

Boyertown Area School District Wiring Standards

The Boyertown Area School District wiring standards documentation is considered to be a dynamic document. The standards are updated continuously to keep abreast of current technology changes. Every effort is made to keep the most current version posted to this web site. Prior to utilizing these standards or any portion thereof for installation practices, check for the latest version at <http://www.boyertownasd.org/domain/44>.

Section 1 - Service Entrance and Termination - Outside Plant

1.1 OVERVIEW

This section provides the necessary guidelines to install service entrance cables to buildings and information for the termination of cables entering buildings.

All outside plant voice, data, video cabling, communication conduits and manholes, shall be designed and/or approved by the District's Department of Information Technology Services (ITS).

1.2 ENTRANCE CABLE

1.2.1 GENERAL

Prior approval and coordination with Information Technology Services, and concerned parties is necessary when a situation requires pulling cable through any communications conduit.

All building entrance cables associated with campus telecommunication networks (telephone, data, LAN, WAN, district TV, and fiber optics) shall be installed, connected and disconnected by Information Technology Services or its designee.

All trunk cables requiring splicing will be performed in accordance with current industry standards. In most cases, trunk cabling is to be installed in a building-to-building manner leaving no splice cases in communication manholes, tunnels or duct systems.

There shall be no cable or wiring with voltages higher than 90 volts AC in communications duct banks.

All twisted pair cables entering a building shall be terminated on protection blocks. Only gas and/or solid state protectors shall be used. See protection specifications in *Section 5*.

Repair or replacement of damaged cable is the responsibility of the party involved causing the damage. This will be done at no cost to the District. Information Technology Services must inspect and approve all repairs to damaged cables. All damages shall be reported immediately to Information Technology

Services (610-473-1777). Plant Ops (610-473-3471) must also be notified about damage(s) due to activities of project contractors under their control.

1.2.2 LABELING

All trunk cables installed in manholes shall be identified as to the owner of the cable, cable number, cable type, number of pairs or strands, origination and termination points and contact number (610-473-1777). The information on the tag shall be in permanent ink encased in a waterproof tag made of plastic or other such material designed to be used in a wet environment, tag may be plastic or aluminum with information stamped or embossed. A tag is required at each end of the cable and at all pull points in between.

All abandoned communications cable shall be removed from tunnels, manholes and conduit. If it is not feasible to remove abandoned cable, it shall be clearly tagged as abandoned, with appropriate labeling as described above, and shall be reported to Information Technology Services and Plant Ops.

1.2.3 AERIAL

No aerial wiring shall be installed on campus unless approved by the Information Technology Services. Information shall be obtained from Information Technology Services in reference to ownership of aerial communication cables and poles.

1.3 ENTRANCE CONDUIT

1.3.1 GENERAL

Conduit sizing and quantities for communications conduits between buildings and manholes shall be determined by Information Technology Services. Minimum requirements are outlined in the following paragraphs.

All campus buildings shall be connected to the nearest manhole/tunnel or new manhole/tunnel. Connection to a tunnel is detailed in *section 1.3.4*. Fireproof seals shall be required by code as detailed in *Section 7*.

Prior approval and coordination with Information Technology Services, and other concerned parties is necessary when the situation requires any modification to the conduit system.

Repair or replacement of damaged conduit is the responsibility of the party involved causing the damage and at no cost to the District. Information Technology Services must review and approve all repairs to damaged communications conduits. All damages shall be reported to Information Technology Services and Plant Ops immediately.

1.3.2 REQUIREMENTS

The minimum size duct bank for entrance conduit to a new building shall be (4) four inch conduits with innerduct. Whenever feasible, buildings larger than 100,000 square feet shall have two means of access to the campus underground communications conduit system.

Two of the four inch conduits will each contain a flexible, multi-cell, textile innerduct. This innerduct will be a 3" x (3) cell configuration with a detectable tracer. Each cell will have a color coded mule tape with distance markers. The mule tape is to be tied off at each end. The flexible innerduct must be pulled with the use of a swivel head pulling eye as to prevent twisting of the innerduct. The other (2) four inch conduits will only contain a mule tape with distance markers extended through the entire length of each conduit. There shall be no splices or knots in the length of the mule tape. The mule tape is to be tied off at each end.

No more than the equivalent of 180 degrees of bends is allowed in a run between the building and the manhole, including offsets.

All existing conduits require a flexible, multi-cell, textile innerduct installed prior to any cabling being pulled into the conduit. The flexible innerduct must be pulled with the use of a swivel head pulling eye as to prevent twisting of the innerduct.

Conduits with an inner diameter of less than 3 inches require a textile innerduct 1 inch to 1¼ inches wide. Each cell is to have a mule tape with distance markers. The mule tape is to be tied off at each end. The flexible innerduct must be pulled with the use of a swivel head pulling eye as to prevent twisting of the innerduct.

1.3.3 UNDERGROUND

All underground conduits and ducts shall be added in groups of 2 or more. Under no circumstances are single underground conduit runs acceptable without specific permission from Information Technology Services.

All underground conduits shall be configured in what is commonly known as a duct bank that is encased in concrete (3500psi minimum) reinforced with steel rebar. Additional reinforcement is to be used when crossing roadways.

The minimum separation for communications ducts and power ducts in a joint trench environment is 3 inches (8 cm) of concrete. All communications ducts shall also be a minimum of 12 inches from steam pipes and condensation lines when crossing perpendicular. The minimum depth for buried conduit and ducts is 30 inches below grade or underside of road bed to top of duct/conduit.

When communication ducts run parallel to steam lines a minimum of a two (2) foot separation is required to avoid conduction of heat. PVC duct is not allowed in steam tunnels. All other duct separations must comply with the National Electric Code.

Rigid steel conduit, encased in reinforced concrete, shall be used in any location subject to excessive heavy weight, such as under foundations or roadways.

All underground communications conduit shall be four (4) inches in diameter, minimum.

All necessary precautions shall be taken by the contractor during construction to prevent the lodging of dirt and construction debris in all conduit, tubing, flow duct, fittings and boxes. All conduit in floors, concrete or below grade, shall be swabbed free of debris and moisture before innerduct is pulled. All newly installed conduits shall be left with a mule tape or flexible, multi-celled, textile innerduct with pull string.

All used and unused conduits and innerducts shall be sealed to provide a watertight fit inside and out.

Installation of communications conduits or duct banks are prohibited under "slab-on-grade" constructed buildings. Entrance conduits in these types of structures shall be turned up through the slab immediately after penetration through the perimeter foundation wall or footer into the MTR. Where the MTR is located further into the interior of the building, conduits shall be turned up through the slab immediately after penetration through the perimeter foundation wall or footer and extend into a 4' x 4' junction box located immediately in the space or above the first floor ceiling. The junction box must have a removable entrance cover either facing outward or towards the floor if above the ceiling. The conduits shall extend from the junction box to the MTR.

1.3.4 TUNNELS

Conduit installed in tunnels must have written approval by Information Technology Services and reviewed by Plant Ops. Unless written exception is provided by Information Technology Services, all conduit placed in and/or sections crossing steam tunnels shall be rigid and galvanized.

