SECTION 11 63 50 – VIDEO PRODUCTION & CONTROL ROOM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work under this Contract includes all labor, materials, tools, transportation services, supervision, coordination, etc., necessary to complete the integration of the Video Production Systems, as described in these specifications and illustrated on the associated drawings. The systems shall be called the “Video Production System” and the installer the “Video Production Installer”. The systems include the following major items:
1. Video production system

B. The Contract also includes:
1. Verification of dimensions and conditions at the job site.
2. Preparation of submittal information.
3. Installation in accordance with the contract documents, manufacturer’s recommendations, and all applicable code requirements.
4. Installers commissioning.
5. Initial tests and adjustments, written report, and documentation.
6. Instruction of operating personnel; provision of manuals.
7. Maintenance services; warranty.

C. The Contract Documents are complementary and are intended to include or imply all items required for the proper execution and completion of the work. Any item of work required by the Specifications or other portion of the Contract Documents, but not shown on the drawings, or shown on the drawings but not required in the Specification, shall be provided by the Contractor without extra charge as if shown or mentioned in both.

1.3 SYSTEM DESCRIPTION

A. The purpose of this system description is to provide proponents a good understanding regarding the operational intent of the Video Production System as well as specific operational and performance requirements of the system. This description should be referred to in conjunction with the equipment listing.

B. The Video Production System is the system that will generate separate video signals to be displayed on the Sporting Facility’s Direct View LED Video Displays (installed by the Scoreboard Systems Installer).

C. The Video Production System is located on the Event Level of the facility. A number of video cameras are dedicated to the video production system. Cameras will have the ability to be connected at JBT locations throughout the facility and patched through to the production system. Based on the camera location, the operator will have the option of shooting in a studio configuration or handheld configuration.
1. A camera may be connected at a panel within a JBT location via one or two strands of single mode fiber to the Camera Control Base Stations in the Video Production space. Six strands of single mode fiber will be pulled to any new JBT boxes added. These lines, terminations and panels will be provided by the project.

2. Tie lines
   a. Connectivity to the PA and TV head end locations

D. The installation of the Video Production System shall be coordinated with the Distributed Television System. The Video Production System installer is providing a number of devices which are interconnected to the Facilities Distributed Television System. Provide signal as indicated on drawings to distributed TV system.

E. The installation of the Video Production System shall be coordinated with the Video and Scoring Display Systems. The Video Production System installer is providing a number of devices which are interconnected to the Video and Scoring Display System Processors. Provide signal as indicated on drawings to Video Board Processors.

F. The installation of the Video Production System shall be coordinated with the Sound Systems. The Video Production System installer is providing a number of devices which are interconnected to the Sound System. Provide signal as indicated on drawings.

G. The installation of the Video Production System shall be coordinated with the Broadcast Cabling Systems. The Video Production System installer is providing a number of devices which are interconnected to the Broadcast System. Provide signal as indicated on drawings.

H. In addition to the cameras the following equipment is provided for video production use:
   1. Video Player(s)/Recorder(s)
   2. Video production switcher
   3. Audio, video, fiber and camera patching between devices
   4. Preview, program and confidence monitors
   5. Miscellaneous distribution, conversion and equalization components
   6. Test and measurement components
   7. Audio mixing and distribution

I. The Video Production System provides intercom for production system operators, scoreboard/video display operators and the PA mixer/announcer position.

1.4 RESPONSIBILITY AND RELATED WORK

A. Supply accessories, software, hardware and minor equipment items needed for a complete system, even if not specifically mentioned herein or on the drawings, without claim for additional payment.

B. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Video Production Installer to supply systems in full working order. Notify the Owner’s Representative of any discrepancies in part numbers or quantities before bid. Failing to provide such notification does not relieve the vendor from supplying items and quantities according to the intent of the Specification and Drawings without claim for additional payment.
C. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner.

D. Signal Cabling, Conduit, cable tray and Junction Boxes (JBT):
   1. Are provided by the project. Verify that the conduit and JBT boxes will be adequate and notify Owner if conflict develops. It is the responsibility of the Video Production installer to supply systems in full working order if conduit needs to be extended and/or JBT boxes need to be replaced.
   2. Do not damage any other signal cabling that may be co-located with video and audio cabling. In the event of damage, bring damage to attention of owner and propose acceptable repair.
   3. Remove and dispose of cabling that is abandoned as part of the project.
   4. Installation shall include all required and operationally necessary low voltage and/or fiber optic cabling.
   5. All cable, whether fiber optic or copper will be run in existing conduit/cable tray from the Control Room area to each device as required. This does not relieve this contractor from providing fire stop material, armored cable and/or innerduct (if project requires it). If additional conduit, j-hooks, etc. are required for a complete system, provide.
   6. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.
   7. Provide any necessary cable management, vertical ladder tray, j-hooks, etc. in areas with no existing pathways.

E. If a conflict develops between the contract documents and the appropriate codes and is reported to the Owner’s Representative prior to proposal opening, the Owner’s Representative will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

F. Power will be provided at the video production space and JBT camera locations. Connect equipment racks to power circuits terminated near equipment rack. Note coordination with video display and existing distributed TV equipment space requirements shall include provision of a reasonable amount of power outlets for their equipment.

G. Coordinate work with other trades to avoid causing delays in the construction schedule.

H. Execute all work in accordance with the National Electrical Code, the National Electrical Safety Code, and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract document and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

I. The Installer is responsible for providing all components necessary for complete and operational system. Any system changes or revisions necessary to make the system conform to the building, walls, steel, electrical services etc., shall be included at time of bid and installed without claims for additional compensation.

J. The drawings included with this specification convey general system concepts. The plans do not show complete and accurate building details. The Installer is responsible for making field measurements necessary to establish exact locations, relationships, load capacities necessary for the installation of these systems.
K. Removal and re-installation of existing Owner Furnished Equipment (OFE) in Room 0167.

1.5 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: At least 5 years’ of experience in the production of specified products.

B. Installer’s Qualifications: Firm experienced in the installation of systems similar in complexity to those required for this project; and meet the following:
   1. At least five years’ of experience with equipment and systems of the specified types.
   2. Experience with comparable scale projects within the last three years.
   3. Maintain a fully staffed and equipped service facility.
   4. At the request of the Owner’s Representative, the Installer shall demonstrate that he has:
      a. Adequate plant and equipment to complete the work.
      b. Adequate staff with commensurate technical experience.
      c. Suitable financial status to meet the obligations of the work.

1.6 SUBMITTALS

A. Submit all shop drawings and submittals in accordance with Project Requirements. Quantities listed herein are the minimum required of this contractor.

B. Shop drawings and submittal data shall contain sufficient information to describe the Work to be performed. Drawings shall be executed at an appropriate scale. Submit 1 reproducible set and 1 blueline set of drawings; submit 3 copies of catalog data sheets neatly bound in sets. Submit all Shop Drawing information at one time. Information shall include but not necessarily be limited to:
   1. Wiring diagrams. Complete, detailed wiring diagrams for all systems, based on the contract documents. Including cable types, identification and color codes, and detailed wiring of connections, both at equipment and between equipment racks and wiring in conduit.
      a. Submit a sample wire run list for approval.
   2. Patch panel layouts and designation (labeling) strips.
   3. Equipment. Location of all equipment in racks, consoles, or on tables, with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
   4. Mounting details for:
      a. Cameras and power supplies
   5. Custom Plates. Provide complete shop drawings on custom fabricated plates or panels. Drawings to include dimensioned locations of components, component types, engraving information, plate material and color.
   6. Representative equipment labeling sizes, styles, and numbering.
   7. Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component lists.
   8. A material list of all equipment to be furnished, arranged in specification order. This list shall be followed by catalog data sheets, arranged in specification order, of all equipment to be furnished. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
   10. Samples as required in various specification paragraphs.
a. Provide for approval at such time that project construction has progressed to such
point that submittal work may be accomplished, but not less than ninety (90)
days from project completion.

b. A site verification of any interference paths predicted by the preliminary
interference analysis; as well as contractor’s proposal for mitigation, alternative
mounting location and/or heights.

c. Site survey of the mounting location for the wireless antennas. Survey includes:
   Use antenna of specified type.
   1) Results of electrical tests performed indicating signal strengths and
      terrestrial interference at the appropriate frequencies.
   2) Identify received signal levels; both primary and reflected signals.
   3) Verify appropriateness of specified antenna.
   4) Structural mounting details for all antennas. Mounting details shall bear a
      state certified engineer’s stamp.
   5) Antenna cut sheets. Antenna purchase will not be approved until site
      survey has been performed.

C. Training and Event Attendance Submittals:
   1. All Operations and Maintenance manuals, as well as as-built drawings must be on site
      for all sessions of training.
   2. Following discussions with Owner, formally submit a Training and Event Attendance
      submittal 2-4 weeks prior to first training. Submittal shall:
      a. Include a separate page/entry for every training session.
      b. Indicate date, time, and approximate length of training session.
      c. Indicate person(s) conducting training.
      d. Indicate whether training will be video recorded.
      e. Intended curriculum and most appropriate attendees (e.g. engineering, operations,
         IT, etc.)
      f. Include signature and title lines for:
         1) Owner acknowledgement and acceptance of training schedule. Include
            both an accepted and rejected box. An alternate schedule time should be
            suggested by the Owner in the event the schedule is rejected.
         2) Countersigning by trainer indicating that training actually occurred.
         3) All persons attending training. Where attendees do not stay for the entire
            session, this should be noted on the form and initialed by Owner’s
            representative attending training.
         4) Owner’s representative attending training at the end of the session shall
            initial that:
            a) Training Occurred.
            b) Training Materials were provided and left with owner
            c) Training was not interrupted or shortened by equipment or system
               troubleshooting. If it is, then there should be a line where Owner and
               Contractor can indicate when make-up training will be provided and
               how long it should be.
            d) Training was generally sufficient for the proposed curriculum.
            g. Include Notes section for Owner and Contractor to note any issues during
               training (areas requiring further development, etc.).
   3. Following training occurrence, submit completed training records no later than 5 days
      following end of training. When training is conducted over a period of weeks,
      completed training submittals shall be consolidated into a single submittal and
      submitted every 2 weeks.
D. Final Inspection Notification Report. Two copies of a typed, neatly prepared checkout report for each piece of equipment and the entire system shall be prepared and submitted; it shall include:
   1. A complete listing of every piece of equipment, the date it was tested and by whom, the results and date re-tested (if failure occurred during any previous tests).
   2. The final report shall indicate that every device tested successfully.
   3. A performance test report indicating that the system meets all of the Installer testing requirements of Part III.

E. Contract close-out submittals:
   1. Keep a complete set of drawings on the job, note any changes made during installation, and submit 1 corrected set of reproducible drawings showing Work as installed.
   2. Submit the following data for review, prepared as indicated, at least one week prior to acceptance testing (exceptions noted):
      3. System Reference Manual:
         a. System Operation and Instructions. Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity. This procedure should describe the operation of all system capabilities. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.
         b. Final Documents:
            1) A list of all equipment, indicating manufacturer, model, serial number, and equipment rack location. Update following acceptance testing, if changed. Manufacturer’s Instruction Manuals for all items of equipment, incorporating or followed by manufacturer's warranty statements.
            2) Where manufacturer registration is required, register warranty in Owner’s name, and at an address determined by Owner. Provide copy of registration.
            3) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
            4) A list of settings of all semi-fixed controls. Update following acceptance testing.
            5) Photographically reproduced schematic wiring diagrams of the video production sub-system based on the as-built documentation, at a reduced scale easy to handle but fully legible. Blueline (or similar diazo process) prints are not acceptable.
            6) Maintenance Instructions, including Installer’s maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
            7) A legend of acronyms and abbreviations must accompany all documentation.
            8) Any other pertinent data generated during the Project or required for future service.
            9) In titled ring binders sized for material below, plus 50% excess; 3 copies:
            10) Printed wire run lists.
            11) Manufacturer’s Service Manuals and parts lists for all equipment. Photocopies are not acceptable. For custom circuits or modifications, complete schematics and parts lists.
12) As-built wiring diagrams and system block diagrams showing nominal input and output levels. (Submit within two weeks after Acceptance Testing.)

