Telecommunications/Networking/Special Projects

Design and Installation Standards Policy

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Notes
This document is reviewed and revised annually.

The vertical line in the left margin indicates a change from the previous revision.

Changes of note in this revision is the newly formed Information Technology Services (ITS) replaces Office of Information Technology (OIT). ITS now includes all of the former OIT divisions as well as Academic Technology Support (ATS), and eLearning.

OIT has been replaced with ITS in this document, without the vertical line in the left margin calling it out.

Sec 1.7, Special Note to Architect, Engineers and General Contractors has been rewritten so not to be in conflict with TBR Policies.
Introduction

**Telecommunications**: Any transmission, emission, and reception of signs, signals, writings, images, and sounds, that is, information of any nature by cable, radio, optical, or other electromagnetic systems.

The intent of this policy is to provide recommended practices for the design and installation of ETSU’s Telecommunications infrastructure that will support a wide variety of existing and future services, using industry accepted design and installation methods. ETSU attempts to define standards that will enable the design and implementation of structured cabling systems for commercial buildings and between buildings in a campus environment. ETSU recognizes and adopts for itself the telecommunications industry standards, codes and practices as defined in the agencies listed in Section 1. ETSU intends to build an ITS system that is vendor neutral and standards based.

This policy is intended to answer FAQ of ETSU ITS’ infrastructure practices and not to be a substitute for knowledge of industry accepted practices, standards and codes. This policy is NOT intended to be used in lieu of a construction specification document, but be an addition to the specifications.

This policy is to be followed by all projects involving Telecommunications including SBC, TBR and in house projects.

Communications technologies are complex. They **shall be designed and installed by experienced professionals**. Telecommunications shall be considered a fourth utility, to be designed, funded and installed with the same importance as Electrical, Plumbing and HVAC. The designer has the responsibility of providing a design using accepted engineering and architectural practices. ETSU ITS strongly recommends a Registered Communications Distribution Designer (RCDD) to be used as a consultant for the design of the telecommunications. In many cases the need will arise to consult with other engineers from other trades or areas of expertise.

ETSU ITS supports or aids in the delivery of telecommunications for a wide variety of services and spaces, on and off campus, the growing list, such as;

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ETSU ITS will have final review, approval and be the acceptance authority for all telecommunications infrastructure, designs, installations, materials and methods, in all phases of the design and installation process.

ETSU Facilities Management and ITS intend to work in a “team” atmosphere with all parties. Our goal is to build a quality Telecommunications Infrastructure, by partnering with the design team, consultants and contractors. It is encouraged for all parties to ask questions and/or resolve conflicts in a professional, reasonable and timely matter.

**CAT5e and CAT6 Installations:**
Installers shall be certified by the manufacture of the system(s) they are installing and be able to certify the installation for the manufacturer’s warranty. Hubbell Premise Wiring will be the benchmarked used for equal or equivalent for material, methods and warranties for copper solutions. ETSU ITS will be the evaluator of authority in determining any possible substitutions.

**Fiber Optic, Coax, Audio Video and other low voltage installations:**
Installers must install the system(s) per Manufacturer’s specifications, this Policy’s methods, and Industry standards. Test per BICSI’s recommendations and methods. See Commissioning and Warranties for details on testing.

Installers must have:
- The necessary tools and calibrated test equipment
- Trained technicians to operate the equipment
- Have the ability to test, record and produce drawings
- Provide material that is new and free of defects, delivered to the job site in the original packing.
- It is recommended that a RCDD be assigned as a Project Manager

Installers to be professional:
- In their interactions with Faculty, Staff and Students.
- In their appearance. No objectionable graphics or language on clothing.
- Follow Campus rules as in the No Tobacco and Parking Policies.

This standard / policy will change to meet industry recognized standards. The designer, consultants and installers are responsible for inquiring about updates. The most recent edition of the Telecommunications Design and Installation Standards Policy is available at [http://www.etsu.edu/its](http://www.etsu.edu/its) under “Policies” for any vendor (General, Electrical, HVAC, Security, Telecommunications and Fire Alarm Contractors) to download.
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1. Design and Installation Codes and Standards

The purpose of codes, in general, is for the practical safeguarding of persons and property from hazards and to ensure the quality of construction. Standards are requirements affecting the performance of a given system. As defined in the TIA Engineering Manual, a standard is “A document that establishes engineering and technical requirements for the processes, procedures, practices and methods that have been adopted by consensus. Standards may also be established for selection, application and design criteria for material.”

It is expected that the Telecommunications Infrastructure be designed and installed to the following codes, standards and practices (current editions):

Be aware that these codes and standards are updated regularly. However, these codes and standards do not necessarily coincide with each others’ revision dates. It is the responsibility of the designer, contractor and installer to be aware of any changes and be governed by these new issues when required.

- ANSI/TIA-569-C, Pathway and Spaces.
  568-C.1 Commercial Building Cabling
  568-C.2 Copper Cabling Components
  568-C.3 Fiber Cabling Components
  568-C.4 Coax Cabling Component
- ANSI/TIA- 606-B, Addendum 1, Administration Standard for Commercial Telecommunications Infrastructure.
- ANSI/TIA-607-B, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- ANSI/TIA-942-A Telecommunications Infrastructure Standard for Data Centers
- ANSI/BICSI 002-2014 Data Center Design and Implementation Best Practices
- ANSI/TIA 1179, Healthcare Infrastructure Standard
- ANSI/EIA/ECA 310-E, Cabinets, Racks, Panels and associated Equipment
- ANSI/SCTE 74 2003, Specification for braided 75 ohm Flexible Coaxial Cable
- FCC Part 68, Connection of Terminal Equipment to the Telephone Network.
- FCC – CC Docket 88-57 (Min demarcation location and type)
- FCC Part 76, Cable Television Service.
- ADA of 2010 and Telecommunications Act of 1996, Physically Impaired and Accessibility.
- IEEE 802.3.xx, Physical and Data Link layer standards for LAN’s, includes Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet.
- IEEE 802.11. xx, Wireless LANs.
- IEEE 802.16, Broadband Wireless Metropolitan Area Networks
- (NFPA-70) NEC-2008. (National Electrical Code )
- NFPA 76, Recommended Practice for Fire Protection of Telecommunications Facilities.
- NFPA 99, Healthcare Facilities Code
- ETA Electronic Technician Assoc. Fiber Optics Installer
- FOA Fiber Optic Assoc. Certified Fiber Optics Technician
- I.B.C. International Building Code
- UL1069, Hospital Signaling and Nurse Call Equipment
- UL2560, Assisted and Independent Living Emergency Call Systems
- ANSI/SCTE 77 Underground Enclosure Integrity
- IEC-61300-3-35 Fiber Optic Connector Endface Visual and Automated Inspection
- ANSI/ESD S7.1-2005 Anti-Static Discharge Flooring
- ANSI/ESD S6.1-2009 Anti-Static Discharge Grounding
- All applicable State, Municipal & Campus codes, standards and statutes.
1.1 ETSU ITS Requirements

The design team shall consult with ETSU ITS for specific needs and practices. These include implementation of Voice over Internet Protocol (VoIP), LAN Security Cameras, LAN equipment, Wireless LAN, Classroom setup and equipment, the use of CAT5E or CAT6, Fiber Optic type and count, CATV etc.

