

## DIVISION 17 – COMMUNICATION

### Section 17100 – Data Network System

#### PART 1 GENERAL

##### 1.1 STIPULATIONS

- A. The specifications sections “General Conditions”, “Special Requirements” and “General Requirements” form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

##### 1.2 ABBREVIATIONS AND DEFINITIONS

- A. MDF/MCF/MDC - Main Distribution Frame / Main Cross-Connect Frame / Main Data Closet. MDF will be used in this document.
- B. IDF/ICF/DC - Intermediate Distribution Frame / Intermediate Cross-Connect Frame / Data Closet, consisting of station wire terminals, riser cable terminals, and various equipment. IDF will be used in this document.
- C. UTP - Unshielded Twisted Pair (telecommunications station cable).

##### 1.3 DESCRIPTION

- A. Provide a complete, tested, cable distribution system for data network (local area network), voice and CATV systems. The data distribution system shall include fully terminated fiber optic backbone and UTP station cables. The voice system shall include fully terminated UTP station cables. The CATV system shall include fully terminated station cables.
- B. Fiber Optic Riser Cables: Fiber optical cables shall be installed from the Main Distribution Frame (MDF) to fiber optic termination enclosures in each Intermediate Distribution Frame (IDF) Data Room.
- C. UTP Cables: UTP cables shall be routed to each data outlet location as indicated on the contract drawings.
- D. Provide specific details consistent with the contract documents as required completing shop drawings for data cable systems including detailed documentation for Professional review and detailed documentation of as-built conditions.
- E. All network electronics including Ethernet switch and MAN (Metropolitan Area Network) Equipment will be furnished by the Owner and installed by Nortel

Networks as specified under this contract. Nortel Networks shall be the sole source provider of devices and implementation as directed by the University. This authorization sets a standard and consistency on University WAN/LAN and is desired for technical ability and experience with networking infrastructure that is required for the successful installing integrator to meet. Nortel Networks must employ a significant engineering staff with extensive network installation experience in hardware electronics as well as the operating systems and network management software. Reference of comparable size and scope must be provided that has been completed in the past twelve months within the educational market space. Nortel Networks Professional Services must have the capability to provide for a four-hour onsite response time should any technical problems arise after the installation is complete.

The design and implementation must be approved by the University Information Technology Services Division including planning design, installation, testing and configuration all network electronics associated with this project. The following is a list (example) of Owner supplied equipment that Nortel Networks is responsible for during the installation, testing and configuring process.

All MDF Core Equipment and IDF Switches must be approved by the Information Technology Services division of Kutztown University.

#### MDF Core Equipment Examples:

1. Passport 8610 10 slot chassis.
2. 8001PS power supplies.
3. Passport 8000 Enterprise routing switch software.
4. Passport 861SF Routing Switch Module.
5. Passport 8608GBE Routing Switch Module.
6. 1-port 1000Base-SX Gigabit interface converter.
7. Optical Shelf supports two optical MUX's.
8. 1-port 1000Base Gigabit interface converter, 1530nm.
9. 1-port 1000Base Gigabit interface converter, 1570nm.
10. 1-port 1000Base Gigabit interface converter, 1610nm.
11. Optical 4-port MUX, 1490nm, 1530nm, 1570nm, 1610nm.

#### IDF Switch Examples:

1. BayStack 470-48T switch.
2. Ethernet Routing Switch 5510-48T.
3. Ethernet Routing Switch 5520-48T-PWR.
4. 5500-SRC Stacking Cable.
5. 1-Port 1000Base-LX Small Form Factor Pluggable GBIC.

F. All Nortel telephone equipment except handsets will be furnished by the Owner,

installed, cross connected, tested and programmed by this Contractor including; remote shelf (as needed), emergency telephones, all cross connects and testing. Telephone handsets not in contract. The installer must be approved by the existing systems management to install, terminate and program the following equipment associated with the telephone system and not void the existing PBX maintenance services contract. The following is a list of Owner supplied telephone equipment that the Contractor is responsible for installing and configuring. (Items per project specifications)

1. Remote fiber Multi-IPE Assembly.
2. Ringing Generator AC.
3. IPE Package AC.
4. Module side covers.
5. Pedestal/top cap package.
6. Overhead cable tray kit.
7. Fiber remote Multi-IPE interface.
8. AC/DC power converter.
9. Analog message waiting line cards.
10. Local fiber multi-IPE assembly.

#### 1.4 APPLICABLE STANDARDS

Materials and equipment shall be manufactured, installed and tested as specified in the latest editions of applicable publications, standards, rulings and determination of:

- A. ANSI – American National Standards Institute.
- B. TIA/EIA – Telecommunications Industry Association/Electronics Industry Alliance.
- C. FCC – Federal Communications Commission.
- D. NEC – National Electric Code.
- E. NFPA 70 – National Fire Protection Association.
- F. ANSI/TIA/EIA-568-B.1, B.2, B.3 - Commercial Building Telecommunications Cabling Standard.
- G. ANSI/TIA/EIA-569-A - Commercial Building Standard for Telecommunications Pathways and Spaces.
- H. ANSI/TIA/EIA-606-A - The Administration Standards for the Telecommunications Infrastructure of Commercial Building.

- I. ANSI/TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
- J. ANSI/TIA/EIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant- OFSTP-7.
- K. ANSI/TIA/EIA/-526-14A-Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant-OFSTP-14.
- L. ANSI/TIA/EIA-455-61. "FOTP-61, Measurement of Fiber or Cable Attenuation Using an OTDR".
- M. ANSI/TIA/EIA-455-171-D "Standard Test Procedures for Fiber Optic Cables".
- N. ANSI/TIA/EIA-604-X "Fiber Optic Connector Intermateability Standards" (FOCIS).
- O. IEEE 802.3 "Carrier Sense Multiple Access with Collision Detection" and all Applicable Supplements A Through Z. Current Edition.
- P. ATM Forum Standard for 155 Mb/s ATM over UTP (AF-PHY-0015.000, 9/94).
- Q. BICSI TDMM (Telecommunications Distribution Methods Manual) Current Edition at Time of Bid.
- R. NECA (National Electrical Contractors Association) – Standard of Installation.
- S. NEMA 250 (National Electrical Manufacturers Association) – Enclosures for Electrical Equipment (1000 Volts Maximum).
- T. FCC Part 15 (addresses electromagnetic radiation).
- U. FCC Part 68 (connection of premise equipment and wiring to the network).
- V. ANSI/ICEA - Insulated Cable Engineers Association.
- W. ASTM – American Society for Testing and Materials.
- X. IEEE – Institute of Electrical and Electronic Engineers.
- Y. SCTE or NCTI CATV Certification.

Z. NEMA – National Electrical Manufacturers Association.

AA. UL – Underwriters Lab.

BB. BICSI – Building Industry Consulting Services International.

## 1.5 REGULATORY REQUIREMENTS

- A. All work shall be performed in accordance with the latest revisions of the following standards and codes:
  - 1. Uniform International Conference of Building Officials.
  - 2. Building Code (ICBO); Regional Office.
- B. Governing Codes and Conflicts: If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall be construed to permit work not conforming to all governing codes and regulations.