13) Duplicate copies of reduced-scale wiring diagrams.

14) Photographically reproduced as-built wiring diagrams and overall building wiring diagrams at a reduced scale. Easy to handle, but fully legible. Blueline (or similar diazo process) prints are not acceptable. Mounted behind clear acetate and located with the equipment racks.

15) CD or DVD incorporating:

16) Editable AutoCAD Drawings

17) Wire run lists in editable format.

F. Submittal Format:

1. Provide each submittal with a unique number and be numbered in consecutive order.

2. Provide each submittal with a complete table of contents with the following information:
   a. Project title and number.
   b. Submittal number. In the case of a re-submittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and be numbered in consecutive order.
   c. Date of submission.
   d. Referenced addendum or change-order number as applicable.
   e. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
   f. Index Product Data sheets by manufacturer and model or part number.

3. Each submission page stamped with Contractor’s certification stamp, initialed or signed certifying:
   a. Review, approval and acceptance of submission.
   b. Certification of product compliance to specification.
   c. Verification product may be incorporated within the work.

4. Arrange product data list in specification order when applicable followed by unspecified product arranged by manufacturer and model or part number. Follow list by manufacturer’s data sheets, arranged in the same order. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.

5. Drawings executed at an appropriate scale, not smaller than 3/8"=1'.

G. Submittal Copies:

1. These requirements represent minimum project requirements; a project’s general conditions may require additional copies for project distribution.

2. Submit one (1) set of reproducible drawings. The processed reproducible shall be returned to Contractor.

3. Submit one (1) set of product data materials (e.g., product submittals).

4. Submit three copies of product or sample finishes as required within this specification.

H. Resubmission Requirements:

1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.

2. Indicate any changes that have been made other than those requested.
1.7 PROJECT CONDITIONS

A. Verify all conditions on the job-site applicable to this work. Notify Owner’s Representative in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The drawings diagrammatically show cables, conduit, wiring, and arrangements of equipment fitting the space available without interference. If conditions exist at the job site which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Owner’s Representative for approval, showing how the work may be installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ship product in its original container to prevent damage or entrance of foreign matter.

B. Handling and shipping in accordance with manufacturer’s recommendation.

C. Provide protective covering during construction, to prevent damaging or entrance of foreign matter.

D. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

E. Coordinate product and materials delivery, offloading, staging, security and transportation with the Owner.

1.9 ACCEPTANCE TESTING

A. Upon completion of installation and initial tests and adjustments specified in Part 3, acceptance testing shall be performed by the Owner’s Representative.

B. Provide two representatives familiar with all aspects of the system to assist the Owner’s Representative during acceptance testing.

C. The process of acceptance testing the System may necessitate moving and adjusting certain component parts; perform such adjustments without claim for additional payment.

D. Final acceptance shall occur after the system has functioned without failure for two games/events (as defined by the Owner).

1.10 WARRANTY

A. Contractor shall warrant equipment to be free of defects in materials and workmanship for one year following the date of the first regular season event or game, trouble free operation, certificate of occupancy, or substantial completion, whichever is later.

B. The system is to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or materials within the Warranty period without charge. Paint and exterior finishes, fuses, and lamps are excluded from this Warranty unless damage or failure is the result of defective materials or workmanship covered by Warranty, or work performed under warranty in the repairing of defects.
C. Within the Warranty period, answer service calls within eight hours, and correct the problem within twenty four hours.

D. This warranty shall not void specific warranties issued by manufacturers for greater periods of time, nor shall it void any rights guaranteed to the Owner by law. Register all manufacturers’ warranties (e.g. software, computers, etc.) in Owner’s name.

E. The contractor is to provide Owner with the name and telephone number of the person to call for service. This information is to be part of Project Record Drawings.

F. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment or transducers discovered during the testing. Correct any defects in wiring or other functional problems reported by Owner. Warranty replacement and service of equipment shall not apply to Owner furnished equipment. Coordinate inspection visit with the Owner.

1.11 SPECIFIED PRODUCTS AND MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed as a standard of quality. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet all of its published manufacturer’s specifications. Verify performance as required. Where two or more acceptable products are listed, the Installer may use either at his option.

B. Other qualified manufacturers will be considered subject to approval of complete technical data, samples, and results of independent testing laboratory tests of proposed equipment, submitted in accordance with project requirements.

C. If proposed system includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.

D. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

E. If product is discontinued or made obsolete due to continuing product development, replace it with manufacturers’ equivalent at time of installation at no additional cost.

1.12 INSTRUCTION OF OWNER PERSONNEL

A. After final completion, provide twenty hours of instruction to Owner designated personnel on the operation and maintenance of the System. If any component is not operational at the time of testing or training, the vendor shall return to complete the testing or training on the component.

B. Develop instructional course based on the use of the system and manufacturer’s recommendations. Provide a minimum of twenty hours of instruction. Arrange course so that operational and maintenance training seminars are separate.

1.13 TECHNICAL SYSTEMS SOFTWARE LICENSE

A. Introduction:
1. All proprietary software provided for the Technical Systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.

2. Contractor shall agree that 3rd party (e.g. manufacturer’s) proprietary software provided with the system shall be subject to this agreement.

3. Contractor and owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and shall supercede any standard manufacturer or Contractor’s standard license agreement.

4. Proprietary software shall be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor based hardware used to program, setup, or operate the system or its components.

5. For sake of this agreement, MS Windows® shall not be considered “proprietary” software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it shall be deemed proprietary.

B. License Grant and Ownership
1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer’s use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the owner.

2. Except as expressly set forth in this paragraph, Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of owner.

3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modification and Use
1. Source code shall be available to owner for a period of not less than 15 years.

2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of owner and its representatives.

3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right in owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.

4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.

5. During the life of the system (defined as a period of not less than 10 years and not more than 15 years), the Contractor shall provide software updates in accordance with all
necessary support requirements to maintain the system. This shall include a commitment to provide appropriate patches, fixes, and interface updates as necessary to maintain the operability and security of the system at a level commensurate with the original system.

   a. In the event that computer and or processor hardware refinements and updates are necessary to support software updates 7 years after substantial completion, said hardware will be provided to owner at the agreed upon terms for change orders of the original contract.

   b. Labor shall be in accordance with change order rates of the original contract, as adjusted for inflation in accordance with conditions and limitations of the general contractor or U.S. Bureau of Labor Statistics’ Consumer Price Index (CPI).

6. All hardware supplied shall support software updates for a period of not less than 7 years following substantial completion.

D. Warranties and Representations

1. Contractor represents and warrants to Owner that:
   a. It has all necessary rights and authority to execute and deliver this Software License and perform its obligations hereunder and to grant the rights granted under this Software License to owner.
   b. The goods and services provided by contractor under this Software License, including the software and all intellectual property provided hereunder, are original to Contractor or its subcontractors or partners.
   c. The software, as delivered as part of the system, will not infringe or otherwise violate the rights of any third party, or violate any applicable law, rule or regulation.

2. Contractor further represents and warrants that, throughout the System Warranty Period, the executable object code of software and the system will perform substantially in accordance with the System Specifications and Agreement. If the software fails to perform as specified and accepted all remedies are pursuant to the policies set forth in the Specification and in the Agreement. No warranty of any type or nature is provided for the source code version of the software which is delivered as is.

1.14 ALTERNATES/OPTIONS

A. VIDEO FILE SERVER (SLO-MO)

1. Slow motion recorder and playback - Abekas Solution
   a. 8 channels
   b. Ability to build, review, select clips or recorded angles at the same time
   c. Melt creation without external server
   d. Clip naming and management, playlist creation
   e. Network file import/export
   f. Real time transcoding
   g. “Hot key” camera angle playback
   h. Multiple file formats
   i. Multi-image viewing
   j. At least 100 hours of storage at 100 Mbits
   1) Abekas Mira-IR-DV-8-02 with
   2) Abekas Mira-IR-CS (SLO MO CP)
   3) Provide with commissioning and training
B. PTZ Camera (CAM3)
   1. PTZ Camera Black (Coordinate location with owner)
      a. Panasonic 3 CMOS with 20X optical zoom (Quantity 2)
      b. Image stabilizer
      c. Power supply AW-PS551PJ
      d. POE+
      e. Integrate with existing Vaddio controller

C. Camera Type 1 (CAM1): Studio configured to follow game action and crowd interaction.
   1. Camera Performance Configuration: (Quantity 2)
      a. Portable 2/3" Chip Camera
      b. 1080i/59.94 capable
      c. HD/SDI
         1) AJ-PX800G
      d. 20X lens with 2X extender
         1) Fujinon XA20SX8.5BERM
         2) MS-01 Rear lens kit
      e. Remote Operator Panel
         1) AK-HRP200GY
      f. Remote Operator Panel Cable
         1) ROP003M
         2) Mount on Countertop
      g. AC Adaptor
         1) TANDEM-70
      h. 9" LCD Monitor/Viewfinder
         1) BT-LH910GJ
      i. D-Tap to 4 pin XLR cable
         1) Powertap-20
      j. Data cable for VF to monitor feed
         1) BTCS910G
   2. Tripod with mid-level spreader and zoom control built into second pan arm
      a. Libec LX10-M
      b. Tripod Adapter plate
         1) SHAN-TM700
   3. Stereo microphone with windscreen
      a. Azden SGM-PII
   4. Intercom Headset
   5. Camera Base Station (CCU):
      a. Telecast Copperhead camera back and base station with correct cable harness
   6. Hard Camera Case with casters to support camera, lens, camera adapter, etc.
      a. NOTE: based on finished hallways/corridors, expansion joints, etc. determine if casters or inflatable tires will be needed to cushion the transport.
   7. Other acceptable suppliers:
      a. Grass Valley
      b. Sony

1.15 UNIT COST

A. Cost to remove Clear Com MS-704 and cabling

B. Cost to remove PTZ Camera
PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed to establish a standard of product quality.

B. Substitution of specified products with other qualified manufacturers and products will be considered providing:
   1. Proper substitution procedures outlined under Division 1 is adhered to.
   2. Sufficient data of the products is presented for prior approval including technical data, manufacturer’s specifications, samples, and, if requested, results of independent testing laboratory tests.

C. If proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review. Include a list of previously installed projects using proposed equipment that are similar in nature to specified System.

D. Provide product not specifically specified commensurate with the quality and standards established by the specified product.

2.2 GENERAL

A. All equipment and materials shall be new. Take care during installation to prevent scratches, dents, chips, etc. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet all of its published manufacturer’s specifications. Verify performance as required.

B. Provide engraved laminoid labels at the front and rear of all signal processing equipment mounted in racks. Mount labels on the equipment and attach in a neat, plumb, and permanent manner. Embossed labels will not be accepted. Provide engraved labels at the rear only of equipment mounted in furniture consoles.

C. Custom rack panels shall be 1/8" thick aluminum, standard rack sizes, brushed black anodized finish unless otherwise noted. (Brush in direction of aluminum grain only.) Custom connector plates (speaker, microphone, etc.) are typically stainless steel; however, it is this Installer’s responsibility to verify plate finish with the Owner’s Representative. Plastic plates will not be accepted.

D. All engraving shall be 1/8" high block sans serif characters unless noted otherwise. On dark panels or push buttons, letters shall be white; on stainless steel or brushed natural aluminum plates, or light-colored push buttons, letters shall be black.

E. In accordance with IEC-268 standard, all XLR connectors shall be wired pin 2 hot (high), pin 3 low, and pin 1 screen (shield).

F. All patch panels shall be wired so that signal “sources” (outputs from devices) appear on the upper row of a row pair; all “loads” (inputs to devices) appear on the lower row of a row pair. All patch panel designation strips shall utilize alphanumeric and descriptive labels. The jack positions in each horizontal row shall be numbered sequentially from left to right. The
horizontal jack rows shall be lettered sequentially from top to bottom. The alphanumeric identification of each jack shall be included on the functional block drawings.

