

SECTION 27 13 00 – COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of backbone cabling between Telecommunications Rooms.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Multi-pair Category 3 UTP Cable
 - 2. UTP Termination Hardware
 - 3. Conventional Fiber Optic Cabling
 - 4. Fiber Optic Splicing and Termination Hardware
 - 5. Fiber Enclosures, Adapter Panels and Splice Trays
 - 6. Fiber Optic Patch Cords.

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. ANSI American National Standards Institute
 - 2. BICSI Building Industry Consulting Service International
 - 3. CMR Communications Riser Cable
 - 4. CMP Communications Plenum Cable
 - 5. DCM Design Criteria Manual
 - 6. EIA Electronics Industries Alliance
 - 7. FOCIS Fiber Optic Connector Intermate ability Standards
 - 8. ICEA Insulated Cable Engineers Association
 - 9. IDC Insulation Displacement Connector
 - 10. IEEE Institute of Electrical and Electronics Engineers
 - 11. MER Main Equipment Room
 - 12. NECA National Electrical Contractors Association
 - 13. NEMA National Electric Manufacturers Association
 - 14. NFPA National Fire Protection Association
 - 15. OAR Owner's Authorized Representative
 - 16. OLTS Optical Loss Test Set
 - 17. OFNR Optical Fiber Nonconductive Riser
 - 18. RCDD Registered Communications Distribution Designer
 - 19. RFP Request for Proposal
 - 20. STD Standard
 - 21. TIA Telecommunications Industry Association
 - 22. TR Telecommunications Room
 - 23. UL Underwriters Laboratories
 - 24. UTP Unshielded Twisted Pair

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.
- C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing communications backbone cabling.
- D. Contractor’s Qualifications:
 - 1. Firms regularly engaged in the installation of Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
 - 2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
 - 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
 - 4. Provide a BICSI RCDD certified professional for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD shall be a full time employee of the contractor.
 - 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- E. Manufacturer’s Qualifications:
 - 1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein shall comply with the applicable requirements of:
 - 1. Texas Army Reserve: Information Technology Manual, October 10, 2024
 - 2. Department of the Army Technical Criteria for the Installation Information Infrastructure Architecture (13A), July 2008
 - 3. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2023
 - 4. ANSI/TIA/EIA Standards
 - 5. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2019
 - 6. ANSI/BICSI N1-2019 – Installation practices for Telecommunications and ICT Cabling and related Cabling Infrastructure
 - 7. ANSI/TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises, 2020
 - 8. ANSI/TIA-568.1-E – Commercial Building Telecommunications Cabling Standard, 2020

9. ANSI/TIA/EIA-568.3 -E - Optical Fiber Cabling Components Standard, 2020
10. ANSI/TIA/EIA-569-E – Commercial Building Standard for Telecommunications Pathways and Spaces, 2019
11. ANSI/TIA/EIA-606-D – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2021
12. ANSI-J-STD-607-E – Joint Standard for Commercial Building Grounding (Earthing)and Bonding Requirements for Telecommunications, 2024
13. ANSI/TIA-942-C – Telecommunications Infrastructure Standard for Data Centers, 2024
14. NFPA 70 – National Electric Code, 2023
15. BICSI – Telecommunications Distribution Methods Manual, 15th Edition
16. NEMA – VE 1 – Metal Cable Tray Systems, 2024
17. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2024
18. ANSI/TIA-568.2-E, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, 2024
19. UL 13 – Standard for Safety for Power-Limited Circuit Cables
20. UL 444 - Standard for Safety Communication Cables
21. IEEE 802 – Local Area Network Standard
22. UFC 3-580-01 – DoD Unified Facilities Criteria, Telecommunications Interior Infrastructure Planning and Design, November 21, 2024
23. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the proposal

- and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Produce Shop Drawings for ALL backbone cabling, to include but not limited to, proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements.
- D. Provide all submittal requirements under this section as a single package.
- E. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Manufacturer's certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer's equipment.
 - 3. Manufacturer's installation specifications for copper cabling and optical fiber, indicating minimum bend radius and maximum pull tension.
 - 4. Outline of administration labeling scheme for voice and data communications cabling and termination locations per ANSI/EIA/TIA-606.
 - 5. Proposed format of as-built documentation

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.