## 1.6 SUBMITTALS

- A. Qualifications: The Contractor shall submit a company description, company certifications and resumes including all information required in Qualifications Section 1.9.
  - 1. The Contractor shall have a BICSI certified RCDD on staff or payroll. A copy of the certification shall be submitted with the Contractors bid documents.
- B. Furnish the following in a single consolidated submittal:
  - 1. The name of the person who will act as the Contractor's official contact with the Department.
  - 2. Electrical permits (where applicable). The Contractor shall obtain all required permits and provide copies to the University.
  - 3. Product Data:
    - a. Complete manufacturer's product literature for all cable; Fiber Optic and UTP.
    - b. Equipment racks, patch panels, wire management, cable supports, cable labels, outlet devices and other products to be used in the installation.
  - 4. Shop Drawings. The Contractor shall submit scaled drawings of all IDF/MDF backboard layouts showing hardware frame placements. The name/number of the room shall be included. The Contractor must show dimensions for LAN network equipment.
  - 5. Category 6 and fiber optic cable test result forms.
  - 6. Test report format and field test report format to include wire map,

insertion loss/attenuation (UTP/fiber), OTDR trace (fiber), length, NEXT, ACR, PSACR, PSNEXT, ELFEXT, PSELFEXT, RETURN LOSS, PROPAGATION DELAY and DELAY SKEW.

7. Qualifications:

- a. The successful bidder shall be thoroughly familiar with the cabling methods set forth in the latest release of the BICSI TDMMs (Telecommunications Distribution Methods Manuals) and unless otherwise specified, shall supervise the installation in accordance with the recommendations and practices outlined in the latest release of the BICSI TDMM.
- b. The Telecommunications contractor must be an approved Ortronics Certified Installer at a Plus tier (CIP, CIP-Gold, CIP-Platinum, and multi-site/national contractors) and Berk-Tek Certified OASIS Integrator. A copy of the company certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Ortronics CI/CIP Program and Berk-Tek OASIS Program. Ortronics/Berk-Tek will extend a NetClear 25-year Static, Dynamic and Applications Warranty to the end user once the Telecommunications contractor fulfills all requirements under Ortronics and Berk-Tek OASIS Program. At least 30 percent of the copper installation and termination crew must be certified by Berk-Tek and Ortronics or by BICSI with a Technician Level of training. Also, at least 20 percent of the optical fiber installation and termination crew must be certified by Berk-Tek and Ortronics or other approved organizations in Optical Fiber installation and termination practices.
- c. The successful bidder shall have at least five (5) years experience installing and servicing Telecommunication systems, and shall provide a list of completed projects equivalent in size and complexity to this project, with names and telephone numbers.
- d. The successful bidder shall submit in writing a list of qualified technicians assigned to this project, including relevant manufacturers training programs completed by each, and years of related experience of each.
- e. The successful bidder shall maintain an office or competent technical presence with appropriate testing equipment and replacement parts within a 60 mile radius from this project.
- f. Contractor must have an RCDD (Registered Communication

Distribution Designer) act as Project Manager/Engineer and be a full-time staff employee of the Telecommunications contractor.

## 1.7 FUNCTION AND OPERATION

- A. The intended function of the data communications cable system is to transmit data signals from a central location where the network infrastructure is in place to the individual data outlet locations. Upon completion of the work outlined in this specification, the system shall be capable of transmitting data signals at a rate of 1000 Mbps (Category 6).
- B. The multimode optical fiber cable system shall be capable of transmitting signals with a minimum bandwidth of 200 MHz at both 850 nm and 1300 nm. The cumulative signal loss, through connectors, jumpers, couplers, and fiber cable, shall be less than 2.0 dB (based on 2 connector pairs and 90 meters of optical fiber cable). This loss may vary slightly because link must meet the maximum channel loss (budget) specified by the data application to be run.
- C. Station cable, from the MDF/IDF to the work area, shall be installed in accordance with EIA/TIA-568B specified installation practices and the manufacturer specified installation practices.
- D. Station cable shall be capable of transmitting a signal at 1000 Mbps with acceptable attenuation and cross-talk measurements. The entire work station cable system, including patch panels, cable, and telecommunications outlets shall be tested for Category 6 standards.

## 1.8 CLOSEOUT SUBMITTALS

- A. As a condition for project acceptance, the Contractor shall submit the following for review and approval:
  - 1. Complete manufacturer product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
  - 2. Records:
    - a. All records shall be created by the Installation Contractor and turned over at the completion of work. The format shall be computer based and both hard and soft copies shall be part of the As-built package. The minimum requirements include:
      - 1) Cable records must contain the identifier, cable type, length, termination positions at ends, manufacturer and part number.
      - 2) Connecting hardware records must contain the identifier, type of hardware and the amount of positions.

- 3) Connecting hardware positions records must contain the identifier, type of position, and the cable identifier attached to it.
  - 4) Test Documentation on all cable types shall be included as part of the As-built package.
  - 5) As-built drawings (AutoCAD 2000 and hard copy).
  - 6) Cable/Termination Record (electronic and hard copy).
3. Reports:
    - a. Cable Reports.
    - b. Cross-connect Reports.
    - c. Connecting Hardware Reports.
  4. As-built label schedule in MS EXCEL of MS ACCESS format, 2 hard copies and 2 electronic copies.
  5. Component informational matrix, to include component name; component model number, serial number and configuration; location and telecommunication room component is served from.
  6. The Communication Systems installer shall provide a twenty-five (25) year manufacturer warranty. This warranty shall include defects in material and workmanship. The warranty period shall begin at the date of the University's acceptance of the work. Quality and workmanship evaluation shall be solely by the University and designated representatives.
  7. All documentation shall be presented in binder form.

## 1.9 QUALIFICATIONS

- A. The University reserves the right to exercise its discretion to require the Contractor to remove from the project any such employee judged by the University to be incompetent, careless, or insubordinate.
- B. The selected Telecommunication Systems installer must be licensed and bonded in the state.
- C. The Contractor must be a certified installer having attended factory training and have current certification of the selected manufacturer's structured cabling system. The Contractor must have been certified for no less than two (2) years, with technicians trained and certified by the manufacturer. The Contractor will completely warrant his work, both in labor and materials, for a period of not less than one (1) year after completion. The Contractor shall provide the warranties from the manufacturer as called out in these specifications. A copy of the installer's certificate shall be submitted with the bid package and kept on file.



- D. The Contractor, sub-contractors, and service organizations shall be no greater than 60 miles from the project site.
- E. The Contractor shall designate in writing to the University a dedicated, full time foreman as a contact for problem resolution, job coordination, additions, changes, etc., who shall be present in the field at all times during the performance of the work. The Contractor's foreman shall have full authority to represent the Contractor in making decisions and executing the work in an acceptable manner.
- F. All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.
- G. The Contractor must have BICSI registered Installers and Technicians on staff and assigned to this project. The project shall be staffed at all times with a minimum of 25% BICSI registered telecommunications installers.

#### 1.10 PRE-INSTALLATION CONFERENCE

- A. Convene minimum one week prior to commencing work of this section.

