MINNESOTA MULTI-PURPOSE STADIUM
MINNEAPOLIS, MINNESOTA

SECTION 276000.10 Revised

BROADCAST CABLING SYSTEM

1.1 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 cabling and infrastructure to support:

1. NFL Officials and Injury review.
2. Local television broadcaster cabling (also known as ENG or Electronic News Gathering cabling) generally originates in JBEs throughout the stadium and terminates in the ENG Racks located in the Local TV ENG room 01.14.24.

3. In house/Replay cabling generally originates in JBA's, POV's or JBE's throughout the stadium and terminate in the Scoreboard/Video Control Room
4. Radio Broadcaster cabling hubs from the Press Level broadcast booths to each outlying cabling point (terminating in JBE boxes throughout the stadium). There are additional audio tie lines to the ENG and Network Interconnect racks.

C. Coaching Cabling:
1. Coaching Video cabling (also known as video coaching) generally originates in JBC's throughout the stadium seating bowl and terminates in the Video Coaching Booths.
2. Coaching intercom cabling originates in their respective coaching booth and terminates at their respective 50 yard line JBC. In addition, intercom cabling is distributed to the counters within each booth. Tele/data lines from the coaches' booth equipment rack to the field JBC's are part of the intercom system.
3. Coordination is required for termination of Network broadcast cabling in the JBC rack in each coach's booth.

D. Broadcast and House Signal Distribution:
1. TV truck program is distributed to the Video Replay and to the ENG TV stations.
2. TV truck EFX's (TV truck audio effects) are distributed to each radio broadcast booth.
3. ISO tie lines are distributed between the TV Interconnect racks and Video Replay.
4. House Video Replay is distributed to the TV Interconnect and ENG TV stations racks.
5. Provide HD/SDI video distribution to the each of the broadcast radio booths for HD/SDI Program and Video replay program.

E. NFL Feeds:
1. NFL Officials Replay infrastructure and SMFO are provided as part of the project. Fiber termination, testing and documentation of the fiber are part of the project. Electronic replay equipment is provided by the league.
2. NFL Injury Review infrastructure and SMFO are provided as part of the project. Fiber termination, testing and documentation are part of the project. Injury Review electronic equipment is provided by the League.

F. Tie Lines:
1. SMFO between Network Interconnect racks and ENG racks.
2. Audio tie lines between the Network Interconnect racks and each Radio Booth.
3. Audio tie lines between the ENG Interconnect racks and each Radio Booth.

G. Distribution:
1. HD/SDI Distribution to each ENG rack and In House Production.
2. IN House Production Distribution to each ENG rack and Network Rack.
3. Broadcast Booth Distribution – Network and In Houses Production to each radio booth.

1.2 RESPNSIBILITY AND RELATED WORK

A. Coordinate the work with the General and Electrical Contractors, and the scheduled work of other trades.

B. Electrical
1. Power is provided at locations shown on electrical riser diagram and/or other drawings/information in electrical drawings and specifications. Power will be terminated to a panel within or near the enclosure. The Installer shall be responsible for termination and distribution electrical power from the panel to the equipment as required (including load center, breakers, etc.). This will include necessary conduit and cabling as required for a complete installation.
2. A ground point will be provided in each equipment room or enclosure electrical panel. The Installer shall be responsible for connecting ground point to all equipment in accordance with NEC code, local codes and standards specified herein.

C. Related Specification Sections:
1. Section 274116 “Audio Video System”
2. Section 276000.20 “Network Broadcast Cabling System”
3. Section 274100 “Video Production”
4. Section 274225 “IPTV Systems”

D. Conduit, wire ways, floor boxes, wall boxes, pull boxes, and junction boxes for 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.

E. 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.

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

Owner’s Representative 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.

1.3 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 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.

1.4 SUBMITTALS:

A. The submittal information required by the specification is to be presented complete and as submissions noted below. Submittals are a crucial and integral part of the construction process; as such the Owner's Representative will not recommend payment to the installer above 25 percent of the scheduled value of this work until all submittal information has been approved. 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 Part 1:
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.

C. Project Submittal Part 2:
1. 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.
2. Drawings:
   a. Provide drawings created on a computer aided drawing (CAD) system compatible with AutoCAD Release 2010.
   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, JBE, JBR and JBA/R) 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.

