

LOUISVILLE ARENA AUTHORITY - KFC YUM! CENTER

PERFORMANCE SPECIFICATIONS: LED SPORTS LIGHTING SYSTEM

PROJECT NUMBER:
KFC19-1622

05.14.2019

PART 1 GENERAL

1.1 DESCRIPTION

- A. The Louisville Arena Authority - KFC YUM! Center (hereinafter referred to as "the Owner") is soliciting proposals for a turnkey LED Sports lighting system from companies that are capable of designing, manufacturing and installing a state-of-the-art solution that illuminates the playing surface in a way that meets or exceeds the *NCAA Basketball Championships Best Lighting Practices: Broadcast Level B* – Approved by NCAA 06.04.18 (NCAA Standards)
- B. The NCAA broadcast environment for the playing surface is a uniform light level and color temperature over the entire playing court and team sidelines. The uniformity in light levels and color are to be maintained over the life of the warranty.
- C. The Contractor is to provide a fully integrated design solution for the sports lighting fixtures at the KFC YUM Center. The fixtures shall be LED and shall operate at a supply voltage of 277 volts. The lighting fixture and application must meet the standards as set forth by the NCAA Standards and meet the needs of UHD and HDTV broadcasts with flicker uniformity of better than 2% as viewed by high frame rate cameras up to 300 frames per second. System to have a minimum of 16 step dimming capability as well as individual and group fixture control.
- D. The Contractor shall be responsible for providing all lighting equipment as required, installation, configuration, tuning, demolition and removal of legacy equipment. At no time is the Contractor to assume use of Owner waste removal mechanisms.
- E. The Contractor shall be responsible for the provision and installation of any secondary structural steel and mounting brackets/hardware required to attach to the catwalk existing pipe railing structures. This includes all labor, materials, equipment, tools, transportation, and project management required for complete a fully operational system(s).
- F. Owner will provide Primary Power at defined demarcation points as identified in provided electrical drawings. Contractor is required to field verify power demarcations and include any additional service requirements as part of their proposal. Contractor shall be responsible for all power and electrical distribution from demarcation point (Secondary Power) to new system(s). Contractor shall provide all secondary power connections/terminations required to power new system(s).
- G. It is the Contractor's responsibility to inspect the site and include all work as part of their proposal. All work shall adhere to all NEC, state, and local electrical code, whichever is the most stringent shall govern.
- H. Upon approval by the Owner, Contractor may use conduits or raceways currently installed in the arena for low voltage, video signal, and/or data communication for new system(s). If existing conduits or raceways are utilized for new wire pulls, all fill ratios and code compliance required. All additional conduit and raceways required to complete a path to each lighting fixture shall be furnished and installed by Contractor. Contractor shall be responsible to furnish, install, and terminate all required cabling needed to make new system(s) complete and fully operational.
- I. Contractor shall be responsible for final engineering of structural and electrical components required for new system, including professional engineering stamp by a licensed/registered engineer in the State of Kentucky.
- J. Contractor is responsible for supplying a complete and fully operational and turnkey system as intended by the RFP documents and any subsequent addendums. Prior to entering into a contract for the project, vendor is responsible for notifying Owner of any equipment omissions in the RFP documents that would prevent the completion of a fully operational and NCAA standards compliant system. If Contractor fails to notify Owner of any equipment omissions, Contractor shall assume responsibility for providing the required equipment at no additional cost to Owner.
- K. Contractor shall field verify all work site conditions, including dimensions and sightlines prior to submitting shop drawings.
- L. Contractor shall grant Owner a license to use all proprietary software provided with this bid package for the life of the system.

1.2 VENDOR QUALIFICATIONS

- A. Owner seeks to contract with a vendor for the full performance of the work as described in this RFP and to obtain long-term service and support for all equipment supplied by the selected vendor. To ensure the chosen vendor has the long-term interests of Owner in mind, the following shall be required to submit a proposal for this project. Failure to submit acceptable responses to all these requirements shall eliminate a vendor from consideration. The Owner, in its sole discretion, shall reserve the right to waive any or all the requirements listed below.
1. Vendor shall provide a list of a minimum of five (5) professional arenas including two (2) NCAA Arena's (facility, contact name, title, address and current phone number) where the vendor has provided equipment and services of similar size and scope to this bid package within the last 3 years.
 2. Vendor shall be required to provide a Letter of Surety from their bonding agent, stating their ability to provide a 100% payment and performance bond if Vendor is awarded the Project.
 3. Vendor shall have a direct service employee or certified contractor capable of providing maintenance response with-in 2 hours of a call for service.
 4. Vendor shall provide a complete list of all Sub-Contractors (Electrical & Mechanical Contractors, Labor Providers, any person(s) not directly employed by Vendor) used to complete this project. Sub-contractor may need to submit additional insurance and state license to work in the City of Louisville and State of Kentucky.

