

SECTION 17000 (27 10 00)

VOICE, DATA, AND VIDEO STRUCTURED CABLING SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, materials, necessary equipment, testing, commissioning, documentation, and start up services for complete communications and networking cabling infrastructure. Cabling infrastructure shall be furnished complete and operational to meet the prevailing project requirements including those stipulated in SBBC Discipline and System Design and Criteria Standards. Items shall include, but not be limited to the following (except for items specifically indicated as **“NIC ITEMS” (Not in Contract)**):
1. Communications Equipment Room systems
 2. Pathways
 3. Cabling **(NIC)**
 4. Information outlets **(NIC)**
 5. Grounding
 6. PBX/KEY Systems **(NIC)**
 7. Servers/Routers/Switches/Hubs **(NIC)**
 8. Data sets/workstations **(NIC)**
 9. Voice sets/telephone instruments **(NIC)**
- B. The specifications herein described and defined are the result of years of experience with cabling projects throughout Broward Schools, and the evolution of Industry Standards. These district standards are based on the work of ANSI/TIA/EIA as reflected by BICSI, and specifications previously developed by the district and state. This document reflects specific reference to those standards and/or additions to the industry standards. Anything not specifically mentioned here is to be done according to the referenced standards.
- C. Construction Manager (CM), Contractor and Communication Systems installer or trade sub contractor/Vendor recognizes by provision of a bid price for the specified communications systems, that he has consulted or requested any technical clarifications thru the Prime Consultant/Architect and his contracted RCDD. The RCDD of record is understood to have a minimum of 5 years design experience for educational facilities Structured Cabling Systems and has prepared this project's communications and technology systems design under his responsible charge.
- D. The provision of a bid is recognition of the bidder that he has reviewed, understands, and is compliant with the bid and project requirements.
- E. The bidder recognizes the contract drawings and specifications are complementary and the entire contract document package shall be used for bidding and coordination purposes.
- F. The purpose of this document is to provide cabling systems designers and contractors a set of technical and installation and testing requirements for work completed in Broward Schools. Close contact between BCPS, the designers, and the communications contractor during the project is essential, the goal is to have a final product that is acceptable to BCPS so project close-out may occur in a timely manner. Communication is essential throughout the design and installation phases.

- G. The design incorporates a hierarchical star wiring system using interconnected telecommunications rooms, connected to individual workstations by home-run cabling. Patch panels allow for connection of different electronic devices to the cabling system. Each outlet's purpose, whether it is voice, video, or data, is determined by the electronics connected to it at the patch panel location. Aesthetics, flexibility, and full documentation are required to maintain an environment conducive to education as well as a system which is easily monitored and maintained by technical and non-technical staff.
- H. Data shall be used as a generic term for all systems in this standard. Therefore, references to data shall apply to the, Voice, Data, and Video systems unless specifically excluded.
- I. These specifications are intended to be a living document which shall be periodically updated to reflect technology enhancements and evolving SBBC standards and practices (such as VOIP, convergence, etc.) Contractor recognizes SBBC may request changes to suit specific project requirements.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. This Section includes the following items for wiring systems used as signal pathways for voice and high-speed data transmission:
 - 1. Mounting elements.
 - 2. Unshielded twisted-pair cabling.
 - 3. Fiber-optic cabling.
 - 4. Coaxial cable.
 - 5. Multi-user telecommunications outlet assemblies.
 - 6. Workstation outlets.
 - 7. Backboards.
 - 8. Identification products.
 - 9. Telecommunications mounting elements.
 - 10. Telecommunications equipment racks and cabinets.
 - 11. Telecommunications service entrance pathways.
 - 12. Grounding.
- B. Related Sections include the following:
 - 1. Section 16050 – Basic Materials and Methods
 - 2. Section 16060 – Grounding
 - 3. Section 16072 – Electrical Supporting Devices
 - 4. Section 16080 – Electrical Inspection and Testing
 - 5. Section 16090 – Alterations, Additions to Existing Work
 - 6. Section 16120 – Wire and Cables
 - 7. Section 16129 – Terminal Lugs
 - 8. Section 16130 – Raceways and Boxes
 - 9. Section 16132 – Conduit, Fittings and Supports
 - 10. Section 16134 – Auxiliary Terminal Panels
 - 11. Section 16137 – Pull and Junction Boxes
 - 12. Section 16138 – Outlet Boxes

13. Section 16140 – Wiring Devices
14. Section 16410 – Circuit Breakers
15. Section 16415 – Transient Voltage Surge Suppressors
16. Section 16430 – Low Voltage Switchgear
17. Section 16440 – Panel boards
18. Section 16490 – Fuses
19. Section 16820 – Sound Field
20. Section 02586 – Exterior Electrical Work Underground.

1.4 DEFINITIONS

Retain acronyms, abbreviations, and terms that remain after this Section has been edited.

- A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms (TR) or floor distribution terminals, the entrance facilities, and the equipment rooms (ER) within or between buildings.
- B. BICSI: Building Industry Consulting Service International.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. LAN - Local Area Network, the interconnections for Voice, Data, and Video on the local campus.
- I. RMC: Rigid metallic conduit.
- J. UTP: Unshielded twisted pair.
- K. ANSI American National Standards Institute
- L. Antenna A device used for sending and receiving wireless signal between the WAP and its clients.
- M. Backbone Wiring: Any communications cabling used to interconnect on ER to a TR or DP.
- N. Bonding Conductor: Wires connecting ground rods and busbars together.
- O. Cable Tray - An open system which may be used to support plenum data cable. Depending on size this may be used to support a few or many cables. Common manufacturer names are Snake Tray, E-Z Tray, etc.
- P. Cabling Any physical connection (copper or fiber) between devices on the network.
- Q. Client Any device which attaches either physically or wirelessly to the network.

- R. CO - Communication outlet: Contains the RJ-45 connections to the horizontal wiring used for connecting the data, voice, and video equipment to the wiring infrastructure.
- S. DP- Distribution Panel: A wall-mount cabinet enclosure used to secure the wiring terminations and electronic equipment when limited space is available. Primarily used within portable classrooms and limited space areas.
- T. EF- Entrance Facility: The EF is the location where the school's wiring system joins with services provided by outside sources, i.e. telephone demarcation.
- U. ER- Equipment Room: The ER is a room where all low voltage equipment resides to begin distribution on the wiring system. This space may include the EF if the room is sized large enough.
- V. Ground - Connection to Earth provided to safely clear electrical faults.
- W. Horizontal Wiring – Unshielded Twisted Pair copper cable (UTP) or fiber optic cable pulled between the telecommunications rooms and workstation outlets without any intermediate splices or cross connections.
- X. Innerduct - A protective sleeve placed within conduit or on cable raceway for the separation or protection of communication cabling, especially fiber.
- Y. Instructional Area - A room or location dedicated to instructional purposes. (e.g. classrooms, media center, auditorium, etc.)
- Z. Ladder Rack - An open system used to support plenum data from wall to communications rack system (NO video) cable. Support rungs are to be no more than 9" apart, and are only to be used in concealed ceiling spaces.
- AA. Office Area - Any location identified as non instructional areas which could be used for school staff and support personnel.
- BB. PSTN - Public Switched Telephone Network
- CC. PR - Power receptacle; provides the grounded 110v electrical power to the workstations.
- DD. RCDD - Registered Communications Distribution Designer, a design specialist for structured cabling certified by BICSI (Building Industry Consulting Service International).
- EE. WLAN Controller A WLAN controller is a device which centrally controls the wireless access points on a network.
- FF. Switch(es) - Device(s) used to interconnect the cabling to the Client.
- GG. Telecommunications - Any network service which ultimately connects to the PSTN (Public Switched Telephone Network) and/or internet).
- HH. TGB - Telecommunications Grounding Busbar. Terminus of all bonding connections in an TR. This bar is then bonded to the Telecommunications Grounding Backbone.
- II. TMGB - Telecommunications Main Grounding Busbar. The terminating connection for all communications grounding in the ground system. Connection to the electrical service ground is made from here.

- JJ. TR - Telecommunications Room. The TR is the location where the horizontal wiring terminates and connections to the main backbone occur with the necessary electronic equipment.
- KK. Transition Point - Location in the horizontal cabling where gel-filled cable connects to plenum rated cable.
- LL. Tray - Tray is a solid bottom fully enclosed metallic pathway system. Tray may be divided into sections to separate each system (voice, data, video) into its own compartment. Used in lieu of multiple conduits in exposed areas.
- MM. WAP - Wireless Access Point. A WAP is a device which allows the connection of clients to the network without the use of cables. These are typically mounted as high as possible to provide maximum Radio Frequency coverage.
- NN. Workstation - Any device connected to the wiring system. Includes computers, telephones, etc.
- OO. WO - Wall Outlet. The collocation of the CO (Communication's outlet) and PR (Power Receptacle) which then provides functional service to the equipment.
- PP. CP – Consolidation Point – Connection hardware between patch panel and moveable horizontal cable.
- QQ. UTP – Unshielded Twisted Pair Copper Cable (refer to Horizontal wiring above).

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01330, "Submittal Procedures".
 - 1. **Shop drawings** and/or samples for all products, listed or not, must be submitted for Broward County Technology Division written approval. Manufacturers and/or products are listed in order of preference (xx denotes unit configuration number). Single manufacturer names means that no other manufacturer's product is accepted without written approval from the Broward County Technology Department. This list is for major components and is not intended to be comprehensive. **NOTE: Any catalog numbers contained in this document are for informational reference purposes. It is the bidder's responsibility to double check the latest catalogs for any update in part numbers and/or completeness of**
- B. Product Data: For features, ratings, and performance of each component specified.
 - 1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. For cabling systems, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
- C. Shop Drawings:
 - 1. At the start of each project it is the responsibility of the contractor to provide shop submittals to include but not limited to the following:
 - a. **Product to be used** - Electronic cover sheets (in Excel workbook format) breaking out sheets for Data, and Telco. The sheets are then to have each item identified with a unique item number (i.e. D1, T2). A minimum of four (4) hard copies of the product cut sheets (**Electronic PDF copies will not**

be accepted) are to be submitted to the project manager for distribution to the appropriate BCPS personnel for review. Each hard copy of the submitted cut sheet is to be marked with the same unique item identifier from the electronic cover sheets with the item being submitted clearly identified. The electronic cover sheets will then be used for distribution of acceptance of the submitted product. Any rejected items will need to be submitted again using the same procedure.

