IT/Telecommunications
Technical and Wiring Standards

FOR

Phillips Exeter Academy
Exeter, NH

No deviations will be permitted from these specifications without the express written consent of Phillips Exeter Academy

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TECHNICAL AND WIRING STANDARDS

1.0 Introduction

This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling at Phillips Exeter Academy. Vertical (Backbone) and Horizontal (workstation) cabling composed of Copper and Fiber Cabling, and support systems are covered under this document.

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 the following sections.

Product specifications, general design considerations, and installation guidelines are provided in this written 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, the items specified for the project shall take precedence. Contractors shall meet or exceed all requirements for the cable system described in this document.

1.1 Regulatory References

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.

All materials shall be listed by UL and shall bear the UL label. 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.

The cabling system described in this document is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:

1) ANSI/TIA/EIA - 568-C Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
2) ANSI/TIA/EIA - 568-C Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components
3) ANSI/TIA/EIA - 568-C Commercial Building Telecommunications Cabling Standard Part 3: Optical Fiber Cabling Components
4) ANSI/TIA/EIA - 569-B Commercial Building Standard for Telecommunications Pathways and Spaces
5) ANSI/TIA/EIA – 570-B Residential Telecommunications Cabling Standard
6) ANSI/TIA/EIA –606-A Administration Standard for Telecommunications Infrastructure of Commercial Buildings
7) ANSI/TIAIEIA – 607-A Commercial Building Grounding and Bonding Requirements for Telecommunications
8) ANSI/ TIA/EIA – 758-A Customer-Owned Outside Plant Telecommunications Cabling Standard
9) BICSI-TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) - 11th. Edition
10) National Fire Protection Agency (NFPA - 70) National Electrical Code (NEC)

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.

This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

2.0 About the Academy Network

2.1 Overview

The Academy campus-wide network consists of:

- Infrastructure
- Fiber optic cable backbone
- Copper and fiber premise wiring
- High-speed data network equipment
- PBX and remote fiber shelves

2.1.1 Infrastructure

Conduit, raceways, risers and cable trays are installed for the physical protection of fiber optic and copper cable. Voice and data network electronics and cross-connect hardware are maintained in a secured space within buildings.

2.1.2 Fiber Optic Cable Backbone

The fiber optic cable system is the distribution medium used to transmit data between and within specified buildings on campus. Multi-mode and/or single-mode fiber cable (depending upon the application) is installed to provide an infinite bandwidth transport system.

2.1.3 Premise Wiring Modifications

Service between distribution frames will be provided by fiber optic cable with Category 6 (or higher) carrying service from the distribution frame to the wall plate.

2.1.4 High-speed Data Network

The data network connects 50 plus buildings, using a Gigabit Ethernet backbone which is currently supporting over 2,000 nodes. It is designed to provide a level of performance and security consistent with policies established by the Academy governing the use of network resources.

2.1.5 PBX and Remote Fiber Shelves

The Academy maintains and supports a Nortel Option 81C-telephone switch with three remote fiber shelves supporting 1,500 telephones on campus.

3.0 Wiring and Cabling Considerations when Specifying and Quoting a Job

3.1 Physical Environment

As a general rule, **fiber innerduct is not run inside buildings.** Exceptions will be determined by the IT department based upon the project. Fiber run inside buildings is installed inside EMT or Armored Fiber Cable. See section 3.6.4 for innerduct specifications.

3.2 Building Distribution

The Main Distribution Frame (MDF) is the primary equipment room in each building. Each building may also have additional wiring rooms referred to as Telecommunications Rooms or Intermediate Distribution Frames (IDF's). Distance determines if an IDF is required with 90 meters being the maximum acceptable copper distance.

The fiber backbone cable system links the MDF's together between each building. Whenever possible, the premise cabling system is designed in a straight vertical line from the basement MDF room up through the telecommunications wiring rooms on each floor. Fiber optic cable will be used in addition to Category 6 (or higher) to support connections exceeding the maximum distance.

3.3 Requirements of MDF, Telecommunications Rooms and IDFs

All telecommunications rooms must conform to ANSI/TIA/EIA 569 requirements.