1.3.5 CONDENSATION

Duct banks shall be pitched to drain to manholes and away from building entrances.

1.3.6 TRAPS

All conduit, tubing, raceways, ducts and duct banks shall be installed in such manner to insure against collection of trapped condensation. Raceway runs shall be arranged to be void of traps.

When conduit passes through exterior concrete walls of any facility, the penetration shall be watertight. Provide pipe sleeves in the concrete with 1/2-inch minimum entrance seal.

1.3.7 TYPES OF CONDUIT

Gas pipe and water pipes shall not be used as conduit under any circumstances.

Two types of conduit are acceptable for underground conduit systems. Project specifications will detail the types of conduit to be used in various locations.

- Rigid galvanized steel conduit with threaded fittings -- This conduit shall be installed with reinforced concrete casing in areas subject to heavy use. If not concrete encased, this conduit shall be painted with two coats of coal tar base paint or have epoxy coating applied by manufacturer.
- Schedule 40 PVC conduit -- This conduit shall be installed with steel reinforced concrete casing.

Rigid steel conduits installed underground shall be field-wrapped with 0.01 inch thick pipe-wrapping plastic tape applied with a 50 percent overlap, or shall have a factory applied plastic resin, epoxy or two coats of a field applied coal tar specifically made for this purpose. Where the coal tar coating method is used, the contractor shall notify Information Technology Services prior to back filling, for inspection and approve the coating before the conduit is covered. Field wrapping or coating shall extend to six (6) inches above ground level where conduit is installed by a pole or side structure or inside a pedestal.

All conduits that extend above ground where turned up at the base of a pole or pedestal must be encased in concrete above ground.

Duct banks shall be rectangular and be a minimum concrete thickness of three (3) inches around any conduit. The duct bank shall be sized and placed as shown on construction documents.

A minimum of four (4), # 4 steel reinforcing rods shall be installed in all duct banks parallel with the conduits. Where conduit enters a building or a manhole the re-bars must be doweled into the existing structure to prevent shearing of the conduits in case of settlement.

All conduits must be terminated with bell ends at the manhole, facility or other termination point.

Duct spacers shall be provided at a maximum of seven feet intervals. Conduit shall be anchored at forty-two inch intervals and at each spacer to prevent duct floating during concrete installation.

Each duct run shall be done with a continuous concrete pour. Broken pours are not allowed without written exception from Information Technology Services. Provide #4 or larger re-bar to extended twelve inches beyond the end of the pour where encasements are not completed end to end in a single pour.

A yellow color agent shall be sprinkled on top of the concrete used for underground communications ducts. The color agent is to comply with industry standards. Marker tape shall be placed 12 inches above the poured concrete duct casing.

1.4 MANHOLES

1.4.1 GENERAL

Manholes shall not be smaller than 7 feet wide, 7 feet long and 7 feet high.

The maximum depth of all manholes shall be ten (10) feet from the manhole cover to bottom of the manhole, unless otherwise approved by Information Technology Services.

The manhole cover and opening shall be round, 36 inches in diameter and shall be engraved or embossed with the word "Communications." Manhole covers shall not have recessed handles that pull out when needed for removal. Notched type covers shall be used.

The maximum distance between manholes in any continuous one run shall not exceed 400 feet.

1.4.2 INTERIOR

All materials used in a manhole shall be resistant to corrosion. All steel shall be galvanized or zinc coated. All racks in manholes shall be galvanized or zinc coated steel.

1.5 DRAWINGS

1.5.1 GENERAL

Detailed diagrams can be obtained from the Boyertown Area School District Department of Plant Ops or Information Technology Services if available. Refer any questions specifically not addressed in this document to Information Technology Services.

Section 2 - TELECOMMUNICATIONS ROOMS AND CABLE TERMINATION

2.1 GENERAL

Telecommunication rooms are special-purpose rooms that contain telecommunications equipment and wiring. These rooms have specific requirements due to the nature, size and complexity of the equipment and wiring located in the room.

2.2.1 SPACE REQUIREMENTS

There are two different types of telecommunications rooms within a building each supporting critical functions as part of the building voice/data/video wiring and communications systems. In general, each room must be large enough to accommodate the wiring and equipment that will be located within them and reserve space for growth. The two types of rooms are:

- The Main Telecommunication Room (MTR), sometimes called the Main Distribution Frame (MDF) will be referred to as the MTR throughout this document.
There is normally only one MTR per building. This room will contain data switches, routers, telecom, and video distribution electronic equipment. This room will also serve as the primary location for communication cabling to enter the building.
- The Telecommunications Equipment Room (TER) also sometimes referred to as the Wiring Closet, Intermediate Distribution Frame (IDF), and Intermediate Cross-connect (IC), Horizontal Cross-connect or Telecommunications Closet (TC)---TER will be used in this document. There is to be at least one TER per floor.

More than one TER per floor is required when the terminated wiring distance between any voice/data communications outlet and the TER exceeds 295 feet (90 meters). The minimum size for a MTR is 225 square feet. The preferable dimensions for this room are 15'X15'. This room will contain telephone equipment, data network equipment, racks, cabinets and other approved networking equipment. Information Technology Services shall be contacted for final dimension approval.

The minimum size for a TER is 100 square feet and the preferable dimensions for this room are 10'X10'. Only in approved Information Technology Services cases shall this room be less than 100 square feet. Information Technology Services must be contacted for final dimension approval. This room will contain telephone equipment, data network equipment and voice/data wiring.

NOTE: *Telecommunications rooms may vary in size according to the square footage of the building, number of floors, tenant characteristics and telecommunications services required. Consideration to the*

future needs of the facility and the end users is a necessity. Information Technology Services will have final approval on room dimensions.

Both the MTR and the TER will have sufficient lighting, HVAC, fire suppression and door access control. In all new facilities door access control to the MTR and the TER will be via a card reader attached to the District's door access control system.

Project specifications will indicate that Information Technology Services personnel or its designee are responsible for furnishing, installing and terminating the various types of communications cabling, racks, panels and other items as specified in this section.

All work shall comply with the National Electrical Code, Local Building Codes, current 568 TIA-EIA standards and the Boyertown Area School District's Low Voltage Structured Cabling Guidelines and Standards.

Electrical panels are strictly prohibited in telecommunications rooms. Services, which are not telecommunications related, shall also be prohibited in these rooms. This includes, but is not limited to, janitorial services and supplies, zone maintenance storage of supplies, tools and equipment, departmental storage of supplies and equipment, annunciating equipment and building security network control devices. There shall never be an exception to these restrictions. Fire alarm and security panels are not permitted in telecommunication rooms.

A 50 percent growth factor shall be built in and provided in each riser unless otherwise specified; consequently any cable or conduit work that pertains to telecommunications must be designed and/or approved by Information Technology Services. Project specifications will include this growth factor.