- b. **Patch Panel Schedules** - submit electronically in AutoCad (latest release) format to the project manager and BCPS Education Technology Services Department. These are to be used for any updates that need to be done throughout the job.
 2. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
 3. For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
 - c. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
 4. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 5. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 6. Cabling Administration Drawings.
 7. Wiring diagrams to show typical wiring schematics including the following:
 - a. Workstation outlets, jacks, and jack assemblies.
 - b. Patch panels.
 - c. Fiber-optic boxes.
 - d. Distribution racks.
 - e. Terminal boxes/transition points.
- D. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.
- E. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Telecommunications Pathways and Spaces: Comply with ANSI/TIA-569-C, 568-C, 570-C.
- C. Grounding: Comply with ANSI/TIA-607-B.
- D. Source quality-control test reports.
- E. Field quality-control test reports.

- F. Submit under provision of Section 01410, "Regulatory Requirements".
- G. Install complete grounding system under provisions of National Electrical Code Section 250.
- H. Ensure all work complies with the most current BICSI (Building Industry Consulting Service International) and TIA/EIA (Telecommunication Industry Association/Electronics Industry Association) Standards.
- I. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- J. Comply with NFPA 70, "National Electrical Code."
- K. The installation shall be made in a workmanlike manner, with all parts securely installed and secured according to accepted standards for structured cabling, educational environment settings, and as approved by the Broward County School Board.
- L. All materials shall be new and free of defects and shall be installed using the manufacturer's latest standard design. All materials shall carry the UL label or shall be manufactured according to that agency's standards where such standards have been established.
- M. All electrical and conduit work for high voltage electrical construction shall be performed by or under the on-site supervision of a Master Electrician.

1.7 QUALIFICATIONS OF CONTRACTOR/INSTALLER

- A. Installer Qualifications: Cabling installer must have on staff personnel certified by BICSI.
 - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings, and field testing program development] by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of a BICSI Certified or equivalent Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
 - 1. Testing Agency's Field Supervisor: Person currently certified by BICSI as an RCDD to supervise field quality-control testing.
- C. Applicants must fully meet the requirements established in this section in order to be qualified for project approval. Applicants must include sufficient written information clearly identifying their ability to meet these qualifications.
- D. BCPS reserves the right to reject any and all applicants and to waive any irregularities in its project award process. Applications which contain false or misleading statements or which provide information or references that are not valid will be rejected.
- E. All work associated with communications systems are to be done under the direction of a "full service" communications contractor. Full service shall refer to a contractor that has sufficient in house staff to meet the criteria set in these requirements. All cable-pulling, terminations, testing, etc. shall be done directly by the communications contractor.

- F. If during construction it is found that due to design error or existing pathway limitations, distance limitations are exceeded, or any other standards requirement violated, and the contractor has not notified the engineer and BCPS in writing of their concerns, prior to the installation of conduit and/or cable, it is the responsibility of the contractor to make all necessary corrections to meet the ANSI/TIA/EIA and BCPS design guidelines.
- G. Qualification Data: For Installer, qualified technician, installation supervisor, and field inspector. Contractors must meet the following qualifications to be eligible to do Voice, Data, Video work for BCPS. Contractors must provide the following information in their application for review by BCPS. Applications not providing this information shall be rejected. Contractors who do not meet these qualifications shall be rejected.
1. Contractor must have a State Electrical Contractors license as a minimum
 2. Contractor must provide proof that 30% of the installers and technicians for all cabling installations are BICSI, Legrand Ortronics certified for the life of the project.
 3. Contractor must provide proof of Legrand Ortronics Certified Installer Plus Certification or BCPS approved equivalent.
 4. Contractor must provide proof of ownership of the required test equipment.
 5. Contractor must show proof of ownership of termination equipment for all structured cabling systems.
 6. Contractor must provide proof of ownership of the required test equipment for Category 6 and 5e testing.
 7. Contractor must maintain an office within Broward County.
 8. Contractor must have at least five (5) years prior company experience in installing and repairing Telephone/Data systems and equipment and related work.
 9. Contractor must be willing to attend BCPS workshops relating to BCPS Structured Wiring Standards and agree to follow the guidelines presented during said workshop.
 10. The contractor must have a local telephone number for contact throughout the construction and warranty period.
- H. Contractor Professional Experience:
1. Indicate total years of company experience in the Southeast Florida area.
 2. Provide a list of at least three (3) major customers, other than BCPS, in the Southeast Florida area for whom services are currently being provided. The list must include a description of the types of services being provided and the name, title, address, and telephone number of a person with each customer who may be contacted for references.
 3. Specify the current geographic area serviced.
 4. Describe prior experience (if any) in performing work for BCPS.
 5. Indicate any factors which would prevent the Contractor from working in all BCPS buildings at all locations within the geographical boundaries of Broward County.
 6. Specify the number of Contractor technicians who will be available to perform work and total years of experience, resumes, certifications, specialized training of each technician.
 7. Describe the nature and scope of any other technical services the Contractor is qualified to perform.
- I. Other Contractor Requirements:
1. Upon request from BCPS or its representatives, the Contractor will provide the names, addresses, social security number and employment history for those technicians who will be performing BCPS work for verification of experience and for background checking, if necessary.
 2. The BCPS will require that while on BCPS property that the Contractor's technicians dress in a manner appropriate to the work to be performed. Contractor technicians will perform their work in a courteous and efficient manner.

3. Contractor must provide a visible employee badge, or other means of identification, that must be worn at all times by each technician while on BCPS property.
4. The Contractor will secure, pay for, and comply with all permits and certificates that may be required by local, state and federal laws and ordinances.
5. Contractor must provide their technicians with transportation, tools, and equipment appropriate to the work to be performed. The BCPS will not provide transportation and will not furnish tools and equipment.

E. Contractor Services to be provided

1. Contractor must complete all BCPS work in full conformance with the most current applicable standards for electrical and telecommunications wiring and the terms and conditions governing the maintenance of complete Legrand Ortronics nCompass warranty coverage where applicable.
2. Contractor must perform all required functional testing of wiring circuits.
3. Contractor must reinstall, restore or reconnect any and all communications or non-communications equipment which may have been moved or temporarily disconnected as a result of authorized system installations, modifications, adds, moves and changes or other work. Upon completion of the work, Contractor personnel will clean up and restore the work place and associated equipment rooms to there original condition ensuring that the terms and conditions of nCompass warranty coverage remains in force. When any work is being performed in occupied areas the work site must be cleaned daily.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.9 COORDINATION

- A. Coordinate layout and installation of voice and data communication cabling with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distribute to other participants.
 3. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SYSTEM REQUIREMENTS

- A. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.
- B. Expansion Capability: Unless otherwise indicated, provide, positions in cross-connect and patch panels, and terminal strips to accommodate 20 percent future increase in the number of workstations shown on Drawings. This expansion requirement does not apply to horizontal cable from workstation outlet to first patch panel.
- C. **COMMUNICATIONS SYSTEM PRODUCTS: To ensure Limited Lifetime Certified Warranty Limited Lifetime Installation Warranty, all products must comply as a minimum with nCompass™ Cat6+ Cabling System specifications and performance warranty coverage requirements.**

2.3 CABINET AND RACKS

- A. **Racks:** Racks shall be used for the installation of cable termination and equipment mounting within secure rooms. All racks shall include the appropriate wire management guides for both the horizontal and vertical management of patch cables as described below. Installation is to insure that all terminated cables are relieved of any strain, and that the rack (whether floor or wall mounted) allows for both the cable to be terminated and the electronic equipment to be mounted. Use racks with Clear Coat finishes, 10-32 threaded rails with marked rack space increments. A six position power strip shall be included with each rack. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management. Free-standing rack shall:
 - 1. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA-568-C.
 - 2. Have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
 - 3. Have EIA hole pattern on front and rear.
 - 4. Be available with a 3.5" channel depth.
 - 5. Be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
 - 6. Assemble as 19" (483 mm) with no additional hardware.
 - 7. Installed with vertical patch cord management: interbay with latches.
 - 8. Provide floor and ceiling access for cable management and distribution.
 - 9. Provide pre-drilled base for floor attachment of rack.
 - 10. Be available in standard color of black.
 - 11. Be manufactured by an ISO 9001 registered company.

Rack Manufacturer: Legrand Ortronics

Refer to Section 2A-8 Voice Data Video Structured Cabling Systems Design Criteria for Rack Configuration.

- B. **Cabinets:** Use of cabinets is required in non-secure rooms. Each cabinet shall be an industry standard, floor or wall mounted, ventilated, cabinet constructed of 14 gauge steel with

a durable black paint finish applied over an iron phosphate coating for rust prevention and shall have provisions for conduit entry. The cabinet body shall have 10-32 threaded pre-drilled mounting rails designed for supporting E.I.A. standard 19" wide units, these rails are to be adjustable from front to back so they may accommodate various equipment depths. Appropriate wire management is to be installed. The cabinet shall have hinged doors to allow access to the front and rear terminals of installed equipment. Cabinet front sections shall be a one-piece hinged door with flush keyed latch. All cabinets at each respective facility shall be keyed alike. Cabinet sizes shall be determined based on the project design. A minimum six position power strip shall be included. Must be able to mount cable tray or cable troughs directly to the top of the cabinet frame.

C.

Cabinet Manufacturers -Based on requirements

General: *Legrand Ortronics* with all required Accessories

Specialized: Specialty Cabinets are only to be used when approved by BCPS Education Technology Services Department.

- D. **Server Cabinets:** Legrand Ortronics or other BCPS approved cabinet inclusive of, but not limited to, all necessary rails, mounting hardware, 42U vented doors and locking apparatus. The cabinets must have a minimum depth of 32' and include 2 ten-position power strips that are designed so that each is plugged into its own dedicated NEMA L5-30R receptacle as specified in the designed criteria. The four post cabinets should have 19 inch industry standard width to support 19" rack mounted equipment. Appropriate fans must be provided. The outlets on the power strips must provide NEMA 5-15 outlets for connecting server equipment. Cabinets must be able to accept airflow baffles for passive side to side cooling.