Perimeters
Typically, no false ceiling; all surfaces treated to reduce dust;
walls and ceiling painted white or pastel to improve visibility.
Limited Access
Typically, single or double 36” x 80” lockable doors with no doorsills.
Other
Typically, no piping, ductwork, mechanical equipment or power cabling should be allowed to pass through the equipment room. No unrelated storage.
Ceiling Height
Minimum clear height in room shall be 8 ft. (2.4 m), the height between the finished floor and the lowest point should be 10 ft. (3 m) to accommodate tall racks and overhead raceways. False ceilings should not be installed.
HVAC
24 hours a day, 365 days a year, 64° to 75° F, 30 to 55 percent humidity, positive pressure, with independent power from telecommunications equipment.

Lighting
Typically, 8.5 ft. high, providing 50 ft. candles at 3 ft. above floor.

Electrical
Typically, a minimum of two dedicated 20A, 110 V AC surge suppression duplex outlets on separate circuits is required. Convenience duplex outlets shall be placed at 6 ft. intervals around the perimeter. Emergency power should be considered and supplied if available.

Bonding and Grounding
Access shall be available to the bonding and grounding as specified in J-STD-607-A.

Dust
Less than 100 micrograms/cubic meter/24 hour period.

Rule of thumb: Allow 1 sq. ft. (929 sq. centimeter) of plywood wallmount for each 200 sq. ft. (19 sq. meter) area of floor space.

3.4.2 **Grounding and Bonding**

The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building's electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

3.5 Cable Access: Internal and External

3.5.1 Internal Cable Access

- Rooms aligned vertically: coring (drilling) of the floor and placement of four (4") sleeves is used unless otherwise specified. A 4" sleeve will require a core hole 5" in diameter to accommodate a 4" EMT sleeve with protective bushings. This conduit needs to meet the same requirements as external conduits entering the building (see 3.5.2).
- Rooms not aligned vertically: raceway systems composed of trays and/or EMT (Electrical Metallic Tubing) is installed.

The installation of all raceway systems should be concealed**.** Conduit, wire mold and fishing the walls are three methods of concealing wires. The Academy standard for horizontal cabling is to have the electrical contractor install conduit with a pull string. All conduits should be reamed to prevent sharp edges or terminated with an insulated bushing.

The other options, fish the walls or use wire-mold, is only acceptable when specified by the Academy for a project. All wall outlets will be installed at 18" AFF or 48" AFF unless otherwise indicated in building specific plans.

The conduit must only transport telecommunications cables and be sized to provide for additional communications demands. In any situation where a conduit is being installed, the fill ratio must not exceed 60%.

If an installation will require more than two 90-degree angle turns in the conduit, a pull box is required. When installing a tray as part of an open raceway system, the tray must be more than one (1) foot from any source of electrical interference (i.e. fluorescent lights, motors, etc.). ANSI/TIA/EIA-606A should be consulted for administration of the conduit system.

3.5.2 External Cable Access

All new administrative/academic and dormitory building penetrations should utilize four (4) 4" conduits to come into the building. This conduit should be continued from the point of penetration to the MDF. All conduits utilized for building penetration should be fire blocked (sealed) after cable installation.

3.5.3 **Telecommunications hand holes** shall:

- not be used in place of a maintenance hole or in a main conduit system
- not be used for splicing cables together
- have provisions for drainage (e.g., drain holes, open bottom, sump hole)
- not be shared with electrical installations other than those needed for telecommunications equipment
- meet applicable code requirements.

3.5.4 Covers

Hand-hole covers should be the same nominal size as the hand-hole. Covers may be made from a variety of materials such as fiberglass, steel and polymer concrete depending on the application. Covers that must withstand vehicular traffic should be rated for vehicular traffic.

3.5.5 Drain Slope

To avoid moisture damage to buried or underground systems underground conduit should be installed with a slope to allow drainage and prevent the accumulation of water. The slope should be no less than 10 mm per meter (.125 in per foot) when extending conduit away from building structures. Where conduit extends between maintenance holes, a slope of 10 mm per meter (.125 in per foot) should extend from the middle of the span to each maintenance hole.

3.5.6 Asbestos

The Academy is responsible for notifying the Contractor of any known asbestos in the buildings prior to work beginning. The telecommunication contractor is responsible for recognizing and preventing any asbestos hazards. Failure to do so may result in the Contractor incurring any cleanup or abatement cost.