D. Submittal Format:

1. Each submittal shall be bound in a three-ring D style binder sized for 150% of the material with a maximum size being a three inch spine. Use multiple volumes if necessary.
2. Provide each submittal with a unique number and be numbered in consecutive order.
3. Provide each submittal binder with a cover and a spine reflecting the project title and submittal number.
4. 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 resubmittal, 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.
5. Separate major grouping with labeled binder tabs.
6. 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.
      1) 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.
      2) Drawings executed at an appropriate scale, not smaller than 1/8"=1'.

E. 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) unbound reproducible drawing set and two (2) bound prints of all drawings. The processed reproducible shall be returned to Contractor. Additional prints will not be reviewed they will be returned un-marked.
3. Submit four binders of bound materials (e.g. product submittals).
4. Submit three copies of product or sample finishes as required within this specification.
5. Submittal shall include CDR with all information, drawings, and reports in .pdf format.

F. 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.

1.5 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 bindings 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 alphanumeric order.
      b. Record drawings: Final rendition of that specified depicting what is actually incorporated within the Work.
      c. Test Reports: Recorded findings of testing specification of this specification.
      d. 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.
   2. 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.
   3. Warranty Manual:
      a. Manufacturer's warranty statements on each product.
      b. Date of substantial completion and ending dates for warranties for each group of products.
      c. Software registration and licenses.
   4. Record drawings:
      a. 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 2004 DWG format and DWF formats. Include CD(s) under a separate section in the Operations Manual.

C. Include any other pertinent data generated during the Project or required for future service.

D. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

E. Include 1 CDR of all manuals and reports in .pdf format.

1.6 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.

1.7 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.

1.8 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.

1.9 WARRANTY

A. Warrant labor and product for fifteen months following the date of the first regular season NFL game, 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.

1.10 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 all pre-football season events (concerts, open houses, etc.) all pre-season football games and the first six regular season football games. The contractor shall be at the facility for the day prior to each event.

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 and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.

B. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturer's published specifications.

C. All cable shall be compliant with NEC as applicable, and UL listed or CSA certified.

D. Provide flooded or direct burial cable for underground conduits.

E. Provide stainless steel mounting hardware for all panel mounting and connector mounting.

2.3 Coax Cabling:

A. Riser Rated Digital Coax Cable:

1. Type: RG-6U.
2. NEC Specification: CMR Rating.
3. Solid center conductor.
4. Acceptable product:
   a. Belden 1694A
   b. Gepco VSD2001
   c. Clark CD7506

B. Plenum rated Digital Coax Cable for use only within plenum spaces or as required by Code:
1. Provide precision video cable.
2. Plenum rated jacket as required by Code.
3. Solid center conductor.
4. Acceptable product:
   a. Gepco VSD2001TS
   b. Belden 1695A
   c. Clark CD7506P

C. Underground rated Video Cable for use only in underground conduits or as required by Code:
1. Provide precision video cable.
2. Underground rated jacket as required by Code.
3. Water Block: Blocking Tape
4. Solid center conductor.
5. Acceptable product:
   a. Gepco VSD2001PEF
   b. Belden 1694WB
   c. Clark CD7506DB

2.4 Analog Audio Cables:

A. Audio Cable 12 pair:
1. Provide multi-pair shielded cable. Use six-pair cabling where six or less pairs are scheduled. Neatly dress unused pairs in rear of junction box or rack.
2. Provide two six pairs for DT-12 cabling.
3. PVC outer jacket.
4. Each pair to be individually jacketed with foil shield with drain wire and two jacketed conductors.
5. Conductors to be 0.76mm nominal outer diameter.
6. Acceptable product:
   a. Gepco GA61812GFC(6612HS where CMP rating is required, heat shrink each pair)
   b. Belden 1818R or 1818P
   c. Clark 712 (22EPS12P where CMP rating is required)

B. Audio Cable 6 pair:
1. Provide multi-pair shielded cable. Use six-pair cabling where six or less pairs are scheduled. Neatly dress unused pairs in rear of junction box or rack.
2. Provide two six pairs for DT-12 cabling.
3. PVC outer jacket.
4. Each pair to be individually jacketed with foil shield with drain wire and two jacketed conductors.
5. Conductors to be 0.76mm nominal outer diameter.
6. Acceptable product:
   a. Gepco GA61806GFC
   b. Belden 1816R
   c. Clark 706

