SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Lamps.

D. Poles and accessories.

E. Luminaire accessories.

1.02 APPROVALS

A. NYCHA reserves the right to approve/reject based on criteria that are site specific. To include aesthetics, assembly of fixture / components and architectural consistency.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 37 - Boxes.

D. Section 26 09 19 - Enclosed Contactors: Lighting contactors.

E. Section 26 09 23 - Lighting Control Devices: Automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.

F. Section 26 09 43 - Network Lighting Controls - Lutron QS/Quantum.

G. Section 26 27 26 - Wiring Devices: Receptacles for installation in poles.

H. Section 26 28 13 - Fuses.

I. Section 26 50 13 - Luminaire Schedule.

J. Section 26 51 00 - Interior Lighting.

K. Section 26 55 37 - Obstruction and Landing Lights.

L. Section 33 71 16.33 - Wood Electrical Utility Poles.

1.04 UNIT PRICES

A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.

B. Exterior Lighting Unit:
   1. Basis of Measurement: Each.
   2. Basis of Payment: Includes concrete foundation, pole, and luminaire(s) with lamps and accessories.

1.05 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals; American Association of State Highway and Transportation Officials; 6th Edition, with 2015 Interim Revisions.

C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.

D. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

E. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.

F. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2015.

G. IEEE C2 - National Electrical Safety Code; 2012.

H. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

I. IESNA LM-5 - Photometric Measurements of Area and Sports Lighting Installations; 2004 (Reaffirmed 2007).

J. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

K. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

L. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

M. IES RP-8 - Roadway Lighting; 2014.

N. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

O. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.

P. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.

Q. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

R. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

S. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

T. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

U. UL 1029 - High-Intensity-Discharge Lamp Ballasts; Current Edition, Including All Revisions.

V. UL 1598 - Luminaires; Current Edition, Including All Revisions.

W. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
   2. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.07 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.
   3. Provide structural calculations for each pole proposed for substitution.
   4. Anchor-bolt templates keyed to specific poles and certified by manufacturer

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
   3. Lamps: Include rated life and initial and mean lumen output.
   4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
   5. For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes
   6. Provide IES file data sheets for each optic and wattage type

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

E. Samples:
   1. Provide one sample(s) of each specified luminaire where indicated.
   2. Provide one sample(s) of each custom luminaire.
   3. Provide one sample(s) of each luminaire proposed for substitution upon request.
   4. Provide one sample of each product finish illustrating color and texture upon request.

F. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

G. Field Quality Control Reports.
   1. Include test report indicating measured illumination levels.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
   3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.
   4. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
   5. Touch-Up Paint: 2 gallons, to match color of pole finish.

K. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.08 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

E. Comply with IEEE C2, "National Electrical Safety Code."

F. Comply with NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings or equal.

B. Acuity Brands, Inc; _____: www.acuitybrands.com.

C. Cooper Lighting, a division of Cooper Industries; _____: www.cooperindustries.com.

D. Hubbell Lighting, Inc; _____: www.hubbelllighting.com.

E. _____.

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 OWNER-FURNISHED PRODUCTS

A. New Products: _____.

B. Existing Products: _____.

2.03 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 LUMINAIRE TYPES

A. Type _____: Pole-mounted HID area luminaire.
   1. Configuration: Four luminaire(s) mounted 90 degrees apart as indicated.
   2. Luminaire(s):
      a. Products:
         1) _____.
         2) _____.
         3) _____.
         4) Substitutions: See Section 01 60 00 - Product Requirements.
      b. Housing: Aluminum.
      c. Finish: _____.
      d. Shape: Rectilinear.
      e. Nominal Size: _____.
      f. Lamp: _____.
      g. Lamp Orientation: Vertical.
      h. Shielding: Flat glass lens.
      i. Lighting Distribution per IES RP-8:

1) Lateral Distribution: Type II.
2) Cutoff Category: Full cutoff.

j. Voltage: 480 V.
k. Ballast: _____.
l. Mounting: _____ arm suitable for mounting on specified pole, finish to match pole.
m. Mounting: _____ arm suitable for wall-mounting, finish to match luminaire.
n. Provide with the following features/accessories:
1) Fusing.
2) Integral locking receptacle for photo control complying with ANSI C136.10.
3) House-side shield, external.
4) Rotatable optics.
5) Vandal shield.
6) _____.

o. Listings:
1) Suitable for wet locations.
2) _____.

p. _____.