3.6 Entrance Facility

Must conform to ANSI/TIA/EIA – 569 requirements

3.6.1 National Electrical Code Adherence

All communications cables are to be installed in accordance with Article 800 of the National Electrical Code.

3.6.2 Protectors

Building Entrance Protectors shall be Circa Enterprises or equivalent. Plugin protector modules shall be black gas tube Avaya 3BIE-W or equivalent.

All protectors shall be grounded using AWG 6 for all lines. This conductor shall be grounded to the Telecommunications Main Grounding Busbar TMGB.

3.6.3 Surge Protectors

The AC power circuit feeding the electronic equipment must be provided with a surge protected outlet. No other equipment should be connected to this circuit.

3.6.4 Innerduct

A sleeved physical channel shall be provided for fiber optic cable. This is to be within the conduit system, unless the innerduct is plenum rated. The innerduct shall contain a pull string. Four one-inch innerducts shall be installed in every four-inch conduit where fiber optic cable is being installed.

4.0 Technical Standards for Administrative, Academic Buildings and Dormitories

The following technical standards are required for all wire and cable installations in administrative/academic buildings and dormitories. Only when all the items described below are properly provided will the Academy approve the installation.

4.1 Approved Products

- 4-pair UTP CAT 6 (or higher) Cable: Berk-Tek-LanMark, Belden or Superior Essex.
- High pair counts UTP Cable: Berk-Tek, Comscope and General.
- Optical Fiber Cable: Berk-Tek.
- Coax Cable: CommScope.
- UTP connection product manufacture: Ortronics.
- Fiber Optic hardware product manufacturer: Ortronics.
- Fiber Optic termination connectors/splices/couplers: Ortronics, Corning.
- Cabinet manufacturer: Ortronics, Hubbell.
- Patch Panels manufacture: Ortronics.
- Voice Termination block manufacturer: NORDX/CDT.
- Building Entrance Protector Terminals manufacturer: 3M.
- Building Entrance Protector Module manufacturer: Circa. or equivalent
- Wall phone jack : Allen Tel - AT630ABC-4-15

4.2 Wall Outlets

The modular jack assembly for administrative and academic buildings and dormitories should be an Ortronics Category 6 (or higher) rated Connector that adheres to the T568B Standard for pair assignments. The Academy standard for residences adheres to the T568A Standard for pair assignments. The Academy has chosen Ortronics hardware as a campus standard for internal wiring. The Academy uses Ortronics Color-Coded Designation Tabs: the red or pink Voice Icon and blue data Icon.

Ortronics Components:

(TracJack Modules)

T568B, 45 exit RJ45 insert for data,
T568B, 180 exit RJ45 insert for voice

4.2.1 Wall Outlet Configurations

With the exception of Allen Tel used for wall phone jacks, Ortronics parts will used for each project.

4.2.2 Wall Outlet Placement

Wall outlet placement is:

(a) Standard outlet: center of station outlet will be 18" AFF (above finished floor). This height may be specified differently for a project in the event the outlet is not flush to the wall.

(b) Wall phone outlet: center of station outlet will be 48" AFF.

(c) Handicapped wall phone outlet: center of station outlet will be according to ADA Standards.

All outlets on each floor of each building section are to be connected to the Telecommunications room closest to the outlet.

4.3 MDF/IDF/Telecommunications components

4.3.1 Voice Termination

The cable will be terminated at the Main Distribution Frame (MDF) and if applicable, on at the Intermediate Distribution Frame (IDF), on BIX™ blocks.

BIX termination labels shall conform to the TIA/EIA 606 color coding; voice horizontal stations on blue, first level backbone cable termination on white and interbuilding backbone cable termination on brown.

Cross-Connections:

BIX™ 25-PR, 5 pair marking NORDX PN QCBIX1A

BIX™ 25-PR, 4 pair marking NORDX PN QCBIX1A4

4.3.2 Equipment cabinets for Data

In a majority of locations telecommunications rooms have lockable cabinets unless specified for the project. In certain situations racks may be specified by the Academy. All of the fiber termination, copper patch panels, Local Area Network hardware, and UPS systems will be contained in the cabinet. The cabinet should have a front door and have proper ventilation. The cabinet should be floor or wall mounted, have lockable doors, access panels and provide for proper ventilation unless otherwise specified. In smaller spaces the cabinet may be wall mounted.