C. Plenum Rated Audio Cable 6 pair:

1. Acceptable product:
    a. Gepco 6606HS (heat shrink each pair)
    b. Belden 1816P
    c. Clark 22EPS6P

D. Underground Rated Audio Cable 6 pair:
1. Acceptable product:
    a. Gepco GA61806PEF
    b. Belden 1816WB
    c. Clark 706DB

E. Audio Cable 4 pair:
1. Provide multi-pair shielded cable. Use four-pair cabling where six or less pairs are scheduled. Neatly dress unused pairs in rear of junction box or rack.
2. PVC outer jacket.
3. Each pair to be individually jacketed with foil shield with drain wire and two jacketed conductors.
4. Conductors to be 0.76mm nominal outer diameter.
5. Acceptable product:
    a. Gepco GA61804GFC
    b. Belden 1815R
    c. Clark 704

F. Plenum Rated Audio Cable 4 pair:
1. Acceptable product:
    a. Gepco 6604HS (heat shrink each pair)
    b. Belden 1815P
    c. Clark 22EPS4P

G. Underground Rated Audio Cable 4 pair:
1. Acceptable product:
    a. Gepco GA61804PEF
    b. Belden 1815WB
    c. Clark 704DB

H. Audio Cable 2 pair:
1. Provide multi-pair shielded cable. Use two-pair cabling where two or less pairs are scheduled. Neatly dress unused pairs in rear of junction box or rack.
2. PVC outer jacket.
3. Each pair to be individually jacketed with foil shield with drain wire and two jacketed conductors.
4. Conductors to be 0.76mm nominal outer diameter.
5. Acceptable product:
    a. Gepco GA61802GFC (or 6602HS where CMP is required, heat shrink each pair)
    b. Belden 1814R (9451DP where CMP rating required)

I. Underground Rated Audio Cable 2 pair:
1. Acceptable product:
    a. Gepco GA61802PEF
    b. Belden 1814WB

J. Analog Audio Cable single pair (Inner Rack Wiring):
1. Provide for inner rack wiring.
2. PVC outer jacket.
3. Conductors to be 0.76mm nominal outer diameter.
4. Acceptable product:

a. Gepco 61801EZ
b. Belden 9451
c. West Penn 451
d. Clark SPA22GS

2.5 SMPTE Hybrid Cable:

A. SMPTE Hybrid Cable:
1. Single HD (SMPTE) Camera Cable:
a. High Definition Television (HDTV) hybrid fiber optic camera cable.
b. Cable to be provided with Appropriate NEC rating.
c. Cable to provide copper and fiber connectivity for a single SMPTE line.
d. Acceptable Product:
1) Mohawk M96921
2) Belden 7804R
3) Clark HFCPV

2.6 Single Mode Fiber Optical Cable:

A. Single Mode Fiber Optic Cable:
1. Single mode gel free fiber optic cable.
2. Provide for inside use.
3. Cable to be provided with Appropriate NEC rating.
4. Provide with interlocking armor to shield against damage.

B. 6 strand single mode fiber.
1. Acceptable Riser Rated Product:
a. Corning 006E8F-31131-A1.
b. Belden B9W230.
c. Clark D006SMRIA
2. Acceptable Plenum Rated Product:
a. Corning 006E8P-31131-A3.
b. Belden B9W240.
c. Clark D006SMPIA

C. 12 strand single mode fiber.
1. Acceptable Riser Rated Product:
a. Corning 012E8F-31131-A1.
b. Belden B9W231.
c. Clark D012SMRIA
2. Acceptable Plenum Rated Product:
a. Corning 012E8P-31131-A3.
b. Belden B9W241.
c. Clark D012SMPIA

D. 24 strand single mode fiber.
1. Acceptable Riser Rated Product.
a. Corning 024E8F-31131-A1.
b. Belden B9W233.
c. Clark D024SMRIA
2. Acceptable Plenum Rated Product.
a. Corning 024E8P-31131-A3.
b. Belden B9W242.
c. Clark D024SMPIA

E. 48 strand single mode fiber.

1. Acceptable Riser Rated Product:
   a. Corning 048E81-61131-A1
   b. Belden.B9W235
2. Acceptable Plenum Rated Product:
   a. Corning 048E88-61131-A3
   b. Belden B9W245.