To facilitate proper installation, routing and placement of cables, wires, premise equipment and terminal fields, telecommunications rooms shall be located on each floor, as close as possible to the middle of the building and stacked one above the other, unless otherwise instructed or approved by Information Technology Services. Architects and Engineers must pay special attention to telecommunication room locations to overcome distance limitations relating to data networks. The total distance of the conduit path, from outlet to the TER or MTR, when the MTR also serves as a TER, shall not exceed 295 feet.

Every network-attached device must be cabled back to the nearest TER or MTR on the same floor. The telecommunication room(s) shall house all and only the equipment directly related to the telecommunications systems.

2.2 REQUIREMENTS

2.2.1 GENERAL

All telecommunications room doors are to be keyed alike as designated by Boyertown School District's Plant Ops. Locks shall be spring lock (self-locking or store room type locks) and Boyertown School District's Plant Ops will install locks. Only authorized Information Technology Services technicians and Plant Ops supervisors may carry a key to these rooms.

New facilities – All new building telecommunication rooms will be on the District's access control system.

Doorways shall be designed with minimum measurements of 3'-0" by 6'-8" minimum and shall open outward into the corridor or adjacent space.

Floors shall be sealed concrete or tile, carpet is prohibited.

MTRs and TERs shall be located above any threat of flooding. Rooms located in basements shall have floor drains with positive drainage, otherwise sump pumps must be provided. When sump pumps are required, they shall be connected to an emergency power supply.

Fire rated plywood, 3/4 inch thick, must be mechanically fastened to the walls specified in the project specifications of each MTR and TER. The fire rated plywood must be fastened in a way that is easily removable. The fire rated plywood shall be painted with two (2) coats of fire resistant paint of a neutral color. The fire rated plywood is to begin at four (4) inches AFF (above finished floor) and end at 8'-4" AFF.

The recommended ceiling height is minimum 8'-6".

Install a minimum of 4 (four) 4 inch sleeves between telecommunications rooms, with sleeves extended 4 (four) inches AFF. In buildings with Plenum rated ceilings, EMT multi-cell conduit shall be used to connect telecommunication closets together.

2.2.2 ENVIRONMENT

All telecommunications rooms shall be environmentally controlled to maintain the room environment at a temperature range of 65 to 75 degrees Fahrenheit, with a relative humidity level of 35 to 75 percent non-conducting, 24 hours a day, 7 days a week. Telecommunications rooms shall be conditioned with a fresh air exchange of three (3) air changes per hour. If HVAC must be shut down then an exhaust connected to emergency power must be provided to remove heat. Generally the system must remove 7,000 BTU per hour.

No plumbing, HVAC ducts, or electrical conduit shall pass through or be directly above any telecommunications room.

2.2.3 ELECTRICAL

Lighting shall be four (4) foot fluorescent type and provide a minimum of 50 FC at 3 feet above the floor and be connected to the emergency generator when available.

A minimum of 2 double duplex AC outlets must be provided to power telephone system components, computer interfaces, network electronics and other telecommunications requirements. Outlets must be flush when cut through plywood. Outlet locations will be determined during the building design stage.

Each double duplex outlet shall be connected to a dedicated circuit breaker. Each dedicated electrical circuit shall be 20-amp, 110V, 60 HZ type. All circuits must be tied to an emergency generator when available. All outlets shall be colored according to Plant Ops standards if connected to a generator and labeled with panel and circuit location.

All breaker panels are to be labeled and identified to avoid being turned off in error. Breakers servicing the MTR or TER shall be equipped with locking devices to prevent turn off. A minimum of 4 (four) 20-amp circuits are to feed each room.

2.2.4 GROUNDING

All MTRs and TERs shall have a grounding bar, which shall be 1 foot long for the TER and 2 feet long for the MTR. Both shall be 4 inches wide by 1/4 inch thick with pre drilled NEMA bolthole sizing and spacing. This bar shall be attached to the main building grounding system with a wire not smaller than #6 AWG copper. The ground wire shall not share the cable tray with communications cabling. It may be installed in a separate conduit, which may be attached to the outside of the communications cabling cable tray.

Each distribution point shall be grounded to the main building ground, NEC and EIA/TIA 607 requirement shall be followed.

2.2.5 LABELING

All Telecommunication Equipment Room Frames, Main Cross-connect Frames and connecting blocks must be properly identified by destination.

All riser cables shall be properly marked with "from and to" indicators. Marker is to be a flat piece of aluminum or wire tied plastic labels. This marking shall be permanent and indicate:

The Origination (Cable it is feeding from MTR #) to

The Destination (TER# it is feeding).

All pairs of the entrance cable must be terminated on a connecting block and identified.

2.3 CABLE

2.3.1 GENERAL

A 50 percent growth factor shall be built in for riser cable and provided for unless otherwise specified, consequently any cable work that pertains to telecommunications must be designed and/or approved by Information Technology Services. Project specifications will include this growth factor.

All riser cables that extend from the MTR to each TER must be 100 percent terminated in the MTR and in each TER.

Plenum communications cable may be run exposed above ceilings, provided this cabling is supported independently of other utilities, such as conduits, pipes, ceiling support systems, and not laid directly on the ceiling panels. PVC jacketed cable may be used in non-plenum areas if such use meets NFPA and NEC standards and local fire codes. PVC cable is only allowed with expressed permission from Information Technology Services.

To facilitate future cable installations, a new pull string, tied off at both ends, shall be installed in conduit simultaneously with the pull-in of cable.

All installed station communication cables for voice and data shall be 4 pair, 24 AWG UTP, Category 6A (Augmented Category 6), tested to 550 megahertz.

2.3.2 DATA RISER CABLE

All data riser cable will be optical fiber cable, of multi-mode and single-mode strands. See *section 2.3.3*

2.3.3 FIBER OPTIC RISER

Fiber optic riser cable shall consist of a minimum of 1 sub-unit of 12 strands of multi-mode fiber and 1 sub-unit of 12 strands of single-mode fiber in a single sheath. Each fiber riser shall be installed in riser-rated inner-duct (1" I.D. min).

Termination in the MTR and TER shall be in standard fiber optic enclosures. The multi-mode fiber and single-mode fiber are to be terminated in its own enclosure. Under no circumstances are multi-mode fiber and single-mode fiber to be housed in the same enclosure. All fiber strands are to be terminated on LC type connectors.

2.3.4 FIBER OPTIC ENTRANCE CABLE

Fiber optic entrance cable shall consist of a minimum of 48 strands of multi-mode fiber and 48 strands of single mode fiber. The 48 strands of single-mode fiber shall be separated into 4 sub-units of 12 strands each.

Termination in the MTR shall be in standard fiber optic enclosures. All fiber strands are to be terminated on LC type connectors.

2.4 RACKS AND PANELS

2.4.1 GENERAL

Each distribution point on the MTR or TER backboard or rack shall be identified as a building entrance and/or a floor service panel. Junction/pull boxes are to be provided on any conduit run longer than 80 feet.

All voice terminations at the MTR will be on standard raised 110 type-connecting blocks, mounted on relay rack or backboards. All data terminations at the TER will be terminated on dark red CAT 6e RJ45 jacks and inserted into Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) connecting panels mounted on relay racks. Where space permits, freestanding racks should be installed in the MTR and the TER and all terminations should be installed on the racks.