2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
3. As-built cable schedules with recorded cable routing and lengths of each designated run.
4. As built documentation of all cabling systems.
5. As built documentation of all pathway systems to include cable tray, conduits (horizontal and vertical), and non-contiguous support.
6. As built documentation of EF/TER/TR modifications and associated cabinet elevations.
7. Laminated as-built drawing sheet of EF/TER/TR service area, with a scale of not less than 1/8IN, mounted in the wall of each EF/TER/TR.

- B. Warranty and Maintenance:
1. Test Report Binder(s)
 2. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

- A. Verify conditions on the job site are 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 Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

- A. Warranty labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01, or for a period of 1 year from date of final completion, whichever is longer. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 ACCEPTABLE DISTRIBUTORS

- A. Contractor shall procure all horizontal cabling components through authorized Manufacturer product distributors.

2.3 UTP PRODUCTS

- A. UTP Cable
 1. Provide multi-pair Category 3 cabling for all copper backbone connectivity.
 2. Conductors shall be at minimum 24 AWG solid annealed copper.
 3. Pairs shall be formed into 25-pair binder groups.
 4. Comply with ICEA S-90-661 for mechanical properties.
 5. Comply with ANSI/TIA-568.1-D for performance specifications.
 6. Provide plenum-rated cable for all plenum environments, riser-rated cable for all non-plenum environments and OSP for all Aerial/Burial Environments.
 7. Refer to drawing set for exact pair count.
 8. Approved products: Intra-Bldg.
 - a. XX-Pair Category 3, CMP (Plenum) Plenum Rated Environment
 - b. XX-Pair Category 3, PVC Riser Rated Environment
 - c. Owner approved equivalent.
 9. Approved Products: Outer-Bldg.
 - a. XX-Pair Category 3, OSP (Outside Plant) Aerial/Burial Environment
 - b. Owner approved equivalent.
- B. UTP Cable Terminating Hardware: Intra-Bldg.
 1. Terminate each end of copper backbone cables with wall mount, or rack mount 110-type Block style field termination kits, as required.
 2. Hardware to exceed the TIA/EIA-568-B.2 Category 3 standard.
 3. Hardware to be field terminable.
 4. Include required quantity of bases and connecting blocks, label holders and labels.
 5. Kit shall include jumper troughs.
 6. Provide 4- and 5-pair connecting blocks, as required.
 7. Provide jumper spools for routing jumpers between blocks, as required.

8. Refer to drawing set for exact pair count.
9. Acceptable products:
 - a. CommScope
 - 1) 50 pr 110 BLOCK with legs PN 558841-1
 - b. CPI 15002-001 Jumper Spool
 - c. Owner approved equivalent.

C. UTP Cable Terminating Hardware: Outer-Bldg.

1. Terminate each end of copper backbone cables with wall mount lightning protection field termination boxes MPN and surge protection modules as required.
2. Hardware to exceed the TIA/EIA-568-B.2 Category 3 standard.
3. Hardware to be field terminable.
4. Include required quantity of bases and connecting blocks, label holders and labels.
5. Kit shall include jumper troughs.
6. Provide jumper spools for routing jumpers between blocks, as required.
7. Refer to drawing set for exact pair count.
8. Acceptable products:
 - a. Circa Telecom
 - b. Owner approved equivalent.

2.4 FIBER OPTIC PRODUCTS

A. Innerduct

1. Provide plenum-rated plastic innerduct for carrying fiber optic cabling if indicated on the drawing set.
2. Innerduct to be of the corrugated variety.
3. The nominal diameter is to be 1-1/4".
4. Include a pull tape in each run of innerduct.
5. Acceptable products:
 - a. Carlon PLM125T
 - b. Approved equivalent

B. Single mode Fiber

1. Provide single mode fiber optic backbone cabling, as indicated in the drawing set.
2. Optical fibers shall be minimum OS1 compliant.
3. Maximum attenuation coefficient shall be:
 - a. 0.65 dB/km at 1310 nm
 - b. 0.65 dB/km at 1383 nm
 - c. 0.65 dB/km at 1550 nm.
4. Provide armored plenum-rated cable for all plenum environments, riser-rated cable for all non-plenum environments and armored OSP for Aerial/Burial

