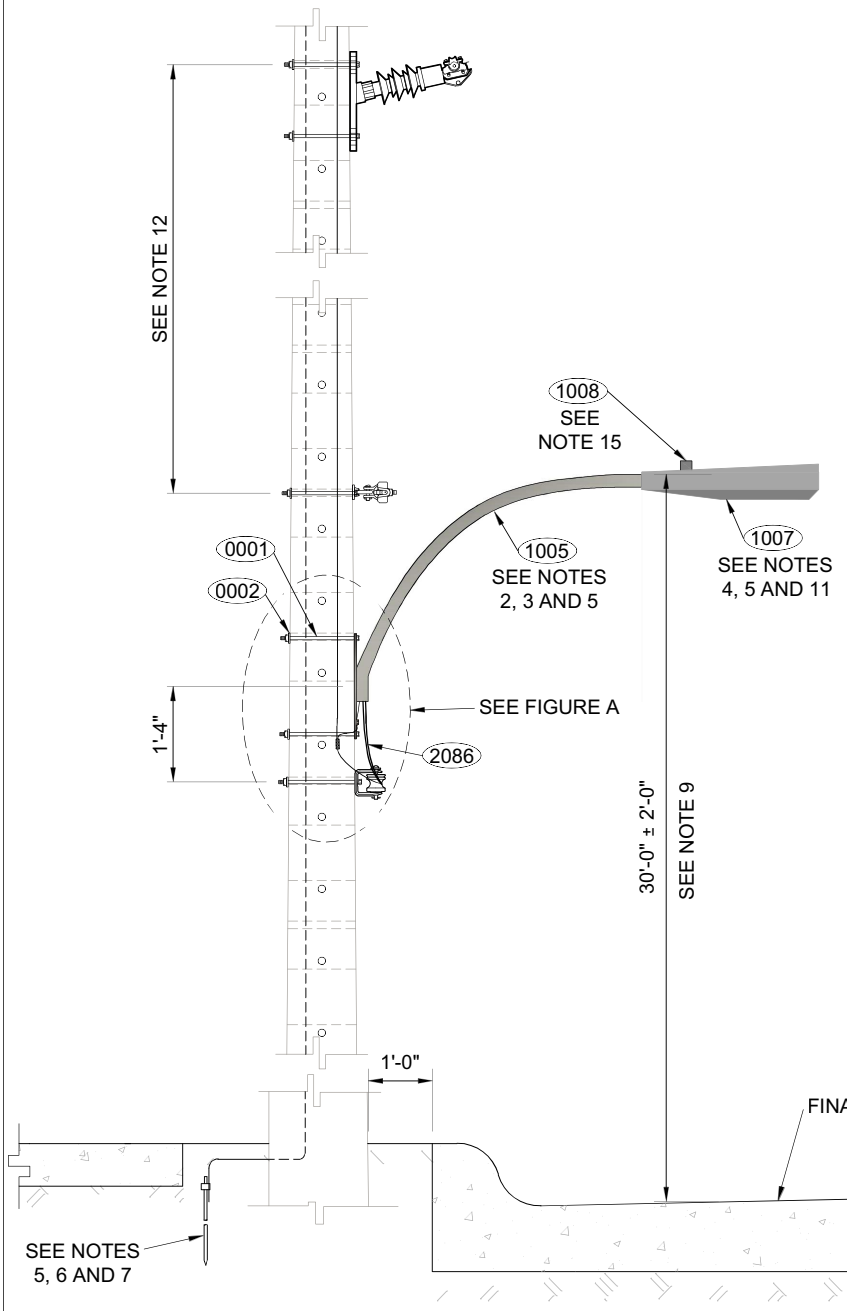
DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR OVERHEAD FED
120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO.	STL-10 VERSION 4
DOCUMENT NO.	4401.021
PAGE	1 OF 5 DATE AUG 24, 2023
SUBMITTED	LUIS R. SOTO LIC. 11658
REVIEWED	IVETTE D. SANCHEZ LIC. 13837
APPROVED	RICARDO CASTRO LIC. 12135
DIGITIZED	EMILIO CUADRADO LIC. 3000



PROFILE VIEW A-A
(SEE NOTE 1)

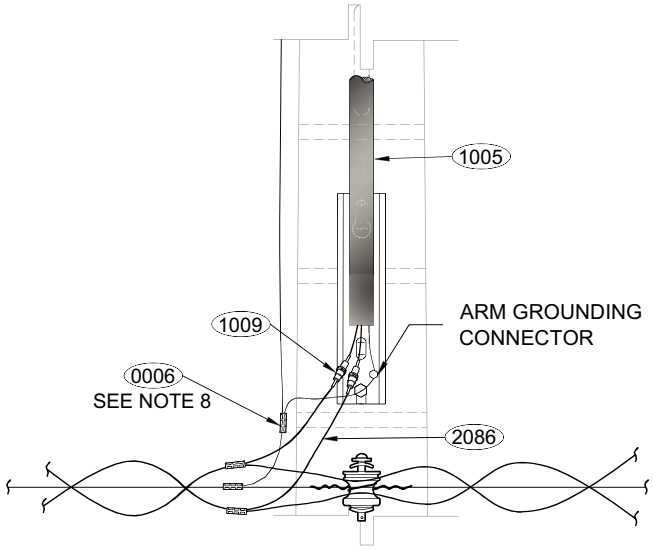


FIGURE A
LED LUMINAIRE
SECONDARY LINE CONNECTION

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR OVERHEAD FED
120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO. STL-10 VERSION 4
DOCUMENT NO. 4401.021
PAGE 2 OF 5 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
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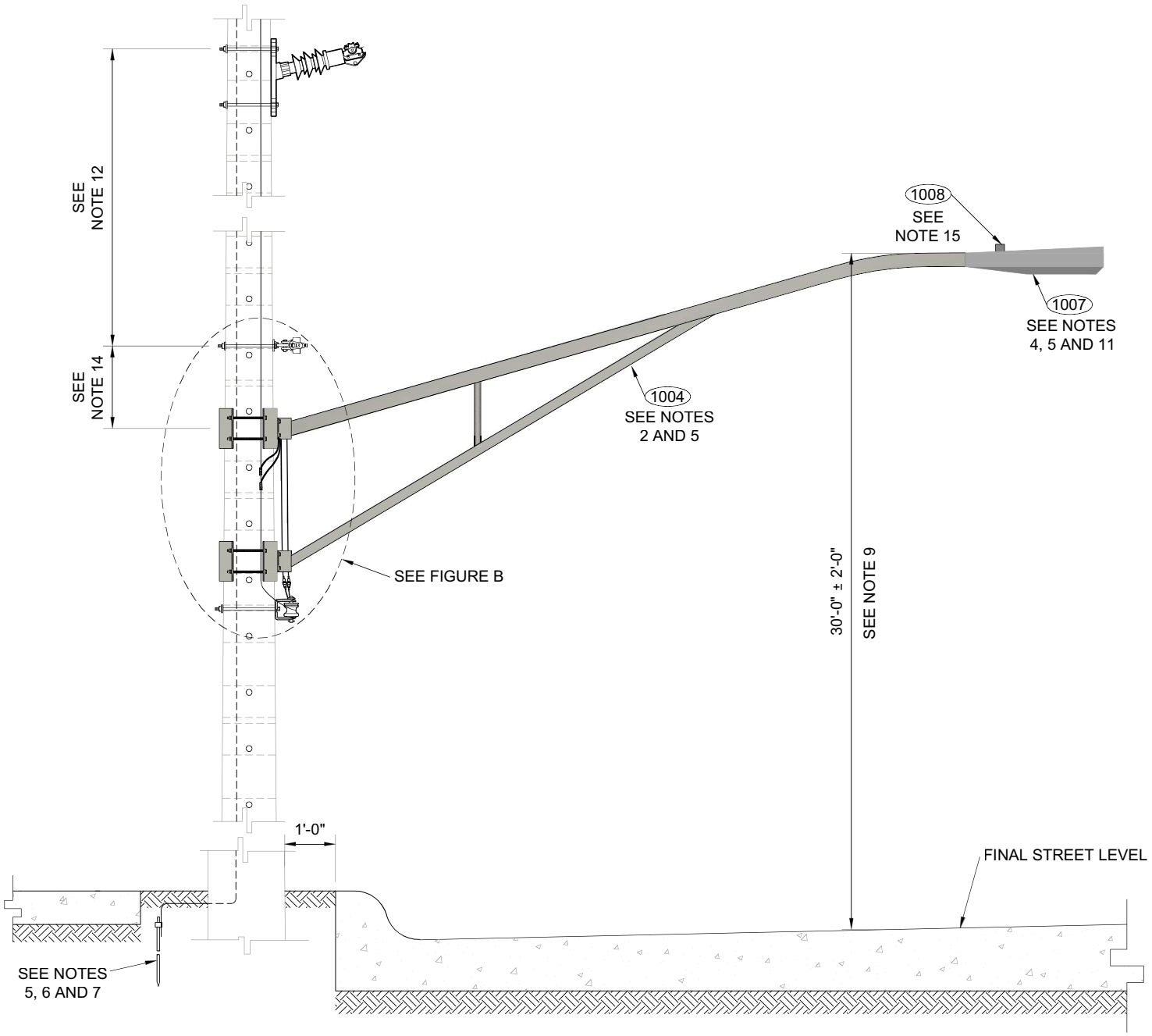

PROFILE VIEW B-B
(SEE NOTE 1)

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR OVERHEAD FED
120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO. STL-10 VERSION 4
DOCUMENT NO. 4401.021
PAGE 3 OF 5 DATE AUG 24, 2023

SUBMITTED LUIS R. SOTO LIC. 11658
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APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