2.3 CAMERA AND SUPPORT EQUIPMENT

A. Camera Type 2 (Cam2) Wireless ENG configured to follow game action and crowd interaction.
   1. Camera performance configuration
      a. Portable 2/3” camera chip
      b. 1080i/59.94 capable
      c. HDSDI
         1) Panasonic AJ-PX800G
      d. Camera lens
         1) Fujinon HAS18X7.6BRD
      e. Camera battery with dual position charger
         1) Hytron140 (Quantity 2)
         2) Titan Twin charger
      f. AC Adaptor
         1) TANDEM-70
      g. ENG style viewfinder
         1) AG-CVF15G
      h. Mic and Mic holder
         1) AG-MC200G
      i. Tripod plate
         1) SHAN-TM700

B. Wireless System
   1. 1.3-7.5 GHz frequency band
   2. HD/SDI in/out
   3. MPEG 4 compression
   4. Coverage on Event level, Practice courts, Outside Plaza (Coordinate with owner)
      a. With camera control interface
      b. With wireless transmitter (WT)
      c. With wireless receiver (WR)
      d. With omni-directional antenna
      e. With mounts, clamps, brackets, tripod
         1) Acceptable product:
            a) AB On-Air
            b) Wave Central Axis System

2.4 VIDEO COMPONENTS

A. ROUTING SWITCHER AND MULTIVIEWERS
   1. Type 1 Digital Routing Switcher (RS)
      a. Performance Requirements
         1) Unit shall provide routing of multiple signals and signal types
         2) Support for the following video formats:
            a) 1080i 59.94, 720P 50, 720P 59.94
         3) Unit shall be sized to accommodate a minimum of 64 SDI inputs and 64 SDI outputs
4) Equip with redundant power supplies
5) Switching shall be synchronous for appropriate devices.
6) Switching shall provide mux, de-mux and full mono level routing of embedded audio and discrete audio input and output
7) Switching shall be controlled by a broadcast standard routing switcher control system.
8) Integrate with existing cabling/equipment.
9) Configure Routing Switcher to interface to all shading joysticks (RCP1)
    This can be accomplished at RS, RS BPS, or RS XY as capable.

b. Acceptable Product
1) Ross Ultrix Solution
   a) Ross Video Ultrix-FR2 (Quantity: 1)
   b) Ross Video Ultrix-HDB-IO (Quantity: 3)
   c) Ross Video Ultrimix (Quantity: 1)
   d) Ross Video SFP-MADI-COAX (Quantity: 1)
   e) Ross Video SFP-HDB—10-3G (Quantity: 7)
   f) Ross Video NK-GPI
   g) Ross Video Ultrix-PS (Quantity: 2)
2) Vendors with Acceptable solution
   a) Evertz
   b) Grass Valley
   c) Imagine Communication
   d) Riedel
   e) As Approved

c. Type 1 Router Control Panel (RS RCP1)
1) Ross Solution
   a) Ross Video RCP-QE36
      (1) Director
      (2) Shader/EIC
2) Vendors with Acceptable Solutions
   a) Evertz
   b) Grass Valley
   c) Imagine Communication
   d) Riedel
   e) As Approved

d. Type 1 Madi to Analog Audio Interface (MADI1)
1) RME M-32AD

B. Video Recording Devices
1. DVD Recorder (DVDR)
   a. Blu-ray and HDD recorder
   b. HD/SDI inputs
      1) JVC SR-HD2700US With rack mount
      2) With (50) recordable discs
2. Hard Disc Recorder (HD-DVR)
   a. Matrox Monarch HDX
      1) HDMI Video Input
      2) HDSDI Video Input/Output
      3) Store Files on USB 2.0 or SD Card

C. Video Distribution Equipment
1. Serial Digital Distribution Amplifier (SDA)
   a. Multi-definition SDI
   b. Minimum of 1 input and 4 output
   c. Re-clock and EQ
   d. Acceptable product:
      1) Ross SEA-9203
      2) Aja HD10A with power supply
      3) Ensemble Designs Brighteye 42

2. Converter (CONV)
   a. HDMI to CAT5
      1) AJA
      2) Cobalt

D. Video Monitors.
1. Type 1 Color Video/Data Monitor (CPXM₁)
   a. 22” LCD Monitor
   b. 1920x1080
   c. DVI/HDMI inputs
   d. Acceptable product:
      1) Samsung LS22B300

2. Type 2 Color Video Monitor (CPXM₂)
   a. 22” LCD
   b. Two selectable HD/SDI inputs per screen with tally
      1) Ikegami UL17

3. Type 3 Color Video Monitor (CPXM₃)
   a. N/A

4. Type 4 Color Video Monitor (CPXM₄)
   a. 50” monitor
   b. HDMI inputs
   c. With wall mount swing arm brackets
   d. Acceptable product:
      1) Samsung EH5000 series
      2) NEC E505 series

E. ESPN3 functionality
1. Video Production Switcher (PS)
   a. Production Switcher:
      1) Six (6) multi-definition inputs SDI Three (3) HDMI inputs and 5 multi-definition outputs
      2) Four (4) keyers
      3) Integrated wipe effects
      4) Multi-image viewer
      5) Media Store
      6) Frame Sync and cross conversion
      7) GPI/O
      8) Tally
      9) Macro
     10) Robotic Camera control
     11) Playlist creation/playback
     12) Metadata tagging and logging
     13) Acceptable Product:
2. Character Generator (CG)
   a. Single channel
   b. Offline creation software
   c. Simultaneous multi-definition outputs
   d. Aspect ratio conversion
   e. Custom resolution video formats
   f. Video codecs license
   g. GPI
   h. Full function keyboard
   i. 2D and 3D DVE
      1) Software + premium 3D bundle package
      2) External data source link
      3) Social Media Interface
   j. Ross XPression

F. Closed captioning for distributed TV system, LED video, etc.
   1. Closed Caption Encoder (CCE)
      a. Universal encoder for HD and SD
      b. Multiple caption sources
      c. Spanish language capable
      d. Upconversion
      e. Direct connect serial inputs
      f. VANC
      g. Basis of design:
         1) EEG EN530
      h. Closed Caption Decoder (CCD)
      i. EIA-708
      j. Front panel control
      k. User selectable fonts, colors, opacity
      l. Spanish language capable
      m. With software decode to scoring system
      n. Basis of design:
         1) EEG DE290

2.5 AUDIO COMPONENTS

A. Audio mixer (MIXER)
   a. 32 input digital for basic monitoring
      1) Behringer X32C

B. Audio Distribution Amplifier (ADA)
   1. Two channel 1x4
      a. Acceptable product:
      b. Ensemble Designs BrightEye 33

C. Audio Interfacing, Matching, and Line Driving Devices.
   1. Universal Line Amplifier (SUM)
   2. Mic/Line Amplifier (LA)
   3. Unbalanced to Balanced Amplifier (UBA)
   4. Balanced to Unbalanced Audio (BUA)
5. Support
6. Acceptable product:
   a. RDL
7. Quantities as required

2.6 INTERCOM

   A. Master Station (IC MS): Allows all personnel to communicate during production event
      1. Type: Four channel
      2. Signaling: call light without causing audible clicks or pops over system.
      3. Headphones: low or high impedance.
      4. Programmable front panel buttons
      5. Connectors: XLR type.
      6. Acceptable product:
         a. Clear Com MS-704
            1) Video Production Room 0167 at Directors position.
            2) Security office 0152, coordinate with owner.
         b. Provide with appropriate number of power supplies (PWS)
         c. Provide intercom patch in Video Control Room for 4 ICOM channel patching.

   B. Belt Pack Station (BP):
      1. Type: Two channel
      2. Signaling: call light without causing audible clicks or pops over system.
      3. Headphones: low or high impedance.
      5. Connectors: XLR type.
      6. Acceptable product:
         a. Clear Com RS-703 with YC-36 cable
         b. Quantity: as shown on drawings

   C. Intercom Cables
      1. Each cable to be provided with heat-shrink label identifying facility name and cable
         length along with hook and loop strip to keep cable coiled.
      2. 25 foot Microphone Cable, Violet (Quantity: 6).

   D. Wireless Transmitter (WIC)
      1. Coverage to include: Event Level, Concourse Level and Back of House (Coordinate
         with owner)
         a. 4 channel based system
         b. Clear Com FreeSpeak ll
      1. Wireless Belt Pack Station (WBP):
         a. Four channels
         b. Clear Com (Quantity 6)
         c. With Clear Com battery charger and spare battery
      2. Wireless Antenna Receiver (WTR)
         a. With tripod for mounting
         b. CAT5 extension cable as required
         c. Clear Com
2.7 MISCELLANEOUS COMPUTER, NETWORK AND EXTENSION COMPONENTS

A. Coaching video equipment upgrade.
   1. Matrox Monarch HDX Channel streaming recording device with associated rack mount.
      a. Quantity 4
   2. Black Magic Designs 1x8 Distribution amplifiers.
      a. Quantity 4
   3. Black Magic Designs Mini converter Analog to SDI.
      a. Quantity 4
   4. Black Magic Designs Mini converter SDI to HDMI.
      a. Quantity 2
   5. Verify equipment that needs to be removed with owner

2.8 VIDEO, AUDIO, FIBER, GENERAL PURPOSE CABLE AND CONTROL WIRING

A. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g. CMR, CMP, etc.). Cables as follows:
   1. Video Cable -- intrarack
      a. Precision video cable, PVC jacketed. Solid center conductor. Color: cable to be ordered in 6 colors (other than black) for each separate cabling type (e.g. analog, digital, timing, component, etc.).
         1) Belden 1694A
         2) Liberty 18-CMR-SD
   2. Video Cable – outside of control room
      a. Precision video cable, PVC jacketed. Solid center conductor. Color: cable to be ordered in 6 colors (other than black) for each separate cabling type (e.g. analog, digital, timing, component, etc.).
         1) Belden 7855A
         2) Liberty equivalent
   3. Video Cable Pre-Assembled
      a. 20AWG solid .31” bare copper conductor with poly insulation, double braid shield
      b. Quantity and Lengths (note: lengths are in feet)
         1) 10 feet (Quantity: 2)
         2) 25 feet (Quantity: 2)
         3) 50 feet (Quantity: 2)
         4) 100 feet (Quantity: 1)
   4. Analog Audio Cable Pre-Assembled
      a. 22AWG, low attenuation, crosstalk, high grade poly dielectric
      b. Quantity and Lengths (note: lengths are in feet)
         1) 10 feet (Quantity: 2)
         2) 25 feet (Quantity: 2)
         3) 50 feet (Quantity: 2)
         4) 100 feet (Quantity: 1)
   5. Analog Audio Cables.
      a. Precision cable, PVC jacketed, twisted pair. Color to be ordered in color other than black and coordinated to be different than video cable color.
         1) Belden 9451
         2) CommScope 4201EZ
         3) Liberty
6. Single Mode Fiber Optic Cabling  
   a. Provided under separate scope
7. Wireless Antenna Cabling  
   a. Belden 1694A
8. Horizontal UTP Cable  
   a. Provide compliant with NEC type CMP, CMR and CM rating as applicable.
   b. Impedance: 100 ohms, plus or minus 15 ohms.
   c. Velocity of propagation: at least 70 per cent nominal.
   d. Frequency attenuation at 60° F less than 6.5 dB per 100 ft at 100 MHz.
   e. Acceptable product:  
      1) Belden 1585A  
      2) CommScope 5504M
9. Intercom Cabling  
   a. Belden 8762
10. Other control cables to be 20 gauge with overall shield and appropriate number of conductors.