1.2 Standards Variance

If the need ever arises that a standard cannot be met, during the design or installation, a “Standards Variance Form” must be filled out and sent to the ETSU Project Coordinator who will deliver to ETSU ITS for approval or denial. A copy of this form can be found in Appendix C.

1.3 Equal or Equivalent / Submittals

Submittals play a critical role in construction. During construction, submittals confirm the contractor has met the designer’s and owner’s intent. Post construction, they serve as part of the as-built resource. Submittals’ shall be submitted in such a way as there is a clear indication of what is being submitted i.e. by circling (not highlighting), manufactures part numbers (not distributors’ numbers), in a legible manner. ETSU has standardized on a number of performance and warranties criteria relating to the campus network infrastructure. ETSU requires the use of the specified products to be used as a benchmark for equal or equivalent (terminology such as “similar” are not to be used). Submittals for any possible substitutions must be submitted to ETSU ITS before the bid process and be consistent with the language of the bid document. The submittals must include full specifications and warranties and verified with a recognized testing laboratory such as UL or ETL.

All communications submittals shall be reviewed and approved prior to their procurement and installation. Submittals shall be provided to ETSU in it’s entirely (including re-submittals) in both printed and PDF formats. No partial submittals accepted without prior permission.
1.4 Master Format 2004/2014

The Construction Specification shall follow the MasterFormat 2004/2011 numbers and titles. Most of the specifications for Telecommunications will be found in Section 27. There are instances where Telecommunications related work will fall into other sections. An example is to keep conduit and pull boxes requirements for Telecommunications in Section 27 and reference them in Section 26 to “see Section 27 05 33”. There are main sections, as in the following:

- 27 00 00 General Communications Requirements
- 27 20 00 Data Communications
- 27 30 00 Voice Communications
- 27 40 00 Audio – Video, MATV Communications
- 27 50 00 Monitoring Systems Communications

Each of these main sections will have many sub sections. The Construction Specifications must include all sections and sub sections that will have any active role in the project and only the specifications related to the project. Each section shall be formatted with:

- **Part 1 General**
  - Summary
  - Codes, Standards, Guidelines (this Standard)
  - Definitions (Warranties, Installers Certifications and Qualifications. Segregation of work; Electrical vs. Telecom, Telecom vs. Fire Alarm, Security AV etc.)
  - Submittals, product info and shop drawings

- **Part 2 Products**
  - List out specific products with manufacturer and part number

- **Part 3 Execution**
  - General installation instructions
  - Specific instructions per product
Examples of Specific Sub Sections to specified:

- 27 05 05 Selective Demolition for Communications
- 27 05 26 Grounding and Bonding
- 27 05 29 Hangers and Supports
- 27 05 33 Conduits and Backboxes
- 27 05 36 Cable trays
- 27 05 53 Identification
- 27 06 00 Schedules for Communications
- 27 08 00 Commissioning and Testing
- 27 11 00 Equipment Room
  - 27 11 13 Entrance Protection
  - 27 11 16 Racks and Frames
  - 27 11 19 Termination Blocks and Patch Panels
- 27 15 00 Horizontal Cabling
  - 27 15 00.19 Data Cabling
  - 27 15 43 Faceplates and Connectors

1.5 T-Drawings

Telecommunications drawings shall be identified as “T” series (Telecommunications) drawings in the approved construction drawings, separated from “E” (Electrical) drawings. The T-series drawings shall include:

- Floor layout, showing work outlets, cable path (j-hooks or cable tray, horizontal and riser), sleeves, conduits.
- Legends, use industry standard symbols and legends, (Appendix G)
- Telecommunications room layout / elevations (Appendix B)
- Equipment rack layout (Appendix K, K-2 & K-3)
- Detailed work area outlet with labeling (Appendix M & P)
- Riser diagram and cabling for voice, data and CATV (Appendix N)
- Outside plant, cabling, methods and paths, with footages and bends (Appendix O)
- Schedule of jacks and rooms (Appendix L)
- Pull Box detail (Appendix F)
- Grounding and Bonding (Appendix E, E-1 & E-2)
- Multimedia Box detail and elevation (Appendix Q)
- Floor Box and Poke Through details (Appendix Q-1)
1.6 Bid Documents

Prior to bid, both the construction specifications (Division 27) and the T-Drawings must be approved by ETSU ITS by formally approving the CD Drawings. Allow time for corrections to be made and not delay the project schedule.

1.7 Special Note to Architect, Engineers and General Contractors

In the State of Tennessee’s Cabling Standards 5/4/2004, it states, “Telecommunications cabling infrastructure must be planned for and funded with the same level of importance and over similar time horizons as all other utilities.” “We are no longer in a world where telecommunications abilities are viewed as a luxury; they are now a necessity to conduct everyday business. The industry now views telecommunications “structured cabling” as the “Fourth Utility” along with Plumbing, Electrical, and HVAC.” In addition to the State’s views, the manufacturer requires the design and the installation of the pathways to meet their requirements to obtain the warranty.

The Telecommunications Contractor shall take charge of this fourth utility. The General Contractor is responsible for the installation for all work including the telecommunications work, which includes all pathways, spaces, conduits, trays, sleeves, etc. The Telecommunications Contractor shall be made available at all progress meetings with the owner once their works begins and be available to discuss the installation with the owner with reasonable notice. The Telecommunications Contractor must have the unrestricted means of requesting information, asking and answering questions. The Telecommunications Contractor, Electrical Contractor, General Contractor, Architect, Electrical Engineer, Mechanical Engineer, ETSU ITS and Facilities must work in a team environment. It will take all trades, designers, and engineers to build an industry standard telecommunication infrastructure. The Telecommunications Contractor along with the General Contractor must take full responsibility for the installation of the telecommunications infrastructure to obtain the manufacturer’s warranty.

It is highly recommended that the Telecommunications be designed by a RCDD. If not, the engineer shall consult with representatives of the manufacturer and have clear knowledge of the installation practices for the manufacture’s products as well as to industry standards.
2. **Telecommunications Spaces and Pathways**

2.1 **Entrance Facility (EF)**

- An EF is a space where telecommunications outside plant (OSP) terminates to the inside facilities. The outside plant will most likely be fiber optics LAN, CATV coax, UTP telephone and MaxCell innerduct. (27 11 13)
- The EF may be in its own space or share a space inside an Equipment Room (ER).
- OSP cables routed inside a building are influenced by fire codes. The designer should be aware of and adhere to local codes, standards and regulations that might be more stringent than ETSU’s recommendation.
- ETSU recommends that OSP cable be terminated or transitioned to listed cable as close as practical upon entry to the building. In no case must this termination or transition exceed 50 feet from point of entrance for exposed cable. The designer may extend the point of entry by enclosing the unlisted outside cables in a rigid or intermediate metal conduit that extends beyond the wall or floor of the building and is properly sealed and bonded to a grounding electrode. At no point shall this cable be exposed prior to the termination point.
- The space needed for the EF is determined by the amount of terminations and if it is shared or not in the same room as the ER.
- The Entrance Facility shall be defined in specifications and T drawings as “EF”.