#### 1.11 COMMUNICATION OUTLET CLASSIFICATIONS

- A. Class 1 - Contains: (1) Category 6 Data Outlet and Category 6 Cable. Install in 2-gang faceplate.
- B. Class 2 - Contains: (1) Category 6 Phone Outlet and Category 6 Cable. Install for wall mounted phone.
- C. Class 3 - Contains: (1) Category 6 Data Outlet and Category 6 Cable.  
(1) Category 6 Phone Outlet and Category 6 Cable.
- D. Class 4 - Contains: (1) Category 6 Data Outlet and Category 6 Cable.  
(2) Category 6 Phone Outlet and Category 6 Cable.
- E. Class 5 - Contains: (2) Category 6 Data Outlet and Category 6 Cable.
- F. Class 6 - Contains: (2) Category 6 Data Outlet and Category 6 Cable.  
(1) Category 6 Phone Outlet and Category 6 Cable.
- G. Class 7 - Contains: (1) Category 6 Data Outlet and Category 6 Cable.  
(1) Category 6 Phone Outlet and Category 6 Cable.  
(1) "F"-Type Connector and RG6/U Coaxial Cable.  
Install in 2-gang faceplate.
- H. Class 8 - Contains: (2) Category 6 Data Outlet and Category 6 Cable.

- (1) Category 6 Phone Outlet and Category 6 Cable.
- (1) "F"-Type Connector and RG6/U Coaxial Cable.  
Install in 2-gang faceplate.

- I. Class 9 - Contains:
  - (3) Category 6 Data Outlet and Category 6 Cable.
  - (1) Category 6 Phone Outlet and Category 6 Cable.
  - (1) "F"-Type Connector and RG6/U Coaxial Cable.
- J. Class 10 – Contains
  - (5) Category 6 Data Outlet and Category 6 Cable.
  - (1) Category 6 Phone Outlet and Category 6 Cable.
  - (1) "F"-Type Connector and RG6/U Coaxial Cable.
- K. Where outlets are shown in surface raceway, install outlets in double gang faceplate.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. All materials including cable, terminating hardware and components shall be verified and tested by both ETL for channel compliance and a UL Certified lab for compliance of the component performance levels as specified this document.
- B. All products shall be new, and brought to the job site in original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
  - 1. CM Communications Cable.
  - 2. CMP Plenum Rated Communications Cable.
  - 3. CMR Riser-rated Communications Cable.
- C. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket, which would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

### 2.2 HORIZONTAL CABLING

- A. Manufacturers - ISO 9001 Certified
  - 1. Berk-Tek LanMARK 2000 Model No. 10032251.
  - 2. Substitutions: Not Permitted.

- B. Description: Unshielded twisted pair cable, Category 6, CMP listed, for use with IEEE Std. 802.3 network, and EIA/TIA-568-B compliant using 4 pairs, 24 AWG solid copper conductors all FEP insulated, colored plenum rated jacket, meeting or exceeding the Category 6 requirements. Use green jacketed cable for data cables. Use white jacketed cable for voice cables.
- C. All 4 pair station cables shall:
1. Conform to EIA/TIA 568-B - Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section.
  2. Be part of the UL LAN Certification and Follow-up Program.
- D. Horizontal cabling shall meet or exceed the specifications for a Category 6 permanent link, and the following electrical and mechanical specifications:

Frequency (MHz)	Attenuation (dB)	Power-Sum NEXT (dB)
1.0	21.9	62.0
4.0	3.5	61.8
8.0	5.0	57.0
10.0	5.5	55.5
16.0	7.0	52.2
20.0	7.9	50.7
25.0	8.9	49.1
31.25	10.0	47.5
62.5	14.4	42.7
100.0	18.6	39.3
200.0	27.4	34.3
250.0	31.1	32.7

DC resistance:	28.6 /1,000 ft (9.38 /100 m) max.
Mutual Capacitance	14 pF/1000 ft (4.6 Nf/100m), max.
Characteristic Impedance	100 ±15 from 1-100 MHz

- E. In addition to the Category 6 requirements for individual products, the end-to-end interconnected and installed channel shall meet or exceed the following requirements:

Frequency (MHz)	Power-Sum ELFEXT (dB)	Return Loss (dB)
1	60.3	19
4	48.2	19

Frequency (MHz)	Power-Sum ELFEXT (dB)	Return Loss (dB)
10	40.3	19
16	36.2	18
20	34.4	17.5
25	32.3	17
31.25	30.4	16.5
62.5	24.3	14
100	20.3	12
200	14.2	9.0
250	12.3	8.0

- F. The copper cabling provided for each data outlet shall be one 4 pair UTP Category 6 cable per jack. For example, where multiple jacks are indicated at a single location, each jack shall have its own dedicated 4 pair UTP cable.
- G. The Category 6 4 pair UTP cable, must be UL Performance Level Tested. Each 1000-foot spool must be individually tested with test results affixed.

### 2.3 HORIZONTAL CABLING (Outlets)

- A. Manufacturers - ISO 9001 Certified
  1. Single modular inserts for voice/data ports shall be Ortronics TracJack, 8 position, 8 conductors, dual reactance technology, universal T568-A/B, 45-degree straight exit and Clarity 6, P/N OR-TJ600-42 (red) for voice and P/N OR-TJ600-45 (green) for data.
  2. Faceplates shall be Ortronics double gang, 8-port, TracJack series, P/N OR-40300554-13 (electrical ivory).
- B. Data Outlets - Category 6 modular jack with 2-gang bezel and straight module insert. Provide quantity of data outlets at the locations as indicated on the drawings. Provide blank inserts for unused openings in bezel. Provide duplex receptacle inserts for mounting data outlets in surface raceway.
- C. Jacks shall be Category 6, 8-position modular jack with contacts plated with at least 50 micro-inches of gold and a termination cap providing strain relief. Jacks shall provide dual color code to allow both T568A and T568B wiring on the same jack, and shall provide a cutting ledge to automatically trim wires during termination. Jacks shall meet TIA/EIA-568-B requirements for Category 6 connecting hardware and additional performance criteria listed.
- D. Faceplates shall be double gang unless noted otherwise and match manufacturer style for 8 position modular jack outlets at all locations. Faceplates shall contain enough openings for all cables. Color of devices and cover plates shall match

other wiring devices in area or as directed by Professional.

- E. Where outlets are installed in surface raceway, jacks must be compatible with the surface raceway faceplate and the surface raceway depth. Faceplate color shall match raceway color. Where outlets are installed in floor boxes, jacks must be compatible with the floor box faceplate or mounting strap. Keystone style jacks are acceptable in floor boxes.
- F. All terminating hardware for 4 pair Category 6 cabling shall:
  - 1. Conform to TIA/EIA 568B - Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section.
  - 2. Be part of the UL LAN Certification and Follow-up Program.
  - 3. Meet or exceed the specifications for Category 6 Channel.
- G. All terminating hardware for 4 pair Category 6 cables shall meet or exceed the following electrical specifications:

Frequency (MHz)	NEXT (dB)	Attenuation (dB)	Return Loss (dB)
1	75	.1	30
4	75	.1	30
8	75	.1	30
10	74	.1	30
16	69.9	.1	30
20	68	.1	30
25	66	.1	30
31.25	64.1	.11	30
62.5	58.1	.16	28.1
100	54	.20	24.0
200	48	.28	18.0
250	46	.32	17.0

- H. Additional electrical and mechanical specifications are:
  - 1. Insulation resistance: 500 MW minimum.
  - 2. Dielectric withstand voltage: 1,000 VAC RMS, 60 Hz minimum, contact-to-contact and 1,500 VAC RMS, 60 Hz minimum from any contact to exposed conductive surface.
  - 3. Contact resistance: 20 mW maximum.
  - 4. Current rating: 1.5 A at 68 degrees F per IEC Publication 512-3.