2.5 WIRE DRESS

2.5.1 DATA STATION WIRES

Drop from telecommunications room cable tray, bundle and route through the backside of the 4 inch by 5 inch vertical wire management duct to the data Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) panel located on the relay rack. Organize and label the cables in sequentially numbered order. The labels are to be placed on the Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) panel in the designation space for each jack.

A single sided 1.5-inch horizontal wire management duct is to be mounted above and below each Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) panel.

2.6 VOICE/DATA RACK AND PATCH PANEL

To install network distribution panels and associated equipment use the following installation method.

In TERs and MTRs serving as TERs containing data terminations, mount two freestanding relay racks in the indicated location. Position the racks to maintain a minimum of three (3) feet clearance from the

front of the rack to the front facing room wall and three (3) feet clearance from the rear of the rack to the rear facing room wall. If a row of racks is to be installed in a MTR or TER, maintain a minimum of two (2) foot clearance from the rightmost or leftmost rack to the opposing wall. Anchor racks to the finished floor. Ground the rack to the MTR or TER grounding bus bar with #6 AWG copper wire.

Mount the voice network riser blocks in the left most rack starting under the fiber interface unit if one is installed. If no fiber interface unit is installed or to be installed in the future, start at the top. Lay out the voice network blocks in ascending serially numbered order from top left to bottom right.

When data jacks for multiple floors are serviced out of the same TER or MTR serving as a TER, the Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) panels shall be laid out and labeled as follows. *

One or more 48 port horizontal Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) panels will be dedicated to each floor. Only under specially approved circumstances shall more than one floor share a 48-port panel section. Panels will be installed with the top floor at the top of the rack and then in descending order by floor.

Additional racks may be required to satisfy this layout. If so, the top floor will be located in the left rack starting again from the top of the rack and then in descending order.

Panel labels shall match the jack labels as described in Section 3.1.2. Each 48-port panel section shall be labeled with the floor code letter.

The right most rack is reserved for mounting network electronics and support equipment.

2.6.1 PUNCH DOWN ON SURFACE MOUNTED BACKBOARDS

Lay down all station wire pairs in serially numbered order from lowest serial number at the top left most position to the highest serial number at the bottom right position. Use 110 type IDC connecting blocks. Route all cables to be punched down to these blocks starting on the left most edge down to the base of the backboard then over and up to the block dressing the cable under the mounting legs. Fasten the mounting brackets to the plywood backboard with #10 x 3/4 inch Phillips head screws.

- VOICE 4-Pair -- Use 110 type IDC 100 pair 110 blocks. Locate the punch blocks on the plywood wiring surface in the area designated as Voice Station Wires. Set blocks in top/down fashion and butt adjacent to each other when installing left to right. Punch down the four (4) unshielded pairs on the block. Minimum bend radius must meet the cable manufacturer's specifications for Category 6A wiring.
- DATA 4-Pair -- Use rack mounted Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) patch panels. Punch down Category 6A four (4) unshielded pairs on the dark red RJ45 jack.

NOTE: *The blocks/panels for terminating the cable may be located on the floor above or below the floor on which the station jack is located. If this is the case, install panels in top/down fashion. Minimum bend radius must meet the cable manufacturer's specifications for Category 6A wiring.*

2.6.2 Terminating and Cabling Standardized Products

Contact Information Technology Services (610-473-1777) for the equipment required for all installations. Panduit communication components are the standardized product solution for installation of voice, data and video terminating devices. Exceptions or substitutions must require specific needs and must be approved by Information Technology Services prior to installation.

Section 3 – COMMUNICATION OUTLETS--INSIDE PLANT WIRING AND RACEWAYS

3.1 GENERAL

3.1.1 OVERVIEW

All telephone and data cabling shall be continuous cabling from the MTR or the TER to the communication outlet. All station cables will be free of kinks, chafes, and tight bends. Any ceiling tiles removed by the contractor for cable installation will be re-installed in good condition. Replacement of damaged tiles is the contractor's responsibility at no cost to the district.

The building occupant's present and future requirements will determine the needs of multiple jack outlets. Final approval for the layout of jacks shall rest with the Information Technology Services. During the programming stage Information Technology Services, consulting with the building occupant(s), will supply the jack layout desired to the project architect for inclusion in the project specifications.

All analog voice connections shall terminate on black RJ-45 eight (8) conductor CAT 6e modular jack assemblies. The Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) faceplate shall be Ivory and will support 4 modular jack assemblies. The voice jack color shall be Ivory and will be placed in the top port(s) of the wall plate. If only one voice jack, it should be terminated in the upper left port. Wire color-coding and termination shall be per EIA/TIA-568-B.2 specifications. If no other jacks are to populate the faceplate, blank modules are to be used to fill the spare positions. The blank modules are to be the same color as the Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) faceplate.

Analog wall phones shall be terminated on stainless steel 630 type jack assemblies.

All data connections shall terminate on Dark Blue RJ-45 eight (8) conductor CAT 6e modular jack assemblies. The Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) faceplate color shall be Ivory and

will support 4 modular jack assemblies. The data jack color shall be Dark Blue and will be placed in the lower port(s) of the wall plate. If only one data jack, it should be terminated in the lower left port. Wire color-coding and termination shall be per EIA/TIA-568-B.2 specifications. If no other jacks are to populate the faceplate, blank modules are to be used to fill the spare positions. The blank modules are to be the same color as the Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) faceplate.

All pairs shall be terminated when connecting to voice and data jacks. Terminate as "568B".

The total wire path length from the data outlet to the MTR or TER termination point must not exceed 295 feet (90 meters). This is important to meet Ethernet requirements of IEEE 802.3. Please note that in most cases the TER that houses network electronics will service both the voice and data jacks on the floor where it is located. This must be considered when determining adherence to the maximum length for the data outlet wiring.

3.1.2 LABELING

Each end of all cables will be labeled at their termination locations.

In newly constructed buildings communications outlets will be labeled with the room numbers as provided on the construction documents. The format is as follows:

Room Number-Closet Number – Patch Panel Number Type Connection

Example: 101-1-1D or 101-1-1V

Where 101 is the Room Number – Data Closet 1 –Patch Panel Number is 1 and identifies the first connection in the room and Type Connection D identifies the connection as a data connection. V is to be used for analog voice connections.

The number of connections in a room is determined by standing at the opening to the room then start counting connections beginning with the number 1 from the immediate left wall following in a clockwise direction around the room.

3.2 COMMUNICATION OUTLET LOCATION

3.2.1 LOCATIONS AND QUANTITIES GUIDELINES

Unless otherwise specified, a Standard Communications Outlet (SCO) shall consist of two data jacks, and two spare ports. Other communication outlets may be installed depending on the function for that particular office or room. Quantities listed for the following areas are minimum counts.

Faculty Offices: One (1) SCO per designated occupant. If there is more than one occupant then outlets are to be installed on opposite walls.

Clerical/Staff Offices/Graduate Student Offices: One (1) SCO at the location of each desk.

