

270000 DATA NETWORK SYSTEM

PART 1 GENERAL

1.1 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).

1.2 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 and telecommunication electronics will be furnished by University IT. These items may include ethernet switching, Analog to IP voice gateways and Wi-Fi access points. Wi-Fi access points are to be installed by the contractor as per the drawings. All other electronics are to be installed by University IT.

1.3 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-568- Commercial Building Telecommunications Cabling Standard.
- G. ANSI/TIA-569 - Commercial Building Standard for Telecom-munications Pathways and Spaces.
- H. ANSI/TIA/ -606 - The Administration Standards for the Telecom-munications Infrastructure of Commercial Building.
- I. ANSI/TIA -607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
- J. ANSI/TIA -526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant- OFSTP-7.
- K. ANSI/TIA/-526-14-Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant-OFSTP-14.
- L. ANSI/TIA-455-61. “FOTP-61, Measurement of Fiber or Cable Attenuation Using an OTDR”.
- M. ANSI/TIA-455-171- “Standard Test Procedures for Fiber Optic Cables”.
- N. ANSI/TIA-604- “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. BICSI TDMM (Telecommunications Distribution Methods Manual) Current Edition at Time of Bid.
- Q. NECA (National Electrical Contractors Association) – Standard of Installation.
- R. NEMA 250 (National Electrical Manufacturers Association) – Enclosures for

Electrical Equipment (1000 Volts Maximum).

- S. FCC Part 15 (addresses electromagnetic radiation).
- T. FCC Part 68 (connection of premise equipment and wiring to the network).
- U. ANSI/ICEA - Insulated Cable Engineers Association.
- V. ASTM – American Society for Testing and Materials.
- W. IEEE – Institute of Electrical and Electronic Engineers.
- X. SCTE or NCTI CATV Certification.
- Y. NEMA – National Electrical Manufacturers Association.
- Z. UL – Underwriters Lab.
- AA. BICSI – Building Industry Consulting Services International.

1.4 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.

1.5 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 6A 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, DELAY SKEW, DC resistance, impedance, and capacitance.
 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 shall be a certified Legrand Data Infrastructure (DAT) installer at the CIP-Elite (preferred) or CIP level. Contractor shall submit Legrand Data Infrastructure (DAT) company certificate with the quote in order for the quote to be valid. The contractor shall also provide a nCompass Standard 40-year limited lifetime warranty for the project. At least 30 percent of the copper installation and termination crew and at least one manager must be in good standing and current with the required training.
 - 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.

1.6 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 10000 Mbps (Category 6A).
- B. Optical fiber cable shall have an attenuation value not to exceed 3.0 dB per kilometer at 850 nm and 1.5 dB per kilometer at 1300 nm. Minimum Bandwidth 3500 MHz per kilometer at 850 nm and 500 MHz per kilometer at 1300 nm. 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 10000 Mbps with acceptable attenuation and cross-talk measurements. The entire workstation cable system, including patch panels, cable, and telecommunications outlets shall be tested for Category 6A standards.

1.7 CLOSEOUT SUBMITTALS

- A. As a condition for project acceptance, the Contractor shall submit the following for review and approval:
 - 1. Any structured cabling product substitutions, from another manufacturer, shall not qualify for nCompass Limited Lifetime Premium Warranty.
 - 2. All substitution requests shall be submitted to Engineer 10 business day prior to bid date for Owner approval.
 - 3. All specified part numbers shall be individually address and part numbers being requested as “equal” shall be stated.

4. All part numbers being requested as “equal” shall meet all “shall” stated requirements for that product.
5. Provide supporting “equal” documentation for each individual part number. The following shall be included but not limited too.
 - a. Data sheets of each part number
 - b. 3rd party test results with performance guarantees highlighted.
 - c. Sample of each part number being requested as equal.
6. 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 and hard copy).
 - 6) Cable/Termination Record (electronic and hard copy).
7. Reports: Submit copies of complete reports of all testing performed to the General Contractor, with copies to the Owner/Engineer prior to job completion.
 - a. Cable Reports.
 - b. Cross-connect Reports.
 - c. Connecting Hardware Reports.
8. As-built label schedule in MS EXCEL format, 2 hard copies and 2 electronic copies.
9. Component informational matrix, to include component name; component model number, serial number and configuration; location and telecommunication room component is served from.
10. The Communication Systems installer shall provide a forty (40) 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.
11. All documentation shall be presented in binder form.