## 2.4 FIBER OPTIC CABLE SPECIFICATIONS

- A. Manufacturers - ISO 9001 Certified

1. Berk-Tek Model No. PDR6B036-024EB3515/25-012AB1010 (for 12SM/24MM laser optimized 62.5um).
- B. Description: ANSI/TIA/EIA 568-B, 24-strand, laser optimized 62.5/125 micron multimode and 12-strand, 8.3 micron single mode optical fiber, plenum rated, hybrid backbone cable. Each with color-coded PVC buffer. Installed between IDF and MDF.
- C. ANSI/TIA/EIA 568-B, 4-strand laser optimized 62.5/125 micron multimode and 2-strand, 8.3 micron single mode optical fiber, plenum rated, hybrid horizontal cable. Installed between workstation outlets and IDF/MDF. Berk-Tek P/N ICP004-3515/25

## 2.5 FIBER OPTIC CABLE TERMINATIONS

- A. Manufacturers - ISO 9001 Certified
  1. Ortronics Model No. OR-205KAS9FA-62 (MM) and OR-205KAS9FA-09 (SM)
  2. Substitutions: Not Permitted.
- B. Use type SC fiber optic connectors.
- C. Optical Fiber Termination Units used in the data closets shall provide termination modular patch panels for SC-type connectors and be of sufficient size and capacity to terminate 100 percent of the fiber count of the fiber optic cables. Patch panels must be installed in 19-inch rack. Provide all termination accessories, enclosures, and testing for a complete fiber optic distribution system.

## 2.6 FIBER OPTIC PATCH CORDS (SINGLE MODE)

- A. Manufacturers:
  1. Ortronics Model No. OR-61150D08003M99C.
  2. Substitutions: Permitted depending on critical circumstances and with authorization approval by personnel from Kutztown University Information Technology Services division.
- B. Product Description: TIA/EIA-568-B and ISO/IEC 11801 compliant 8.3/125 micron single mode duplex fiber optic patch cord with SC – SC / ST – SC / ST – ST connectors. All patch cords must be consistent with existing infrastructure.
- C. Rating: Fiber optic patch cords shall:
  1. Be available in standard length of 3 meters and/or appropriate for interconnecting to existing infrastructure, and shall meet or exceed standards as defined in ANSI/TIA/EIA-568-B and ISO/IEC 11801. This must be approved by the Kutztown University Information Technology

- Services division.
2. Utilize duplex fiber cable that is 8.3/125 micron singlemode, OFNR riser grade, and meets the requirements of UL 1666.
  3. Utilize cable where the attenuation shall not exceed wavelength or 1.0 dB/km at 1310 nm or 155 nm.
  4. Utilize Angled Physical Contact (APC) type polish.
  5. Terminated connectors shall exhibit maximum insertion loss of 0.5 dB with an average of 0.3 dB when tested at either 1310 nm or 1550 nm wavelengths for 8.3/125 nm.
  6. Have a minimum return loss of 40 dB (53 dB typical) at both 1310 nm and 1550 nm.
  7. Be made by an ISO 9001 Certified Manufacturer.
  8. Be UL 1666 approved.

## 2.7 FIBER OPTIC PATCH CORDS (MULTIMODE)

- A. Manufacturers:
1. Ortronics Model No. OR-61150D62003M99C.
  2. Substitutions: Permitted depending on critical circumstances and with authorization approval by personnel from Kutztown University Information Technology Services division.
- B. Product Description: TIA/EIA-568-B and ISO/IEC 11801 compliant, laser optimized 62.5/125 micron multimode duplex fiber optic patch cord with appropriate connectors for interconnection with existing infrastructure
- C. Rating: Fiber optic patch cords shall:
1. Be available in standard length of 3 meters, and shall meet or exceed standards as defined in ANSI/TIA/EIA-568-B and ISO/IEC 11801.
  2. Utilize duplex fiber cable that is laser optimized 62.5/125 micron multimode, OFNR riser grade, and meets the requirements of UL 1666.
  3. Utilize cable where the attenuation shall not exceed 3.5 dB/m @ 850 nm wavelength or 1.0 dB/km @ 1300 nm.
  4. The connectors shall include a ceramic ferrule.
  5. Terminated SC connectors, which exhibit a maximum insertion loss of 0.50 dB with an average of 0.30 dB when tested at either 850 nm or 1300 nm wavelengths for laser optimized 62.5/125 nm.
  6. Have a minimum return loss of 20 dB (25 dB typical) at both 850 nm and 1300 nm.
  7. Be made by an ISO 9001 Certified Manufacturer.
  8. Be UL 1666 approved.

## 2.8 COPPER PATCH CORDS

- A. Manufacturers - ISO 9001 Certified
  - 1. Ortronics Model No.
    - OR-MC605-06 (5' green patch cord)
    - OR-MC607-06 (7' green patch cord)
    - OR-MC609-06 (9' green patch cord)
    - OR-MC615-06 (15' green patch cord)
  - 2. Substitutions: Not Permitted.
- B. Product Description: Patch cord assemblies shall be Ortronics Clarity category 6 engineered using center tuned technology. Patch cord assemblies shall be green in color, must have the same rating as the horizontal wiring, i.e., shall meet or exceed the specifications for Category 6 performance, and shall be factory-manufactured in 5 foot, 7 foot, 9 foot, and 15 foot lengths.
- C. Provide two (2) patch cords for each data outlet; (provide 20 percent in 5-foot lengths, 30 percent in 7-foot lengths, 30 percent in 9-foot lengths, and 20 percent in 15-foot lengths). Provide copper patch cord assemblies at the MDF/IDF and workstation outlets as required to make all interconnections between patch panels and hubs and/or Ethernet switch.

## 2.9 MDF/IDF TERMINATION HARDWARE – COPPER PATCH PANEL

- A. Manufacturers - ISO 9001 Certified
  - 1. Ortronics Model No. OR-PHD66U48.
  - 2. Substitutions: Not Permitted.
- B. The Category 6 data horizontal cables shall be terminated on Category 6 8-position modular, RJ-45, jack patch panels with circuit board construction in all MDF/IDF locations. The panels shall have rolled upper and lower edges for rigidity and shall provide front and rear side labeling visible after the cables and cords are installed. The 8-position modular jack patch panels shall be rack mounted with cable management panels above and below each patch panel. The contractor is responsible for all wall brackets, patch panels, and cable management panels for all MDF/IDF layouts and equipment rack configurations. Provide 48 port panels (T568B wired, EIA/TIA-568-B). Provide quantity as required to terminate a minimum of 25 percent spare ports in patch panels.
- C. Cable Manager: The cable manager shall have 5 rings and provide the capability to organize and contain up to ninety-six (96) patch cords on the front of the panel. The front of the panel shall provide five (5) high capacity 1.7 x 3.5 inch horizontal distribution rings to reduce stress on stored cables to retain optimal cable geometry. All distribution rings shall have radius edges to protect cables from nicks and tears. The cable manager shall be no more than 2 rack unit high, and shall fit a standard 19-inch rack. Ortronics model no. OR-808004818.



