

UW Medicine MASTER SPECIFICATION PART 2

COMMUNICATIONS SYSTEMS CABLING

PART 1 - GENERAL

1.1 SCOPE

- A. Provide a complete copper, fiber, and coaxial communications cable plant distribution system as specified herein and as shown in the Contract Documents.
- B. The Contractor shall provide all necessary project management, labor, materials, equipment, services, and other items required, whether specified or not, to furnish a complete and functional distribution facility. Among the items required are
 - 1. Provision for riser fiber and copper
 - 2. Voice patch panels in the TDR Room for voice station cable
 - 3. Fiber patch panels for data riser
 - 4. Data patch panels in the TDR Room for data station cabling
 - 5. Category 6 unshielded twisted-pair station cable for voice and data
 - 6. Category 6 termination outlets for voice and data
 - 7. Category 6 UTP cable and termination outlets for security cameras
 - 8. Termination in floor boxes and at all stations
 - 9. Terminated station drop cable bundles
 - 10. Outlet devices and faceplates
 - 11. Labeling in rooms and at station locations
 - 12. Installation test data
 - 13. Connection to ground bar
 - 14. Equipment cabinets
 - 15. Racks and accessories
 - 16. Cable pathway and accessories.
 - 17. Category 6A UTP cable and termination outlets for WAPs
 - 18. WAP layouts
- C. Related Sections
 - 1. If not addressed in this section or the Contract Documents, the Contractor shall comply with the requirements and specifications contained in Division 0, Division 01, and Division 26. Refer to Division 01 for meeting attendance and submittal requirements.
- D. Comply with all requirements of 26 05 00, 27 10 00 and 27 20 00.

1.2 QUALITY ASSURANCE

- A. Contractor Qualifications
 - 1. Copper Cable Installation Requirements
 - a. General

- 1) Work in this section shall be performed by a low-voltage Contractor with demonstrated experience in the installation of structured cabling.
 - 2) The Contractor shall have demonstrated experience in the installation and testing of all cable plant components specified herein.
 - 3) The Contractor shall have installed cable plant in buildings similar in size and scope to this project.
- b. Contractor shall be trained by the Equipment Manufacturers in the installation and testing of the proposed system. As requested by the owner, the technicians in the field shall demonstrate knowledge of material and installation on the product line. Only full-time permanent employees/staff of the company are approved to provide site supervision and testing.
- c. Contractor's employees directly involved with the supervision, installation, testing, and certification of the system shall be trained and certified by the selected system manufacturers. Training and certifications by employee type are required as shown below:
- 1) Supervisors/Project Foremen: All (100%) shall be trained/certified for installation and testing
 - 2) Test Technicians: All (100%) shall be trained/certified for installation and testing.
 - 3) Installation Technicians: Prior to bidding, half (50%) shall be trained/certified for installation. Upon award of the project, the remaining untrained installation technicians shall be trained and certified by the manufacturer at no cost to the Owner.
 - 4) Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the system (i.e. project managers, cleanup crew, etc.) are not required to be manufacturer trained and certified. Otherwise, personnel not manufacturer-trained and certified shall not be allowed on the job site.
- d. Contractor's employees whose duties include the application of firestopping material shall be trained and certified by the specified firestopping manufacturer. Training and certifications by employee type are required as shown below:
- 1) Supervisors/Project Foremen: All (100%) shall be trained/certified for installation.
 - 2) Firestopping Technician: All (100%) shall be trained/certified for installation.
- e. In addition Contractor shall employ a minimum of one Registered Communications Distribution Designer (RCDD), certified by and in current good standing with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/sub-contractor to the Contractor is not acceptable) and be onsite throughout the project when work is ongoing. Contractor shall continue to employ the RCDD throughout the duration of the project and submit documentation or a formal request for acceptance by the owner if a different RCDD is proposed. Submit a document with the resume of the RCDD and the document shall declare that the RCDD is a direct full time employee of the Contractor and that the Contractor will continue to employ the RCDD throughout the duration of the

project and that the RCDD will be onsite during all work. Provide current copy of RCDD certificate.

- f. Contractor and all subcontractors shall have successfully completed no less than five (5) similar projects (in terms of size and construction cost) under the Contractor's current business name within the past three (3) years.
2. Fiber Installer Qualifications
- a. Work in this section shall be performed by a low-voltage Contractor with demonstrated experience in the installation of singlemode fiber optic cabling and testing of all components specified herein.
 - b. The Fiber Optic Cable Installation Contractor shall have successfully completed no fewer than five (5) similar projects (in terms of size and construction cost) with the same equipment under the Contractor's current business name within the past three (3) years.
 - c. The Contractor shall be industry trained in the installation and testing of the proposed system. The technicians in the field shall demonstrate knowledge of material and installation of the product line and testing. Only full-time, permanent employees/staff of the company are approved to provide site supervision and testing.
 - d. The Fiber Optic Cable Installation Contractor shall submit, but not be limited to, the following:
 - 1) A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
 - 2) A list of the test equipment by name and serial number proposed for use and evidence of recent calibration for each proposed device.
 - 3) A technical resume of experience and certifications for the Contractor's Project Manager, on-site installation supervisor, and technicians who will be assigned to this project.
 - 4) A list of technical product training, specific to this project, attended by the Contractor's personnel who will install, terminate, pigtail splice and test the fiber optic cabling system.
 - 5) Any Sub-Contractor, who will assist the Contractor in the installation of fiber optics, shall have and submit the same training and certification as noted above for the Contractor's personnel.
 - 6) The Fiber Optic Cable Installation Contractor shall submit current industry-recognized certification from major fiber optic manufacturers and organizations such as BICSI, Electronics Technician Association (ETA), Fiber Optic Association (FOA), etc.
 - 7) Submit copies of installer(s) current certificates as described above 45 days prior to any work being initiated. If on-site personnel changes occur, appropriate certification paperwork shall be provided to reflect new personnel qualifications.
 - 8) The Fiber Optic Cable Installation Contractor shall schedule and attend a qualifying interview with the Owner (UW TECH) to demonstrate their experience and knowledge of fiber optic cabling installation, termination, and testing. This interview shall be required prior to commencement of cable installation.

- 9) The fiber optic cable installation, termination, and testing shall be done under the direct supervision of an RCDD Registered Technician and shall be present at all times when work of this section is performed at the project site.

1.3 WARRANTY

- A. Refer to Division 01.
- B. Regulatory Requirements
 1. All work shall be performed in accordance with the latest revisions of all national and local governing codes and standards, including:
 - a. ANSI American National Standards Institute
 - b. ASTM American Society for Testing and Materials
 - c. BICSI Building Industry Consulting Services International
 - d. EIA Electronic Industries Association
 - e. FCC Federal Communications Commission
 - f. ICEA Insulated Cable Engineers Association
 - g. IEEE Institute of Electrical & Electronics Engineers
 - h. NCTA National Cable and Telecommunications Association
 - i. NEC National Electrical Code
 - j. NECA National Electrical Contractors Association
 - k. NEMA National Electrical Manufacturers Association
 - l. NESC National Electrical Safety Code
 - m. NETA National Electrical Testing Association
 - n. NFPA National Fire Protection Association
 - o. NIST National Institute of Standards & Technology
 - p. OSHA Occupational Safety and Health Administration
 - q. TIA Telecommunications Industries Association
 - r. UL Underwriters Laboratories, Inc.
 2. All work shall also be performed in accordance with the latest revisions of UWIT standards.
- C. Conflicts Among Governing Codes and Documents
 1. Refer to Division 01.