F. 72 strand single mode fiber.
1. Acceptable Riser Rated Product:
   a. Corning 072E81-T3131-A1
   b. Belden B9W236
2. Acceptable Plenum Rated Product:
   a. Corning 072E88-T3131-A3
   b. Belden B9W246

G. 144 strand single mode fiber.
1. Acceptable Riser Rated Product:
   a. Corning 144E81-T3131-A1
   b. Belden B9W238
2. Acceptable Plenum Rated Product:
   a. Corning 144E88-T3131-A3
   b. Belden B9W248

2.7 In-House Portable Broadcast Cables:

A. Cross Connect Jumpers for “In House” use. Jumpers will either be used to connect truck “is” feeds to in-house distribution or to cross connect field cabling to tie lines. Provide with permanent label with team’s name on each cable.
1. Digital Coax Cable Jumpers:
   a. Provide appropriately terminated video cables.
   b. Use connectors listed herein.
   c. Length: 6 Foot
   d. Color: Blue
   e. Quantity: 5
      1) Gepco GVC11
      2) Clark X-CD706-6-6
   f. Length: 10 Foot
   g. Color: Blue
   h. Quantity: 4
      1) Gepco GVC11
      2) Clark X-CD7506-6-10
   i. Length: 20 foot
   j. Color: Blue
   k. Quantity: 4
      1) Gepco GVC11
      2) Clark X-CD7506-6-20
2. Audio Cable Jumpers:
   a. Provide 10 ft. audio snakes of (12) audio cable appropriately terminated to connect between Truck Interface Panel locations.
   b. Quantity: 5
      1) Gepco SKJX12-10-XF-XM
      2) Clark X-712-10-MXLR-FXLR
   c. Provide 100 ft. audio snakes of (12) audio cables appropriately terminated to connect between Truck Interface Panel locations.

d. Quantity: 2
   1) Gepco SKJX12 – 100- XF-XM.
   2) Clark X-712-100-MXLR-FXLR
e. Provide 4 ft. long DT-12 to XLR adapters (a.k.a. “fan outs”).
f. Quantity: 3
   1) Gepco DTFAN48F12MG
   2) Clark X-DT12-M-FXLR-4
   3) Gepco DTFAB48M12FG Quantity :3
   4) Clark X-DT12-F-MXLR-4

3. ST to ST Fiber Tactical Snakes:
   a. Single Mode tactical fiber cable.
   b. Overboot for connector protection.
   c. Acceptable product:
      1) Gepco GST06B-12-ST/ST-B (Qty. 2)
      2) Gepco GST06B-6-ST/ST-B (Qty. 2)
4. Video coaching Field Cables:
   a. Two fiber channels per connector.
   b. Coordinate camera end fiber connector with video coaching equipment provider.
   c. Field verify lengths of cables required.
   d. Shutter mechanism for protecting fiber contacts.
   e. Acceptable product:
      1) Gepco GNO2ROS-0-6 (Qty.15)
      2) Gepco GNO2ROS-0-12 (Qty. 10)
5. Coaches’ Portable Intercom Snake Cable.
   a. Supply 12 channel snakes for home and visitors coaches′ intercom at field.
   b. Provide with gold plated connectors on each end.
   c. Acceptable product:
      1) Gepco SK612-50-XM-XF (Qty. 3).
   d. Acceptable product:
      1) Gepco SK612-75-XM-XF (Qty 3).
6. Radio Booth Patch Cable Holders:
   a. Provide wall mountable patch cable holders
   b. Quantity: Provide to hold above cables
   c. Coordinate location with owner
   d. Acceptable product:
      1) Audio Patch Cable Holder: ADC, Pomona or Trompeter
7. Radio Booth Patch Cables:
   a. Type: 24AWG twisted pair with braided shield.
   b. Connectors: XLR’s with gold contacts:
   c. 3’ long cables.
   d. Quantity: 10 per radio booth.
      1) ProCo AQ-3.
      2) Clark X-STUDFLEX-3-MFXB
   e. 10’ long cables.
   f. Quantity: 10 per radio booth.
      1) ProCo AQ-10.
      2) Clark X-STUDFLEX-10-MFXB
8. SMFO Duplex LC Patch Cables:
   a. For use at the Network House rack for crossing patching In House Production fiber.
   b. Type: SMFO Duplex LC.
   c. Acceptable product:
      1) Corning 04-04RJ131 003 F (Qty. 30)
      2) Corning 04-04RJ131 010 F (Qty. 10)
      3) Corning 04-04RJ131 020 F (Qty. 10)