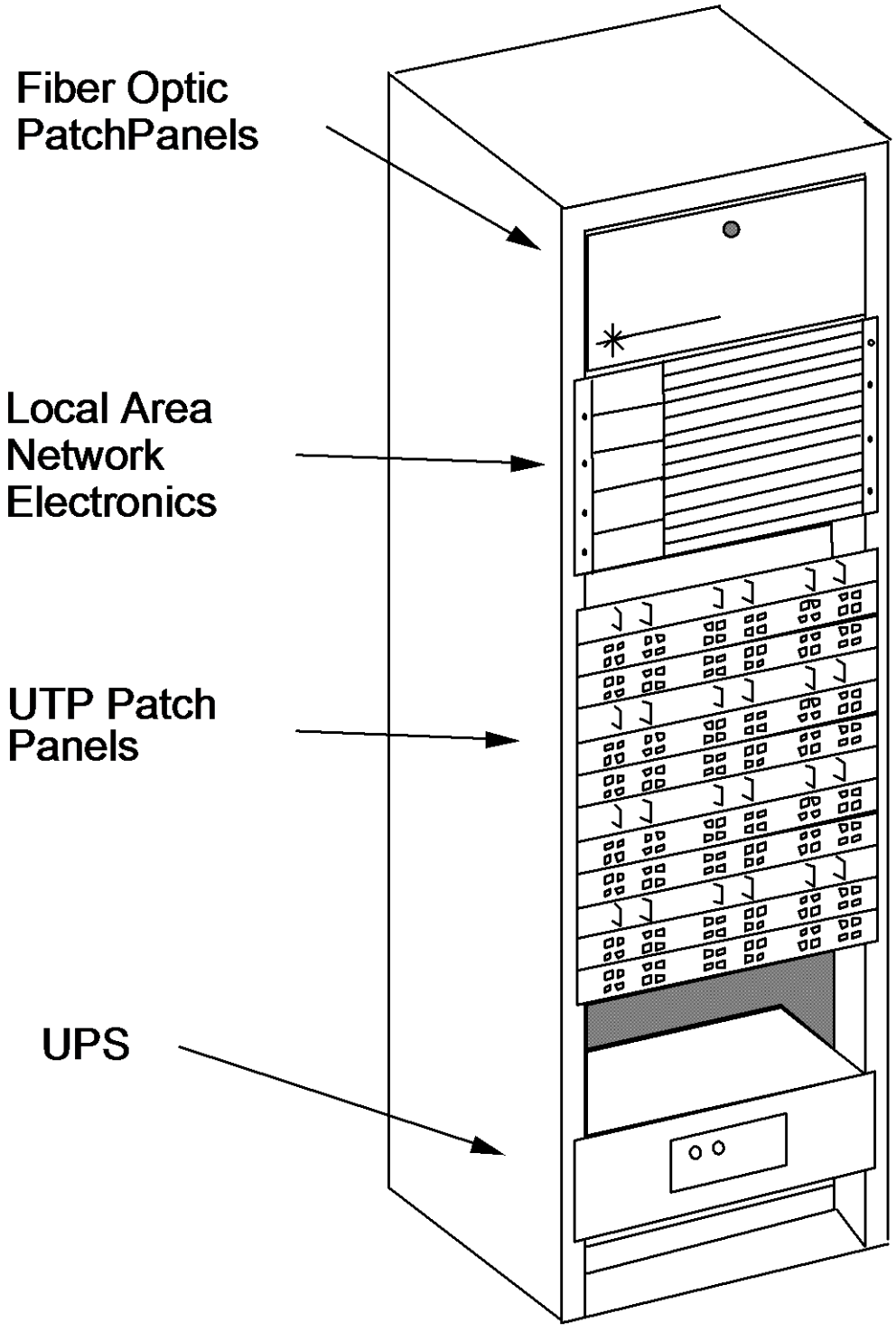
Additional issues to note:

1. Equipment cabinets containing active equipment such as a network concentrator chassis and UPS should be ventilated. To reduce heat build-up in densely populated cabinets a filtered ventilation fan system may be required.
2. An additional three (3) feet of cable should be left coiled and tied with Velcro wraps in the cabinets.
3. Equipment cabinets should be hinged to provide free space front and rear for access and servicing.
4. All equipment cabinets will be keyed to the same master.