1.4 MATERIALS, EQUIPMENT, AND PRODUCT SUBSTITUTIONS

- A. Refer to Division 01; Materials, Equipment, and Product Substitutions.
- B. The materials, equipment, and products specified herein have been extensively tested and vetted by UWIT. In many cases, multiple manufacturers or products are listed for common solutions. Refer to the Product Standards column of the Product Appendix for applicable requirements.
- C. "Required Product" within these documents is considered a product having no functional equivalent for UWIT campus standards.

- D. "Performance Equivalent" within these documents is considered a product standard for functional performance for UWIT. Substitution requests shall be evaluated strictly on performance.
- E. "Recommended Product" within these documents is considered a product familiar and acceptable to UWIT.

1.5 SUBMITTALS

- A. Refer to Division 01; Submittals.
 - 1. Provide complete manufacturer's product literature (not distributor's catalog sheets) for all products specified here in, referenced to the applicable paragraph in Part 2 the Product Section.
 - 2. Provide manufacturer's recommended installation methods including maximum cable pull tension and minimum bend radius of all cable.
 - 3. Organize product submittal in the same order the products appear in the Specification Section Part 2.
 - 4. Provide pointers/markers to identify product being submitted if more than one product is listed on a page.
 - 5. Non-compliance with the above provisions will result in submittal rejection.

1.6 PRODUCT SUBSTITUTIONS

- A. Submit substitution requests per Division 01 Sections.
- B. If substitutions to the recommended products are proposed, the Contractor shall submit complete manufacturer's product literature (not distributor's catalog sheets) demonstrating compatibility with other related products and provide samples for evaluation two weeks prior to the bid date. No "custom" items, (e.g., to meet unusual physical requirements of the installation site), shall be used except as specified in the Construction Documents or as reviewed and approved by OWNER

1.7 CONSTRUCTION SCHEDULE

- A. Refer to Division 01, Construction Schedule
- B. Prior to commencing construction of the copper, fiber optic, and coaxial cable plant, the Contractors shall coordinate a pre-installation walk-through with UWMC Operations and Maintenance, Division 26 Contractor installation lead, and all trades having work within or connected to the TDR. Walk-through shall address installation of all pathways, installation requirements and layouts in TDR, and other building cable plant installation requirements prior to drywall cover.
- C. In addition to the requirements in the above referenced section, the following milestones shall be referenced in the project construction schedule
 - 1. Start/completion of continuity-of-service work.
 - 2. Elevator inspection and other early building service commissioning dates.
 - 3. Walkthrough for inspection of early building service pathway.

4. Walkthrough for inspection of overall building pathway (continuity/bushings/pull strings/etc.) prior to drywall cover and drop ceiling install.
5. Start of cable tray in TDR.
6. Pre-install walkthrough for TDR's walk and rack build out.
7. Start of racks and ladder rack.
8. Pre-install walkthrough for routing of electrical outlets on racks.
9. Mounting OSP punch down block for use by others.
10. *Start and completion of early building service cable plant install and testing.
11. Start of overall building cable plant.
12. Start of termination.
13. Start of testing with target testing completion dates by TDR.

- ONE MONTH FOR UWMC OPERATIONS AND MAINTENANCE and UWIT:
- UWIT Switches (1 week)
- UWMC Operations and Maintenance and UWIT Installer (1 week)
- Project Communications Subcontractor needs to coordinate with UWMC Operations and Maintenance point-of-contact to install any TEC-supported early building service cable during WEEK 3.

- D. The service provider/UWMC Operations and Maintenance requires access to the TEC and TDR's one (1) month prior to early building service activation date. Contractor schedule and work shall be directed to provide TEC and TDR's finished, including early building service termination, testing, labeling, and a dust-free environment to allow installation of Owner equipment for early building services. The Contractor shall coordinate this requirement with Contractor and all related trades. The Contractor shall notify the Owner of this date for coordination with the service provider.

1.8 PRE-INSTALLATION WALK-THROUGH

- A. This Section Contractor shall attend communication pathway pre-installation walk-through with UWMC Operations and Maintenance representative and Electrical Foreman. Refer to Division 26 for requirements. This walk-through shall occur prior to commencement of the cable tray and dry wall installation.
- B. Prior to commencement of installation work in the TEC/TDR'S, the Contractor shall arrange a site survey with Owner to "mark layout" for actual location of termination equipment in the TEC Room and TDR rooms. Owner has the authority to make modifications to the layout of these Rooms with no additional cost to the Owner. The Contractor's Foreman, who will be managing the cable installation, shall be present at the pre-installation walk-through.
- C. Early Service Completion Notice
1. The overall building cable installation schedule shall be established such that the riser cables are installed first, starting with the TEC, then TDR, followed

by the building service locations and then the terminations and testing of cables. **(Coordinate with UWMC Facilities, Operations and Maintenance.)**

D. Partial Completion Notification

1. The overall building cable installation schedule shall be established and followed such that the TDR Room is completed first and pathways completed after. All rooms must be complete prior to Partial Completion Notification.
2. The cable plant Contractor shall complete work early enough that Owner has adequate time to install equipment and related functions prior to substantial completion. (UWMC Operations and Maintenance and UWIT require a minimum of one month or approximately one week per TEC and TDR for projects with more than four riser rooms.) **Note to Contractor: This time is in addition to the one month required prior to the early building service inspection date.**
3. Hard copy test results will be provided as the TDR room is completed for the service area it supports.

E. Construction Facilities and Trailer Farm

1. Refer to Division 01.

F. Inspection and Substantial Completion

1. Refer to Division 01; Contract Closeout.

G. Contract Closeout

1. Refer to Division 01; Contract Closeout.

PART 2 - PRODUCTS

2.1 INTRODUCTION

- A. All materials constituting the voice and data transmission facility shall conform to the specifications herein.
- B. The products included in each specification have been extensively evaluated by the University of Washington and constitute items of demonstrated functionality and compatibility.
- C. All products shall be new and shall be brought to the job site in original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All communications cable shall bear the manufacturer's label in accordance with NEC 800 based on flammability testing as follows:
 - CMR Riser-rated Communications Cable
 - CMP Plenum-rated Communications Cable
 - OFNR Riser-rated Fiber Optic Cable
 - OFNP Plenum-rated Fiber Optic Cable

