SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 – GENERAL

1.1 PURPOSE

A. This guideline is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. PSP is to apply the principles of this section such that the University of Texas at Arlington (UTA) may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be approved by UTA and may require justification through Life Cycle Cost (LCC) analysis and submitted to UTA for approval.

1.2 **LESSONS LEARNED AND DESIGN CONSIDERATIONS**

A. Telecommunications Contractor shall review and adhere to all of University of Texas at Arlington Standards of Installation for Network Cabling.

1.3 SUMMARY/OVERVIEW

A. This section includes the horizontal cabling portion of a structured cabling system (SCS) including:
   1. Optical fiber
   2. Copper and coaxial backbone cabling
   3. Termination and patch cables

B. Provide all horizontal cabling, terminating hardware, adapters, and cross-connecting hardware necessary to interconnect all system equipment including equipment located in Communications rooms.

C. Related Sections
   1. Section 27 00 00 – Communications
   2. Section 27 05 26 – Grounding and Bonding for Communications Systems
   3. Section 27 05 28 – Pathways for Communications Systems
   4. Section 27 05 43 – Underground Ducts and Raceways for Communications Systems
   5. Section 27 11 00 – Communications Equipment Room Fittings
   6. Section 27 13 00 – Communications Backbone Cabling

1.4 REFERENCES

A. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.

B. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean the latest printed edition of each in effect at the date of contract unless the document is shown dated.

C. Conflicts
   1. Refer to Section 27 00 00.

D. Codes and Standards:
   1. ANSI/TIA-568-C, Commercial Building Telecommunications Wiring Standards.
   2. ANSI/TIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces.
   3. ANSI/TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
   4. ANSI/NECA/BICSI-607, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
   5. ANSI/TIA-758-A, Telecommunications Standard for Outside Plant.
   6. National Electrical Code (NEC); current edition.
   7. Building Industry Consulting Services International (BICSI).
   8. Local, county, state and federal regulations and codes in effect as of date of purchase.
   9. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

1.5 SUBMITTALS

A. Refer to Section 27 00 00 and 27 13 00.

1.6 QUALITY ASSURANCE
A. Refer to Section 27 00 00.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Refer to section 270000 and 27 13 00.
B. Storage temperature range: -40°F to 149°F (-40°C to 65°C)

1.8 PROJECT/SITE CONDITIONS
A. Refer to Section 27 00 00.

1.9 WARRANTY
A. Refer to Section 27 00 00.

1.10 MAINTENANCE AND SUPPORT
A. Refer to Section 27 00 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Horizontal UTP Cable Plenum-rated (must be partnered for Panduit warranty):
   1. Mohawk
   2. Berktek
   3. CommScope
   4. Superior Essex
   5. Owner approved alternate.
B. Information outlet components (Jacks-Inserts):
   1. Panduit CAT 6A UTP
   2. Owner approved alternate.
   3. Video Transport, CAT 6A STP Superior Essex P/N 6T-272-3B and Contractor to terminate shielded CAT 6A STP plugs onsite.
C. 48-Port Patch Panels, CAT 6A:
   1. Panduit
   2. Owner approved alternate.
D. Wall and Rack Mount 110 Termination Blocks:
   1. Leviton
   2. Panduit
   3. Owner approved alternate.
E. Faceplate for wall-mount telephones:
   1. Panduit
   2. Owner approved alternate.
F. Fiber Horizontal Cable Plenum-rated:
   1. Panduit
   2. Corning
   3. Owner approved alternate.
G. Fiber Connectors, (LC):
   1. Panduit
   2. Owner approved alternate.
H. Fiber Termination Shelves and Cabinets (Rack-Mountable).
   1. Panduit
   2. Owner approved alternate.
I. Fiber Distribution Cabinet (Wall –Mounted):
   1. Panduit
   2. Owner approved alternate.
J. Fiber adapter panels (6-port-LC)
   1. Panduit