Conference Rooms: Seven (7) SCO's for rooms up to 200 square feet. One (1) SCO on each wall and two (2) SCO's located above the ceiling tile. A minimum of eight (8) SCO's per room for rooms over 200 square feet. One (1) SCO shall be located on each wall with two (2) spaced equally on the longer walls and two (2) SCO's above the ceiling tile. Rooms with more than 500 square feet shall have additional outlets equally spaced on each wall and have two (2) SCO's above the ceiling tile or (1) SCO with 4 terminated data connect.

Computer Labs: One communications port for each desk space, one (1) SCO at the location of each desk to include the teacher desk and two (2) SCO's above the ceiling tile or (1) SCO with 4 terminated data connect. Additional outlet requirements will be determined based on size and in the design phase of the project. Locations will be determined during the design phase.

Classrooms/Lecture Halls/Auditoriums: Classrooms with teaching stations are required to have three (3) SCO's and two (2) SCO's above the ceiling tile or (1) SCO with 4 terminated data connections. Locations will be determined during the design phase.

Storage Areas: One (1) communication outlet per room. One (1) SCO for a room over 500 square feet and one (1) additional SCO for each additional 2000 square feet. Locations will be determined during the design phase.

Mechanical Rooms: Consult the Department of Plant Ops. Some rooms may require communications outlets for telephones or energy management devices. Locations will be determined during the design phase.

MTR and TERs: One (1) SCO per room minimum.

3.3 COMMUNICATION OUTLET HOUSING INSTALLATION

3.3.1 MOUNTING

Use a dual gang outlet box similar to Steel City, part number 72171-3/4 or BASD approved equivalent. When mounting the outlet box in a steel studded wall, use a back brace.

Use Steel City plaster rings, part number 72-C13, (single gang) or 72-C-17 (double gang) or their BASD approved equivalent. It is absolutely critical that the inside opening area match the outlet installation enclosure. The plaster rings must be level and positioned flush with the finished surface. For single voice/data outlets use a single gang plaster ring.

Outlets are to be mounted at standard industry heights and positions, unless otherwise specified by the Plant Ops, Design and Construction and/or Information Technology Services. Standard mounting height of communication outlets:

Desk

- 18 inches, AFF. (above finished floor)
- (Single gang plaster ring)

Handicapped wall mount

- 48 inches, AFF.
- (Single gang plaster ring only)

High Tech Classroom

- See Section 4.

NOTE: Electrical outlets shall be provided for projection and multimedia devices by contractor or Plant Ops.

3.4 WIRING PATHWAYS

3.4.1 GENERAL

To avoid electromagnetic interference (EMI), all pathways should provide clearance of at least:

- 4 feet (1.2 m) from motors or transformers
- 1 foot (0.3 m) from conduit and cables used for electrical power distribution
- 5 in. (12 cm) from fluorescent lighting or power lines over 2kVA and 24 inches from any power line over 5kVA. In general, communications cabling is routed separately or several feet away from power cabling. Similarly, communications cabling is routed away from large motors, generators, induction heaters, arc welders, x-ray equipment, and radio frequency, microwave or radar sources. Whenever possible, pathways should cross perpendicular to fluorescent lighting and electrical power cables or conduits.

3.5 CONDUIT

3.5.1 GENERAL

All conduit work shall meet the requirements of the National Electrical Code.

All voice, data and video wiring inside rooms shall be protected by metallic conduit or other means such as metallic wire mold or troughs in the floor. Aluminum is not acceptable in caustic environments.

Plastic surface mount molding is not acceptable in any application. EMT conduit or metallic surface mount molding shall be used for all interior wiring. All conduits are to be concealed whenever possible.

No more than an equivalent of two (2) 90-degree bends are allowed in a run between junction boxes or pull boxes.

No 90° condulets (LBs) are permitted.

Entrance to junction boxes or distribution panels shall be adjacent to the corners or directly across from each other.

The use of plenum cable instead of conduit shall be determined on a case-by-case basis. Information Technology Services must be contacted for approval.

In major renovation and new construction projects where the MTR and TER(s) are not in alignment, the contract shall include provisions for installation of two (2) riser conduits (4 inches minimum diameter) from the MTR to each TER. A pull string and appropriate junction pull box shall also be provided in each conduit run to facilitate future installation of cable(s). Innerduct is required in all conduits. Quantity of innerduct shall be determined from project design.

To reduce EMI, all conduits in slab shall be a minimum of 1 1/4 inches galvanized steel with threaded fittings. All exceptions shall be determined during the design stage of the project and shall be subject to the approval of Information Technology Services.

All sleeves must protrude four (4) inches AFF and below and be capped at both ends and firestopped. Coordinate with Information Technology Services for the number of conduits entering the facility.

No horizontal conduit run shall be more than 80 feet between pull boxes.

Conduit for telephone or computer outlets shall be terminated in a dual gang box. Steel City, part numbers 52151-1, 72151-1, 52-C-17 or 72-C-17 for one (1) inch with dual gang plaster ring and 52151-3/4, 72151-3/4, 52-C-13 or 72-C-13, for 3/4 inch with single gang plastic ring. BASD approved equivalents to the Steel City part numbers may be used.

All communications outlets shall be minimum 3/4-inch conduit, with a minimum of bends, from the outlet to the cable tray, wire way or homerun directly to the MTR or TER. Home run conduit is required when the cable path above the ceiling is not easily accessible. Examples of ceilings where conduit is required include dry wall and interlocking ceiling tiles. Pull boxes must be installed every 180 degrees or 80 feet of the conduit run. See *Section 4* for conduit installation requirement for High Tech Classroom outlets.

All conduits must extend from the station end to the MTR or TER as a home run or to a cable tray that extends to the MTR or TER. Conduits extending to a cable tray shall be mechanically bonded to the tray. No conduits shall stub in to a ceiling space and stop.

All station run conduits shall have a pull string installed.

3.5.2 CONDUIT CAPACITY

Conduit shall be sized using industry standard guidelines for telecommunications distribution methods. Such guidelines can be found in the Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual. Capacity is typically a 40% fill rate.

3.6 CABLE TRAYS

3.6.1 GENERAL

All communications cable trays shall be designed to accommodate all types of communications cabling; consequently any cable work that pertains to telecommunications must be designed and/or approved for use in the trays by Information Technology Services.

Communications cable trays shall be made of welded steel wire mesh construction commonly known as "basket tray". No use of solid surface construction cable tray is allowed except in penetrations through firewalls. In these cases the entrance and exit of the tray penetrating the wall shall not exceed 6 inches beyond either side. Removable solid surface top covers on the wire mesh tray are allowed.

The minimum dimensions for a communications cable tray shall be 12 inches wide and 4 inches deep. In certain instances where a smaller tray may be required due to space constraints, Information Technology Services shall have final design approval.

Contract documents shall show cross section of the communication wire way or cable tray. The drawing must show reference to other installed utilities in the building.

All conduits terminating at a cable tray must be easily accessible. Avoid ending conduits at tray in locations that are not accessible by removable ceiling tile or ceiling access panel. No conduit shall extend into the wire way area of the tray. All conduits used for communications cabling are to be bonded to the communications cable tray.