2.2 **Equipment Room (ER) & Telecommunications Room (TR)**

2.2a **ER/TR Layout**

Ideally the ER/TR’s should be located in center of building and be stacked directly above and below each other floor to floor. ER/TR’s shall be located so that access is made directly from a public or common hallway. Access shall not interrupt normal business, workflow of occupants.

The ER/TR shall be rectangular in shape. Triangle, L-shape and curved walls are not acceptable. There shall be one ER per building and one TR per floor, vertically aligned. Designs other than this arrangement must be approved via the Standards Variance form in Appendix C.

When the designer does not know the specific equipment that will be housed in the ER/TR, the designer can take the following steps in determining the size of the ER. Deduct all of the core areas from the total square footage the room will serve. If core areas are not known, divide the total square footage by 20%.
- If the floor serving area is 5,000ft² or less, size the room 10’ X 8’
• If the floor serving area is 5,000ft² to 8,000ft², size the room 10’ X 9’
• If the floor serving area is 8,000ft² to 10,000ft², size the room 10’ X 11’
• If the floor serving area is 10,000ft² to 20,000ft², size the room 10’ X 15’
• It is not recommended by ETSU ITS to house other services in the Telecommunications Rooms, due to network security. If other services such as Fire Alarm panels or CBord panels have to be housed in an ER or TR, (see Appendix C, Standards Variance Form) increase the size of the room 20%.
• NOTE: Designer must consult with ETSU Facilities Management and ITS before initial space planning for the ER/TR. Special conditions exist, as dictated by industry standards that can greatly increase the needed space requirements of these rooms based on use and construction types. (Medical, Classrooms, Labs, Law Enforcement, etc.).

Equipment not related to the support of the ER/TR (e.g., piping, ductwork, pneumatic tubing, etc.) shall not be installed in, pass through, or enter the ER/TR. The ceiling must be free and clear of any obstructions including architectural / structural members not directly related to the ER/TR.

Ceiling heights in an ER/TR is recommended to be 10’ maximum. No acoustical / false ceilings lay in tile, or suspended ceiling grid are permitted in the ER/TR or any other areas designed or designated for the distribution of communications cabling or equipment. All ceilings in the ER/TR shall be constructed of solid gypsum or other approved material. Walls shall extend from floor to ceiling. Conduits and sleeves must enter below ceiling and above ladder tray.

Doors shall be a minimum of 36” wide and 7’6” tall. Doors must swing out of room or increase room size 3’. Doors shall be secured with Onity card reader locks.

Floors are to meet ESD standards (electrostatic discharge), developed by the ESD Assoc.(ANSI/ESD S7.1-2005 Flooring and ANSI/ESD S6.1.2009 Grounding) to prevent static damage to equipment. Light in color to enhance lighting and be either VCT or treated / painted concrete to prevent dust. A Rack Base Insulator Kit must be installed at the base of each rack to isolate the racks from the floor.

There should not be any windows in an ER/TR. If there is, they must be sealed to prevent opening and equipped with blinds.

There will be a minimum of two network racks with vertical wire management per ER/TR, each rack has a footprint of 2’X 2’ and shall be
bolted and bonded together. One rack is for cabling and the other for 
equipment. There shall be a minimum of 3 ft. clearance around all sides 
of the connected racks, measured from equipment mounted on wall, not 
the wall itself (see Appendix B). Install appropriate 24-port or 48-port 
patch panels in the cabling rack and fiber optic patch panel in the 
equipment rack. There shall be horizontal wire management for patch 
panels, one installed above and the other underneath the patch panel. 
Provide and install rear cable management bar for strain relief at each 
patch panel. Cables shall be dressed and terminated evenly 50/50 split left 
and right in groups of 48 or 24 depending on the numbers of ports of the 
patch panel. Racks shall be labeled top and bottom, front and back, to 
TIA-606B standards. When determining the port quantities add 25% for 
future growth.

A minimum of 18” wide ladder tray shall be installed around room and to 
each rack.

All walls shall be covered with ¾” AC grade plywood (“C” side facing the 
wall), covered on all 6 sides with two coats of fire retardant, light colored 
paint. See Appendix A for paint part number. Plywood shall be above 
electrical outlets (17” above finished floor typical) and extend to above 
ladder tray.

Terminate traditional phone on plywood with 110 blocks, with the copper 
UTP riser/backbone cables. VoIP, terminate on the network patch panels. 
In many cases, VoIP cabling will be traditional data cabling, with the 
designation determined by ITS (not the installer) after installation.

2.2b ER/TR HVAC

Today’s network equipment consumes more power and generates more 
heat than yesterday’s equipment. It is safe to say tomorrow’s equipment 
will also increase power and heat from today’s equipment. It is important 
to design for future growth of added equipment and network equipment 
upgrades. Design for a minimum of 5,000 BTU’s from equipment, for up 
to 144 data outlets, add 1,000 BTU’s for every 48 additional outlets 
served. HVAC shall be provided on a 24 hours-per-day, 365 days-per 
year basis. A stand-alone unit should be considered. When building is 
being backed up by generated power, it is required that the ER/TR’s 
HVAC be tied into the back up power, to keep the life safety network and 
telephones working during a power outage.

- The temperature and humidity shall be controlled to provide 
  continuous operating ranges of 68° F to 77° F with 40% to 55% 
  relative humidity.
• The ambient temperature and humidity shall be measured at a distance of 5 ft. above floor level, after equipment is in operation, at any point along an equipment aisle centerline.
• When a UPS system is installed in the ER, the engineer will need to factor in the units BTU’s.
• The ER/TR shall have positive air pressure with at least one air change per hour.
• When split systems are specified for the ER/TR, those systems shall be provided with a manufacturer-specified auto restart function to ensure the unit comes back on fully functional automatically after a power failure. Manual restart after a power interruption is not acceptable.

2.2c ER/TR Power Requirements

• It is highly recommended that the electrical feed to the ER/TR be backed up by a generator, including all convenience outlets.
• When generator power is provided to the building: All power, including power to all mechanical systems, in the ER/TR shall be installed to the buildings generator. All electrical outlets hooked to the generator must be red in color with red faceplates. Circuit ID to be labeled on faceplate.
• Outlets and faceplates with a generator feed shall be red.
• A separate supply circuit serving the ER/TR shall be provided and terminated in its own electrical panel inside the ER/TR.
• A minimum of two dedicated nonswitched 3-wire, NEMA 20 amp, 120Vac duplex electrical receptacle for equipment power, each on separate branch circuits. These outlets shall be mounted to the equipment rack vertical wire manager at 3’6” AFF. (Not the cabling rack). All electrical circuits installed on the equipment rack shall be installed from ceiling space down to elevation specified.
• Separate quad 120Vac convenience outlets for tools, test equipment etc., placed at maximum of 6’ (wall space) intervals around perimeter of room and below the plywood.
• Grounding and bonding shall be in accordance with ANSI/TIA-607-B standard.
• Follow manufactures recommendations for power needs of a UPS system.