1.3 SUBMITTAL REQUIREMENTS

- A. Initial Submittals and Shop Drawings
1. Contractor shall be required to provide submittals and shop drawings to Owner within thirty (30) calendar days of date shown on award notice, acknowledged with a binding letter of intent. Contractor shall advise the Owner of any discrepancy that could affect installation. If Contractor fails to notify Owner of any discrepancies, Contractor shall assume responsibility for providing the required equipment or correcting such discrepancies at no additional cost to Owner.
 - a. Submit three (3) sets of shop drawings and (1) electronic copy, product data photometric studies and samples together in one package within thirty (30) calendar days of date shown on award notice to Contract and prior to ordering equipment.
 - b. Provide all required submittals as outlined in the NCAA Championship Best Practices Lighting Standards document accompanying this RFP.
 - c. Submit catalog data sheets, neatly bound with title page, space for submittal stamps, and tabbed dividers between Sections. Provide a complete list of proposed equipment with reference to its corresponding specification paragraph number or equipment title in specification paragraph order. Denote all approved substitutions.
 - d. Submit method of attachment for lighting fixtures required for this scope of work. A licensed/registered engineer in the State of Kentucky shall stamp all structural drawings.
 - e. Submit sectional and longitudinal section drawings showing relation of the proposed light fixture positions in relation to all obstructions including the structure, scoreboard, team banners, all entertainment and audio equipment, and flags.
 - f. Submit point-to-point wiring diagrams and typed wire lists identifying every connection. Include electronic devices such as switches, transformers and terminal blocks. Indicate locations of all components. Identify cables by type, color, and wire numbers.
 - g. Submit conduit riser diagrams showing required conduits and junction boxes along with types of quantities of cables to be contained in each conduit. Show details of grounding, strain relief and cable support, fire stop protection, and wall penetrations through all rated partitions.
 - h. Submit rack layouts indicating the proposed arrangement of mounted equipment including power junction box location. Rack layouts shall include front and rear views.

- i. Submittal drawings shall indicate proposed color selections and finishes for all exposed surfaces and custom fabricated items. Submit actual color/finish samples, wall plates, and custom labels.
- j. Submit a list of all lower tier subcontractors and suppliers. List shall include lower tier subcontractor's qualifications indicating performance of similar work on past projects of this type and scope.
- k. Submit a project schedule in Gantt Chart format outlining equipment delivery dates and installation start and finish dates. Project schedule shall be broken down into sufficient detail (work task and duration) to permit Owner to monitor installation progress daily. Coordinate submittal review requirements and order dates for long lead items in critical path of submitted schedule.
- l. Copies of all required business and contractor licenses.
- m. Copies of proof of insurance.
- n. Approval of submitted items indicates only the acceptance of the manufacturer and quality. Specific requirements, arrangements, and quantities shall comply with the intent of the Contract Documents as interpreted by the Owner unless specifically approved in writing.
- o. Submittals that are incomplete, deviate significantly from the requirements of the Contract Documents, or contain numerous errors will be returned without review for rework and re-submittal, and may result in back charges to the contractor.

B. Contract Closeout Submittal:

1. When the installation is substantially complete including the Testing Reports in Part 3 of this Section, Contractor shall submit two (2) complete initial hard copy sets of contract closeout submittals to the Owner for review. After review and approval of initial set, Owner shall return one (1) initial hard copy to Contractor with comments for updating. Contractor shall provide four (4) final sets of closeout submittals to Owner and one (1) electronic copy in searchable PDF format. Closeout submittals shall include, but not be limited to:
 - a. Project Record Drawings (As-Built Drawings).
 - b. A list of all equipment provided and its location within the facility. List shall include manufacturer name, model identifier, serial number, and any other pertinent information needed to obtain service, maintenance, and/or replacement.
 - c. A list of all Subcontractors who performed work for Contractor during installation. List shall include company name, short description of work performed by contractor, physical company address, phone number, and contact person(s).
 - d. All testing reports as specified in Section 3 – Testing and Acceptance.