2.4 FIBER OPTIC CABLES

- A. At a minimum, Indoor/Outdoor Optical Fiber Non-Conductive Riser (OFNR) Loose Tube with 10 Gigabit Laser Optimized 50/125 Optical Fibers.
1. Each Multimode Fiber shall be:
 - a) Graded-index optical fiber wave-guide with nominal 50/125 μ m-core/cladding diameter.
 - b) The fiber shall comply with the latest revision of ANSI/EIA/TIA-492AAAC.
 - c) Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-78.
 - d) Information transmission capacity shall be measured in accordance with ANSI/EIA/TIA-455-204 or -455-220.
 - e) The measurements shall be performed at 23°C \pm 5°C.
 - f) Maximum attenuation dB/km @ 850/1300 nm: 3.5/1.5
 - g) Bandwidth: 1500 MHz-km @ 850nm for overfilled launch,
 - h) Bandwidth 500 MHz-km @ 1300nm.
 - i) Bandwidth 2000 MHz-km characterized using FOTP-220
 - j) Optical Fiber shall be laser optimized and guaranteed for 10 Gigabit Ethernet distances of 300m/300m for 850nm and 1300nm respectively
 - k) Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of 1000m/600m for 850nm and 1300nm respectively
 2. Physical Characteristics:
 - a) Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
 - b) Shall be suitable for use in risers and horizontal applications.
 - c) Shall have a dry water blocking system for cable core and buffer tubes.
 - d) Shall be available with a fiber strand count range from 6 to 144.

- e) Shall have a 3.0 mm sub-unit diameter.
 - f) Shall have and be marked with an OFNR.
 - g) Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEA S-87-640.
 - h) Strength members shall be dielectric and may be either fiberglass or aramid yarn.
 - i) Suitable for underground or aboveground conduits.
 - j) Loose Tube fibers shall be color coded in accordance with EIA/TIA-598 with an overall aqua jacket.
 - k) Shall have a ripcord for overall jacket.
 - l) Suitable for operation between -40°C to +75°C
 - m) Shall be UV resistant
 - n) Shall be of an all dielectric design
3. Design Make:
- a) Superior Essex F360 or F460-Series loose tube optical fiber cable with EnduraLite laser optimized 50/125 micron fiber or Superior Essex Series .
- B. At a minimum, Indoor/Outdoor Optical Fiber Non-Conductive Riser (OFNR) loose tube 10 Gigabit Laser Optimized 50/125 Optical Fibers.
4. Each Multimode Fiber shall be:
- l) Graded-index optical fiber wave-guide with nominal 50/125□m-core/cladding diameter.
 - m) The fiber shall comply with the latest revision of ANSI/EIA/TIA-492AAAC.
 - n) Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-78.
 - o) Information transmission capacity shall be measured in accordance with ANSI/EIA/TIA-455-204 or -455-220.
 - p) The measurements shall be performed at 23°C ± 5°C.
 - q) Maximum attenuation dB/km @ 850/1300 nm: 3.5/1.5
 - r) Bandwidth: 1500 MHz-km @ 850nm for overfilled launch,
 - s) Bandwidth 500 MHz-km @ 1300nm.
 - t) Bandwidth 2000 MHz-km characterized using FOTP-220
 - u) Optical Fiber shall be laser optimized and guaranteed for 10 Gigabit Ethernet distances of 300m/300m for 850nm and 1300nm respectively
 - v) Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of 1000m/550m for 850nm and 1300nm respectively
5. Physical Characteristics:
- o) Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
 - p) Shall be suitable for use in risers, plenum and horizontal applications.
 - q) Shall have a dry water blocking system for cable core and buffer tubes.
 - r) Shall be available with a fiber strand count range from 6 to 12
 - s) Shall have and be marked with an OFNR
 - t) Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEA S-87-640.
 - u) Suitable for underground or aboveground conduits.
6. Design Make:
- Superior Essex Series 53 or Superior Essex Dura Lite

2.5 FIBER OPTIC CROSS CONNECT PANELS

- A. Legrand Ortronics fully enclosed rack mounted cross connect cabinets and products for fiber termination. These are to be appropriately sized for the number of terminations required.

2.6 FIBER OPTIC CONNECTORS

- A. Each SC Fiber Connector as specified as a nCompass solution and shall at a minimum:
1. Be available in single mode and multimode versions
 2. Have a domed zirconia ferrule.
 3. Be a PC polish type connector.
 4. Accept a nominal fiber diameter of 125 micrometers
 5. Have a typical insertion loss of 0.1 dB for multimode and 0.1 dB for single mode
 6. Have repairable tips.
 7. Singlemode connector shall be tunable
 8. Have an insertion loss change of less than 0.2 dB after 500 reconnects.
 9. Be stable over an operating range of -40C to +75 degrees C

2.7 MODULAR PATCH PANELS AND WIRE MANAGEMENT

- A. Patch panels shall be provided in the ER, TR, and DP for termination of horizontal cabling. Modular patch panels shall subscribe to all requirements of the nCompass warranty criteria. Patch panels shall:
- (1) Be Cat 6 certified with 8 wire, 8 position (8W8P) ANSI/TIA/EIA T568B modular output ports pre-wired to Type 110 input terminals and be verified by a third-party nationally recognized independent testing laboratory. High density unloaded patch panels may be used with high density jacks using a lacing cap termination method instead of Type 110 to ensure higher density in a smaller space.
 - (2) Be suitable for both rack mounting to standard 19-inch racks and wall mounting using hinged brackets.
 - (3) Not exceed 96 ports.
 - (4) Include corresponding horizontal wire management modules so that a module will be located at both the top and bottom of the rack as well as between each patch panel. Ensure that all horizontal wire management modules are aligned across the racks. **A module with a minimum height of 3" shall be used.**
 - (5) Have vertical wire management for each side of a rack or cabinet.
 1. Use low emission IDC contacts.
 2. Use dual reactance technology to enhance the signal-to-noise ratio.
 3. Require standard termination practices using a 110 impact tool.
 4. Use a single piece IDC housing designed to accept larger Category 6 conductors.
 5. Include easy to follow wiring labels.
 6. Include label fields.
 7. Allow for the use of icons.
 8. Include full length metal rear cable management.
 9. Must be high density.
 10. Be backward compatible to category 3, 5 and 5e.
 11. Be center tuned to category 6 test specifications.
- B. Acceptable manufacturer: *Legrand Ortronics*

2.8 HORIZONTAL DISTRIBUTION CABLES

- A. All horizontal data station cable and voice cable shall terminate on modular patch panels (copper or fiber), 110 cross-connecting blocks (copper), or patch/splice cabinets (fiber) in their respective Telecommunications Room or Equipment Room as specified on the drawings.
- B. 100 OHM Category 6 UNSHIELDED TWISTED PAIR CABLE (UTP)
1. 100-ohm, 4-pair, balanced UTP, with fire-resistant thermoplastic jacket.
 2. Solid annealed copper conductors
 3. 23 AWG copper conductors
 4. Low-dielectric thermoplastic insulation
 5. Pair-separator for improved performance
 6. Plenum-rated flame retardant PVC
 7. Characteristic Impedance: 100 ± 15 Ohms
 8. Nominal Velocity of Propagation: 71
 9. Comply with UL 444
 10. Comply with NFPA 262
 11. Comply with ICEA S-90-661 for mechanical properties.
 12. Comply with ANSI/TIA-568-C.2 for Category 6 UTP cables.
 13. Listed as CMP by an NRTL acceptable to the AHJ.
 14. Verified for Category 6 performance by an NRTL
 15. RoHS compliant materials
 16. Performance Criteria
 17. Guaranteed electrical performance up to 400 MHz
 18. Guaranteed 3 dB margin over ANSI/TIA-568-C.2 requirements for NEXT and PSNEXT
 19. Guaranteed 3 dB margin over ANSI/TIA-568-C.2 calculated requirements for ACR and PSACR
 20. Printed with unique alpha-numeric code for each package of product
 21. Printed in both feet and meters with the units of length decrementing to indicate the amount of cable remaining in the box.
 22. Tip colors shall be a lighter version of the ring color.
- C. Approved Product:
Superior Essex DataGain approved for performance warranty coverage with nCompass Cat 6+ solution. *A cut sheet and sample long enough to read all jacket markings are to be submitted to the owner for approval prior to installation.*

2.9 WORKSTATION OUTLETS

- A. Shall consist of modularized interchangeable jack assemblies, which snap into a faceplate and mate with a contained connector permanently attached to the UTP cable. Jack assemblies shall be certified to perform to Category 6 standards. Outlets shall be provided in configurations of two, three or four modular jacks installed as required. All faceplates shall be completed with the appropriate number of jacks and blanks. The jacks shall be 8-position non-keyed (ANSI/TIA/EIA T568B) jacks. The color coding on the jack assembly shall match that of the associated patch panel as follows: Blue, Green, Yellow, and Purple. **The application of the jacks will be universal and is determined by the connection made at the ER, TR, or DP (i.e. data, voice or video).**

- B. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.
- C. The Telecommunications Outlet Assembly shall accommodate:
1. A minimum of two (2) modular jacks
 2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary
 3. A blank filler will be installed when extra ports are not used.
 4. A dust cap shall be provided on all modular jacks with the circuit number on the identifier strip.
 5. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the telecommunications contractor shall submit the proposed configuration for each outlet assembly for review by the Owner.
 6. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA-606-A standard specifications. Labels shall be printed using Legrand Ortronics label program using a printer such as a Brady hand held printer. Hand printed labels will not be accepted.
- D. Faceplates: The faceplates shall:
1. Be Legrand Ortronics TracJack or Series II style as appropriate to fit the modular jack used
 2. Be UL listed and CSA certified.
 3. Be constructed of high impact, ABS plastic UL 94V-0 construction (except where noted otherwise).
 4. Shall match the faceplate color used for other utilities in the building or match the color of the raceway if installed in surface raceway.
 5. be compliant with the above requirements along with the following when incorporating optical fiber:
 - a) be a low profile assembly,
 - b) incorporate a mechanism for storage of cable and fiber slack needed for termination,
 - c) position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
 - d) incorporate a shroud that protects the optical couplings from impact damage.
 6. Be available as single-gang.
 7. Shall provide easy access for adds, moves, and changes by front removal of jack modules.
 8. Possess recessed designation windows to facilitate labeling and identification.
 9. Shall include a clear plastic cover to protect labels in the designation window.
 10. Have mounting screws located under recessed designation windows.
 11. Comply with ANSI/TIA/EIA-606-B work area labeling standard.
 12. Allow for the UTP modules to be inverted in place for termination purposes.
- E. Voice / Data Jacks
1. Voice/Data jacks shall be 8-position modular jacks and shall be Category 6 performance as defined by the references in this document including ANSI/TIA-568-C.2-1. All pair combinations must be considered, with the

worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.