2.2d ER/TR Lighting

• Provide a minimum of 500 lux (50 foot-candles) measured 3’ above finish floor.
• Locate light(s) 8.5’ above finished floor.
• Power for lighting should not come from the power panel located inside the ER.
• At least one light to be powered from generator.
• The walls and ceiling of the ER/TR shall be painted in light colored paint to enhance lighting.
• Coordinate the lighting layout with equipment layout, especially ladder trays.

2.3 Telecommunications Enclosures (TE)

A TE should serve an area not greater than 3600ft² and only to be used if a TR is not available or impractical. ETSU ITS will determine the size and if a TE is to be used. The TE is not to be installed in furniture systems. The TE should be accessible and controlled against unauthorized access.

If active equipment is to be housed in the TE:

• A minimum of one dedicated 120V, 20 amp, nonswitched, duplex electrical outlet receptacle should be provided.
• Sufficient number of air changes. Refer to equipment manufacturer for Standards.
• Must be bonded and grounded per ANSI J-STD-607-A.
• Doors hinged or removable to open at least 90°.
• Light measured within the TE should be a minimum of 500 lux (50 foot-candles).
• TE’s must not be used in lieu of a TR on a given floor.

2.4 Telecommunications Pathways

When designing a telecommunications pathway system, it is important to consider the design’s ability to:

• Accommodate cabling changes
• Minimize occupant disruption when pathways are accessed
• Facilitate the ongoing maintenance of cabling

The designer should locate telecommunications pathways away from sources of Electromagnetic Interference (EMI), including:

• Electrical power cables and transformers
• Radio frequency (RF) sources
• Motors and generators
• Induction Heaters
• Arc welders
• X-Ray equipment
• Photocopy equipment
The designer should plan for a pathway capacity that accommodates a minimum of three cables per every WAO. Although a minimum of only two cables is required, additional capacity would facilitate additions and changes to user needs and as applications evolve.

2.4a Conduits and Sleeves

- Vertically aligned TR’s with connecting sleeves are the most common type of backbone pathway.
- There shall be a minimum of three 4” conduit sleeves between each TR. (one filled with 2 3X3 MaxCell, each with their own color ID).
- No more than two 90° bends or a total of 180°
- Be less than 100’ in distance
- If over 100’ and or more than 180°, install a 31” wide X 60” length X 8” deep Pull Box (PB).
- The PB needs to be located in an accessible area.
- A PB is not to be used in lieu of a bend. Conduits are to enter and exit the PB in an aligned fashion.
- Empty conduits over 1” shall have a minimum 3/8” nylon rope pull line rated for 200lb. test. Conduits 1” and less shall have a polyline (Greenlee 430) installed.
- If more than 1 conduit in a room, install different colored polyline or rope.
- Conduits in the EF/ER/TR shall extend at least 3” and no more than 4” from floor, wall or ceiling.
- Adhere to the BICSI TDMM for conduit fill capacity.
- All WAO are to be fed within a minimum of 1” metal conduit. Consult ETSU ITS on conduit sizing prior to design installation.
- All conduits must be installed per NEC 2008 and be terminated into a box or bushing prior to cabling. See Appendix P for more detail.
- When determining the size conduit sleeve from corridor to office or room, add up all the WAO and times by three to get the number of cables and design for 40% fill and 25% growth. Minimum conduit sleeve (only 1 WAO) is 1”. Multiple conduit sleeves are acceptable.
- All conduits shall be labeled, to/from.
- Conduit interior shall be fire stopped with Hilti CP-618. Exterior, around conduit, fire stop with Hilti CP-601S.
- Conduits shall be inspected by ETSU ITS prior to installation of cables.
### 2.4b  Cable Management Systems

Ladder tray or baskets for backbone and horizontal cabling shall be sized appropriately (allow 25% growth) and have a 2” minimum depth. All ER/TR’s shall have ladder tray with a minimum width of 18”, around perimeter of room, with branches off to each network rack and bonded to an approved ground. All CAT6 installations shall be installed in ladder tray or basket. Ladder tray shall be located a minimum of 3” above ceiling tile and have a minimum of 12” of unobstructed access above tray. When designing the layout of the ladder tray, the designer should ensure that other building components (e.g., lighting fixtures, structural supports, air ducts) do not restrict access to the ladder tray. Wire basket must be cut using cutting tool for wire basket and not bolt cutters, see Appendix A.

### 2.4c  J-Hooks

J-Hooks are to be used in CAT5E installations. Use appropriate size J-Hooks with a maximum of 40 CAT5E cables in any J-Hook, regardless of the J-Hook’s manufacturer’s specifications. When there are more than 40 CAT5E cables, ladder tray, wire basket or multiple J-Hook paths are required. J-Hooks for CAT6 is limited to maximum of 10 cables. All cables (CAT5E, CAT6, Coax) must be secured every 4’-5’, anchor J-hooks to studs.

### 2.5  Outside Plant (OSP)

Before designing any OSP, the designer and or consultants will need to meet with ETSU ITS for system requirements and methods. All OSP at ETSU is underground and in conduit. No aerial and no direct bury. The contractor shall be responsible with all conditions, duties and liabilities as respects to utility and underground locating prior to any work and all associated / required permissions for work and consulting with all parties of vested interest throughout the design and construction process. Tennessee Board of Regents policies shall supersede if any conflicts arise. See additional TBR documents for details. Underground requirements:

- 4” PVC Schedule 40 conduit for most applications.
- 4” PVC Schedule 80 conduit under parking lots, streets and driveways.
- A minimum of 24” from top of conduit to finished grade.
- Minimum of 12” of well tamped earth or minimum of 3” concrete separation from electrical power, 24” from steam lines.
- Minimum of three 4” conduits from Handholes (HH) to HH.
- Minimum of three 4” conduits from HH to Building. ETSU ITS will determine if more are required.
- At least one of the 4” conduits is to have two 3X3 MaxCell MXD detectable installed. Each MaxCell is to have different color ID markings. MaxCell must be installed to manufacturer’s instruction including the use of ball bearing swivels and the MaxCell’s pull tapes must remain free floating throughout installation. (Plastic flexible inner duct not allowed).
- Install cables in the center cell of the MaxCell first.
- All conduits (including when filled with MaxCell) are to have a pull rope (no strings) installed.
- Conduits entering the buildings must be sloped away from building.
- HH’s are to be open bottom (on top of 4” of rock), with a minimum size of 30” X 48”, cover labeled “Communications”. Cover to have pull slot with center pin.
- HH’s are to be installed at a maximum distance of 150’ intervals for straight runs. This distance could be shorter after calculating bends and cable pulling tensions.
- No 90° bends in conduit. Communications sweeps are to be used.
- No “elbows or LB’s” (Smart LB allowed, see appendix H), terminate conduit in an appropriate sized pull box (PB).
- When tying into an existing HH, first consult with ETSU ITS to determine if a HH needs to be replaced with a larger size.
- When entering a HH, with conduit, enter minimum of 24” below finished grade, do not drill or punch holes in sides of HH higher than 24”. Do not stub up in center area of HH, see Appendix F. A HH is not to be used in lieu of a bend, see Appendix F & F1.
- HH’s are not to be installed in streets or parking lots. If one has to be installed in traffic areas, it must meet AASHTO H20 standards.
- Conduits are to be free of debris and water. Seal conduits with pliable / non-hardening duct seal to keep out rodents and moisture (Ideal 31-605 or Gardner Bender GB-DS-110N or equivalent).
- Cabling is to be neat and professional inside HH & PB’s. Route and secure cables around edges to free up room for future cabling.
- All cables are to be labeled inside HH or PB. Consult ETSU ITS.
- All cables (ISP & OSP) shall be permanently labeled within 1” of the end of the cable at the point of termination.
- Every other HH is to have a 25’ maintenance loop for fiber optics. Secure loop to side of HH.
- Install “Caution Fiber Optics” detectable Orange tape, along the cable pathway in one continuous piece, 12” below the final grade.
- When splicing is necessary, use approved splicing methods and enclosures. All coax connectors are to be enclosed with heat shrink, with at least 2” of shrink tube covering outer jacket. Use flame spread head to avoid scorching and melting center dielectric. Consult with ETSU ITS before any splicing is designed or requested.
- Before backfill, all underground installations must pass ETSU ITS inspections.
3. **Horizontal Cabling**