C. Operation and Maintenance Manual

1. Upon substantial completion and prior to on site training with the Owner, Contractor shall provide four (4) final Operation & Maintenance Manuals (O&M Manuals). O&M Manuals shall have tab dividers and shall be logically organized to provide easy access to information without the need to research through entire manual. All documents provided in the O&M Manual shall be written in English and shall provide sufficient detail as to be understood by an individual with no knowledge of LED Lighting or the associated control equipment and/or operating systems. Contents of the O&M Manual shall include, but not be limited to:
 - a. Table of Contents
 - b. Contractor/subcontractor/supplier list including all items from 1.3.B.1.d
 - c. Warranty certificates for each component
 - d. Description / overview of system(s) including key features and operational procedures.
 - e. Full start up procedure for all control room rack equipment and LED lighting equipment written under the assumption that all equipment was in full powered off mode.

- f. As simplified as possible step by step Operation sequences and procedures for operators of each system.
- g. Full shutdown procedure for all control room rack equipment and LED lighting equipment written under the assumption that the facility is in an extended power failure situation.
- h. Troubleshooting procedures for all equipment provided by Contractor. Troubleshooting procedures shall have included demonstration photos and/or diagrams as required.
- i. Maintenance procedures for all equipment provided by Contractor. Maintenance procedures shall include demonstration photos and/or diagrams as required. Contractor shall indicate whether maintenance procedures should be performed monthly, bi-annually, or annually.
- j. Owner's Manuals for all third party and/or "off the shelf" type equipment provided by Contractor; e.g., KVM's, fiber modems, network switches/routers, and UPS battery back ups.
- k. All third-party equipment and/or "off the shelf" equipment warranties and a notarized System Warranty.

1.4 EQUIPMENT GENERAL SPECIFICATIONS

- A. All equipment and materials, except owner furnished, shall be new and the latest version at the time of bid and shall conform to applicable UL, ULC, or ANSI provisions. Re-manufactured or "B" stock equipment will not be accepted without prior written consent from the Owner. Evidence of unauthorized re-manufactured or "B" stock equipment on the project site will be deemed evidence of the contractor's failure to perform the work.
- B. Contractor shall take care during installation to prevent scratches, dents, chips or disfiguration of equipment and materials supplied. All damaged equipment and/or materials shall be repaired or replaced at Owner's discretion. Contractor shall perform either option selected by Owner at no additional cost to the Owner.
- C. All power and data cabling are to be labeled at each end of the cable with a description in English OR with a reference to a wire designation on a wiring diagram. This includes all cables internal to the displays, all cables between displays and control room, and all cables internal to the control room. These diagrams must be part of the Project documentation submitted to the Owner at time of acceptance.
- D. Each device shall meet all its published manufacturer's specifications. Verify performance as required.
- E. Provide engraved self-adhesive phenolic labels at the front and rear of all rack-mounted signal processing, control, and graphics equipment. Mount labels on the equipment chassis and attach in a neat and permanent manner. Embossed label will not be accepted. Label equipment with schematic enumeration reference, and with descriptive information regarding its function or area it is serving. Similarly, provide engraved labels at the rear only of equipment mounted in furniture consoles.
- F. All engraving shall be 1/8" block lettering unless noted otherwise. On dark panels or pushbuttons, letters shall be white. Letters shall be black on stainless steel, brushed natural aluminum plates or light-colored pushbuttons.
- G. Per IEC-268 standard, all XLR connectors not mounted on equipment shall be wired pin 2 hot (high), pin 3 low, and pin 1 screen (shield).
- H. Contractor shall exercise care when wiring racks to avoid damaging cables and equipment. Contractor shall install grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.

1.5 QUALITY ASSURANCE

- A. All requirements of the latest published editions of the following standards shall apply, unless otherwise noted. In the event of conflict between cited or referenced standards, the more stringent shall govern.

