SECTION 26 56 13
OUTDOOR LIGHTING SYSTEMS SPECIFICATIONS

PART 1  GENERAL

1.1  SUMMARY

A. Furnish and install all materials and equipment and provide all labor to complete the work shown on the drawings and/or specified for a complete installation. Items not specifically mentioned, but reasonably inferred for a complete installation including all accessories required for testing are included. It is the intent of the drawings and specifications that all systems are complete, and ready for operation.

B. Section includes outdoor lighting fixtures for roads, parking lots and pathways. Types of lighting must be approved by University Architect / Campus Planning and Design office. Lighting installation and modification must be coordinated with Utilities, High-Volt shop.

C. DEFINITIONS (APPLICABLE TO DRAWINGS AND SPECIFICATIONS):

1. Above Grade: Not buried in ground and not embedded in concrete slab on grade
2. Below Grade: Buried in ground or embedded in concrete slab on grade.
3. Concealed: Inside building above grade and located within walls, furred spaces, crawl spaces, attics, above suspended ceilings, etc. In general, any item not visible or directly accessible.
5. Exposed: Either visible or subject to mechanical or weather damage, indoors or outdoors, including areas such as mechanical and storage rooms. In general any item that is directly accessible without removing panels, walls, ceilings, or other parts of structure.
6. Furnish: Supply and deliver a specified item.
7. Install: Place, secure and connect as required to make fully operational.
8. Luminaire: Complete lighting unit, not including the mounting pole or arm.
9. Light: Complete assembly of luminaire and pole.
10. Project Manager: Representative of Stanford with overall responsibility for the project.
11. Provide: Furnish and install as defined above; perform work.
12. Underground: Buried in ground, including under building slabs.
13. Provide: Furnish and install as defined above; perform work.
14. Underground: Buried in ground, including under building slabs.
15. Use (verb): Furnish and install as defined above.
16. Wiring: Electrical raceway, conductors and connections.
D. CODE COMPLIANCE: All work and materials shall comply with the latest rules, codes and regulations, including, but not limited to the following:
   1. Occupational Safety and Health Act Standards (OSHA).
   2. California Electrical Code (CEC).
   4. Uniform Fire Code (UFC) as adopted by local authorities.
   5. Americans With Disabilities Act (ADA) for mounting heights and alarm equipment.
   6. Applicable Federal, State and local laws and regulations.
   7. Code compliance is mandatory. Nothing in these Drawings and Specifications implies acceptance of work not conforming to these codes. Where work is shown to exceed minimum code requirements, comply with drawings and specifications.
   8. Do not conceal any work until after inspection and approval by proper authorities. If work is concealed without inspection and approval, open and restore the concealed areas and make the required modifications without cost to the Owner.

1.2 RELATED WORK
   A. University Architect / Campus Planning and Design: Standards for Lights
   B. FDG Section 31 23 33: Trenching, Backfilling, and Compacting

1.3 SUBMITTALS
   A. FDG Section 01 33 00 - Submittal Procedures: Submittal procedures.
   B. Submit shop drawings and product descriptive literature as specified for review:
      1. Conduit
      2. Wire and Cable
      3. Splicing Materials
      4. Fuseholders and Fuses
      5. Luminaires and Poles that are furnished by the Contractor including color samples if non-standard finishes are shown on the Drawings.
      6. Electrical Enclosures and Controls
      7. Underground pullboxes and lids
   C. Submit shop drawings and product descriptive literature as specified. The material list shall not include items where no specific manufacturer is shown in the Specifications. Where manufacturers are shown, the material list shall include only one manufacturer for each type of equipment or system.
   D. Review of submittals is for general conformance to design concept and general compliance with Contract Documents. Review comments do not relieve the Contractor from responsibility for compliance with Contract Documents.
   E. Mark all proposed deviations from specifications prominently in the submittals. Deviations not so marked may be disallowed before or after installation of equipment.
   F. Confirm confirming and correlate all quantities and dimensions, select fabrication processes and techniques of construction. Where dimensions of proposed equipment
differ significantly from that shown on contract documents, submit scaled drawings showing proposed layout of equipment with shop drawing submittal.

G. Shop Drawings: Indicate fixture outline and construction, circuit arrangements, lamp, connection diagram for external wiring, and details of conduit and wiring connections and terminations.

H. Product Data: Submit electrical characteristics and connection requirements for fixtures.

1.4 CLOSEOUT SUBMITTALS

A. Maintain a separate set of electrical drawings at the job site for record drawings. Keep this set current with all changes and additions and deliver to the Project Manager at the completion of the job.

B. Mark and dimension actual routing and depth of underground and underslab conduits including stub-outs for future connections.

1.5 QUALIFICATIONS

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

1.6 DELIVERY, STORAGE, AND HANDLING

Protect products from moisture and dust by storing them in a clean, dry location remote from areas involved in construction operations. Provide additional protection in accordance with manufacturer's instructions.