2. Owner approved alternate.

K. Patch Cords, Copper:
1. Panduit CAT 6A
2. Owner approved alternate.

L. Fiber Duplex Patch Cables LC to LC (Type SM and MM):
1. Panduit
2. Owner approved alternate.

M. Labeling:
1. Refer to section 27 00 00.

N. Firestopping:
1. Refer to section 27 00 00.

2.2 ACCESSORIES

A. The Contractor shall:
1. Mount one laminated full-size hard copy in color of an as-built floor plan designating workstation locations, pathways, and communications room locations. Confirm hard copy size with Owner.
2. Provide clear plastic lamination serving each communication room.
3. Install the laminated drawings within a protective Plexiglas encasement on the wall of the servicing communications rooms. To ease accessibility the Plexiglas encasement shall be in either flip-down format or file folder format.

2.3 HORIZONTAL CABLING

A. Recognized cabling for providing the signal medium from the work area to the communications room shall include the following:
1. 50 µm or 62.5 µm multi-mode optical fiber (OM-3)
2. Four-pair Category 6A UTP cable
3. Four-pair Category 6A STP cable (Video Transport)
4. 75 ohm coaxial cable (for CATV applications only)

B. Optical Fiber Requirements – Refer to Section 271300 Backbone Cabling and Terminations for additional general requirements:
1. Multi-mode fibers shall have dual wavelength capability; transmitting at 850 and 1300 nm ranges.
2. Laser optimized 50 µm OM-3 rated
3. 125 µm ± 1 µm cladding diameter
4. Maximum Fiber Loss: 3.5 dB/km at 850 nm and 1.0 dB/km at 1300 nm
5. Minimum Bandwidth: 200 MHz at 850 nm and 500 MHz at 1300 nm
6. Single mode shall not be used for horizontal cabling.

C. Category 6A UTP Cable Requirements: High performance Category 6 UTP shall adhere to the following:
1. 23/24 AWG solid bare copper, black color cable sheath.
2. Cable jacket shall comply with NEC Article 800 for use as a plenum cable and shall be UL and c (UL) Listed Type CMP (communications multipurpose plenum)
3. Cable shall terminate on an eight-pin modular jack at each outlet. All horizontal cabling shall meet or exceed the ANSI/EIA/TIA-568-B.2 Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components
4. Cables shall be marked as UL verified with a minimum of Category 6 rating
5. The cable shall support Voice, Analog Base band Video/Audio, Fax, Modem, Switched- 56, T-1, ISDN, RS-232, RS-422, RS-485, 10BASE-T Ethernet, Token Ring, 100Mbps TP- PMD, 100BASE-T Ethernet, 155 Mbps ATM, AES/EBU Digital Audio, 270 Mbps Digital Video, 622 Mbps 64-CAP ATM and emerging high-bandwidth applications, including 1 Gbps Ethernet, gigabit ATM, as well as all 77 channels (550 Mhz) of analog broadband video
6. The maximum horizontal cable length for Category 6 copper cable from the termination of the cable in the communications room to the outlet is 295 feet
7. Cable shall meet or exceed the following electrical characteristics:
   a. Cable shall be specified to 250 MHz and shall meet the manufacturer's guaranteed electrical performance and physical specifications as follows:
   b. Cable shall be specified to 500 MHz and shall meet the manufacturer's guaranteed electrical performance and physical specifications.