2.2 RISER/TIE CABLES

- A. The following paragraphs describe the products intra-building riser/tie cabling between the TEC Room(s) and the TDR Rooms.
- B. Copper Cable
 - 1. Patient Monitoring CAT6 Tie Cables
 - a. Horizontal tie cables between TDR Rooms criteria.
 - 1) Suitable for installation in environment defined.
 - 2) Unshielded Twisted 4-pair.
 - 3) Have insulated solid annealed copper pairs, 24 AWG.
 - 4) Category 6.
 - 5) Have an NEC Article 800 cable rating type CMP, UL Listed.
 - 6) Jacket Color: White or gray.
 - 7) Required Product: CommScope CS34P.
- C. Fiber Optic Cable
 - 1. Single-mode fiber optic cable criteria:
 - a. Sufficiently free of surface imperfections and occlusions to meet optical, mechanical, and environmental requirements of this specification.
 - b. Have been subjected to minimum tensile proof test by fiber manufacturer equivalent to 100-kpsi.
 - c. Have transmission windows of 1310 nm and 1550 nm.
 - d. Suitable for installation in free air, in building risers, in conduit, and in cable tray.
 - e. Dielectric materials (no conductive materials).
 - f. Have jacket material of as required for cable rating.
 - g. Have a cable rating of OFNR.
 - h. Have dielectric strength members.
 - i. TEC to TDR vertical cable system
 - j. Required Products;
 - 1) Field terminated ribbon fiber: Intra-building, Riser – Corning 0XXEC8-14101-20 (Where XX = quantity of SM strands with LC terminations).
- D. Connectors/Hardware: The following paragraphs describe the products used to terminate the riser/tie cabling within the building. Product shall be located in TEC/TDR Rooms as directed by Owner during pre-installation walk-through.
 - 1. 110 cross-connect blocks criteria:
 - a. 110-style high-density cross-connect blocks.
 - b. 300-pair blocks with legs.
 - c. Have each horizontal row of block be capable of terminating one 25-pair binder group of Backbone Copper Cable.
 - d. Have ability to terminate 24-26 AWG plastic-insulated, solid copper conductors.
 - e. Provide direct connection between riser, tie and/or backbone cable and jumper wires.

- f. Designed to maintain cable pair twists as closely as possible to point of mechanical termination.
- g. The blocks used in the TEC and TDR Rooms for copper riser and riser tie cable terminations shall be 300- pair 110-type wiring blocks. Blocks shall be mounted to stand-off cans (bracket).
- h. Cross-connects for use by UWMC Operations and Maintenance.
- i. Cross-connects from buildings riser/tie backbone cables to rack-mounted tie panels.
- j. Required Products: Systimax - 110AW2-300 wiring block and Braka Industries - Stand-off Can - RMNT-0010.
- 2. 5-pair connector clips
 - a. Copper riser backbone cable blocks shall be provided with 5-pair connector clips, IDC style displacement.
 - b. Required Products: Systimax - C-5 clips 110C-5.
- 3. 110 cross-connect wire management:
 - a. Mounted on standoff can.
 - b. Provided with legs.
 - c. Mounted above each 110 block as indicated on the Drawings.
 - d. Manufactured with high-strength, flame-retardant thermoplastic.
 - e. Required Products: Systimax Solutions 188B2.
- 4. 110 block labels:
 - a. Provided with each 110 block.
 - b. Provided with clear plastic protective cover for attachment to 110 block.
 - c. Affixed to each row on the 110 block.
 - d. White with dark black lettering.
 - e. Required Products: Systimax - Clear cover 1884T1-50; White labels 110WA2-4500L.
- 5. Copper tie cable patch panel 48-port.
 - a. Include RJ45 to IDC connectors.
 - b. Terminated 4 pair per port.
 - c. Rack-mountable.
 - d. 4 RU's high.
 - e. Include integral wire-management bracket.
 - f. Include white adhesive labels with dark black lettering.
 - g. Required Products: Systimax - PM2150PSE-48.
- 6. Fiber Optic Cable Termination Hardware
 - a. Singlemode.
 - 1) Fiber optic distribution/splice shelf at TDRs, An enclosed assembly.
 - a) Incorporate hinged or retractable cover.
 - b) Rack-mountable.
 - c) Provide strain relief for incoming cables.
 - d) Incorporate radius control mechanisms.
 - e) Include provisions for permanent labeling.
 - f) Incorporate splice shelf for fusion-spliced pigtail assemblies.
 - g) Incorporate splice organizer to manage pigtail assemblies and incoming fiber.
 - h) Incorporate LC coupler panels for single-mode couplers.

- i) Ratio for 24 strand and above fiber: 20 UPC/ 4 APC, at both ends in TEC /TDRs.
- 2) Required Products by Corning:
 - a) Pretium edge 4RU and 1RU Hardware; PCH-04U and PCH-01U.
 - b) Splice tray manager and bracket; PC4-GOV-SPLC.
 - c) Ribbon splice tray; M67-076.
 - d) 12 fiber ribbon heat-shrink; 2806031-012.
 - e) 12 cable installation bracket; CDF-RJ12-BKT.
 - f) Ribbon termination kit; 15-211-14.
 - g) Fiber optic duplex couplers shall accommodate single-mode UPC and APC connectors. Required Product: Duplex Singlemode - LC connectors with 20 UPC and 4 APC connectors in the same panel; Corning CCH-CP24-A9B3-P03RJ

2.3 STATIONS

- A. Copper Cable: The following paragraphs describe the cabling for voice and data station outlets.
 - 1. Standard outlet twisted-pair cable criteria:
 - a. Suitable for installation in environment defined.
 - b. CAT6 rated.
 - c. Have insulated solid annealed copper pairs, 24 AWG.
 - d. Have an NEC Article 800 cable rating type CMP (Plenum rated), UL Listed.
 - e. Jacket Color: WHITE.
 - f. Refer to Part 3 - EXECUTION and Outlet Schedule for specific configurations
 - g. Required Products: CommScope CS34P .
 - 2. Security Surveillance Camera Horizontal Cable.
 - a. CAT6 rated.
 - b. Plenum rated.
 - c. Color GREEN.
 - d. 4-pair, UTP, 23 AWG.
 - e. Required Product by Systimax Solutions, Part No. 2071E-SG 4/23. No substitutions.
 - 3. Wireless Access Point (WAP) Horizontal Cable.
 - a. CAT6A rated.
 - b. Plenum rated.
 - c. Jacket color: BLUE.
 - d. 4-pair, UTP, 23 AWG.
 - e. Required Product by Systimax Solutions, Part No. 2091B WH (or SL) 4/23 W1000 (or R1000). No substitutions.
 - f. Required Products: CommScope
- B. Connectors/Hardware for Station Outlets: The following paragraphs specify the standard modular copper, fiber, and multimedia outlet devices, which shall be used in

all new construction and remodeled installations. Typical configurations combine a modular information jack with or without a mounting frame and a faceplate.