3. Pole:
a. Products:
1) _____.
2) _____.
3) _____.
4) Substitutions: See Section 01 60 00 - Product Requirements.

b. Material: Steel.
c. Shape: Square straight.
d. Finish: Match luminaire finish.
e. Mounting Height: _____.
f. Mounting: Install on concrete foundation, height as indicated on the drawings.
g. Provide with the following features/accessories:
1) Top cap.
2) Handhole, _____ size.
3) Anchor base cover.
4) Provision for pole-mounted weatherproof GFI receptacle where indicated.
5) Brackets: _____.
6) Hinged base.
7) Pole-top tenon, _____ inch.
8) _____.

h. _____.

B. Type _____: Pole-mounted HID flood luminaire.
1. Configuration: Two luminaire(s) mounted 180 degrees apart as indicated.
2. Luminaire(s):
a. Products:
1) _____.
2) _____.
3) _____.
4) Substitutions: See Section 01 60 00 - Product Requirements.

b. Housing: Aluminum.
c. Finish: _____.
d. Nominal Size: _____.
e. Lamp: _____.
f. Shielding: Flat glass lens.
g. Lighting Distribution: _____.
h. Voltage: 480 V.

i. Ballast: _____.
j. Mounting Provision: Yoke mount.
k. Mounting: Pole-top bracket suitable for mounting on specified pole, finish to match pole.
1) Product: _____.
2) Substitutions: See Section 01 60 00 - Product Requirements.
l. Mounting: Bracket suitable for wall-mounting, finish to match luminaire.
1) Product: _____.
2) Substitutions: See Section 01 60 00 - Product Requirements.
m. Mounting: Ground-mounted on concrete foundation, height as indicated on the drawings.
n. Provide with the following features/accessories:
1) Fusing.
2) Integral locking receptacle for photo control complying with ANSI C136.10.
3) Integral button type photo control.
4) Wireguard.
5) Glare shielding: Full visor.
6) Vandal shield.
7) _____.
o. Listings:
1) Suitable for wet locations.
2) _____.
p. _____.

3. Pole:
a. Products:
1) _____.
2) _____.
3) _____.
4) Substitutions: See Section 01 60 00 - Product Requirements.
b. Material: Steel.
c. Shape: Square straight.
d. Finish: Match luminaire finish.
e. Mounting Height: _____.
f. Mounting: Install on concrete foundation, height as indicated on the drawings.
g. Provide with the following features/accessories:
1) Top cap.
2) Handhole, _____ size.
3) Provision for pole-mounted weatherproof GFI receptacle where indicated.
4) Brackets: _____.
5) Hinged base.
6) Pole-top tenon, _____ inch.
7) _____.
h. _____.

C. Type _____: Wall-mounted HID security luminaire.
1. Products:
a. _____.
b. _____.
c. _____.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Housing: Aluminum.
3. Finish: _____.
4. Shape: Rectangular.
5. Nominal Size: _____.

6. Lamp: _____.
7. Shielding: Clear tempered glass lens.
8. Lighting Distribution:
    a. Lateral Distribution: Forward throw.
    b. Cutoff Category: Full cutoff.
9. Voltage: Multi-tap 120/208/240/277 V.
10. Ballast: _____.
11. Mounting: Surface mount at _____.
12. Provide quartz restrike system with time delay in luminaires designated with "Q" on the drawings.
13. Provide emergency power supply unit in luminaires designated with "EM" on the drawings.
14. Provide with the following features/accessories:
    a. Fusing.
    b. Integral button type photo control.
    c. Wireguard.
    d. _____.
15. Listings:
    a. Suitable for wet locations.
    b. _____.
16. _____.

D. Type _____: HID bollard luminaire.
1. Products:
    a. _____.
    b. _____.
    c. _____.
    d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Housing: Aluminum.
3. Finish: _____.
4. Shape: Round.
5. Nominal Size: _____.
6. Nominal Height: _____.
7. Lamp: _____.
8. Shielding: Clear acrylic lens.
9. Lighting Distribution: Symmetrical.
10. Voltage: Multi-tap 120/208/240/277 V.
11. Ballast: _____.
12. Mounting: _____.
13. Provide with the following features/accessories:
    a. Fusing.
    b. Anchor bolts.
    c. _____.
14. Listings:
    a. Suitable for wet locations.
    b. _____.
15. _____.