- environments.
- 5. Jacket to be yellow in color for Intra-Bldg.
- 6. Jacket to be Black in color for Outer-Bldg.
- 7. Jacket to be imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.
- 8. Refer to the drawing set for exact fiber counts.
- 9. Approved products: Intra-Bldg. and Outer Bldg.
 - a. Corning - 0XXE88-33131-A3 (Yellow) Intra-Bldg. / 0XXE8P-31131-A3 (Black) Outer-Bldg.
 - b. CommScope
 - c. Superior Essex
 - d. Approved equivalent.
- C. Fiber Optic Connectors
 - 1. Provide LC field terminated connectors for each end of each fiber.
 - 2. Quick-connect, duplex, type LC connectors.
 - 3. Connector to comply with FOCIS specifications of TIA-604-10B.
 - 4. Insertion loss of not more than 0.75 dB.
 - 5. Acceptable Products:
 - a. Corning 95-051-98-SP-X Anaerobic Connector, Multimode, LC
 - b. Corning 95-201-98-SP Anaerobic Connector, Single mode, LC
 - c. Approved equivalent
- D. Fiber Enclosures
 - 1. Provide rack mount modular fiber enclosures.
 - 2. Enclosures shall accept splice modules and fiber adapter modules.
 - 3. Populate unused fiber adapter panel openings with blank filler plates.
 - 4. Refer to the drawing set to determine exact size and configuration.
 - 5. Acceptable Products:
 - a. Corning CCH-02U Rack Mount Fiber Enclosure 2RU
 - b. Corning CCH-03U Rack Mount Fiber Enclosure 3RU
 - c. Corning CCH-04U Rack Mount Fiber Enclosure 4RU
 - d. Approved equivalent
- E. Fiber Adapter Panel
 - 1. Provide LC duplex fiber adapter panels for fiber enclosures.
 - 2. Modules shall be LC duplex for either 12 or 24 fibers.
 - 3. Modules shall be designed to install in rack mount fiber enclosures.
 - 4. Provide a quantity to accommodate every fiber within each enclosure
 - 5. Acceptable products:
 - a. Corning CCH-CP24-A9 Single mode Fiber Adapter Panel, 12 duplex LC
 - b. Corning CCH-CP12-A9 Single mode Fiber Adapter Panel, 6 duplex LC
 - c. Approved equivalent
- F. Fiber Optic Patch Cords
 - 1. Provide factory-made, duplex fiber jumpers.
 - 2. Single mode jumpers shall be constructed of 9/125µm (OS1 minimum) fiber.
 - 3. Provide a variety of lengths (1M, 2M and 3M), as needed, based on the rack elevations in the drawing set.
 - 4. Refer to the fiber usage schedules to determine patch cord quantities for each closet. Provide an additional 20% for spares.
 - 5. Acceptable Products:
 - a. Corning 0404-02-R5116-002-M LC to LC Jumper, Duplex, Single mode, 2m
 - b. Corning 0404-02-R5116-003-M LC to LC Jumper, Duplex, Single mode,

- c. 3m
Approved equivalent

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Install cables in conduits, raceways and cable trays.
- B. Install plenum cable in environmental air spaces where cabling will be exposed, including plenum ceilings.
- C. Bundle, lace, and train cables within racks and enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and wiring troughs, as required.

3.3 INSTALLATION OF CABLES

- A. General Requirements for Cabling:
 - 1. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 2. Install 110-style IDC termination hardware unless otherwise indicated unless otherwise specified on the drawings.
 - 3. Terminate all conductors; no cable shall contain unterminated elements.
 - 4. UTP Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and no more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 5. Verify that installed cable's minimum bend radius does not exceed the installed conduit's bend radius at any point. Coordinate any conduit bend radius conflicts with Installing/General Contractor prior to installation of cable.
- B. Installation of Cable Routed Exposed under Raised Floors:
 - 1. Install plenum-rated cable only.
 - 2. Install cabling after the flooring system has been installed in raised floor areas.
 - 3. Coil cable 6 feet long no less than 12 inches in diameter below each feed point.

3.4 POST-INSTALLATION TESTING

- A. Contractor shall test each pair or strand of every cable prior to acceptance. (100% PASS)
- 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. Copper backbone shall exceed ANSI/TIA-568.2-E Backbone Cabling requirements and meet the manufacturer's specifications for the installed product.