B. Patch Panels.  
1. SDI patch panel with normal through patch jacks.  
   a. (Quantity: As required with 10% excess capacity)  
   b. ADC  
   c. Bittree  
   d. Switchcraft
2. Audio, Time Code and Intercom Patch Panels  
   a. (Quantity: As required with 15% excess capacity).  
   b. ADC
3. Fiber Optic Patch Panel

C. Patch Cables.  
1. Video Patch Cables  
   a. Standard Video Patch Cords; each length in a different color 
      1) 2’ in length in red (10)  
      2) 3’ in length in green (2)  
       a) ADC  
   b. Video Patch Cord with patch panel plug connector at one end and BNC male connector on the other; 1.8m long.
2. Audio Patch cords to be at least 1m long and have 2-conductor shielded plugs. Provide patch cord storage hanger. Patch Cords to be:  
   a. Standard audio patch cord:  
      1) ADC
3. Fiber Optic Patch Cord
4. Patch Cable Holders  
   a. Provide wall mountable patch cable holders  
   b. Quantity: 2  
   c. Acceptable product:  
      1) Video Patch Cable Holder: Pomona or Trompeter  
      2) Audio Patch Cable Holder: ADC

D. Connectors: All audio, video, and control equipment not a part of manufactured equipment shall have gold plated contacts excepting phone and patch jacks and plugs.
1. XLR type connectors shall incorporate metal shells and bodies and employ a non-hydroscopic dielectric. Panel connectors to be removable from panel front for solder and repair work. Male and Female panel connectors to fit in the same cutout. XLR connectors:
   a. Neutrik

2. BNC Bulkhead Connections to utilize gold plated center contacts, insulated from panel feed-through connection:
   a. ADC

3. BNC cable connections to utilize gold plated center contact, dual crimp connections:
   a. AMP
   b. Equal
   c. ADC

4. RCA Connectors:
   a. Provide commercial style gold plated compression type connections.
   b. Acceptable product:
      1) Cable Pro
      2) Canare
      3) ADC

5. XLR Connector
   a. Provide gold plated connector incorporating metal shells and bodies as required on audio cable.
   b. Acceptable product:
      1) Neutrik

6. Fiber Optic Connector
   a. Provide commercial style FC/APC/FC/SC and ST connections compatible with fiber equipment and where indicated on plans.
   b. Provide connectors recommended by the manufacturer for compatibility with equipment and mounting panels and sub plates.

2.9 CAMERA CABLING INTERFACE BOX PLATES

A. Provided by Broadcast Cabling Installer

PART 3 EXECUTION

3.1 GENERAL

A. All equipment and materials shall be new. Take care during installation to prevent scratches, dents, chips, etc.

B. Mount equipment and enclosures plumb and square. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least three. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.

C. Cover edges of cable pass-through holes in chassis, racks, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.
3.2 AC POWER AND GROUNDING

A. Coordinate final connection of power and ground wiring to racks. For all devices with detachable power cord, provide a “shortened” cable to connect directly to power strip without “bundling”; this power cable is preferred in a color other than black. Provide owner 10 of the original length power cables.

3.3 SYSTEM WIRING

A. Take precautions to prevent and guard against electromagnetic and electrostatic hum. For line level audio signals, float cable shields at the output of source device. Shields not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shields.

B. Exercise care in wiring; damaged cables or equipment will not be accepted. Isolate cables of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.

C. Make joints and connections with rosin-core solder or with mechanical connectors approved by the Owner’s Representative; where spade lugs are used, crimp properly with ratchet type tool. Spade lugs mounted on 22 gauge or smaller cable to be soldered after crimping.

D. Execute wiring in strict adherence to:
   4. EIA/TIA 568A (February 2000).
   5. In accordance with standard professional practice.

E. Neatly lace vertical wiring inside rack. Horizontal wiring in rack to be neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Ties to be flush cut as to prevent jagged and sharp edges. Provide horizontal support bars if cable bundles sag. Neatly bundle excess AC power cable from rack mounted equipment with plastic cable ties. Rack wiring to be bundled with plastic cable ties or lacing twine. Electrical tape and adhesive backed cable tie anchors are not acceptable.

F. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out, to their locked position without straining cable.
G. Wiring and connections shall be completely visible and labeled in rack. Termination resistors shall be 1% tolerance; fully visible and not concealed within equipment or connectors.

H. Custom rack panels shall be 1/8" thick aluminum, standard rack sizes, brushed black anodized finish unless otherwise noted. (Brush in direction of aluminum grain only.) Custom connector plates (speaker, microphone, etc.) are typically stainless steel; however, it is this Installer’s responsibility to verify plate finish with the Owner’s Representative. Plastic plates will not be accepted.
   1. All engraving shall be 1/8“ block sans serif characters unless noted otherwise. On dark panels or push buttons, letters shall be white; on stainless steel or brushed natural aluminum plates, or light-colored push buttons, letters shall be black.

I. General Equipment and Cable Labeling
   1. Provide engraved lamicoid labels on the front and rear of active equipment mounted in racks. Mount labels in a neat, plumb and permanent manner. Embossed labels are not acceptable. Equipment labels to have at least three lines of engraving with the first line listing the general name of the device, i.e., DVDR or Frame Sync. The second line to include the schematic reference of the device, i.e., DVDR, or FS. The bottom line to indicate what other devices or areas this equipment controls, i.e., FEEDS SPLITTER or MONITOR/RECEIVER.
   2. Provide an engraved label over each user-operated control that describes the function or purpose of the control. Label size to be adjusted to fit available space.
   3. Engraved labels to have 1/8" high minimum characters. Labels to be black with white characters except where indicated.
   4. Cables and wiring to be logically, legibly and permanently labeled for easy identification. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style label. Hand-written or self-laminating type labels are not acceptable.
   5. Locate the cable designation at the start and end of each cable run and within 2” of the point of termination or connection. For cable runs that have intermediate splice points, the cable shall have the same designation throughout with an additional suffix to indicate each segment of the run. Actual cable designation assignments to be coordinated with owner. Add cable designation codes to system schematic drawings included with Project Record Drawings.
   6. Label each terminal strip with a unique identification code in addition to a numerical label for each terminal. Show terminal strip codes on system schematic drawings included with Project Record Drawings.
   7. Provide adhesive labels on the rear of equipment where cables attach to indicate the designation of the cable connected at that point.

J. Video System Tests. Verify performance of all video equipment, components and systems, as specified herein.
   1. Video (Analog Signal):
      a. S/N (peak to RMS), unweighted DC to 4.2 MHz: 55 dB minimum.
      b. Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum.
      c. Frequency Response: Within plus to minus 0.5 dB to 4.2 MHz.
      d. Line and Field Tilt: 2% maximum.
      e. Differential Gain: 2% maximum.
      f. Differential Phase: 2 degrees maximum.
      g. Signal level: within plus or minus 0.5 dB.
      h. System shall fully conform to SMPTE standards.
i. Video (timing):
  1) System timing: Sync coincidence within 20 nanoseconds.
  2) Color timing: Within 1/2 degree at 3.58 MHz.

2. Video (Digital Signal):
   a. Amplitude: 800mv +/- 10%
   b. Overshoot: 10% of Amplitude
   c. Rise/Fall Time: No less than 0.4 ns, no greater than 1.5 ns, +/- 0.5 ns
   d. Jitter Timing (10Hz): 0.2 UI (740 ps)
   e. Jitter Alignment: 0.2 UI (740 ps) @ 1kHz

3. Video Timing: All video signals shall be in time at switcher inputs without readjustment of source phasing, delay lines, or equalizers for all equipment inputs.

4. Key Signals: All video key signals shall be timed coincident with their associated fill signals at all switcher inputs.

5. Although some delay units (active or passive) may be shown on the video functional block drawing to achieve the required video timing, the Contractor shall be responsible for providing all such units, whether shown on not, that may be required to meet these performance specifications.

6. The delineation of the above signal paths shall not exempt the Contractor from responsibility for checking all paths and outlets for appropriate compliance with the Performance Standards.

3.4 INSTALLER TESTS AND ADJUSTMENTS

A. Verify the following before beginning actual tests and adjustments on the system:
   1. Electronic devices are properly grounded.
   2. Powered devices have AC power from the proper circuit and hot, neutral, and ground conductors are connected correctly.
   3. All products are installed in proper and safe manner according to manufacturers’ instructions.
   4. Insulation and shrink tubing are present where required.
   5. Dust, debris, solder splatter, etc. is removed.
   6. Cable is terminated and tested with a passing grade.
   7. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
   8. All products are neat, clean and unmarred and parts securely attached.
   9. All broken work, including glass, raised flooring supports, ceiling tiles and supports, walls, doors and debris cleaned up and discarded.
   10. All extra materials, portable equipment and spares shall be delivered and stored at the premises as directed.

B. Preparation for Acceptance, prior to final inspection:
   1. Verify each individual component is operating properly
   2. Verify each individual component’s performance meets the manufacturer’s published performance for this unit.
   3. Verify proper operation from controlling devices to controlled devices.
   4. Verify proper adjustment, balance and alignment of equipment for optimum quality and to meet the manufacturer’s published specifications.
   5. Establish and mark normal settings for each level control, and appropriately record these settings within the “System Operation and Maintenance Manual.”
   6. Verify that all communications and networking services are installed and in proper working condition (Ethernet, IP addressing, VLAN, firewall, etc.)
   7. Other tests on equipment or systems as deemed appropriate, such as, but not limited to:
a. Cameras:
   1) Verify Camera power on
   2) Verify all indicators on Camera reflect no short circuit or open circuit conditions
   3) Verify Pan-Tilt arms function smoothly
   4) Verify Focus control is connected and working
   5) Verify Zoom control is connected and working
   6) Verify Camera Head is balanced in front, back and center
   7) Verify Intercom headset is working
   8) Verify the Video mode is set proper mode (HD/SD)
   9) Verify Aspect Ratio is set to proper mode (16:9/4:3)
  10) Verify audio is functional and at appropriate levels
b. Camera Base Stations:
   1) Verify all connectors from base stations to cameras fit snugly into each other and are secure.
   2) Verify that there is no interruption in cable by checking communication link indicator between camera and base station is OK.
   3) Verify On-Air/Tally and ISO indicators function as per manufacturer’s specifications.
   4) Verify cable lengths do not exceed standard maximum recommended lengths for respective cable.
c. CCUs/OCPs:
   1) Verify all cameras are assigned and connected to respective CCU/OCP.
   2) Verify assigned IP addresses and subnet mask are configured correctly
   3) Verify iris control sensitivity, mode, range and center is setup and joystick is calibrated
   4) Verify shading control is turned on
   5) Verify White Balance is set and parameters stored.
   6) Verify control of camera iris
d. Video Production Switcher
   1) Verify assigned IP address and subnet mask is configured correctly
   2) Verify all sources are defined, labeled and routed accurately
   3) Verify all output assignments are accurate and labeled (program vs. preview)
   4) Verify all external devices (DVDRs, SLO MOs, Cameras, etc) are routed accurately
   5) Verify source to button mapping and labeling is to end user preferences
   6) Verify inputs requiring frame sync assigned correctly
   7) Verify tally is operational
   8) Multi-image viewer is configured
e. Monitors
   1) Verify all camera preview cameras have picture from assigned cameras and are labeled as such
   2) Verify program and preview monitors have the correct picture routed to them from production switcher
   3) Verify DVDRs, SLO MO, SHADE monitors have picture
   4) Verify correct aspect ratio is set
   5) Verify monitors are calibrated and color matched
f. Slo Motion electronics
   1) Verify units receive signal on every channel
   2) Verify units transmit signal on every channel
3) Verify software is configured properly
4) Verify playback speeds are operating properly
5) Verify recording and playlists are operating.
6) Verify control panel is operable
7) Verify network and external USB devices transmit/receive
   g. Character Generator
   h. Distribution and conversion components:
      1) Verify units receive and transmit specified cable signal
      2) Verify proper video mode is selected.
   i. Patch bays
      1) Verify each source and destination is correctly labeled
      2) Verify each source and destination patch is clean and has no interference on the line.

C. Commissioning: The following is an attempt to identify some of the commissioning tasks expected of the integrator. At this time this list is not comprehensive, and should be considered a general guideline for the integrator without a defined commissioning process statement.