1.8 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. Contractor shall submit Legrand Data Infrastructure (DAT) company certificate. Training certificate of telecommunications contractor doing the work shall be submitted with bid. Certificate and letter shall state that contractor is a CIP-Elite or CIP within the DAT contractor certification program. The Contractor shall have experience in the installation and testing of similar systems as specified herein and shall have completed at least two projects of similar size and scope within the last 24 months. The Contractor shall provide references upon request (including the project name, address, date of implementation, client name, title, telephone number, and project description.)
- 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.
- H. The Contractor must meet all training requirements from Ortronics as a CIP-Elite (formerly CIP-ESP) or CIP contractor. The contractor must be in good standing with minimum 30% of the technicians on site and at least one manager current with the required training.

1.9 PRE-INSTALLATION CONFERENCE

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

1.10 COMMUNICATION OUTLET CLASSIFICATIONS

- A. Class 1 - Contains: (1) Category 6A Data Outlet and Category 6A Cable.

Install in 2-gang faceplate.

- B. Class 2 - Contains: (2) Category 6A Data Outlet and Category 6A Cable.
- C. Class 4 - Contains: (4) Category 6A Data Outlet and Category 6A Cable.
- D. Class 4AV – Contains: (4) Category 6A Data Outlet and Category 6A Cable to the MDF/IDF and (1) Category 6A AV Outlet (blue) and Category 6A AV Cable (blue) to stay within the room
- E. Class 6 - Contains: (6) Category 6A Data Outlet and Category 6A Cable.
- F. Class 6AV - Contains: (6) Category 6A Data Outlet and Category 6A Cable to MDF/IDF and (2) Category 6A AV Outlet (blue) and Category 6A AV Cable (blue) to stay within the room
- G. Class 7 - Contains: (1) Category 6A Data Outlet and Category 6A Cable.
(1) “F”-Type Connector and RG6/U Coaxial Cable.
- I. Class 8 - Contains: (2) Category 6A Data Outlet and Category 6A Cable.
(1) “F”-Type Connector and RG6/U Coaxial Cable.
- J. Class 9 - Contains: (4) Category 6A Data Outlet and Category 6A Cable.
(1)“F”-Type Connector and RG6/U Coaxial Cable.
- K. Class 11 – Contains: (1) Category 6A Phone Outlet and Category 6A Cable
- L. 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. Approved manufacturer and part numbers: Superior Essex 10Gain XP+ CAT 6A
 - a. Plenum Rated 6B-272-xB (x=color)
 - b. Riser Rated 6B-272-xA (x=color)
 - 2. Substitutions: Not permitted.
- B. Description: 10Gain XP+ CAT 6A cable meets or exceeds all industry requirements including ANSI/TIA-568.2-D. This cable utilizes a proprietary core wrap which assures excellent alien crosstalk performance. This cable fully complies with UL 444 requirements for an unshielded twisted pair product. 10Gain XP+ has a nominal 0.25" (CMP) or 0.275" (CMR) diameter that allows for higher cable density than other CAT 6A cable products. 10Gain XP is ideal for PoE applications requiring higher levels of current and simultaneously up to 10 Gigabit Ethernet. Use green jacketed cable for data cables. Use white jacketed cable for voice cables.
- C. All 4 pair station cables shall:
 - 1. Conform to ANSI/TIA 568 - Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section.
 - 2. Be part of the UL LAN Certification and Follow-up Program.
- F. The copper cabling provided for each data outlet shall be one 4 pair UTP Category 6A 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 6A 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 Legrand Clarity, 8 position, 8 conductors, rear-loading, lacing cap/crimp termination style, universal T568-A/B, and Clarity 6A, P/N OR-TJ6A-42 or HDJ6A-42 (red)

for voice and P/N OR-TJ6A-45 or HDJ6A-45 (green) for data. HDJ sold in qty. of 20.

