

~~~~~ **PROJECT NOTE** ~~~~~

ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS. REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ **END OF PROJECT NOTE** ~~~

SECTION 26 56 68
EXTERIOR SPORTS FIELD LIGHTING

~~~~~ **PROJECT NOTE** ~~~~~

SPORTS LIGHTING IS FOR DESIGNATED FIELDS/PLAY AREAS. OTHER SITE LIGHTING TO UTILIZE EXTERIOR LIGHTING SPECIFICATIONS FOR SPECTATOR AREAS, PUBLIC AREAS, PARKING, ETC.

~~~ **END OF PROJECT NOTE** ~~~

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior sports field lighting system including:
 - 1. LED luminaires, drivers, and accessories.
 - 2. Lighting control system.
 - 3. Poles and bases.

1.02 REFERENCE STANDARDS

- A. 29 CFR 1910 - Occupational Safety and Health Standards Current Edition.
- B. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals 2013, with Editorial Revision (2022).
- C. ASCE 7-10 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures 2010.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.

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- F. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel 2021.
- G. City of Chicago Building Code - Chicago Construction Codes, Title 14B Current Edition.
- H. ICC (IBC)-2018 - International Building Code 2018.
- I. IEEE C2 - National Electrical Safety Code(R) (NESC(R)) 2023.
- J. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- K. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
- L. IES RP-6 - Recommended Practice: Lighting Sports and Recreational Areas 2022.
- M. IESNA LM-5-04 - Guide for Photometric Measurements of Area and Sports Lighting Installations Current Edition.
- N. IESNA LM-64 - Photometric Measurements of Parking Areas 2001 (Reaffirmed 2007).
- O. ISO 1461 - Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods 2009.
- P. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- Q. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2006.
- R. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- S. NFPA 780 - Standard for the Installation of Lightning Protection Systems 2023.
- T. UL 96 - Lightning Protection Components Current Edition, Including All Revisions.
- U. UL 96A - Standard for Installation Requirements for Lightning Protection Systems Current Edition, Including All Revisions.
- V. UL 1598 - Luminaires Current Edition, Including All Revisions.

1.03 DEFINITIONS

- A. CV: Coefficient of Variation: A statistical measure of the weighted average of all relevant illumination values for the playing area, expressed as the ratio of the standard deviation for all illuminance values to the mean illuminance value.
- B. Delegated Design Submittals: Documents, including drawings, calculations, and material and product specifications prepared as a responsibility of Contractor to obtain acceptance by Board and authorities having jurisdiction.
- C. Eye Illuminance (E_e): Measured or calculated illuminance value, in footcandles (lux), at eye level, on a vertical plane perpendicular to a line of eyesight, looking (aimed) at a light source.
- D. Horizontal Illuminance: Measured or calculated illuminance value, in foot-candles (lux), on a horizontal plane, at a designated elevation above a surface.
- E. LLF: Light loss factor.
- F. CCT: Correlated Color Temperature of light source
- G. Luminaire: A complete lighting assembly or product consisting of, not less than a light source(s) and related device(s) to position the light source(s), housing or enclosure, light source control, optics and shielding, and light source power supply/control devices.
- H. Target Illuminance: Average maintained illuminance level, calculated by multiplying initial illuminance by LLF.

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GRADIENT IN PARAGRAPH BELOW IS A COMPUTER-GENERATED OUTPUT PARAMETER OF

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SPORTS LIGHTING SOFTWARE USED TO MODEL AND COMPARE ALTERNATIVE SOLUTIONS FOR A PROJECT DESIGN. PERMISSIBLE UG DEPENDS ON THE SPEED OF THE SPORT BEING LIGHTED; THE UPPER LIMITS FOR THIS PARAMETER ARE GIVEN IN IES RP-6.

~~~ **END OF PROJECT NOTE** ~~~~

- I. UG: Uniformity gradient; the rate of change of illuminance on the playing field, expressed as a ratio between the illuminances of adjacent measuring points on a uniform grid.