1. Cameras and tripods
   a. Setup camera in accordance with Manufacturer’s procedure
   b. Balance camera and lens on tripod
   c. Confirm presence and proper operation of:
      1) Lens controllers
      2) Tripod feet, spreaders
      3) All cases and carts
      4) Viewfinders and attachments
      5) Batteries and battery chargers
      6) Specified wireless hardware
   d. Set lens back-focus
   e. Exercise full zoom/focus control on lens
   f. Confirm Remote control panel properly interacts with camera
   g. Confirm tallies function as expected at each CCU and Camera. Provide/plan on green and red tally.
   h. Confirm Intercom connections are balanced and functional; including CCU front panel connections
   i. Confirm video and audio are present
   j. Camera fiber optic operation and troubleshooting

2. Time Code
   a. Confirm time code is set to appropriate clock and offset for team/league requirements
   b. Confirm time code is distributed to all devices with time code inputs (including file servers, tape machines, multi-viewers, etc.)
   c. Confirm time code records properly at all devices
   d. Confirm time code does not cross talk into audio or video circuits

3. Computers, Networking, IP and Data
   a. Coordinate IP address for any equipment supplied herein.
      1) Program Gateways
      2) Program subnets
      3) Coordinate subnets and V-lans with other systems including, but not limited to AV, scoring and video displays, and league statistics.
b. Coordinate firewall and routing configuration if needed between Video Production and house system

c. Set all clocks, software and hardware, to listen to local or network NTP server.

d. If appropriate create auto-logon scripts

e. Establish logical share names, including, but not limited to, AV, scoring and video displays, and league statistics.

f. Set startup process to include logging into appropriate services and servers

g. Establish a defined back up process and train user

h. Install all relevant software including, but not limited to:

1) Clients preference for browser(s)
2) Word processing, spreadsheet, presentation and general office software
3) Adobe Acrobat
4) Software used to control, monitor and troubleshoot any hardware provided herein
5) Creative/Graphic suites as appropriate

i. Ghost all boot and configuration hard drives after setup and acceptance, but before the users begin training.

j. Ghost all boot and configuration hard drives 1 month after acceptance.

k. KVM Systems

1) Label all source and destinations with meaningful labels (e.g. COMP 15-01 is not acceptable; C15-01; Technical Director is).

2) As all sources appear on two separately provided KVMs (one by Video Production and one by Video Scoring Displays) be sure to:
   a) Coordinate labeling
   b) Determine the extent that certain users should be locked out (e.g. not all users should have access to CG keyboard).
   c) Setup a default user environment as to which users can share or just monitor

3) Setup KVM in a training mode, to allow a single user to operate the software, while multiple users can Monitor only the trainer.

l. Connect all data interlinked devices (e.g. Slo Mo, Clips, switcher, protocol translators, robotic cameras, etc) with their sources using appropriate control routing switcher, patches, distribution devices and the like, Confirm:

1) Baud rate, programming speed

2) Desired operations are functional and reliable

3) Interconnection with other systems including, but not limited to, AV, scoring and video displays, and league statistics.

4. Intercom

a. Setup each matrix station with labels as coordinated with the Owner.

b. Setup each party line circuit with labels as coordinate with owner

c. Program each matrix user station in accordance with Owner direction for sources and destinations. Unless otherwise noted, user stations of same type and functional use shall be initially programmed identically.

d. Test each user station to every other station.

e. Stress test the system under event standards so that users are located at each station and attempt to communicate as they would for the event.

f. Setup all wireless communication so that talk/listen is available throughout the covered area. Test with high ambient noise conditions.

g. Balance all users, user station, and intercom sources.

h. Null all party line circuits

i. Test audio monitoring paths and verify appropriate gain structure
5. Audio Phase and Stereo imaging
   a. Check audio phase from each device to each destination, through routing switcher and direct patch. Correct any anomalies.
   b. Check Left/Right pairing from each device to each destination, through routing switcher and direct patch. Correct any anomalies.
   c. Set audio levels through each device to each destination, through routing switcher and direct patch for unity gain. Adjust interfacing devices to accommodate level differences that occur. Correct any anomalies.
   d. Use appropriate test tapes and signals and tones to verify playback level of file servers, tape machines and any device with audio playback capability.

6. SMATV, IPTV, Broadcast cabling and Sound System interconnections
   a. Check audio phase from each device to each destination, through routing switcher and direct patch. Correct any anomalies.
   b. Check Left/Right pairing from each device to each destination, through routing switcher and direct patch. Correct any anomalies.
   c. Set audio levels through each device to each destination, through routing switcher and direct patch for unity gain. Adjust interfacing devices to accommodate level differences that occur. Correct any anomalies.
   d. Check audio and video sources are correctly received at CATV installer location
   e. Check audio and video signals from truck parking area are transmitting and receiving properly.

7. Coordinate proper naming and labeling between video and audio sources and destinations that originate elsewhere including, but not limited to Sound, Broadcast, Distributed TV, Display and LED Scoring devices which may be related work. This shall include but not be limited to: common device labels and nomenclature at each end, rack numbering, all routing interfaces.
   a. After cables are landed and coordinate verify proper connection with each supplier.
   b. Confirm that physical labels correspond to drawing labels and most importantly any alphanumeric control system

8. Production and Routing switcher configurations to Owner/Operator preferences this shall include, but not be limited to:
   a. All equipment settings
   b. Configurations
   c. Software setup
   d. All hardware, button, and software labeling on devices into groups as requested by Owner/Operator.
   e. Routing switcher programming including real and virtual naming configurations, salvo setup and programming and the like.
   f. Assist user in setting up routing to DVDRs and File servers for appropriate game and non-game audio configurations.
   g. Proper Alphanumeric transfer of sources to destinations including under-monitor tally designations, tally and between production and routing switchers. This shall include, but not be limited to:
      1) Multi-viewers
      2) In-monitor tally/under monitor displays whether connected via router or direct to auxiliary bus
   h. Interfaces to other devices for proper operation (e.g. machine and file server control from the production switcher, through a control routing layer, to the end devices).
   i. Tally programming
j. Setup and configure all protocol converters that may be used between devices including but not limited to:
   1) Switchers
   2) Scoring and Video Display systems controllers
   3) File servers
   4) Camera robotics

9. Slo Motion electronics configurations to Owner/Operator preferences

10. Video Routing and Multi-image viewing
   a. Using a SMPTE pattern test each check video path from each device to each destination through routing switcher and direct patch. Correct any anomalies.
   b. With user, determine initial multi-image viewer configuration and layout.
   c. Assign both functional drawing reference and operational naming convention.
   d. Video board processors
   e. Setup of video processing returns

11. Distribution Gear and Signal Processing. Setup all software remote interface and operation software including but not limited to:
   a. Device labeling corresponding to drawings as well as functional use
   b. Signal path processing and/or interconnection paths as allowable
   c. Set alarm and notifications screens as allowed.

12. Record all software settings and create appropriate back up records (paper and electronic as appropriate).

13. Confirm all equipment, loose or fixed, is on site. Provide written list and confirmation of such. Note that this list may be the same as the serial number list required for closeout submittals.

14. Temporary facilities and utilities shall be properly disconnected, removed and disposed of off-site.

15. All systems, equipment and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

16. All materials shall be neat, clean and unmarred and parts securely attached.

17. All broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. shall be replaced or properly repaired, and debris cleaned up and discarded.

18. All extra materials, portable equipment, and spares shall be delivered and stored at the premises as directed.

### 3.5 TEST EQUIPMENT

A. Provide the following equipment on site for final acceptance testing. Test equipment to be available for the entire period through final system acceptance. Prior to start of testing, provide a list to the Owner’s Representative of test equipment make and model numbers that will be used.

1. Dual-trace storage oscilloscope:
2. Television signal generator: Fiber Optic Test Kit:
3. Fiber Optic Visual Fault Locater
4. Video Test Tape/DVD for each format DVD as supplied or recommended by manufacturer.

### 3.6 ACCEPTANCE

A. Upon completion of installation and initial tests and report specified in Part 3, acceptance testing shall be performed by the Owner’s Representative.
B. Acceptance testing will include operation of each major system and any other components deemed necessary. Installer will assist in this testing and provide any test equipment required specified herein. Installer shall provide at least 1 technician available for the entire testing period (day and night), to assist in tests, adjustments, and final modifications. Tools and material required to make any necessary repairs, corrections, or adjustments shall be furnished by the Installer. Testing process is estimated to take a minimum of 1 day.

C. The following procedures will be performed on each System:
   1. Video Signal: From all source inputs (for cameras, character generators, video tape units, etc.) through all VDAs, processors, switchers, etc., to all signal destinations. Verification of correct signal timing for each source, via each path will be made using standard test patterns. Each processing device will be checked such that the signal passes through the device in the no processing mode such that unity luminance, chrominance, and signal timing and phasing conditions are achieved.
   2. Control functions shall be checked for proper operation, from controlling devices to controlled devices.
   3. The audio fidelity test shall consist of driving the system with pink noise and measuring the response in each 1/3 octave band from 40 to 16,000 Hz. Octave, 1/3 octave, or notch filters as specified shall be used to adjust the response as necessary to fit the requirements of the space.
   4. Adjust, balance, and align equipment for optimum quality and to meet the manufacturer’s published specifications. Establish and mark normal settings for each level control with small white, adhesive dots, and record these settings, in the “System Operation and Maintenance Manual.”
   5. Installed and loose equipment will be inventoried for correct quantity.
   6. Any other test on any piece of equipment or system deemed appropriate.

D. In the event the need for further adjustment or work becomes evident during equalization and/or acceptance testing, the Installer will continue his work until the system is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, the Installer will pay for additional time and expenses of the Owner’s Representative.

E. The Owner’s Representative’s fees and costs involved in acceptance testing are not the responsibility of the Video Production Installer, except as described in Part 3 of this specification.

F. In the event that the Video Production system is used prior to final acceptance, attendance in support of that usage shall not be construed as acceptance, or as event attendance.

G. Final Acceptance shall occur after the system has functioned without failure for two regular season home games or delivery of closeout documents, whichever is later. Failure due to owner’s operators, spectators, or force majeur will not be considered event failure; failure due to installer’s operators will be considered a failure.

3.7 DEMONSTRATIONS AND TRAINING

A. Manufacturer’s trainers to provide operations and service training on the following major equipment components and subject matter:
   1. Production Switcher
      a. Internal timing adjustments
b. Normal switcher operations
c. Use of Aux Buss with DVE
d. Programming switcher effects memory
e. Software configuration
f. Switcher configuration

2. CG/Clips
3. Slo Mo

B. Integrator’s trainers to provide operations and service training on the following major
equipment components and subject matter
1. Camera and lens training
2. Camera shade/paint control
3. Intercom
4. Audio and Video routing
5. Camera fiber optic operation and troubleshooting

C. Manufacturer training will not be required where the item of equipment is owner furnished,
part of an option that is not selected, or an item of equipment that is not actually purchased.

D. Training Schedules
1. Manufacturer’s training should be assumed to take place on the project site, unless
   agreed to by the Owner.
2. Training should be scheduled to be non-overlapping, unless agreed to by the Owner.
3. Actual training schedule shall be by agreement with Owner.
4. In the event that a portion of the training time is occupied in troubleshooting the
equipment installation, then the training time shall be extended an equal amount of
time.

E. The following is a general idea of the training “curriculum”:
1. A general familiarization of the device
2. An explanation of how the device interfaces to the rest of the video production system
   (including data connections; timing requirements and the like).
3. General training on operating the device
4. Specific training on device operation
5. Saving information; backing information up.
6. Basic troubleshooting
7. Specific troubleshooting (this information may be conveyed to personnel other than the
device’s “operators”).
8. How to upgrade software; precautions taken while doing (e.g. backing-up existing
   software)

F. In addition to Manufacturer training, provide no less than 4 hours of “systems operation and
maintenance” instruction to Owner designated personnel on the use and operation of the
System. This instruction will consist of two portions:
1. A minimum of one session, by an instructor fully knowledgeable and qualified in
   system operation. The System Reference Manuals should be complete and on site at the
time of this instruction. It is anticipated that these sessions will break down into:
   a. A general system familiarization for all control room operators
   b. A detailed system operational training
   c. An Engineering training focusing on the system’s configuration and maintenance
3.8 EVENT ATTENDANCE

A. Be present at the four (4) events of the season as designated by Owner.

B. Schedule (1) day with Owner during mid-season to review systems and equipment operation.

C. During these events, attendance shall begin at the first crew call and conclude when the crew is released. During these events perform such tasks (e.g. assistance with timing, patching, routing, shading, troubleshooting cabling problems, etc.) as requested by user. Tasks shall be strictly assistance, not operation.

D. In the event that the system is used prior to final acceptance, attendance in support of system usage shall not be construed as acceptance, or as event attendance.

E. Coordinate these schedules with the owner.

END OF SECTION 116350
SECTION 27 60 00 – BROADCAST CABLELING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination, provision, installation, inspection, configuration, testing, instruction, and warranties of a high quality, large scale, Broadcast Cabling system

B. Labor, equipment, materials, tools, transportation services, supervision, coordination, etc., to accomplish this and have a complete working system.