2.8 Connectors

A. Receptacles:

1. XLR-3M:
   a. Connector type: XLR.
   b. Gender: Male.
   c. Style: Panel mount.
   d. Capacitance between contacts: ≤ 4 pF.
   e. Contact resistance: ≤ 5 milliohms.
   f. Rated current per contact: 16 A.
   g. Rated voltage per contact: 50 V.
   h. Wire size: maximum 2.5 mm2.
   i. Wiring: solder contacts.
   j. Mounting: Holes with M3 threads.
   k. Contact plating: 0.2 μm gold hard alloy over 2 μm nickel.
   l. Contacts: Brass.
   m. Shell: Zinc diecast.
   n. Shell plating: Black chromium.
   o. Acceptable product:
      1) Neutrik NC3MDL-B-1.
2. XLR-3F:
   a. Connector type: XLR.
   b. Gender: Female.
   c. Style: Panel mount.
   d. Capacitance between contacts: ≤ 4 pF.
   e. Contact resistance: ≤ 5 milliohms.
   f. Rated current per contact: 16 A.
   g. Rated voltage per contact: 50 V.
   h. Wire size: maximum 2.5 mm2.
   i. Wiring: solder contacts.
   j. Mounting: Holes with M3 threads.
   k. Contact plating: 0.2 μm gold hard alloy over 2 μm nickel.
   l. Contacts: Bronze.
   m. Shell: Zinc diecast.
   n. Shell plating: Black chromium.
   o. Acceptable product:
      1) Neutrik NC3FDL-B-1.
3. BNC Bulkhead Connectors:
   a. Connector type: 75 ohm BNC.
   b. Gender: Female.
   c. Style: Bulkhead Jack.
   d. Contact resistance: .030 ohms.
   e. Impedance: 75 ohm.
   f. Rated voltage per contact: 1500 Volts RMS.
   g. Return Loss: Better than 26 dB to 1GHz: 18 dB to 2 GHZ: 16 dB to 3 GHZ.
   h. Wiring: Bulkhead jack.
   i. Center Contact plating: 50 millionths inch gold plating MIL-G-45204 Type 1, Grade C, Class 1.
   j. Body/Bayonet: Tarnish –resistant electroless nickel plating.
   k. Corrison (Salt Spray): MIL-STD-202 Method 101, Test Condition B.
   l. Provide with isolation washers.
   m. Acceptable product:
      1) ADC BNC-BHJ-series
4. Coaching Video Chassis Fiber Connector:
   a. Gender: Female.

b. Chassis mount: standard D mount.
c. Electrical: 4 solder contacts.
d. Voltage rating: 50 V.
e. Current rating per contact: 6 A.
f. Contact Resistance: < 7 mΩ.
g. Optical contacts: LC-Duplex Feed Through.
h. Fiber type: Single Mode Fiber.
i. Lifetime: > 5000 mating cycles.
j. Locking Device: Push – Pull.
k. Shell: Zinc diecast.
l. Protection Class: IP 65.
m. Acceptable product:
1) Neutrik opticalCon Duo NO2-4FDW-R

5. RJ-45:
a. Connector type: 8 conductor RJ series data.
b. Gender: Female.
c. Style: Panel mount.
d. Contact resistance: ≤ 10 milliohms.
e. Frequency range: 1 - 250 MHz
f. Rated current per contact: 1.5 A.
g. Rated voltage per contact: 50 V.
h. Transmission performance: Category 6.
i. Standards compliance: TIA/EIA 586B, IEC11801.
j. Wire size: 0.5 - 0.65 mm2.
k. Wiring: Insulation displacement punch down terminals.
l. Contact plating: 0.7 μm gold over 1.2 μm nickel.
m. Contacts: Bronze.
n. Shell: Zinc diecast.
o. Shell plating: Black chromium.
p. Strain relief: Stainless steel.
q. Environmental protection: Rated to IP65.
r. Acceptable product:
1) Neutrik NE8 series.