2. Optical fiber shall exceed ANSI/TIA-568.3-E Optical Fiber Cabling Components Standard requirements and meet the manufacturer's specifications for the installed product.
 3. Contractor shall certify to TIA/TSB-140 Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.
- E. Cable Test Documentation:
1. Optical Fiber: Testing shall be performed on all fibers in the completed end-to-end system.
 - a. Power Meter and Source Loss Reports: Testing shall consist of a bi-directional, dual wave length end to end test. The system loss measurements shall be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for single mode fibers.
 - 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. Reflective events (connections) shall not exceed 0.75 dB.
 - c. Non-reflective events (splices) shall not exceed 0.3 dB.
 - d. Fibers shall be inspected at 250X or 400X magnification. 250X magnification is suitable for inspecting multimode and single mode fibers. 400X magnification may be used for detailed examination of single mode fibers.
 - e. Testing shall be performed on each cabling segment (connector to connector).
 - f. Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for optical loss test set (OLTS) testing shall be between one meter and five meters in length. The test cords for OTDR testing shall be approximately 100 meters for the launch cable and at least 25 meters for the receive cable.
 - g. Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner's instructions.
 2. Test results saved within the field-test instrument shall be transferred into a Windows™ based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., "as saved in the field-test instrument". The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
 3. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information:
 - a. The identification of the customer site as specified by the end-user.
 - b. The name of the test limit selected to execute the stored test results.
 - c. The name of the personnel performing the test.
 - d. The date and time the test results were saved.
 - e. The manufacturer, model and serial number of the test instrument.
 - f. The version of the test software and the version of the test limit database held within the test instrument.
 - g. The fiber identification number.
 - h. The length for each optical fiber.
 - i. The index of refraction used for length calculation when using a length capable OLTS.
 - j. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the

- measured attenuation and the test limit value).
- k. Test results to include OTDR link and channel traces and event tables at the appropriate wavelength(s).
- l. The length for each optical fiber as calculated by the OTDR
- m. Overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements.
- n. Circuit IDs reported by the test instrument should match the specified label ID.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections in accordance with project specifications. Provide minimum 24 hours notice to OAR prior to testing. All testing shall be witnessed by OAR, at OAR's discretion.
- B. Tests and Inspections:
 - 1. Furnish proposed test procedures, recording forms, list of testing personnel and test equipment to OAR for review prior to commencement of testing.
 - 2. Follow recommended procedures for testing as published by test equipment manufacturer.
- C. Copper Cable Testing:
 - 1. Testing of all copper wiring shall be performed prior to system cutover. 100% of riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage.
 - 2. Category 3 riser cables shall be tested for conformance to TIA 568C.
 - 3. OAR shall randomly perform unannounced, onsite reviews during installation. OAR shall perform final inspection and a complete review of test results before installation is accepted.
- D. Optical Fiber Testing with OTDR
 - 1. The Contractor shall test all optical fiber cable prior to installation. The Contractor shall assume all liability for the replacement of the cable should it be found defective at a later date.
 - 2. All fiber testing shall be performed on all fibers in the completed system. Bidirectional end-to-end OTDR testing shall be performed in accordance with TIA 455-78-B. The system loss measurement shall be provided at 850 and 1310 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.
 - 3. Fiber links shall have a maximum loss of (allowable cable loss per km) (km of fiber in the link) + (.4dB)(number of mated connectors) = maximum allowable loss.
 - 4. Documentation shall be provided in both hard copy and CD format to the OAR.
- E. Optical Fiber Testing with Power Meter
 - 1. Multimode Horizontal Link Segments should be tested in both directions at 850-nm and 1300-nm wavelengths.
 - 2. Multimode backbone and composite link segments should be tested in both directions at both 850-nm and 1300-nm wavelengths.
 - 3. Single mode horizontal link segments shall be tested in both directions at 1300-nm and 1550-nm wavelengths.
 - 4. Single mode backbone and composite link segments should be tested in both direction at both 1310-nm and 1550-nm wavelengths.
- F. Testing documentation shall be submitted in accordance with TIA/EIA 526-14-A "Optical Power Loss Measurement in Installed Multimode Fiber Cable Plant" and

TIA/EIA 526-7 “Measurement of Optical Power Loss of Installed Single mode Fiber Cable Plant”. At minimum, the following information shall be documented during testing:

1. Names of personnel conducting the test.
2. Type of test equipment used (manufacturer, model, serial number).
3. Date test is being performed.
4. Fiber identification.
5. End point locations.
6. Test direction.
7. Reference power measurement (when not using a power meter with a relative power measurement mode).
8. Measured attenuation of the link segment.
9. Acceptable link attenuation.
10. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

END OF SECTION