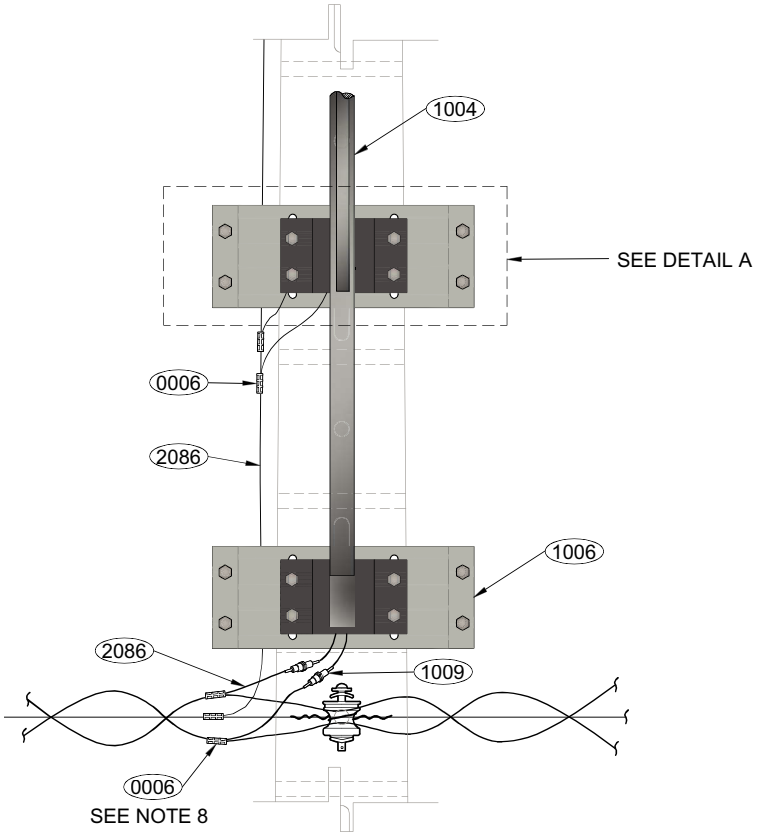
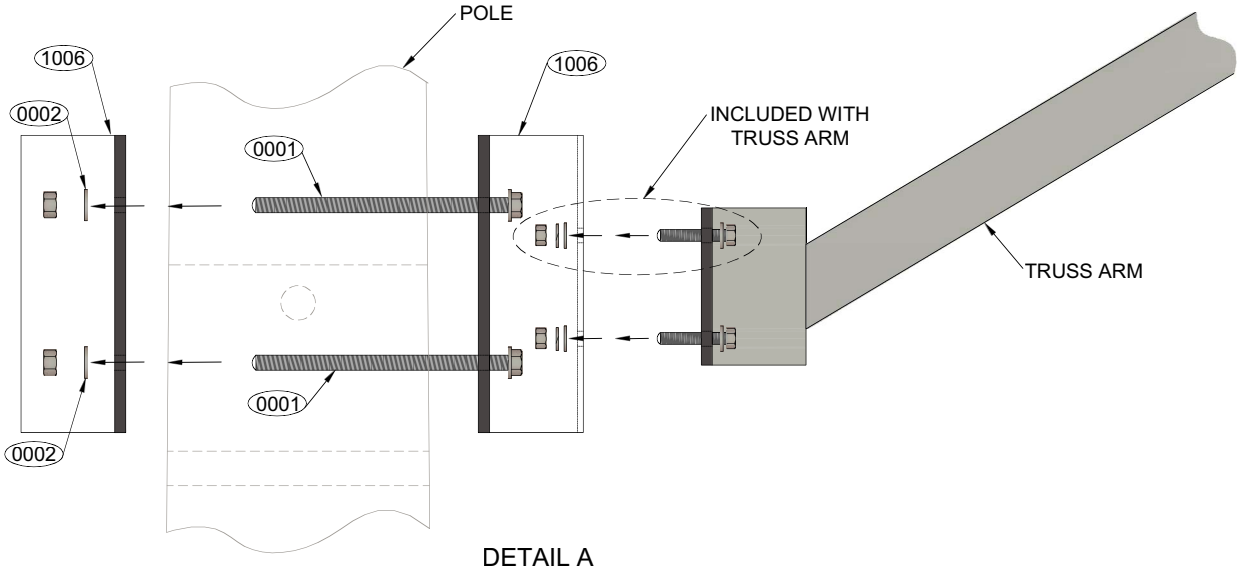


FIGURE B
LED LUMINAIRE
SECONDARY LINE CONNECTION



DETAIL A
BRACKET FOR TRUSS ARM
ASSEMBLY

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR OVERHEAD FED 120 / 240 V LED LUMINAIRE MAXIMUM VOLTAGE: 240 V NOTES

STANDARD NO. STL-10 VERSION 4
DOCUMENT NO. 4401.021
PAGE 4 OF 5 DATE AUG 24, 2023

SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

NOTES:

1. THIS STANDARD IS FOR STREET LIGHT OR DISTRIBUTION POLES, REFER TO OVERHEAD ELECTRICAL DISTRIBUTION SYSTEM MANUAL FOR MORE DETAILS.
2. ARMS FOR LED LUMINAIRES TO BE INSTALLED ON CONCRETE POLES (ITEM 0147) CAN BE 4' OR 8' LONG SINGLE ARM (ITEM 1005) OR 12' OR 15' LONG TRUSS ARM (ITEM 1004) USING WITH BRACKET FOR TRUSS ARM (ITEM 1006).
3. ARMS FOR LED LUMINAIRES TO BE INSTALLED ON GALVANIZED STEEL OR COMPOSITE POLE (ITEM 0148) CAN BE 4' OR 8' LONG SINGLE ARMS FOR LED LUMINAIRE (ITEM 1005).
4. LED LUMINAIRES CAN BE 65 W OR 125 W ACCORDING TO THE DESIGN, CONNECTED TO 240 V CIRCUIT.
5. THE NEUTRAL CONDUCTOR MUST BE EFFECTIVELY BONDED TO GROUND CONNECTION SYSTEM (SEE ASSEMBLY NO. ASSY-1511 OF THE OVERHEAD ELECTRICAL DISTRIBUTION MANUAL). ENSURE GROUND CONNECTION AT POLE, ARM FOR LED LUMINAIRE AND LED LUMINAIRE.
6. STRUCTURE'S FOOTING RESISTANCE TO GROUND SHALL BE BETWEEN 5 AND 10 OHMS OR LESS. USE ADDITIONAL RODS AS NECESSARY WITH THE DESIGNING ENGINEER GUIDANCE.
7. GROUND RODS WITH A MINIMUM LENGTH OF 8' SHALL BE USED FOR THE GROUNDING SYSTEM. TWO OR MORE SECTIONS OF 4' LONG GROUND RODS JOINED TOGETHER CAN ALSO BE USED.
8. COMPRESSION CONNECTORS SHALL BE COVERED WITH A FEW LAYERS OF VINYL INSULATING TAPE (ITEM 0077).
9. LED LUMINARIES SHALL BE INSTALLED AT 28' TO 32' MOUNTING HEIGHT FROM FINAL STREET LEVEL.
10. INSTALLATION OF WIRELESS CAMERAS OR ANTENNAS IS ALLOWED ON DISTRIBUTION POLES. REFER TO OVERHEAD ELECTRICAL DISTRIBUTION SYSTEM MANUAL FOR MORE DETAILS.
11. AMBER LED LUMINAIRE (ITEM 1007) SHALL BE USED TO REDUCE LIGHT POLLUTION IN SPECIAL AREAS OR BEACHES WHERE SEA TURTLES NESTS.
12. PREFERRED MINIMUM PHASE TO NEUTRAL SPACING IS 10'-0". IN RURAL AREAS WITH LIMITED CUSTOMERS EXPANSION, MINIMUM PHASE TO NEUTRAL SPACING CAN BE REDUCED TO 2'-0".
13. FOR MINIMUM VERTICAL CLEARANCES REQUIRED FOR DISTRIBUTION POWER LINES AND THIRD PARTY ATTACHMENTS, REFER TO STANDARDS NO. M-5 AND M-5-D OF THE OVERHEAD ELECTRICAL DISTRIBUTION SYSTEM MANUAL.
14. THE INSTALLATION OF THE TRUSS ARM WILL BE MADE OVER THE SECONDARY LINE AT A HEIGHT OF APPROXIMATELY 26' FROM FINAL STREET LEVEL. IF NECESSARY, THE HEIGHT OF THE SECONDARY LINE AND THE NEUTRAL OF THE DISTRIBUTION FEEDER WILL BE MODIFIED TO PROVIDE ADEQUATE SPACE FOR THE INSTALLATION OF THE TRUSS ARM, COMPLYING WITH THE REQUIRED CLEARANCES. THE SECONDARY LINE SHALL BE A MINIMUM OF 6" FROM THE BOTTOM TRUSS ARM SUPPORT. THE NEUTRAL OF THE DISTRIBUTION FEEDER MUST BE A MINIMUM OF 12" FROM THE UPPER TRUSS ARM SUPPORT.
15. FOR LIGHTING CIRCUITS IN MAIN ROADS OR HIGHWAYS, A LUMINAIRES CONTROLLER (ITEM 1012) IS REQUIRED. USE OF A SHORTING CAP (ITEM 1010) ON EACH LED LUMINAIRE TO PROVIDE POWER. IN CASES WHEN A LUMINAIRES CONTROLLER IS NOT INSTALLED A PHOTO CONTROL (ITEM 1008), FACING NORTH, IS REQUIRED IN EACH LED LUMINAIRE. FOR DETAILED INSTALLATION, REFER TO STANDARD NO. STL-14.

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR OVERHEAD FED
120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V
BILL OF MATERIAL

STANDARD NO. STL-10 VERSION 4
DOCUMENT NO. 4401.021
PAGE 5 OF 5 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

MATERIALS				
NO.	GENERAL DESCRIPTION	WAREHOUSE ITEM	"A-A" QTY.	"B-B" QTY.
0001	THROUGH BOLT	VARIES	2	8
0002	FLAT SQUARE WASHER	VARIES	2	8
0006	COMPRESSION SPLICES AND CONNECTORS	VARIES	AS REQ.	AS REQ.
0077	VINYL INSULATING TAPE	VARIES	AS REQ.	AS REQ.
1004	ARM FOR LED LUMINAIRE IN ALUMINUM POLES	VARIES	-	1
1005	ARM FOR LED LUMINAIRE IN SQUARE CONCRETE, GALVANIZED STEEL OR COMPOSITE POLE	VARIES	1	-
1006	BRACKET FOR TRUSS ARM	VARIES	-	4
1007	LED LUMINAIRE	VARIES	1	1
1008	PHOTO CONTROL	030-78111	AS REQ.	AS REQ.
1009	MIDGET FUSE HOLDER	038-00729	2	2
1010	SHORTING CAP	030-80074	AS REQ.	AS REQ.
1012	LUMUNAIRES CONTROLLER	030-82824	AS REQ.	AS REQ.
2086	STRANDED COPPER CABLE, 600 V, THHN / THWN-2	VARIES	AS REQ.	AS-REQ