PERFORMANCE SPECIFICATIONS
LOUISVILLE ARENA AUTHORITY - KFC YUM CENTER LED SPORTS LIGHTING SYSTEM

1. *NCAA Basketball Championships Best Lighting Practices: Broadcast Level B* – Approved by NCAA 06.04.18 (NCAA Standards)
 2. National Electric Code (NEC).
 3. National Electrical Manufacturers Association (NEMA)
 4. American National Safety Institute (ANSI)
 5. Occupational Safety and Health Administration (OSHA)
 6. American Iron and Steel Institute (AISI)
 7. Underwriters Laboratories (UL)
 8. Federal Communications Commission (F.C.C.) Rules and Regulations, Part 76.
 9. Society of Cable Television Engineers (S.C.T.E.)
 10. Society of Motion Picture and Television Engineers (S.M.P.T.E.)
 11. American Society of Testing Materials (A.S.T.M.)
 12. National Cable Television Association (N.C.T.A)
 13. Electronic Industries Association (E.I.A.)
 14. Telecommunications Industries Association (T.I.A.)
- B. Review all available architectural, civil, structural, mechanical, electrical, and other project documents relative to this work.
- C. Verify all dimensions and site conditions prior to starting work.
- D. Contractor to provide a plot of measured lighting levels per the NCAA Specifications.
- E. Coordinate the specified work with all other trades.
- F. Maintain a competent supervisor and supporting technical personnel, acceptable to the Owner during the entire installation. Change of supervisor during the project shall not be permitted without prior written approval from the Owner.
- G. Provide all items not indicated on the drawings or mentioned in the specifications that are necessary, required or appropriate for this work to realize a complete and fully operational system that performs in stable and safe manor.
- H. Review project documentation and continuously make known any conflicts discovered and provide all items necessary to complete this work to the satisfaction of the Owner without additional expense. In all cases where a device or item or equipment is referred to in singular number or without quantity, each such reference shall apply to as many such devices or items as are required to complete the work.
- I. Provide additional support or positioning members as required for the proper installation and operation of equipment, materials and devices provided as part of this work as approved by the Owner, without additional cost to the Owner.
- J. Regularly examine all construction, and the work of others, which may affect Contractors work to ensure proper conditions exist at site for the equipment and devices before their manufacture, fabrication or installation. Contractor shall be responsible for the proper fitting of the systems, equipment, materials, and devices provided as part of this work.
- K. Promptly notify the Owner in writing of any difficulties that may prevent proper coordination or timely completion of this work. Failure to do so shall constitute acceptance of construction as suitable in all ways to receive this work, except for defects that may develop in the work of others after its execution.
- L. All Lifts and Crane's (Mechanical, Electric, Gas or Diesel) must meet all OSHA Regulations, City and State Code and have current inspection licenses with all equipment.
- M. MSDS Sheets shall be organized in a binder, available at site at all times and comply with all OSHA and Local and State Codes.

- N. All Hazardous materials shall be stored in an OSHA compliant storage container and placed in area directed by client.
- O. After installation, submit photographs showing cable entries and terminations within equipment racks, enclosures and pedestals at the job site