D. Cabling Method:
1. The Contractor shall:

c. Provide cabling in accessible spaces, cable tray, (surface and/or enclosed raceway), conduits, and/or J-Hook cable support system. Within consoles, racks, cabinets, desks, and counters, in accessible ceilings spaces and in gypsum board partitions where open cable method may be used. Use UL or ETL listed plenum rated cable in all spaces. Conceal raceway and cabling except in unfinished spaces as is practical.
d. Utilize conduits/cable tray as indicated on the drawings.
e. Route data and voice cables separately in a neat and orderly fashion. No cable ties or wraps shall be used to secure the cables in the runway outside of the communications rooms.
f. Examine pathway elements intended for cable. Check raceways and other elements for compliance with space allocations, installation tolerances, debris, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Application of Media:
1. Horizontal cabling
a. The Contractor shall:
1). Install cable using techniques, practices, and methods that are consistent with specified data cabling and the installed components and that ensure specified performance levels of completed and linked signal paths, end to end.
2). Install cables in continuous lengths from communications outlet to specified patch panels for data and termination blocks for voice.
3). Terminate horizontal voice cables into termination blocks without damaging twisted pairs or jacket.
4). Terminate horizontal data cables onto 8P8C modular patch panels without damaging twisted pairs or jacket.
5). Pull cables in smooth and regular motions using methods that prevent cable kinking.
6). If necessary use approved cable pulling lubricant.
7). Keep all items protected before and after installation with dust and moisture proof barrier materials/envelopes. If wiring is terminated on patch panels, data, voice jacks prior to painting, carpet installation, and general finish clean up, these jacks shall be placed in a protective envelope to ensure dust, debris, moisture, and other foreign material do not settle onto jacks' contacts. Envelope will be removed on final trim out after other trades have finished their finish work. It shall be the contractor's responsibility to ensure the integrity of these protective measures throughout the life/installation of the project.
8). Do not bind cables tightly together with tie or other wraps. Wraps shall slip loosely around cables. Use Velcro wraps instead of cables ties for all bundling in the communications rooms.
9). Pull cables simultaneously if more than one is being installed in the same raceway/pathway.
10). Use pulling means, including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.
11). Install open cabling parallel and perpendicular to surfaces or structural members following surface contours where possible.
12). Not bend cable greater than a bend radius of 1.00 inch.
b. Cable bundles brought into the communications rooms shall be routed and dressed in such a manner that prior to termination the cables are not subject to damage and misuse such as installers walking on the bundles that are lying on the floor. Cable pulling force shall not exceed 25 pounds of pulling tension or cable manufacturer's recommended pulling tensions.
c. When exiting runway and/or conduit via a means to ensure support of the cable, shall thereafter be supported with approved materials, and space supporting hardware to maintain performance characteristics, or as listed below.

F. Separation of Wires and Cabling Installation Practices:
1. The Contractor shall:
a. Comply with EIA/TIA rules for separating unshielded copper communication and data-processing equipment cables from potential EMI sources, including electrical power lines and equipment.
b. Maintain a minimum spacing of 18 inches from electrical feeders and/or branch circuit wiring.
c. Maintain a minimum spacing of 12 inches from auxiliary systems cabling.
d. Maintain a 1-inch separation where UTP cables must pass perpendicularly to electrical, plumbing, or other wiring, conduit, or piping systems. Use non-conduit bushings, if necessary to maintain separation, which allow for the addition of a reasonable number of cables in the future.

e. Maintain communications pathways away from electrical apparatus such as motor driven equipment and transformers, minimum separation distance of 10-feet is recommended.
f. Provide all necessary installation materials, hardware, tools and equipment to perform insulation displacement type terminations at all data outlets, patch panels, and voice termination materials.
g. Terminate horizontal cables in consistent consecutive order.
h. Arrange cables on patch panels and voice termination hardware in ascending order of room numbers and outlet numbers within rooms.
i. Provide a 10-foot service loop for horizontal cables at each rack in communications rooms. Locate loop at ceiling deck or on bottom of cable runway in minimum 18-inch diameter.
j. Provide a 3-foot 6-inch service loop for horizontal cables at I/O's. Locate service loop above or below I/O were vertical cable run transitions to horizontal run.
k. Maintain twists in cable pairs to within .5-inch of termination.
l. Group all specialty cables such as the pay phone cables, elevator line, etc which do not have their own termination hardware, in one group, clearly labeled as to cable number and function, in the last positions on the horizontal cabling blocks in each communications room.
m. Limit cable-bending radius to 20 times the cable diameter during installation, and 15 times the cable diameter after installation.
n. Do not leave cables on the floor unprotected or cable bundles hanging from the ceilings. Coil them up in a temporary manner and protect them from damage.
o. Start numbering at the left of the main door to the room and continue in a clockwise direction around the room.
p. The cables within the room will be terminated starting with the cables located to the left of the main door to the room and continue around the room in a clockwise direction.