2.05 LUMINAIRES

A. Manufacturers:
1. Acuity Brands, Inc; _____: www.acuitybrands.com.
2. Cooper Lighting, a division of Cooper Industries; _____: www.cooperindustries.com.
3. Hubbell Lighting, Inc; _____: www.hubbelllighting.com.
4. _____.

5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Provide products complying with Federal Energy Management Program (FEMP) requirements.

F. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

G. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

I. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

J. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

K. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

L. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

M. HID Luminaires:
   1. HID High Bay Luminaires: Provide safety chain or power hook unless otherwise indicated.
   2. HID Luminaires with Quartz Restrike Systems: Factory-installed supplementary quartz lamp automatically switches on when power interruption causes primary HID lamp to drop out or during cold startup.

N. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

O. Exposed Hardware: Stainless steel.

2.06 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Fixture (Type W) Wall-pack
   1. INPUT WATTAGE: Shall be a maximum of 75W at 120V.
   2. DELIVERED LUMENS: Shall have no less than 3 lumen packages, ranging between 4000 and 9000 delivered lumens.
   3. LED ARRAY: Shall have a metal core printed circuit board. Lumen maintenance factor no less than .85 at 100,000 hours.
   4. Product MUST have an option for Integral Emergency backup.
   5. LED CCT: shall be provided in 4000K
   6. LED CRI: Shall be 70+ at 4000K color temperature.
   7. LED DRIVER: Luminaires are equipped with an LED driver that accepts 120V through 277V, 50hz to 60hz, input. Driver output is either 350 mA, 530 mA or 700 mA, based on the LED wattage selected. Component-to-component wiring within the luminaire will carry no more than 80% of rated current and is listed by UL for use at 600 VAC at 302°F/150°C

or higher. Plug disconnects are listed by UL for use at 600 VAC, 15A or higher. Power factor is not less than 90%. Luminaires consume 0.0 watts in the off state.

8. EFFICACY: Shall have ability to produce at least 80 lumens per watt.
9. B.U.G RATING: Shall not exceed B1-U0-G3.
10. SURGE PROTECTION: The LED driver has <3kV surge suppression built in. The LED driver is installed on the enclosure door, keeping it mechanically and thermally separated from the housing which doubles as the LED array heat sink.
11. OPTICAL: LED luminaires shall utilize lensed LED arrays set to achieve IES Type II, Type III, and Type IV distributions, as well as a Medium Throw distribution. Individual LED arrays are replaceable. Luminaires feature high performance Class 1 LED systems. Luminaires are supplied standard with a clear lens.
12. IES DISTRIBUTION: Shall be Type III or others for best design practice.
13. INGRESS RATING: Optics and housing shall be rated to IP66 or greater against water and dirt infiltration.
14. LUMINAIRE CONSTRUCTION: Shall be low copper, (equal to or less than 6%) copper content and corrosion resistance cast aluminum for corrosion resistance and long life.
15. FINISH: Each standard color luminaire receives a fade and abrasion resistant, electrostatically applied, thermally cured, triglycidal isocyanurate (TGIC) textured polyester powder coat finish.
16. LISTINGS: UL, DLC.
17. INSTALLATION and MAINTAINENCE: Luminaire shall have ease of access electrical components.
18. WARRANTY: 5 years on mechanical and electrical components.
19. ACCEPTABLE MANUFACTURERS: The following products/manufacturers are acceptable, subject to meeting the requirements of these specifications:
20. Type W-1: Philips Gardco - 121 LED Performance Sconce or approved Equal.
21. Type W-EM: Philips Gardco - 121-EP1 or approved Equal.

