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**SECTION 26 5668**  
**EXTERIOR ATHLETIC LIGHTING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.
- B. The purpose of these specifications is to define the lighting system performance and design standards for High School Athletic Fields using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.
- C. The sports lighting will be for the following venue:
  - 1. Football Field.
  - 2. Track.
  - 3. Baseball Field.
  - 4. Softball Field.
- D. The primary goals of this sports lighting project are:
  - 1. **Guaranteed Light Levels:** Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore, light levels are guaranteed to not drop below specified target values for a period of 25 years.
  - 2. **Environmental Light Control:** It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors. ~~The LED design should provide better control than a good HID design.~~
  - 3. **Life-cycle Cost:** In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.
  - 4. **Control and Monitoring:** To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Field should be proactively monitored to detect luminaire outages over a 25-year life-cycle. All communication and monitoring costs for 25-year period shall be included in the bid.
- E. All lighting designs shall comply with UIL standards, except where exceeded by this specification, and local lighting ordinances.

**1.2 LIGHTING PERFORMANCE**

- A. **Illumination Levels and Design Factors:** Playing surfaces shall be lit to an average target illumination level and uniformity in the chart below. Lighting manufacturers will provide a guarantee that light levels will be sustained over the life of the warranty period. Lighting calculations shall be developed and field measurements taken on the grid spacing with a minimum number of grid points specified below. Manufacturers will provide lumen maintenance data of the LED luminaires used per TM-21-11 and will incorporate the lumen maintenance projections into the lighting designs to ensure target light levels are achieved throughout the guaranteed period of the system. Per IES guidelines, lumen maintenance hours should be reported based on the 6x multiplier of testing hours. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-05-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Average Target Light Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Football	<del>50-75</del> footcandles	2.0:1.0	72	30' x 30'
Track	<del>30-20</del> footcandles	5.0:1.0	48	30' x 30'
<u>Field Events</u>	<u>15</u> footcandles	<u>N/A</u>	<u>217</u>	<u>10' x 10'</u>
<u>Home Bleachers</u>	<u>15</u> footcandles	<u>N/A</u>	<u>48</u>	<u>10' x 10'</u>
Baseball (Infield)	50 footcandles	2.0:1.0	25	30' x 30'
Baseball (Outfield)	30 footcandles	2.5:1.0	105	30' x 30'
Baseball (Bullpens)	<del>30-20</del> footcandles	<del>2.5:1.0</del> N/A	<del>32/24</del> <u>24</u>	10' X 10'
Baseball ( <del>Batting Cage</del> <u>Bleachers</u> )	<del>30-10</del> footcandles	<del>2.5:1.0</del> N/A	<del>46</del> <u>42</u>	<del>20' X 14'</del> <u>10' x 10'</u>
Softball (Infield)	50 footcandles	2.0:1.0	25	20' X 20'
Softball (Outfield)	30 footcandles	2.5:1.0	86	20' X 20'
Softball (Bullpens)	<del>30-20</del> footcandles	<del>2.5:1.0</del> N/A	<del>48/24</del> <u>24</u>	10' X 10'
Softball ( <del>Batting Cage</del> <u>Bleachers</u> )	<del>30-10</del> footcandles	<del>2.5:1.0</del> N/A	<del>46</del> <u>42</u>	<del>20' X 14'</del> <u>10' x 10'</u>

~~B. Hours of Usage: Designs shall be based on 150 hours annual usage and 3,750 hours over a 25-year usage period.~~

~~C.B. Color:~~ The lighting system shall have a minimum color temperature of 5700K and a CRI of 75.