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RETAIN FIRST OPTION IN PARAGRAPH BELOW IF LIGHTING INSTALLATION IS SYMMETRICAL;
RETAIN SECOND IF NONSYMMETRICAL.

~~~ **END OF PROJECT NOTE** ~~~~

- J. Vertical Illuminance:  
K. Eye Illuminance measurement or  
1. Calculation in foot-candles (lux).

#### 1.04 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/Engineer of Record of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

#### 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.  
B. Shop Drawings:  
1. Indicate dimensions and components for each luminaire.  
2. Provide photometric calculations.  
a. Scaled photometry plots of each sport playing surface and area, indicating:  
1) Targeted illuminance points, expressed as horizontal footcandle values across the specific playing surface, per the number of grid points previously specified, at 3 ft. above the playing surface.  
2) A tabulation of average, maximum, minimum, Avg: Min. and Avg: Max., horizontal footcandle values for each area, tabulated by sport or activity.  
3) The CV horizontal uniformity, proving conformance with, and not exceed the CV values recommend in IES RP-6, for the particular sport and class of play.  
4) The Uniformity Gradient (UG) of horizontal illuminance values, proving conformance with and not exceed the UG values recommended in IES RP-6, for the particular speed of sport.  
5) For outdoor playing surfaces, horizontal footcandle values, at 3 ft. above the playing surface, along each area property line boundary, at a point 20 ft. beyond the property line boundary.

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- 6) For outdoor playing surface, vertical footcandle values for spill (trespass) light, taken at 30 ft. intervals, along each property line, at the property line, at eye level (approximately 66 inches above the surface).
- 7) For outdoor playing surface, vertical footcandle values for spill (trespass) light, along each property line, at a point 20 ft. beyond the property line, on a 20 ft. grid (x = length of the property line, z = 20 ft. increments to height of pole).
- 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.
  2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
- D. Pole and cross arm details and luminaire cluster/configurations on the cross arms.
- E. Pole anchor bolt pattern and erection details.
- F. Remote LED drivers enclosure details, including component part locations, interconnection wiring diagrams, physical size, finishes, etc. proving specification conformance.
- G. Control Equipment Enclosure(s): Physical size(s), finishes, interconnection wiring diagrams, etc., proving specification conformance.
- H. Delegated Design Submittals: Provide the following documents signed and sealed by a professional engineer licensed in the State of Illinois.
  1. Drawings and Specifications supporting the design, fabrication, and erection of the sport lighting structural elements.
  2. Structural analysis data and calculations used for pole selection and foundation design.
    - a. Manufacturer Seismic Qualification Certification: Submit certification that sports lighting components and their mounting and anchorage provisions are designed to remain in place without separation of any parts when subjected to the seismic forces defined in Section 26 05 48 - Noise and Vibration Control for Electrical Systems. Include the following:
      - 1) Basis for Certification: Indicate whether withstand certifications are based on actual test of assembled components or on calculation.
      - 2) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
    - b. Manufacturer Wind Load Strength Certification: Submit certification that selected total support system, including poles, complies with AASHTO LTS-4 for location of Project.
    - c. Foundations: Submit calculations for the specific design. Foundations shall be designed for sport lighting equipment weight, and for the specified seismic and wind loads.
- I. Manufacturer's determination of LLF used in design calculations. Provide the following information:
  1. Light source lumen depreciation per IES TM-21 standard.
  2. Luminaire dirt depreciation.
  3. Ambient temperature factor.

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- 4. Voltage factor.
  - J. 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.
  - K. Field Quality Control Reports.
    - 1. Include test report indicating measured illumination levels.
  - L. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
  - M. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.
- 1.06 MAINTENANCE MATERIAL
- A. In addition to the products and materials required to provide the specified design, furnish extra materials described below that shall match those products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    - 1. Luminaires: Provide a quantity equal to, but not less than, 1% percent of the total number installed, and not less than (1) one of each different type, wattage, distribution style, etc.
    - 2. LED drivers: Provide a quantity equal to, but not less than 1% percent of the total number installed, and not less than (1) one of each different wattage, design, characteristic, etc.
    - 3. Fuses: Provide a quantity equal to, but not less than 1% percent of the total number installed, and not less than (1) one of each size, rating, etc.
- 1.07 QUALITY ASSURANCE
- A. Comply with requirements of NFPA 70.
  - B. Manufacturer Qualifications: A qualified, CPS approved manufacturer/vendor that will provide a service center capable of providing training, parts, and emergency maintenance repairs.
    - 1. Manufacturer's responsibilities include fabricating sports lighting and providing professional engineering services needed to assume engineering responsibility.
    - 2. Engineering Responsibility: Preparation of delegated design submittals and comprehensive engineering analysis by a licensed professional engineer.
- 1.08 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. The Contractor shall provide all labor, materials, rigging, and equipment associated with the receipt, unloading, handling, and storage of delivered materials. The Contractor shall protect, house and otherwise store delivered materials in a safe, secure and insured manner.
  - D. Follow manufacturer's directions and recommendations for material handling, erection, assembly, etc. Damaged materials, components, equipment, etc., discovered after initial delivery, shall be the responsibility of the Contractor to replace, at no cost to the Board.