1. Station Outlets: copper inserts (connector jacks) criteria:
 - a. Meet or exceed performance requirements for Category 6.
 - b. Color Orange.
 - c. RJ45, wired to pin-out T568B.
 - 1) Provide RJ45 jacks (two jacks per four pair cable) for cables routed from an existing TDR for the single voice cable. The two data cables for existing TDRs will require RJ45 jacks. Cabling for 3EE, 7EE & 7NN shall be considered as an existing TDR and terminations shall be as below. One cable from each faceplate shall be a voice cable and terminated per procedures below unless directed otherwise by cable schedule.
 - a) Terminate the Blue and orange pairs of the cat 6 cable on the first RJ45 jack on the blue and orange pairs of the jack. The green and brown pairs of the cable shall be terminated on the blue and orange pairs of the jack.
 - d. Non-keyed.
 - e. Insulation displacement type contact.
 - f. Maintain cable's pair twist as close as possible to point of mechanical termination
 - g. Required Products: Systimax Solutions - MPSI00E-112.
 - 1) Provide M1AH product for RJ45 jacks
2. Wireless Access Point (WAP) Outlets: copper inserts (connector jacks) criteria:
 - a. Meet or exceed performance requirements for Category 6A.
 - b. Color Orange.
 - c. RJ45, wired to pin-out T568B.
 - d. Non-keyed.
 - e. Insulation displacement type contact.
 - f. Maintain cable's pair twist as close as possible to point of mechanical termination
 - g. Required Products: Systimax Solutions – MGS600-112 ORANGE.
3. Standard Faceplates criteria:
 - a. Double-gang.
 - b. Accommodate a minimum of 8 modular inserts or connector jacks.
 - c. Plastic.
 - d. Color ivory.
 - e. Required Products: Systimax Solutions Systimax - M28L-246.
4. Station Recessed Floor Box Faceplates and Adapters
 - a. Plastic.
 - b. Color ivory and gray.
 - c. Required Products: Systimax Solutions- M26L-246 (ivory) and Hubbell HBLLT309SGY (gray color).
5. Wall Mount Phone Faceplate and Adapters criteria:
 - a. Integrated faceplate and jack assembly.
 - b. Stainless steel faceplate.
 - c. Required Products: Systimax - 630B.

6. Wireless Access Point Faceplate and Adapters
 - a. Wireless access point outlets located in ceiling shall be provided with a 2-port biscuit jack and ten (10) feet of cable coiled at each station, temporarily supported from structure.
 - 1) Required Products: Systimax Solutions - M102SMB-A-246.
 - b. Wireless access point outlets in wall shall be provided with standard box and faceplate.
 - 1) Required Products: Systimax - M28L-246.

C. FIBER OPTIC CABLE

1. Fiber optic cable to be provided and installed in the horizontal cabling environment shall be six strands of multimode. The cable shall have a central strength member and Aramid yarn surrounding the strands.
 - a. Cable shall be a tight buffer cable
 - b. Multimode fiber shall be LOMMF, OM3 grade
 - 1) Laser bandwidth shall be 2,000 MHz*km minimum
 - c. Cable shall have 900 micron jacket
2. NFPA 70 type OFNP plenum
3. Provide LC connections on each end of the cable.

2.4 TDR TERMINATION HARDWARE

- A. Patch Panels: The following paragraphs describe the products used to terminate the cabling within the TDR.
 1. Be rack-mountable in standard EIA 19" equipment racks.
 2. Have cable support and strain relief.
 3. Ensure minimum bend radius requirements are satisfied.
 4. Include integral labeling means. Labels shall be white with black lettering and backed with adhesive.
 5. Be 48 port Category 6.
 6. Be IDC to RJ45 T568B termination style.
 7. Have integral wire-management rings on the front.
 8. Required Products: Systimax - 48 port PM2150PSE-48.
- B. Security Surveillance Camera Patch Panels.
 1. 24-port.
 2. CAT6 wired with T568B pin configuration.
 3. 2-RU's high.
 4. Required Product by Systimax Solutions, Part No. 360-PM-GS3-2U. No substitutions.
- C. Data and Voice Station Termination
 1. Patch Panel
 - a. 48 port Standard Density, Patchmax system with inserts for all 48 ports and built in wire management. Category 6. Systimax #760062364, PM-GS3-48 w/Termination Mgt. Completely filled with RJ45 jacks
 - b.

- D. Patient Monitoring Tie Cable Patch Panels
 - 1. 24 port Standard Density, Patchmax system with inserts for all 24 ports and built in wire management. Category 6. Systimax #760062364, PM-GS3-48 w/Termination Mgt. Completely filled with CAT 6 RJ45 jacks.
- E. Wireless Access Point (WAP) Patch Panels
 - 1. 48-port.
 - 2. CAT6A wired with T568B pin configuration.
 - 3. 2-RU's high.
 - 4. Required Product by Systimax Solutions, Part #760128207, 360-PM-GS6-2U-48. No substitutions.

2.5 ASSOCIATED PRODUCTS

- A. Fiber Optic Media Converters
 - 1. Recommended Products:
 - a. Transition Networks SBFFG1013-105 or approved equal
 - b. Provide patch cords and power supplies as needed for complete system
- B. Cable lubricants
 - 1. Recommended Products:
 - a. Twisted-pair cable: Dyna-Blue American Polywater
- C. Fire stopping
 - 1. Recommended Products:
 - a. Hilti, Inc.
 - b. T&B Flame Safe Compound
 - c. 3M Fire Barrier Caulk
- D. Pull Strings
 - 1. 3/32-inch diameter, 200-pound strength polyethylene pull line shall be installed in all communication system conduit, both empty and with cable.

PART 3 - EXECUTION

3.1 WAP LOCATION IDENTIFICATION

- A. As part of the cable installation, this contractor shall work with an Aruba certified vendor to optimize placement of the WAPs. Refer to Section 27 20 00.

3.2 PRODUCT INSPECTIONS

- A. Pre-installation Walk-Through
 - 1. Prior to commencement of cable installation, the Contractor shall arrange a site survey with Owner to "mark layout" for actual location of termination equipment in the TEC and TDR Rooms. Owner has the authority to make

modifications to the layout of these Rooms with no additional cost to the Owner. The Contractor's Foreman, who will be managing the cable installation, shall be present at the pre-installation walk-through.

B. Owner Review

1. All products shall be inspected prior to installation to verify that they are of proper gauge, contains the correct number of pairs, and otherwise meets specifications. Any physical damage to products is unacceptable. Uniform jacket thickness, tightness, or buckling should be checked. All outlet devices, cross-connect blocks, and other components shall also be inspected prior to installation.
2. Within one week of inspection, the Contractor shall submit a statement certifying that all cable and components met specifications or were replaced.