1.6 WARRANTY AND SERVICE

- A. Contractor shall warrant labor and materials for ten years following the date of Final Acceptance.
- B. During the warranty period the system shall be free of defects and deficiencies and conform to the drawings and specifications with respect to the performance, quality, function, and characteristics stated.
- C. Contractor shall repair or replace defects that occur in labor or materials within the warranty period. If repair is affected using Owners spare parts allotment, Contractor shall replenish all parts used to keep Owner's inventory at the amount required by the contract.
- D. On-site labor shall be included at any time during the warranty period:
 - 1. When 10% or more of the fixtures are out or light levels fall 10% below the design criteria values.
 - 2. When color balance and uniformity exceed a 10% variation of the initial TLCI or CRI readings.
 - 3. When system is out of NCAA Standards compliance for any reason.
- E. Failed parts shall be returned to the Contractor at the Contractor's expense for repair at a service facility located in the United States. Contractor shall identify the location of its service facility in the documentation provided when submitting a bid for this work.
- F. The Contractor shall replace failed parts that cannot be repaired.
- G. Upon receipt of a failed part, Contractor shall return a repaired or replacement part to the Owner within fifteen (15) business days from receipt of failed part.
- H. Contractor shall supply at least one local service employee or local authorized service agent for servicing and repair of all equipment during the warranty period. Local service employee or local authorized service agent shall be located within 100 miles of Owner's facility. Individual or firm intended to meet this requirement shall be submitted with responsibility review materials.
- I. The local service employee or local authorized service agent shall be entity responsible for providing the following emergency response availability:
 - 1. Telephone service assistance and technical support 24 hours a day at Owner's facility, 7-days per week.
 - 2. Answer all service calls and requests for information within one (1) hour during the warranty period.
 - 3. A parts exchange program, including same day shipment of exchange parts. The manufacturer shall keep a ready stock of key assemblies available to ship out upon notice of a parts failure if part is not available in spare parts inventory at Owner's facility.
 - 4. The advance replacement should contain all the shipping information and packaging necessary to return the defective part or assembly back to Contractor at no cost to the Owner.
- J. Warranty shall cover all equipment, including controllers, operating systems, and software.
- K. Warranty shall include nine annual on-site system check-ups by a qualified technician who is a full-time employee of the Contractor. Visit to occur approximately 2-3 weeks prior to the start of the NCAA season or as determined by Owner.
- L. Check-up shall include a complete service and maintenance of the system; including module or fixture replacement as needed.
- M. Warranty shall include any and all necessary assistance required by the Owner to demonstrate compliance with NCAA Standards.

1.7 SPARE PARTS

- A. Contractor shall supply a spare parts inventory containing 2% spare drivers (minimum of one (1)) and 2% spare power supplies (minimum of one (1)) whichever is greater, and a minimum of one (1) of every critical component not listed above. Spare parts inventory shall be based on quantity of components used to complete the system. Contractor shall provide proposed spare parts inventory as part of the bid submission.
- B. At the time of final completion, Contractor shall supply the specified spare parts inventory regardless of spare parts used during initial "shake out", "burn in" and/or testing of newly installed LED Fixtures.
- C. Manufacturer of the LED lighting system components shall continue to make all parts necessary for the continued functioning of the system for a minimum of ten (10) years after acceptance of this project. Furthermore, upon end of life of any component used in the LED lighting fixtures, that is not replaced by a "backwards compatible" component, Manufacturer shall notify Owner of end of life status being given to components of this system and shall give Owner an opportunity to buy spare parts from stock or a last production run, at then commercially viable prices.

END OF PART 1 GENERAL

PART 2 PRODUCTS

2.1 LED SPORTS LIGHTING SYSTEM – PERFORMANCE REQUIREMENTS

- A. Reference accompanying Excel Bid Sheet documents for template to provide pricing. Note that Bidders may provide their pricing in their native format but must also be provided in the Excel template provided.
- B. The performance criteria for the LED Lighting system is mandated by the NCAA and shall be maintained throughout the 10-year warranty period.
- C. Reference Accompanying: *NCAA Basketball Championships Best Lighting Practices: Broadcast Level B* – Approved by NCAA 06.04.18
- D. It is the responsibility of the Contractor to propose a system that meets or exceeds the referenced NCAA Championship lighting standards and is approved by NCAA. Contractor is responsible for any and all expenses incurred to make the system(s) NCAA compliant. Contractor is responsible for any re-engineering or re-design and associated expenses if the system is determined not in compliance by NCAA review.
- E. Flicker uniformity of better than 2% as viewed by high frame rate cameras up to 300 frames per second
- F. System must have the ability to dim all fixtures a minimum of 16 steps from 0 to 100%.
- G. System must have the ability to control fixtures in groups of fixtures, banks and individual fixtures, allowing for special effects.
- H. System must be FCC compliant for Electro Magnetic Interference (EMI) and Radio Frequency Interference (RFI) emissions.

