

RETROFIT LIGHTING SPECIFICATION  
PREPARED FOR

**Livonia Churchill High School**

Football Field Lighting Project  
Livonia, Michigan  
November 14, 2024

Project # 239633

SUBMITTED BY:

**Musco Sports Lighting, LLC**

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**SECTION 26 56 68 – EXTERIOR ATHLETIC LIGHTING**

**Retrofit Lighting System with LED Upgrade**

**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 Livonia Churchill High School Football 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 venues:
  - 1. Football Field
  - 2. Track
  - 3. Home Bleachers
  - 4. Visitor Bleachers
- D. The primary goals of this sports lighting project are:
  - 1. Energy Efficient Lighting Design – Upgrade by replacing existing HID luminaires with the same number of LED luminaires (or fewer), maintaining existing minimum required light levels and achieving the greatest possible amount of energy savings.
    - a. 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 for product on existing Musco Lighting Poles, and 10 years for product on Cell Tower, pole F1.
    - b. 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.
    - c. 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.
  - 2. 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 25-year life cycle. All communication and monitoring costs for 25-year period shall be included in the bid.
    - a. Control and monitoring system shall provide contactor control of all existing circuits, replacing existing contactor cabinets. Key switches shall be provided to provide field-level control of existing circuit groups.
    - b. Entertainment Features: Incorporation of theatrical light shows enhance the presentation and enjoyment of players and spectators. Control system shall incorporate pre-programmed light shows such as "chase", "wave", and "score." Control system shall incorporate the ability to initiate these shows locally. System shall be able to time light shows to customer-supplied music.
    - c. Accent Lighting: To allow for custom lighting effects, including team colors, lighting for special occasions, and theatrical effects, all poles should be equipped with RGB accent luminaires to illuminate the structures in various custom colors. Colors should be selectable via an onsite device.

**1.2 ONFIELD LIGHTING PERFORMANCE**

- 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 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 the 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.

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Football Field	50fc	2.0:1	72	30' x 30'
Track	29fc	8:1	44	30' x 30'
Home Bleachers	14fc	9:1	95	10' x 10'
Visitor Bleachers	9fc	3:1	36	10' x 10'

- B. Color Temperature: 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.
  - 1. 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.
  - 2. Glare control technology – Luminaires selected should have glare control technology including, but not limited to: external visors, internal shields and louvers. No symmetrical beam patterns are acceptable.
  - 3. 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.

**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. Spill Light and Glare Control: The lighting equipment manufacturer shall assess both spill and glare at all areas of concern on adjacent properties. To minimize impact, values must not exceed the following levels taken at 3 feet above grade. Field measurements of spill light and glare shall be taken at the areas of concern.

150' from Track	Average	Maximum
Specified Spill Line Horizontal Footcandles	0.0 fc	0.0 fc
Specified Spill Line Max Vertical Footcandles	0.0 fc	0.2 fc
Specified Spill Line Max Candela (taken at 5 ft above grade)	< 2,400 cd	<6,200 cd

- C. Environmental Glare Impact Scans: Environmental glare impact scans must be submitted showing the maximum candela from the field edge on a map of the surrounding area until 1000 candela or less is achieved.
- D. 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 IESNA LM-5-04 after a 1 hour warm up.
- E. Sample Photometry: 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.
- F. Field Verification – Lighting manufacturer shall supply field verification of environmental light control using a meter calibrated within the last 12 months:
  - 1. Spill verification: The light sensing surface of the light meter should be held 36 inches above the playing surface with the sensing surface horizontal (for horizontal readings) or vertically pointed at the brightest light bank (for max vertical readings)
  - 2. Glare verification: The light sensing surface of the luminous intensity meter should be held 60 inches above grade with the aperture adjusted so that it detects luminous intensity from the brightest luminaire on each light bank.

## **PART 2 – PRODUCT**

### **2.1 SPORTS 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, 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 is intended to mount to existing structures and shall reuse existing foundations, poles, underground supply wiring. The system shall consist of the following:
1. Existing equipment: Lighting manufacturer is required to provide an analysis and inspection of existing poles and foundations to ensure poles are strong enough to handle weight and windloading of new lighting equipment, except for the Cell Tower (Pole F1)
  1. Poletop luminaire assembly: Galvanized steel poletop luminaire assemblies to replace existing poletop by slip fit over the pole sections, or clamping to pole. Lighting manufacturers must supply new crossarms. The lighting manufacturer must supply new galvanized steel bolt-on crossarm assemblies for the Cell Tower (Pole F1)
  2. All luminaires, visors, and poletop luminaire assemblies shall withstand 150 mi/h winds and maintain luminaire aiming alignment.
  3. 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. 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\_2002.
  5. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
  6. Control cabinet to provide remote on-off control, monitoring, and entertainment features of the lighting system. See Section 2.3 for further details.
  8. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.
    - a. Cell Tower: Manufacturer shall supply grounding electrodes, down conductors, and exothermic weld kits. For steel poles, down conductor required from bottom of steel. For concrete poles full length down conductor is required. Electrodes and conductors shall be sized as required by NFPA 780 or confirm proper grounding per local/state required codes.
    - a. Existing Musco Poles: If grounding is not integrated into the structure, the manufacturer or installer shall supply grounding electrodes, down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780.
- D. Safety: All system components shall be UL listed for the appropriate application.
- E. ***The installation contractor is responsible to coordinate with the Cell Tower provider for shut down of the tower to perform needed work.***

### **2.2 ELECTRICAL**

- A. Electric Power Requirements for the Sports Lighting Equipment:
1. Electric power: 480 Volt, 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 be 62.72 kW.