The positioning of the equipment within the enclosure is important and the Academy requires consistency throughout the campus.

Fiber optic patch panels will be in the top most position followed by the Local Area Network electronics (which will be installed by the Academy IT Staff). Under the LAN electronics, cable wire management will be installed just above the Cat6 (or higher) patch panels. Wire management should be positioned in between each 12, 16, 24 or 48 port patch panel (see diagram). The UPS will be placed in the bottom most position of the cabinet.

Equipment Location within the Enclosure



4.3.3 Data Patch Panel

All data cables are terminated on a rack-mounted category 6 (or higher) rated multi-port 568B Ortronics patch panel (in administrative, academic and dormitories) with IDC (BIX-block type) rear connectors and numbered RJ-45 connectors on the front. Wall mounting data panels can be utilized in certain applications. Cable runs are permanently attached to the rear of the Patch Panel and the panel remains stationary to guarantee cable connection integrity. Wall mounted Patch Panels should be mounted on hinged brackets for easy access to the rear of the Patch Panel. All cables must be properly supported in the rear of the patch panels to prevent and reduce cable strain.

Each port of the patch panel should be sequentially labeled in accordance with the specifications in this guide. (Section 6.1)

Although the Telecommunications Contractor does **not** install patch cables, either the contractor or PEA ITS department may purchase the cables. This should be determined when planning the project.

4.3.4 Station Wiring (Horizontal Distribution)

Standard station wiring is always separate sheaths of 4-pair Cat 6 (or higher) solid copper twisted pair (24 AWG). All station wiring runs will home run directly to the Telecommunications room. Neither intermediate distribution points nor splices will be permitted. Station cables shall be installed in conduit. Free-air routing must be avoided unless an approved support is identified on the drawings and in modular furniture.

Two possible coverings (depending on the building environment) that can be used for the cables are:

- Poly-vinyl chloride (PVC) - used in the majority of plans
- Teflon - will be used where cable is placed in air plenum ceilings
- Color Code of Outer Sheath: Data – Blue, Voice - Gray

Distribution rings shall be provided with the BIX frames to provide orderly routing of crosswire from station to feeder frame.

If station wiring is to be installed near fluorescent lamps, a minimum of 12” will be maintained between the wiring and the lamp fixture. Station wiring will not be installed next to high-voltage sources, electrical motors, or other sources of interference.

Splices in the horizontal wiring are not acceptable.

All cables run in ceilings for horizontal distribution must be bundled together and self-supported from the floor above or the building structure inside the ceiling every four linear feet with cable “J” hook type supports. They cannot be supported by the ceiling, ceiling hangers, or other utilities in the ceiling and must not lie on the ceiling. When horizontal cabling penetrates firewalls the opening will be sleeved and firestopped using an approved UL method.

Unprotected wire drops from ceilings or exposed wiring along ceilings is not acceptable.

4.3.5 Concealment

1. Station wiring must be concealed for protection and aesthetic reasons. The preferred concealment method is to pull cables through conduit within walls.

2. Cable trays and raceways (wire mold) are alternatives that the Academy will specify if the building or project does not provide for conduit.
3. Raceways (wire mold): if raceways are used the type of raceway and route will be specified by The Academy.
4. Conduit, cable trays and raceways (wire mold) will be installed in accordance with building and electrical codes.

No deviations will be permitted from these specifications without the express written consent of Phillips Exeter Academy.

4.4 Voice and Data Riser Systems

4.4.1 Voice Cable System

4.4.1.1 Composition

Composed of 24 gauge solid copper conductors, configured in twisted-pairs, insulated with expanded polyethylene covered by a PVC skin. This construction, in conjunction with a corrugated aluminum shield bonded to the outer jacket of PVC, form an ALVYN type sheath.

4.4.1.2 Sizing

Riser cable pairs will be two (2) times the number of stations to allow for the recommended 50% growth per station. Type ARMM riser-rated cable or an equivalent cable conforming to TIA/EIA 568B is acceptable. This cable will have a minimum rating of Category 2 or higher.