2. In cases where necessary, Single modular inserts for voice/data ports shall be Legrand TracJack, 8 position, 8 conductors, dual reactance technology, universal T568-A/B, 45-straight exit and Clarity 6A, P/N OR-TJ6A-42 (red) for voice and P/N OR-TJ6A-45 (green) for data.
 3. Faceplates shall be Legrand dual gang, 12-port, HDJ series, P/N OR-403HDJ212-13 (electrical ivory).
 4. In cases where necessary, faceplates shall be Legrand double gang, 8-port, TracJack series, P/N OR-40300554-13 (electrical ivory).
- B. Data Outlets - Category 6A 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 6A, 8-position modular jack with contacts plated with at least 50 micro-inches of gold. 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 ANSI/TIA-568-B requirements for Category 6A connecting hardware and additional performance criteria listed.
- D. Faceplates shall be dual gang unless noted otherwise and match manufacturer style for 12 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 6A cabling shall:
1. Conform to ANSI/TIA 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 6A Channel.

2.4 FIBER OPTIC CABLE SPECIFICATIONS

- A. Manufacturers - ISO 9001 Certified

1. Superior Essex TeraFlex® 10G-500 fiber. P/N 44012PG01 (OM4 Plenum Rated, 12 strand) or 43012PG01 (OM4 Riser Rated, 12 strand).
 2. Superior Essex TeraFlex® G.657.A1 Single Mode fiber. P/N 44012K101 (OS2 Plenum Rated, 12 strand) or 43012K101 (OS2 Riser Rated, 12 strand).
- B. Description: Single unit, single jacket RoHS-compliant design. ANSI/TIA 568.3-D compliant, 12-strand, flexible 900 micron tight buffered industry standard 250 micron fibers (900/250/125 micron) and is suitable for use with standard connectors, like the SC, ST, and FC, and small-form-factor connectors like the LC. Dielectric aramid yarns are applied for strength while maintaining flexibility. A durable, flame resistant outer jacket is applied over the cable core using appropriate OFNR or OFNP rated materials.

2.5 FIBER OPTIC CABLE TERMINATIONS

- A. Manufacturers - ISO 9001 Certified
1. Ortronics Model No. OR-205KNT9GA-50T (MM mechanical) or OR-205KNF9GA-50E (MM fusion), and OR-205KNT9SA-09 (SM mechanical) or OR-205KNF9SA-09 (SM fusion).
 2. Substitutions: Not Permitted.
- B. Use type LC fiber optic connectors.
- C. Optical Fiber Termination Units used in the data closets shall provide termination modular patch panels for LC-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. L1-01010B2JYD0003M or L3-0101B2JYD1003M.
 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 single mode duplex fiber optic patch cord with LC-LC connectors and A-B polarity. 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-568-B and ISO/IEC 11801. This must

be approved by the Kutztown University Information Technology Services division.

2. Single-mode cords shall have performance values aligned with the following values:
 - i. Core (L1) – 0.30dB maximum insertion loss 52.0dB (UPC) and 55.0dB (APC) maximum return loss
 - ii. Ultra (L3) – 0.25dB maximum insertion loss 52.0dB (UPC) and 55.0dB (APC) maximum return loss
3. Cords shall be LC to LC required quantities and lengths.
4. Cords shall be available as A-A or A-B polarity.

2.7 FIBER OPTIC PATCH CORDS (MULTIMODE)

- A. Manufacturers:
 1. Ortronics Model No. L1-0101B2EAD0003M and L3-0101B2EAD1003M.
 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 multimode duplex fiber optic patch cord with LC-LC connectors and A-B polarity.
- 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-568-B and ISO/IEC 11801.
 2. Utilize duplex fiber cable that is laser optimized multimode and OFNP plenum grade rated.
 3. Multimode cords shall have performance values aligned with the following values:
 - a. Core – 0.50dB maximum insertion loss 19.0dB maximum return loss.
 - b. Ultra – 0.15dB maximum insertion loss 19.0dB maximum return loss.
 4. Cords shall be LC to LC required quantities and lengths.
 5. Cords shall be available as A-A or A-B polarity.