3.3 SERVICE INTERRUPTION

A. General

1. The Contractor shall be responsible for identifying any possible service interruptions. Coordination with Owner shall be required to develop a plan.
2. Contractor shall schedule a pre-demolition walkthrough with UWMC Operations and Maintenance prior to commencing any work.
3. The Contractor shall maintain continuity of existing service in the construction area and for building occupants not otherwise affected by the Project throughout the demolition and construction phases, unless prior arrangements have been negotiated.
4. The Contractor shall notify the Architect in writing of all copper, fiber optic, and coaxial communications cables (which are serving occupied areas) that must be relocated. The Contractor shall be responsible for relocating existing cables that are to remain in service after consultation with Owner.
5. The Contractor shall prevent interruption of service by identifying and providing temporary supports and protection of all existing communications cables, cross-connect blocks, and equipment throughout demolition and construction. Coordinate requirements for continuity with UWMC Operations and Maintenance. In both cases, UWMC Operations and Maintenance approval is required prior to final solution.
6. Upon disruption of service, the Contractor shall notify the University Construction Coordinator immediately so that a repair crew can be assigned to correct the problem.

B. Construction Services

1. Work Planning
 - a. The Contractor shall disconnect and remove communication cable and termination equipment serving construction trailers and temporary offices installed for the purpose of supporting this project. Contractor shall coordinate decommissioning with Owner prior to performing this work. Two (2) weeks' notice is required.
2. Building Systems Interface

- a. The Contractor shall coordinate timely installation of communication cable and termination equipment with the Sub-Contractors providing Elevator Service, Fire Alarm System, Security System, Card Access System (CAAMS), Building Automation System, etc. Termination outlets shall be mounted adjacent to respective system panel per the communication outlet schedule. Out-of-sequence construction may be required to support testing and Authority Having Jurisdiction (AHJ) witnessing of building systems. The Contractor shall provide timely installation of outlets and cable plant serving the building systems to accommodate commissioning and testing.
- b. Refer to requirements in Part One for construction schedule and partial completion notification.

3.4 CABLE INSTALLATION

A. General Installation Requirements

1. The Contractor shall ensure that communications cable is installed with care and in raceway or cable tray, using techniques which prevent kinking, sharp bends, scraping, cutting, or deforming the jacket, or other damage. Installation shall be subject to periodic inspections by Owner. The Contractor shall replace unacceptable cable at no additional expense to the University. No cable shall be routed open or in J-Hooks, all in raceway or cable tray. The only exception is in D-Rings in the TEC / TDR from the Cable Tray/Cable Runway to the final termination.
2. Furnish all required installation tools to facilitate cable pulling without damage to cable jacket.
3. Pull all cable by hand unless installation conditions require mechanical assistance.
4. Install cable in conduit or metal raceway system (cable tray or equivalent) in public areas and as designated on plans.
5. Station cable in TDR shall be routed and supported utilizing "D-type" mounting rings and overhead cable tray.
6. Backbone in the TDR shall be routed and supported utilizing overhead cable runway and D-rings.
7. Cabling shall be neatly laced, dressed, and supported.
8. Repair damage to interior spaces caused by installation of cable, raceway, or other hardware. Repairs or replacements must match preexisting color and finish of walls, floors, and ceilings.
9. Splices
 - a. Copper cables shall be installed splice-free.
 - b. Optical fiber cable shall not be spliced except, when specified, fiber terminations shall utilize fusion-spliced pigtails.
10. Routing
 - a. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purpose (e.g., access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures).

- b. The installation of cable around movable devices, instruments, sub-panels, etc., shall be provided with a fixed standard outlet adjacent to device. Final connectivity shall only be provided through patch cable.
11. Pull Lines
- a. A 3/32-inch diameter, 200-pound minimum strength polyethylene pull line shall be installed in all communication system conduit, both empty and with cable. This provides a pull line available for the next cable installation. Each end of the pull line shall be secured. Secure pull line to conduit end and box end.
12. Cable Bend Radius and Pull Tension
- a. During pulling operation, adequate number of workers shall be present to allow cable observation at all points of raceway entry and exit, as well as to feed cable and operate pulling machinery.
 - b. Pull cables in accordance with cable manufacturer's recommendations and ANSI/EEE C2 Standards.
 - c. Recommended pulling tensions and bending radii shall not be exceeded.
 - d. Where mechanical assistance is used, ensure that maximum tensile load for cable is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of "break-away" or other approved method.
13. Cable Lubricants
- a. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces shall be cleaned free of lubricant residue.
14. Cable Support
- a. All cable shall be supported every 4 feet vertically and horizontally within TEC and TDR Rooms.
 - b. Separately supported "D-rings" shall be used to support cable vertically and horizontally by means of D-rings screwed to the backboard. Installation of these supports shall be done with care, so as not to cause crushing or distortion of the cable or result in tighter radius bends than the minimum radius permitted for each type of cable. Cable not dressed in a neat fashion or installed with excessive slack shall be rejected.
 - c. Station cables shall be organized neatly by system (copper/fiber).
15. Grounding
- a. Bond Riser Cable shields in TDR to the telecommunications grounding bus-bar provided.
16. Removal
- a. All communications cable that has been decommissioned, slated for demolition, or otherwise found abandoned shall be removed from ceiling spaces, conduit, cable tray, and other raceway within the construction area.
 - b. Provide demolition of cable complete from point of origin (TEC, TDRs) to outlet.
17. Conduit Usage/Fill
- a. General

- 1) All communications conduits and sleeves shall be grounded, dedicated, meet NEC fill requirements, meet bend radius, supplied with pull lines, and labeled.
 - 2) Contractors shall not attach any devices, raceway, or other building systems to communications conduits.
- b. Grounding
 - 1) All communications cable shall be installed in grounded metal conduit.
 - 2) A grounding riser shall be established for all communications cabling devices and supports. Refer to Section 27 10 00 for grounding requirements and coordination with trades.
 - 3) Riser cable shields in each TDR shall be connected to telecommunications ground bus bar.
- c. Dedicated Use
 - 1) Communications cable shall not share conduit with electrical power wiring, department system wiring, or any other building system.
- d. Fill
 - 1) Communications conduit shall not be filled beyond 40% fill ratio. Refer to NEC and TIA Standards for conduit capacity for various trade sizes of conduit.
- e. Cable Lubricants
 - 1) Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces shall be cleaned free of lubricant residue.
18. Cable Tray Usage/Fill
 - a. General
 - 1) All communications cable tray shall be grounded, dedicated, meet NEC fill requirements, and meet bend radius.
 - 2) Contractor shall not attach any devices, raceway, or other building systems to sides or bottom of cable tray.
 - b. Fill
 - 1) Communications cable shall be installed in cable tray as indicated in the Contract Documents. Cable tray fill shall not exceed 50% of total tray cross-sectional area.
 - c. Transitions
 - 1) Install cable so that entry to and exit from tray is supported by drop-out plates or other listed devices installed to ensure cable is not stressed at the point at which it enters or exits the tray.
 - 2) Where the cable bundle makes a transition from conduit to cable tray, the cables shall drop, as much as possible, perpendicular to the tray. (They shall not slope to a point more than one foot along the tray.)
 - d. Dressing Cable
 - 1) Wherever cable tray is exposed in hallways, whether completely visible or partially concealed, extra care shall be taken to neatly dress all cable between the conduit and the tray. Do not secure cable in bundles while inside the tray. Cable shall remain loose, not bound, but neatly managed in tray.