3.1a 100 ohm UTP CAT5e / CAT6

Prior to design, the designer and or consultant must meet with ETSU ITS to determine applications, methods and material.

The maximum **cable distance** from the ER/TR to the WAO is 90m (295’). When deductions are made for mandatory minimum slack, the cable distance is approximately 85m (281’).

- Cable slack in the ER/TR, minimum of 3m (10’). Above WAO, 1m (3.28’), and at the WAO for termination 8”. Cable slack should not be stored in bundled loops. Cable loops have a degrading effect on cabling performance. Cable slack should be stored in an extended loop or in a figure-eight configuration.
- All UTP terminations shall be done to TIA-568-C.2 Section 5.7.5 as **T-568A** scheme for pin/pair assignments.
- J-Hooks are allowed for CAT5E cabling, with 40 cable limit and CAT6 with a 10 cable limit.
- No splices in telecommunications copper cabling.
- Flexible metallic conduit or plastic tubing not allowed. Short lengths of smooth flexible Non-Metallic Conduit is allowed when the size is increased 1 trade size, with prior ITS approval.
- No vinyl cable ties are permitted in EF/ER/TR/TE. Contractor shall provide and install approved Velcro strips for securing cables in the EF/ER/TR/TE.
Installers are responsible when pulling cables through conduit or sleeves that are installed by themselves or others. Installations that do not meet standards or codes (Section 1), shall be redone at the discretion and direction of ITS. This includes,

- Fill percent
- Conduit size,
- Number of bends between pull points,
- Improper pull box and or size,
- Conduit ends not terminated properly with bushings or connectors.
- Installers are responsible of maintaining proper clearances above ceiling tile and away from EMI sources.
- Installers shall not use other trade’s pathways or allow them to use theirs.

Before any terminations and installation of equipment, the EF/ER/TR must be in its finished stage. Free of dust and debris with all walls and ceiling painted to finish coat and floors installed or treated. This will need to be coordinated with the building / project schedule for Fire Alarm, Elevator, Building Automation Systems and Access Controls testing, inspections and certifications. General Contractor is responsible for dust, debris and moisture. After terminations and equipment are installed, the EF/ER/TR’s door must be kept closed and locked at all times. If dust and debris occurs after terminations, the terminations will have to be re-terminated and tested.

All work is subject to inspection and review at anytime by qualified ETSU personnel.

All rough in work will be inspected by ETSU personnel before finished walls and ceilings are installed.

Final walk through inspections must be done prior to turning in final documentation and test results. The preliminary documentations will be made available for review during this walk through inspection. Cables with visible defects, kinks, twists, crushed, cuts or smashed will be replaced regardless if they pass tests.

Installer must take reasonable steps to protect their installation in a construction environment. Free of dirt, defects and debris.

### 3.1b Coaxial Cable

All CATV installations shall comply with FCC Part 76 signal leakage requirements.
Coax must be installed free of kinks, dents or any physical damage.

There shall not be more than two CATV amplifiers in cascade in a building. Design the CATV system to a minimum of 750MHZ.

Design for range of 3dBmV to 10dBmV signal at the CATV outlet. No more than 17dBmV signal on an F-fitting.

All CATV drops are to be home run from TR to outlet, no series wiring.

As part of the submittal process, CATV termination tools and test equipment (field strength meter, TDR) must be listed and approved.

3.1c Work Area Outlets (WAO)

Angled 4 port, electrical ivory faceplates are the standard faceplate used in Administration, Classroom, Mechanical and Building Automation spaces. 1 or 2 port flat faceplates are used in student rooms. Angled faceplates are only to be used in the vertical position. The use of other type or color faceplates will be determined on a case by case basis and shall have prior approval from ITS. ETSU has standardized on the colors of the jacks. CAT5e data jacks are to be blue. CAT6 data jacks are to be orange. Special circuits are to be yellow. Existing legacy phone jacks are white. On new installations, all drops are to be considered data unless noted otherwise. See Appendix P for outlet detail.

3.1d Office Space

Each office space is to have a minimum of two WAO’s, one with 2 data cables fed within a 1” conduit, a second blank outlet on opposite wall for future or additional cabling. Cable offices by, routing cable to center of office before installing to WAO so the cables can be used in either WAO. Department Heads that will actually occupy the space will need to be consulted with to insure their needs are met. Network printers and fax machines locations often get overlooked.

3.1e Modular Furniture

Telecommunications and Power distribution planning should be coordinated to avoid conflicting pathway assignments. Untried distribution or terminations strategies should be avoided. Permanent cables shall be installed only in or on permanent walls. All modular furniture shall be fed from a “Consolidation Point” (CP). No direct horizontal cabling. Horizontal cables do not terminate in modular
furniture. Locate CP in an accessible area free from workstations and heavy file cabinets. Cabling from CP to modular furniture shall be through a service pole or through the wall if not blocked from furniture. Do not block access to horizontal cabling pathways or outlets. No cabling or WAO allowed behind modular furniture. Label “Consolidation Point” with adhesive label on ceiling grid where the CP is installed. Designer must calculate the maximum cables capacity allowed in the modular furniture’s raceway and feed with multiple service poles if necessary.

3.1f Multi Media Classroom / Labs

The designer will need to consult with ETSU ITS’ Special Project Manager for design specifications for Classrooms and Computer Labs.

With the introduction of digital audio\visual and sun setting analog, all classrooms will be compliant with High-bandwidth Digital Content Protection (HDCP) using High-Definition Multi Interface (HDMI) components. Components will be controlled by a Crestron processor\switcher and use Crestron’s proprietary cable DM-CBL-8G as the backbone for transmitting digital audio\visual signaling and control.