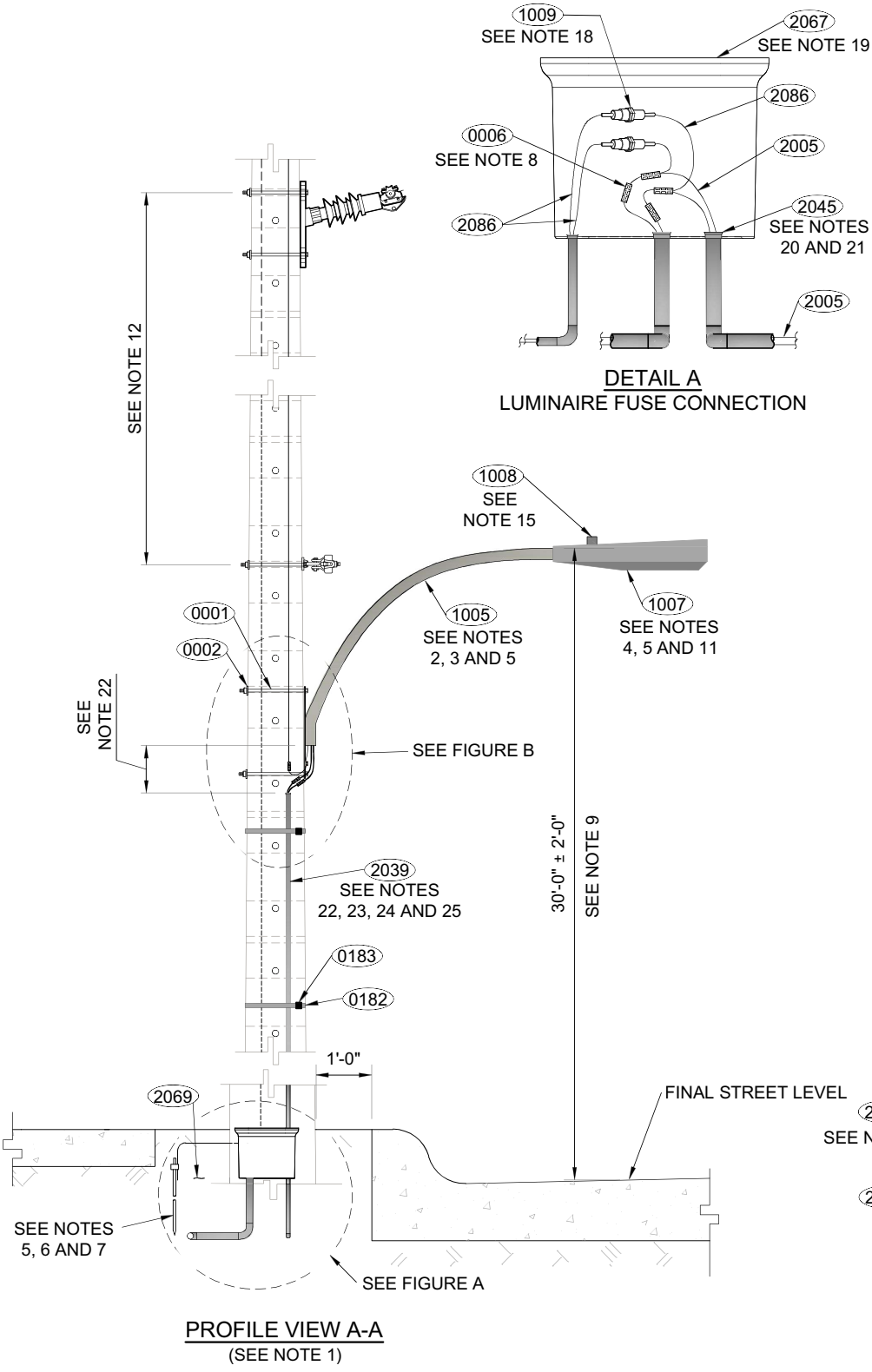
DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR UNDERGROUND FED
120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO. STL-11 VERSION 4
DOCUMENT NO. 4401.023
PAGE 1 OF 6 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000



PROFILE VIEW A-A
(SEE NOTE 1)

DETAIL A
LUMINAIRE FUSE CONNECTION

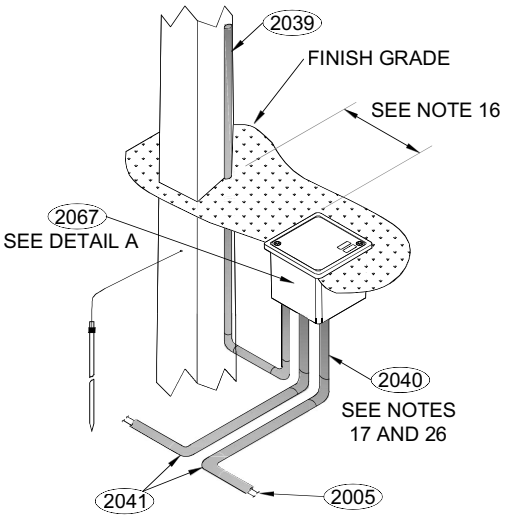


FIGURE A
UNDERGROUND CABLE ENTRY AT
THE POLE RISER

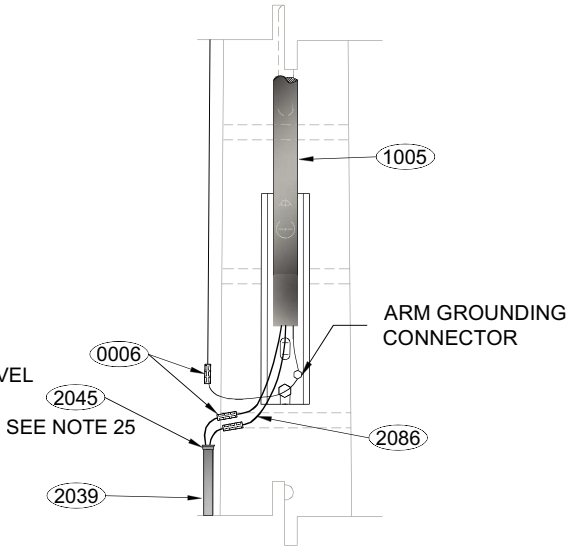


FIGURE B
LED LUMINAIRE CONNECTION

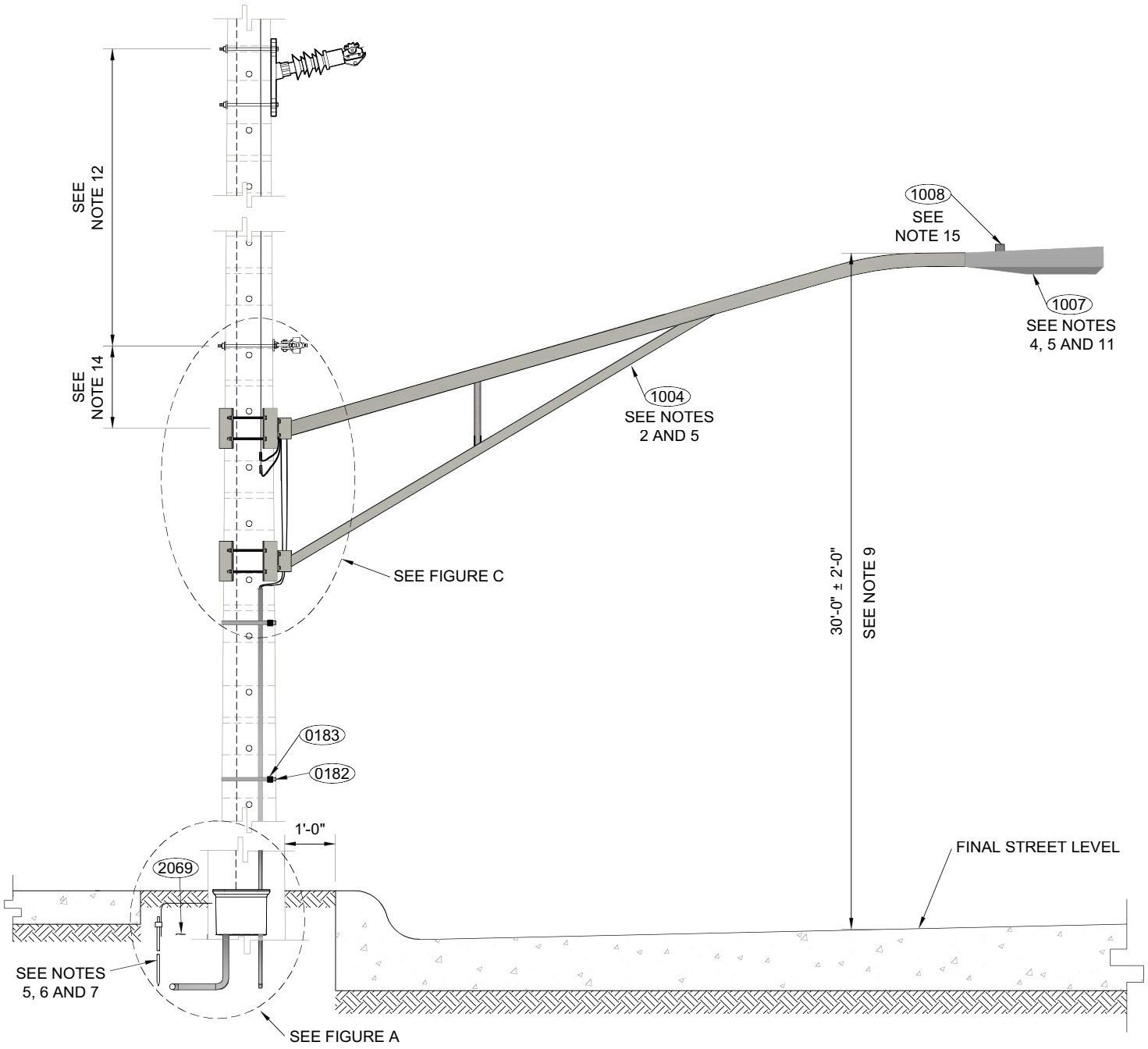
DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR UNDERGROUND FED
120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO. STL-11 VERSION 4
DOCUMENT NO. 4401.023
PAGE 2 OF 6 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000



PROFILE VIEW B-B
(SEE NOTE 1)

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR UNDERGROUND FED
120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V