- D. Vented Equipment Shelf: One shelf shall be installed on each rack in each wiring closet. Ortronics model no. OR-604045081

## 2.10 MDF/IDF TERMINATION HARDWARE – FIBER OPTIC PATCH PANEL

- A. Manufacturers - ISO 9001 Certified
  1. Fiber optic patch panels shall be Ortronics Model No. OR-615MMC-72P-00.
  2. Multimode connector panels shall be Ortronics Model No. OR-615SCDSM6.
  3. Singlemode connector panels shall be Ortronics Model No. OR-615SCDSM6C.
  4. Substitutions: Not Permitted.
- B. For the MDF connection to the Campus Backbone fiber, provide two (2) fiber optic patch panels capable of terminating up to 48 fibers each, one (1) for multimode fiber and one (1) for single-mode fiber. Provide pre-loaded connector panels (each with 6 duplex SC connections) for both multimode and single mode fiber. Install connector housings in the data rack located in the data closet. Provide blank covers for unused openings in closet connector housings.
- C. Each MDF connection to each IDF- intrabuilding backbone cable, provide fiber optic patch panels to separately terminate single mode and multimode fiber. Provide pre-loaded connector panels (each with 6 duplex SC connections) for multimode fibers and single mode fibers. Install connector housings in the data rack located in the data closet. Provide blank covers for unused openings in closet connector housings.
- D. Each IDF- horizontal cable, provide fiber optic patch panels capable of terminating up to 144 fibers each. Provide separate patch panels for multimode fiber and single-mode fiber. Provide pre-loaded connector panels (each with 6 duplex SC connections) for multimode fibers and single-mode fibers. Install connector housings in the data rack located in the data closet. Provide blank covers for unused openings in closet connector housings.

## 2.11 FLOOR MOUNTED RACK

- A. Manufacturers:
  1. Ortronics Model No. OR-60400169.
  2. Substitutions: Not Permitted.
- B. Product Description; Free standing, floor mounted 7 feet x 19 inches steel equipment rack with horizontal and vertical cable management. Racks are to be permanently bolted to the floor. Where cable runway is provided above the rack, provide additional bracing between rack and cable tray.

- C. Construction: Aluminum with protective finish.
- D. Accessories: provide vertical and horizontal cable management channels with channel retainers and Velcro ties.
- E. Provide one rack mountable 8 outlet surge strip. Provide outlet strip with minimum 10-foot long cord.
- F. Provide ground terminal block/lug for each rack.
- G. Provide appropriate mounting hardware, and j-bolt/runway connector kits.
- H. Vertical cable management racks to be installed between floor mounted racks.
- I. The hole spacing should be 1/2", 1/2", 5/8".
- J. Individual patch panels can have a maximum of 48 ports.
- K. All patch panels shall have their own cable management above and below them. In the event there is more than one rack in the wiring room the racks shall have vertical cable management devices separating them with management of the cables in both the front and rear of the racks.
- L. All racks shall have the bottom 2 1/2 feet open for air circulation.

## 2.12 RACK MOUNTED UPS

- A. Manufacturers:
  1. APC (American Power Conversion) Model: SUA1500RM2U.
  2. Best Model No. 0520-1425-RU.
  3. Tripplite Model No. SMART 1400RM.
  4. Substitutions: Not Permitted.
- B. Product Description; Rack mounted uninterruptable power supply, minimum capacity 1400 VA with monitoring software.

## 2.13 COAXIAL CABLE

- A. Manufacturer:
  1. Berk-Tek Model No. 10057996
  2. Substitutions: Not Permitted.
- B. Description: RG-6 quad-shield, plenum rated type (CMP), flexible coaxial cable, 75-ohm characteristic impedance, with solid 18-gauge copper-clad steel wire

inner conductor, solid polyethylene dielectric core, with black jacket.

- C. Terminations/connectors for RG-6 cable shall be HEX crimped.
- D. Provide RG-6 cable from each outlet shown on the drawings back to the Data Closet.
- E. Provide duplex receptacle inserts for mounting outlets in surface raceway. Shall be Ortronics Model No. OR-63700006-00, TracJack F-Connector

#### 2.14 INTER BUILDING BACKBONE CABLE – VOICE

- A. Manufacturers – ISO 9001 certified.
  - 1. BerkTek Power Sum.
  - 2. Substitutions: Not Permitted.
- B. Product Description: Conductors are solid annealed copper. Insulated with a PVC skin over expanded polyethylene conductors are twisted to form pairs, and fully color coded. Jacket is fire resistant FR PVC plastic. Cables conform to TIA/EIA-568-B. UL listed CMR shall be rated Category 3 or higher.
- C. Accessories: Provide cable straps and associated hardware.
- D. Installation: All backbone cable shall be neatly installed and properly trained. Secure cable with straps as recommended by cable manufacturer and installed per industry standards.
- E. Termination: Utilize existing splice case in manhole specific to location, for connection to Campus Backbone Distribution System. Existing cable from this splice case will be removed during the demolition phase of this project. Properly seal splice case to provide a complete termination system impervious to water. Secure splice case to manhole structure. Properly train cables in manhole to maximize clear working space.
- F. Testing: Test all circuits between the terminal boards for opens, shorts, grounds, and impedance to ensure integrity of the telephone cable.
- G. Lightning protection required where necessary. See section 2.16 for further details.

#### 2.15 MDF/IDF TERMINATION HARDWARE – VOICE

- A. Manufacturers
  - 1. Ortronics Model No. OR-110ABC6100.
  - 2. Substitutions: Not Permitted.

- B. Product Description: Modular, high-density, 110 style cross-connect wiring blocks. Wiring blocks are to be mounted on the plywood backboards in the MDF's and IDF's, as indicated on the drawings. Install blocks as per manufactures recommendations and industry standards.
- C. Construction: Fire retardant, molded plastic termination blocks with legs.
- D. Accessories: Provide vertical and horizontal cable management channels with channel retainers and Velcro ties. Provide matching grounding kit.
- E. Ground termination blocks to telecommunications grounding busbar with #6 AWG copper cable.
- F. Provide quantity of termination blocks as required to properly terminate all the cables as indicated on the drawings. Provide an additional 30% for future growth
- G. Provide appropriate mounting hardware, label holders, labels, cable managers and covers.

## 2.16 BUILDING ENTRANCE PROTECTION

- A. Manufacturers:
  1. Circa.
  2. Substitutions: Not Permitted.
- B. Provide solid state 5-pin protectors, 300V nominal clamping voltage, with positive temperature coefficient technology for sneak current protection. Provide 10 spare protectors.
- C. Provide additional 110 style cross-connect wiring blocks required to connect Building Entrance Protection to the voice cabling system.