2. The modular jack shall use dual reactance modular contact array.
3. The modular jack shall have low emission IDC contacts.
4. The modular jack shall use standard termination practice using 110 impact tool
5. The modular jack shall be backwards compatible to Category 3, 5, and 5e.
6. The modular jack shall be center tuned to category 6 test specifications.
7. The modular jack shall conform to warranty requirements for an nCompass Cat6+ Solution.
8. Dust covers shall be used on each termination.

Approved Manufacturers: *Legrand Ortronics*

2.10 MOUNTING ELEMENTS

- A. Backboards: 3/4-inch (19-mm), marine-grade, fire-retardant-treated plywood; palero gray painted and treated including surfaces and edges. Coordinate with Drawings.
- B. Distribution Racks: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
 1. Module Dimension: Width compatible with EIA 310 standard 19-inch (480-mm) panel mounting.
 2. Finish: Baked-polyester powder coat.
- C. Power Strips: For mounting in the rack, with 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles, number as indicated, but in no case fewer than 6, and including the following:
- D. LED indicator lights for power and protection status.
 1. LED indicator lights for reverse polarity and open outlet ground.
 2. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.
 3. Circuit breaker and thermal fusing. Unit continues to supply power if protection is lost.
 4. Close-coupled, direct plug-in Cord connected with **15-foot (4.5-m)]** line cord.
 5. Rocker-type on-off switch, illuminated when in on position.
 6. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
 7. Protection modes shall be line-to-neutral, line-to-ground, and neutral-to-ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.
 8. One RJ11/12C telephone line protector, suitable for modem connection. Maximum clamping voltage 220 peak on pins No. 3 and No. 4.
- E. Wall-Mounting Rack: Aluminum, hinged wall bracket with provisions for power strip mounting.

- F. Floor-Mounting Rack: Steel, freestanding, modular, with vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.
- G. Cabinets: Steel, freestanding, modular, with removable and lockable side panels, front and rear doors, ventilation openings in rear door and top panel, and the following components:
 - 1. Provisions for a roof-mounted ventilation fan.
 - 2. 250-cfm (118-L/s) roof-mounted ventilation fan.
 - 3. Key all locks alike.

2.11 BACKBOARDS

- A. ~~Void-free plywood, 84 inches (2130 mm) high and 3/4 inch (19 mm) thick, fire rated.~~

2.12 GROUNDING AND BONDING

- A. Materials: Comply with NFPA 70, TIA/EIA-607, and UL 467 and nCompass Cat6+ requirement.

2.13 IDENTIFICATION PRODUCTS

- A. Style and Manufacturers:
 - 1. Conform to SBBC standards.
 - 2. Obtain sample labeling format, style, material and appearance from SBBC.
- B. Comply with TIA/EIA-607-B, 606-B.
- C. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.
- D. Computer-based cable management system, with integrated database and graphic capabilities.
 - 1. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.
 - 2. Information shall be presented in database view technical drawings.
 - a. **AutoCAD** drawing software shall be used as drawing and schematic plans software.
 - 3. System shall interface with the following testing and recording devices:
 - a. Direct upload tests from circuit testing instrument into the PC.
 - b. Direct download circuit labeling into labeling printer.

2.14 SOURCE QUALITY CONTROL

- A. Fiber-Optic Cable: Each cable spool tested at factory before shipping at 850 and 1300 nm. Test and inspect to EIA/TIA Standards
- B. UTP Cable Verification of Performance: Test every cable package or reel at factory to verify that cable complies with TIA/EIA-568-C.2 requirements.

2.15 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-C.

- B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
 - 2. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 3. Lacing bars, spools, J-hooks, and D-rings.
 - 4. Straps and other devices.
- C. Cable Trays:
 - 1. Manufacturers: Subject to compliance with requirements:
 - a. Per SBBC approved manufacturers. Legrand Cablofil basket tray
- D. Conduit and Boxes: Comply with requirements in Division 16. Flexible metal conduit shall not be used.
 - 1. Outlet boxes shall be no smaller 4 inches (50 mm) wide, 4 inches (75 mm) high, and 2 1/4 deep with a single gang mudring.

2.16 POWER STRIPS

- A. Power Strips: Comply with UL 1363.
 - 1. Rack mounting.
 - 2. **Six** receptacles.
 - 3. LED indicator lights for power and protection status.
 - 4. LED indicator lights for reverse polarity and open outlet ground.
 - 5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
 - 6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
 - 7. Cord connected with 15-foot (4.5-m) line cord.
 - 8. Rocker-type on-off switch, illuminated when in on position.
 - 9. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
 - 10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.17 GROUNDING

- A. Comply with requirements in Division 16 Section for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
 - 1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
 - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI/TIA-607-B.

2.18 LABELING

- A. Comply with TIA/EIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.19 SUMMARY OF APPROVED MANUFACTURERS PRODUCTS LIST

- A. Shop drawings and/or samples for all products, listed or not, must be submitted for Broward County Technology Division written approval. Manufacturers and/or products are listed in order of preference (xx denotes unit configuration number). Single manufacturer names means that no other manufacturer's product is accepted without written approval from the Broward County Technology Department. This list is for major components and is not intended to be comprehensive. NOTE: Any catalog numbers contained in this document are for informational reference purposes. Double check the latest manufacture's product data for any update in part numbers and/or completeness of items.

2.20 Data Products:

Surface Raceway: Nonmetallic	Legrand Wiremold Workstation Raceway Solutions-
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Raceway Outlet Plates: plates	Legrand Ortronics single gang Plastic Series II Face-
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Hubbell:	Hubbell scrubshield LCFBCA, with LCFBCALTC cover and flange, and four LCFBP8 as needed, with Legrand Ortronics 106 duplex modular frame.
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Cable raceway:	Cooper B-Line Cent-R-Rail® Systems and appropriate parts Cablofil and appropriate parts or BCPS approved equivalent.
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Data Racks:	Legrand Ortronics OR-19-84-T2SDB or BCPS approved equivalent.
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Horizontal Wire Manager:	Legrand Ortronics OR-808044855
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Vertical Wire Manager:	Legrand Ortronics OR-MM6VML704
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Provide 10-32 threaded rails, appropriate fans and appropriate power strips (6 outlet min.).

Small Wall mount TR's	Legrand Ortronics 30" deep Cabinet or BCPS approved equivalent.
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Server Cabinet:	Ortronics w/M6 rails and hardware, and vented doors. Minimum 32" depth.
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50/125 Fiber Optic Cable:	Superior Essex 53012B101 or W4012BG01
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Fiber Box:	Legrand Ortronics OR615MMC-18P-00, OR615MMC-36P-00, OR615MMC-72P-00
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- Fiber Connectors: Legrand Ortronics OR-205KNT9GA-09 LC/OR-205KNT9FA-50T SC CONNECTORS, OR BCPS APPROVED EQUIVALENT.
- Category 6 Cable: Superior Essex 66-240-7B DataGAIN CMP.
- Category 3 Backbone Cable: 25PR PE89 (OSP SHIELDED CABLE)
- Lightning Protection: Portasystems general lightning protector with GPS tube fuse.
- Patch Cables: Legrand Ortronics/QuikTron OR-MC6, OR-MC6, OR-MC6category 6 Clarity patch cord with Paralign 2 Plug Design.
- Patch Panels: Legrand Ortronics PHD66U24, 24PT C6 PATCH PNL
Legrand Ortronics , PHD66U48, 48PT C6 PATCH PNL
Legrand Ortronics , PHD66U96, 96PT C6 PATCH
PANEL
- Small Patch Panels: Legrand Ortronics - OR-PMP612H
- Wall Outlet Plates: Legrand Ortronics R-854045421, SERIES II
FACEPLATE, OR-4030054X TRACJACK
- Data Outlet Jacks: Legrand Ortronics S22600, SERIES II DUALJACK C6
Legrand Ortronics , S21600, SERIES II SINGLE JACK,
OR-TJ600 TRACJACK
- Data Outlet Blanks: Legrand Ortronics , OR40300191, SERIES II BLANKS
- Data Surge Protection: PORTA LAN BLOCK FOR Cat 6, PORTA VOICE MOD
FOR LAN BLOCK, DATA MOD FOR LAN BLOCK

2.21 TEST EQUIPMENT

Fluke - DTX 1xxx Series, Cat6 Permanent Link

VIAMI 40G CERTIFIER - CCTV Tester

*x = variable number

^ = shall only be used if the Panduit product is not available.

PART 3 - EXECUTION

3.1 INSTALLATION STANDARDS

- A. Comply with BICSI TCI, TIA/EIA-568-C.1, TIA/EIA-568-C.2, TIA/EIA-568-C.3, and TIA/EIA-569-C.
- B. All exterior/inter-building conduits and pull boxes for use with voice and data cabling, in addition to meeting size requirements and any other technical specifications noted in Division 17000, must be designed and installed according to BICSI standards to accommodate the placement of fiber optic and voice grading cabling.