4.4.1.3 Installation

Standard installation method is to run the riser cable in conduit or floor sleeves from BIX™ blocks in the MDF or IDFs. Riser Cable will be home run from the IDF to the MDF. There will be no additional junction points between the IDF and the MDF. It is also appropriate to run riser cable horizontally on the same floor when suggested by MDF and IDF placement. Academy IT staff will do voice station and riser crosswiring.

4.4.2.1 Fiber Optic Cable and Hardware Specifications

The following specifications describe the installation of the fiber optic cable for the Phillips Exeter Academy backbone. Backbone Cable shall be run in cable tray and/or conduit as identified for the project. To future proof the Academy on longer run installations, the highest OM fiber rating should be used when installing new fiber between buildings. Lower OM fiber rated cables may be used on shorter runs within buildings. These initiatives should be approved by ITS prior to installation.

4.4.2.2 Fiber Cable

The optical fiber cable shall be 62.5/125 or 50/125 micron multimode with a UL rating of OFNR or OFNP, as appropriate.

4.4.2.3 Fiber Terminations

All Fibers shall be terminated with SC connectors. Exposed fiber strands at termination should be coiled and secured to base of patch panel using fiber rings supplied with patch panels.

Approved connectors are Corning:

- Multimode 62.5 or 50/125 micron fiber optic cable Corning Epoxy Polish PN 95-100-48 or UniCam PN 95-000-41.
- Singlemode Corning Epoxy Polish PN 95-250-08 or UniCam PN 95-200-42.

4.4.2.4 Fiber Optic Splicing

Fiber splicing should only be done at the request by Phillips Exeter Academy.

Insertion Loss (Attenuation) and Return Loss

ANSI/TIA/EIA-455-8 (OTDR Testing) defines acceptable results for splice insertion loss and splice return loss. Splice insertion loss shall not exceed 0.1 dB mean (0.3 dB maximum) and splice return loss shall have a return loss greater than or equal to 45.0 dB mean (40.0 dB minimum) for singlemode fiber.

Mechanical protection

Each fusion or mechanical splice shall be protected in a splice tray or similar protective device that will mount inside an enclosure.

The tray shall:

- store and organize the fibers and splices
- protect the fibers
- prevent the fibers from exceeding the minimum bend radius.

4.4.2.5 Fiber patch panels

Ortronics fiber optic patch panels, fiber cabinets and wall mount panels are acceptable.
Location of the patch panel within the building shall be as shown on drawings. The patch panel shall contain the required number of bulkhead feed-through adapters necessary to terminate each fiber cable as specified in the project.

4.5 UTP Horizontal Cabling

4.5.1 Category 6 Cable or greater

The Horizontal (workstation) Cabling System is based on the installation of (1) 4-pair Unshielded Twisted Pair (UTP) DATA (Category 6 rated or higher) Copper Cable. A quantity of (1) 4-Pair UTP VOICE (Category 6 rated or higher) Copper Cable will be added to the count if a combination DATA/VOICE location is needed. The cables shall be installed from the standard information wall outlet in the work area to the Telecommunications Room and routed to the appropriate MDF or IDF serving that area and terminated as specified in this document.

4.5.2 ANSI/TIA/EIA 568B defines the specific characteristics of the Category 6 system.

Category 6 Connecting Components

The connecting components include things such as patch panels, station jack assemblies, and cross-connect block system. The specifications also cover patch cords and cross-connect jumpers for which The Academy is responsible for the installation of these items.

4.5.3 Category 6 Cabling System Installation TIA/EIA 568-B and 569 provide guidance for the proper installation procedures for routing and terminating cable in a Category 6 system.

Horizontal cabling shall be 24 AWG, 4-pair UTFI, and UUNEC CMP (plenum-rated) as needed. Individual conductors shall be FEP insulated. Cable jacketing shall be lead-free. Cable shall meet full Enhanced Category 6 (or higher) performance as defined in this spec.