STANDARD NO. STL-11 VERSION 4
DOCUMENT NO. 4401.023
PAGE 3 OF 6 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

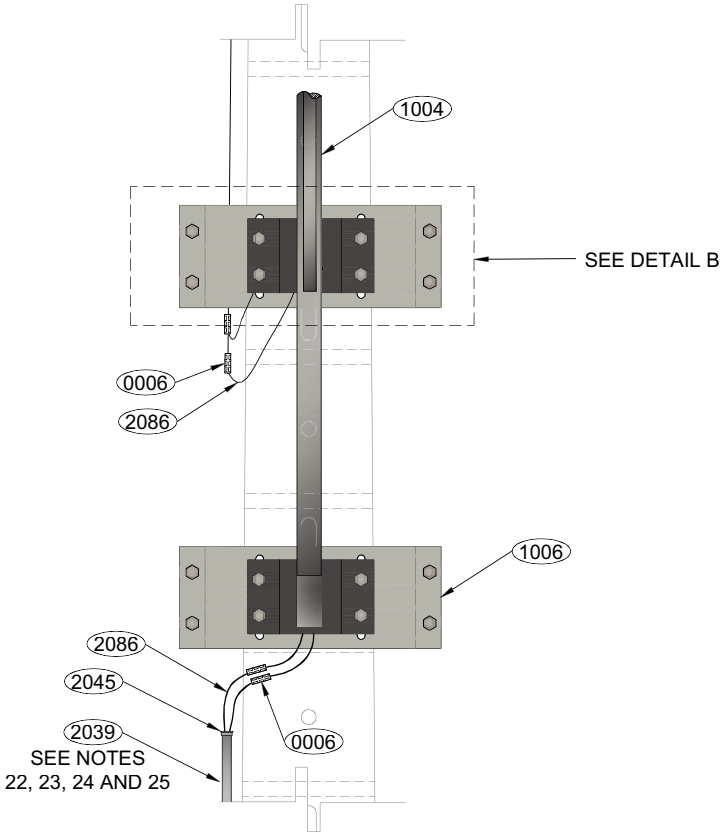
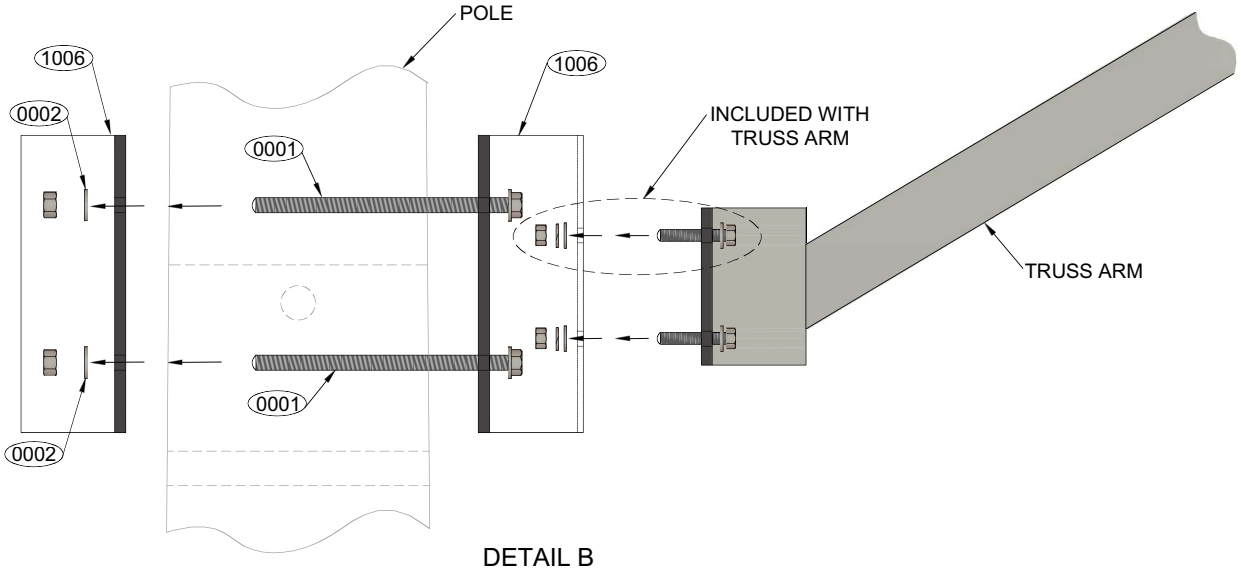


FIGURE C
LED LUMINAIRE CONNECTION



DETAIL B
BRACKET FOR TRUSS ARM
ASSEMBLY

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR UNDERGROUND FED 120 / 240 V LED LUMINAIRE MAXIMUM VOLTAGE: 240 V NOTES

STANDARD NO. STL-11 VERSION 4
DOCUMENT NO. 4401.023
PAGE 4 OF 6 DATE AUG 24, 2023

SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

NOTES:

1. THIS STANDARD IS FOR STREET LIGHTING ON DISTRIBUTION POLES. REFER TO THE OVERHEAD ELECTRICAL DISTRIBUTION SYSTEM MANUAL (DOCUMENT NO. 4301.001) FOR MORE DETAILS.
2. ARMS FOR LED LUMINAIRES TO BE INSTALLED ON CONCRETE POLES (ITEM 0147) CAN BE 4' OR 8' LONG SINGLE ARM (ITEM 1005) OR 12' OR 15' LONG TRUSS ARM (ITEM 1004) BRACKET SHALL BE USED FOR TRUSS ARM (ITEM 1006) INSTALLATION.
3. ARMS FOR LED LUMINAIRES TO BE INSTALLED ON GALVANIZED STEEL OR COMPOSITE POLE (ITEM 0148) CAN BE 4' OR 8' LONG SINGLE ARM (ITEM 1005).
4. LED LUMINAIRES CAN BE 65 W OR 125 W ACCORDING TO THE DESIGN, CONNECTED TO 240 V CIRCUIT.
5. THE NEUTRAL CONDUCTOR MUST BE EFFECTIVELY BONDED TO THE GROUND CONNECTION SYSTEM (SEE ASSEMBLY NO. ASSY-1511) OF THE OVERHEAD ELECTRICAL DISTRIBUTION MANUAL. ENSURE GROUND CONNECTION AT POLE, ARM AND LED LUMINAIRE.
6. STRUCTURE'S FOOTING RESISTANCE TO GROUND SHALL BE BETWEEN 5 AND 10 OHMS OR LESS. USE ADDITIONAL RODS AS NECESSARY WITH THE DESIGNING ENGINEER GUIDANCE.
7. GROUND RODS WITH A MINIMUM LENGTH OF 8' SHALL BE USED FOR THE GROUNDING SYSTEM. TWO OR MORE SECTIONS OF 4' LONG GROUND RODS JOINED TOGETHER CAN ALSO BE USED.
8. COMPRESSION CONNECTORS SHALL BE COVERED WITH A FEW LAYERS OF VINYL INSULATING TAPE (ITEM 0077).
9. LED LUMINARIES SHALL BE INSTALLED AT 28' TO 32' MOUNTING HEIGHT FROM FINAL FINAL STREET LEVEL.
10. INSTALLATION OF WIRELESS CAMERAS OR ANTENNAS IS ALLOWED ON DISTRIBUTION POLES. REFER TO THE OVERHEAD ELECTRICAL DISTRIBUTION SYSTEM MANUAL FOR MORE DETAILS.
11. AMBER LED LUMINARIE (ITEM 1007) SHALL BE USED TO REDUCE LIGHT POLLUTION IN SPECIAL AREAS OR BEACHES WHERE SEA TURTLES NESTS.
12. PREFERRED MINIMUM PHASE TO NEUTRAL SPACING IS 10'-0". IN RURAL AREAS WITH LIMITED CUSTOMERS EXPANSION, MINIMUM PHASE TO NEUTRAL SPACING CAN BE REDUCED TO 2'-0".
13. FOR MINIMUM VERTICAL CLEARANCES REQUIRED FOR DISTRIBUTION POWER LINES AND THIRD PARTY ATTACHMENTS, REFER TO STANDARDS NO. M-5 AND M-5-D OF THE OVERHEAD ELECTRICAL DISTRIBUTION SYSTEM MANUAL.
14. TRUSS ARM INSTALLATION WILL BE APPROXIMATELY 26' HEIGHT FROM FINAL STREET LEVEL. IF NECESSARY, THE HEIGHT OF THE NEUTRAL OF THE DISTRIBUTION FEEDER WILL BE MODIFIED TO PROVIDE ADEQUATE SPACE FOR TRUSS ARM INSTALLATION, COMPLYING WITH THE REQUIRED CLEARANCES. THE NEUTRAL OF THE DISTRIBUTION FEEDER MUST BE A MINIMUM OF 16" FROM THE UPPER TRUSS ARMS SUPPORT.
15. FOR LIGHTING CIRCUITS IN MAIN ROADS OR HIGHWAYS, A LUMINAIRES CONTROLLER (ITEM 1012) IS REQUIRED. USE OF A SHORTING CAP (ITEM 1010) ON EACH LED LUMINAIRE IS REQUIRED TO PROVIDE POWER. WHEN A LUMINAIRES CONTROLLER IS NOT INSTALLED, A PHOTO CONTROL (ITEM 1008), FACING NORTH, IS REQUIRED IN EACH LED LUMINAIRE. FOR DETAILED INSTALLATION, REFER TO STANDARD NO. STL-14.
16. SERVICE PEDESTAL (ITEM 2067) SHALL BE INSTALLED BETWEEN 1' TO 2' FROM POLE IN THE PLANTING AREA. IT SHALL BE INSTALLED FLUSH WITH THE FINISH GRADE.
17. FOR STREET LIGHTING CIRCUITS, A PVC SCH-40 DUCT (ITEM 2040) WITH MINIMUM DIAMETER OF ¾" WILL BE USED FOR #12 AWG CABLES, AND 2" DIAMETER PVC SCH-40 DUCT FOR CABLES OF GAUGE NOT LARGER THAN 4/0 AWG. PVC SCH-40 DUCT FOR STREET LIGHTING CIRCUITS SHALL BE INSTALLED 24" DEEP. HAZARD WARNING TAPE (ITEM 2069) SHALL BE INSTALLED 12" BELOW THE FINISH GRADE.
18. EACH LIGHTING POLE SHALL BE FUSED WITH A 10 A MIDGET TYPE FUSE ON THE NEAREST SERVICE PEDESTAL. MIDGET FUSE HOLDER MAXIMUM RATING SHALL BE 30 A.
19. EXCAVATION SHALL BE APPROXIMATELY 6" DEEPER THAN THE DEPTH OF THE SERVICE PEDESTAL. #67 CLEAN CRUSHED STONE OR GRAVEL (ITEM 2050) WITH A MINIMUM THICKNESS OF 6" SHALL BE PLACED FOR DRAINAGE. THIS MATERIAL SHALL BE UNIFORMLY GRADED AND SIZED FROM 3/4" DOWN TO FINE PARTICLES. IT SHALL BE FREE FROM SOFT AND DISINTEGRATED PIECES, CLAY, ORGANIC OR OTHER DELETERIOUS MATTER. THE PEDESTAL SHALL BE INSTALLED ENSURING THAT THE TOP COVER IS AT FINISH GRADE LEVEL. IT SHALL BE FILLED WITH SOIL AROUND THE SERVICE PEDESTAL AND COMPACTED.
20. AFTER INSTALLATION OF ALL CABLES IS COMPLETED, DUCTS SHALL BE SEALED WITH A DUCT SEALING COMPOUND (ITEM 2014).
21. DUCTS SHALL HAVE A PVC END BELL (ITEM 2045) TO PROVIDE A SMOOTH SAFE CABLE ENTRY.
22. THE TOP OF THE RISER DUCT SHALL BE BETWEEN 8" OR 10" BELOW THE ARM FOR LED LUMINAIRE. USE A PVC SCH-80 DUCT (ITEM 2039).
23. RISER DUCTS SHALL BE INSTALLED PARALLEL TO THE STREET, ON THE SIDE OF THE POLE THAT IS IN THE OPPOSITE DIRECTION OF VEHICULAR TRAFFIC, WHERE IT IS LESS SUSCEPTIBLE TO DAMAGE FROM VEHICLE IMPACT.
24. THE RISER DUCT SHALL BE ATTACHED TO THE POLE WITH FIXING BANDS (ITEMS 0182 AND 0183).
25. THE RISER DUCT SHALL HAVE A PVC END BELL (ITEM 2045) SEALED WITH DUCT SEALING COMPOUND (ITEM 2014) OR WEATHERHEAD AT THE TOP TO PREVENT THE ENTRY OF WATER.
26. FOR STREET LIGHTING CIRCUITS CONDUIT TRENCH CONSTRUCTION DETAIL, REFER TO STANDARD NO. STL-16.