C. Also includes:
   1. Required licenses and permits including payment of charges and fees.
   2. Verification of dimensions and conditions.
   4. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.
   5. Extension of electrical service, including ground, to equipment locations.

1.2 ABBREVIATIONS

A. The following abbreviations may be used throughout this Division
   1. AES/EBU — Audio Engineering Society – European Broadcasting Union
   2. ANSI — American National Standards Institute
   3. ASME — American Society of Mechanical Engineers
   4. ASTM — American Society for Testing Materials
   5. ADA — Americans with Disabilities Act
   6. AKA — Also known as
   7. AM — Amplitude Modulation
   8. AV — Audio Video
   9. AWG — American Wire Gauge
   10. BD — Blu-Ray Disc
   11. BFU — Board of Fire Underwriters
   12. BICSI — Building Industry Consulting Services International
   13. BET — Building Entrance Terminal
   14. CATV — Community antenna television
   15. CFCI — Customer Furnished Customer Installed
   16. CD — Compact Disc
   17. C-EST — Certified – Electronic Systems Technician
   18. CO-OSP — Customer owned outside plant
   19. CSA — Canadian Standards Association
   20. CTS-I — Certified Technology Specialist - Installation
   21. DB — Decibel
   22. DBM — Decibel referenced to one millivolt
   23. DEC — Department of Environmental Conservation
   24. DSP — Digital Signal Processing
   25. DVD — Digital Video Disc AKA Digital Versatile Disc
   26. DVI — Digital Visual Interface
   27. EF — Entrance facility
28. EIA — Electronic Industries Alliance
29. EMI — Electromagnetic interference
30. ER — Equipment Room
31. ES — Electronic Systems
32. ESPA — Electronic Systems Professional Alliance
33. FCC — Federal Communications Commission
34. FM — Frequency modulation
35. GB — Gigabyte
36. Gb — Gigabit
37. GE — Ground Equalizer
38. GPIO — General Purpose Input Output
39. HC — Horizontal Cross-Connect (IDF)
40. HD — High Definition
41. HDCP — High-bandwidth Digital Content Protection
42. HDMI — High Definition Multimedia Interface
43. HD-SDI — Serial digital interface standardized by SMPTE
44. HVAC — Heating, ventilation, and air conditioning
45. Hz — Hertz
46. IC — Intermediate Cross-Connect
47. IDC — Insulation Displacement Connector
48. IDF — Intermediate Distribution Frame
49. IDR — Intermediate Distribution Room
50. IEEE — The Institute of Electrical and Electronics Engineers
51. I/O — Information Outlet or Work Area Information Outlet
52. IPTV — Internet Protocol Television
53. ISD — Information Systems Division
54. ISO — International Standards Organization
55. ITS — Information Transport System
56. JBA — Connection Interface for “In House Production Cabling”
57. JBC — Connection Interface for “Coaching Cables”
58. JBE — Connection Interface for ENG Cables
59. JBK — Connection Interface for Aerial Camera Cables
60. JBT — Connection Interface for Network Broadcast Cables
61. KB — Kilobyte
62. Kb — Kilobit
63. KHz — Kilohertz
64. LAN — Local Area Network
65. LCD — Liquid Crystal Display
66. LED — Light Emitting Diode
67. Mb/s — Megabits per second
68. MC — Main cross-connect AKA Main Distribution Frame (MDF)
69. MDF — Main distribution frame AKA main cross-connect (MC)
70. MHz — Megahertz
71. N/A — Not Applicable
72. NEC — National Electrical Code
73. NEMA — National Electrical Manufacturers Association
74. NESC — National Electrical Safety Code
75. NICET — National Institute for Certification in Engineering Technologies
76. NFPA — National Fire Protection Association
77. NIC — Not In Contract
78. OB — Outside Broadcast (Mobile Broadcast Unit)
1.3 RELATED WORK

A. Division: Electrical.

B. Division: AV, Video Production

1.4 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
2. Electronics Industries Association (EIA).
1.5 DESCRIPTIONS AND REQUIREMENTS

A. The following is intended to further describe the Work and clarify design intent and is not an exhaustive description of the Broadcast Cabling Systems.

B. The Broadcast Cabling System consists of “pool” cabling to support television broadcast systems and in-house video replay (In House Production). Each system has cable home run from the field origination to the Video Production with tie lines between the pedestal and the video production room. This will give patchable access for both entities to use lines to various areas of the facility.

1. JBT’s are used by Television Broadcasters and in-house production. All cables terminate at the Network Cross Connect racks at the Truck Dock TVRP.

   a. All cables terminating in the Cross Connect racks shall terminate in a rack-mounted interface plates.

      1) NOTE: Fiber optic cabling is specified by CCG and not part of this scope

C. Triax panels:

   1. Field panels are to provide isolated modularity to mount any combination of triax connectors with up to 2 connectors on a single panel.

   2. Cross Connect panels are the same basic panel with the cable types being grouped into different sections.

D. Single Mode Fiber Optic Cable:

   1. Specified by CCG

1.6 RESPONSIBILITY AND RELATED WORK

A. The Installer is to coordinate the work with the General and Electrical Contractors, and the scheduled work of other trades.

B. Conduit, wire ways, floor boxes, wall boxes, pull boxes, junction boxes, and AC power circuits and ground wiring to the Broadcast Cabling System are provided by the Electrical Contractor. This does not relieve the Broadcast Cabling System Installer from responsibility
for a complete working system. Coordination with the Electrical Contractor is required to achieve a proper conduit system.

C. Supply accessories and minor equipment items needed for a complete system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.

D. The Installer is responsible for providing all components necessary for complete and operational system. Any system changes or revisions necessary to make the system conform to the building, walls, steel, electrical services etc., shall be included at time of bid and installed without claims for additional compensation.

E. The owner reserves the right to make reasonable device and equipment location changes prior to rough installation without claim for additional expense.

F. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Broadcast Cabling System Installer to supply systems in full working order. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification requires Broadcast Cabling System Installer to supply items and quantities according to the intent of the Specifications and associated Drawings without claim for additional payment.

G. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner including any associated charges or fees.

H. Execute all work in accordance with the National Electrical Code, the National Electrical Safety Code, and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract document and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

1.7 QUALITY ASSURANCE

A. Contractor’s Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:
   1. No less than three years of experience with equipment and systems of the specified types.
   2. Experience with at least three comparable scale projects within the last two years.
   3. Be a franchised dealer and service facility for the manufacturer’s products furnished.
   4. Provide manufacturer-certified installer for passive LAN components. Submit copies of certification.
   5. Maintain a fully staffed and equipped service facility.
   6. At the request of the Owner’s Representative, demonstrate that:
      a. Adequate plant and equipment is available to complete the work.
      b. Adequate staff with commensurate technical experience is available.

B. Manufacturer's Qualifications: No less than 5 years continuous experience in the production of specified types of product. Production per applicable NEMA standards.
1.8 SUBMITTALS:

A. The submittal information required by the specification is to be presented complete and as submissions noted below. Cost for the Owner’s Representative to review secondary and re-submittals due to the Installer's failure to include all required submittal information, or rejection of incomplete or improperly prepared submittal information will be the responsibility of the Installer.

B. Project Submittal:
   1. Provide for approval not later than thirty (30) days after issuance of Notice to Proceed and prior to commencement of Work:
      a. Section 1: A complete schedule of submittals.
      b. Section 2: A chronological schedule of Work in bar chart form. Revise and resubmit schedule as required to reflect construction progress.
   2. Provide for approval no later than sixty (60) days after issuance of notice to proceed and in accordance with previously submitted submittal schedule.
      a. Section 1: Complete list of product to be incorporated within the Work.
      b. Section 2: Manufacturer’s data sheets for each product. Provide original manufacturer’s data sheets in order as they appear in the specification. These data sheets are submitted for each product in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the Work.
      c. Section 3: Samples of field and rack panel materials.
   3. Drawings:
      a. Provide drawings created on a computer aided drawing (CAD) system compatible with AutoCAD.
      b. Installation Drawings: Provide drawings showing special details depicting methods and means specific to each product, assembly and each product manufacturer’s recommended installation methods and means.
      c. Schematic Drawings: Provide drawings detailing inter-component and intra-component, on contractor assembled components or fabricated products, wiring and cabling diagram depicting cable types, designator and color codes. Give each component a unique designator and use this designator consistently throughout the project.
      d. Equipment Drawings. Provide drawings showing location of equipment in racks or other locations (JBT etc.) with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
      e. Floor plan and Section Drawings. Provide drawings showing the exact location of all installed equipment on floor plans and/or sections such as, racks, service boxes, etc.
      f. Patch Panel Drawings. Provide detailed drawing of patch panel layouts and designation (labeling) strips, including color schemes.
      g. Custom Enclosures and Millwork Drawings. Provide full fabrication detail drawings indicating size, material, finish and openings for equipment.
      h. Fabricated Plates and Panels Drawings. Provide complete drawings on custom fabricated plates or panels. Drawings to include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
      i. Schedule Drawings. Provide wiring schedule drawings showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting and location.
j. Labeling Drawing. Provide representative equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and descriptor and designator schedule.

k. General Detail Drawings. Provide detail drawings depicting any unique installation methods specific to each product.

l. Any other pertinent data generated which is necessary to provide the Work.

4. Submittal Format:
   a. Provide each submittal with a unique number and be numbered in consecutive order.
   b. Provide each submittal with a cover reflecting the project title and submittal number.
   c. Provide each submittal with a complete table of contents with the following information:
      1) Project title and number.
      2) Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and be numbered in consecutive order.
      3) Date of submission.
      4) Referenced addendum or change-order number as applicable.
      5) Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
      6) Index Product Data sheets by manufacturer and model or part number.
      7) Separate major grouping with labeled binder tabs.
      8) Each submission page stamped with Contractor’s certification stamp, initialed or signed certifying:
         a) Review, approval and acceptance of submission.
         b) Certification of product compliance to specification.
         c) Verification product may be incorporated within the work.
      9) Arrange product data list in alpha-numeric order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer’s data sheets, arranged in the same order. If a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
      10) Drawings executed at an appropriate scale, not smaller than 1/8"=1'.

5. Submittal Copies:
   a. These requirements represent minimum project requirements; a project’s general conditions may require additional copies for project distribution.
   b. Submittal shall include CDR with all information, drawings, and reports in .pdf format.

6. Resubmission Requirements:
   a. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
   b. Indicate any changes that have been made other than those requested.

1.9 PROJECT RECORD MANUAL

A. Submit three bound original sets (this is a minimum of two for the Owner and one for the Owner’s Representative; additional copies may be required by the project’s general conditions) after substantial completion and prior to final inspection.

B. The Project Record Manual shall be segregated into three separate sections as follows:
1. Operations Manual:
   a. Product Data: Product actually incorporated within the Work:
      1) Manufacturer's data for each type of product conforming to the scheme
         above. The list shall include manufacturer’s serial numbers.
      2) Each products Owner/Instruction Manual.
      3) For custom circuits or modifications, a description of the purpose,
         capabilities, and operation of each item.
      4) Manufacturer's wiring diagram for each type of product actually
         incorporated.
      5) Separately bound list by manufacturer and model or part number of all
         products incorporated within the Work arranged in alphanumerical order.

2. Record drawings: Final rendition of that specified depicting what is actually
   incorporated within the Work.
   a. Test Reports: Recorded findings of testing requirements outlined in Part 3.
   b. System Operation and Instructions: Prepare a complete and typical procedure for
      the operation of the equipment as a system, organized by subsystem or activity.
      1) This procedure should describe the operation of all system capabilities.
      2) Assume the intended reader of the manual to be technically experienced
         but unfamiliar with the components and the facility.