1.7 COORDINATION

A. Call Underground Service Alert (USA), (800) 227-2600, two (2) working days prior to any excavation. USA will mark existing utilities. After placing your call, contact Stanford Maps & Records USA Marking Staff.

B. New light installation or modifications to existing ones must be coordinated with the Utilities, High-Volt shop, which is responsible for maintenance and repair of most outdoor lighting systems.

C. Contractor shall repair damage to marked, existing utilities without charge to the Owner. Repair of damage to irrigation systems (whether marked, or not) and restoration of any all planting, landscape and pavement to its original condition shall be performed by the Contractor without additional charges to the Owner. If trees or shrubs are damaged, the contractor will replace in kind and to comparable size. If the disrupted area is to an existing asphalt path or road, repair shall include a slurry seal of the entire path/road to a determined juncture acceptable to the University Architect/Planning Office. If the disrupted area is to a concrete or paver area, match in kind quality is assumed. Replacement of damage to any existing signs or site furnishing is assumed.

1.8 SYSTEM DESCRIPTION
A. For lighting fixture selection criteria and other information on the historical basis for the Outdoor Lighting standards for the campus, please refer to Exterior Lighting Plans available through the University Architect/Planning Office.

B. Outdoor lighting systems shall generally be group controlled by a contactor with a 120 volt control circuit to a plug-in type photocell. A bypass switch shall be provided adjacent to the contactor. Mount the photocell on top of the first luminaire that is not shaded, or obstructed. Where specifically directed, the luminaires will be connected to a continuously energized circuit and controlled by individual photocells on top of each luminaire.

C. Refer to ES-25 in the FDG for outdoor lighting controls wiring.

D. Time switch control is not permitted.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: All electrical materials shall be new and UL listed.

B. Fixtures: The drawings and fixture schedule indicates the type, specification and distributor for each fixture.

C. All deviations from these approved fixtures must be submitted to the Stanford University Architect/Planning Office for approval.

2.2 LIGHT (LUMINAIRE SELECTIONS):

New installations shall be as approved by the Project Manager and the University Architect/Campus Planning and Design office. See Stanford General Design Documents (http://maps.stanford.edu/fdg_available): Exterior Lighting Guidelines/Pathway and Courtyard Standard Lighting

2.3 EQUIPMENT

A. General: All electrical equipment shall be new and UL listed.

B. Color: All outdoor lighting fixtures will be low-sheen black in color.

C. Pull boxes: Pull boxes shall be Christy N16 with N16-D lids in landscaped and pedestrian areas; use 1732 boxes where subject to damage from vehicles. Substitutions shall be only as specifically approved. Lids and covers shall be marked "STREET LIGHTING."

D. Control Enclosures: Low profile, Tesco, or equivalent. Other enclosures by special approval.

E. Contactors: Contactors shall be sized in accordance with load requirements but in no case smaller than NEMA size 1 (30 ampere). Enclosures shall be NEMA 1 for dry
locations and NEMA 12 or 3R for manholes or damp locations. Control circuits shall be 120 volt only.

F. Circuit Breakers: Provide thermal magnetic breakers with interrupting rating adequate for the application. Circuit breakers are to be equipped with NO and NC auxiliary contacts for breaker status monitoring. Provide NEMA 1 enclosures for dry locations and NEMA 12 or 3R for manholes or damp locations.

G. Photocells: Plug-in type (not hard wired) designed for outdoor use. Provide approved outdoor receptacles, where the receptacle is not integral with the fixture.

H. Ballasts: Use constant wattage, high power factor type for HID sources. Use manufacturer’s LED drivers, multi-voltage, 300V max rating for up to 277V and 600V max rating for 480V.

I. Fuses for Individual Luminaires:
   1. Fuse holders: Buss Tron type HEB (single-pole) for circuits with one ungrounded conductor, or type HEX (two-pole) for circuits with two ungrounded conductors.
   2. Fuses: five ampere (5 A), Buss type KTK.

**PART 3  EXECUTION**

3.1 INSTALLATION

A. General:
   1. Luminaire Installation: Refer to FDG Standard Drawings and confirm latest version at time of construction.
   2. Locations of lights and electrical wiring indicated on the drawings are generally diagrammatic. Specific locations of all fixtures will be established by University and staked in the field by the Engineer.
   3. Pruning of trees and shrubs in construction areas will be accomplished by University personnel. Contractor shall not cut or damage any trees, or shrubs.
   4. All exterior egress lights shall be on emergency power.

B. Conduit Installation:
   1. Underground conduits in landscaped areas shall be PVC, schedule 40, 2 inch minimum size with solvent weld couplings, except conduits from concrete pull boxes to lighting fixture bases shall be one (1) inch minimum and stubbed up six (6) inches from the bottom of pull box.
   2. Where horizontal boring is specifically allowed use Sched 40 PVC with mechanically locked couplings (Carlon Bore-Gard or equal).
   3. Type DB, Schedule 20 PVC, and HDPE conduits are not allowed.
   4. Minimum depth of bury shall be twenty-four (24) inches in all locations except where special techniques are specifically approved. Trench shall be cleared of rocks and loose dirt and backfilled with smooth sand to depth of three (3) inch under and
six (6) inch over conduit. Refer to Section 31 23 33: Trenching, Backfilling, and Compacting.

