

## **SPECIFICATION STANDARD COMMUNICATIONS OPTICAL FIBER HORIZONTAL CABLING 27 15 23**

### **PART 1: GENERAL**

#### **1.01 SCOPE OF WORK**

- A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of horizontal optical fiber infrastructure as described on the drawings and/or required by these specifications.
- B. Coordinate the work in this section with section 27 13 23 OPTICAL FIBER BACKBONE CABLING
- C. **The Contractor shall complete all work and turn over a completed and standards compliant optical fiber horizontal cabling system to meet the requirements of the UNM IT network system installation and activation. The scheduled date for completion of optical fiber cabling and associated copper and wireless systems shall incorporate the activation dates for services need to provide all services including voice, data, special systems needed for a Certificate of Occupancy, the testing and operation of Building Monitoring Systems, and Electronic Safety and Security Systems.**

#### **1.02 RELATED SECTIONS & REFERENCES**

- A. The Contractor is held responsible to be knowledgeable with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation. The Contractor is held responsible is assumed to possess the working knowledge, manpower, and materials applicable to the completion of the installation as specified in all specifications within the UNM IT Division 27 standards specifications and in particular the following Section:
  - 1. Division 27, Section 27 05 28 Pathways for Communication Systems.
  - 2. Division 27, Section 27 05 43 Underground Ducts and Raceways for Communication Systems.
  - 3. Division 27, Section 27 05 53 Identification for Communication Systems.
  - 4. Division 27, Section 27 11 16 Communications Cabinets, Racks, Frames, and Enclosures.
  - 5. Division 27, Section 27 11 19 Communications Termination Blocks and Patch Panels.
  - 6. Division 27, Section 27 11 23 Communications Cable Management and Ladder Rack
  - 7. Division 27, Section 27 13 13 Communications Copper Backbone Cabling.
  - 8. Division 27, Section 27 13 23 Communications Optical Fiber Backbone Cabling.
  - 9. Division 27, Section 27 13 33 Communications Coaxial Backbone Cabling

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10. Division 27, Section 27 15 13 Communications Copper Horizontal Cabling
11. Division 27, Section 27 15 33 Communications Coaxial Horizontal Cabling.
12. Division 27, Section 27 15 43 Communications Faceplates and Connectors.
13. Division 27, Section 27 08 00 Communications Commissioning, Testing and Acceptance.

- B. Design, install and test data distribution systems per manufacturer's requirements and in accordance with NFPA 70 (National Electric Code), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards and practices.

1. UNM IT Specifications and Standards
2. BICSI TDM, Current Edition
3. ANSI/TIA-568-C.0, *Generic Telecommunications Cabling for Customer Premises*
4. ANSI/TIA/568-C.1, *Commercial Building Telecommunications Cabling Standard*
5. ANSI/TIA/568-C.2, *Copper Cabling Components Standard*
6. ANSI/TIA/568-C.3, *Optical Fiber Cabling Components Standard*
7. ANSI/TIA/EIA-569-B, *Commercial Building Standard for Telecommunications Pathways and Spaces*
8. ANSI/TIA/EIA-606-A, *Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*
9. ANSI/J-STD-607-A, *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*
10. ANSI/TIA-942, *Telecommunications Infrastructure Standard for Data Centers*

The Contractor is responsible to determine and adhere to the most recent edition of these standards when developing their responses and completing the project installation.

## **1.03 QUALITY ASSURANCE**

- A. UNM IT will inspect installation in progress. It is the responsibility of the Contractor to schedule regular and milestone inspection times with UNM IT. It is incumbent upon the Contractor to verify that the installation and material used has been inspected before it is enclosed within building features, buried, or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected.
- B. The Contractor will provide electronic test results and a 20 year manufacturer's warranty with a copy of the warranty to be submitted to UNM IT at the completion of work.

## **1.04 OPTICAL FIBER HORIZONTAL SYSTEM DESCRIPTION**

- A. The main Equipment Room (ER) and each Telecommunications Room (TR) shall house both voice and data backbone cabling and active equipment to support

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networking requirements. The ER in most cases shall be the main point of entry for outside services as well as main distribution point for all backbone cabling to the TR. Fiber optic horizontal cable, when specified, shall be employed between the work area outlet and the ER or TR for voice, data and special systems connectivity.