B. Street Lighting Fixture (Type SA & SB)

1. Type SA: Single head, Type SB: Double head.
2. INPUT WATTAGE: Shall be a maximum of 120W at 120V for mounting heights of 20ft or less.
3. DELIVERED LUMENS: Shall deliver between 10,000 - 12000 lumens.
4. LED CCT: Shall be provided in 4000K.
5. LED CRI: Shall be 70 minimum.
6. LED DRIVER: 700mA Class 1 electronic driver, >90% power factor, THD <20%, and expected life of 100,000 hours at 25 degrees C.
7. EFFICACY: Shall have ability to produce 100+ lumens per watt.
8. B.U.G RATING: Shall not exceed B3-U0-G2.
9. SURGE PROTECTION: Shall meet ANSI/IEEE C62.41.2 surge protection and be field replaceable.
10. OPTICAL: Composed of high-performance optical grade PMMA acrylic refractor lenses to achieve desired distribution optimized to get maximum spacing, target lumens and a superior lighting uniformity. Performance shall be tested per LM-63, LM-79 and TM-15 (IESNA) certifying its photometric performance. Dark Sky compliant with 0% uplight and U0 per IESNA TM-15.
11. IES DISTRIBUTION: Shall have Type II, Type III and Type IV distribution types as required.
12. INGRESS RATING: Optics and housing shall be rated to IP66 against water and dirt infiltration.
13. LUMINAIRE CONSTRUCTION: Shall be low copper, (equal to or less than 6%) copper content and corrosion resistance cast aluminum for corrosion resistance and long life.
14. THERMAL MANAGEMENT: Heat Sink: Built in the housing, the heat sink is a unique thermal dissipating design with wide angular channels that allow for natural removal of dirt and debris. Product does not use any cooling device with moving parts (only passive

cooling). Entire luminaire is rated for operation in ambient temperature of -40°C / -40°F up to +40°C / +104°F.

15. FINISH: Color to be in accordance with the AAMA 2603 standard. Application of polyester powder coat paint (3-6 mils/76-152 microns). The Thermosetting resins provides a discoloration resistant finish in accordance with the ASTM D2244 standard, as well as luster retention in keeping with the ASTM D523 standard and humidity proof in accordance with the ASTM D2247 standard.
16. LISTINGS: UL. 3G vibration rating. Meet 1000 hour salt fog test.
17. INSTALLATION and MAINTAINENCE: Luminaire shall have ease of access electrical components. Pole shall be sized to achieve approved fixture mounting height.
18. WARRANTY: 5 years on mechanical and electrical components.
19. Certifications and Compliance: UL8750 and UL1598 compliant. ETL and cETL Listed to U.S. and Canadian safety standards for wet locations. Luminaire meets DOE and MSSLC Model Specification for LED Roadway Luminaires. In accordance with applicable ANSI C136 standards.
20. ACCEPTABLE MANUFACTURERS: The following products/manufacturers are acceptable, subject to meeting the requirements of these specifications:
21. Type SA-1 & SB-1: Philips - Roadfocus OR APPROVED EQUAL

C. LED Entrance Light: (Type EA / EB)
1. EA is the Canopy Entrance and EB is the wall mounted entrance.
2. Both Canopy and Wall Entrance light shall have Integral Emergency Backup
3. Ballast/Driver.
4. INPUT WATTAGE: Shall be a maximum of 50W at 120V.
5. DELIVERED LUMENS: Shall deliver 2000 lumens +/- 40 lumens at 4000K CCT.
6. LED ARRAY: Lumen maintenance factor no less than .70 at 50,000 hours at 25 degrees C.
7. LED CCT: evaluation samples shall be provided in 4000K.
8. LED CRI: Shall be 65+.
9. LED DRIVER: 700Ma Class 1 electronic driver, >90% power factor, THD <20%, and expected life of 50,000 hours.
10. EFFICACY: Shall have ability to produce 48+ lumens per watt.
11. SURGE PROTECTION: Shall meet ANSI/IEEE C62.41.2 surge protection and be field replaceable.
12. OPTICAL: Shall be polycarbonate impact resistant.
13. INGRESS RATING: Optics and housing shall be rated to IP66 against water and dirt infiltration.
14. LUMINAIRE CONSTRUCTION: Shall be round in design, low copper (<1%CU content) cast aluminum for corrosion resistance and long life. Shall be tamper resistant.
15. FINISH: Shall be thermal setting polyester powder coat after a pretreatment process.
16. LISTINGS: CSA or UL
17. INSTALLATION and MAINTAINENCE: Luminaire shall have ease of access electrical components.
18. WARRANTY: 5 years on mechanical and electrical components.