2. Fiber Optic Cable Installation
   a. Fiber optic cable shall be installed in innerduct from near end termination point to far end termination point. Only UL-approved plenum-rated innerduct shall be installed in all plenum areas. Metallic conduit may be used in lieu of innerduct in plenum-rated ceilings if it is bonded and grounded correctly.
   b. Only technicians-trained and certified by the product manufacturer shall perform terminations. Terminations shall be made in a controlled environment. Cables may be assembled off -site, although testing must be completed with the cable in its final installed condition. Test optical fiber on the reel for distance and continuity verification before installation.
   c. At each location where fiber cable is exposed to human intrusion, it shall be marked with warning tags. These tags shall be yellow or orange in color, and shall contain the warning "CAUTION FIBER OPTIC CABLE". The text shall be permanent, black, block characters, and at least .1875-inch high. A warning tag shall be permanently affixed to each exposed cable or bundle of cables, at intervals of not less than 5 feet. Any section of exposed cable that is less than 5 feet in length shall have at least one warning tag affixed to it.

G. Wireless Access Point Cable Requirements
   1. The Contractor shall:
      a. Install two (2) Category 6 cables from dedicated wireless patch panel(s) in telecommunications room to outlets having 8P8C connectors (wired to T568B) in two separate Single Gang Boxes with 1-port faceplates each.
   2. Enclosures shall be NEMA rated for the environment to which they are exposed.
   3. Thirty (30) feet of cable slack shall be coiled and hung on a "J"-hook at the enclosure location.

H. Coaxial Cable Requirements:
   1. RG-11 shall be considered if distances are long; designer shall evaluate distance, bandwidth and frequency of operation.
   2. Shall consist of a #20 AWG solid-copper center conductor with 95% copper braided shield. The cable shall be UL and (UL) Listed for Fire Safety and ISO 9001 Certified.
   3. Characteristic Impedance shall be 75 Ohms at 50 MHz.

2.4 TERMINATION HARDWARE

A. Station Hardware
   1. Flush mount jacks shall be mounted in a faceplate with back box.
   2. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches without prior Owner approval.

3. 8P8C Jack Pin Assignments - Pin connections for voice and data information outlets and patch panels shall match T-568B termination standard under the EIA/TIA 568- A code.
4. Pin assignments at all voice and data panels or connecting blocks shall match pin assignments at the information outlets.

B. Optical Fiber Interconnect Units, Distribution Shelves, and Adapter panels.
1. Modular in design and used in fiber optic interconnection and cross-connection.
2. 19-inch rack-mountable
3. Owner approved industry-standard connectors.

C. Optical Fiber Outlets:
1. Modular in design
2. Duplex fiber optic coupling/adapter

D. Copper patch panels:
1. Copper patch panels shall be rated to match installed cable plant
2. Horizontal copper cables shall be terminated in eight position/eight conductor (8P8C) modular patch panels with no distinction between voice and data.
3. The termination modular inserts on the patch panel shall support the appropriate applications, including 100 Base-T, 52/155 Mbps ATM, and 1000 BASE-T Gigabit & 10 Gigabit Ethernet, and facilitate cross connection and inter connection using modular patch cords.
4. All Modular jack panels shall be wired to T-568B unless requested otherwise by Owner.
5. The wiring block shall accommodate #23 AWG cable conductors.
6. All modular cross connect panels shall be UL-listed.

E. Work area outlets:
1. 8P8C non-keyed modular outlets for applications up to 10 Gb/ps and ANSI/TIA/EIA-568- B compliant for the specified transmission requirements.
2. Part of the UL LAN Certification and Follow-up Program.
3. Universal eight-position jack pin/pair assignments.
4. White in color for data outlets and blue in color for voice outlets.

F. Outlet Faceplates:
1. White or ivory to match electrical outlets.
2. Four-position with blanks inserted in unused ports.