19. Fire-stopping

a. General

- 1) During the final review and inspection period, following the Owner inspection of cable installed and tested acceptable, but prior to substantial completion, all sleeves passing through floors, roofs, and exterior walls shall be filled with approved fire-stop material in accordance with NEC 300-21. All firewall penetrations shall likewise be filled with suitable fire-stop material. Unused sleeves shall be capped or grouted.
- 2) In situations where cable tray, conduit, or sleeves extend outside the construction area into occupied portions of the building, they shall be capped or fire-stopped throughout the course of construction.
- 3) The ancillary space around all sleeves passing through fire-rated construction shall be sealed with approved fire-stop material in accordance with NEC 300-21. Unused sleeves shall be sealed with approved fire-stop material. UL listed fire-rated conduit caps may be used to seal unused sleeves and conduit except where conduits have grounding bushings.
- 4) In situations where cable tray, conduit, or sleeves extend outside the construction area through fire-rated construction, they shall be capped or sealed throughout the course of construction.
- 5) Where conduits extend through walls to the exterior of buildings, conduits shall be sealed with weatherproof material or capped. Unused conduits in outside cable plant pull vaults or duct banks shall be capped.
- 6) Regardless of building code requirements, all sleeves and conduit entering or exiting an TDR shall be firestopped or be a manufactured fire-rated assembly for both horizontal and vertical interconnections.
- 7) All new penetrations shall utilize the STI EZ-Path product or Hilti Speed Sleeves.

3.5 RISER CABLE PLANT

A. Cable Installation

1. General

- a. Coordinate Construction Schedule to assure outside plant cable (by Owner) is installed in TEC prior to any riser or station cable routing in TEC.
- b. Copper riser cable, optical fiber riser cable, and coaxial riser cable shall be routed inside the TEC and TDR Rooms as three distinct and separate cable bundles.

2. Cable Sleeve Usage and Cable Routing

- a. Install cable in the TEC and the TDR per the Contract Documents. Allocation of riser sleeves shall be as indicated on the riser diagram. Unless otherwise noted in the contract drawings, each sleeve shall be filled to maximum fill allowed by the NEC before adjacent sleeve is used. For existing conditions, use partially filled sleeves before using adjacent unused sleeves.

- b. Station cables shall be installed in conduits and sleeves as directed by UWMC Operations and Maintenance during pre-installation walk-through.
 - c. Cable shall be routed as close as possible to the ceiling, floor, or corners to ensure that adequate wall or backboard space is available for future equipment and for cable termination.
 - d. Cable shall be routed over a path that will offer minimum obstruction to future installation of equipment, backboards, or other cables. Avoid crossing areas horizontally just above or below riser sleeve or cable tray penetrations.
 - e. Copper Riser Cables: Provide standoff can for cables to pass through behind blocks.
 - f. Exact cable routing and backboard layout shall be coordinated with Owner during pre-installation walk-through.
3. Cable
- a. Optical Fiber Riser Cable
 - 1) Individual optical fiber cables shall be installed from the termination point in the TEC to the patch panel in each TDR. Refer to the contract drawings for strand counts and cable type. Provide service loop consisting of 10 feet of slack, coiled to manufacturer recommendation in loop, in the TEC and at each TDR termination point. Cable jacket label shall be visible for Authority Having Jurisdiction inspection.
 - 2) The 24 strand fiber cables shall be terminated as follows: the first 20 strands with LC UPC connectors and the last 4 strands with LC APC connectors.

B. Cable Terminations

- 1. General Requirements
 - a. The exact position of copper, fiber, and coaxial riser termination locations shall be based on the pre-installation walk-through with the Owner prior to rough-in of the cable plant. Refer to Section 3.1 for requirements.
- 2. Technology Equipment Center Room (TEC)
 - a. Fiber optic cables shall be terminated in rack-mounted optical fiber patch panels using mass fusion spliced pigtail terminations. The patch panels shall be organized by floor and by TDR as specifically shown in the Contract Documents on the rack elevation detail and as discussed during the pre-installation walkthrough.
 - b. Copper riser pairs shall terminate to 300-pair 110 blocks mounted to stand-off cans. All pairs shall be terminated with 4- or 5-pair 110 connectors.
 - c. 110 blocks shall be organized into fields designated as riser and riser tie cross-connect. Additionally, fields shall be further subdivided by floor and by TDR where multiple TDR's exist for each floor.
 - d. Copper riser pairs shall be cross-connected to rack-mounted Telco patch panels utilizing separate riser tie 110 blocks.
 - e. Voice riser cables need to terminate onto wall mounted 110 style wiring blocks then tie cables need to be provided between the 110 wiring blocks and rack mounted patch panels. Circuits originating from the riser cables will then be cross-connected to the tie cables then patch cord connected

between rack mounted patch panels. UWMC uses the TIA Standard T586B pin-out configuration for outlet jacks and patch panels, The tie cables will be terminated on the rack mounted patch panels in each telecom room in the following manner unless noted otherwise:

- 1) (2) 48-port patch panels with a single pair terminated on the patch panel to appear on pins 4&5 or the Blue/White pair only.
 - 2) (2) 48-port patch panel with two-pairs terminated on the first 24 patch panel ports to appear on pins 4&5 and 3&6 or the Blue/White and Green/White pairs and the second (last) 24 patch panel ports with four pairs terminated on each jack using all 8 pins.
3. Intermediate Distribution Frame Room (TDR)
- a. Fiber optic cables shall be terminated to rack-mounted optical fiber patch panels using pigtailed. The patch panels shall be organized as specifically shown in the Contract Documents on the rack elevation details and as discussed during the pre-installation walkthrough.
 - b. Copper riser cables shall be terminated on 110-style, 300-pair blocks mounted to stand-off cans. All pairs shall be terminated with 4- or 5-pair 110 connectors.
 - c. These blocks shall be organized into fields designated for riser and riser tie cross-connect.
 - d. Voice riser cables need to terminate onto wall mounted 110 style wiring blocks then tie cables need to be provided between the 110 wiring blocks and rack mounted patch panels. Circuits originating from the riser cables will then be cross-connected to the tie cables then patch cord connected between rack mounted patch panels. UW MC uses the TIA Standard T586B pin-out configuration for outlet jacks and patch panels, The tie cables will be terminated on the rack mounted patch panels in each telecom room in the following manner unless noted otherwise:
 - 1) (2) 48-port patch panels with a single pair terminated on the patch panel to appear on pins 4&5 or the Blue/White pair only.
 - 2) (2) 48-port patch panel with two-pairs terminated on the first 24 patch panel ports to appear on pins 4&5 and 3&6 or the Blue/White and Green/White pairs and the second (last) 24 patch panel ports with four pairs terminated on each jack using all 8 pins.
 - e. Terminating 25-pair cable binder groups on the patch panels will follow the following sequences:
 - 1) Patch Panels terminated with one pair per jack: terminate the 1st pair (BL-W) on the first patch panel jack continuing to follow the color code until the 24th pair (BN-V) is terminated on the 24th and last jack on the patch panel row. The remaining 25th pair (SL-V) will be coiled and left as spare.
 - 2) Patch Panels terminated with two pair per jack: terminate the 1st pair (BL-W) on the first patch panel jack on pins 4&5, terminate the 2nd pair (O-W) on the first patch panel jack on pins 3&6. In the T568B jack wiring scheme pins 4&5 are the BL-W pair and pins 3&6 are the G-W pair. Continuing to follow the color code until the 23rd pair (G-V) pair is terminated on pins 4&5 of the 12th patch panel jack and the 24th pair (BN-V) is terminated on pins 3&6 of the 12th jack. The