3.2 EXAMINATION

- A. Examine pathway elements intended for cables.
 - 1. Verify proposed routes of pathways. Check raceways, cable trays, and other elements for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation. Verify that cabling can be installed complying with EMI clearance requirements.
 - 2. Prepare wall penetrations and verify that penetrations of rated fire walls are made using products labeled for type of wall penetrated.
 - 3. Identify plan to support cables and raceways in suspended ceilings. Verify weight of individual types and sizes of cables. Verify that load capacity of cable support structures is adequate for each pathway.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- C. Wiring Method: Install cables in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces. Cable trays are specified in Division 16 Section "Cable Trays." Raceways and boxes are specified in Division 16 Section "Raceways and Boxes."
- D. Cable Installation:
 - 1. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
 - 2. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 3. Pulling Cable: Do not exceed manufacturer's written recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

5. Secure and support cables at intervals not exceeding nCompass requirements.
 6. Install UTP cables using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
 - a. Do not untwist more than 1/2 inch (12 mm) of Categories 5e and 6 cables at connector terminations.
 7. Outdoor Coaxial Cable:
 - b. Outdoor connections shall be installed in enclosures complying with NEMA 250, Type 4X. Connectors shall be corrosion resistant with properly designed O-rings to keep out moisture.
 - c. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
- E. Separation from EMI Sources: Comply with BICSI TDM and TIA/EIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment. Comply with the following minimum separation distances from possible sources of EMI:
1. Separation between unshielded power lines or electrical equipment in proximity to open cables or cables in nonmetallic raceways is as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: 24 inches (610 mm).
 2. Separation between unshielded power lines or electrical equipment in proximity to cables in grounded metallic raceways is as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: 12 inches (300 mm).
 3. Separation between power lines and electrical equipment located in grounded metallic conduits or enclosures in proximity to cables in grounded metallic raceways is as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: 6 inches (150 mm).
 4. Electrical Motors and Transformers, 5 kVA or HP and Larger: 48 inches (1200 mm).
 5. Fluorescent Fixtures: 5 inches (127 mm).
- F. Conduit:
1. Comply with TIA/EIA-569-C for maximum length of conduit and bends between pull points, and for pull-box sizing.
 2. Use manufactured conduit sweeps and long-radius ells whenever possible.
 3. In telecommunications rooms, position conduit ends adjacent to a corner on backboard (in case of a single piece of plywood) or in the corner of room (where multiple sheets of plywood are installed around perimeter walls of room). Use cable trays to route cables if conduits cannot be located in these positions. Secure conduits to backboard when entering room from overhead. Extend conduits 1 to 3 inches (25 to 76 mm) in finished floor.

Backboards: Install marine grade with 84-inch (2130-mm) dimension from floor up toward ceiling. Butt adjacent sheets tightly, and form smooth gap-free corners.

3.4 Cabling Distribution Requirements

A. Inter-building Backbone Wiring

- a) (Two 2 inch conduits home run from the ER to each TR)
- b) Multimode fiber optic cable with a minimum of 12 50/125 micron fibers (Data)
- c) 12 pair Black Gel-filled voice grade cable to each TR> Terminate, protect and ground on 66 type blocks, then a tie should be made to the rack patch panel(s). Terminate 1 or 2 pairs per jack depending on the phone system requirements. Each TR interconnection shall be sized according to the minimum needs of one telephone line per classroom and one per administrative outlet.

Note: All copper cabling requires grounded lightning surge protection devices at both ends of each pair of wires.

B. Intrabuilding Backbone Horizontal Wiring

- a) (Minimum 2" conduit for each of the following)
- b) Multimode fiber optic cable with a minimum of 12 50/125 micron fibers (Data/Voice)
- c) 12 pair Black Gel-filled voice grade cable to each TR> Terminate, protect and ground on 66 type blocks, then a tie should be made to the rack patch panel(s). Terminate 1 or 2 pairs per jack depending on the phone system requirements. Each TR interconnection shall be sized according to the minimum needs of one telephone line per classroom and one per administrative outlet.

Note: All copper cabling requires grounded lightning surge protection devices at both ends of each pair of wires.

C. Intrabuilding Horizontal Wiring

- a) 6 (minimum) Four Pair, 24 AWG, Category 6 data grade UTP cables (Data, Voice) per classroom separated out to three two drop locations .
- b) 2 (minimum) Four Pair, 24 AWG, Category 6 data grade UTP cables (WAP/ Projector) per classroom and other locations as specified.
- c) 4 (minimum) Four Pair, 24 AWG, Category 6 data grade UTP cables (Data, Voice) per office outlet location.

3.5 CABLE REQUIREMENTS

A. General

Plenum cable shall be required whether or not the suspended space is return air plenum, except where the installation uses fully enclosed conduit systems.

The wiring systems specified in these guidelines are based on the requirements of ANSI/TIA/EIA 568-C, as reflected by the BICSI design manuals for horizontal premise wiring. All products must be UL listed and meet applicable local and State codes.

B. Fiber Optic Cable

Fiber optic cable must be used for the data system inter building and intra building backbone wiring. This includes all ER to TR/DP wiring. All fiber optic cabling must be Indoor/Outdoor Optical Fiber Non-Conductive Plenum (OFNP) Loose Tube with Extended Bandwidth 10 Gigabit Laser Optimized 50/125 Optical Fibers, unless specifically approved by BCPS Education Technology Services Department. A minimum of 12 strands shall be used for all backbone cables. All fibers must be terminated and contain no breaks. Cables that provide additional fibers to replace defective fibers are not permitted.

C. Copper Cable

The horizontal wiring from the ER, TR, and/or DP to the workstation outlets is to be 24 AWG four (4) pair unshielded twisted pair (UTP). The UTP cable used must be certified ANSI/TIA/EIA Category 6 or better. The UTP cable used must meet NFPA 262-1985 and UL 910 standards and be marked CMP or Plenum (UL).

3.6 PATCH PANELS

Patch Panels will be used in the ER, TR and DP to terminate all horizontal wiring. The panels used to administer the system shall be RJ-45 modular in the front to IDC (110) in the back. The panels shall perform to Category 6 standards and be wired per ANSI/TIA/EIA 568C.

3.7 COMMUNICATION OUTLET

Outlets shall be provided in configurations of one, two, four or six modular jacks installed as required. All faceplates shall be completed with the appropriate number of jacks and blanks. The quad outlet in each instructional area shall be located by the teacher's workstation. The dual outlet in each instructional area shall be located in the student computer area. The other dual outlet in each instructional area shall be mounted on the wall above the ceiling above the teacher's work area.

When used for data, all wall outlet boxes, baseboard raceways and modular office partition feeds shall at least be stubbed into the ceiling with 1-inch minimum conduit, which has been reamed and bushed.

(Retrofits) - The CO should be recessed into the wall whenever possible. When this is not possible surface mounting may be done. The CO should then be installed in surface mounted raceway or directly into modular furniture.

3.8 Workstation Outlets Locations

The workstation outlet (WO) is the combination of the communications outlet (CO) and the power receptacles (PR). Connections are accomplished using communications jacks and electrical plugs.

Each workstation location shall have a WO within three feet.

Every user area shall include a minimum of one WO. When determining the location of outlets, alternate room arrangements that would meet instructional and/or office needs should also be considered during design. (*Retrofit only: Long areas designated as workstation areas may be served using dual channel divided raceway with PR and CO located as needed.*)

3.9 Wireless Overlay Design - Basic WAP Design Guidelines

All wiring of wireless access point locations shall be done using a minimum of two (2) Cat6 cables. This is to provide both future growth and to warn that not only is there a Network signal on the cable, but also power on the cable. All access point wiring shall terminate in the TR on specially designated patch panels used for wireless cable termination exclusively.

All cabling for Access Points shall be done following all District standards. All identification of the cable shall be similar to labeling for standard outlets or floor boxes. The exception is that the final designator shall be (i.e. 100).

Cabling Design for WAP in New Construction

Since a site survey cannot be performed prior to construction the stipulated guidelines shall apply with the following changes. The designer shall design a grid cabling system for the building so as to allow the support cables to be installed during construction. When designing the cabling infrastructure for the Wireless Access Point (WAP) the base distance between terminations shall NOT exceed 250 ft from the point of origin in the ER or TR. The above distance is to allow for adjustments in the actual WAP locations to optimize the signal for the actual conditions. It also is to include the required maintenance loops required for any cabling. After construction is complete, a wireless site survey shall be performed to identify the actual WAP locations and cables to be used to provide the required wireless coverage..

3.10 Telephone System

- A. Wiring for the telephone system from the ER, TR or DP to the WO in the user areas is accomplished as part of the horizontal wiring. The RJ11 plugs of the telephone instruments will connect to the RJ45 type jack in the WO at the locations selected by the school. ER, TR or DP's are to be interconnected using a minimum 25 pair Category 3 or Gel-filled Black voice grade cable. ***Each TR interconnection shall be sized according to the minimum needs of one telephone line per classroom and one per administrative outlet.***

- B. A standard quad CO shall be included from the Telephone System Backboard to the ER Patch Panels for use by the telephone and voice mail systems.

- C. Wiring standards for voice systems will normally be accomplished as part of the horizontal structured wiring related to all district/school projects. This includes the wiring from the ER and TRs to the CO in the user areas. ER and same building TRs are to be interconnected using a minimum 25 pair Category 6 UTP plenum rated wire. ER and different building TRs are to be interconnected using a minimum 25 pair gel- filled black voice grade cable with appropriate transition points to Category 6 UTP plenum rated wire for termination to racks. For new construction buildings added to existing campus sites each TR interconnection shall be sized to accommodate a minimum need of one telephone line per classroom and one per administrative outlet. For entire new site construction ER and TRs are to be interconnected using a minimum 25 pair appropriately rated cable/wiring. Provide a standard CO on the telephone board to the closest data rack. There must be single pair termination per port for each horizontal wire connection.
- D. BCPS (owner) shall work with the carrier to determine the school's need for:
 - a) Number of cable pairs (copper and fiber) to be brought into the school.
 - b) Locations and types of telephone sets. This information will be shared with the contractor in the design phase of the project.
- E. The contractor shall coordinate with ATT Facilities Office (or applicable service vendor) at the site property line/utility easement to determine where interface occurs and how the interface is configured. This action shall be completed in such a timely manner that there will be no delay in provisioning of services for use at the time of Substantial Completion of the project. ATT Building Industry Consultant, usually provides project-specific documents and instructions back to the contractor. The contractor shall incorporate BellSouth's documents and instructions into the project construction documents.
- F. The Contractor shall furnish and install all wiring, connections, hardware, equipment, terminal blocks, and accessories to completely wire the telecommunications from the BellSouth interface into the Main Distribution Facility, and onto the backboard to the demarcation blocks.

3.11 Provisions for Portable Classrooms

Interbuilding wiring distribution shall follow this section standards. Fiber optics shall be used for data services. Lightning surge protection devices are required at each end of the cable where copper cabling is provided.

3.12 Identification

All cables, terminations, conduit routes, electrical circuits, panels, TR, DP, etc. are to be labeled according to the standards identified in of this document.

Data system labels shall be nominal 3/8-inch high, 1-inch wide, machine printed, self-laminating, vinyl labels with white background and black text. Attach labels directly on/or adjacent to respective connector.

Use final FISH identifiers for final labeling and not temporary construction identifiers. Rooms are to be arranged in sequential order on the patch panels. Mis-

ordered and/or mislabeled cables will have to be reordered in proper sequence and retested. Coordinate Labeling with BCPS(owner) Education Technology Services Department Division.