D. Walkway Fixture (Type P)
1. INPUT WATTAGE: Shall be a maximum of 100W at 120V.
2. DELIVERED LUMENS: Shall deliver 8000 lumens to 9000 lumens at 4000K CCT.
3. LED ARRAY: Composed of 80 high performance white LEDs. Color temperature of 4000 Kelvin nominal, 70 CRI. Use of metal core board ensures greater heat transfer and longer lifespan of the light engine.
4. LED CCT: evaluation samples shall be provided in 4000K.
5. LED CRI: Shall be greater than 70.
6. LED DRIVER: High power factor of 95%. Electronic driver, operating range 50/60 Hz. Auto adjusting universal voltage input from 120 to 277 VAC rated for both application line

to line or line to neutral, Class I, THD of 20% max. Maximum ambient operating temperature from 40F

7. (40C) to 130F(55C) degrees. Certified in compliance to UL1310 cULus requirement. Dry and damp location. Assembled on a unitized removable tray with Tyco quick disconnect plug resisting to 221F(105C) degrees. Driver comes with dimming compatible 0 10 volts..
8. EFFICACY: Shall have ability to produce greater than 95 lumens per watt.
9. SURGE PROTECTION: Shall meet ANSI/IEEE C62.41.2 surge protection and be field replaceable.
10. OPTICAL: Composed of high performance optical polymer refractor lenses to achieve desired distribution optimized to get maximum spacing, target lumens and a superior lighting uniformity. System is rated IP66. Performance shall be tested per LM 63, LM 79 and TM 15 (IESNA) certifying its photometric performance. Street side indicated. Dark Sky compliant with 0% uplight and U0 per IESNA TM 15.
11. IES DISTRIBUTION: Type I, II, III, or IV as required.
12. INGRESS RATING: System shall be rated IP66.
13. LUMINAIRE CONSTRUCTION: Shall be round in design, low copper (equal to or less than 6%) die cast aluminum for corrosion resistance and long life.
14. FINISH: Color to be VERIFIED with NYCHA and in accordance with the AAMA 2603 standard. Application of polyester powder coat paint (4 mils/100 microns) with ± 1 mils/24 microns of tolerance. The Thermosetting resins provides a discoloration resistant finish in accordance with the ASTM D2244 standard, as well as luster retention in keeping with the ASTM D523 standard and humidity proof in accordance with the ASTM D2247 standard.
15. The surface treatment achieves a minimum of 2000 hours for salt spray resistant finish in accordance with testing performed and per ASTM B117 standard.
16. LISTINGS: UL.
17. INSTALLATION and MAINTAINENCE: Luminaire shall have ease of access electrical components.
18. POLE HEIGHT: 12 feet.
19. WARRANTY: 5 years on mechanical and electrical components.
20. ACCEPTABLE MANUFACTURERS: The following products/manufacturers are acceptable, subject to meeting the requirements of these specifications
21. Type P-1: Philips-MetroScape MPTCRR or approved equal.

E. LED Flood light Fixtures (Type FA)

1. INPUT WATTAGE: Shall be a maximum of 215W at 120V.
2. DELIVERED LUMENS: Shall deliver 20500 to 22000 lumens +/- 50 lumens at 4000K CCT.
3. LED ARRAY: 64 high power LEDs. Warm, Neutral, and Cool Color temperatures available. Metal core printed circuit board. RoHS compliant.
4. LED CCT: evaluation samples shall be provided in 4000K.
5. LED CRI: Shall be 70+.
6. Distribution: Shall be per the design criteria.
7. LED DRIVER: High efficiency multi-volt driver (50 or 60Hz), maintains constant current flow to LEDs to accommodate LED variations. High power factor (0.9 standard). Constant current: 530,700, or 1000 mA. Voltage: 120-277, 347, 480. Ambient temperature range: -40°C (-40°F) to 40°C (104°F).
8. Integral Controls: Shall provide an AUTO Profile dimming system to be both pre programed and field adjusted. Must also have a motion response override.
9. EFFICACY: Shall have ability to produce equal to or greater than 100 lumens per watt.
10. SURGE PROTECTION: Open / short circuit protection. RoHS compliant. The surge protector is in accordance with IEEE / ANSI C62.41.2 guidelines, with a surge current rating of 10 KV / 5 KA.