remaining 25th pair (SL-V) will be coiled and left as spare. Continue with the next 25 pair binder group terminating the 1st pair (BL-W) on pins 4&5 of the 13th jack in the row. Terminate the 2nd pair (O-W) on pins 3&6 of the 13th jack. Continue the color code until the 23rd pair (G-V) pair is terminated on pins 4&5 of the 24th patch panel jack and the 24th pair (BN-V) is terminated on pins 3&6 of the 24th jack. The remaining 25th pair (SL-V) will be coiled and left as spare.

- 3) Patch Panels terminated with four pair per jack: terminate the first four pair of the 25 pair binder group on the first patch panel using the T568B pin out scheme until 24 pairs are used. Coil the remaining 25th pair and leave it as spare. In this method it will take four 25 pair cables to complete 24 patch panel jacks.

3.6 STATION CABLE PLANT

A. Cable Installation

1. Cable Routing

- a. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purpose (e.g., access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures).
- b. To reduce effects of EMI, the following minimum separation distances shall be adhered to:
 - 1) 5" from power lines of 2 kVA.
 - 2) 18" from high-voltage lighting (including fluorescent).
 - 3) 39" from power lines of 5 kVA or greater.
 - 4) 39" from transformers and motors.
- c. Station copper and fiber cables shall be home run to TDR or TEC from station outlet.
- d. Maximum station cable length shall not exceed 295 ft (90 meters) measured from termination in TDR or TEC to station outlet, including slack required for installation and termination. Contractor is responsible for installing station cable to avoid unnecessarily long runs. Coordinate with Division 26 Contractor to assure pathways are adequately installed.
- e. Any area that cannot be reached within above constraints shall be identified and reported to Engineer/UWMC Operations and Maintenance prior to installation.

B. Cable Terminations

1. TDR

- a. The exact position of voice, data, and video station termination hardware shall be based on a walk-through with the Owner prior to rough-in of the termination points. The Contractor shall request the meeting be arranged (3) three weeks prior to needing the information that will be discussed in the walk-through.

- b. Station copper cable shall terminate to rack-mounted patch panels. Additionally, furnish and install dedicated patch panel(s) for wireless access point copper cables.
- c. Cables shall have pair twists preserved to point of termination.
- d. Cable jacket shall be continuous to within 1/2" of termination.
- e. Terminate cables using T568B wiring standard.
- 2. Cable Termination Sequence - Copper Patch Panel
 - a. Station copper cables shall terminate in sequential order on patch panels from top left port to bottom right port.
 - b. Wireless access point copper cables shall terminate in sequential order on dedicated patch panel from top left port to bottom right port.

C. Outlet Device

- 1. Cable Termination at Workstation
 - a. The standard communications outlet consists of 2 cables of unshielded twisted 4-pair Category 6. Unless noted otherwise, this cable bundle shall be installed from each outlet location to the TDR designated in the Outlet Schedule.
 - 1) For cables installed terminating in existing TDRs (for example for cabling associated with 8SE, 7EE and several 2nd floor TDRs), provide three cat 6 cables.
 - a) One cable shall be used for voice cabling and terminated on 110 type blocks on the wallfield in the TDR and on two RJ45 jacks at the work stations.
 - b) The remaining two cables shall be terminated on patch panels in the TDR and on two RJ45 jacks at the work stations.
 - b. The standard wall phone outlet consists of 1 cable of unshielded twisted 4-pair Category 6 cable.
 - c. The standard wireless outlet consists of 1 cable of unshielded twisted 4-pair Category 6 cable.
 - d. The standard security camera outlet consists of 1 cable of unshielded twisted 4-pair Category 6 cable. Terminate with surface mount jack.
 - e. At the outlet location, approximately 6-9 inches of slack cable shall remain to facilitate servicing after the installation.
 - f. Cables shall have pair twists preserved to point of termination.
 - g. Cable jacket shall be continuous to within 1/2" of termination.
 - h. Terminate cables using T568B wiring standard.
 - i. All cable installed to floor boxes shall be terminated at floor box in specified faceplate. It is not acceptable to extend station cable out of a floor box. Refer to Outlet Schedule.
- 2. Standard Outlet Box
 - a. The standard outlet box is a deep 4-11/16 inch by 4-11/16 -inch by 2.125-inch flush-mounted electrical outlet box with a double gang mud-ring.
- 3. Wall-Mounted Telephone
 - a. The Contractor shall terminate cable in the prescribed wall outlet termination device.
- 4. Furniture Outlets

- a. The Contractor shall terminate system furniture outlets after the completion of the furniture installation. Refer to the Contract Documents for details of this activation.
- 5. Building Systems
 - a. CAAMS
 - 1) Provide and install per outlet schedule and CAAMS wall layout detail.
 - b. Building Automation System (BAS), (DDC)
 - 1) Provide cables (and terminations) per outlet schedule.

D. Cable Identification

- 1. General Labeling Requirements
 - a. All cables shall be labeled.
 - b. Label cables with tags adhesively wrapped around each cable within 4 inches of cable termination.
 - c. Labeling shall be by mechanical means in black ink on non-removable tags.
 - d. Hand-lettered designations are not allowed.
- 2. Vertical Riser Cable Labels
 - a. Labels shall be placed at the following locations:
 - 1) Riser blocks and patch panels in the TEC and each TDR.
 - 2) Six inches above the floor penetration (sleeve or conduit) in each TEC and TDR.
 - 3) For optical fiber, labels shall be placed 6 inches before the service loops, 6 inches after the service loops, and 6 inches below the sleeve opening at the ceiling or from the wall.
- 3. General Station Cable Label Identification
 - a. All station cables shall be labeled per the Contract Documents. Cable shall be labeled in the TDR Rooms on the termination hardware at both ends.
 - b. Labeling shall be by mechanical means in black ink on non-removable tags.
- 4. Station Cable Termination Label Identification in TDR
 - a. Copper cable labels shall be by mechanical means in black ink on white adhesive label inserted behind a clear protective cover.
 - b. Refer to example in details.
 - c. Riser tie panel port labels shall be by mechanical means in black ink on white label adhesive label inserted behind a clear protective cover.
 - d. Refer to example in details.
 - e. Optical Fiber Patch Panel labels shall be by mechanical means in black ink on white adhesive label inserted behind a clear protective cover.
- 5. Station Cable Termination Labels at Outlet Device
 - a. All faceplate identification shall be consistent with the numbers on the Outlet Schedule included in the Contract Documents. Document grid numbers are unacceptable. Owner-assigned room numbers shall be used. Verify architectural backgrounds include Owner-assigned room numbers; no conversion outlet schedules will be accepted.
 - b. As specified in the Construction Documents, all plastic faceplates shall be provided with a mechanical label in black ink securely attached to the faceplate indicating that location's ID number. The Contractor shall provide

blank faceplates on all device boxes and SMR sections that do not get served with station cable. This includes replacing pre-punched section of SMR (Isoduct) with new blank section. Blank faceplates shall be labeled "comm." with same material as other outlet labels.