- 1.09 WARRANTY
- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
  - B. 10-Year Warranty: Provide a signed warranty covering the entire system for 10 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 conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.

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- C. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 10 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of 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. Board agrees to check fuses in the event of a luminaire outage.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Cooper Lighting – Ephesus
- B. Hubbell – Sports Lighting Systems
- C. Musco Lighting, Inc.
- D. Nafco Lighting
- E. Qualite Sport Lighting Systems.

### **2.02 GENERAL**

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Luminaire Photometric Data Testing Laboratory: Provided by manufacturer's laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- D. Field Testing Agency Qualifications: An independent testing agency that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, or an NRTL as defined by OSHA in 29 CFR 1910.7, with the experience and capability to conduct field testing according to IES LM-5.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Provide products listed, classified, and labeled as suitable for the purpose intended.
- G. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, remote drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- H. 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.
- I. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

### **2.03 SYSTEM PERFORMANCE REQUIREMENTS**

- A. The purpose of these specifications is to define the lighting system performance and design standards using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.
- B. 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 10 years.
- C. Guaranteed CCT light sources consistency: no visible color shift for a period of 10 years.
- D. 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.

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- E. Cost of Ownership: 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.
- F. 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. Fields should be proactively monitored to detect luminaire outages over a 10-year life cycle. All communication and monitoring costs for 10-year period shall be included in the bid.
- G. 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/A123M. 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, 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/A153M and ISO 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.

#### 2.04 LIGHTING PERFORMANCE REQUIREMENTS

- A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IES LM 5-04. Illumination levels shall not to drop below desired target values in accordance to IES RP-6-20, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

| Area of Lighting | Average Target Illumination Levels | Maximum to Minimum Uniformity Ratio | Grid Points | Grid Spacing |
|------------------|------------------------------------|-------------------------------------|-------------|--------------|
|                  |                                    |                                     |             |              |
|                  |                                    |                                     |             |              |

- B. Illumination Criteria: Comply with criteria in IES RP-6, or as indicated on the Drawings, for the following:
  - 1. Minimum average or maintained illuminance level for each lighted area and for the indicated class of play.
  - 2. CV and maximum-to-minimum uniformity ratios for each lighted area equal to or less than those indicated in IES RP-6 IESNA RP-6 for the indicated class of play.
  - 3. UG levels within each lighted area and between adjacent lighted areas equal to or less than those indicated in IES RP-6 IESNA RP-6 for the indicated speed of sport.
- C. Color: The lighting system shall have a minimum color temperature of 5700K and a CRI of 75.
- D. Illumination Calculations: Provide computer-analyzed point method complying with IES RP-6 to optimize selection, location, and aiming of luminaires.
  - 1. Grid Pattern Dimensions: For playing surfaces of each sport and designated spill light control areas, correlate and reference calculated parameters to the grid areas and intersection points of the indicated grid pattern.

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SELECT SOURCE INTENSITY OF LUMINAIRES IN PARAGRAPH BELOW TO SUIT PROJECT

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2. Design source intensity of luminaires calculated at an elevation of 66 inches above finished grade from nearby properties shall be less than [12,000] [20,000] [30,000] candela when so observed.
3. Use a field factor of 15 percent according to IES RP-6, in calculating initial illuminance.
4. Luminaire Installation Height: Comply with recommendations in IES RP-6, with consideration for requirements to minimize spill light and glare onto adjacent property.

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RETAIN AND REVISE SIX PARAGRAPHS AND ASSOCIATED SUBPARAGRAPHS BELOW SO EACH SPORTS VENUE IN PROJECT IS REPRESENTED AND MATCHED, AS CLOSELY AS POSSIBLE, TO THE CLASS OF PLAY AND SPEED OF SPORT FOR WHICH ITS LIGHTING SHOULD BE DESIGNED.

CLASS I: STADIUM FACILITIES WITH SPECTATOR CAPACITY OVER 5,000, CLASS II: FACILITIES WITH SPECTATOR CAPACITY UP TO 5,000, CLASS III: FACILITIES WITH SPECTATOR CAPACITY UP TO 2,000, CLASS IV: FACILITIES WITH LIMITED OR NO PROVISION FOR SPECTATOR.

STADIUM: CLASS OF PLAY I

HIGH SCHOOL: CLASS OF PLAY II, III OR IV,

TRAINING FACILITIES: CLASS OF PLAY III, IV,

ELEMENTARY SCHOOL: CLASS OF PLAY IV SPEED OF PLAY

VISUAL TARGETS (I.E., BALLS OR PUCKS) OF VARIOUS SPORTS ARE PLAYED AT A WIDE RANGE OF SPEEDS AGAINST VARIOUS LUMINANCES AND BACKGROUND COLORS. WHEN THE VISUAL TARGET IS SMALL, THE DIFFICULTY OF THE SEEING TASK INCREASES. WHEN THE TARGET TRAVELS AT HIGH SPEED AND IS VIEWED AT CLOSE RANGE (E.G., IN BASEBALL, TENNIS BALL, AND RACQUETBALL), HIGHER ILLUMINANCE LEVELS ARE REQUIRED.

GRID DIMENSIONS LISTED FOR EACH SPORT ARE TYPICAL FOR THAT SPORT IN BOTH COMPUTER DESIGN CALCULATIONS AND FIELD MEASUREMENTS AFTER CONSTRUCTION HAS BEEN COMPLETED. FOR GRID DIMENSIONS FOR SPORTS NOT LISTED, REFER TO IESs "IES LIGHTING HANDBOOK: REFERENCE AND APPLICATION" AND TO MANUFACTURERS' LITERATURE.