~~C. Playability: Lighting design and luminaire selection should be optimized for playability by reducing glare onfield and providing sufficient uplight.~~

~~D.1. Mounting Heights: To ensure proper aiming angles, for reduced glare and to provide better playability, minimum mounting heights shall be as described below follows. Higher mounting heights may be necessary for luminaire with lesser glare control to meet field angle requirements described herein required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.~~

~~1.a. Football: Two (2) Four (4) 80-feet and two (2) 70-feet~~

~~2.b. Baseball: Two (2) 90-feet, two (2) 8070-feet, and two (2) four (4) 7080-feet~~

~~c. Softball: Two (2) 80-feet and two (2) Four (4) 70-feet~~

~~2. Aiming Angles: To reduce glare, luminaire aiming should ensure the top of the luminaire field angle (based on sample photometric reports) is a minimum of 10 degrees below horizontal.~~

~~3. Glare Control Technology: Luminaires selected should have glare control technology including, but not limited to, external visors and internal shields and louvers. No symmetrical beam patterns are acceptable.~~

~~3.4. Aerial Lighting: Adequate illumination must be provided above the field in order to see the ball in flight. It is recommended that a lighting analysis be performed above the field of play to evaluate the visibility of the ball over its typical trajectory to ensure the participants will adequately see the ball. Calculation planes should be evaluated up to the maximum anticipated height for the level of play.~~

~~E.D. Security Fixtures: There shall be security lights on certain poles as shown on the Drawings. The fixture(s) shall be provided by the field lighting manufacturer and integrated into the lighting system structure with remote electrical components located 10-feet above grade. Fixtures to be on a separate circuit from field lighting.~~

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### 1.3 ENVIRONMENTAL LIGHT CONTROL

- A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.
- B. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified independent testing laboratory with a minimum of five years' experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

### 1.4 ~~LIFE-CYCLE COST~~COST OF OWNERSHIP

- A. Manufacturer shall submit a 25-year ~~life-cycle cost calculation~~cost of ownership summary that includes energy consumption, anticipated maintenance costs, and control costs as outlined in the required submittal information. All costs associated with faulty luminaire replacement (equipment rentals, removal and installation labor, shipping) are to be included in the maintenance costs.
- ~~B. Preventative and Spot Maintenance: Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 25 years from the date of equipment shipment. Individual outages shall be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.~~

### 1.5 ACTION SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Electrical Shop Drawings and Submittals" for products specified under PART 2 - PRODUCTS.
- B. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 26 Section "Electrical Shop Drawings and Submittals".
- C. Product Data: For each type of luminaire.
  - ~~1-2.~~ Arrange in order of luminaire designation.
  - ~~2-3.~~ Include data on features, accessories, and finishes.
  - ~~3-4.~~ Include physical description and dimensions of luminaire.
  - ~~4-5.~~ Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - ~~5-6.~~ Photometric data and adjustment factors based on laboratory tests, complying with IES LM-79.
    - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
  - ~~6-7.~~ Wiring diagrams for power, control, and signal wiring.
  - ~~7-8.~~ Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For luminaire supports.
  - 1. Include design calculations for luminaire supports.
- F. Warranty: Sample of special warranty.

### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing laboratory providing photometric data for luminaires.
- B. Product Certificates: For each type of luminaire.

- C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Source quality-control reports.

**1.7 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
- B. Warranty: Copy of special warranty.

**1.8 WARRANTY AND GUARANTEE**

- A. 25-Year Warranty: Manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather condition events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.
- B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage or any field is materially impacted. Manufacturer is responsible for removal and replacement of failed luminaires, including all parts, labor, shipping, and equipment rental associated with maintenance. Owner agrees to check fuses in the event of a luminaire outage.

**PART 2 - PRODUCT**

**2.1 MANUFACTURER**

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Musco Lighting.
- B. Design Approval: The Owner and Engineer will review shop drawings from the manufacturer to ensure compliance to the specification.

**2.2 LIGHTING SYSTEM CONSTRUCTION**

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.
- B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
- C. System Description: Lighting system shall consist of the following:
  - 1. Galvanized steel poles and cross arm assembly
  - 2. Non-approved pole technology:
    - a. Square static cast concrete poles.
    - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long-term performance concerns.

