SECTION 26.56.68
SPORTS FIELD LIGHTING

PART 1 - GENERAL

1.01 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 performance and design standards for East Tennessee State University Johnson City, TN. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth by the criteria set forth in these specifications.

C. The sports lighting will be for the following fields:
   1. Football

D. The primary goals of this sports lighting project are:
   1. 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, and the field(s) should be proactively monitored to detect fixture outages over a 30 year life cycle. 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.
   2. Environmental Light Control: These fields are located in the City of Johnson City. It is a goal of this project to minimize spill light and glare.
   3. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore the lighting system shall be designed such that the light levels are guaranteed for a period of 30 years.

1.02 LIGHTING PERFORMANCE

A. Performance Requirements: Playing surfaces shall be lit to a target average illuminance level and uniformity as specified in the chart below. Light levels shall be held guaranteed for 30 years. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Measured average illumination level shall be +/- 10% of predicted mean in accordance with IESNA RP-6-01, and measured at the first 100 hours of operation.

<table>
<thead>
<tr>
<th>Area of Lighting</th>
<th>Target average Light Levels</th>
<th>Maximum to Minimum Uniformity Ratio</th>
<th>Grid Points</th>
<th>Grid Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football</td>
<td>100 foot candles</td>
<td>1.7:1.0</td>
<td>96</td>
<td>30’ x 30’</td>
</tr>
</tbody>
</table>

The system shall be the latest NCAA Best Lighting Practices Approved by the NCAA and ESPN, dated 5-3-10 for a National Broadcast of Football. For Camera # 1 on the 50 yard line, the average vertical footcandles shall be 100 and the uniformity shall be 1.7.1.0. For Camera # 21 in the end zone, the average vertical footcandles shall be 50.

B. Mounting Heights and Pole Details: To ensure proper aiming angles for reduced glare and to provide better playability, the pole heights shall be 100’ regardless of grade elevation.

1.03 ENVIRONMENTAL LIGHT CONTROL

A. Spill Light Control: Average horizontal footcandles at the property line shall not exceed 10 footcandles. Footcandle readings shall be taken at 30’ intervals along the specified line. Measured average illumination level shall allow a 10% variance of predicted mean in accordance with IESNA RP-6-01, and be measured at the first 100 hours of operation.
1.04 LIFE CYCLE COSTS

A. Energy Consumption: The average kWh consumption for the field lighting system shall be 300 KVA or less. This figure does not account for future fixtures.

B. Complete Lamp Replacement: Manufacturer shall include all group lamp replacements required to provide 30 years of operation based upon 300 usage hours per year.

C. Preventative and Spot Maintenance: Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 30 years from the date of equipment shipment. Individual lamp 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.

D. 30-Year Life Cycle Cost: Manufacturer shall submit 30-year life cycle cost calculations as follows. Equipment price and total life cycle cost shall be entered separately on bid form.

<table>
<thead>
<tr>
<th>Description</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminaire energy consumption</td>
<td>184 luminaires x 1.625 kW demand per luminaire x $0.12 kWh rate x 300 annual usage hours x 30 years</td>
</tr>
<tr>
<td>Cost for spot relamping and maintenance over 30 years if not included with bid</td>
<td>Assume 7.5 repairs at $ 500 each if not included with the bid +</td>
</tr>
<tr>
<td>Cost to relamp all luminaires during 30 years if not included with the bid</td>
<td>400 annual usage hours x 30 years / lamp replacement hours specified in section 1.8 x $125 lamp &amp; labor x # fixtures if not included with the bid +</td>
</tr>
<tr>
<td>Extra energy used without base bid automated control system if control system not included with the bid</td>
<td>$ Energy consumption in item a. x 10% if control system not included with the bid +</td>
</tr>
<tr>
<td>TOTAL 30-Year Life Cycle Operating Cost</td>
<td>=</td>
</tr>
</tbody>
</table>

1.05 MONITORING AND CONTROLS

Digital wireless controls; providing the following functions, integrated into a control station with multiple presets and individual light zone control. Control system shall include the following features:

A. 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 manufacturer shall notify the owner of outages within 24 hours, or the next business day. The controller shall determine switch position (Manual or Auto) and contactor status (open or closed).

B. 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 communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs. 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. 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.

C. Management Tools: Manufacturer shall provide a web-based database of actual field usage and provide reports by facility and user group.

D. Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system as is readily accessible to the owner.
E. Cumulative hours: shall be tracked to show the total hours used by the facility
F. Current lamp hours: shall be tracked separately to reflect the amount of hours on the current set of lamps being used, so re-lamping can be scheduled accurately
G. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 25 years

1.06 WARRANTY AND GUARANTEE
A. 30-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 30 years. Warranty shall guarantee light levels; lamp replacements; system energy consumption; monitoring, maintenance and control services, spill light control, and structural integrity. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty may exclude fuses, storm damage, vandalism, abuse and unauthorized repairs or alterations.

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

1.08 PRE-BID SUBMITTAL REQUIREMENTS
A. Qualite’s Universal Series™ System is the basis of design but equal products/systems by other manufactures including MUSCO and Carolina High Mast will be considered.

PART 2 - PRODUCT

2.01 LIGHTING SYSTEM CONSTRUCTION
A. System Description: Lighting system shall consist of the following:
1. Steel poles and Galvanized steel cross-arm assembly. The two poles on the skybox structure shall have integral base plates for connection to the structure. The six poles on grade may use a pre-stressed concrete pole base embedded in concrete backfill per the manufacturers guidelines or an integral base plate and engineered concrete poured in place base, see 2.02 below.
3. All luminaires shall be constructed with spun aluminum housings.
4. Manufacturer will remote all ballasts and supporting electrical equipment in NEMA 3R enclosures galvanized, powder coated and mounted approximately 10’ above grade or pole base. The enclosures shall include ballast, capacitor and fusing for each luminaire. Safety disconnect per circuit for each pole structure will be located within the enclosure assembly.
5. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.