2.5 PATCH CABLES

A. Multi-mode Optical Fiber
1. The Contractor shall:
   a. Verify exact quantities and lengths with Owner prior to purchase
   b. Provide the appropriately-rated (matched to the installed cable plant) Modular Patch Cords for the appropriate location and equipment.
2. Patch cords shall be:
   a. Buffered, graded-index fiber with a 50 μm core and a 125 μm cladding (OM-3).
   b. Aramid yarn and a jacket of flame-retardant PVC shall cover the fiber cladding.
   c. Duplex SC connectors shall meet the following specifications:
      1). Mated Connector Loss: μ = 0.3 dB, a = 0.2 dB.
      2). Operating temperature: -4° to 158° F (-20 to 70° C)
      3). Cable Retention: 50 lb. (220 N) minimum
      4). Connection Repeatability: 0.20 dB maximum change per 100 reconnects
      5). ISO 9001 Certified Manufacturer
   d. Made and warranted by the manufacturer of the cabling system installed in this project and shall meet or exceed patch cord specifications as outlined in TIA/EIA standards.
   e. Patch cords shall be in original packaging when presented to the Owner. e.g., sealed plastic bags.

B. Copper Patch Cords
1. The Contractor shall:
   a. Verify exact quantities and lengths with Owner prior to purchase
   b. Provide the appropriately-rated (matched to the installed cable plant) Modular Patch Cords at the workstation outlet and the communications room for each installed port.
   c. Where applicable (connecting voice outlets to copper riser), provide the appropriately-rated patch cords. Cords shall be one-pair stranded 8P8C connector on one end and 110GS on the other end and shall be of appropriate length for application.

d. Supply an equal number of 3-foot, 5-foot, and 7-foot patch cords for the telecommunications room; and supply an equal number of 10-foot and 15-foot patch cords for the workstation outlet.
e. Place each size/length patch cord in a separate container, and mark the containers that hold the patch cords with the length of patch cords contained within.

2. All cords shall conform to the requirements of ANSI/TIA/EIA-568-B.2 Commercial Building Telecommunications Cabling Standard, Horizontal Cabling Section, and be part of the UL LAN Certification and Follow-up Program.
3. Cords shall be equipped with an eight-pin modular connector on each end, wired straight through and shall be of appropriate length for application.
4. All rated patch cords shall be round, and consist of #23 AWG copper, stranded conductors, tightly twisted into individual pairs.
5. Maximum equipment cable length from the work area outlet to the device should be limited to 10 feet. Maximum cable length for jumpers and patch cords in the communications room should be limited to 20 feet.
6. Patch cords shall be made and warranted by the manufacturer of the cabling system installed in this project and shall meet or exceed patch cord specifications as outlined in TIA/EIA standards.

2.6 IDENTIFICATION (LABELING) SYSTEM

A. Refer to section 27 00 00 and 27 13 00.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Refer to section 27 00 00.
B. Verify the following before proceeding:
1. Conduits, cable trays and pull boxes are properly installed following section 270528.
2. Plywood backboards in communications rooms are properly installed following section 271100.
3. Grounding system is properly installed and tested following section 270526
4. All high-pair count copper cables are routed properly and attached.
5. All optical fiber links are terminated and tested.
6. All backbone cabling service loops are installed and protected.
7. Liquid-carrying pipes are not installed in or above voice and data system communications rooms. Do not proceed with installation in affected areas until removed.

3.2 PREPARATION

A. Refer to section 27 00 00.

3.3 INSTALLATION

A. Refer to section 27 00 00.
B. All installation shall be done in conformance with ANSI/TIA/EIA-568-B standards, BICSI methods, industry standards and manufacturer's installation guidelines. The contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines shall require the contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the contractor during the implementation.
C. The Contractor shall:
1. Provide a 10-foot service loop at the communications room and shall provide a 3-foot service loop above the access ceiling or cable trays unless specified otherwise. All service loops shall be a minimum of 18 inches in diameter and be accessible for maintenance.
2. Coordinate loop placement and orientation with the technology consultant. This allows for future changes or expansion without installing new cables.
D. Cabling between communications rooms and workstation locations shall be made as individual “home runs”. No intermediate punch down blocks or splices may be installed or utilized between the communications rooms and the information outlets at the workstation location.
E. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the

cable. There shall never be more than .5 inches of unsheathed Category 6A UTP cable at either the wiring closet or the workstation termination locations.