11. OPTICAL: Internal Concentric Glare Louver (ICL) options reduce glare and increase visual comfort. Shields are mounted internally, and do not disrupt the overall aesthetic of the luminaire.
12. Shields can be ordered as an option and installed in the factory, or as an accessory for
13. field installation. Barn doors are also available. INGRESS RATING: IP66
14. LUMINAIRE CONSTRUCTION: Shall be round in design, low copper (equal to or less than 6%) die cast aluminum for corrosion resistance and long life.
15. FINISH: Color to be in accordance with the AAMA 2603 standard. Application of polyester powder coat paint (3-6 mils/76-152 microns). The Thermosetting resins provides a discoloration re-sistant finish in accordance with the ASTM D2244 standard, as well as luster retention in keeping with the ASTM D523 standard and humidity proof in accordance with the ASTM D2247 standard.
16. Type FA: may have different configurations based on design criteria. Bullhorn brackets to be used per configuration requirement.
17. LISTINGS: CSA or UL and 3G rated.
18. INSTALLATION and MAINTAINENCE: Luminaire shall have ease of access electrical components.
19. POLE HEIGHT: 20 feet.
20. WARRANTY: 5 years on mechanical and electrical components.
21. ACCEPTABLE MANUFACTURERS: The following products/manufacturers are acceptable, subject to meeting the requirements of these specifications:
22. Type FA-1 & FB-1: Philips - Clearscape CSFM or Approved equal

2.07 BALLASTS

A. Manufacturers:
   1. General Electric Company/GE Lighting; _____: www.gelighting.com.
   2. Osram Sylvania; _____: www.sylvania.com.
   3. Philips Lighting Electronics/Advance; _____: www.advance.philips.com.
   4. _____.
   5. Substitutions: See Section 01 60 00 - Product Requirements.
   6. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
   7. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. All Ballasts:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

C. Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
   1. Inrush Current: Not exceeding peak currents specified in NEMA 410.
   2. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
   3. Total Harmonic Distortion: Not greater than 20 percent.
   4. Power Factor: Not less than 0.95.
   5. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.
   6. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
   7. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
   8. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
   9. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
      a. Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.

b. Do not operate lamp(s) within the frequencies from _____ in order to avoid interference with _____.

10. Lamp Current Crest Factor: Not greater than 1.7.
11. Lamp Wiring Method:
    a. Instant Start Ballasts: Parallel wired.
    b. Rapid Start Ballasts: Series wired.
    c. Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.
12. Lamp Starting Method:
    a. T8 Lamp Ballasts: Instant start unless otherwise indicated.
    b. T5 Lamp Ballasts: Programmed start unless otherwise indicated.
    c. Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.
13. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F unless otherwise indicated.
14. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
15. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
16. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
17. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class A, non-consumer application.
18. Provide high efficiency T8 lamp ballasts certified as NEMA premium where indicated.
19. Provide lamp striation reduction circuitry where indicated.
20. Ballast Marking: Include wiring diagrams with lamp connections.

D. High Intensity Discharge (HID) Ballasts: Unless otherwise indicated, provide electromagnetic ballasts complying with ANSI C82.4 and listed and labeled as complying with UL 1029.
    1. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 5 percent.
    2. Power Factor: Not less than 0.90 unless otherwise indicated.
    3. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of -22 degrees F.

2.08 LAMPS

A. Manufacturers:
    1. General Electric Company/GE Lighting; _____: www.gelighting.com.
    2. Osram Sylvania; _____: www.sylvania.com.
    3. Philips Lighting Company; _____: www.lighting.philips.com.
    4. _____.
    5. Substitutions: See Section 01 60 00 - Product Requirements.
    6. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
    7. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Lamps - General Requirements:
    1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
    2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
    3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
    4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