3. Lighting systems shall use concrete foundations as defined below:
  - a. For a foundation using pre-stressed concrete base embedded in concrete backfill, the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection, actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.
  - b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or re-enforced pier design, pole erection may occur after 7 days or after a concrete sample from the same batch achieves a certain strength.
4. Manufacturer will supply all drivers and supporting electrical equipment.
  - a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure.
5. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2\_2002.
6. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
7. All luminaires, visors, and cross-arm assemblies shall withstand 150 mph winds and maintain luminaire aiming alignment.
8. Control cabinet to provide remote on-off control and monitoring of the lighting system. See Section 2.45 for further details.
9. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.
  - a. Integrated grounding via concrete encased electrode grounding system.
  - b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL Listed for the appropriate application.

### 2.3 ELECTRICAL

A. Electric Power Requirements for the Sports Lighting Equipment.

1. Electric Power: 480V, 3-phase.
2. Maximum Total Voltage Drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

B. Energy Consumption: The kW consumption for the field lighting system shall not exceed 144 kW ~~be 124 kW or less~~.

### 2.4 STRUCTURAL PARAMETERS

A. Wind Loads: Poles and other support structures, brackets, arms, bases, anchorages and foundations shall be designed to resist wind loads as determined by ASCE 7-10 based on a Wind Speed (3 second gust) as indicated for the Project location in the Mapped Basic Wind Speeds for Risk Category and Exposure Category indicated. Luminaires, visors and crossarms shall be designed to resist wind loads while maintaining luminaire aiming alignment. All designs shall comply with the 2015 International Building Code (IBC).

1. Ultimate Wind Speed: 151 mph (3-second gust)

2. Nominal Wind Speed: 117 mph (3-second gust)
  3. Risk Category: III
  4. Exposure Category: C
- B. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2013 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-6).
- C. Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. If a geotechnical report is not provided the foundation design shall be based on class 5 soils.
- D. Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole. These drawings must be submitted at time of bid to allow for accurate pricing.

## 2.5 CONTROL

- A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.
- ~~B.~~ Lighting contactor cabinet constructed of NEMA Type 4 aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.
- ~~C.~~ Contactor Control of Lights: To minimize wear on drivers and other electrical components and prevent lights from turning on due to communication loss, circuits must be controlled via contactor.
- ~~B-D.~~ Dimming: System shall provide for 3-stage dimming (high-medium-low). Dimming will be set via scheduling options (website, app, phone, email).
- ~~C-E.~~ Remote Lighting Control System: System shall allow Owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communications link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.
1. The Owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute “early off” commands by phone. Scheduling tool shall be capable of setting curfew limits.
  2. Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.
- ~~D-F.~~ Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).
- ~~E-G.~~ Management Tools: Provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.
- ~~F-H.~~ Hours of Usage: Provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the Owner.
1. Cumulative Hours: Tracked to show the total hours used by the facility.
  2. Report hours saved by using early off and push buttons by users.
- ~~I.~~ Communication Costs: Include communications costs for operating the controls and monitoring system for a period of 25 years.

G-J. Communication with Luminaire Drivers: Control system shall interface with drivers in electrical components enclosures by means of powerline communication.

### **PART 3 - EXECUTION**

#### **3.1 FIELD QUALITY CONTROL**

- A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- B. Field Light Level Accountability:
  - 1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 years. These levels will be specifically stated as "guaranteed" on the illumination summary provided by the manufacturer.
  - 2. The Contractor/Manufacturer shall be responsible for conducting initial light level testing and anfor an additional inspection one year from the date of commissioning of the lighting system and will utilize the Owner's light meter in the presence of the Owner.
  - 3. The Contractor/Manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.
- C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy the Owner.

#### **3.2 SOIL QUALITY CONTROL**

- A. It shall be the Contractor's responsibility to notify the Owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request / estimate for the Owner's approval / payment for additional costs associated with:
  - 1. Providing engineered foundation embedment design by a registered engineer in the State of Texas for soils other than specified soil conditions.
  - 2. Additional materials required to achieve alternate foundation.
  - 3. Excavation and removal of materials other than normal soils, such as rock caliche, etc.

#### **3.3 DELIVERY TIMING**

- A. Delivery Timing Equipment On-Site: The equipment must be on-site 6-8-12 weeks from receipt of approved submittals and receipt of complete order information.

**END OF SECTION 26 5668**