5. Field-cut ends of rigid steel conduits shall be reamed smooth. Running threads shall not be used.

6. Insulated throat grounding bushings shall be installed at each end of all metallic conduit runs. Terminations of PVC conduits at pull boxes shall be provided with end-bells or suitable bushings and stubbed up six (6) inches from the bottom of pull box.

7. Pull boxes shall be installed firmly on a bedding of gravel and shall be set at grade in pavement and two (2) inches above grade in unpaved areas. Seal the bottoms of pull boxes against rodents with at least one inch (1") of concrete grout. Provide a pull box adjacent to each luminaire.

C. Wiring:
   1. Wire shall be sized in accordance with the drawings, but in no case smaller than No. 10 AWG, except fixture wire shall not be smaller than No. 16 AWG. Color coding shall be phase A - black, B - red, C - blue, for 208Y/120 volts and A - brown, B - yellow, C - purple for 480Y/277 volts; neutral - white, and Ground - green.
   2. Splices in wires No. 8 and smaller shall be made with twist-on, expandable, spring-type, solderless connectors with insulated metal shell, Scotchlok or approved equal. Splices in pull boxes and other damp locations shall be epoxy encapsulated with Scotchcast or approved equal waterproof material.
   3. Splices in wires No. 6 and larger shall be made with copper split-bolt connectors, enveloped in insulating putty (Scotchfil or approved equal), taped, and painted with Scotchkote or approved equal. Exception: compression sleeves insulated with approved heat shrink or cold shrink watertight kits may be used.
   4. Splices in equipment grounding conductors shall be made with uninsulated copper split-bolt connectors.
   5. Provide each luminaire with an individual fuse in a weatherproof fuseholder described above. Install fuses in the concrete pull boxes adjacent to the luminaire. Do not install fuses behind the handholes in the poles.

D. Grounding:
   1. Metal poles and metallic parts of luminaires shall be grounded.
   2. Ground wires shall be connected to grounding studs, where provided, with compression lugs.
   3. Ground wires for old-style SU-I and SU-II luminaires shall be secured to fixture anchor bolts by means of ground clamps inside the poles.
   4. Ground rods at individual lights are usually not required and shall be specifically indicated on the plans where needed. An equipment grounding conductor from the source is always required. Where needed, ground rods shall be driven in pullboxes so that no luminaire is more than 400 feet from a ground rod.
5. An equipment grounding conductor shall be run with phase and neutral wires in each conduit and shall interconnect all ground rods and luminaires. Grounding conductors shall be sized in accordance with the CEC, except minimum size shall be No. 10 AWG, copper.

E. Fixture Installation:

1. Contractor shall carefully inspect new and used lights, poles, and accessories that are furnished to the Contractor by Stanford. Note defective, broken, or missing parts. The Contractor shall notify the Project Manager in writing immediately of any defects.

2. Install pullboxes firmly on a bedding of gravel; set at grade in pavement and two inches above grade in unpaved areas. Seal the bottoms of pullboxes against rodents with one inch (1") of concrete grout.

3. Provide a pullbox adjacent to each pole and run lighting circuit between pullboxes. Provide a 1" conduit and tap the circuit at each pole. Do not run the lighting circuit from pole-to-pole. Exception: Where indicated on the Drawings, bollard lighting circuits may originate a a single pullbox and run from one bollard to the next.

4. Do not locate pullboxes in streets or roadways unless specifically directed.

5. Lights removed from existing installations as part of work under the Contract shall be inspected carefully prior to reinstallation at a new location. Any damage, serious deterioration of paint, unsuitable ballast or lamp, or missing parts shall be reported in writing to the Project Manager. No such luminaire shall be reinstalled until the Project Manager has determined it to be suitable.

6. All luminaires and poles installed shall be secured in a truly plumb position and grouted. Exception: SU-1 luminaires on pave surfaces shall be set plum on the pavement and not grouted.

7. After installation of new luminaires and poles, all areas of damaged paint shall be repaired using equivalent and matching paint, carbon black in color.

8. All luminaires installed but not operating, shall be covered with burlap sack or equal until they are placed in service. Protection of the paint on the fixtures is assumed.

9. Each foundation from which a luminaire has been removed and that is to be abandoned shall have all projections above the concrete removed flush and conduits grouted. Grind all burrs and sharp edges smooth. Remove abandoned concrete foundations to 12" below grade.

10. Concrete pole foundations shall be constructed as shown on the drawings or as recommended by the manufacturer. Use pole manufacturer’s anchor bolt templates.

3.2 FIELD QUALITY CONTROL

A. Contractor shall test each completed system and verify that it is fully operational.

B. All switching of existing circuits shall be performed by Owner personnel; however, the Contractor shall independently verify that all circuits are safely de-energized.
END OF SECTION