Multi Media design, installation, cabling, materials and methods, shall be done to the standards of ANSI/InfoComm Audiovisual Standards, and Accredited Standards Developer (ASD). Multi Media requirements include:

- Lectern with dedicated power
- Five networking drops
- Projectors or large displays with dedicated power
- Zoned fluorescent lighting
- Zoned canned dimmable LED type lights
- Dimmable track lighting for Instructor
- Crestron Control Systems
- Digital Components
- White Boards/ Smart Boards / Screens
- Document Cameras
- Overhead speakers and projectors, secured to ceiling with safety wire
- A chase to house an 8” X 8” electrical box fed with 2” conduit for signal and 2” conduit for data, extended 4” above chase wall.
- Multi Media wall plates, connectors and cables.
- Blackout Shades

**ITV/ distance learning/ e-learning.**

**Special room lighting, sound and carpet considerations**

- Ideally ITV room should be sound reinforced with carpet and acoustical panels.
- Dedicated power for lectern equipment, projector and displays
- Zoned lighting Fluorescent Lighting
- Zoned canned LED type lights
- Dimmable track light for instructor
- Blackout Shades

**Computer Labs:**

- Raceway to house both electrical and data separately, utilizing Hubbell plates and connectors installed with T-Series Panduit, elevation dependent upon computer-lab table model.

3.1.1g **Residence Life (Housing)**

Each student bedroom is to have two data cables and one CATV outlet. The data and CATV WAO’s shall be in separate outlets. Each living room shall have a minimum of one CATV outlet. See Appendix A for data/phone and CATV faceplates and jacks.

When there is more than one CATV drop in a Housing unit, residential wiring scheme is permitted for CATV. Run one CATV drop to unit and split signal to other outlets in unit through ¾” conduits. Locate in wall box near electrical panel secure splitter to back of box and bond to electrical panel with #14 AWG green insulated wire.

The main entrances to a housing building shall be equipped with an outside weatherproof wall or pedestal mounted Emergency Phone. Locate phone near card reader door access.
3.1h Conference Rooms

Each conference room shall have a minimum of two WAO on opposite walls consisting of two data and one CATV cable. One of these two can be installed in same faceplate as the multi media. A floor box consisting of a duplex electrical outlet, 6 communications (combination data, voice, audio, video). Wall plate, HDMI, VGA, 3.5mm audio, data, CATV. Locate all wall WAO’s near electrical outlets. Cabling from wall plate to floor box, shall be housed into either 2(two) 3/4:” or 1 (one) 1 ½” conduit for the HDMI, VGA, 3.5mm cables. One separate ¾” conduit for data and voice. Table shall have HDMI, VGA, 3.5mm audio, 2 duplex electric, data and voice. It is recommended that the conference room table have cable management and cutouts or “pop-up” surface boxes for electrical, data and USB charging to eliminate cables routed over the top and through seating areas.

- Poke Through Floor: Thomas Betts FPT4-2P-6C or Hubbell S1PTAL
- In slab concrete: Hubbell HBLCFB301BASE
See Appendix A for complete assembly part numbers.

3.1i Break Rooms, Lobby / Others

As a general rule, each break room area should have one wall mounted WAO (ADA compliant). The Department Head should be consulted with for specific needs in their space.

Lobbies and corridors shall have wall mounted courtesy phones. Locate courtesy phones near elevators and or near main entrances /exits.
3.1j Wireless LAN (WLAN)

All buildings on ETSU’s campus will have access throughout the building to ITS’ WLAN. WLAN is not intended to replace wired data WAO’s, but is to provide flexibility and mobility. A RF survey must be done prior to design and installation of renovated buildings to ensure radio-frequency integrity, optimum location for coverage, and to identify possible interference problems. This survey should be done after 100% Design and Development and before 100% Construction Documents.

Cabling for Wireless:

Horizontal cables shall not directly terminate to equipment.

Suspended / False Ceilings

Access points located in areas with a suspended or false ceiling will have the outlet terminated in a single gang work area outlet (WAO) on the nearest wall or column, within 15 feet of the proposed access point location. If the distance from WAO and access point is greater than 15 feet, install ¼” conduit to directly above access point. Use appropriate ceiling grid clips to secure access point to ceiling grid, depending upon if tile is flush or recessed. Patch cable must be installed to standards and be secured every 4’ to 5’ and kept away from florescent light ballast and other EMI sources.
High Ceilings

In locations where the ceiling height is 12’ or greater, the access point will be mounted on wall at a height of 9 feet. Extend a ¾” conduit from above to a single gang WAO. An Oberon 1029-00 or equivalent will be installed around the WAO. Use a 1 foot patch cable to connect access point.

Solid Ceilings

In new construction, conduit will be installed in areas with solid ceilings. Terminate conduit in a recessed single gang WAO. The access point will mount directly to the WAO and flush with ceiling. Use a 1 foot patch cable to connect access point. Solid ceilings in existing buildings will be addresses on building by building bases. Access above the ceiling or attaching to the ceiling may not be an option. Consult with ITS regarding solid ceiling in existing buildings to determine access or workaround.

Open Ceiling

For open ceilings of 12 feet or less, conduit will be installed and terminated on the nearest wall if within 15 feet from RF prediction, into a shallow single gang WAO. The height of the Oberon mount will be 9 feet above finished floor. Use a 1 foot patch cable to connect access point.

If the nearest wall or column is greater than 15 feet, the conduit and WAO will terminate at the access point prediction; location. The height of the WAO should be level with metallic structures, which may require the conduits to stub down, but still have the access point mount horizontally. The access point will be mounted directly to the WAO. Use a 1 foot patch cable to connect access point.
3.1k Security e-Watch Cameras

Deployment of Security Cameras must follow ETSU’s FP-34 Security Camera Policy, including but not limited to appropriation, use and feasibility. ETSU has established the e-Watch cameras as sole source. Camera placement on new or renovated buildings to be coordinated with Public Safety and ITS prior to final design. During construction, a site visit needs to be arranged with ITS for the exact location and height. This visit shall occur after wall studs are installed and before drywall installation or external facade. Provisions in design shall be made for the pathways and power requirements. Install and design per manufacture’s specifications.

There are three main types of installations for cameras:

1. **Exterior Camera**, requires data cabling and 24Vac power cable. AWG for the power cable is dependent on distance, see owner’s manual. A power supply is required in Telecommunications Room. All cabling requires outside WAO to be a 2 gang recessed box, metal plate with center ¾” knock out. Terminate data inside box. Install ¾” seal tight non metallic conduit from faceplate to camera with patch cable and 2 conductor shielded cable inside.

2. **Ceiling Grid Mount** interior camera. Install 1 port surface box at nearest wall, above ceiling. Patch cable from WAO to camera location, 15’ maximum, secure patch cable every 4’-5’. If over 15’, install ½” conduit from directly above ceiling camera to the nearest wall. Terminate horizontal cabling at the end of conduit at camera location.

3. **Dome Wall Mount** interior camera. Install recessed WAO center 4” below ceiling.
3.11 Emergency Phones

Emergency Phone’s type and location will need to be coordinated with ETSU’s Health and Safety Department in the design phase and specified in the construction documents. Install as per the manufactures specifications, including grounding with 5/8”, 10’ ground rod and bonding the electrical ground with the telecommunications cable’s sheath and protector. Button height to be 43” minimum to 48” maximum.
3.1m   Elevator Phones

Elevator phone cable shall be CAT5e or CAT6 (same as rest of building’s cabling) and be protected in conduit from elevator control panel to the TR. Terminate inside control room inside a minimum 4X4 electrical box outside of the equipment panel with a single port surface box. (Demarcation Point) Installation, testing and labeling shall be consistent with material and methods found in this standard.