3.13 Design Drawings

Once the design work is complete, provide both a 24"x36" sized and a half sized hard copy set of CAD produced drawings of the communications systems to BCPS Education Technology Services Department. Any changes made to these systems during construction need to be reviewed with BCPS Education Technology Services Department, and drawing updates issued. Provide these hard copy versions of the final design prior to Walk Thru requests. Once the walk thru and punch list is complete, make all as built corrections to the drawings. Provide final electronic versions and one hard copy to BCPS Education Technology Services Department.

3.14 System Testing

The contractor is required to perform all system tests regarding fiber optics, UTP cables, and power receptacles as described in this specification. System verification and acceptance documentation signed and dated by the installer (Contractor) and the design professional shall also be provided to BCPS. This documentation shall include test measurements and system calibrations performed on each system in their entirety. Sample system operations shall be performed with actual hardware or using Contractor provided test equipment and documented to verify that the system is operational and ready for acceptance. This shall also establish the baseline performance of the system. **The system shall not be certified as complete until ALL test reports for ALL cables, both copper and fiber, have been received and verified by BCPS(owner) Education Technology Services Department.**

3.15 System Documentation

- A. As part of the wiring system installation, the contractor and/or engineer shall provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes:
1. 3 Sets of printed As-built drawings, as well as one electronic set in Auto-CAD format (most recent version) with all cables, pull points and terminations identified.
 2. Once all test reports are verified then the contractor will submit:

One (1) Printed Report divided into individual notebooks, w/clear front pockets to allow labeling, for each TR. Each communications room shall have its own notebook with the corresponding test reports for both the fiber and copper cabling within.

Two (2) electronic copies in an owner specified format which incorporates all reports into a single sorted database for the fiber and one for the copper results.

3. A bill of materials of all installed equipment and wiring, rack and back-board equipment layouts showing placement of support equipment, and model and serial numbers of all installed equipment.
4. The labeling nomenclature described in Section VIII is to be used on all documentation and cable labeling so as to facilitate locating and identifying each cable.

3.16 Demonstration and Training

Training of school and district personnel shall be provided upon request. Training will cover the location nomenclature, documentation structure and contents, documentation maintenance procedure, a "walk through" for location and labeling orientation, system re-configuration using ER, TR, and DP facilities (termination hardware, patch cables, etc.), test documentation, and trouble shooting of the signal and location of the electrical panels servicing the power portions of the installation.

3.17 Conduit and Cable Distribution System

- A. A conduit system is the preferred method for protection of the communications wiring system. This is required for use in all grade or below-grade level concrete slabs and for intra-building distribution. All wiring between the ER and TRs must be run in appropriate conduit and make accommodations for the use of fiber optic cabling such as long radius bends with as few bends as possible and in accordance with industry standards. All accessible ceiling areas used for cable installations shall be interconnected, utilizing appropriately sized conduit. Cable trays, instead of multiple conduits, shall be used for the distribution of the horizontal cabling. Where suspended ceilings are available, the design of the horizontal distribution system from the TR to workstations may use basket trays with a maximum support spacing of 5 feet. Plenum rated cable must then be installed. Plenum cable shall be required whether or not the suspended space is return air plenum. Where open cables penetrate a wall, floor, or other building member, provide the appropriately sized conduit sleeve with a non-metallic bushing and nipple on each end to extend a minimum of 2-inches beyond each side of the penetration. Insulated throats are an acceptable alternative. Conduit sleeve installation shall comply with all provisions of Section III as applicable and be fire stopped.
- B. All workstation and backbone cables in exposed locations, run between buildings, and extending from above accessible ceilings to wall mounted outlets, terminal cabinets, and backboards shall be in conduit or channel installed in accordance with Section III. **Cable Trays must be aluminum designated to support 50 pounds per linear foot as described in Section 16114 Cable Trays of BCPS Design and Materials Standards documentation. No cable pathways shall be exposed in any mechanical or electrical room. Use conduit.**
- C. The minimum bend radius required by manufacturer specifications or the ANSI/TIA/EIA standards (whichever is greater) for the cabling specified in this document shall be required for all conduit systems. Conduit shall have no more than 180° of bend between pull boxes.

All conduit between buildings shall have no more than two 90° bends. Provide pull boxes, stand-off channels, or conduits as necessary to comply with this requirement.

1. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
2. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
3. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type or 40%.
4. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
5. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
6. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
7. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported per nCompass required intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
8. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
9. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
10. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
11. Cables shall be identified by a self-adhesive label in accordance with 3.27 of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
12. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
13. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.
14. All gel-filled cable used within a building must be in conduit.

- D. Provide separate conduits for backbone and workstation communications cables. All conduits for backbone cables shall be 2 inch diameter minimum and account for the minimum bend radius of the specified fiber optic cable. All fiber optic cables shall be installed in conduit between TRs. **Conduits used for workstation communications cables shall be 1-inch diameter minimum.** Cable trays used to serve multiple COs shall be used where practical instead of using individual home run conduits to serve each outlet. Locate main runs of cable tray systems serving multiple outlets at common corridors or walkways instead of routing through classrooms and administrative areas when possible.
- E. The installation path for all cables shall be carefully planned to minimize the total length of each cable run. The twisted pair cable length between a distribution frame termination and a workstation outlet shall not exceed 250 feet, to include an allowance of 10 feet of slack at the closet and 1 foot at the outlet. **When due to actual conditions, the distance of a planned route is a concern to the contractor, all proposed installation paths should be inspected and approved by the owner/and engineer prior to installation.** If this is not done then it becomes the contractor's responsibility to make all corrections.
- F. Firestop all penetrations using UL approved systems and materials.
1. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
 2. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped.
 3. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).
 4. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.
 5. Coordinate with the service providers for the final locations of the placement of entrance conduits.

3.18 Backboards, Rack, and Cabinets

- A. Each communications backboard shall be made of 3/4" thick, marine grade fire retardant plywood panels painted, on all sides, with a minimum of 2 coats of fire retardant gray semi-gloss enamel. Leave all plywood grade stamps exposed prior to inspection. Install double duplex receptacles (on dedicated circuits tied back to a generator supported electrical distribution panel) for power at upper left or right corner of each backboard section depending on placement of racks (i.e. telco, intercom, security, etc.). Each conduit

extended to the backboard shall be bonded to the TGB and terminate 3 inches below the ceiling level with a non-metallic nipple and bushing.

- B. Racks shall be securely attached to all pathways and mounting surfaces (floors and walls).
- C. Where existing security and/or environmental conditions are not suitable for installation of racks, cabinets must be utilized. Provide enough cabinets and/or racks to mount all patch panels, wire managers, and equipment required for the network. Cabinets shall be securely attached to mounting surface (floor and/or wall). Wall cabinets shall be installed in a manner suitable for supporting 60 pounds of equipment installed within the rack. **Power receptacles shall be mounted at the lower left corner of each cabinet. All cables extended to terminal cabinets and backboards shall be provided with a minimum of 36-inches slack cable at termination locations.**

All areas within TR's and DP's shall use Velcro Ties.

3.19 Cabinet Entry (Not to be used for Server Cabinet specifications)

Cabinet power and the TGB are to be mounted within the cabinet. Connect ground bar to all rails in the cabinet as well as the cabinet itself. Use #6 Green Ground Wire. Power receptacles shall be mounted within the lower left rear corner of any cabinet. Conduit entry shall penetrate into the cabinet. Designs and installations must include power strips with a minimum of 6 outlets for each cabinet.

When pathway (conduit and/or cable tray) enters into the ER / TR, from a non-environmentally conditioned space, seal all pipes with putty prior to entry into the room and/or cabinet.

3.20 Telephone Backbone Cable and Terminations

- A. New Site
 - 1. Wiring for the telephone system from the ER, TR or DP to the WO in the user areas is accomplished as part of the horizontal wiring. ER, TR, or DP'S are to be interconnected using a minimum 12 pair Category 3 or Gel-filled Black voice grade cable.
 - 2. New Site: Wiring for the telephone system from the ER, TR or DP to the WO in the user areas is accomplished as part of the horizontal wiring. ER, TR or DP's are to be interconnected using a minimum 12 pair Category 3 or Gel-filled Black voice grade cable. Designs for telephone systems must include a dedicated 120V-20A circuit behind the voice systems rack in the ER.
 - 3. Classroom/Administrative Addition- Wiring for the telephone system from the ER, TR or DP to the WO in the user areas is accomplished as part of the horizontal wiring. The RJ11 plugs of the telephone instruments will connect to the RJ45 type jack in the WO at the locations selected by the school. ER, TR or DP's are to be interconnected

using a minimum 25 pair Category 5e or Gel-filled Black voice grade cable. Each TR interconnection shall be sized according to the minimum needs of one telephone line per classroom and one per administrative outlet

3.21 Patch Panels

- A. Modular feed through and patch panels shall be rack, cabinet, or wall mounted in the closets and panels for termination of horizontal cabling.
- B. Each horizontal cable shall be permanently machine labeled and be terminated to the corresponding color-coded connection on the patch panel using a 110 punch down tool.
- C. Each rack or cabinet where termination to patch panels occurs shall include both vertical and horizontal wire management for patch cables to be neatly routed.
- D. Each patch panel shall include corresponding wire management modules so that a module will be located at both the top and bottom of the rack as well as between each patch panel.
- E. Wall mounted patch panels shall be provided with respectively sized hinged brackets for access to the termination connectors.
- F. Each patch panel port shall be labeled to indicate the respective data cable connected thereto using easily read typewritten or computer generated label strips installed so the designations shall not be easily removed, but easily read.
- G. Patch panels are to be sized to allow for a minimum 20% growth at each ER, TR, or DP location.
- H. No more than five (5) 48-port patch panels and their corresponding wire managers shall be installed per 7 foot rack or cabinet (3 per 4 foot) without express written approval of BCPS Education Technology Services Department. Provide enough cabinet and/or rack space to mount all patch panels, wire managers, and required system equipment.
- I. All patch panels must be high-density.
- J. Provide a 24 port high density patch panel in the ER for the termination of miscellaneous analog dial tone from the local exchange carrier voice services to be labeled "AUX".