~~~ **END OF PROJECT NOTE** ~~~~

- E. Baseball Fields:
 1. IES RP-6, Class of Play: I
 2. Speed of Play: Fast
 3. Grid Pattern Dimensions: 30 by 30 feet.
- F. Softball Fields:
 1. IES RP-6, Class of Play: I

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2. Speed of Play: Fast
3. Grid Pattern Dimensions: 20 by 20 feet.
- G. Football and Lacrosse Fields:
 1. IES RP-6, Class of Play: I
 2. Speed of Play: Fast
 3. Grid Pattern Dimensions: 30 by 30 feet.
- H. Soccer Fields:
 1. IES RP-6, Class of Play: I
 2. Speed of Play: Fast
 3. Grid Pattern Dimensions: 30 by 30 feet.
- I. Outdoor Tennis Courts:
 1. IES RP-6, Class of Play: I
 2. Speed of Play: Fast
 3. Grid Pattern Dimensions: 20 by 20 feet.
- J. Track and Field:
 1. IES RP-6, Class of Play: I
 2. Speed of Play: Moderate
 3. Grid Pattern Dimensions: 20 by 20 feet.
- K. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

| # of Poles | Pole Designation | Pole Height |
|------------|------------------|-------------|
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2.05 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.
 1. Glare Control: Maximum candela viewed from any one luminaire shall not exceed 7,500 candela at a distance of 150 feet from the playing field. Provide design illumination calculations for each playing surface area to minimize direct glare in adjacent and nearby areas.
 2. Spill Scans: Spill scans must be submitted indicating the amount of horizontal and vertical footcandles along the specified lines. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights. Illumination level shall be measured in accordance with the IES LM-5-04 after 1 hour warm up. Show that the designated spill light thresholds have been met, for each playing surface at the designated boundaries of adjacent on-premises and off-premises properties.
 - a. Lighting design shall be such that no luminaire shall be aimed above 62 degrees, with respect to nadir.
 - b. For areas shown on Drawings as "spill-light critical," limit the level of illuminance directed into the area from any luminaire or group of luminaires, to the following:
 - 1) Maximum Horizontal Illuminance: 0.25 fc, at 36 inches above grade, at 10 feet beyond the property line.

- 2) Maximum Vertical Eye Illuminance: In the direction of the brightest light source, 0.1 fc at 66 inches.
- c. Calculate the horizontal and vertical illuminance due to spill light for points spaced 10 feet apart in areas shown on Drawings as "spill-light critical," to ensure that design meets the above limits.
- 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 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.