C. Lamps - Sustainable Design Requirements:
   1. Maximum Mercury Content:
      a. T8 Linear Fluorescent, 96 Inch: 10 mg.
      b. T8 Linear Fluorescent, 48 Inch: 3.5 mg.
      c. T8 Linear Fluorescent, 36 Inch and 24 Inch: 3.5 mg.
      d. T8 Linear Fluorescent, U-Bent: 6 mg.
      e. T5 Linear Fluorescent: 2.5 mg.
      f. T5 Circular Fluorescent: 9 mg.
      g. Compact Fluorescent, Nonintegral Ballast: 3.5 mg.
      h. Compact Fluorescent, Integral Ballast: 3.5 mg (ENERGY STAR qualified).
      i. High Pressure Sodium, Up to 400 W: 10 mg.
      j. High Pressure Sodium, Greater Than 400 W: 32 mg.
   2. Minimum Rated Lamp Life:
      a. T8 Linear Fluorescent, 96 Inch: 24,000 hours for standard output lamps on instant start ballasts; 18,000 hours for high output lamps on instant start or programmed start ballasts; based on three hours per start.
      b. T8 Linear Fluorescent, 48 Inch: 30,000 hours for standard and high output lamps on instant start ballasts; 36,000 hours on programmed start ballasts; based on three hours per start.
      c. T8 Linear Fluorescent, 36 Inch and 24 Inch: 24,000 hours on instant start or programmed start ballasts; based on three hours per start.
      d. T8 Linear Fluorescent, U-Bent: 18,000 hours on instant start ballasts; 24,000 hours on programmed start ballasts; based on three hours per start.
      e. T5 Linear Fluorescent: 25,000 hours for standard and high output lamps on programmed start ballasts.
      f. T5 Circular Fluorescent: 25,000 hours for standard and high output lamps on programmed start ballasts.
      g. Compact Fluorescent, Nonintegral Ballast: 12,000 hours.
      h. Compact Fluorescent, Integral Ballast: 10,000 hours for bare bulbs; 8,000 hours for covered models such as globes, reflectors, and A-19 lamps.
      i. High Pressure Sodium: Use only non-cycling type lamps.

D. Incandescent Lamps: Wattage and bulb type as indicated, with base type as required for lighting fixture; 130 V rated.
   1. Reflector Type Incandescent Lamps: Beam pattern as indicated.
   2. Non-Reflector Type Incandescent Lamps: Inside frosted lamp finish unless otherwise indicated.

E. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
   1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
   2. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
   3. Color Rendering Index (CRI): Not less than 80.
   4. Average Rated Life: Not less than 10,000 hours for an operating cycle of three hours per start.

F. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
   1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
   2. T8 Linear Fluorescent Lamps:
      a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
      b. Color Rendering Index (CRI): Not less than 80.
      c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.

3. T5 Linear Fluorescent Lamps:
    a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
    b. Color Rendering Index (CRI): Not less than 80.
    c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.

G. High Intensity Discharge (HID) Lamps: Wattage as indicated, with bulb type, burning position, and base type as required for luminaire.
1. Metal Halide Lamps:
    a. Non-Reflector Type Metal Halide Lamps: Clear lamp finish unless otherwise indicated.
    b. Provide ANSI type O-rated protected metal halide lamps where required for open luminaires provided with compatible exclusionary sockets.
    c. Ceramic Metal Halide Lamps:
        1) Correlated Color Temperature (CCT): 3,000 K unless otherwise indicated.
        2) Color Rendering Index (CRI): Not less than 80.
2. High Pressure Sodium Lamps:
    a. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
    b. Average Rated Life: Not less than 24,000 hours for an operating cycle of ten hours per start.

2.09 POLES

A. Manufacturers:
1. Acuity Brands, Inc; _____: www.acuitybrands.com.
2. Cooper Lighting, a division of Cooper Industries; _____: www.cooperindustries.com.
3. Hubbell Lighting, Inc; _____: www.hubbelllighting.com.
4. _____.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Poles:
1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
2. Structural Design Criteria:
    a. Comply with AASHTO LTS.
    b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
        1) Design Wind Speed: 100 miles per hour, with gust factor of 1.3. For poles 50 feet high or less.
            (a) Wind Importance Factor: 1.0.
            (b) Minimum Design Life: 25 years.
            (c) Velocity Conversion Factors: 1.0.
        2) Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
    c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories. Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS -4-M.
    d. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.
    e. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.
    f. _____.
    g. Include structural calculations demonstrating compliance with submittals.
3. Material: Steel, unless otherwise indicated.
4. Shape: Square straight, unless otherwise indicated.