## 2.17 EMERGENCY TELEPHONES

- A. Manufacturers:
  1. Gai-Tronics Corporation Model No. 298-003.  
Or similar product as manufactured by
  2. Viking.
  3. Ramtech.
  4. Rath Microtech.
  5. Substitutions: Not Permitted.
- B. Provide flush mount line powered phone with brushed, stainless steel finish. Provide surface mount in finished areas. Surface mount unit must not exceed

ADA requirements for space intrusion. Provide all back boxes.

- C. Product Description: Sealed metal keypad ideal for access control or similar local calls. Microphone and speaker located for optimal performance. Large emergency activation button capable of remote programming and auto answer. Auxiliary output for activation of peripheral equipment. ADA compliant installation must be followed to include proper height and include a Braille Help tag.
- D. Provide a complete system, terminated and tested for proper operation. The contractor must test the phones in conjunction with the Public Safety department. The contractor must provide location and proper phone number to the University Public Safety department.
- E. Power Fail phones require a complete copper connection from the location to the University main PBX. If this, or any other phone, is to be used as a **power fail transfer phone** then a copper connection must be made back to the main PBX. Cost is to be included into the project.
- F. Emergency phones are wired like a normal phone.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. The contractor shall provide 2-inch conduit sleeves above ceilings between firewalls in corridors and areas where data outlets are located, and elsewhere where required to install data cabling where cable tray and conduit systems are not installed.
- B. Any penetration through fire rated walls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling, and wall penetrations in fire or smoke barriers and in the wiring closets.
- C. Cable Lubricants: 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 must be cleaned free of lubricant residue.
- D. Recommended Products:
  - 1. Twisted-pair cable: Dyna-Blue, American Polywater
  - 2. Optical fiber cable: Optic-Lube, Ideal
- E. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings,

loosely twisted and over twisted pairs at terminals, and sheath removed too far (over 1 inch).

### 3.2 LABELS

- A. The labeling plan shall be as follows: by the Contractor and approved by University. The Contractor will label all outlets following the detailed shop drawing design, using permanent/legible typed or machine engraved labels. Terminals in the data closets shall be labeled by the Contractor using designation strips as applicable to terminal hardware. All copper/fiber terminals for riser cables in the data closets shall correspond to terminal numbering in the MDF. All fiber cables must be labeled per the Kutztown University standards, which will be provided to the contractor by personnel from Kutztown University Information Technology Services division.
- B. The labels on IDF horizontal cabling and terminals shall be numerically sequential. Outlets shall be labeled to match the labels on the corresponding terminal position.
1. The first three numbers are the room designation consistent with the codes in the current building/room standards document.
  2. Each cable will be labeled with a hyphen and a number to designate the number of the cable.
  3. The following is an example of Office 111 having two drops. These cables will be terminated in Data Closet 166.
    - a. In the wiring closet the cable labels would look similar to:
      - 1) **111-1** for the first cable.
      - 2) **111-2** for the second cable.
    - b. In the office each of the wall plates should look similar to:
      - 1) **166Pn-P** for the first wall plate. This label should be placed in close proximity to the outlet jack.
      - 2) **111-n** where n denotes the drop in the office. This label should be placed on the box so that the user easily sees it. The number represented by n starts a 1 and is incremented by one for each subsequent drop. The number 1 drop is the first drop on the left side after entering the room and increments clockwise.
      - 3) **166Pn-P** for the second wall plate.
      - 4) **111-n** where n denotes the drop in the office.
- Where n denotes the patch panel number and p denotes the port on the patch panel. Such that an outlet with one connection going to patch panel 2 port 8 in room 111 would look like: **166P2-8 111-1**
- C. The labels on Intra Building and Inter Building backbone cabling will begin with

two letters designating the Building Name followed by a hyphen followed by a 4 digit number followed by a hyphen followed by a D for data; V for voice; C for CATV; MMF for multi mode fiber; SMF for single mode fiber; F for a fiber bundle consisting of more than one type of fiber. Personnel from the Information Technology Services division at Kutztown University will determine the starting number of the first cable.

- D. A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.
- E. All labels shall correspond to as-built and to final test reports.
- F. All labels will be placed no closer than 4 inches and no further than 5 inches from the area where the individual pairs or fibers are broken out from the main bundle. In the case of composite cable, the labels will be placed no closer than 2 inches and no further than 3 inches from the point where both the fiber and copper are broken out of the main jacketing. In the case of the composite cable both the fiber and the copper are to be labeled along with the composite jacket itself.

### 3.3 WIRING INSTALLATION

- A. All Category 6 and Fiber Optic cable shall be installed by individuals trained in low voltage data cable system installation.
- B. All Category 6 4-pair UTP cable must be handled with care during installation so as not to change performance specifications. The Contractor shall not over tighten Velcro wraps or over bend the Category 6 UTP cable.
- C. Where an outlet is surface mounted, surface raceway shall be used to cover the horizontal cable or as indicated on the drawings.
- D. All wiring shall be placed in cable tray or basket tray where available. All wiring shall be organized in such a manner to allow easy access to existing wiring and facilitate future installations.
- E. All wiring and associated hardware shall be placed so as to make efficient use of available space in coordination with other uses. All wiring and associated hardware shall be placed so as to not impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).
- F. All wiring placed in ceiling areas must be tied or clamped. When wire is placed in ceiling areas or other non-exposed areas fasteners, shall be placed at random intervals no greater than 60 inches and preferably on 48 inch centers. Cable sag between supports shall not exceed 12 inches. Attaching wire to pipes or other mechanical items is not permitted. At all runs of twenty or more cables, provide

J-hooks at 60 inch (maximum) centers to hang cable where conduit or a tray system is not indicated on the drawings.

- G. All low voltage cable shall be routed to avoid light fixtures (18 inches minimum spacing), sources of heat (12 inches minimum spacing) power feeder conduits (12 inches minimum spacing). Low voltage cabling must be spaced a minimum 120 inches (10 feet) from bus duct.

### 3.4 FIBER OPTIC CABLE INSTALLATION

- A. All runs of fiber optic cable between data closets shall be installed in 1-1/4 inch orange innerduct with pulltape in a 4 inch conduit (EMT) or as indicated on the drawings. Provide a nylon pull string and or muletape along with the orange innerduct in the conduit. EMT shall be run to the data rack, turned down above the data rack, and terminated with a plastic bushing. Data closets that stack shall have 4-inch conduit (EMT) sleeves between floors or as indicated on the drawings, sleeves shall have plastic bushings. All innerduct shall be properly secured in the data closets. Innerduct shall be secured within 12 inches of the entering or exiting conduits or sleeves and secured every 3 feet on plywood backboards with appropriate straps. When routing in a cable tray or basket tray, secure with Velcro wraps every 4 feet. All innerducts shall be kept parallel with all surfaces and maintaining acceptable bend radiuses when making transitions.
- B. Conduit and cable shall be installed in accordance with manufacturer's instructions and industry standards. Care shall be taken to avoid kinking the cable or applying excessive tension during the installation process.

### 3.5 STATION HARDWARE

- A. Eight (8) position modular jack Pin Assignments:
  - 1. Pin connections for data station 8 position modular jacks and patch panels shall match EIA/TIA-568-B modular jack recommendation T568B that is both 1000 BaseT and ISDN compatible.
  - 2. Pin connections at data jack panels shall match pin connections at outlets with straight through wiring.