END OF PART 2 PRODUCTS

PART 3 EXECUTION

3.1 SCOPE OF WORK

- A. The following outlines the turnkey delivery and installation responsibilities that define the project scope of work. Any and all work outlined in this section is the responsibility of the Contractor unless otherwise noted. Any and all dates referenced in this document are approximate projected dates and are subject to change.
- B. Contractor is required to provide all labor, materials, tools, supervision and equipment to perform the following:
 - 1. Remove and dispose of all existing equipment that is being replaced in this package, as well as all packaging, scrap, and trash from new fixtures and materials.
 - 2. Provide and install all equipment required to conform to NCAA Standards, including any and all equipment not specifically listed that is required to provide a completely functional system.
 - 3. Ensure all components above occupied areas are secondarily secured by manufacturer approved affixation e.g. safety cables and compliant with all relevant local, state, national codes.
 - 4. Meet all design and commissioning requirements as established by the NCAA Standards and performance criteria.
 - 5. Primary control of system will be via the Building Automation System (Lutron), with existing stations at Building Electrician, Building Engineer, and Security Office.
 - 6. Contractor to provide feeds back to the existing generator backup system where applicable.
 - 7. Contractor to provide all necessary precautions for protection of all facility components, including playing surface and arena seating, if necessary. Contractor is responsible for repair or replacement of any damaged facility components caused by the Contractor and/or any subcontractors hired by Contractor to perform work on site.
 - 8. Contractor to provide all required new conduit for signal cable to each fixture back to DMX control system.
 - 9. Provide required electrical and data cable: connect all equipment with power, signal and control wiring.
 - 10. Coordinate with Owner regarding placement of new equipment rack(s) and electrical components.
 - 11. Provide all required permits and licenses.
 - 12. Provide a competent on-site installation supervisor
 - 13. Deliver all Equipment to site and convey to appropriate locations within site as directed by Owner.
 - 14. Store all Equipment in a safe and secure manner until installed, or otherwise directed by Owner.

3.2 DMX CONTROL

- A. Provide DMX lighting controller for dimming and theatrical control of the fixtures.
 - 1. DMX Controller will be secondary to the primary on and off for the existing Venue Lighting Control System.
- B. Provide three (3) wall-mount touch panels shall be provided for event staff and security to access control for on/off and scene selection without physical input at the DMX controller.

3.3 WORK LIGHTS

- A. Provide an alternate for LED fixtures to replace existing (184) 900-watt quartz work lighting fixtures that illuminate arena seating and arena floor areas, work lighting shall be controlled by the house Lutron lighting system and be connected to arena emergency generator system.
 - 1. LED fixtures shall be turned on/off by means of the Lutron control system, associated touch panels, and control dimming via DMX controller.

3.4 ENGINEERING

- A. The Contractor shall submit drawings and calculations stamped by a professional engineer who shall be licensed/registered in the State of Kentucky.
- B. Contractor is responsible for taking all seismic, and environmental considerations into account and making structural provisions for any such requirements.
- C. Owner and/or Architect/Engineer must approve all drawings in writing prior to the fabrication and installation of any equipment.
- D. Engineered drawings are to include both structural and electrical.
- E. The Contractor is solely responsible for verification the integrity of all engineering calculations. Contractor is responsible for verification of all information provided or implied.

3.5 STRUCTURAL CONSIDERATIONS

- A. Bolted and/or field welded connections shall be subject to special inspection by an independent testing & inspection agency certifying that bolted and/or welded connections meet the minimum requirements of the engineered structural drawings, the governing building code, or as required by the building official; whichever is more restrictive. Inspections shall take place prior to painting any connection.
- B. Safety cables, and or secondary fasteners are required for any and all overhead apparatus.
- C. Documentation shall be provided to Owner verifying acceptable results from all required inspections. All items failing inspection shall be repaired or replaced and re-inspected at no additional cost to the Owner.
- D. All components to be painted and otherwise finished for exterior service conditions shall be warranted to be free of rust or other defects for a period of ten years.
- E. All welders must be certified, and certificates must be on site and available for inspection as requested.

3.6 ELECTRICAL AND DATA

- A. The electrical design and installation of all branch circuits by the Contractor shall comply with NEC, state and local codes, as well as Owner regulations and guidelines.
- B. The Contractor shall provide electrical and data one-line diagrams.
- C. Electrical design and engineering must be reviewed and approved by the Owner prior to any electrical work by the Contractor.
- D. The Contractor will be responsible for power distribution from the demarcation points noted on the included electrical drawings. Any additional electrical components required for a complete and fully operational system but not shown on the electrical drawings shall be the responsibility of the Contractor.
- E. Any additional raceway (conduit, cable tray, J hooks) required to provide a complete system for both power and signal/data shall be furnished and installed by Contractor. Any additional raceway required shall have routing of raceway approved by Owner prior to installation.
- F. The Contractor shall be responsible for termination and final connect of power to all elements. All secondary electrical panels must be clearly marked with names of the branch circuits controlled by

each breaker to aid in troubleshooting or isolating problems. All electrical services, disconnects, and breaker panels are to be labeled with what they control and where they are fed from.