2.8 COPPER PATCH CORDS

- A. Manufacturers - ISO 9001 Certified
 1. Ortronics Model No.

- i. MC6A-YY-XX (XX = color, YYY = length in feet, Cat 6A)
- ii. EZFPMxyyQaa-zz (x = category, yy = length in feet, aa = quantity in package, zz = color)
- iii. EZCxyyQaa-zz (x = category, yy = length in feet, aa = quantity in package, zz = color)

2. Substitutions: Not Permitted.

- A. Product Description: Patch cord assemblies shall be Ortronics Clarity category 6A 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 6A 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-PSDHJU48 or OR-PHD66U48 (HDJ or TJ).
 - 2. Substitutions: Not Permitted.
- B. The Category 6A data horizontal cables shall be terminated on its respective Category 6A patch panel 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 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. INFC0XU-M4E (X = #RU).
 - 2. Multimode and single-mode connector panels shall be Ortronics Model No. HDFP-LCxxxx (multimode or single-mode LC adapter panel, interfaces with enclosure).
 - 3. 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 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 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 (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-MM20710.
 - 2. Substitutions: Not Permitted.
- B. Product Description: Aluminum equipment rack with horizontal and vertical cable management. 7 ft tall and can be adjusted to be 19” or 23” wide. 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: Rust-free aluminum construction with durable black powder coat

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: SRT1000RMXLA-NC. 1000VA / 900W double-conversion UPS with network card
 - 2. Substitutions not permitted.
- B. Contractor to supply 1 UPS unit as specified above, per network closet, to provide battery backup protection to network equipment in the network closet. If any network closet will have 144 or more Cat-6A data connections, this will require that the closet receive 2 UPS units due to the amount of network electronics required.

2.13 COAXIAL CABLE

- A. Manufacturer:
 - 1. Superior Essex Part Number 78-14C-91
 - 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 or HDJF.

2.14 INTER BUILDING BACKBONE CABLE – VOICE

- A. Manufacturers – ISO 9001 certified.
 - 1. Superior Essex MEGAPIC® OSP Broadband Backbone Category 5
 - 2. Substitutions: Not Permitted.
- B. Product Description: Conductors are solid annealed copper. Insulated with solid polyethylene, conductors are twisted to form pairs. Jacket is black, sunlight and weather resistant polyethylene. Cables conform to ANSI/TIA-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. 397-001.
 2. 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. 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 IT1-1. (IT Room 1 – 1st Floor)
 - 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) **IT1-1 Pn-P** for the first wall plate. This label should be placed in close proximity to the outlet jack.
 - 2) **IT1-1-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) **IT1-1 Pn-P** for the second wall plate.
 - 4) **IT1-1-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: **1IT1-1 P2-8 111-1**
- 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 6A and Fiber Optic cable shall be installed by individuals trained in low voltage data cable system installation.
- B. All Category 6A 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 6A 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 ANSI/TIA-568 modular jack recommendation T568B.
 - 2. Pin connections at data jack panels shall match pin connections at outlets with straight through wiring.
- B. Install stuffer caps on each workstation outlet and patch panel port after cable has been terminated on 110 IDC.