5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting Height: _____, unless otherwise indicated.
7. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
8. Unless otherwise indicated, provide with the following features/accessories:
    a. Top cap.
    b. Handhole, _____ size.
    c. Anchor bolts with leveling nuts or leveling shims.
    d. Anchor base cover.
    e. Provision for pole-mounted weatherproof GFI receptacle where indicated.
    f. Brackets: _____.
    g. Hinged base.
    h. Pole-top tenon, _____ inch.
    i. _____.

C. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.10 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.
1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of [1.1] to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainlesss-steel captive screws. Handhole shall be mounted above the maximum expected 100 year flood elevation.

E. Concrete Pole Foundations: Pre-cast concrete, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Pre-Cast Concrete."

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.11 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.

B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
1. Pedestrian Poles: AMT6F-12-VPA or approved equal
    a. Shall be round, tapered aluminum.

b. Decorative cast base cover
c. (VPA) Vandalproof screw(s), Allen type vandalproof screw(s), with pin in socket tamper resistant head.
d. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
e. Pole finish shall match the fixture.

2. Parking Lot Poles: USS7050C-17.5-VPA or approved equal
a. Shall be round, tapered aluminum.
b. Cast base cover
c. (VPA) Vandalproof screw(s), Allen type vandalproof screw(s), with pin in socket tamper resistant head.
d. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
e. Pole finish shall match the fixture.

3. Flood Light Poles: USS7050C-20-VPA or approved equal
a. Shall be round, tapered aluminum.
b. Cast base cover
c. (VPA) Vandalproof screw(s), Allen type vandalproof screw(s), with pin in socket tamper resistant head.
d. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
e. Pole finish shall match the fixture.

C. All Poles (as required per site design)
1. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
2. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
3. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
4. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
5. Finish: Color to be Per NYCHA Spec, textured Color and in accordance with the AAMA 2603 standard. Application of polyester powder coat paint (4 mils/100 microns) with ± 1 mils/24 microns of tolerance. The Thermosetting resins provides a discoloration resistant finish in accordance with the ASTM D2244 standard, as well as luster retention in keeping with the ASTM D523 standard and humidity proof in accordance with the ASTM D2247 standard.

2.12 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Luminaire Installation:
   1. Fasten luminaire to indicated structural supports.
   2. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
   3. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

F. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

G. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Pole-Mounted Luminaires:
   1. Maintain the following minimum clearances:
      a. Comply with IEEE C2.
      b. Comply with utility company requirements.
      c. _____.
   2. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 30 00.
         1) Install anchor bolts plumb per template furnished by pole manufacturer.
         2) Position conduits to enter pole shaft.
      b. Install foundations plumb.
      c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.

d. Tighten anchor bolt nuts to manufacturer's recommended torque.
e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
f. Install anchor base covers or anchor bolt covers as indicated.

3. Embedded Poles: Install poles plumb as indicated.
4. Grounding:
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   b. Provide supplementary ground rod electrode as specified in Section 26 05 26 at each pole bonded to grounding system as indicated.
5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
6. Install non-breakaway in-line fuse holders and fuses complying with Section 26 28 13 in pole handhole or transformer base for each ungrounded conductor.
7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 27 26 in designated poles.

J. Pole Installation:
1. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
2. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
   a. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
   b. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m) .
   c. Trees: 15 feet (5 m) from tree trunk.
3. Concrete Pole Foundations: Pre-cast pole foundations.
4. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
   a. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
   b. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
   c. Install base covers unless otherwise indicated.
   d. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
   e. Cure concrete a minimum of 72 hours before performing work on pole.
5. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
6. Raise and set poles using web fabric slings (not chain or cable).

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Install lamps in each luminaire.

3.04 CORROSION PREVENTION:

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.05 GROUNDING:

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
   1. Install grounding electrode for each pole unless otherwise indicated.
   2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
   1. Install grounding electrode for each pole.
   2. Install grounding conductor and conductor protector.
   3. Ground metallic components of pole accessories and foundations.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

E. Measure illumination levels at night with calibrated meters to verify conformance with performance requirements. Record test results in written report to be included with submittals.
   1. Test according to IESNA LM-5 (area and sports lighting installations).

3.07 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.08 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.09 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.10 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.11 ATTACHMENTS

A. Luminaire schedule.

B. Luminaire cutsheets.

END OF SECTION