3.1n   Building Access / C-Bord / Security

Indicate on the T-Series drawings the placement of the C-Bord equipment and network outlet. Cabling within the TR shall comply with the ETSU ITS Telecommunications Standards. Building Access, C-Bord and Security shall provide their own pathways and not use other trades pathways.
3.10 Building Automation Systems / BAS

BAS can consist of:
- HVAC and Electrical monitoring
- Electronic Access Control (EAC)
- Electronic Safety and Security (ESS)

Or any system that:
- Monitors
- Controls
- Operates
- Manages building services

**Cabling connecting** BAS to the ETSU ITS network must follow the standards spelled out in ANSI/TIA/EIA 862 and adhere to the methods and materials of this standard. All cabling (fiber and copper) to be connected to ETSU’s network must be certified and follow the standards and test methods spelled out in this standard.

**Network connectivity** to the ETSU ITS network must meet the following criteria:
- Ethernet 10/100 auto negotiate
- 1 MAC address per port (per drop)
- DHCP for IP addressing – reservations may be requested if a persistent address is required.
- Network devices that extend or share connectivity such as switches and routers are prohibited.
- Special configurations such as Vendor Class Options and PXE will be considered on a case by case basis and may be granted if they do not interfere with other services.
- Special needs such as Firewall exemptions, VPN or DNS requests, will have to get permissions and authorizations through ETSU ITS Networking Director.
VPN

Firewall, Static IP, DNS,

3.1p Fire Alarm Communications

Cabling connecting the Fire Alarm System to the ETSU fiber optic network must follow the standards spelled out in this document. Fiber optic cabling shall terminate in a wall mounted patch panel (see Appendix- A) using a red patch cable to connect to the ETSU fiber patch panel (demarcation point). It is up to the contractor to determine what connector is required for this patch. Fire Alarms that use phone lines for telecommunications must follow codes and methods of the Authority Having Jurisdiction and installed per BICSI and ANSI/TIA/EIA standards. All Fire Alarm cabling must be physically protected. Coordinate Fire Marshall Inspections with ETSU Health and Safety, Project Manager and ITS. Contractor is not to independently schedule such inspections.

3.1q Digital Signage

Digital signage in a building shall consist of 1 data and 1 coax in a WAO, next to an electrical outlet. Outlets shall be located at a height so it will be behind the flat screen monitor/TV.
4. **Backbone Cabling Inside Plant (ISP)**

The recommended backbone pathway, connecting Telecomm Rooms together, is to align them vertically. This provides the most flexibility, protection of critical services and reduces costs of extending 4” conduits, bonding/ground wire, installing large pull boxes or ladder tray. When the rooms are vertically aligned, connect by installing a minimum of three 4” sleeves, following BICSI standards. Install proper fire stop to make sure the conduits are able to be re-entered. See Appendix J. When the Telecomm Rooms are not vertically aligned, connect rooms by either installing a minimum of two 4” conduits with one of them filled with 2 3X3 MaxCell or installing a separate ladder tray above horizontal cabling paths. When installing conduit backbone paths, follow the standards as to length and degrees of bends and placing proper sized pull boxes. In addition, install proper sized grounding/ bonding conductor in separate conduit. Install proper fire stop to make sure the conduits are able to be re-entered. See Appendix J. When installing a separate ladder tray for backbone cabling, in addition to installing above horizontal cable path, clearly label tray at every support, “Telecommunications Backbone Cables Only” with machine originated label, with large font size.

4.1a **Fiber Optics**

The fiber optic riser backbone cable connecting 2 TR’s shall be a minimum of 12 single mode (OS2) and 12 50 micron multi mode fiber optic cables (OM2). Plastic inner duct is not allowed. Fibers are to be either in conduit or use Corning non-metallic armored cables. See Appendix A for part numbers and colors. Test per BICSI’s recommendations & methods and Chapter 5, Commissioning, Warranties and Documentation.

4.1b **UTP Copper Cables**

The requirement to install copper backbone cables will be a decision of ETSU ITS. The most likely purpose of copper backbone is for life safety, Fire Alarm, Elevator Phones, Emergency Phones, etc. When installed it must be protected (conduit). The type and cable pair count will be determined on a case by case basis. Follow standards for bonding/grounding, labeling, and testing.

4.1c **Coax CATV Cables**

Coax CATV backbone cabling under 300’ between TR’s is to install RG11 riser rated cable. For installations over 300’, install .500 PIII Plenum hardline coax. See Appendix A. There shall be no noticeable defects, dents, twists, kinks or splices in the cable. Terminate TDR length and label.
5. Commissioning, Warranties and Documentation

5.1a Inspections and Walk Through

- All work is subject to inspection and review at anytime by qualified ETSU personnel.
- All rough in work will be inspected by ETSU personnel before finished walls and ceilings are installed.
- Final walk through inspections must be done prior to turning in final documentation and test results. The preliminary documentations will be made available for review during this walk through inspection.
- Cables with visible defects, kinks, twists, crushed, cuts or smashed will be replaced regardless if they pass tests.

Installer must take reasonable steps to protect their installation in a construction environment. Free of dirt, defects and debris.

5.1b Commissioning

ETSU ITS requires the newly installed infrastructure to be tested and certified. Follow the Standards of ANSI/TIA/EIA-568-C.1,2,3,4 for testing criteria of the permanent link. See Appendix D for approved test equipment to obtain a manufacture warranty.

Testing shall commence only after all materials are permanently installed, adjusted, bonded and labeled. Installer must retest and save both the original and retested results when any of the above occurs.

Testing shall commence only in a clean environment, free of moisture, dirt, dust and debris. Terminations exposed to such environments after testing will require retesting.

In addition to the cabling being commissioned and certified, the electrical grounding and bonding systems must also be tested and certified.

- The electrical contractor is responsible for testing the Alternating Current (AC) Grounding Electrode System.
- The telecommunications installer is responsible for testing the Equipment Grounding (Bonding) System.
- Refer to the BICSI TDMM latest edition, for approved test equipment and acceptable results.
5.1c  Warranties

ETSU ITS requires all copper installations to have a 25-year warranty. This warranty shall include all types of telecommunications services such as Power over Ethernet (PoE) Voice over IP (VoIP), LAN Security Cameras, Wireless LAN and any future services that meet CAT5E or CAT6 ANSI/TIA/EIA and or IEEE specifications. As part of the equal and equivalent in section 2.3, ETSU ITS has benched marked the Hubbell's MISSION CRITICAL®Warranty and System Performance Guarantee Program in determining equal or equivalent. As stated in the Introduction, installers must be certified by the manufacture of the systems they are installing. Follow the instructions of Appendix D. For further information on the warranty program go to: http://www.hubbell-premise.com/MissionCritical.asp

5.1d  Test Results

Follow the manufacturer’s warranty submittals and submit a copy of all results (including CATV, Fiber Optics and Grounding/Bonding) to ETSU ITS before final certification.