### 3.6 BACKBOARD CABLING/EQUIPMENT RACK CONFIGURATION

- A. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, network equipment mounting, access hatches to air filters, switches or electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings. Provide a minimum of 36 inches for a service loop



to the patch panel.

- B. 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 current and future equipment and for cable terminations. Cables shall not be Velcro wrapped to existing electrical conduit or other equipment. Minimum bend radius shall be observed.
- C. Lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Lace or Velcro wrap all similarly routed cables together, and attach by means of clamps screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via “square” corners over a path that will offer minimum obstruction to future installations of equipment, backboards, or other cables.
- D. Do not over tighten Velcro wraps on Category 6 station cable. Observe Category 6 cable bend radius and TIA/EIA conduit fill ratios (40 percent).

### 3.7 CABLE TESTING

- A. This Contractor shall test all cabling to the parameters identified in the specification and to parameters required by cabling system manufacturer.
- B. 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 for fiber optic and all copper plant wiring.
- C. Acceptance of the sample test procedures discussed below is predicated on the Contractor’s use of the recommended products (including but not limited to twisted pair cable, patch panels, and outlet devices specified in the Products paragraph) and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.
- D. Test Criteria: The system shall be tested to Category 6 compliance. The test path shall include workstation jacks, station cables, patch panels, and adapter cables.
- E. The Contractor shall test
  1. All station drop cable pairs from termination patch panels to outlet device 8-position modular jacks.
  2. All backbone cabling.
- F. All horizontal and backbone category 6 UTP cable shall be tested in both directions for the parameters listed below using a Level III hand-held tester. These parameters

are defined in ANSI/EIA/TIA-568-B.1. Tests must show a “PASS” to be accepted.

1. Wire Map
2. Length
3. Insertion Loss
4. Near-end crosstalk (NEXT) loss
5. Power sum near-end crosstalk (PSNEXT) loss
6. Equal-level-far-end crosstalk (ELFEXT)
7. Power sum equal-level-far-end crosstalk (PSELFEXT) loss
8. Return Loss
9. Propagation Delay
10. Delay Skew

G. All video coax cables shall be tested for the parameters listed below using a Level IIE or III hand-held tester. Tests must show a “PASS” to be accepted.

1. Continuity
2. Shorts
3. Opens
4. Length

H. When errors are found, the source of each error shall be determined, corrected, and the cable re-tested. All defective components shall be replaced and retested. Defective components not corrected shall be reported to the University Information Technology Division with explanations of the corrective actions attempted.

I. Test records shall be maintained using the test results forms outlined below. The form shall record closet number, riser pair number or outlet ID, outcome of test, indication of errors found (e.g., a, b, c, d, or e) cable length, re-test results after problem resolution and signature of the technician completing the tests.

J. Test results for each 4 pair, Category 6 UTP cable must be submitted with identification to match labels on all patch panel ports and 8 position modular jacks, and identification to match as-builts associated with that cable.

K. An independent contractor not associated with the cable installer will conduct the testing and submit the test results.

L. Work Station Cable: The results of the workstation cable tests shall be provided in the form of printouts from the test equipment.

### 3.8 FIBER OPTIC TESTING SPECIFICATIONS

- A. Each fiber strand shall undergo bi-directional testing, at both wavelengths for signal attenuation losses. (Multimode fiber is tested at 850nm and 1300 nm. Single mode fiber is tested at 1310nm and 1500nm). Each fiber strand shall be tested using a certified OTDR.
- B. Test Equipment: Light Source and Level III Power Meter manufactured by Microtest, Wavetek, Tektronix, or Noyes Fiber Systems.
- C. All testing shall be performed by trained personnel.
- D. All installed fiber optic cable EIA 455-171 Method D procedures will be adhered to. (Bi-directional)
- E. Connector loss shall not exceed 0.5 dB per termination.
- F. The Fiber Optic Cable loss shall not exceed 3.5dB per kilometer tested at 850nm and 1.5dB per kilometer tested at 1300nm for laser enhanced 62.5/125 multimode fiber. The Fiber Optic Cable loss shall not exceed 1.5dB per kilometer tested at 1310nm and 1.5dB per kilometer tested at 1550nm for laser enhanced 8.3/125 singlemode fiber.
- G. The contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer's specifications.
- H. An independent contractor not associated with the cable installer will conduct the testing and provide the test results documentation.

### 3.9 DOCUMENTATION

- A. The installer contractor shall provide documentation for the as-built drawings.
- B. The testing contractor shall provide documentation for the test results.
- C. Fiber Test Results: The results of the fiber testing shall be recorded on a form entitled "Fiber Attenuation Test Results". Hand written results are not acceptable. Copies of test results are not acceptable. Only original signed copies will be acceptable.

### 3.10 ACCEPTANCE

- A. Acceptance of the Data Network System shall be based on the results of testing, functionality, and the receipt of documentation. With regard to testing, all fiber segments and all copper cables must meet the criteria established above. With a minimum regard to functionality, Contractor must demonstrate to University that 1000 Mbps data signals can be successfully transmitted, bi-directionally, from the

MDF to and from some number of individual data outlets. The number of outlet locations to be tested shall be determined by the University Information Technology Services Division. With regard to documentation, all required documentation shall be submitted to the University Information Technology Services Division.

### 3.11 MINIMUM WARRANTY

- A. The Cabling System shall meet the performance requirements of the ANSI/TIA/EIA-568-B standard. The warranty on the material, services, and operation of the cabling system to this specification must be for a period of 25 years and cover connecting hardware against defects in material and workmanship.
- B. The warranty must include the following statements regarding the cabling system:
  - 1. “Will support and conform to TIA/EIA-568-B” specifications covering ANY CURRENT OR FUTURE APPLICATION which supports transmission over a properly constructed horizontal cabling system premises network which meets the channel and/or permanent link performance as described in TIA/EIA-568-B.
  - 2. “Will be free from defects in material or faulty workmanship”.
  - 3. Warranty shall guarantee that cabling infrastructure will support 1000 Base-T.
- C. The warranty must be provided by either the cable manufacturer or the hardware manufacturer, and must be fully executed prior to project closeout.

### 3.12 TELECOMUNICATION ROOM REQUIREMENTS

- A. Objective: To define minimum considerations for Data Communications Wiring Rooms
- B. Considerations:
  - 1. Occupancy
  - 2. Size
  - 3. Power
  - 4. Lighting
  - 5. Security
  - 6. Location

7. Layout
  8. Environment
  9. Fire Protection
  10. Documentation
  11. Infrastructure
  12. Labeling
  13. National and International Standards
- C. Occupancy: The wiring room shall be a dedicated space that is not shared with other trades. The wiring room access shall be through key ABM7. The wiring room shall provide termination points for voice, video, and data. No other devices or services are to be housed in the wiring room.
- D. Size: The minimum wiring room dimensions shall be 14' x 14' with a minimum ceiling height of 9'. As a rule of thumb each Primary Wiring room will require 1.25 square feet per drop with all other wiring rooms requiring 0.9 square foot per drop. In all cases there must be a minimum of 128 square feet of unobstructed wall space. All of the walls are to be covered with 4' x 8' x 3/4" one side finished fireproof plywood painted in accordance with the University standard. The plywood shall begin at the floor or within 6" of the floor and extend upwards for an additional 8'. Floors shall be anti-static VCT.
- E. Power:
1. The electronics in the wiring room supports the underlying infrastructure; therefore, the electrical supply supporting the wiring room shall be fed from separate sources. There shall be a minimum of 4 quad outlets per wiring room. The actual amount will depend on the electronics that supports the wiring room and this shall be coordinated through the University Information Technology. The outlets shall be coordinated with the placement of the racks so that there are no cords run across pathways in the wiring room. All racking is to be grounded in accordance with NEMA standards.
  2. All electronics shall be supported by an UPS system capable of maintaining the system for a minimum of 120 minutes in the event of a power failure. Along with the 120 minutes up time the UPS shall be sized to support the current draw of the electronics plus an additional 50% capacity. Only the electronics can plug into the UPS system. The UPS

will be SNMP manageable.