B. Plugs:
1. XLR-3MP:
a. Connector type: XLR 3-pin.
b. Gender: Male.
c. Style: Cable mount.
d. Capacitance between contacts: ≤ 4 pF.
e. Contact resistance: ≤ 3 milliohms.
f. Rated current per contact: 16 A.
g. Rated voltage per contact: 50 V.
h. Wire size: maximum 2.5 mm2.
i. Wiring: solder contacts.
j. Boot: Polyuretan.
k. Bushing: Polyamide.
l. Contact plating: 0.2 μm gold hard alloy over 2 μm nickel.
m. Contacts: Brass.
n. Insert: Polyamide.
o. Shell: Zinc diecast.
p. Shell plating: Black chromium.
q. Strain relief: Polyacetal.
r. Acceptable product:
1) Neutrik NC3MX-B.
2. XLR-3FP:

a. Connector type: XLR 3-pin.
b. Gender: Female.
c. Style: Cable mount.
d. Capacitance between contacts: ≤ 4 pF.
e. Contact resistance: ≤ 3 milliohms.
f. Rated current per contact: 16 A.
g. Rated voltage per contact: 50 V.
h. Wire size: maximum 2.5 mm2.
i. Wiring: solder contacts.
j. Boot: Polyuretan.
k. Bushing: Polyamide.
l. Contact plating: 0.2 μm gold hard alloy over 2 μm nickel.
m. Contacts: Bronze.
n. Insert: Polyamide.
o. Shell: Zinc diecast.
p. Shell plating: Black chromium.
q. Strain relief: Polyacetal.
r. Acceptable product:
   1) Neutrik NC3FX-B.

3. BNC Straight Cable Connector:
   a. Connector type: 75 ohm BNC.
   b. Gender: Male.
   c. Style: Cable Connector.
   d. Center contact resistance: .0014 ohms.
   e. Impedance: 75 ohm.
   f. Rated voltage per contact: 500 Volts RMS.
   g. Return Loss: Better than 36 dB to 1GHz: 25 dB to 2 GHZ: 23 dB to 3 GHZ.
   h. Wiring: Bulkhead jack.
   i. Center Contact plating: 50 millionths inch gold plating MIL-G-45204 Type 1, Grade C, Class 1.
   j. Body/Bayonet: Tarnish –resistant electroless nickel plating.
   k. Corrison (Salt Spray): MIL-STD-202 Method 101, Test Condition B.
   l. Provide with isolation washers.
   m. Acceptable product:
      1) Kings 2064-10-9

4. Single Mode Fiber Optic ST Connector:
   a. Connector Type: Single Mode Fiber ST connector.
   b. Temperature Cycling: ≤0.3dB change, -40° to +75° C.
   c. Insertion Loss Average: 0.2 dB with UniCam Tool Kit.
   d. Reflectance: ≤ 40 dB typical.
   e. Re-matings: minimum of 500.
   f. Provide 25 spare connectors after turn over.
   g. Provide with High Performance Installation Kit for ST connectors to Owner.
   h. Acceptable product:
      1) Corning Pretium Performance 95-200-51
   i. Provide with High Performance Installation Kit for ST connectors to Owner.
   j. Acceptable product:
      1) Corning Pretium Toolkit TKT-UNICAM-PFC.
   k. ST Cleaning Tool:
   l. Acceptable product to include the following:
      1) Gepco SCK-SC-250 (Qty. 1)
      2) Gepco WST.K1.125.34 (Qty. 10)
      3) Gepco GEP-HFCS (Qty 1)

5 Single Mode Fiber Optic LC UPC Connector:
   a. Connector Type: Single Mode Fiber LC connector for use with Neutrik opticalCON

connector.

b. Temperature Cycling: ≤0.3dB change, -40° to +75° C.
c. Insertion Loss Average: 0.2 dB with UniCam Tool Kit.
d. Reflectance: ≤ 55 dB typical.
e. Re-matings: minimum of 500.
f. Provide 25 spare connectors after turn over.
g. Provide with High Performance Installation Kit for LC connectors to Owner.
h. Acceptable product:
   1) Corning Pretium High Performance 95-200-99
   2) Gepco 951-191-111

2.9 PANELS:

A. Blank Panels:
1. Type: Flanged.
2. Material: 16 gauge aluminum.
3. Finish: Black brushed anodized.
4. Acceptable product:
   a. Middle Atlantic BL series

B. Vent Panels:
1. Type: Flanged.
2. Material: 18 gauge steel.
3. Finish: Black power coat finish.
4. Acceptable product:
   a. Middle Atlantic VTF series

C. ENG Fiber Enclosure:
1. Rack mount enclosure.
2. Provide for internal fusion splicing and cable management.
3. Provide for external strain relief for cables.
4. Front Panel: Zirconia sleeve SMFO ST feed through with metal dust caps attached to front panel with stainless steel mounting hardware.
5. Blank unused ports.
6. Acceptable product:
   a. Clark Wire and Cable Custom ENG fiber enclosure.