3. Service & Maintenance Manual:
   a. Provide an original copy of the service manual on every piece of equipment for
      which the manufacturer offers a service manual. Arrange manuals in the same
      order as the operations manual.
   b. Manufacturer’s maintenance and care instructions.
   c. Maintenance Instructions, including maintenance phone number(s) and hours;
      maintenance schedule; description of products recommended or provided for
      maintenance purposes, and instructions for the proper use of these products.
   d. Warranty Manual:
      1) Manufacturer's warranty statements on each product.
      2) Date of substantial completion and ending dates for warranties for each
         group of products.
      3) Software registration and licenses.
   e. Record drawings:
      1) Final rendition Shop Drawings defined in this section depicting system as
         installed. Provide a CD-ROM containing all CAD generated drawings
         prepared in conjunction with this project. Drawing files to be in both
         AutoCAD Release 2010 DWG format and DWF formats. Include CD(s)
         under a separate section in the Operations Manual.

4. Include any other pertinent data generated during the Project or required for future
   service.
5. Appropriately duplicate data within the separate bindings when it will reasonably
   clarify procedures, e.g., operational data in maintenance binding.
6. Include 1 CDR of all manuals and reports in .pdf format.

1.10 DELIVERY, STORAGE, AND HANDLING

   A. Ship product in its original container, to prevent damaging or entrance of foreign matter.

   B. Handling and shipping in accordance with manufacturer’s recommendation.
C. Provide protective covering during construction, to prevent damaging or entrance of foreign matter.

D. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Owner’s Representative for approval, showing how the work may be installed.

1.12 FINAL INSPECTION AND TEST

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Owner’s Representative no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one (1) person for inspection and two (2) persons for testing familiar with aspects of the System to assist the Owner.

C. The process of testing the System may necessitate moving and adjusting certain component parts. Perform such adjustments without claim for additional payment.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, and any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner’s Representative, at the standard rate in effect at that time.

1.13 WARRANTY

A. Warrant labor and product for twelve months following the date of the first trouble free operation, or substantial completion, whichever is later.

B. System is to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge.

C. This warranty shall not void specific warranties issued by the manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.
D. Within the warranty period, answer service calls within eight hours, and correct the deficiency within twenty four hours.

1.14 INSTRUCTION OF OWNER PERSONNEL

A. After final completion, provide instruction to Owner designated personnel on the use, operation, maintenance and care of the System.

B. Develop instructional course based on the use of the System and manufacturers’ recommendation. Develop course so no period will last longer than one and a half hours without a fifteen minute break. Partition course so that operational and maintenance training are independent and subsequent.

C. Submit an outline of the course with sample instructional aids for approval thirty days prior to scheduled instructions.

D. System installer shall be present at first event where cabling is utilized.

1.15 ADD ALTERNATES

A. The following systems are to be priced as additive alternates to the base building broadcast cabling system.
   1. Pricing shall include costs necessary to fully implement the system and interface it into the base building system.
   2. Each alternate shall be considered independent and not reliant on the acceptance of another alternate.

B. Alternate BC-1 (JBT Slash position)
   1. Provide Box and cable as shown on drawings and box/cable schedule

C. Alternate BC-2 (JBT Outside Home Locker room)
   1. Provide Box and cable as shown on drawings and box/cable schedule

D. Alternate BC-3 (JBT Outside Visitors Locker room)
   1. Provide Box and cable as shown on drawings and box/cable schedule

E. Alternate BC-4 (JBT End line)
   1. Provide Box and cable as shown on drawings and box/cable schedule

F. Alternate BC-5 (Pull 6 Coax lines from Video Production to SE Floor box)
   1. Provide cable as shown on box/cable schedule

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed to establish a standard of product quality.

B. Substitution of specified products with other qualified manufacturers and products will be considered providing:
1. Proper substitution procedures outline under Division 1 is adhered to.
2. Sufficient data of the products is presented for prior approval including technical data, manufacturer’s specifications, samples, and, if requested, results of independent testing laboratory tests.

C. If proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review. Include a list of previously installed projects using proposed equipment that are similar in nature to specified System.

D. Provide product not specifically specified commensurate with the quality and standards established by the specified product.

2.2 GENERAL

A. Products shall be new, free from defects.
B. All materials shall fully comply with Underwriters’ Laboratories or other acceptable testing agencies acceptable to local authorities with jurisdiction
C. Provide product of a given type from one manufacturer.
D. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturer's published specifications.
E. All cable shall be compliant with NEC as applicable, and UL listed or CSA certified.
F. Provide flooded or direct burial cable for underground conduits.
G. Provide stainless steel mounting hardware for all panel mounting and connector mounting.
H. Sealing Conduits:
   1. The inside the building conduits and the end (outdoor JBT) of a conduit to be sealed to prevent air movement to or from the building. Use a duct sealer that is compatible with cable jacket.
   2. Re-seal conduits whenever additional cable is installed.

2.3 TRIAX CABLE

A. Riser Rated Triax Cable:
   1. Standard of Performance
      a. Belden 8233A
      b. Clark TV7511DR
      c. Gepco VT61811 or VT61811SC (where underground/riser rated cable is required).

B. Plenum Rated Triax Cable:
   1. Standard of Performance
      a. Belden 8233P
      b. Clark TV7511DP
      c. Gepco VT61811TK
C. Underground Rated Triax Cable:
   1. Standard of Performance
      a. Belden 8233WP
      b. Clark TV7511DB
      c. Gepco VT61811PEF

2.4 ANALOG AUDIO CABLE

A. Riser Rated Audio Cable 6 pair:
   1. Standard of Performance:
      a. Belden 1816R
      b. Clark 706
      c. Gepco GA61806GFC

B. Plenum Rated Audio Cable 6 pair:
   1. Standard of Performance:
      a. Belden 1816P
      b. Clark 22EPS6P
      c. Gepco 6606HS (heat shrink each pair required)

C. Underground Rated Audio Cable 6 pair:
   1. Standard of Performance:
      a. Belden 1816WB
      b. Clark 706DB
      c. Gepco GA61806PEF

D. Riser Rated Audio Cable 4 pair:
   1. Standard of Performance:
      a. Belden 1815R
      b. Clark 704
      c. Gepco GA61804GFC

E. Plenum Rated Audio Cable 4 pair:
   1. Standard of Performance:
      a. Belden 1815P
      b. Clark 22EPS4P
      c. Gepco 6604HS (heat shrink each pair required)

F. Underground Rated Audio Cable 4 pair:
   1. Standard of Performance:
      a. Belden 1815WB
      b. Clark 704DB
      c. Gepco GA61804PEF
      d. Lake Cable AVB224ASCDB

G. Riser Rated Audio Cable 2 pair:
   1. Standard of Performance:
      a. Belden 1814R or 9451D
      b. Gepco GA61802GFC

H. Plenum Rated Audio Cable 2 pair:
1. Standard of Performance:
   a. Belden 9451DP
   b. Gepco 6602HS, (heat shrink each pair required)

I. Underground Rated Audio Cable 2 pair:
   1. Standard of Performance:
      a. Belden 1814WB
      b. Gepco GA61802PEF

J. Analog Audio Cable single pair (Inner Rack Wiring):
   1. Standard of Performance:
      a. Belden 9451
      b. Clark SPA22GS
      c. Gepco 61801EZ
      d. West Penn 451

2.5 UTP Cable

A. Telephone/TieLine UTP Cable:
   1. Standard of Performance:
      a. CommScope 7504.
      b. Belden 7852A
      c. Mohawk M56905
      d. Gepco CT604/450P

2.6 MISCELLANEOUS CABLE

A. DMX Control Cable:
   1. Standard of Performance:

2.7 CONNECTORS

A. Receptacles:
   1. XLR-3M:
      a. Standard of Performance:
         1) Neutrik NC3MDL-B-1.
   2. XLR-3F:
      a. Standard of Performance:
         1) Neutrik NC3FDL-B-1.
   3. Triax Cable Connector:
      a. Standard of Performance:
         1) Kings 7703-6
         2) ADC ProAx ATCJ-A12

B. Plugs:
   1. XLR-3MP:
      a. Standard of Performance:
         1) Neutrik NC3MX-B.
   2. XLR-3FP:
      a. Standard of Performance:
         1) Neutrik NC3FX-B.
3. Triax Cable Connector:
   a. Standard of Performance:
      1) Kings 7705-3
      2) ADC ProAx ATCP-A12

4. Triax Crimping Tool:
   a. Standard of Performance:
      1) Gepco G37MP
      2) King

2.8 PANELS:

A. Blank Panels:
   1. Standard of Performance:
      a. Middle Atlantic BL series

B. Vent Panels:
   1. Standard of Performance:
      a. Middle Atlantic VTF series

C. Triax/SMPTE Plug/Jack Panel:
   1. Standard of Performance:
      a. Field (camera platform) panel:
         1) Clark Modular Frame MPA-ISS with MP-T Kings triax module.
         2) Gepco Modular
         3) Whirlwind custom
      b. Interconnect (rack) panel:
         1) Clark Modular Frame MPS-OSS with MP-T Kings triax module.
         2) Gepco Modular
         3) Whirlwind custom

D. Audio Panels:
   1. Standard of Performance:
      1) Clark Wire and Cable Custom
      2) Gepco Custom
      3) Whirlwind custom

E. Broadcast Rack Mount Screws:
   1. Standard of Performance:
      a. McMaster-Carr or equal

2.9 HD-SDI AND FIBER DISTRIBUTION

A. HD-SDI to HDMI Convertor (CONV):
   2. Video input Impedance: 75 ohms.
   3. Video output: 1 HDMI Type A connector
   4. Digital Processing: 30-bit: 8, 10 and 12 bits per color.
   5. Provide rack mount kit.
   6. Acceptable product:
      a. Extron DSC 3G A-DA3
B. HDMI DA
   1. Video input: HDMI Type A connector.
   2. Local video output: HDMI.
   3. Resolution range: 2K, 4K @ 30Hz.
   4. Interconnection between transmitter and receivers: HDBaseT.
   5. Provide with rack mount kit.
   6. Acceptable product:
      a. Extron DTP HD DA8 330

C. HDMI Receiver (DV):
   1. Video output: HDMI Type A connector.
   2. Mounting: 2 gang wall plate.
   3. Power: remotely from transmitter.
   4. Acceptable product:
      a. Extron DTP HDMI 330 D Rx

D. Fiber Transmitter (FOTX):
   1. Provide a single card fiber transmitter for: analog, SDI or HD-SDI video and 4 analog
      or AES audio channels.
   2. Inputs: video and audio inputs are auto-sensing.
   3. Supports analog to digital and digital to analog conversions.
   4. Connectors: ST single mode fiber and unbalanced AES.
      a. Evertz 7707ADVT-HD.

E. Fiber Receiver (FORX):
   1. Provide a single card fiber transmitter for: SDI or HD-SDI video and 4 AES audio
      channels.
   2. Inputs: video and audio inputs are auto-sensing.
   4. Connectors: ST single mode fiber and unbalanced AES.
      a. Evertz 7707ADVR-HD.

F. Rack Frames:
   1. Provide EIA rack mounted card frame.
   2. Provides for 20 front mounted cards.
   3. Quantities as required.
      a. Evertz 7800FR with redundant power supply.

G. Court Side Snakes:
   1. Single Mode Fiber Snakes
      a. Verify length of cables from JBT box to side court tables
         b. Standard of Performance
            1) Gepco GST18-B-##-ST/ST-B
   2. Audio Snakes:
      a. Verify length of cables from JBT box to side court tables
      b. Connectors: Male XLR on one end and female XLR on the opposite end
      c. Standard of Performance
        1) Gepco SKJX12 – ##- XF-XM
2.10 AUDIO AND SDI DISTRIBUTION

A. Audio Distribution Amplifier (ADA):
   1. Standard of Performance:
      a. ATI System DA2016-1.

B. Transformers:
   1. Standard of Performance:
      a. Jensen PI-2XX

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.

B. The installation recommendations contained within ASDI and TDMM are mandatory minimum standards and requirements.

C. Mount equipment and enclosures plumb and level.

D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five.

3.2 INSTALLATION OF CABLE AND WIRING

A. Cabling and Wiring:
   1. Install cable in a manner to adhere to manufacturer’s specifications for maximum cable pulling tension, minimum bend radius, and rigging calculations and restrictions.
   2. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
   3. Provide splice free wiring and cabling from origination to destination.
   4. Make joints and connections with rosin-core solder or with mechanical connectors approved by the Owner’s Representative; where spade lugs are used, crimp properly with ratchet type tool.
   5. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signal, float cable shield at the output of source device. Shield not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
   6. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section in compliance with ASDI article 12.3.
   7. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommeting.
   8. Install cable so that a radius bend of no less than ten times the cables OD is maintained.