Notes:

- Cable shall be packaged in a way that minimizes tangling and kinking of cable during installation. Examples are packages that incorporate a rotating reel inside a box if available. Cables must not be kinked or deformed during installation.
- Ortronics recommends jacket stripback should be limited to no more than 1 inch from the point of termination.
- The amount of untwisting in a pair as a result of termination to connecting hardware shall be no greater than .5 inches.
- All Category 6 (or higher) cables that are terminated on patch panels will be properly supported on the back of the patch panels via a horizontal bar or brace. This bar can be part of the patch panel or mounted on the rack.

4.5.4 Horizontal Pathway Separation from EMI Sources

Article 800-52 of ANSI/NFPA 70 shall apply for separation

- From power cables
- And barriers within raceways
- Within outlet boxes or compartments

Other Related Requirements :

- The building shall be protected from lightning (see ANSI/NFPA 780, ref D.4)
- Surge protection shall be provided at the electrical service entrance
- Lightning Surge Protection is required for all Copper Cables connected to Network and installed outside of buildings.
- ANSI/TIA/EIA 607 shall be followed

Precautions should be taken to ensure that water will not penetrate the pathway system. See ANSI/NFPA-70 Article 100 for definitions.

Coax Cabling Requirements

- **Video Copper Cable** - Horizontal cabling shall be RG6 Quad Shield 75-Ohm cable, and CATVP (plenum-rated) as needed.
- Jack module shall be Ortronics TracJack and be 180^{o} exit.

5.0 Cabling Standards for Academy Residential Houses

During new construction or renovations of residential houses, the Academy will install copper for residential voice and/or data and coax for commercial TV and/or broadband service. Fishing

through the walls or wire mold is acceptable when specified or approved by the Academy IT/Telecommunications Department.

Cabling and components should be installed in accordance with the 570A standard. Applicable national, state and local codes will take precedence over this standard.

Each individual wall outlet is cabled in a star fashion with each cable pulled back to a central point (Distribution Device) in the residence. One distribution device (cabinet) will accommodate voice, data, and CATV installed on an Academy standard backboard (see 3.3). Two dedicated 20Amp, 120Vac, non-switchable duplex electrical outlets will be installed by the electrical contractor; one within 5 feet of the distribution device and a second outlet installed in the device for voice and data.

Notes to the electrical contractor installing the conduit:

- Wall outlets would be located near electrical outlets but preferably one stud space away.
- Low voltage cables must maintain a minimum of 2" separation from 120V electrical wiring inside wall or ceiling spaces.
- The horizontal distribution of cables should be done as much as possible in crawlspace, basement or attic rather than through stud holes.

Installing Category 6 in residences during new construction or a renovation:

- Do not apply more than 25 feet/pounds of pulling tension when installing.
- Avoid cable kinking or nicking the outer jacket
- Do not exceed the minimum cable bend radius (4 times cable outer diameter (OD) for twisted pair and 10 times cable OD, unloaded and 20 times cable OD, loaded for coaxial cable.
- Unless the Telecommunications contractor gets prior approval from the Academy, cables should not be spliced. If a problem occurs, pull a new cable.
- Leave cable slack at both the Wall Outlet (a minimum of eight (8) inches) and the Distribution Device (3 feet).
- The Academy's labeling standards (section 6.1 of this guide) are to be followed in residences.

Ortronics Trackjack Components for Academy Residences are acceptable.

Blank inserts

RJ45 single insert for data, T568A, 45^{o} exit

RJ45 single insert for voice, T568A, 180^{o} exit

Coax insert, F-Connector, 180^{o} exit

Ortronics residential enclosure with hinged door

6.0 Administrative

ANSI/TIA/EIA 606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings is incorporated by reference and is to be complied with. Each pathway (conduit, tray, raceway, etc.) that conveys telecommunications media from space to space must be given a unique identifier and labeled at each end-point.

Each telecommunications space (equipment room, telecommunications room, work area, entrance facility, manhole and handhold) must be uniquely identified and labeled.

6.1 Labeling

The Academy will submit to the cable vendor, floor plans which clearly document the appropriate port labels for all rooms. At a minimum, the labeling system shall clearly identify all components of the system, cabinets, patch panels, cables and if applicable, racks.

The labeling system shall designate the cables origin and destination with a unique identifier for the cable within the system. Horizontal cables shall be labeled at the workstation end and the cross-connect end. Backbone cables (whether riser or horizontal) shall have an identifying number that is labeled at each - end. Labels shall be the same color on each end. Cable identifier must be linked to all pathways which it runs.