- G. Contractor shall not use wire nuts or electrical tape for any power or signal connection or any part of the work including internal LED display power jumpers or power connections to signage elements. All connections shall use a proper terminal block and spade terminal, or terminal block and direct connection as required. Covers shall be provided over all high-power terminal blocks to prevent electrical shock.
- H. Permanent power distribution from Owner provided primary power source shall use rigid metal conduit and wire or metal clad (MC) cable. The use of SO cord or rubber jacket type power cables shall not be permitted for permanent installations. Strain relief on all connections shall be per manufacturers recommendations. Contractor shall submit manufacturers strain relief recommendations for all connectors during the submittal process.
- I. The Contractor will be responsible for providing stamped electrical drawings. A licensed/registered engineer in the State of Kentucky where this project is located shall stamp all electrical drawings.
- J. Any equipment not certified as required in Section 1.4 shall require on site certification by a listed testing agency. All cost associated with obtaining on site certification shall be the responsibility of the Contractor. Written proof of certification or equivalent will be required prior to any work being performed on site.

3.7 TRAINING

- A. The Contractor at its own expense will provide designated Owner employees' operator and maintenance training.
- B. Training will be performed at the site by a qualified technician and shall occur immediately following substantial completion. Operation and Maintenance Manuals per Section 1.3 shall be provided to Owner prior to training.
- C. The training shall cover the operation, routine maintenance and troubleshooting of the system and control equipment.
- D. Training shall consist of at least 24 hours (over the course of 3-5 days) of instruction.
- E. Contractor to provide programming of a minimum of twelve (12) DMX Scenes per design concepts provided by Owner.
- F. Contractor will be required to have a technician on site for the first event and continue to be on site for three (3) consecutive problem free events. "Problem-free" constitutes an event where the control system, and any other components installed by the Contractor are without failure during an event. Each successful event will need to be signed off by the Owner until three (3) consecutive events are achieved.
- G. Warranty period will commence at conclusion of the third consecutive successful event and Final Acceptance

3.8 TESTING AND ACCEPTANCE

- A. Contractor must demonstrate the full capabilities of the provided systems and prove performance meets contractual specifications and receive approval from the NCAA.
- B. The Contractor is responsible to provide any additional fixtures required to obtain final approval from the NCAA.
- C. Contractor must provide all necessary testing equipment for acceptance.
- D. Upon notice from the Contractor of substantial completion and at a time to be mutually agreed upon, the Contractor will arrange for the testing of all operations of the systems comprised in scope of work at the time of substantial completion.
- E. Document all acceptance testing, calibration and correction procedures described herein. Include the following information:

1. Performance date of the given procedure.
 2. Condition of performance of procedure.
 3. Type of procedure, and description.
 4. Parameters measured and their values, including values measured prior to calibration or correction, as applicable.
 5. The names of personnel conducting the procedure.
 6. The equipment used to conduct the procedure.
 7. The most recent calibration results of equipment used to conduct procedure.
- F. Upon completion of initial tests and adjustments, submit written report of tests to the Owner along with all documents, diagrams, and recorded drawings required herein.
- G. Close out Procedures
1. Perform any and all "punch-list" work to correct inadequate performance or unacceptable conditions, as determined by the Owner, at no additional expense to the Owner.
 2. Furnish all portable (includes spare parts) equipment to the Owner along with complete inventory documentation. All portable equipment shall be presented in the original manufacturers packing, complete with all included instructions, miscellaneous manuals, and additional documents.
 3. Provide new acceptance testing in the same format as initial test reports.
 4. Check, inspect, and if necessary, adjust all systems, equipment, devices and components specified, at the Owner's convenience, approximately thirty (30) days after the Owners acceptance.
 5. Upon completion of the Work, the Owner may elect to verify test data as part of acceptance procedure. Provide personnel and equipment, at the convenience of the Owner, to reasonably demonstrate system performance and to assist with such tests without additional cost to the Owner.

END OF PART 3 EXECUTION