2.06 SYSTEM DESCRIPTION

- A. Lighting system shall consist of the following:
 1. Galvanized steel poles and cross-arm assembly. Alternate: Concrete pole with a minimum of 8,000 psi and installed with concrete backfill will be an acceptable alternative provided building code, wind speed and foundation designs per specifications are adhered to.
 2. The following technology is NOT approved for use
 - a. Square static cast concrete poles will not be accepted.
 - 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.
 - a. For a foundation using a 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 reinforced 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 LED drivers and supporting electrical equipment
 - a. Remote LED 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. Integral drivers are not allowed.
 - b. 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.
 5. LUMINAIRES
 - a. Luminaires: Listed and labeled, by an NRTL acceptable to authorities having jurisdiction, for compliance with UL 1598 for installation in wet locations.
 - b. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit changing LED modules without using tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent

- their accidental falling during LED sources replacement and when secured in operating position. Door shall be removable for cleaning or replacing lens.
- c. Exposed Hardware: Stainless steel latches, fasteners, and hinges.
 - d. Spill Light Control Devices: May be internal louvers or external baffles furnished by manufacturer and designed for secure attachment to specific luminaire.
 - e. Luminaires for shall be bracket mounted, full cutoff type
- 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 mi/h winds and maintain luminaire aiming alignment.
 - 8. Control cabinet to provide remote on-off control, monitoring, and entertainment features of the lighting system.
 - 9. Contactor cabinet to provide on-off control.
 - 10. 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.
 - 11. Surge Protection: Comply with requirements in Division 26 Section "Panelboards" for Transient-Voltage Suppression for Low Voltage Electrical Power Circuits and include surge suppressors with the following requirements:
 - a. Panelboard type.
 - b. Nonmodular, with LED indicator lights and one set of dry contacts.
 - c. Peak Single-Impulse Surge Current Rating 40kA per phase.

2.07 ELECTRICAL

- A. Electric Power Requirements for the Sports Lighting Equipment:

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EOR PROVIDE VOLTAGE AND PHASE INFORMATION BELOW.

~~~ END OF PROJECT NOTE ~~~

- 1. Electric power: Volt, Phase
- B. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.
- C. Energy Consumption: The kW consumption for the field lighting system shall be .

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DESIGN TEAM TO IDENTIFY THE LOCATIONS OF THE LIGHTING CONTROLS SPECIFIC TO THE PROJECT

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~~~ **END OF PROJECT NOTE** ~~~~

2.08 LIGHTING CONTROLS

- A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.
- B. Lighting contactor cabinet(s) 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. Remote Lighting Control System: System shall allow Board and authorized 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.
  - 1. The Board 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. 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. Management Tools: Manufacturer shall 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.
  - 1. Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the Board.
  - 2. Cumulative hours: shall be tracked to show the total hours used by the facility
  - 3. Report hours saved by using early off and push buttons by users.
- F. Communication Costs: Manufacturer shall include communication costs for operating the control and monitoring system for a period of 10 years.
- G. Communication with luminaire drivers: Control system shall interface with drivers in electrical components enclosures by means of powerline communication.
- H. Provide drawing details and wiring schematics as required.
  - 1. Provide 2 separate sport lighting control locations, Control locations shall be identified per project and Board direction coordinated with Sports Administration (i.e. press box, nearest electrical room, security office)
  - 2. Provide, at each sport lighting control location, a custom fabricated sport lighting control enclosure, containing not less than the following devices, components, etc., and their associated wiring (specific to project selected manufacturer):
    - a. Separate, key operated switches, providing the "ARM" and "DISARM" inputs to the standby/emergency lighting equipment, and to initiate the ALL ON, 2/3 ON and 1/3 ON lighting schemes.

- b. Switches shall be removable key type, and shall be keyed alike, requiring only one key to operate each.
  - c. Provide not less than six keys for facility personnel.
  - d. Separate LED pilot lights for each switch, providing visual feedback that the ARM/DISARM modes, and lighting schemes has been initiated.
  - e. Control power transformer(s), sized as required, to provide the proper control voltage to components.
  - f. Separate engraved labels, identifying and describing each switch and lighting scheme.
3. Provide control devices, equipment, wiring, components, etc., to allow the Board to operate the sports lighting, at each of the individual playing fields, as follows:
- a. ALL ON – All luminaires lighted, on all structures, for use during Sporting Events, and as required.
  - b. 2/3 ON – 2/3 of the luminaires lighted, on each structure, for use during Practice, and as required.
  - c. 1/3 ON – 1/3 of the luminaires lighted, on each structure, for use during Cleanup Operations, and as required.
  - d. ALL ON, 2/3 ON, and 1/3 ON control devices shall be manually initiated, and individually switch selectable at the previously specified control locations.
  - e. All Exterior Sports Field Lighting shall be turned off after each event described above by authorized personnel

## 2.09 STRUCTURAL PARAMETERS

- A. Wind Loads: Wind loads shall be based on the ICC (IBC)-2018. Wind loads to be calculated using ASCE 7-10, an ultimate design wind speed of 115 MPH and exposure category C.
- B. Support Structure Seismic Strength: Poles, brackets, arms, appurtenances, base, anchorage, and foundation shall be designed to prevent separation of components or fracture of poles, luminaire supports, or pole foundations during a seismic event.
- C. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to AASHTO LTS-6.
- D. Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. If no geotechnical report is available, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by City of Chicago Building Code Table 1806.2.
- E. Foundation Drawings: Project specific foundation drawings stamped by a licensed structural engineer in the State of Illinois. 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.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that conditions are satisfactory for installation prior to starting work.
- C. Soil Conditions: It shall be the Contractor's responsibility to notify the Board if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

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- B. Install luminaires in accordance with NECA/IESNA 501.
- C. Pole-Mounted Luminaires:
  - 1. Maintain the following minimum clearances:
    - a. Comply with IEEE C2.
    - b. Comply with utility company requirements.
  - 2. Foundation-Mounted Poles:
    - a. Provide cast-in-place concrete foundations for poles as indicated.
      - 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 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.
  - 5. Control equipment
    - a. Verify proposed location(s) of control enclosures, with Board, prior to roughing.
    - b. Verify the proposed control scheme(s) and actuations of same, with Board, prior to fabrication.
    - c. Upon completion of installation, test all modes of operation, in the presence of the Board, and train Board's personnel on the proper operation of the control system

### 3.03 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 drivers as determined by Architect/Engineer of Record.
- E. Illumination Measurements: Prior to Preliminary Acceptance of the project and in the presence of the Contractor, Project Engineer, Board's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IES LM-5-04.
- F. Field Light Level Accountability
  - 1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 10 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 an additional inspection of the system, in the presence of the Board's representative, one year from the date of commissioning of the lighting.
  - 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.

4. After installing sport lighting system and after electrical circuits have been energized, perform proof-of-performance field measurements and analysis for compliance with these requirements.
  5. Playing and Other Designated Surfaces and Areas: Make field measurements at intersections of grids, dimensioned and located as specified in Part 1 "Performance Requirements" Article and as described below.
    - a. Baseball: Measure at least 25 points of the infield and 87 points of the outfield. Extend the grid 15 feet outside the foul lines, extending to outfield boundary or fence.
    - b. Softball: Measure at least 16 points of the infield and 48 points of the outfield. Extend the grid 15 feet outside the foul lines, extending to outfield boundary.
    - c. Football and Lacrosse: Lighted area is 180 by 360 feet. Measure at least 91 points.
    - d. Soccer: Lighted area is 210 by 370 feet. Measure at least 91 points.
    - e. Tennis: Measure at least 30 points for a double court.
    - f. Track and Field: Lighted area is 180 by 360 feet plus entirety of surrounding track. Measure at least 91 points.
  - G. Correcting Non-Conformance: If, in the opinion of the Board 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 Board.
- 3.04 DEMONSTRATION AND TRAINING
- A. Engage a factory-authorized service representative to train Board's maintenance personnel to adjust, operate, and maintain sports lighting.
  - B. In addition to in person training, record the training session for future reference.
  - C. Digital Recordings of the training session: Submit digital video recording of each demonstration and training session for Board's subsequent use. The manufacturer may submit a standard training video for review as an alternate to video recording of the training session. The standard training video must be reviewed and accepted by the Board for the alternate to be acceptable.
- 3.05 CLOSEOUT ACTIVITIES
- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
  - B. See Section 01 79 00 - Demonstration, Training and Commissioning, for additional requirements.

**END OF SECTION**

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