F. Placement - All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair equipment's efficient use of their full capacity.

G. Exposed Cable
   1. All station cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the drawings and will only be allowed when no other options exist. Owner must approve all exceptions.

H. All cabling placed above drop ceilings must be supported by cable tray, j-hooks, caddy bags or conduit. The Contractor shall permanently affix cable supports to the building structure or substrates and provide attachment hardware and anchors designed for the structure to which attached and are suitably sized to sustain the weight of the cables to be supported. Attaching cable to pipes or other mechanical items is not permitted. Communication cables shall be routed so as to provide a minimum of 18 inches spacing whenever possible from light fixtures, sources of heat and EMI sources. Cabling shall not be attached to ceiling grid wires. Multiple cables are to be dressed every 5 feet to 7 feet. Maximum cable sag between cable hooks is 3”-6”. Plastic/nylon tie-wraps are not allowed on Category 5e or 6 or 6A cable. (See Section 270529 Hangers and Supports for Communications Systems).

I. Identification - The Contractor shall:
   1. Label cable terminations on designation strips.
   2. Label all cable at each terminating point.
   3. Label each port of the work area outlet.
   4. Cable identification numbers shall not be duplicated.
   5. Labeling convention to be coordinated with Owner.
   6. Label data patch panels and voice blocks in the communications rooms to match those on the corresponding voice and data outlets. The font shall be at least .125-inch in height.
   7. All labels shall correspond to as-built drawings and to final test reports.
   8. Coordinate with Owner for specifications on labeling of all hardware, cabling, and related equipment prior to any testing.
   9. Label each distribution rack, block and other terminating equipment unit and field within that unit within 4 inches from the block or patch panel termination. Keep labels in a neat and orderly lineup.
   10. Label each connector and each discrete unit of cable-terminating and connecting hardware within connector fields, in wiring closets and equipment rooms. Where similar jacks and plugs are used for both communication and data-processing equipment, use a different color for jacks and plugs of each service.
   11. Post the cable schedule in a prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations.
   12. Provide electronic copy of final comprehensive schedules for project in software and format selected by Owner.

J. Documentation:
   1. All cable inventory data documentation shall be submitted in format coordinated with and approved by owner so that data can be incorporated into existing databases.
   2. Documentation shall include cable identification number, source and destination, type of cable, length of cable and number of pairs or fibers.
   3. Complete cross connect documentation is required. It shall include detailed documentation of each pair of all copper backbone cable and strand of fiber.

3.4 FIELD QUALITY CONTROL

A. Refer to section 27 00 00.

3.5 POST-INSTALLATION TESTING for Category 6A cable

A. Contractor shall test each Category 6A cable and each fiber strand of every optical fiber cable prior to acceptance.

B. Contractor shall supply all of the required test equipment used to conduct acceptance tests.

C. Contractor shall submit acceptance documentation as defined below. No cabling installation is considered complete until test results have been completed, submitted and approved.

D. Standards Compliance and Test Requirements:
   1. Category 6 Copper Backbone Cabling shall meet ANSI/TIA/EIA-568-B.2 Category 6 Horizontal cabling

requirements.
2. Optical fiber shall exceed ANSI/TIA/EIA-568-B.3 Optical Fiber Cabling Components Standard requirements.