- B. Optical fiber cabling in the horizontal system shall consist of single mode multi-fiber horizontal cables and connectors, pathways, fiber enclosures, terminations, equipment racks, cable management, labeling and documentation. The end-to-end cable segment begins at the outlet and shall include the work area outlet with LC connectors, multi-fiber horizontal distribution single mode cable, and an optical fiber enclosure, terminating in a TR or ER with an LC connector. The exact size optical fiber cable will be determined by UNM IT. The size of optical fiber inter building cabling systems may vary depending upon system design, but a 4 tight buffered optical fiber SM horizontal distribution cable is typical. The typical optical fiber work area outlet may also include two Category 6 links.
- C. Optical Fibers shall be terminated using a pre polished LC mechanical connector assembly that are terminated to the horizontal optical fibers, unless otherwise specified and housed in rack-mount fiber optic enclosures with cable supports or work area outlet.
- D. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors and fibers of each installed cable shall be verified useable prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced at the providers expense in order to ensure 100% useable conductors in all installed cables.

## **PART 2 - PRODUCTS**

### **2.01 General**

- A. The materials and products specified herein reflect the minimum acceptable standards of fabrication and manufacture.
- B. All materials and products supplied by the Contractor and specified herein are to be new, unused, of first quality and in original packaging or shipping containers.
- C. Provide materials as specified or as approved equivalent by UNM IT.
- D. The following manufacturer's warranted systems are approved unless otherwise specified:
  - 1. AMP
  - 2. Belden

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3. Berk-Tek
4. CommScope
5. Ortronics
6. Siemons

## **2.02 SUBSTITUTIONS**

A. Product substitutions shall be managed according to the following guidelines:

1. All substitutions shall be submitted to and approved by UNM IT.
2. Acceptance of substitutions is at UNM IT discretion: UNM IT reserves the right to determine suitability of the substitute product and reject any and all materials submitted for substitution. Submit requests for substitutions in writing to UNM IT for approval within 10 days of contract award, or sooner if required to maintain the construction schedule.
3. Products rejected or otherwise judged unsatisfactory by the UNM IT will not be authorized for use in completing the work. Any unapproved products discovered as part of the installation will be removed and replaced with UNM IT specified and approved products at the Contractor's expense.
4. Project Drawings may be based on equipment configuration of a particular manufacturer. If a substitution is approved, the Contractor shall make changes needed to accommodate the substitution at no expense to the University of New Mexico, including work under other divisions.

## **2.03 SINGLE MODE HORIZONTAL OPTICAL FIBER CABLE & CONNECTORS (Typical)**

- A. Single mode fiber is the standard media and shall be a premise type construction, tight buffered 900 um, Low water-peak, laser optimized, suitable for CWDM use and complies with the ITU G.562.c/d. standard.
- B. The typical fiber outlets consist of a four-strand fiber. Number of strands may vary depending on the project and intended use.
- C. Terminate optical fibers using mechanical, factory polished LC connectors.
- D. Install into blue coupler panels.

## **2.04 MULTI-MODE HORIZONTAL OPTICAL FIBER CABLE CONNECTORS (Non Typical)**

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- A. Multi-mode fiber optic cable shall only be installed when specified and approved by UNM IT and shall be a premise type, tight buffered 900 um, OM3 50/125 MM.
- B. The typical fiber outlets consist of a four-strand fiber. Number of strands may vary depending on the project and the intended use.
- E. Install a horizontal distribution type, OFNP, plenum optical fiber cable.
- C. Install 50 UM optical fiber into aqua coupler panels.
- D. For installations that 62.5 UM optical fiber is specified with UNM IT approval, install beige couple panels.

### **2.05 RACK – MOUNTED ENCLOSURES FOR HORIZONTAL OPTICAL FIBER**

- A. Horizontal fiber optic cable terminations in each Telecommunications Room (TR) shall be housed in rack-mount enclosures.
- B. The fiber optic enclosures shall be mounted in 19" x 7' rack(s). Fiber optic enclosures shall be capable of containing 24, 48, 72, 96, 192, or 288 fiber connections as specified by UNM IT.
- C. All equipment racks shall be augmented with vertical and horizontal cable management hardware, both front and rear, to properly dress horizontal cables and patch cords.
- D. For additional requirements see Division 27, Section 27 11 16 - Racks, Frames and Enclosures and Section - 27 11 19 - Termination Blocks and Patch Panels.