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 6A station cable. Observe Category 6A cable bend radius and ANSI/TIA 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. The following criteria must be met before certification testing can begin:
 - a. In new construction, the above ceiling work of all trades shall be 90% complete.
 - b. Work within the TR must be substantially complete. Only troubleshooting of cabling should occur in proximity of cables that have been tested.
 - c. Terminations must be complete and in their final positions. Dust caps must be installed on both ends of the termination and faceplates in place.
- C. 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.
- D. 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.
- E. Test Criteria: The system shall be tested to Category 6A compliance. The test path shall include workstation jacks, station cables, patch panels, and adapter cables. The path shall be tested with a level V accuracy tester factory calibrated within the last 12 months at the time of use (approved tester list on DAT contractor dashboard).
- F. 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. Field Testing shall include the following parameters for each pair of each cable installed:
 - a. Store number and name
 - b. Test equipment manufacturer and model number

- c. Cable I.D. The test sheets will be in numerical order by cable ID
 - d. Date of test
 - e. Wire map (pin to pin connectivity and polarity check) i.e. near 12345678, far 12345678
 - f. Length (in feet)
 - g. Insertion Loss
 - h. Near End Crosstalk (NEXT)
 - i. Power Sum Near End Crosstalk (PSNEXT)
 - j. Equal-Level Far End Crosstalk (ELFEXT)
 - k. Power Sum Equal-Level Far End Crosstalk (PSELFEXT)
 - l. Return Loss
 - m. Delay Skew
 - n. Attenuation to Crosstalk ratio (ACR)
 - o. DC Resistance per 100M/328 feet
 - p. Impedance
 - q. Capacitance
1. Record test results for each cable and turn over to the General Contractor two weeks prior to occupancy. Correct malfunctions when detected, and re-test to demonstrate compliance.
- 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 6A 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. Workstation Cable: The results of the workstation cable tests shall be provided in the form of printouts from the test equipment.
- M. The Warranty Submittal must be completed online within 30 days of installation completion. Copies of all certification test reports must be submitted as part of the Warranty Submittal. Test results must be kept on file by the registrant to be resubmitted when requested by Supplier. Data must be saved and submitted in raw data and summary formats (in tester's original format). The test data shall be submitted via online upload to contractor website. If online upload is unsuccessful, the data can be submitted via e-mail or disc.

3.8 FIBER OPTIC TESTING SPECIFICATIONS

- A. Each fiber strand shall undergo 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. Obtain the cable manufacturer power meter test results for each reel used on the project. Prior to completion of project, turn over the completed optical fiber test form, optical fiber cable reel ID tags and optical fiber cable manufacturer's test results.
- B. Test Equipment: Light Source and Level III Power Meter manufactured by Fluke, Viavi, FINISH WHEN ACCESS TO LIST.
- 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. After terminating optical fiber cables the system shall be tested using Tier 1 test format. Tier 1 testing is mandatory. Tier 2 testing, (OTDR testing), is optional.
- E. Connector loss shall not exceed 0.5 dB per termination.
- F. Multimode optical fiber attenuation shall be tested on all individual fibers of each cable segment with an nCompass approved field certification tester.
 - 1) Encircled Flux Compliant as required by TIA-526-14-B. Source shall be EF compliant. Matched test reference cords per TIA TSB-4979.
 - 2) 1 Jumper reference method shall be used.

- 3) Verification of test reference cords are required and shall be stored automatically as part of test data.
 - 4) 850/1300 nm wave lengths shall be tested on all fibers.
- 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. Test Results: Must be completed and turned over to the General Contractor prior to active equipment installation. Specific due dates for optical fiber will be established at pre-install meeting.
1. The Warranty Submittal must be completed online within 30 days of installation completion. Copies of all certification test reports must be submitted as part of the Warranty Submittal. Test results must be kept on file by the registrant to be resubmitted when requested by Supplier. Data must be saved and submitted in raw data and summary formats (in tester's original format). The test data shall be submitted via online upload to contractor website. If online upload is unsuccessful, the data can be submitted via e-mail or disc.

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". Handwritten 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 10000 Mbps data signals can be successfully transmitted 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-568-B standard. The warranty on the material, services, and operation of the cabling system to this specification must be for a period of 40 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 ANSI/TIA-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 ANSI/TIA-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.
- B. 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 TELECOMMUNICATION 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 quadbox 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 LED or 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 ANSI/TIA 568, ANSI/TIA 569, ANSI/TIA 607, and ANSI/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 ANSI/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 the contractor as specified under this contract.
- 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.