D. Triax/SMPTE Plug/Jack Panel:
1. Panel is to be a modular system type to provide flexibility between triax and SMPTE connectors.
2. Connectors are to electrically isolate from the panel.
3. Triax connectors: Field = Kings 7702-1, Truck Interconnect = Kings 7705-1
4. Neutrik opticalCON: NO2-4FDW-1-A for field and interconnect.
5. SMPTE hybrid connectors: Field = Canare FCS015A-FR, Truck Interconnect = Canare FCS015A-MR
6. Modules are to be nonconductive plastic.
7. Acceptable product:
   a. Field (camera platform) panel:
      1) Clark Modular Frame MPA-ISS with MP-T Kings triax module or MP-S SMPTE module.
   b. Interconnect (rack) panel:
      1) Clark Modular Frame MPS-OSS with MP-T Kings triax module, MP-S SMPTE module.

~~I.E.~~ Broadcast Rack Mount Screws:

1. Head Style: Large Diameter Truss Head.
2. Material: 18-8 Stainless Steel.
3. Drive type: Phillips.
4. Finish: Fully Threaded.
5. Provide for JBT, JBE JBA, Uplink and ENG pedestals and Interconnect racks.
6. Acceptable Product:
   a. McMaster-Carr or equal

2.10 Distribution

A. 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.

B. 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.
   3. Supports digital and digital conversions.
   4. Connectors: ST single mode fiber and unbalanced AES.
      a. Evertz 7707ADVR-HD.

~~F.C.~~ 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.

D. Digital Video DA (DVDA):
   1. Input: SMPTE 424, SMPTE292-1.
   2. Outputs: 7 re-clocked outputs.
   3. Quantities as required.
      a. Evertz7700DA7-3G.

E. Audio Distribution (ADA):
   1. Audio Distribution Amplifier used for ENG audio distribution.
      a. Provide EIA rack mounted modular audio distribution amplifier.
      b. Metering: Output
      c. Outputs: transformer isolated.
      d. Maximum output level: +22dBm
      e. Provide with one extender board.
      f. Part of PA and EFX distribution.
      g. Quantities as required
      h. Acceptable product:
         1) ATI System 10000 with MIDA100-1 modules.
      ~~a.~~2.

2.11 Portable Equipment

A. HD/SDI to HDMI Convertor:
   1. Provide 2 for each radio/Aux TV booth for BV wall plates under counters.

2. Input formats: 1080i 50/59.4/60, 1080p 30/59.4/60
3. Video inputs: #g, HD and SD-SDI auto selected
4. Video output: HDMI v1.13a,
5. Audio: HDMI embedded
6. Acceptable product:
   a. AJA Hi5-3G

B. HDMI Cable:
1. Provide 2 for each radio/Aux TV booth for BV wall plates under counters plus 4 spares.
2. Length: 6 feet
3. Acceptable product:
   a. Canare HDM02E
   b. Or equal

EXCUTION

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 grommetting.

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.

B. Hardwire power wiring directly to internal AC receptacles to ensure uninterrupted operation.

C. Provide 3-conductor, 120 VAC outlets as required within each housing plus two spare outlets.

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 ENGRAVING

3.7 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
   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
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.
3) OTDR
   a) Provide printed copies of the OTDR trace for records. Provide location and cable number if applicable.

d. 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.
3) OTDR
   a) 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
   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:
   b. 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.

c. Submit graphs of TDR tests for review by the consultant.

d. The test results show when and where a fault was found.

8. SMFO Cables:
   a. List each fiber strand separately with description and cable number. Include the measured length of the cable using OTDR and power attenuation.
9. Audio Cables:
   a. List each cable separately with a description and cable number. Include DT-12 connector where applicable.
   b. The test results show when and where a fault was found.
10. 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.

3.8 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.
9. Time Domain Reflectometry (TDR).
10. Spectrum Analyzer with internal sweep generator.
11. Provide fiber optic test equipment meeting TIA/EIA-526-14A (1998) and TIA/EAI-526-7(1998) standards.

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.

3.9 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 276000.10 Revised