B. Housing Cabling and Wiring:
   1. Provide 1”-6” minimum service loop within junction boxes to enable plates to be removed from the junction box and serviced.
2. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag.

3. Cables should be dressed to permit individual plates and panels to be removed, without disturbing adjacent plates or panels.

4. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.

5. Provide plastic cable ties or lacing twine to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.

6. Install with connections completely visible and labeled.

3.3 INSTALLATION OF CONNECTORS, PLATES AND PANELS

A. Mount equipment and enclosures plumb and square. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least three. Seismic bracing shall be installed on appropriate equipment where local and state codes require installation.

B. Custom rack panels shall be 1/8 inch thick aluminum with flanges, standard EIA sizes, brushed black anodized finish (brushed in direction of aluminum grain only), unless otherwise noted.

C. Custom connector plates (speaker, microphone, etc.) are typically stainless steel, unless otherwise noted or specified. However, it is the Installer’s responsibility to verify plate finish with the Owner’s Representative.

D. Install XLR type connectors in accordance with IEC-268 standard, with a wiring scheme of pin 2 hot (high), pin 3 (low), and pin 1 screen (shield).

E. All patch panels shall be wired so that signal “sources” (output from devices) appear on the upper row of a row pair and all “loads” (inputs to devices) appear on the lower row of a row pair.

3.4 INSTALLATION OF POWER AND GROUNDING

A. Coordinate final connection of power and ground wiring to housings.

3.5 LABELING OF EQUIPMENT

A. Provide engraved lamicoid label adjacent to the front and rear of equipment mounted in housing. Install in a plumb, level, and permanent manner. Provide rear mounted labels on equipment mounted in furniture console.

B. Provide typed label on each patch panel designating port signal. If patch panel does not have labels provided, then provide on 80 pound paper stock utilizing 10 point block sans serif font.

C. Provide engraved label over each user-operated control that describes the function or purpose of the control. Adjust label size to fit available space.

D. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on System schematic drawing.
E. Provide logical and legible cable and wiring label permanently affixed for easy identification.

F. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style

G. The cable label nomenclature shall correspond to the owner’s directed signage and way finding program.

H. Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection. Provide cable designator on circuits with intermediate splice points with an additional suffix to indicate each segment.

I. Provide simple one line diagrams and floor plans with box locations and labels in each radio booth.

J. Provide a 24 inch by 36 inch reference diagram detailing all patch panel connections for each system (e.g. Event Broadcaster, ENG and Video Replay). Diagram shall be laminated or sandwiched between Plexiglas, mounted in interconnect rooms. Diagram shall show remote input locations, patch panel normals, tie lines, and generally be a useful and informative diagram. Provide color-coding where it will enhance clarity and understanding.

3.6 INSTALLER TESTS AND ADJUSTMENTS

A. Verify the following before beginning actual tests and adjustments on the system:
   1. Electronic devices are properly grounded.
   2. Powered devices have AC power from the proper circuit and hot, neutral, and ground conductors are connected correctly.
   3. Insulation and shrink tubing are present where required.
   4. Dust, debris, solder splatter, etc. is removed.
   5. Cable is dressed, routed, and labeled.
   6. Connections are consistent with polarity.

B. Preparation for Acceptance, prior to final inspection:
   1. Temporary facilities and utilities shall be properly disconnected, removed and disposed of off-site.
   2. All systems, equipment and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
   3. All materials shall be neat and clean, unmarred and parts securely attached.
   4. All broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc., shall be replaced or properly repaired and debris removed and discarded.
   5. All extra materials, portable equipment, and spares shall be delivered and stored at the premises as directed by Owner.

C. Grounding System Tests:
   1. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.
   2. Temporarily lift the technical ground from the main electrical ground, measure and record the DC resistance between them. Resistance should be at least 1000 ohms.

D. Cabling System Tests:
1. SMPTE Hybrid Cable - ALTERNATE
   a. Refer to LEMO SQL-04-BO98E for SMPTE testing procedures.
   b. Record readings for power loss and return loss.
   c. Test installed cable, without pigtails, first.
      1) Attenuation testing from both ends
   d. SMFO: test at 1310 and 1550 nm
      1) Identify any wiring errors and repair as required.
      2) Provide hard copies of attenuation tests.
      3) Above test reports to include link attenuation = Calculated cable
         attenuation + connector attenuation + splice attenuation.
   e. OTDR
      1) Provide printed copies of the OTDR trace for records. Provide location and
         cable number if applicable.
   f. Test Installed cable, with pigtails.
      1) Attenuation testing from both ends
      2) SMFO: test at 1310 and 1550 nm
         a) Identify any wiring errors and repair as required.
         b) Provide hard copies of attenuation tests.
         c) Above test reports to include link attenuation = Calculated cable
            attenuation + connector attenuation + splice attenuation.
   g. OTDR
      1) Provide printed copies of the OTDR trace for records. Provide location and
         cable number if applicable.

2. Triax Cable
   a. Low Power Tests: Utilize a Gepco TT-22 or equal for test units. Identify any
      wiring errors and repair.
   b. High Power Test: After low power test, perform a high voltage wiring and
      cabling test with a megohmeter (Megger®) to test for the following:
   c. Center conductor to inner shield isolation: Test using 2500 volt DC for a period
      of not more than 2 seconds and look for high capacitance in the cable. Set the
      sensitivity for over-current to 50% setting.
   d. Inner shield to outer shield isolation: Test using 2500 volt DC for a period of not
      more than 2 seconds. The braid cabling and thin dielectric should exhibit a high
      capacitance. This is an important test as most triax cameras are powered over the
      two shields. The cameras typically operate between 160 to 240 volts DC or AC.
   e. TDR tests:
      1) Perform Time Domain Reflectometer (TDR) tests on triax cable to test for
         cable irregularities and length.
      2) Perform TDR test on the inner conductor and inner shield. Provide test data
         in graph form as part of the as built documentation provided to owner.
      3) Perform TDR between the inner and outer shields to check for kinks, water
         ingress or defects between shields. Provide test data in graph form as part
         of the as built documentation provided to owner.
   f. Return Loss (RL) Tests:
      1) Provide a dual port network analyzer with VSWR bridge and impedance
         matching transformers.
      2) Sweep cables from 5Mhz to 3GHz.
      3) Repair cables that do not meet manufactures Return Loss (RL). Typical
         return loss readings for RG-11 triax.
      4) From 5Mhz to 850MHz – Minimum of -20dB
      5) From 850MHz to 3GHz – Minimum of -15dB
6) Provide test data in graph form as part of the as built documentation provided to owner. Provide manufacture’s stated Return Loss as part of the documentation.

g. Sweep Tests:
   1) Sweep triax inner conductor and inner shield using a spectrum analyzer with an internal generator. Provide a triax jumper cable to loop test signal from tracking generator back to analyzer.
   2) Sweep cables up to a minimum of 3GHz. Record the coax loss at 200MHz, 1.5GHz and 3GHz.

3. Video Coax
   a. Low Power Tests: Utilize a Gepco TT-22 with Triax to BNC adapters or equal for test units. Identify any wiring errors and repair.
   b. High Power Test: After low power test, perform a high voltage wiring and cabling test with a megohmeter (Megger®) to test for the following:
      1) Center conductor to shield isolation: Test using 2500 volt DC for a period of not more than 2 seconds and look for high capacitance in the cable. Set the sensitivity for over-current to 50% setting.
   c. TDR tests:
      1) Perform Time Domain Reflectometer (TDR) tests on coax cable to test for cable irregularities and length.
      2) Perform TDR test on the inner conductor and shield. Provide test data in graph form as part of the as built documentation provided to owner.
   d. Or Return Loss (RL) Tests:
      1) Provide a dual port network analyzer with VSWR bridge and impedance matching transformers.
      2) Sweep cables from 5Mhz to 3GHz.
      3) Repair cables that do not meet manufactures Return Loss (RL). Typical return loss readings for RG-6 digital coax.
      4) From 5MHz to 1.6GHz – Min -21dB
      5) From 1.6GHz to 3GHz – Min -20dB
      6) Provide test data in graph form as part of the as built documentation provided to owner. Provide manufacture’s stated Return Loss as part of the documentation.
      7) Sweep Tests:
      8) Sweep using a spectrum analyzer with an internal generator. Provide a coax jumper cable to loop test signal from tracking generator back to analyzer.
      9) Sweep cables up to a minimum of 3GHz. Record the coax loss at 200MHz, 1.5GHz and 3GHz.

4. Audio Cables
   a. Test XLR’s and DT-12 (multi-connector) where they are hard split.
   b. Test conductors and shield for shorts to building ground.
   c. Test for shorts between conductors and shield.
   d. Test that cable is wired to industry standard pin 2 high, pin 3 low and pin 1 screen (shield).

5. Test UTP cable at in accordance with the referenced "Standards". Provide two hard copies and computer disk of record and printouts of test results.

6. SMFO Cable - ALTERNATE
   a. Extensive testing as these are the primary cables for HD and Slo-motion cameras.
   b. Cable Tests:
   c. Attenuation testing from both ends
d. SMFO: test at 1310 and 1550 nm
   1) Identify any wiring errors
   2) Identify any wiring errors
   3) Provide hard copies of attenuation tests.
   4) Above test reports to include link attenuation = Calculated cable attenuation + connector attenuation + splice attenuation

e. OTDR
   1) Provide printed copies of the OTDR trace for records. Provide location and cable number if applicable.

7. Test Results:
   a. Coax and Triax Cables:
      1) List each video coax and triax cable separately with description and cable number. Include the measured length of the cable using TDR, return loss graphs and the measured sweep losses up to 3GHz using the spectrum analyzer; include the manufactures stated cable loss at 200MHz, 1.5GHz and 3GHz.
      2) Submit graphs of TDR tests for review by the consultant.
      3) The test results show when and where a fault was found.
   b. SMFO Cables:
      1) List each fiber strand separately with description and cable number. Include the measured length of the cable using OTDR and power attenuation.
   c. Audio Cables:
      1) List each cable separately with a description and cable number. Include DT-12 connector where applicable.
      2) The test results show when and where a fault was found.

8. Narrative of Test Setup
   a. Provide information of the test equipment (manufacture and model #) used for tests. Date of last calibration if applicable.
   b. Provide a written detail and functional diagram (if it provides information that is difficult to describe) of test setup with description of test cables used (including lengths if applicable for TDR and OTDR tests) to allow duplicate tests to be performed during the consultant check out.

3.7 TEST EQUIPMENT

A. Equipment listed by manufacturer and model number establishes a standard of quality; other approved equal equipment will be acceptable.

B. Thirty days prior to start of testing, provide a list to the Owner’s Representative of test equipment make, model numbers and calibration dates that will be used.

C. Furnish the following equipment. Equipment to be available for the entire test period through final System testing.
   1. Signal Level Meter.
   2. Blonder-Tongue SA-7U Variable Attenuator.
   3. Dual-trace oscilloscope: 100 MHz bandwidth, 1mV/cm sensitivity.
   4. Multimeter: measurement range, DC to 20,000 Hz, 100 mV to 300 V, 10ma to 10A.
   5. Television signal generator. HD-SDI.
   6. 75ohm, 1 percent resistors.
   7. Megohmeter.
8. Ladders and scaffolding necessary to inspect cable in cable trays and ceiling mounted junction boxes.
10. Spectrum Analyzer with internal sweep generator.

D. Provide two portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project.
   1. Include rechargeable batteries and recharger along with "holster" for wearing on belt.
   2. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

3.8 ACCEPTANCE

A. Upon completion of installation and initial tests and report specified in Part 3, acceptance testing shall be performed by the Owners’ representative:

B. Acceptance testing will include operation of each major system and any other components deemed necessary. Installer will assist in this testing and provide any test equipment required specified herein. Installer shall provide at least (1) technician available for the entire testing period (day and night) to assist in tests, adjustments, and final modifications. Tools and materials required to make any necessary repairs, corrections, or adjustments shall be furnished by the Installer. Testing process is estimated to take minimum of (5) days.

END OF SECTION 276000