Consideration may be given for installation of other types of cables in a cable tray to prevent interference on unshielded cables. Information Technology Services shall approve location of such installation.

The communications cable tray is to be supported with allthread rods in a trapeze form. Supports for cable trays larger than 12 inches in width are to be installed according to the manufacturer's specifications. Supports for cable trays 12 inches or less may be farther apart but must meet the

manufacturer's installation requirements. A single support is not acceptable. All supports are to be fastened to the building structure above.

Information Technology Services or its designee will not install any cable or perform any work until all communications cable tray installations are in compliance with specifications listed above.

3.6.2 MOUNTING

Cable trays must maintain a minimum of six (6) inch clearance from obstructions above the tray and a minimum of eight (8) feet (6) inches AFF to bottom of tray. Trays are to provide access via the most direct path to all communications outlets on the floor.

Install sweeping 90s for all turns. Use end-of tray terminations where wire drops down to walls to prevent abrasions and cuts from metal edges. Use a trapeze cable tray mounting method suspended by manufacturer recommended size allthread. Fasten allthread to ceiling anchors, allowing no bends in allthread. Support the cable tray in this manner at every section-to-section junction and at five (5) feet to six (6) feet intervals (mid span) between joints. Whenever possible, the tray should be no closer than six (6) inches from the structural ceiling, ducts or pipes, considering all other possible obstructions. A minimum of 5 inches distance from lighting, especially fluorescent lighting, is required.

3.7 OPEN TOP CABLE SUPPORTS AND RINGS

3.7.1 GENERAL

All open top cable supports (J-supports) and cable rings must be suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight. When used, J-supports or cable rings shall be located on 24 to 36 inch centers to adequately support and distribute the weight of cables. These types of supports may typically hold up to fifty 0.25-inch diameter cables.

For larger quantities of cables that convene at the Telecommunication Closets, provide cable trays or other special supports that are specifically designed to support the required cable weight and volume.

3.8 UNDERFLOOR DUCT SYSTEM

3.8.1 GENERAL

This type of raceway is to be used minimally at all costs. Care must be taken to design a system that will consider electrical and communications requirements. Adequate electricity must be available at all locations. With proper planning, an adequate system can be installed but it is discouraged.

Section 4 - TELEVISION CABLE – Currently under review with local provider.

4.1.1 GENERAL

Project specifications will indicate who is to be responsible for furnishing, installing and terminating the various types of communications cabling, outlets, panels and other components specified in this section. Unless otherwise noted, Information Technology Services personnel or its designee will be responsible.

4.2 VIDEO/PROJECTION DEVICES

4.2.1 GENERAL

Information Technology Services shall provide the specifications for projection devices and /or monitors.

Projection devices are either ceiling or wall type mounts. In each case the conduit must be connected to the front of the classroom or control area.

Contact Mr. Scott Major at 610-473-1777 or smajor@boyertownasd.org.

4.3 SMART CLASSROOMS

4.3.1 GENERAL

Information Technology Services shall provide the specifications for the conduit installation and outlet(s) required for a room designated as a Smart Classroom. A Smart Classroom outlet will provide for the connection of VGA, HDMI, audio and USB.

4.3.2 LABELING

Each end of all cables (UTP, VGA, HDMI, audio, etc.) and all pairs will be labeled at their termination locations.

4.3.3 CONDUIT / OUTLET BOXES

In general, the necessary conduit shall be provided as follows:

- Primary Smart Classroom outlet box (4"X4"X3") in front of room or teaching station to hall cable tray— two 1"
- Primary Smart Classroom outlet to ceiling mounted box (6"X6"X4") servicing video projector - one 2"

The location and necessity of each will be determined during final design, based on the intended function of the room. The room will always have one primary Smart Classroom outlet.

4.3.4 CABLE

The voice UTP cable shall each be four (4) pair 24 AWG Category 6A, 500 Megahertz rated (minimum) plenum cable.

The data and spare UTP cable each shall be four (4) pair Category 6A, 500 Megahertz rated (minimum) plenum cable.

4.3.5 OUTLETS

The communication outlet will contain a Category 6A jack for voice, a Category 6A jack for data, a Category 6A jack for spare.

4.3.6 PATCH PANELS AND TERMINATIONS

The High Tech Classroom cables shall be terminated in the MTR or TER as follows:

Data: (2) 4 pair Category 6A on Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) panel

Spare: 4 pair Category 6A on data Panduit Mini-Com Modular Faceplate (CPPL48M6BLY) panel

Section 5 - PROTECTION, GROUNDING AND BONDING

5.1.1 GENERAL

Lightning protection of telecommunications facilities is essential. While federal and state standards must be adhered to, local conditions may require additional investigation and/or modifications to meet site, equipment, environmental or safety requirements.

NEC Articles 250 "Grounding" and 800 "Communications Circuits" cover general requirements for grounding, bonding and protecting electrical and communications circuits. NFPA 78 "Lightning Protection" addresses zone protection and other items that are beneficial.

All cabling (including grounding to building ground) within the building and entrance facilities shall be installed with protection from lightning and power surges via grounding and bonding.

5.1.2 MATERIALS

The three most frequently used lightning protectors are listed below. Consult Information Technology Services for a determination of the most appropriate protection for the condition.

AT&T Protector -- AT&T, part number 189B1-25 for 25 pair protection, 189B1-50 for 50 pair and 189B1-100 for 100 pair. Use AT&T, part number 3B1E-W gas protector modules. Homaco part number 50M-201-_19 rack mounting shall be provided. ITS will specify part number suffix required for the particular application.

RELTEC Protection Block -- part number R66P25QCVS. The gas protection module shall be AT&T, part number 3B1E-W. Use AT&T, part number 110ANA1-06 for single drops of 6-pair or less. Use AT&T, part number 3B1E-W gas protector modules.

5.2 GROUNDING

5.2.1 GENERAL

All MTR grounding shall use a single point scheme from the building main transformer. EIA/TIA 607 requirements must be followed.

All shields shall be bonded to a common ground.

All entrance cables must be properly grounded to the building ground through grounding facilities provided at the MTR.

All protector blocks shall be connected to the backboard ground busbar using NEC code 6 AWG copper wire.

5.3 BONDING

5.3.1 GENERAL

Bonding is to be durable, strong and of low impedance to assure electrical continuity. EIA/TIA 607 requirements must be followed.

All conduits terminating to cable trays and wireways shall be mechanically fastened to the tray clamps or equivalent. The cable tray or wire way shall be grounded to the main building grounding system with a wire not smaller than #6 AWG copper.

A resistance of .001 ohm or less indicates a high-quality junction and is required per the Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual.

Section 6 - INSPECTION, TESTING AND DOCUMENTATION

6.1.1 GENERAL

Information Technology Services or its designees shall have access to construction sites.

To enable Information Technology Services to inspect telecommunications facilities work, the contractor must:

- Provide a progress schedule with the installation of telephone raceways and spaces shown as a separate item.
- Immediately notify Information Technology Services of any change in architectural drawings and/or plans affecting telecommunications and provide as-builts.
- Provide proper access to facilities for inspections.
- Notify Information Technology Services when any work is ready for inspection.