E. Cable Test Documentation:
1. Cable test documentation shall be submitted in hard copy and electronic formats. If proprietary software is used, disk or CD shall contain any necessary software application required to view test results. If the results are delivered in a standard format like Excel, Access, CSV files, etc., software to read these files is not required. Electronic reports shall be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate shall reference traceable circuit numbers that match the electronic record.
2. Each test record shall contain the cable ID as follows: "MEDIA TYPE – SOURCE ROOM – DESTINATION ROOM – STRAND/PAIR #", e.g. MM-MC-HC23-001.
3. Copper: Test reports shall include the following information for each cabling element:
   a. Wire map results that indicate that 100 percent of the cabling has been tested for shorts, opens, miss-wires, splits, polarity reversals, transpositions, presence of AC voltage and end-to-end connectivity.
   b. Length, propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
   c. For Category 6A cabling: Attenuation, NEXT, PSNEXT, Return Loss, ELFEXT, and PSELFEXT data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions when required by the appropriate standards. Any individual test that fails the relevant performance specification shall be marked as a FAIL. Test shall also include mutual capacitance and characteristic impedance.
   d. Cable manufacturer, cable model number/type, and NVP
   e. Tester manufacturer, model, serial number, hardware version, and software version.
   f. Cable ID and project name
   g. Auto-test specification used
   h. Overall pass/fail indication
   i. Date of test
4. Optical Fiber: Testing shall be performed on all fibers in the completed end-to-end system.
   a. Refer to section 27 00 00.
   b. Optical Time Domain Reflectometer (OTDR) Reports: Testing shall consist of a bi- directional end to end OTDR trace performed per TIA/EIA 455-61. The system loss measurements shall be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for single mode fibers.
   c. The acceptable link attenuation for a multimode horizontal optical fiber cabling system is based on the maximum distance of 295 feet.
   d. The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. This value is based on the loss of two connector pairs, one pair at the telecommunications outlet/connector and one pair at the horizontal cross-connect, plus 295 feet of optical fiber cable.
   e. A horizontal link in a network with a consolidation point may be tested using a fixed upper limit for attenuation of 2.75 dB.

F. Cable Test Equipment:
1. Test equipment used under this contract shall be from a manufacturer that has a minimum of 5 years' experience in producing field test equipment. Manufacturer shall be ISO 9001 certified.
   a. Copper: Fluke DTX CableAnalyzer or submitted and Owner-approved equivalent.
   b. Fiber Optic: Fluke DTX CableAnalyzer or submitted and Owner-approved equivalent.
2. Test equipment for Category 6A UTP shall be UL-verified to meet Level III accuracy as specified in ANSI/TIA/EIA-568-B.2-1. The cable installers shall have a copy of this reference in their possession and be familiar with the contents.
3. Test equipment for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA- 526-14-A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455- 50B, Method A. The cable installers shall have a copy of these references in their possession and be familiar with the contents
4. Test equipment for single mode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-7-1998: Optical Power Loss Measurements of Installed Single Mode Fiber Cable Plant-OFSTP-7.

5. The test instrument shall be within the calibration period recommended by the manufacturer.
6. Test instruments shall have the latest software and firmware installed.
7. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.
8. Test adapter cables shall be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.
9. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.
10. Test adapter cables must be replaced after 1000 tests to ensure accuracy.
11. Test equipment must have a dynamic range of at least 100 dB to minimize measurement uncertainty.
12. Test equipment must be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
13. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
14. Test equipment must be capable of running individual NEXT, return loss, etc. measurements in addition to auto tests. Individual tests increase productivity when diagnosing faults.
15. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
16. Test equipment must be capable of running individual NEXT, return loss, etc. measurements in addition to auto tests. Individual tests increase productivity when diagnosing faults.
17. Test equipment must include a library of cable types, sorted by major manufacturer.
18. Test equipment must store at least 1000 Category 6 auto tests in internal memory.
19. Test equipment must be able to internally group auto tests and cables in project folders for good records management.
20. Test equipment must include DSP technology for support of advanced measurements.
21. Test equipment must make swept frequency measurements in compliance with TIA standards.
22. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

3.6 CLEANING

A. Refer to section 27 00 00.

3.7 ACCEPTANCE

A. Once all work has been completed, test documentation has been submitted and approved, and the Owner is satisfied that all work has been completed in accordance with contract documents, the Owner will notify Contractor in writing of formal acceptance of the system.
B. Contractor's RCDD shall warrant in writing that 100 percent of the installation meets the requirements specified herein.
C. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100 percent PASS rating, and submittal and approval of full documentation as described above. Tests with the "* PASS" (asterisk) will not be acceptable. These circuits must be repaired to meet "PASS".

END OF SECTION