## **PART 3 - EXECUTION**

### **3.01 General - OPTICAL FIBER HORIZONTAL INSTALLATION**

- A. This Section describes the installation of the products and materials for optical fiber horizontal cabling. The Project Specifications, Drawings and UNM IT Standard Specifications shall be followed during the course of the installation.
- B. The Contractor shall verify the outlet locations shown on the project drawings are based upon the latest design information.
- C. The Contractor is instructed to coordinate his efforts with other trades who may be working within the same vicinity to avoid conflicts, lost time, cleaned environment for

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splicing and termination and potential injury. UNM IT will assist in contractor coordination as requested or as required.

- D. The Contractor shall install all materials plumb, square and in a workman-like manner.
- E. The Contractor is required to supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.
- F. The Contractor shall verify space requirements and locations with UNM IT before starting cable installations and terminations.
- G. The Contractor shall verify the cable type and jacket rating required for use with UNM IT before starting fiber installation.
- H. The Contractor shall comply with all National, State of New Mexico, Local and University of New Mexico Codes and Standards during the course of installation. Should any portion of these Specifications conflict with applicable Codes, the Contractor shall cease work on that particular aspect of the Project and notify UNM IT immediately.
- I. All optical fiber cable system components shall be installed in a neat and professional manner, arranged for convenient operation, testing and future maintenance.
- J. All fiber cables shall be installed and terminated by technicians trained and experienced in the installation and termination of fiber cables. The Contractor shall employ certified system installation technicians and have at least 5 years experience in the installation of similar and equivalent systems. The Contractor shall supply verification of experience upon request by UNM IT.

## **3.02 GENERAL FIBER INSTALLATION**

- A. Cable lengths within boxes shall be adequate to permit installation and removal of device for inspection without damage to cable or connections (minimum of 36 inches).
- B. Cable bends radius shall not be greater than that recommended by the manufacturer of the cable.
- C. Care shall be taken so as not to damage cable during the installation process and that manufacturer's pull tension specification is not exceeded.
- D. Route cables so that no horizontal cable exceeds 90 meters between TR termination and device jack termination. Contact UNM IT if this is not probable with TR location.

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- E. Provide a minimum 8 feet and maximum 10 feet of slack in the TR and in the ceiling above the work area outlet.
- F. Within TRs, cables shall be snugly wrapped using Velcro reusable cable ties, a minimum of every 3 feet for cable organization. Velcro ties shall be tightened so as not to deform cable jackets and thus affect cable performance.
- G. The Contractor shall verify existing cable fill in conduit, raceway or cable tray system before installation of additional cables so as not to exceed 40% cable fill on the initial installation. Contractor will be responsible for installation of additional conduit, raceway or cable tray where additional cables to be added will exceed the 40% cable fill.

## **3.03 HORIZONTAL FIBER TERMINATION**

- A. New TRs must be free from dust, dirt, and other foreign materials before the installation of any termination hardware or the termination of fiber optic cables. The door to the telecommunication rooms must be installed and closed during termination.
- B. The horizontal fiber cabling will be terminated at the TR or ER in a rack mountable enclosure.
- C. Mechanical factory polished LC connectors are approved termination methods in the horizontal segment only, unless otherwise specified or approved by UNM IT.
- D. Contractor shall be responsible to obtain and follow the specified and recommended manufacturer's installation instructions for correct termination methods and optical fiber cable management of cables on respective products.

## **3.04 FIBER COLOR CODES**

- A. Fiber Color Code approved for sequencing follows:

Number	Color
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White
7	Red
8	Black



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9	Yellow
10	Violet
11	Rose
12	Aqua

### 3.07 CABLE TESTING

- A. 100% testing required is required for all horizontal optical fiber links.
- B. 100% verification by UNM IT of all horizontal fiber cable tests may be performed. The contractor shall notify the UNM IT before the start of testing. Contractor may request UNM IT to accompany them in the testing of cables to ensure proper information entry into the tester.
- C. The contractor shall schedule a site survey with IT Facilities at the completion of labeling and prior to testing with UNM IT prior to the start of testing to verify labeling.
- D. The fiber optic cables shall be tested utilizing a power meter and stabilized light source capable of testing at 850 nm and 1300 nm for multimode and 1310 nm and 1550 nm for single-mode. Contractor shall complete a fiber optic post installation report at the time of testing containing meter readings at both 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single-mode in both direction (TR to outlet) on each fiber, actual loss and other pertinent data regarding the cables tested, including model and serial number of test equipment, cable part #, installed fiber length, building span loss at 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single-mode and date tested. Submit full test results in LinkWare.
- E. Testing requirements for Attenuation and Reflection
  - 1. Acceptable attenuation shall be calculated based upon on connector, type, number of splices and optical fiber length and shall comply with TIA/EIA 526. Attenuation shall not exceed the specified perimeters established by the manufacturer and the requirements of this section
  - 2. Reflection test perimeter shall not exceed > - 40 db per connector or splice
- F. Maximum Acceptable Attenuation Values