All underground work must be inspected and approved by Information Technology Services and/or Plant Ops before the site is covered with dirt or concrete. Failure to have the work inspected shall result in uncovering the area at the contractor's expense.

Per contract documents, the contractor shall provide a final checkout certification letter and inspection reports to Information Technology Services on all telecommunications work.

6.2 TESTING

6.2.1 GENERAL

Testing shall conform to ANSI/TIA/EIA-568-B.1-B.2 and B.3 standards. Whereas ANSI/TIA/EIA-568-B.1 addresses cabling system requirements, ANSI/TIA/EIA-568-B.2 addresses copper components and ANSI/TIA/EIA-568-B.3 addresses fiber components.

The contractor shall submit to Information Technology Services, a detailed test procedure to be used for the project. All cables shall be tested for length, attenuation, impedance, grounds, shorts, reversals, return loss, insertion loss, NEXT, PSNEXT, Attenuation to Crosstalk, Attenuation to PSNEXT, FEXT, ELFEXT, PSELFEXT, ACRPSACR and continuity of communications conductors and shields.

Upon completion, test results shall be submitted in printed hard copy form to Information Technology Services for final approval and acceptance. The contractor shall guarantee 100 percent continuity on all fiber and copper conductors on all cables.

Failure during testing and warranty period will result in re-pulling and terminating cables at the contractor expense.

6.2.2 STATION CABLES

The total cable length from the communications outlet to the telecommunications room, must not exceed 295 feet (90 meters) in any case.

6.3 DOCUMENTATION STANDARDS

6.3.1 CONTRACTOR DOCUMENTATION REQUIREMENTS

Upon project completion, the installing contractor shall provide to Information Technology Services a list of voice communication outlet identification labels, data communication outlet identification labels, their corresponding room numbers, location within the room, and punch block or data panel termination points. Voice and data communication outlet identification labels at the jack locations, shall also be placed on the as-built drawings and provided to Information Technology Services.

OTDR and/or power meter test results to manufacturer's specifications and BASD standards for all fiber optic cable installed. The documentation must include OTDR or power meter readings, fiber route diagrams, length, and end-to-end attenuation results for multimode and singlemode fiber cable. All fiber OTDR or power meter readings shall be made bi-directionally on all fiber cable. Test results shall be provided in hard copy.

Station cable tests shall be performed to manufacturer and Boyertown Area School Districts standards. Test results shall be provided in hard copy.

Riser cable tests shall be performed to manufacturer's specifications and BASD standards. Trunk cable tests shall be performed to manufacturer's specifications and BASD standards. Test results shall be provided in hard copy.

6.3.2 DISTRICT PROVIDED DOCUMENTATION

- Contract drawings for the project.
- Labeling information for termination equipment.

Section 7 - FIRE STOPPING

7.1 GENERAL

Provide fireproof seals in accordance with the National Fire Protection Association (NFPA) and the National Electric Code (NEC), Article 300-21 and EIA/TIA 569 Standards.

Fire-stop all penetrations in accordance with the current edition of the National Fire Protection Association (NFPA).

Do not use concrete for fire stopping on cable trays, wireways or conduit. Contractors who use this method will be required to replace and test all cables adversely affected.

Section 8 - LOCAL AREA NETWORKS

8.1 GENERAL

Cabling for LANs is strictly controlled by the Information Technology Services.

As a mission-critical component of the district's infrastructure, the communications network is managed to insure maximum availability, performance, security, and reliability.

The policy of the district is that only authorized Information Technology staff may install, manage or change the network infrastructure. Unauthorized changes to the network can seriously compromise the reliability, performance, security and availability of the network and its services. In addition, illegal wiring may be in violation of FCC regulations, and fire or building codes, which may create a public safety hazard.

It is a violation of this policy for departments or individuals to install their own communications infrastructure, or modify the existing communications infrastructure in any way. Departments or individuals installing their own communications wiring or networking equipment will not receive IP addresses for their computing systems and will be subject to disconnection from the university network.

8.2 DETERMINING REQUIREMENTS

Consult Information Technology Services for requirements of specific wiring needs.

8.3 WIRING TYPE

Consult Information Technology Services for specifications.

8.3.1 THINWIRE 10 Base-2

Thinwire ethernet cable shall not be installed for any projects.

8.3.2 THICKWIRE 10 Base-5

Thickwire ethernet cable shall not be installed for any projects.

8.3.3 TWISTED PAIR

4 pair enhanced Category 6A UTP cable rated 500 megahertz is the minimum cable type allowed.

Maximum segment length is 295 feet (90 meters) from the TER and/or the MTR serving as a TER to the communications outlet.

No splitting of pairs is allowed. This includes cabling used in voice applications.

Communication outlet patch cords must be minimum Category 6A.

TER patch cords must be minimum Category 6A.

See *Section 3.1.1* for standard wiring on the jacks.

Section 9 - WIDE AREA NETWORKS, METROPOLITAN AREA

9.1 SYSTEM DESIGN

Information Technology Services will provide the necessary design. The location of service access points and a list of materials required for the installation or expansion of the network will be provided.

Section 10 – LOW VOLTAGE STRUCTURED CABLE TECHNOLOGY

10.1 OVERVIEW

Cabling technology at the District is comprised in two mediums; fiber optic and UTP. All cabling used for horizontal installations shall be rated for use in a plenum type ceiling. Cabling for use in building risers should be rated as specified for the application.

10.1.1 GENERAL

Information Technology Services shall approve all low voltage structured cable planning, installation and specifications. All cable that is to be connected or disconnected from the campus telecommunications network such as telephone, data, video, and fiber optics, shall be done by Information Technology Services or its designee.

10.2 FIBER OPTIC CABLE

10.2.1 GENERAL

Multi-mode and single-mode fibers are both utilized at the District. In all cases of multi-mode-fiber installation, 62.5/125MM will be used.

Direct burial of fiber optic cable is not allowed.

When installing fiber optic cable in ductwork and manholes between buildings, there shall be a minimum of one complete loop; minimum of 30 feet in length, in the manhole and it shall be pulled in a protective liner inside the manhole to prevent damage to the cable.

All fiber optic cables shall be terminated with ST type connector and properly connected to the fiber enclosure. Fiber cable metallic sheath if attached shall be properly grounded.

When installing fiber optic cable, in existing conduit that is not Multi-Cell or does not contain flow duct, it shall be pulled in a protective textile innerduct, minimum 3/4 inch inside diameter. When placed in a cable tray or on a runway where there is the possibility of someone standing, walking or sitting on the cable, it shall be placed inside a protective liner. When floor duct is utilized one chamber will be used exclusively for the fiber.

All cable placed along runways, relay racks and distribution shelves shall comply with the manufacturer's minimum bend radius requirements for that particular type cable. Cable is to be secured by Velcro so as not to be pulled tight at any point that causes the cable jacket to be crushed flat or indented.

Use vertical and horizontal wire management on relay racks to accommodate the fiber cable to be dressed into the fiber terminating enclosures.