## 2.3 **CONTROL**

- 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. 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 switching, not dimming driver output to zero.
- D. Dimming: System shall provide for 3-stage 4-stage dimming (high-medium-low-blackout). Dimming will be set via scheduling options (Website, app, phone, fax, email).
- 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 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. Scheduling tool shall be capable of setting curfew limits.

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.

- 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).
- G. 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.  
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 owner.
  - 1. Cumulative hours: shall be tracked to show the total hours used by the facility
  - 2. Report hours saved by using early off and push buttons by users.
- H. Communication Costs: Manufacturer shall include communication costs for operating the control and monitoring system for a period of 25 years.
- I. Communication with luminaire drivers: Control system shall interface with drivers in electrical components enclosures by means of powerline communication.
- J. Entertainment Features: Show controller shall provide six (6) preprogrammed light shows per field with option for customized scenes, plus four (4) minutes of custom preprogrammed light shows set to music supplied by customer. Manufacturer-provided user interfaces include touchscreens, pushbuttons, and/or other external control devices.

## 2.4 **STRUCTURAL PARAMETERS**

- A. Wind Loads: Wind loads shall be based on the 2015 International Building Code. Wind loads to be calculated using ASCE 7-10, an ultimate design wind speed of 115 and exposure category C.
- B. Pole Structural Analysis: 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).

## **PART 3 – EXECUTION**

### 3.1 **DELIVERY TIMING**

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

### **3.2 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 and offsite Glare 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 and glare (candela) testing and an additional inspection of the system, in the presence of the owner, 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.
- C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles, uniformity ratios, upright for aerial visibility, and offsite candela readings 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 Owner.

### **3.4 WARRANTY AND GUARANTEE**

- A. 25-Year Warranty (for product on existing Musco Poles): Each 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 conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.
- A. 10-Year Warranty, 2 years labor (for product on Cell Tower): Each manufacturer shall supply a signed warranty covering the entire system for 10 years from the date of shipment. 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.
- 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 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. Owner agrees to check fuses in the event of a luminaire outage.

## **PART 4 - DESIGN APPROVAL**

### **4.0 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)**

- A. Design Approval: The owner / engineer will review pre-bid submittals per section 4.0.B from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.
- B. Approved Product: Musco's Light-Structure System™ Retrofit with TLC for LED™ (for existing Musco poles), SportsCluster System with TLC for LED™ (for Cell Tower) is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.
- C. All listed manufacturers not pre-approved shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing approved lighting manufacturers and the design method to be used.
- D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

**REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS (NOT PRE-APPROVED) 10 DAYS PRIOR TO BID**

*All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. **Submit checklist below with submittal.***

<b>Yes/ No</b>	<b>Tab</b>	<b>Item</b>	<b>Description</b>
	<b>A</b>	Letter/ Checklist	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.
	<b>B</b>	Equipment Layout	Drawing(s) showing field layouts with pole locations
	<b>C</b>	On Field Lighting Design	Lighting design drawing(s) showing: <ol style="list-style-type: none"> <li>a. Field Name, date, file number, prepared by</li> <li>b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x &amp; y), Illuminance levels at grid spacing specified</li> <li>c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics</li> <li>d. Height of light test meter above field surface.</li> <li>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 (CV), coefficient of utilization (CU) uniformity gradient; number of luminaires, total kilowatts, average tilt factor; light loss factor.</li> </ol>
	<b>D</b>	Off Field Lighting Design	Lighting design drawing showing initial spill light levels along the boundary line (defined on bid drawings) in footcandles. Lighting design showing glare along the boundary line in candela. 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.
	<b>E</b>	Photometric Report	Provide first page of photometric report for all luminaire types being proposed showing candela 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.
	<b>F</b>	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 to not fall below target levels for warranty period. Glare values in candela must be guaranteed to not be exceeded.
	<b>G</b>	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system and entertainment packages. They will also provide ten (10) references of customers currently using proposed system in the state of Michigan.
	<b>H</b>	Warranty	Provide written warranty information including all terms and conditions. Provide ten (10) references of customers currently under specified warranty in the state of Michigan.
	<b>I</b>	Project References	Manufacturer to provide a list of ten (10) projects where the technology and specific fixture proposed for this project has been installed in the state of Michigan. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number.
	<b>J</b>	Product Information	Complete bill of material and current brochures/cut sheets for all product being provided.
	<b>K</b>	Delivery	Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information.
	<b>L</b>	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.
	<b>M</b>	Environmental Light Control Design	Environmental glare impact scans must be submitted showing the maximum candela from the field edge on a map of the surrounding area until 1000 candela or less is achieved.

The information supplied herein shall be used for the purpose of complying with the specifications for Livonia Churchill High School Football. By signing below, I agree that all requirements of the specifications have been met and 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 the Non-Compliance section.

**Manufacturer:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Contact Name:** \_\_\_\_\_

**Date:** \_\_\_\_/\_\_\_\_/\_\_\_\_

**Contractor:** \_\_\_\_\_

**Signature:** \_\_\_\_\_