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR UNDERGROUND FED 120 / 240 V LED LUMINAIRE MAXIMUM VOLTAGE: 240 V BILL OF MATERIAL

STANDARD NO. STL-11 VERSION 4
DOCUMENT NO. 4401.023
PAGE 5 OF 6 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

MATERIALS				
NO.	GENERAL DESCRIPTION	WAREHOUSE ITEM	"A-A" QTY.	"B-B" QTY.
0001	THROUGH BOLT	VARIES	2	8
0002	FLAT SQUARE WASHER	VARIES	2	8
0006	COMPRESSION SPLICES AND CONNECTORS	VARIES	AS REQ.	AS REQ.
0077	VINYL INSULATING TAPE	VARIES	AS REQ.	AS REQ.
0182	FIXING BAND	107-04344	AS REQ.	AS REQ.
0183	BUCKLE FOR FIXING BAND	107-03031	AS REQ.	AS REQ.
1004	ARM FOR LED LUMINAIRE IN ALUMINUM POLE	VARIES	-	1
1005	ARM FOR LED LUMINAIRE IN SQUARE CONCRETE, GALVANIZED STEEL OR COMPOSITE POLE	VARIES	1	-
1006	BRACKET FOR TRUSS ARM	VARIES	-	4
1007	LED LUMINAIRE	VARIES	AS REQ.	AS REQ.
1008	PHOTO CONTROL	030-78111	AS REQ.	AS REQ.
1009	MIDGET FUSE HOLDER	038-00729	2	2
1010	SHORTING CAP	030-80074	AS REQ.	AS REQ.
1012	LUMINAIRES CONTROLLER	030-82824	AS REQ.	AS REQ.
2005	STRANDED COPPER CABLE, 600 V, XHHW-2	VARIES	AS REQ.	AS REQ.
2014	DUCT SEALING COMPOUND	003-02935	AS REQ.	AS REQ.
2039	PVC SCH-80 DUCT	VARIES	AS REQ.	AS REQ.
2040	PVC SCH-40 DUCT	VARIES	AS REQ.	AS REQ.
2041	90° PVC ELBOW	VARIES	AS REQ.	AS REQ.
2043	PVC COUPLING	VARIES	AS REQ.	AS REQ.
2045	PVC END BELL	VARIES	AS REQ.	AS REQ.
2050	#67 CRUSHED STONE OR GRAVEL	038-83208	AS REQ.	AS REQ.

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

DISTRIBUTION POLE MOUNTING FOR UNDERGROUND FED
120 / 240 V LED LUMINAIRE
MAXIMUM VOLTAGE: 240 V
BILL OF MATERIAL

STANDARD NO. STL-11 VERSION 4
DOCUMENT NO. 4401.023
PAGE 6 OF 6 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

MATERIALS				
NO.	GENERAL DESCRIPTION	WAREHOUSE ITEM	"A-A" QTY.	"B-B" QTY.
2067	12" X 12" SERVICE PEDESTAL	038-01984	1	1
2069	HAZARD WARNING TAPE	072-83464	AS REQ.	AS REQ.
2086	STRANDED COPPER CABLE, 600 V, THHN / THWN-2	VARIES	AS REQ.	AS REQ.

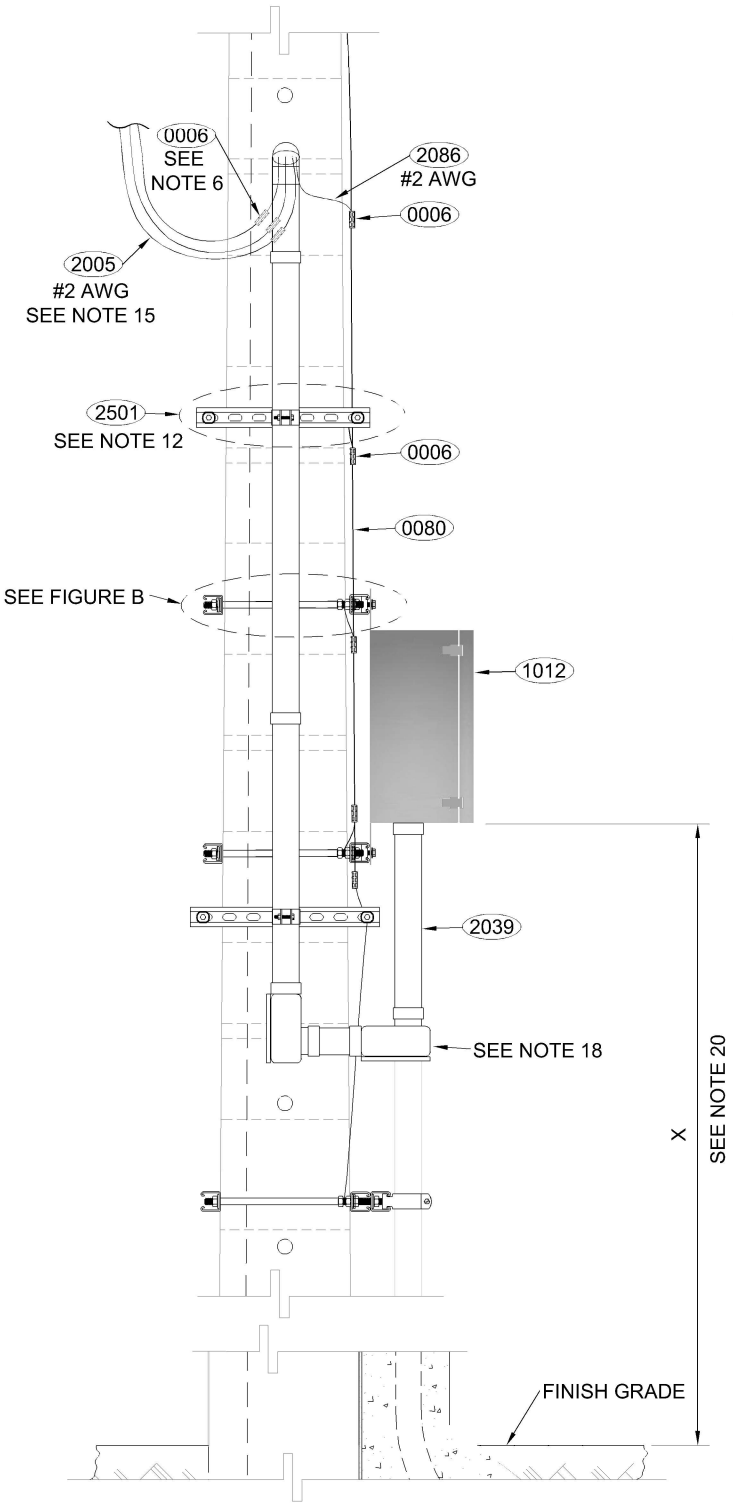
DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

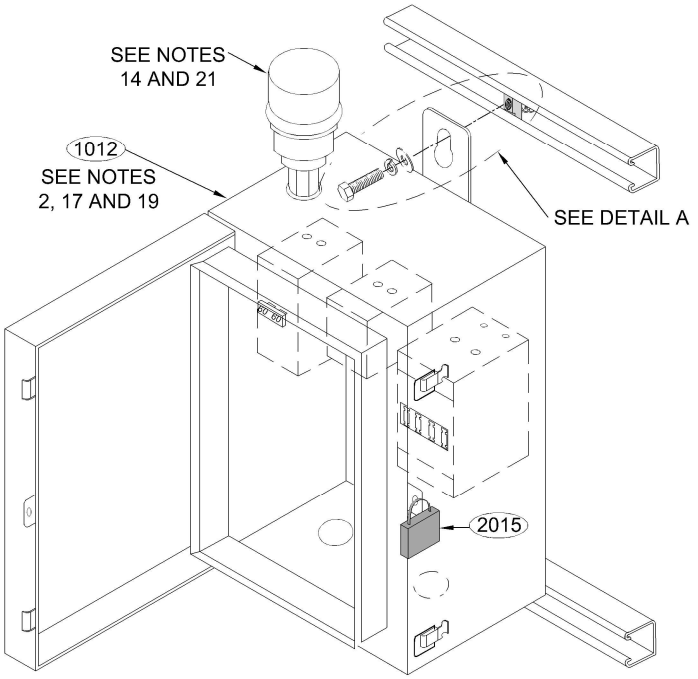
TITLE:

100 A LUMINAIRES CONTROLLER
MAXIMUM VOLTAGE: 240 V

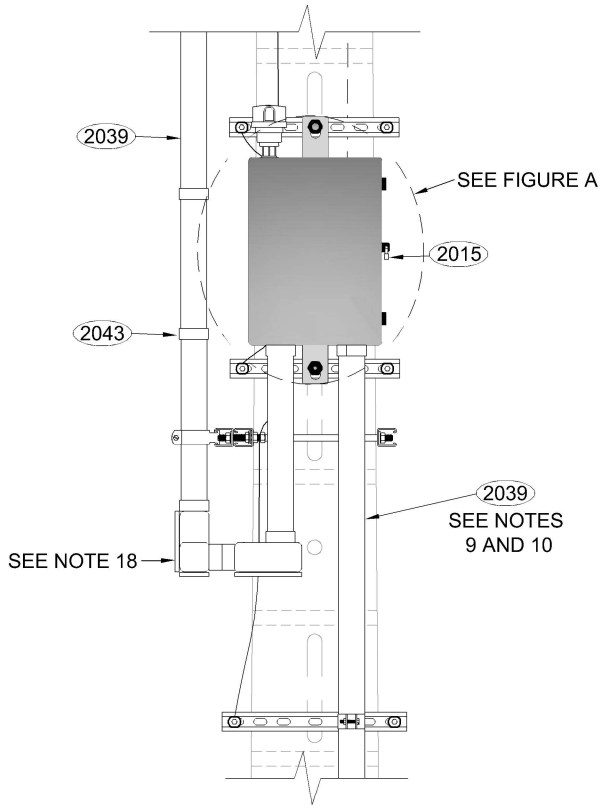
STANDARD NO.	STL-14 VERSION 4
DOCUMENT NO.	4401.036
PAGE	1 OF 4 DATE AUG 24, 2023
SUBMITTED	LUIS R. SOTO LIC. 11658
REVIEWED	IVETTE D. SANCHEZ LIC. 13837
APPROVED	RICARDO CASTRO LIC. 12135
DIGITIZED	EMILIO CUADRADO LIC. 3000



PROFILE VIEW
(SEE NOTES 1 AND 13)