B. Manufacturing Requirements: All components shall be designed, manufactured and UL approved as a system. All luminaires, wire harnesses, ballast and other enclosures shall be factory assembled, aimed, wired and tested.

C. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed steel shall be hot dip galvanized per ASTM A123. All exposed hardware and fasteners shall be stainless steel of at least 18-8 grade, passivated and polymer coated to prevent possible galvanic corrosion to adjoining metals. All wiring shall be enclosed within the crossarms, pole, or electrical components enclosure.

D. Lightning Protection: All structures shall be equipped with lightning protection meeting NFPA 780 standards. For poles on grade, the contractor shall supply and install a ground rod of not less than 5/8” in diameter and 8’ in length, with a minimum of 10’ embedment. Ground rod should be connected to the structure by a copper main down conductor with a minimum size of #2 for poles

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with less than 75’ mounting height and 2/0 for poles with more than 75’ mounting height. For poles on the skybox structure, a 2/0 shall be connected to the building lightning protection system.

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

F. Electric Power Requirements for the Sports Lighting Equipment:
   1. Electric power: Voltage and Phasing per electrical plans
   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.

2.02 STRUCTURAL PARAMETERS

A. Support Structure Wind Load Strength: Poles and other support structures, brackets, arms, bases, anchorages and foundations shall be determined based on AASHTO LTS-5, wind speed of 100 MPH, exposure category C and an importance factor of 1.0. Luminaire, visor, and crossarm shall withstand 150 mph winds and maintain luminaire aiming alignment. Foundation design will be based on AASHTO LTS-5, wind speed of 100 MPH, exposure category C and an importance factor of 1.0. Provide additional capacity for 10 fixtures, equal to field lighting fixtures, on each pole.


C. Soil Conditions: The design criteria for these specifications are based on soil design parameters as outlined in the geotechnical report. If a geotechnical report is not provided by the owner, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2007 CBC, Table 1804.2.

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 Tennessee.
   2. Additional materials required to achieve alternate foundation.
   3. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.

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.

PART 3 – EXECUTION

3.01 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 RP-6-01, Appendix B.

B. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles, uniformity ratios, and maximum kilowatt consumptions are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be liable to any or all of the following:
   1. Manufacturer shall at his expense provide and install any necessary additional fixtures to meet the minimum lighting standards. The Manufacturer shall also either replace the existing poles to meet the new wind load (EPA) requirements or verify by certification by a licensed structural engineer that the existing poles will withstand the additional wind load.
   2. Manufacturer shall minimize the Owner's additional long term fixture maintenance and
energy consumption costs created by the additional fixtures by reimbursing the Owner the amount of $1,000.00 (one thousand dollars) for each additional fixture required.

**SUBMITTAL INFORMATION**
Design Submittal Data Checklist and Certification

<table>
<thead>
<tr>
<th>Included</th>
<th>Tab</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Letter/Checklist</td>
<td>Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer’s local representative and his/her phone number. Signed submittal checklist to be included.</td>
<td></td>
</tr>
</tbody>
</table>
| B | On Field Lighting Design | Lighting design drawing(s) showing:
  a. Field Name, date, file number, prepared by, and other pertinent data
  b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y).
  c. Pole height, number of fixtures per pole, as well as luminaire information including wattage, lumens and optics
d. Height of meter above field surface
e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance and uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor.
f. If bidding constant light, Independent field test report from licensed professional engineer
g. Alternate manufacturers shall provide both initial and maintained light scans using a maximum Recoverable Light Loss Factor as specified in section 1.8 to calculate maintained values. |
| C | Off Field Lighting Design | Lighting design drawings showing spill light levels in footcandles as specified in section 1.3 A (if applicable). |
| D | Photometric Report | Provide photometric report for a typical luminaire used showing candelas tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years experience. |
| E | Life Cycle Cost calculation | Document life cycle cost calculations as defined in the specification. Identify energy costs for operating the luminaires, maintenance cost for the system including spot lamp replacement, and group relamping costs. All costs should be based on 30 Years. |
| F | Luminaire Aiming Summary | Document showing each luminaire’s aiming angle and the poles on which the luminaries are mounted. Each aiming point shall identify the type of luminaire. |
| G | Structural Calculations | Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Tennessee. |
| H | Control and Monitoring | Manufacturer shall provide written definition and schematics for automated control system to include monitoring. They will also provide examples of system reporting and access for numbers for personal contact to operate the system. |
| I | Electrical distribution plans | If bidding an alternate system, manufacturer must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Tennessee. |
| J | Performance Guarantee | Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed per specification for 30 years. |
| K | Warranty | Provide written warranty information including all terms and conditions. |
| L | Project References | Manufacturer to provide a list of project references of similar products completed within the past three years. |
| M | Product Information | Complete set of product brochures for all components, including a complete parts list and UL Listings. |
| N | Non-Compliance | Manufacturer shall list all items that do not comply with the specifications. |
| O | Compliance | Manufacturer shall sign off that all requirements of the specifications have been met at that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in item N – Non-Compliance |

Manufacturer: ____________________________  Signature: ____________________________

Contact Name: ____________________________  Date: ______/_____/______

**END OF SECTION**

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