Fiber Type	Test Wavelength	Mated Pair Connector Loss (each)
50/125 Multimode	850nm	0.5 dB
50/125 Multimode	1300nm	0.5 dB
62.5/125Multimode	850nm	0.5 dB
62.5/125Multimode	1300nm	0.5 dB
Single-mode	1310nm	0.5 dB



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Single-mode

1550nm

0.5 dB

## 3.08 AS-BUILT INFORMATION

- A. Contractor shall provide as-built information to UNM IT to accompany all test result information.
- B. As-built information shall be in electronic format in AutoCAD, the most current version... Indicate location of all outlets, distribution cable trays, junction boxes, FDU with configuration, optical fiber cable equipment rack layout with cable designators and counts and all additions and deletions pertaining to the horizontal optical fiber cabling system. Include correct outlet labeling next to all telecom symbols.
- C. Contractor shall provide one set of preliminary as-build information, splice diagrams and test results including all test result information 30 days prior to occupancy to ensure the scheduled installation and activation of UNM IT equipment and services.
- D. Failure of the contractor to provide the required as-built information in a timely manner for UNM IT to prepare cutover information may cause an installation delay for the project due to the contractors not meeting these requirements. The delivery of the as-built documentation needs to be coordinated with UNM IT as a project milestone.**
- E. Partial as-builds shall be submitted as additional cabling is completed to meet installation schedules.
- F. The Contractor shall provide at substantial completion a list of all uncompleted work and a punch list of open items to the IT Facilities Manager at substantial completion and prior to UNM scheduled activations.
- G. If construction drawings are not utilized, contractor shall provide all telecommunications location information on an accurate and electronic formatted scaled floor plan preapproved by UNM IT.
- H. Partial as-builds shall be submitted as additional cabling is completed to meet installation schedules. The Contractor shall provide one set of preliminary as-build information, equipment layouts including elevations and test results to meet the schedule requirements of the UNM IT equipment installation and activation.
- I. As final submission, provide a 2 CD with copies of the IBNS in Excel format one copy shall be locked and the second shall be in an open, searchable format. Provide floor plans with outlet locations and ID's in Auto Cad and CompleteTest results (not just summary sheet) in LinkWare.

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- J. The final as-built shall be submitted with all corrections made no later than 30 days after cabling installation is completed.

## **3.09 SYSTEM WARRANTY REQUIREMENTS**

- A. Contractor shall provide a 20-year extended manufacturer's warranty in addition to the contractor's warranty provided to the project. The warranty shall be titled to the UNM IT Department. The warranty shall begin at the system acceptance date and remain in effect for a period of 20 years from that date.
- B. The umbrella warranty provided for the horizontal copper cabling system shall be issued by the manufacture of the cabling system. The contractor shall provide to UNM IT any additional warranties from partners in addition to the cabling system warranty, i.e. cable manufacturer, contractor warranties. Acceptable manufacturer warrantees include:
  - 1. AMP
  - 2. Belden
  - 3. CommScope/Systimax/Uniprise
  - 4. Ortronics
  - 5. Siemons
- C. All installed systems must conform to the manufacturer's official published specifications. Any exceptions agreed to by the contractor and the manufacturer shall be approved by UNM IT. The contractor shall submit in writing and obtain approval from UNM IT for all exceptions pertaining to the cabling system's warranty prior to the request being submitted to the manufacturer.
- D. The warranty shall include a warranty of the applications published by the manufacturer at the time of the warranty application. The contractor is to provide to UNM IT a list of these applications.
- E. The contractor will provide UNM IT with a copy of the warranty application at the time of submittal to the manufacturer.
- F. Contractor shall perform all labeling requirements and provide testing documentation for verification and submittal to the manufacturer and UNM IT. A copy of the warranty application and all documentation and test results shall be submitted simultaneously to UNM IT and the manufacturer.
- G. Contractor shall provide copies floor plans sent to the manufacture showing final locations of all telecommunication outlets, patch panels, FDU's and spaces prior to submission of the warranty application. The contractor is to ensure that the warranty submittals match the submitted as-built.

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- H. Contractor shall submit for the warranty all cable records to reflect moves, adds, and changes as built.
- I. The contractor shall include and schedule UNM IT in all site surveys and inspections that relate to the warranty application or processes.

**END OF SECTION**