3. The outlets in the wiring room shall be supported by the Emergency Power system capable of maintaining the system for the duration in the event of a power failure.
- F. Lighting: All lighting must be **incandescent**. Under **NO CIRCUMSTANCES** is fluorescent lighting permitted inside the wiring room. All lighting must be positioned so that the physical plant does not obstruct the illumination. Lighting shall be controlled by motion sensitive devices so that the wiring room is illuminated when someone enters and returns to dark upon their exit. The minimum acceptable light output is 50 foot candles at 3 feet above the floor.
- G. Security:
1. The door lock on this room shall be on the separate (ABM7) key system. The wiring room contains Information Technology Services equipment only. It shall be keyed so the Vice President for Information Technology controls access to the wiring rooms. In the event that someone requests an additional key, that request must pass through the Vice President for Information Technology.
  2. In the event that a wiring room is entered the Vice President for Information Technology and Public Safety Department shall receive notification that the area's security has been breached. All wiring rooms shall be windowless. In the event a window is present it must be covered by a security gate that can only be operated from within the wiring room.
- H. Location: All wiring room locations must conform to EIA/TIA 568, EIA/TIA 569, EIA/TIA 607, and EIA/TIA 606 standards. The wiring room must be located physically so that the farthest point served by the wiring room does not exceed 300 feet.
- I. Layout: Using University specified standard components, all cabling is to be supported from the point it enters the wiring room to the point it terminates or is stored for future termination. Physical components are to be secured with industry standard devices in accordance with the manufacturer's directives. Prior to any construction activity in a wiring room, detailed drawings and worksheets shall be forwarded to the University Information Technology Division, for review and approval.
- J. Environment: Each wiring room shall be cooled with a filtered air source that provides a positive atmospheric pressure to prevent the introduction of airborne particulate matter into the wiring room. The wiring room must maintain humidity

30% - 55% and temperature of 65° - 75°F or as specified by the manufacturer of the equipment placed in the wiring room. A monitoring system shall be in place to inform the Public Safety Department, the University Information Technology Division, and the tradesperson responsible for maintaining the environment. Dust migration must be less than 100 micrograms/cubic meter/24 hour period. Floors shall be anti-static VCT.

K. Fire Protection: The wiring room shall be equipped with a fire detection system and a form of fire extinguishing system. Sprinkler system must be offset from all network equipment in order to prevent damage in case of leaks or accidental discharge.

L. Documentation:

1. Upon completion of the wiring room 3 copies of all test results, as built drawings and any other pertinent documentation shall be provided. This shall be provided in both hard copy and electronic media. One copy shall be forwarded to the Director of Physical Facilities and two copies shall be forwarded to the University Information Technology Services Division. The wiring room will not be considered complete until the documentation is reviewed and accepted by both the Director of Physical Facilities and the University Information Technology Services Division.

M. Infrastructure:

1. The University has standardized on several pieces of hardware for the support of the infrastructure. Each rack shall be a standard 19" by 84" rack, unless otherwise noted. The racks shall be aluminum and with a clear finish. The hole spacing should be 1/2", 1/2", 5/8". Individual patch panels can have a maximum of 48 ports. All patch panels shall have their own cable management above and below them. In the event there is more than one rack in the wiring room the racks shall have vertical cable management devices separating them with management of the cables in both the front and rear of the racks. All racks shall have the bottom 2 1/2 feet open for air circulation. All of the racks shall be secured to the floor in accordance with the manufacturer's specifications and have a cable runway to support the cabling from the point of entry to the rack. The cable runway shall reach to the wall and be secured at the walls and secured to the ceilings at intervals as recommended by the manufacturers. In all cases the ONLY acceptable cable tie is a Velcro device. Voice Cabling shall be broken out and attached to the Plywood covered wall. The voice cable shall be supported with the use of D rings places in accordance with the manufacturer's specifications. The cable shall terminate in cross connect blocks that are attached to the plywood and all cross connections shall be supported with wire spools in accordance with the manufacturer's specifications. The design plans along with a bill of materials shall be presented to the University Information Technology

- Services Division for approval prior to beginning any work.
2. In the event coaxial cable is part of the infrastructure: The cable must be separated and placed onto one of the plywood walls. It shall be attached in accordance with the manufacturer's instruction. Fiber optic cable that is not terminated shall be coiled and secured with a service loop that is consistent with the standards in the next section of this document.
  3. It is important to note: UNIVERSITY POLICY IS NOT TO CUT EXCESS FIBER! Excess fiber will be coiled and marked in accordance with EIA/TIA 568 A/B standards. Fiber will be marked with labels designating it as fiber optic cable in accordance with the standards in the next section of this document
  4. The above paragraphs DO NOT describe a bill of materials; the University has selected several vendors' products that meet University specifications. However, the University Information Technology Services Division shall be provided with cut sheets and consulted with the current document. In all cases the University Information Technology Services Division shall approve the plan for cabling and construction of the wiring room.
- N. Labeling: All labeling will be done consistent with the current standards document. In the event a contractor wishes to substitute a different material, samples must be submitted to and prior written approval must be obtained from the University Information Technology Division before using the alternate material.

## PART 4 WIRELESS NETWORKS

### 4.1 GENERAL

- A. All wireless network electronics including WLAN (Wireless Local Area Network) and LAN (Local Area Network) Equipment will be furnished by the Owner and installed by a University approved vendor as specified under this contract. Cisco Systems should be the sole source provider of devices and implementation as directed by the University. Deviation of the above is subject to approval by Kutztown University Information Technology. This authorization sets a standard and consistency on University WAN/LAN and is desired for technical ability and experience with the current wireless networking infrastructure.
- B. Wireless site surveys and integrator must be approved by Kutztown University Information Technology Services Division. The approved integrator must be a certified wireless installer. The integrator must provide references of wireless projects of comparable size and scope that have been completed in the past twelve months.
- C. Specifications:



1. Assign "strong" passwords to access points.
2. Turn SSID broadcasting "on".
3. Utilize static IP addresses.
4. Turn WEP "off".
5. Utilize dynamic key exchange mechanisms.
6. Ensure NIC and access point firmware is up-to-date.
7. Implement mutual authentication mechanisms.
8. Minimize radio wave propagation in non-user areas.