3.22 Connectors and Terminations

- A. Backbone fiber cables shall terminate in an appropriately sized fiber distribution box. Fiber termination panels shall always be enclosed. All fibers must be terminated and contain no breaks. Cables that provide additional fibers to replace defective fibers are not permitted. Fiber optic cable connectors and break out kits shall be installed in strict accordance with manufacturer's instructions. All tools, sealants, lapping film and etc. for installation of each connector shall consist of products specifically recommended by the connector manufacturer for the type of connector provided. Each connection shall be done by people experienced and certified (manufacturer certified) in installing fiber optic cable connectors.

- B. All fiber cable shall be inserted into the fiber cross connect box so that the number and color identifier have the following correspondence:

1- Blue	5- Slate	9 - Yellow
2- Orange	6- White	10 -Violet
3- Green	7- Red	11 -Rose
4- Brown	8- Black	12 -Aqua

- C. All horizontal cables shall be routed in such a manner that the front portion of the wire management shall be used solely for the routing of patch cables. **No horizontal wire shall be routed in the front of any cabinet or rack.**
- D. Horizontal cables shall be connected to patch panels and WOs in compliance with ANSI/TIA/EIA T568B Category 6 wiring requirements. Connections are to be made in accordance with the manufacturer's recommendations, using tools specifically designed for making such terminations.

3.23 Communications Outlets

- A. Communication outlets shall be provided in all administrative spaces, instructional areas, media centers and other locations as specified by the Owner. The CO should be recessed into the wall utilizing a 4" x 4" x 2 1/8" square box with a single gang plaster mud ring for attachment of a standard outlet cover plate. *Retrofitted surface mounted boxes or channel shall be of the same depth.* Mounting height shall be typically 18-inches above floor except where directed otherwise. Each modular jack shall be supplied with a separate communications cable with 12" of working slack for maintenance purposes. Provide the corresponding blank covers and wall plates based on the number of outlets needed in each location. Each data wire shall have 12 inches of working slack for maintenance purposes at the CO.
- B. **Retrofits** - The JB should be recessed into the wall whenever possible. When this is not practical surface mounting may be done. The CO should then be installed in surface mounted raceway of sufficient capacity and channel configuration or directly into modular furniture.

3.24 Access Points

All wiring for wireless access point locations including horizontal and patch cables shall be done using plenum jacketed cabling. Each WAP shall be done using a minimum of two (2) Cat 6 cables. All access point wiring shall land in the TR on separate panels, or on specially designated patch panel locations at the end of a panel. Extra power and/or outlets shall be part of system designs and installed as needed.

All cabling for Wireless Access Points shall be done following all District standards. All identification of the cable shall be similar to labeling for standard outlets or floor boxes. The exception is that the final designator shall be rm # - jack identifier (i.e. 100A).

3.25 Identification

- A. Items 3.27 through 3.31 are to be compliant for identification means and methods.

3.26 As-Built Drawings

- A. At the end of the project, the contractor is to provide a set of AS-Built drawings to the engineer. All drawings are then to be updated by the engineer. A minimum of 3 printed sets and 1 electronic set of updated as built drawings are to be provided to BCPS Education Technology Services Department. **Drawings are to be corrected As Built documents.** The contractor is also to provide simple maps to identify the rooms and areas a TR actually serves. Maps shall be located in the folders for each closet containing the local copy of the cabling test results.

3.27 Conductor and Jacket Color Coding

Color coding shall be by factory applied color-impregnated insulation. All Cat 6 data cable shall be Yellow in color.

3.28 Backbone and Workstation Cables

- A. All cables for both communications and power, shall be identified and labeled at the origination point (ER, TR, DP, etc) and at the termination point (WO and PR).
- B. Each backbone cable shall be labeled with a unique identifier at each end, and at all pull or junction boxes. Additionally, at each cabinet location each backbone cable shall be provided with a vinyl cable tag marked to indicate the destination of the respective cable i.e. "To TR - 110A" etc. Each workstation data cable is to be identified at each end with a standard vinyl cable tag located within 12-inches of the cable's end. Cables are to be pre-labeled prior to punch down. Use light heat shrink or tubing so labels may still be moved for maintenance.

3.29 Patch Panels and Communications Outlets

- A. All cabling is to be identified using the ANSI/TIA/EIA 606B standard, whereby each outlet jack is completely identified by the originating TR, patch panel and the port, (i.e. TR1-1-1). Each room identifier shall be a unique designation consisting of the space FISH number where the outlet is located and a sequentially incrementing suffix letter for each outlet connector located in the space (i.e. 100-A, 100-B, etc
- B. Labels shall be nominal 3/8-inch high, 2/3-inch wide, machine printed, self-laminating, vinyl labels with white background and black text. Attach labels directly on/or adjacent to respective connector.

C. **Use final FISH identifiers for final labeling and not temporary construction identifiers. Rooms are to be arranged in sequential order on the patch panels. Misordered and/or mislabeled cables will have to be reordered in proper sequence and retested.**

D. **The complete identifier is to be used for test identification purposes.** If all components have been properly labeled the sequence should be simple to create.

Format: BB-TR rrr - R rr - PP - O
BB...Building Number
TR rrr...TR room number
R rr...Rack Number (if more than one)
PP...Patch Panel number
O...Outlet Number

i.e. - B1-TR217-R1-1-1

3.30 Fiber Optic Panels

A. **The complete identifier for fiber optic labeling shall be created using the following format.**

Format: BB-TR rrr - BP - SC
BB.....Building Number
TR rrr...TR room number
BP.....Bulkhead Position number
SC.....Strand Color

i.e. - B1-TR217-1-BL

B. Use the following abbreviations for Strand Color:

BL - Blue, OR - Orange,
GR - Green, BR - Brown,
SL - Slate, WH - White,
RD - Red, BK - Black,
YL - Yellow, VI - Violet,
RS - Rose, AQ - Aqua.

C. All tests shall be identified based on the location the test is performed from to where the fiber is going, plus the wavelength at which the test is performed. Using the above information would create the following format.

BB-TRrr-TRrr-BP-SC-W
BB.....Building Number
TR rrr...TR room number testing from
TR rrr...TR room number testing to
BP.....Bulkhead Position number
SC.....Strand Color

i.e. - B1-TR217-TR101-1-BL-85
i.e. - B1-TR217-TR101-1-BL-13

3.31 Grounding and Bonding Infrastructure

- A. *Each telecommunications bonding conductor shall be labeled in accordance to ANSI/TIA-607B, ANSI/TIA/EIA 606B, and the NEC. See the appropriate Appendix for specifics. Labeling at all connections points shall include warnings as required by code. Identifiers shall be laminated plastic with a minimum 1/4-inch high white engraved letters on red background and shall be affixed by two rustproof screws, epoxy cement, or substantial double-stick tape. The following should appear on each of the identifiers:*

If ground is disconnected contact BCPS.

- B. All Communications Ground Conductors shall be insulated GREEN. If due to size, green is unavailable then phase all visible parts of the conductors with Green Tape.

3.32 FIELD QUALITY CONTROL-Documentation and Testing Requirements

- A. Submittals

At the start of each project it is the responsibility of the contractor to provide shop submittals to include but not limited to the following:

Product to be used - Electronic cover sheets (in Excel workbook format) breaking out sheets for Data, and Telco. The sheets are then to have each item identified with a unique item number (i.e. D1, T2). A minimum of three (3) hard copies of the product cut sheets (**Electronic PDF copies will not be accepted**) are to be submitted to the project manager for distribution to the appropriate BCPS personnel for review. Each hard copy of the submitted cut sheet is to be marked with the same unique item identifier from the electronic cover sheets with the item being submitted clearly identified. The electronic cover sheets will then be used for distribution of acceptance of the submitted product. Any rejected items will need to be submitted again using the same procedure.

- B. Patch Panel Schedules – submit electronically in AutoCAD (latest release) format to the project manager and BCPS Education Technology Services Department. These are to be used for any updates that need to be done throughout the job.

- C. Copper Testing

1. Upon completion of each installation and prior to acceptance by the Broward County School Board the contractor shall test the cabling system in accordance with the most current version of the nCompass Performance Warranty criteria, the ANSI/TIA/EIA standards, the Legrand Ortronics Certification Program Information Manual and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution. **Any cables not fully passing testing requirements must be corrected.** It is the responsibility of the installing contractor to make all corrections necessary to achieve passing test results.

- D. Sample system operations may be performed by BCPS with actual hardware or using Contractor provided test equipment and documented to verify that the system is operational and ready for acceptance. This shall also establish the baseline performance of the system.
- E. The contractor must use the approved testers as noted in section 2.22 and their software.
- F. If during testing it is found that distance limitations have been exceeded due to design error and/or pathway limitations, it is the responsibility of the contractor to make all necessary corrections to meet the ANSI/TIA/EIA design guidelines.
- G. **Fiber Testing**
 - 1) Setup of all fiber optic testing shall be completed in accordance with the most current version of the nCompass Performance Warranty criteria, the ANSI/TIA/EIA standards, the Legrand Ortronics Certification Program Information Manual and best industry practice. Current minimum requirements include:
 - a. All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless clearly defined in an RFP. Testing shall consist of an end to end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
 - b. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
 - c. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
 - d. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
 - e. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.
 - (a) If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution. **Any cables not fully passing testing requirements must be corrected.** It is the responsibility of the installing contractor to make all corrections necessary to achieve passing test results.
 - 2) Fiber tests are to be submitted directly to BCPS Education Technology Services Department electronically for review. Once all fiber tests have been approved then each test shall be printed by the contractor using the established A-B points. Tests shall then be placed in each TR's respective test report notebook.
 - 3) Questions about this procedure or requirements must be submitted in writing for written response from BCPS project manager.

H. Test Documentation

Upon completion of testing and the correction of all failures the contractor shall compile and submit a sorted electronic report in the following manner:

- 1) Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- 2) The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-C including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.
- 3) Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package and delivery. The telecommunications contractor must furnish this information in electronic file format as approved by BCPS but meeting the following general requirements:

One (1) Printed Report divided into multiple individual notebooks w/clear front pockets to allow labeling. Each communications room shall have its own notebook with the corresponding test reports for both the fiber and copper cabling within. **Reports shall be tabulated and sorted on a per cable basis using the outlet identifier for horizontal cables and/or the tagged cable identification number for backbone cables. The report notebooks are to be clearly identified using the locations unique identifier. Maps identifying the areas covered by the closet are to be included.**

- 4) When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.
- 5) Two (2) electronic copies in the previously specified formats which incorporate all reports into a single sorted database for the fiber and one for the copper results shall be supplied to BCPS Education Technology Services by the contractor.