Racks and patch panels shall be labeled to identify the location within the cable system infrastructure.

All labeling information shall be recorded on the as-built drawings and test documentation.

All label printing will be machine generated by or a label maker or software (such as Ortronics Label MO software) using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on or in the device. Wall outlets require a label both on the top (for voice) and bottom (for data) of the outlet.

Voice riser pairs need to be labeled in the basement, wiring rooms or IDFs with station jack ID numbers. BIX termination labels shall conform to the TIA/EIA 606 color coding specified in section 4.3.1.

6.2 Testing and Acceptance

6.2.1 General

All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B Addendum 5, TSB-67 and TSB-95. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

To support future expansion, reconfiguration and maintenance, complete records of all system characteristics will be developed and maintained. On each element in the route, identification labels should be completed and attached. Labels will meet the requirements of UL 969 Standard for Marking and Labeling Systems. A Final Report will record system configuration, unique identifier, fiber labels, pathways (documentation of conduit runs would most likely be supplied by the electrical contractor) and "as built" details. Loss measurements and OTDR traces will also be

included with the records. This report should be submitted as a hard copy and on diskette in Microsoft Excel format.

6.2.2 Copper Testing

All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a level IIe test unit.

(a) Continuity

Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested before final acceptance.

(b) Length

Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIAIEIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

(c) Verifying Category 6 (or higher) Performance

A level IIe or better test unit is required and must be updated to include the requirements of ANSIITIA/EIA-568-B.

The tests required are:

- Wire Map and Length
- Attenuation
- NEXT (Near end crosstalk)
- Return Loss
- ELFEXT Loss
- Propagation Delay
- Delay skew
- PSNEXT (Power sum near-end crosstalk loss)
- ACR
- PSACR
- PSELFEXT (Power sum equal level far-end crosstalk loss)

The minimum test requirements for 75 Ohm coaxial cable shall include a continuity test for the center conductor and shield.

6.2.3 Singlemode and Multimode Fiber Testing

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 ANSI/TIA/EIA (OTDR Testing) These tests also include continuity checking of each fiber. Test set-up and performance shall be conducted in accordance with Industry Standards. (ANSI/TIA/EIA)

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 values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.

6.3 System Documentation

Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to The Academy IT department for approval. Documentation shall include the items detailed in the sub-sections below.

(1) Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

(2) The Academy may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by The Academy, including a 100% re-test. This re-test shall be at no additional cost to The Academy.

6.3.1 Test Results

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.

The field test equipment shall meet the requirements of ANSI/TIAIEIA-568-B including applicable TSB's and amendments. The appropriate tester shall be used to verify the cabling systems.

The results generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. These results shall be submitted by the telecommunications contractor in electronic format (CD's). These diskettes shall contain the electronic equivalent of the test results as defined by the bid specification.

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.

6.3.2 As-Built Drawings

The drawings are to include cable routes and outlet locations. If the conduit is installed by the electrical contractor, documentation regarding pathways will be provided to the cable vendor. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in electronic format (DWG, AutoCAD v14 or 2000) on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

The Contractors shall annotate the base drawings and return them in electronic (AutoCAD v14 or 2000) format.

Final Acceptance & System Certification

Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two-week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, and approval by Ortronics, the end user shall be provided a numbered certificate identifying the project.

Certifications

Ortronics Certified Technicians for Copper Cable installations

Corning Certified Technicians for Fiber Optic Cable installations

Any exceptions must be approved by ITS

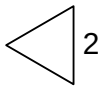
Appendix A – Communications Symbols Legend

The following symbols indicate Phillips Exeter Academy standards for labeling voice, data and video drops on construction plans, design documents.


1 Data


1 Voice


1V - 1D

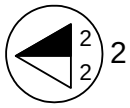


2 - Data

2 - Voice

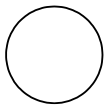
Wall Mount Phone

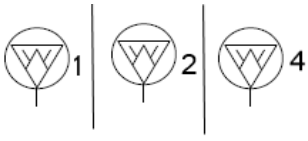

1V -1D - 1 CATV



2V -2D - 2 CATV


1V -1D - Floor Mounted


1 CATV



Wireless - 1Data │2Data │4Data