ISOMETRIC VIEW
LUMINAIRE CONTROLLER INSTALLATION



ELEVATION VIEW

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

100 A LUMINAIRES CONTROLLER
MAXIMUM VOLTAGE: 240 V

STANDARD NO. STL-14 VERSION 4
DOCUMENT NO. 4401.036
PAGE 2 OF 4 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

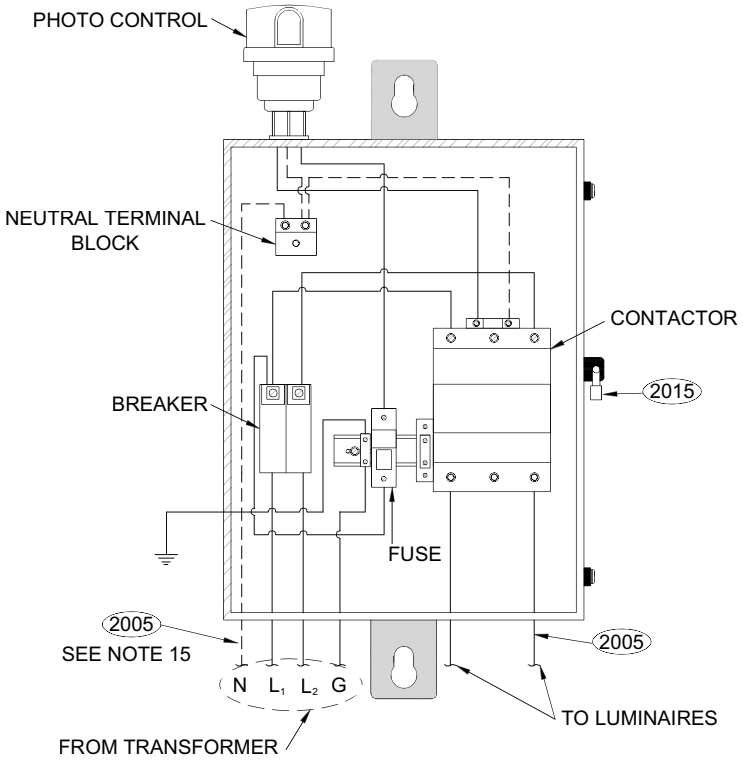


FIGURE A
LUMINAIRES CONTROLLER CONNECTION

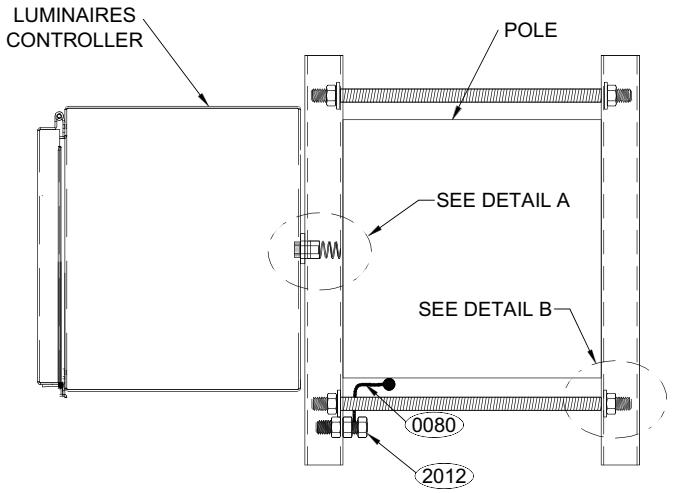
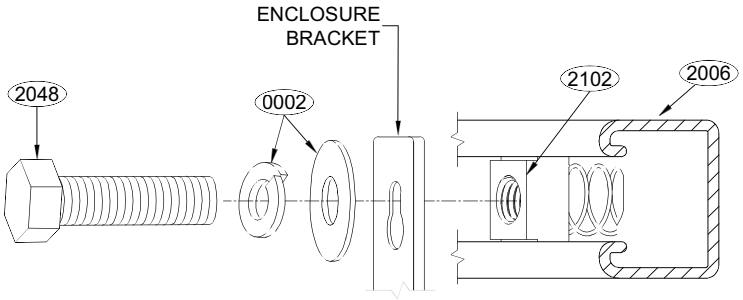
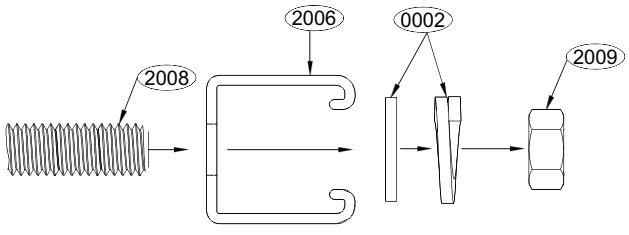


FIGURE B
LUMINAIRES CONTROLLER
TOP VIEW



DETAIL A
STRUT CHANNEL NUT ASSEMBLY



DETAIL B
STRUT CHANNEL ASSEMBLY

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

100 A LUMINAIRES CONTROLLER
MAXIMUM VOLTAGE: 240 V
NOTES

STANDARD NO. STL-14 VERSION 4
DOCUMENT NO. 4401.036
PAGE 3 OF 4 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

NOTES:

1. THIS STANDARD IS FOR STREET LIGHTING ON DISTRIBUTION POLES. REFER TO THE OVERHEAD ELECTRICAL DISTRIBUTION SYSTEM MANUAL (DOCUMENT NO. 4304.001) FOR MORE DETAILS.
2. LUMINAIRES CONTROLLER (ITEM 1012) SHALL BE CONNECTED TO 240 V CIRCUIT.
3. THE NEUTRAL CONDUCTOR MUST BE EFFECTIVELY BONDED TO THE GROUND CONNECTION SYSTEM (SEE ASSEMBLY NO. ASSY-1511 OF THE OVERHEAD ELECTRICAL DISTRIBUTION SYSTEM MANUAL). ENSURE GROUND CONNECTION AT POLE, LUMINAIRES CONTROLLER, AND STRUT CHANNEL SUPPORTS.
4. STRUCTURE'S FOOTING RESISTANCE TO GROUND SHALL BE BETWEEN 5 AND 10 OHMS OR LESS. USE ADDITIONAL RODS AS NECESSARY WITH THE DESIGNING ENGINEER GUIDANCE.
5. GROUND RODS WITH A MINIMUM LENGTH OF 8' SHALL BE USED FOR THE GROUNDING SYSTEM. TWO OR MORE SECTIONS OF 4' LONG GROUND RODS JOINED TOGETHER CAN ALSO BE USED.
6. COMPRESSION CONNECTORS SHALL BE COVERED WITH A FEW LAYERS OF VINYL INSULATING TAPE (ITEM 0077).
7. FOR MINIMUM VERTICAL CLEARANCES REQUIRED FOR DISTRIBUTION POWER LINES, REFER TO STANDARD NO. M-5 OF THE OVERHEAD ELECTRICAL DISTRIBUTION SYSTEM MANUAL.
8. THE TOP OF THE RISER DUCT SHALL BE 3' BELOW THE NEUTRAL CONDUCTOR.
9. RISER DUCTS SHALL BE INSTALLED PARALLEL TO THE STREET, ON THE SIDE OF THE POLE THAT IS IN THE OPPOSITE DIRECTION OF VEHICULAR TRAFFIC, WHERE IT IS LESS SUSCEPTIBLE TO DAMAGE FROM VEHICLE IMPACT.
10. RISER SHALL BE A PVC SCH-80 DUCT (ITEM 2039) WITH MINIMUM DIAMETER OF 2”.
11. RISER DUCT SHALL HAVE A WEATHERHEAD AT THE TOP TO PREVENT THE ENTRY OF WATER.
12. RISER DUCT SHALL BE ATTACHED TO THE POLE WITH A STRUT CHANNEL BRACKET (SEE ASSEMBLY NO. ASSY-2501 OF THE UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM MANUAL).
13. FOR DETAILS OF THE RISER'S CONCRETE BASE SUPPORT, SEE STANDARDS NO. URD-4 AND URD-4-A OF THE UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM MANUAL.
14. EACH LED LUMINAIRE REQUIRES A SHORTING CAP (ITEM 1010) TO COMPLETE THE CIRCUIT.
15. FEEDER FROM TRANSFORMER TO MAIN BREAKER SHALL USE STRANDED COPPER CABLE, 600 V, XHHW-2 (ITEM 2005), 3 CABLES #2 AWG WITH 1 CABLE #12 AWG.
16. INSTALLATION OF SURVEILLANCE CAMERA AND WIRELESS COMMUNICATION EQUIPMENT IS NOT ALLOWED.
17. LUMINAIRES CONTROLLER (ITEM 1012) CAN BE INSTALLED ON POLE BACK TO BACK.
18. INSTALL CONDUIT BODIES AND FITTINGS THROUGH THE BOTTOM OF THE LUMINAIRES CONTROLLER TO PREVENT WATER INTRUSION.
19. INSTALL A LUMINAIRES CONTROLLER (ITEM 1012) INSIDE A CONTROL CABINET WHERE AN OVERHEAD ELECTRICAL SYSTEM IS NOT AVAILABLE, CONNECT IT FROM THE NEAREST PAD MOUNTED SUBSTATION USING A DEDICATED CIRCUIT.
20. MOUNTING HEIGHT SHALL BE 12' ABOVE THE FINISH GRADE.
21. PHOTO CONTROL IN EACH LUMINAIRES CONTROLLER SHALL BE ORIENTED TO THE NORTH.

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

100 A LUMINAIRES CONTROLLER
MAXIMUM VOLTAGE: 240 V
Bill OF MATERIAL

STANDARD NO. STL-14 VERSION 4
DOCUMENT NO. 4401.036
PAGE 4 OF 4 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

MATERIALS			
NO.	GENERAL DESCRIPTION	WAREHOUSE ITEM	QTY.
0002	FLAT ROUND WASHER	VARIES	8
	SPLIT ROUND WASHER	VARIES	8
0006	COMPRESSION SPLICES AND CONNECTORS	VARIES	AS REQ.
0077	VINYL INSULATING TAPE	VARIES	AS REQ.
0080	COPPER BARE CONDUCTOR	006-82621	AS REQ.
1012	LUMINAIRES CONTROLLER	030-82824	1
2005	STRANDED COPPER CABLE 600 V, XHHW-2	006-00833	AS REQ.
2006	1⅝" STRUT CHANNEL	VARIES	AS REQ.
2008	½" FULLY THREADED ROD	VARIES	AS REQ.
2009	½" HEXAGONAL NUT	VARIES	8
2012	BRONZE MALE SERVICE POST CONNECTOR	VARIES	2
2015	PADLOCK	VARIES	1
2039	PVC SCH-80 DUCT	038-83314	AS REQ.
2043	PVC COUPLING	038-01909	AS REQ.
2048	HEX HEAD BOLT	VARIES	2
2086	STRANDED COPPER CABLE, 600 V, THHN / THWN-2	040-00774	AS REQ.
2102	STRUT CHANNEL NUT	002-84270	AS REQ.
2501	RISER SUPPORT ASSEMBLY	ASSY-2501	AS REQ.