I. Telephone Backbone Testing

All telephone backbone wiring shall be tested for Wire Map and Continuity at a minimum. All bad pairs shall be corrected.

J. Telephone Backbone Documentation

Provide test report documenting the tests for Wire Map and Continuity based on the color codes of each wire pair. Provide location of cable termination and lightning protection at the point of cable transition from black, gel-filled cable to UTP cable where applicable.

3.33 Commissioning and Acceptance

A. On-Site Field Inspection

All conduit installed underground, in floor slabs, or concealed in ceilings and/or walls shall be inspected by BCPS building Department Inspectors prior to cover up or reinstallation of finished ceilings. The Contractor shall notify the Broward County School Board at least (5) five days prior to completing work necessitating this required field inspection.

B. Above the Ceiling Pathway Inspection

This inspection shall be called for prior to any cables being pulled, and a minimum of 5 days prior to concealment of pathways by ceilings. This inspection shall include:

1. verification of the main telecommunications grounding system
2. proper pathway installation techniques
3. distance concerns raised by the contractor
4. **NO** cables shall be pulled until **ALL** inspections issues have been
5. Approved as completed by BCPS.

C. Testing Verification

This shall include determining that all cables have been tested and pass to BCPS satisfaction. All as-built drawings and written documentation have been submitted.

D. Substantial Completion

- 1) Prior to requesting the substantial completion walk thru:
 - 1) Complete all work required including all Fire stopping and labeling.
 - 2) Furnish required wiring diagrams and test reports as described in Testing a Documentation Section.
 - 3) Touch-up any scratches on electrical equipment such as wireways, pull boxes, data hub cabinets etc.
- 2) Walk thru punch list items must then be completed in a timely manner. All items on the Walk Thru Check List must be complete and inspected before any payment requests can be processed.

E. Training

- 1) Training of school and district personnel shall be provided as requested. Training will cover the location nomenclature, documentation structure and contents, documentation maintenance procedure, a "walk through" for location and labeling orientation, system reconfiguration using ER, TR, and DP facilities (termination hardware, patch cables, etc.), operation of the network equipment provided as part of the contract, test documentation, and trouble shooting of the signal and power cable portion of the installation.

F. **Final Acceptance**

- 1) Acceptance will be made by the Broward County School Board on the basis of the following being completed.
 - a. All required documentation must have been delivered to BCPS Education Technology Services Department for written approval. Including test results, patch panel schedules, and As-Built drawings. Patch cable delivery must also have been verified.
 - b. Owner's verification that system is capable of working as intended, verification of the completion of the Walk Thru Check List Items, observations of the project, and any necessary corrections based on test results having been completed.
 - c. The Contractor shall furnish all necessary mechanics, and test instruments and equipment, to demonstrate the operation of the systems required during a Final Walk Thru.
 - d. At the end of the project, the contractor is to provide a set of AS-Built drawings to the engineer. All drawings are then to be updated by the engineer. A minimum of 3 printed sets and 1 electronic set of updated as built drawings are to be provided to BCPS Education Technology Services Department. **Drawings are to be corrected As Built documents.** The contractor is also to provide simple maps to identify the rooms and areas a TR actually serves. Maps shall be located in the folders for each closet containing the local copy of the cabling test results.

3.34 **GROUNDING**

- A. Comply with Division 16 Section "Grounding and Bonding" and with TIA/EIA 607.
- B. Grounding Points:
 4. Locate grounding terminals in each equipment room, wiring closet, rack, and cabinet.
 5. Telecommunications Grounding Busbars: Mount on wall of telecommunications entrance facility, equipment room, and closet, with standoff insulators.
- C. Bonding Conductors:

Extend from telecommunications entrance facility to electrical entrance facility and connect to grounding electrode.

 - a) Where a panelboard for telecommunications is located in same room or space as a grounding busbar, bond to equipment ground bus of electrical panelboard.
 - b) Extend from telecommunications entrance facility to grounding busbars.
 - c) Extend from grounding busbars to ground terminals in equipment racks and cabinets.
 - d) Extend from grounding busbars to building metal frame within room, or to metal frame external to room but readily accessible.
- D. Special Requirements:

- e) Bonding conductors shall be insulated copper, green No. 6 AWG minimum.
- f) Install only in nonmetallic conduit, unless specifically required for protection of conductor. Metallic conduit, if used, shall be RMC. For RMC that exceeds 36 inches (915 mm) in length, conductors shall be bonded at each end of conduit.
- g) Bonding conductors shall be installed without splices unless approved by Architect because of special circumstances. Where splices are necessary, they shall be accessible and shall be located in telecommunications spaces. Splices shall be by irreversible compression connectors or by exothermic welding.

3.35 IDENTIFICATION

- A. In addition to requirements in this Article, comply with TIA/EIA-606-A and with applicable requirements in Division 16 Section "Electrical Identification."
 - 1. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Using cable and asset management software as required by BCPS, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable, jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement. At completion, cable and asset management software shall reflect as-built conditions.
- C. Use logical and systematic designations for facility's architectural arrangement and nomenclature, and a consistent color-coded identification of individual conductors.
- D. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
- 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.

5. Within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. At Workstations: [Label cables within outlet boxes] [Attach label to device plate].
 - i. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
 - ii. Cabling Administration Drawings: Show building floor plans with cable administration-point labeling. Identify labeling convention and show labels for telecommunications closets, [backbone pathways and cables,] [entrance pathways and cables,] terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

3.36 nCompass PERFORMANCE WARRANTY- nCompass Technical Specifications

- A. To assist the bidder, this section includes a partial representation of the **nCompass Cat 6+** Technical Specifications. **The bidder recognizes he must obtain the latest and complete version of the nCompass technical specifications from the BCPS, prior to bidding.** The submission of a bid is recognition by the bidder that he has obtained the complete **nCompass** specifications for SBBC Warranty performance and he has included all labor, material, testing, certifications in his bid to meet the specifications of **nCompass** and this division's and SBBC project requirements.
- B. General Specifications
 1. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling at the new or remodeled buildings for the **JOBNAME**. Backbone and horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.
 2. The Horizontal (workstation) Cabling System shall consist of a minimum of two (2) 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the Telecommunications Room (TR) located on the same floor, and routed to the appropriate rack serving that area and terminated as specified in this document.
 3. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document.
 4. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this

specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

Regulatory References:

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.
- B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- C. The work and installation shall comply with the requirements of BCPS Section 2A-8 Voice, Data, and Video Structure Cabling Systems Design Criteria.
- D. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 6 component and channel compliant.
- E. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
 - 1. ANSI/TIA/EIA - 568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements, April, 2001
 - 2. ANSI/TIA/EIA - 568-C.2, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components, April, 2001
 - 3. ANSI/TIA/EIA - 568-C.2-1, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted Pair Cabling Components, Addendum 1 – Transmission Performance Specifications for 4-pair 100 Ω Category 6 Cabling
 - 4. ANSI/TIA/EIA - 568-C.3, Commercial Building Telecommunications Cabling Standard Part 3: Optical Fiber Cabling Components, March, 2000
 - 5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, February, 1998
 - 6. ANSI/TIA/EIA – 570-A, Residential Telecommunications Cabling Standard, October, 1999
 - 7. ANSI/TIA/EIA – 606 - B, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002
 - 8. J-STD- 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
 - 9. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999
 - 10. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) – 10th Edition, 2003
 - 11. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) - 2002

- F. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
- G. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

Approved Contractor

- A. The Telecommunications contractor must be an approved Legrand Ortronics Certified Installer at a Plus tier (CIP, CIP-GOLD, CIP-PLATINUM, and multi-site/national contractors). A copy of 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 Legrand Ortronics CI/CIP Program. Legrand Ortronics/Superior Essex will extend an nCompass limited lifetime Static, Dynamic and Applications Warranty to the end user once the Telecommunications contractor fulfills all requirements under Legrand Ortronics CI/CIP. At least 30 percent of the copper installation and termination crew must be certified by BICSI, Legrand Ortronics with a Technicians Level of Training. Also, at least 10 percent of the optical fiber installation and termination crew must be certified by Legrand Ortronics or other approved organizations in Optical Fiber installation and termination practices.

Approved Products

- A. Approved 4-pair UTP Cable : Superior Essex DataGAIN Enhanced Category 6 Cable (Plenum/Non-Plenum/Limited Combustible)
- B. Approved Optical Fiber Cable manufacturer: Superior Essex
- C. Approved UTP connector product manufacturer: Legrand Ortronics
- D. Approved Fiber Optic cabinet product manufacturer: Legrand Ortronics
- E. Approved Fiber Optic connectors/splices/couplers: Legrand Ortronics
- F. Approved Rack and Cabinet manufacturer: Legrand Ortronics
- G. Approved Patch Panel manufacturer: Legrand Ortronics
- H. Approved UTP Patch Cord manufacture: Legrand Ortronics

Work Included

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.

- B. The work shall include, but not be limited to the following:
1. Furnish and install a complete telecommunications wiring infrastructure.
 2. Furnish, install, and terminate all UTP and Optical Fiber cable
 3. Furnish and install all wall plates, jacks, patch panels, and patch cords.
 4. Furnish and install all required cabinets and/or racks as required and as indicated.
 5. Furnish any other material required to form a complete system.
 6. Perform link or channel testing (100% of horizontal and/or backbone links/channels) and certification of all components.
 7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
 8. Adhere and comply with all requirements of Legrand Ortronics Certification.
 9. Provide owner training and documentation. (Testing documentation and As-built drawings)

Submittals

- A. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:
1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
 2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
 3. Submit appropriate cut sheets and samples for all products, hardware and cabling.
- B. Work shall not proceed without the Owner's approval of the submitted items.
- C. The telecommunications contractor shall receive approval from the Owners on all substitutions of material. No substituted materials shall be installed except by written approval from the Owner.

Quality Assurance

- A. The Legrand Ortronics CIP telecommunications contractor shall be a company specializing in communication cabling installation. At least 30 percent of the copper installation and termination crew must be certified by BICSI, Legrand Ortronics with a Technicians Level of Training. At least 10 percent of the optical fiber installation and termination crew must be certified by BICSI Legrand Ortronics in optical fiber installation and termination practices.

Delivery, Storage and Handling

- A. Delivery and receipt of products shall be at the site described in the Scope Section.
- B. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.
- C. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

Drawings

- A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
- B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.
- C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.

END OF SECTION