- c. All faceplates shall be labeled. The mechanical labels shall be legible, permanent, and securely attached to the respective faceplate. Position the room and outlet identifier at the top of the faceplate and the TDR room number at the bottom.
 - 1) (TDR RM#/) RM#.XX

3.7 TESTING

A. General Testing Requirements

1. Work Planning

- a. Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms, and timetable. Owner shall be notified 2 weeks prior to any testing so that the testing may be witnessed.
- b. Acceptance of the simple test procedures discussed below is predicated on the Contractor's use of the recommended products (including, but not limited to, twisted-pair, fiber and coaxial cable, and outlet devices specified in the Products paragraph), and adherence to the inspection requirements and practices set forth.
- c. The Contractor shall test:
 - 1) All riser cable from TEC to TDR, TEC to Main PBX Room, TEC to Router Rooms, and TEC to Data Center termination points.
 - 2) All station cable from TEC / TDR termination points to outlet device.

B. Riser Cable Testing

1. Optical Fiber Cable Testing Requirements

- a. Provide evidence of certification of all fiber optic test equipment to UWMC Operations and Maintenance (and UWIT) prior to commencement of testing. Certification dates provided shall be current through construction schedule.
- b. Before installation, all optical fiber cable shall be tested on the reel using an OTDR (Optical Time Domain Reflectometer) to ensure that it meets the manufacturer's specifications.
- c. The procedure for testing optical fiber cables requires a power meter and a light source with the capability to record test data on a CD in non-proprietary standard format. A hard copy of the summary test results on CD shall be provided to the Owner including link loss and a reference reading. The power meter and the light source shall have the proper interface (patch cord) to test LC connector terminations.
- d. Each optical fiber strand shall be tested using the same patch cord for each port to keep readings consistent.
- e. After installation, the Contractor shall test each fiber strand utilizing an OTDR.

- f. All OTDR tests shall be performed using the same 100-foot launch cable.
- g. After installation, the Contractor shall also test each fiber strand utilizing a power meter at both 1310 nm and 1550 nm wavelengths to include:
 - 1) Continuity
 - 2) Length (calculated from difference between footage markers on cable).
 - 3) Total segment (end-to-end) loss (dB) at each end.
 - 4) Bi-directional testing.
 - 5) Acceptable connector loss shall not exceed 0.4 dB.
 - 6) If loss is greater than 0.4 dB, check connector for proper buffing or contaminants before retesting.
 - 7) If the source of high loss is the LC-to-LC interface and it cannot be corrected, verify that the fault does not lie with the pigtail assembly.
 - 8) When loss is greater than 0.75 dB, replace the pigtail assembly.
 - 9) If any fractures, no matter how small, are detected during examination of the fiber in the LC, the pigtail assembly shall be replaced.
- 2. Twisted-Pair Copper Cable
 - a. A visual inspection shall be made to ensure that the cables have been terminated on the punch-down blocks in proper color code order. An end-to-end continuity test is to be made for each pair to ensure wire continuity and correct tip and ring polarity. Riser cable shall be tested from the TEC frame punch-down blocks to each TDR punch-down block.
 - b. Vertical and horizontal riser cables shall be tested to ensure that they meet the current requirements of EIA/TIA-568-A cabling standard for the category of cable being installed (i.e., Category 3 cable shall meet Category 3 parameters). Documentation shall include cable ID; pair ID, results of testing, and as-built information.

C. Station UTP Cable Testing

- 1. Copper Cable Testing Requirements
 - a. All testing shall be done using the permanent link parameters.
 - b. All pairs shall test "pass" and meet appropriate performance parameters. Open, split, miss-terminated pairs, deviations from the manufacturer's installation specifications, defective connections, and bad installation practices shall not be accepted and shall be corrected. Test all station cables.
 - c. Test results shall meet or exceed the performance test requirements as specified in the current ANSI/TIA/EIA specifications.
 - d. Provide one (1) hard copy of summary (one-line per jack) test results to UWMC Operations and Maintenance as each TEC / TDR room is completed and save electronically complete documentation of all tests. Documentation shall include outlet number and results of performance testing done with the cable analyzer. Analyzer documentation of testing shall consist of test result recorded in a ".txt" or ".csv" file onto a CD in each TEC or TDR. Tests results shall be submitted and approved prior to substantial completion and final payment approval.

- e. Special Case: Wall-mounted phone unit locations. These are pre-assembled with a Cat 3 jack; therefore, test to Cat 3 standards for continuity, polarity, and loss.

D. Defects

- 1. Defects Identified Through Testing
 - a. When errors are found, the source of each error shall be determined and corrected and the cable retested.
 - b. All defective components shall be replaced and retested following the procedure described above.
 - c. A list shall be submitted for University approval of any defective components that the Contractor is unable to correct with a detailed explanation and alternative proposals.

E. Test Records

- 1. Required Submittal to Owner
 - a. Test records for cable shall be maintained using an organized format. The forms for twisted-pair and optical fiber cable shall record TEC / TDR Room number, riser pair/strand number or outlet ID, outcome of test, re-test results after problem resolution, and signature of the technician completing the tests. Test results shall be submitted in electronic format.
 - b. In addition to the requirements stated in Division 1, the Vendor shall provide:
 - 1) Pathway review walkthrough with UWMC Operations and Maintenance prior to drywall cover.
 - 2) Pre-construction Conference: Early in the construction time line, and before any shop drawings are produced, a representative of the low-voltage installer shall attend a pre-conference meeting where installation details, including labeling and wire management, will be discussed.
 - 3) Pre-installation walkthrough with UWMC Operations and Maintenance prior to taping of rooms.
 - 4) Project Initiation: The Contractor shall furnish the following in a single consolidated submittal:
 - a) List of all foremen, all lead installers, and all copper cable testing technicians who will work on this project. Include a summary of experience and training class certificates for each technician.
 - 5) Shop Drawings: The Contractor shall submit shop drawings to show his intent during installation. Shop drawings shall be submitted at least forty-five (45) days before any cable installation and shall include at least the following:
 - a) Sample labels for all cable label and termination label types including station outlet tapes (with printed sample).
 - b) Details of all TDR cable management wherever the Contractor may suggest an alternate method from that shown in the drawings.
 - c) Shop drawings shall indicate expected cable types and routing.

2. Provide a hard copy of signal loss calculations to UWMC Operations and Maintenance as TDR is completed. Test results shall be submitted and approved prior to substantial completion and final payment approval.

END OF SECTION