Fiber optic patch cords are to be used to connect different fibers together for continuation of service. Do not wrap a jumper completely around a routing guide or other type bracket. When using routing guides on a relay rack always use the rear portion of the guides to hold vertical jumper runs and the front portion of the guides to hold horizontal jumpers. Always use the front routing guide to enter or leave a housing.

There should be a minimum 30 ft. service loop left in a TER, mounted in a circular configuration on fire rated plywood (3/4 in.) or left in the wiring tray.

All fiber strands shall be terminated in accordance with industry standards and laid out in order of industry color codes.

Label all fiber cable and each fiber strand at termination locations. Information Technology Services will provide fiber cable nomenclature.

Test all strands using an optical time domain reflectometer (OTDR) and/or optical loss test sets (OLTS). Fiber cable runs less than 100 meters in length shall be tested with an approved light meter. Provide hardcopy test results of each fiber strand to Information Technology Services. See *Section 6* for additional testing information.

10.3 UTP

All four pair UTP cable installed in the District will be at a minimum Category 6A and rated at least 500Megahertz.

All UTP riser cable installed at the District will be Category 6A rated and 100 pairs minimum.

10.4 SPECIFICATIONS

For exact specifications contact Information Technology Services.

Section 11 - MISCELLANEOUS AND SPECIAL SITUATIONS

11.1 GENERAL

11.2 WIRELESS LANS

Due to the unique nature of wireless LANs and the probable interference between access points if frequency allocations (channel assignments) are not controlled, only wireless LAN equipment installed and configured by Information Technology Services (ITS) will be permitted in the district. BASD has standardized on the Ruckus 7962 and 7982 series Access Points. This solution conforms to the IEEE 802.11a/g/n standard and is fully compliant with the Wi-Fi Alliance Wi-Fi standard.

Information for accessing the wireless network can be found at

<http://www.boyertownasd.org/Page/577>

WIRELESS LAN ACCESS POINT COVERAGE

The following are the initial starting points for the recommended number of access points to provide wireless LAN coverage in the various types of spaces in the district. A site survey is recommended during the design stage of the project to determine the recommended access point quantities and locations. The quantities stated below are initial guideline numbers only.

Section 12 - CODES, STANDARDS AND REGULATIONS

12.1 GENERAL

To design facilities for an effective telecommunications system, the designer and installer must be familiar with national and local regulations. Both the designer and the contractor must be familiar with

and adhere to the standards of the telecommunications and building industries. A designer hired by the District shall be a currently certified Registered Communication Design Consultant (RCDD).

EXTREMELY IMPORTANT:

The installing contractor and/or its designee must be a current BICSI certified installer. This is a mandatory requirement in order for the District to ensure the installation of its communication infrastructure is current with industry standards. NO exceptions will be permitted on this requirement.

12.2 AGENCIES

The following agencies and their codes, standards and regulations shall govern all telecommunications work performed at the Boyertown Area School District.

- ANSI American National Standards Institute
- BICSI Building Industry Consulting Service International
- Telecommunications Distribution Methods Manual (current edition)
- Building Officials and Code BOCA Administrators (Standard Building Code)
- EIA Electronic Industries Association
- FCC Federal Communications Commission
- International Conference of ICBO Building Officials (Uniform Building Code)
- IEEE Institute of Electrical and Electronic Engineers, Inc.
- NBC National Building Code
- NFPA National Fire Protection Association
- NEC National Electrical Code
- TIA Telecommunications Industry Association

Section 13 – STANDARDIZED EQUIPMENT

13.1 STANDARDIZED SOLUTION

The Boyertown Area School District installs a Panduit/Category 6A (tested to 500Mhz) solution. Contact Information Technology Services for product specifications. (610-473-1777)

Section 14 – INFORMATION TECHNOLOGY SERVICES INFORMATION

14.1 GENERAL

Mission

The Department of Information Technology will provide the highest quality technology-based services, in the most cost-effective manner, to facilitate the District's mission as it applies to the management, teaching, learning, and community service.

Vision

To innovate, provide and sustain resources that will allow the District to weave technology into the fabric of our work to optimize learning; increase productivity and innovation; and engage our community to maximize student achievement.

Information Technology Strategic Plan Initiatives for Communication Services

- Develop network infrastructure to support research and progressive education
- Create processes to prioritize work according to the authentic learning emphasis at the District
- Provide network infrastructure to support an anytime-anywhere education
- Develop and recommend minimal standards for video compatibility and interoperability
- Assist in planning and development of infrastructure to support Boyertown's Online Learning Environment
- Develop partnerships and joint ventures in support of instruction, research and service
- Support the district in development and communication of academic technology standards
- Provide infrastructure and support for the deployment of university wide applications including eSchool PLUS, Performance PLUS and document imaging
- Information Technology Services will continue to provide statewide leadership in delivery of information technology and networking infrastructure initiatives

Major Functions

- Information Technology Network Delivery (voice, data, and video converged networks)
- Partnerships fostered in delivery and sharing of Information Technology
- Research and Development of new Infrastructure Technologies
- Research and deployment of New Telecommunications Technologies (wireless, satellite systems, HD district television offerings, VoIP, etc.)
- FCC rules and regulatory licenses management of voice, data and video converged networks
- Network Engineering and Management Center (Voice, data, video converged networks)
- Long distance service delivery and account management

Services/Activities

- Provide efficient and effective delivery of and access to information technologies (Voice, Data, and Video converged networks)
- Assist customers in the efficient delivery of and access to information and network design
- Research, develop, and deploy effective networking and infrastructure standards

- Provide network management and engineering services for all control, scheduling, operations, switching, and change management of the voice, data, and video distribution and infrastructure
- Design, maintain and manage the installation of all cable, fiber, coax, and other network infrastructure facilities to support the campus community
- Coordinate and manage technology leasing, billing services
- Investigate and evaluate new network and telecommunication services and products in order to provide efficient and cost-effective technology solutions for the District
- Provide overall management for all communication services, account management, and billing

Customers

Information Technology Services' customers include those members of the Boyertown community and other external associates seeking assistance in regard to the above services and activities

14.2 CONTACTS

A list of contacts and telephone numbers is provided for your convenience.

INFORMATION TECHNOLOGY SERVICES (ITS)

Director of Information Technology – Scott D Major: 610-473-3501

Department Secretary – Bobbie Eddinger: 610-473-1777

ITS CUSTOMER SUPPORT

Support Center: 610-473-3503 – For information regarding Service Request status, call directors.

ITS NETWORK FACILITIES and MANAGEMENT – For information regarding VLANs, VPNs, Internet connectivity, WAN connectivity, LAN connectivity, low voltage structured cabling systems, wireless access and communication duct systems.

Network Administrator - John Saugling: 610-473-3504

Network Technician - Aaron Scott: 610-473-3972

ITS APPLICATIONS SERVICES – For information regarding VoIP, Lync and Email.

Sr. Systems Administrator - Chase Roth: 610-473-3502

Jr. Systems Administrator - Kelley Catagnus: 610-473-5390