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

STREET LIGHTING CIRCUITS CONDUIT TRENCH CONSTRUCTION DETAIL

STANDARD NO. STL-16 VERSION 4
DOCUMENT NO. 4401.038
PAGE 1 OF 4 DATE AUG 24, 2023
SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

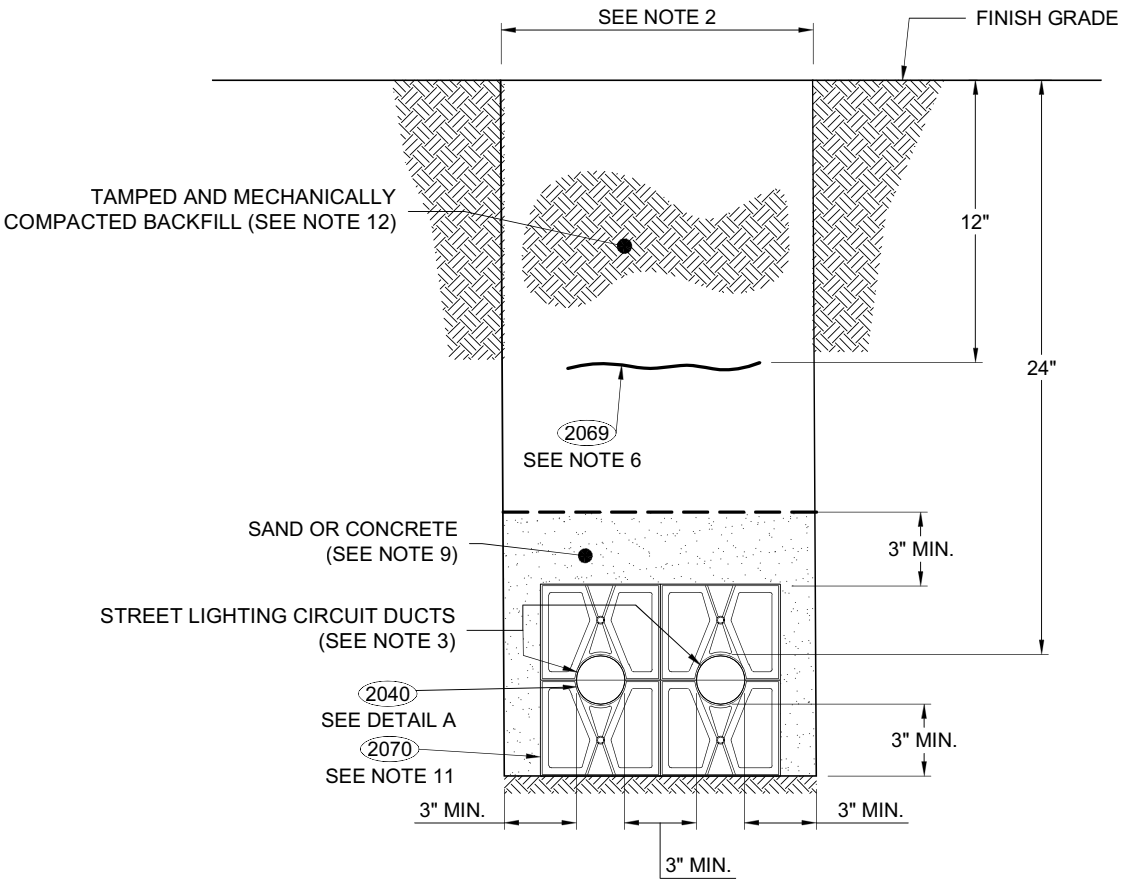
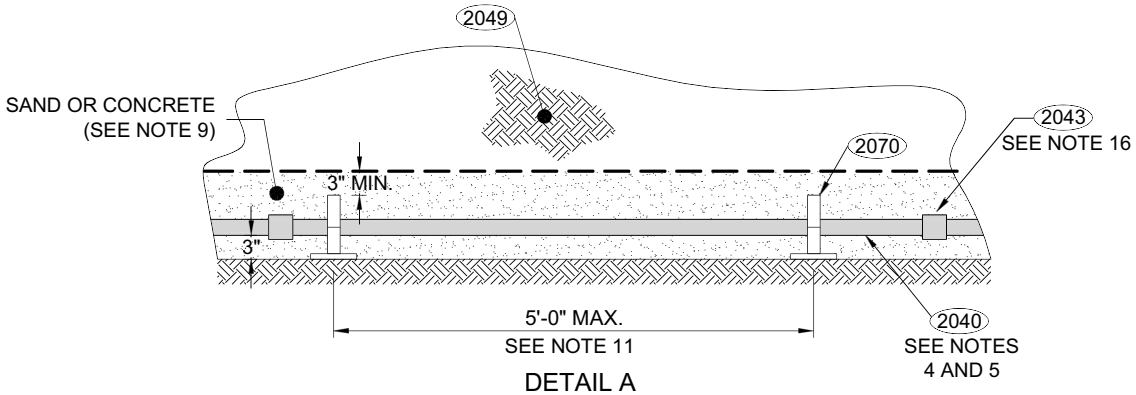


FIGURE A
DUCT INSTALLATION AT 24" DEPTH
(SEE NOTE 1)



DETAIL A
DUCT SPACER INSTALLATION

TITLE:

STREET LIGHTING CIRCUITS CONDUIT TRENCH CONSTRUCTION DETAIL

STANDARD NO. STL-16 VERSION 4
DOCUMENT NO. 4401.038
PAGE 2 OF 4 DATE AUG 24, 2023
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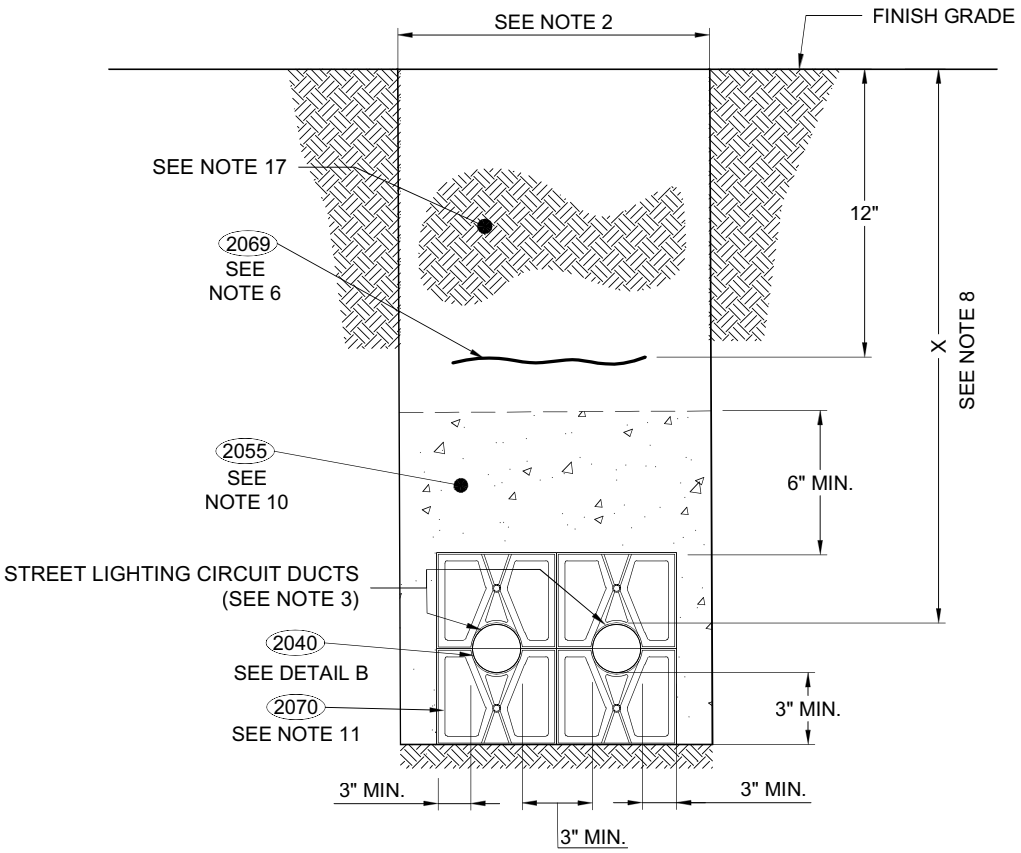
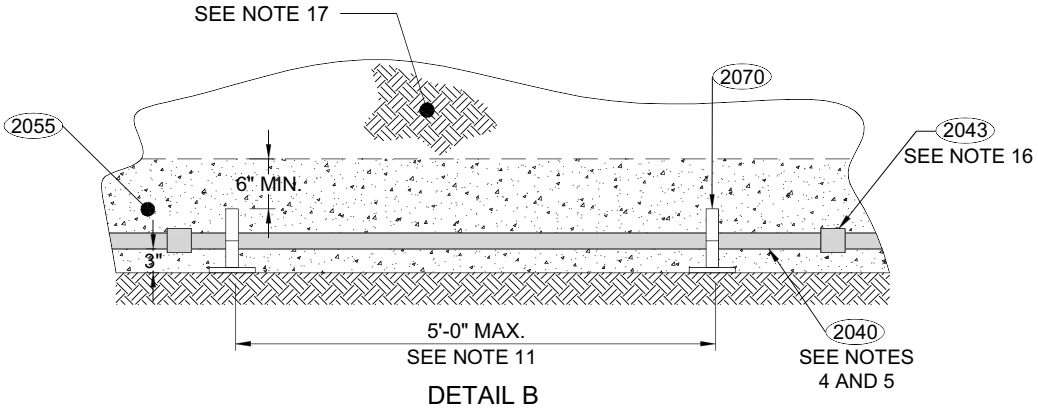


FIGURE B
DUCT INSTALLATION AT LESS THAN 24" DEPTH
(SEE NOTE 1)



DETAIL B
DUCT SPACER INSTALLATION

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

STREET LIGHTING CIRCUITS CONDUIT TRENCH CONSTRUCTION DETAIL NOTES

STANDARD NO. STL-16 VERSION 4
DOCUMENT NO. 4401.038
PAGE 3 OF 4 DATE AUG 24, 2023

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REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

NOTES:

1. THESE TRENCH DETAILS ARE EXCLUSIVELY FOR STREET LIGHTING CIRCUITS, FOR EVERYTHING ELSE REFER TO THE STANDARDS NO. URD-7 AND URD-8 OF THE UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM MANUAL.
2. TRENCH WIDTH WILL VARY ACCORDING TO THE NUMBER AND SIZE OF DUCTS, SOIL HEAT CONDUCTING PROPERTIES AND SPACING BETWEEN DUCTS.
3. IF MORE THAN ONE CIRCUIT IS INSTALLED IN THE SAME TRENCH, THEY SHALL BE INSTALLED IN SEPARATED DUCTS.
4. AFTER CONDUITS HAVE BEEN INSTALLED, IT IS NECESSARY TO CHECK THE INTERNAL CONDITION OF EACH DUCT. THEY SHALL BE CLEANED, AND ANY DEBRIS REMOVED. A MANDREL SHALL BE USED TO PERFORM THIS PROCESS AND PULL BACK WITH A #8 GALVANIZED STEEL PULLING WIRE OR PULLING ROPE/TAPE ($\frac{9}{16}$") LEFT IN PLACE FOR CONTINUOUS RUNS TO ASSIST CABLE INSTALLATION.
5. STREET LIGHTING CIRCUITS SHALL BE INSTALLED IN PVC SCH-40 DUCTS (ITEM 2040), MINIMUM DIAMETER OF 2". DIRECT BURIED INSTALLATION IS NOT ALLOWED.
6. A HAZARD WARNING TAPE (ITEM 2069) SHALL BE INSTALLED AT 12" BELOW THE FINISH GRADE.
7. THE DUCTS SHALL BE LAID ON A 3" THICK LAYER OF CLEAN SAND OR SOIL FREE OF LUMPS OR ROCKS.
8. DISTANCE "X" SHALL NEVER BE LESS THAN 12". IF DISTANCE "X" SHOWN ON FIGURE B IS LESS THAN 24", THE DUCTS SHALL BE ENCASED IN A LAYER OF CONCRETE, BUT WILL NEED SPECIAL APPROVAL FROM LUMA.
9. AT ALL DUCTS' TRENCHES INSTALLED IN ROADWAYS, STREET CROSSINGS, HIGHWAYS, ROADS, OR ANY OTHER LOCATION WHERE ANOTHER PUBLIC OR PRIVATE SERVICE COMPANY HAS PIPES, DUCTS SHALL BE ENCASED IN READY MIX CONCRETE (ITEM 2055). (REFER TO FIGURE A)
10. CONCRETE USED SHALL BE PROPORTIONED AND MIXED TO OBTAIN A 28 DAY COMPRESSIVE STRENGTH OF 3,000 PSI. ALL CONCRETE SHALL BE MIXED AND DELIVERED IN ACCORDANCE WITH THE REQUIREMENTS SET FOR IN THE STANDARD NO. ASTM C94, SPECIFICATIONS FOR READY MIX CONCRETE, LATEST EDITION.
11. DUCT SPACERS (ITEM 2070) ARE REQUIRED EVERY 5' OR LESS, WITH A MINIMUM SPACING OF 3" BETWEEN DUCTS.
12. BACKFILL SHALL BE PLACED IN UNIFORM LAYERS, NOT TO EXCEED 8" DEPTH, AND COMPACTED TO A MINIMUM OF 95% OF STANDARD MAXIMUM DENSITY AT THE PROPER MOISTURE CONTENT OF THE UNDISTURBED SOIL, ACCORDING TO THE LATEST VERSION OF STANDARD NO. ASTM D698.
13. IN LOCATIONS WHERE STREET LINES ARE NOT DETERMINED BY CURBS, SIDEWALK OR PLANTING AREAS, THE INSTALLATION OF DUCTS SHALL BE DONE ACCORDING TO STANDARD NO. URD-24 OF THE UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM MANUAL.
14. DISTANCE BETWEEN ELECTRICAL LINES' DUCTS AND TELECOMMUNICATIONS' DUCTS SHALL BE A MINIMUM OF 13". FOR WATER LINES, GAS AND FUEL PIPES, THE DISTANCE SHALL BE 24". REFER TO STANDARD NO. URD-24 OF THE UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM MANUAL.
15. THE BOTTOM OF THE TRENCH SHALL NOT HAVE ROCKS OR SHARP OBJECTS AND SHALL BE COMPACTED TO A MINIMUM OF 95% OF STANDARD MAXIMUM DENSITY AT THE PROPER MOISTURE CONTENT OF THE UNDISTURBED SOIL, ACCORDING TO THE LATEST VERSION OF STANDARD NO. ASTM D698.
16. IF TRENCH CONTAINS MORE THAN ONE LEVEL OF DUCTS, PVC COUPLINGS (ITEM 2043) SHALL BE STAGGERED. REFER TO FIGURE A OF STANDARDS NO. URD-7 AND URD-8 OF THE UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM MANUAL.
17. FOR CASES WHERE THE DISTANCE "X" SHOWN ON FIGURE B IS LESS THAN 24":
    A. IF THE DEPTH BETWEEN THE FINISH GRADE OF THE STREET OR SIDEWALK AND TOP OF CONCRETE ENCASEMENT IS LESS THAN OR EQUAL TO 4", THE FILL MATERIAL SHALL BE THE SAME AS SURFACE MATERIAL.
    B. IF THE DEPTH BETWEEN THE FINISH GRADE OF THE STREET OR SIDEWALK AND TOP OF CONCRETE ENCASEMENT IS GREATER THAN 4", THE FILL MATERIAL SHALL BE TAMPED AND MECHANICALLY COMPACTED BACKFILL, AND THE SAME SURFACE MATERIAL.

DISTRIBUTION ENGINEERING

STREET LIGHTING STANDARDS

TITLE:

STREET LIGHTING CIRCUITS CONDUIT TRENCH CONSTRUCTION DETAIL BILL OF MATERIAL

STANDARD NO. STL-16 VERSION 4
DOCUMENT NO. 4401.038
PAGE 4 OF 4 DATE AUG 24, 2023

SUBMITTED LUIS R. SOTO LIC. 11658
REVIEWED IVETTE D. SANCHEZ LIC. 13837
APPROVED RICARDO CASTRO LIC. 12135
DIGITIZED EMILIO CUADRADO LIC. 3000

MATERIALS			
NO.	GENERAL DESCRIPTION	WAREHOUSE ITEM	QTY.
2040	PVC SCH-40 DUCT	038-01867	AS REQ.
2043	PVC COUPLING	038-01909	AS REQ.
2049	A-2-4 BACKFILL MATERIAL	038-83207	AS REQ.
2055	READY MIX CONCRETE	038-44668	AS REQ.
2069	HAZARD WARNING TAPE	072-83464	AS REQ.
2070	DUCT SPACER	VARIES	AS REQ.

Appendix A. Roadway Lighting Design Principles

Recommended illuminance levels according to the area and road classification:

- Levels are in footcandles (fc) for average horizontal illumination.
- The uniformity ratio (E_{avg}/E_{min}) shall be 3:1 for freeways, expressways, and major roads. For collector roads, shall be 4:1, and for local roads, shall be 6:1.

Table 4. Illuminance Levels Based on Type of Road, Pedestrian Conflict Areas, and Pavement Classification

Road and Pedestrian Conflict Area		Pavement Classification (minimum maintained average values)			Maximum Uniformity Ratio (E_{avg}/E_{min})	Veiling Luminance Ratio (Lv_{max}/L_{avg})
Road	Pedestrian Conflict Area	R1 (lux / fc)	R2 and R3 (lux / fc)	R4 (lux / fc)		
Freeway Class A		6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	3.0	0.3
Freeway Class B		4.0 / 0.4	6.0 / 0.6	5.0 / 0.5	3.0	0.3
Expressway	High	10.0 / 1.0	14.0 / 1.4	13.0 / 1.3	3.0	0.3
	Medium	8.0 / 0.8	12.0 / 1.2	10.0 / 1.0	3.0	0.3
	Low	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	3.0	0.3
Major	High	12.0 / 1.2	17.0 / 1.7	15.0 / 1.5	3.0	0.3
	Medium	9.0 / 0.9	13.0 / 1.3	11.0 / 1.1	3.0	0.3
	Low	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	3.0	0.3
Collector	High	8.0 / 0.8	12.0 / 1.2	10.0 / 1.0	4.0	0.4
	Medium	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	4.0	0.4
	Low	4.0 / 0.4	6.0 / 0.6	5.0 / 0.5	4.0	0.4
Local	High	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	6.0	0.4
	Medium	5.0 / 0.5	7.0 / 0.7	6.0 / 0.6	6.0	0.4
	Low	3.0 / 0.3	4.0 / 0.4	4.0 / 0.4	6.0	0.4

Source: ANSI/IES RP-08-18

Table 5. Illuminance Levels for Intersections and Pedestrian Conflict Areas

Functional Classification	Average Maintained Illumination at Pavement by Pedestrian Area Classification* (lux/fc)			Maximum Uniformity Ratio (E_{avg} /E_{min})
	High	Medium	Low	
Major/Major	34.0 / 3.2	26.0 / 2.4	18.0 / 1.7	3.0
Major/Collector	29.0 / 2.7	22.0 / 2.0	15.0 / 1.4	3.0
Major/Local	26.0 / 2.4	20.0 / 1.9	13.0 / 1.2	3.0
Collector/Collector	24.0 / 2.2	18.0 / 1.7	12.0 / 1.1	4.0
Collector/Local	21.0 / 2.0	16.0 / 1.5	10.0 / 0.9	4.0
Local/Local	18.0 / 1.7	14.0 / 1.3	8.0 / 0.7	6.0

*All values are for R2 and R3 pavement classification

Source: ANSI/IES RP-08-18

Appendix B. BUG Ratings

Table 6. Backlight Ratings

	Secondary Solid Angles	B0	B1	B2	B3	B4	B5
BACKLIGHT	BH	110	500	1000	2500	5000	>5000
	BM	220	1000	2500	500	8500	>8500
	BL	110	500	1000	2500	5000	>5000

Table 7. Uplight Ratings

	Secondary Solid Angles	U0	U1	U2	U3	U4	U5
UPLIGHT	UH	0	10	50	500	1000	>1000
	UL	0	10	50	500	1000	>1000

Table 8. Glare Ratings for Asymmetrical Luminaire Types (I, II, III and IV)

	Secondary Solid Angles	G0	G1	G2	G3	G4	G5
GLARE	FVH	10	100	225	500	750	>750
	BVH	10	100	225	500	750	>750
	FH	660	1800	5000	7500	12000	>12000
	BH	110	500	1000	2500	5000	>5000

Table 9. Glare Ratings for Symmetrical Luminaire Types (V and V Square)

	Secondary Solid Angles	G0	G1	G2	G3	G4	G5
GLARE	FVH	10	100	225	500	750	>750
	BVH	10	100	225	500	750	>750
	FH	660	1800	5000	7500	12000	>12000
	BH	660	1800	5000	7500	12000	>12000

Source: ANSI/IES RP-08-18

Appendix C. LUMA's Street Lighting System Design Criteria

Table 10 contains the required design criteria accepted for the Street Lighting System infrastructure to be transferred to PREPA.

Table 10. Design Criteria

Design Criteria Parameters	
System Layout, Geometry & Mounting	
Road Width	Varies per number and width of lanes as per road functional classification
Arm Length	4, 8, 12, or 15 feet
Mounting Height	30 or 40 feet
Arrangement	One-Sided, Staggered, Opposite, Median
Average Illuminance	Varies as shown in Table 4 and Table 5
Light Distribution	
Transversal Distribution	Type II (35 W Amber LED and 65 W LED), Type III (125 W LED)
Longitudinal Distribution	Medium
Maximum BUG Rating	B3-U1-G3
Luminaire Requirements	
Type	Light Emitting Diode (LED)
Maximum Power (W)	35 W Amber (turtle friendly), 65 W, or 125 W
Circuit Voltage	120/240 V
Frequency	60 Hz
Minimum Light Output (lm)	1,500 lm (35 W Amber), 4,000 lm (65 W), or 9,000 lm (125 W)
Nominal Correlated Color Temperature (CCT)	2200K (35 W Amber), 3000K (65 W and 125 W)
Color Rendering Index (CRI/Ra)	≥70 (except for turtle friendly lighting)
System Rated Life (L70)	>90,000 hours
Light Loss Factor (LLF)	0.80 (35 W Amber), or 0.88 (65 W and 125 W)
Operating Temperature	-20°C (-4°F) to 40°C (104°F)
LED Driver	
Operating Current (I)	250 mA (±50 mA) ≤ I ≤ 1,300 mA (±50 mA)
Rated Expected Life	≥80,000 hours for case temperature (TC) around 75°C (±5°C)
Mean Time Between Failure (MTBF)	>300,000 hours @ 25°C
Power Factor	≥0.90