Test results shall be provided in the following Sections, Format and Order*:

Section 1:  Cover sheet clearly indicating project name / number and date of testing.
Section 2:  Summary sheet with a single table indicating all ID’s in order, total cable quantity and a pass or fail result for each.
Section 3:  Individual sheets for each individual twisted pair cable or optical fiber strand pair in order showing all applicable test results per TIA standards.

Note: Test results submitted in any other format will be rejected.

- All UTP cable test results must be submitted in their original format from tester. UTP testing and results shall conform to TIA-568C.2 Section 6 for the permanent link.
- CATV signal loss and attenuation, length, signal leakage report and document on spreadsheet.

* UTP cables terminated on a patch panel shall be in order by room number starting with port 1 with lowest room number. Fiber Optics in order of standard color code, single mode first, multi-mode second, CATV in order of room number.
• Fiber testing:

**OPTICAL FIBER TESTING PARAMETERS**

<table>
<thead>
<tr>
<th>Optical Fiber Type</th>
<th>Testing Method per TIA-568-C.0 (Section 6 and Annex E)</th>
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<tr>
<td>Singlemode OSP</td>
<td>Tier 1 and Tier 2 testing required:</td>
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<tr>
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<td>- Tier 1: Attenuation measurement for permanent link</td>
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<tr>
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<td>measured with optical loss test set (OLTS) using</td>
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<tr>
<td></td>
<td>methods specified by TIA-526-7, method A.1.</td>
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<td></td>
<td>- Tier 2: Additional attenuation measurement with</td>
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<td>optical time domain reflectometer (OTDR) using</td>
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<td></td>
<td>methods specified by TIA-526-7, method B.</td>
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<td>Singlemode ISP</td>
<td>Tier 1 testing required (Tier 2 optional unless</td>
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<tr>
<td></td>
<td>specified):</td>
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<td>methods specified by TIA-526-7, method A.1.</td>
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<tr>
<td>Multimode ISP and</td>
<td>Tier 1 testing required (Tier 2 optional unless</td>
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**OPTICAL FIBER ATTENUATION (LINK LOSS) BUDGETS**

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<th>Allowable loss per kilometer at wavelength</th>
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<tr>
<td>Singlemode indoor / (outdoor)</td>
<td>1.0dB @ 1310nm / (0.5dB @ 1310nm)</td>
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<tr>
<td></td>
<td>1.0dB @ 1550nm / (0.5dB @ 1550nm)</td>
</tr>
<tr>
<td>Multimode ISP and OSP</td>
<td>3.5dB @ 850nm</td>
</tr>
<tr>
<td></td>
<td>1.5dB @ 1300nm</td>
</tr>
<tr>
<td>Connector loss (per mated pair)</td>
<td>0.75dB</td>
</tr>
<tr>
<td>Splice (per each)</td>
<td>0.3dB</td>
</tr>
</tbody>
</table>

Note: Optical fiber splices shall be measured in accordance with ANSI/TIA-455-78-B for field testing.

Document; results, test procedure and methods, wavelengths, equipment used, calibration dates of test equipment and test personnel.

Tests must pass manufactures specifications as well as industry standards. Cables with visible defects and deformations such as, kinks, twists or crushed will fail and needs to be replaced regardless of test results.

Note. The contractor shall ensure the proper usage of optical fiber patch cords during testing, having the correct core to cladding offset (i.e. 50/125 um vs. 62.5/125 um) patch cable for the cable under test. Test results shall show calculated loss budget for each fiber length and type. The use of mode-conditioned launch cables and fiber mandrels shall be employed where applicable.

5.1e Administration / Labeling

It has become more important to accurately document every outlet and every port, so the information can assist in a 911 data base.

All WAO’s, patch panels, 110 blocks, conduits, trays, backbone cables, grounding and racks shall be labeled according to ANSI/TIA 606-B, Class 3 standards, with specific labeling scheme of ETSU ITS. All labeling
material, methods and scheme shall be submitted during the required submittal process. All labels shall be printed or generated by a mechanical device. See Appendix M and M2 for examples. Labeling is to include:

- Identifiers required in class 3 administration
- “Caution Fiber Optic” adhesive marker every HH. Label to include SM & MM fiber count and “to and from”.
- “Caution Fiber Optic” adhesive marker every 50’ of exposed fiber in building (including in ladder tray). Label to include SM & MM fiber count and “to and from”.
- OSP UTP cables shall be labeled with permanent and neat penmanship in every HH and EF with “to and from” and cable pair count.
- OSP CATV coax cables shall be labeled with permanent and neat penmanship in every HH and EF with “to and from”.

6. Firestopping

Telecommunication’s conduits and sleeves are meant to be re-entered numerous times over the life of the building. Firestopping methods must meet the requirements of the Authority Having Jurisdiction (AHJ) and also be flexible enough for future moves, adds and changes for telecommunications.

Firestopping around the conduits shall be elastomeric (permanent). Firestopping inside the conduit shall be pliable putty (removable). Conduits must be available for re-entry for future cabling without “digging out” hardened fire stop.

In lieu of conduit sleeves, other firestop assemblies are approved as long as they meet the Fire Rating of floor/wall and are made to be re-entered. Such as Hilti CP-653.

All rated penetrations shall be labeled at each accessible entry and exit (both sides of wall for wall penetrations or on wall near floor for floor penetrations).

Firestopping shall be accomplished by listed and approved methods and materials. (UL 1479 / ASTM E814) See Appendix J.

Contractors are responsible for obtaining, (prior to their procurement, fabrication and installation), official documentation from the AHJ that all materials intended for firestop thru-penetrations are approved.
Appendix A
Material and Parts List

The following materials are to be used unless a timely submitted substitute is approved by ETSU ITS.

CABLES

**CAT5E Cable,**
Mohawk MegaLAN M56167B
Hubbell Speedgain C5EPRRB
Belden DataTwist 1200, 1212 006U1000
Indoor/Outdoor, Mohawk M58932,
Outdoor Only, Belden 7997A

**CAT6e+ Cable,**
Mohawk AdvanceNet M57202
Hubbell Nextspeed C6RRB
Belden Datatwist 4800, 4812 006A1000
Indoor/Outdoor, Mohawk M58772
Outdoor Only, Belden OSPU6U

**Fiber Optic OSP Cable,** (Check with ITS on which one to use)

<table>
<thead>
<tr>
<th>Corning Freedm One Cable / Short runs 24 strands or less</th>
</tr>
</thead>
<tbody>
<tr>
<td>24) single mode (yellow) OS2 024E8F-31131-29</td>
</tr>
<tr>
<td>24) 50/125um multi mode (aqua) OM3 024T8F-31180-29</td>
</tr>
<tr>
<td>12) 62.5um multi mode (orange) OM1 012K8F-31130-29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Corning Altos / Longer pulls and or high fiber counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXX = fiber count (048, 084, 144 etc.)</td>
</tr>
</tbody>
</table>

Single mode OS2 XXXEU4-T4101D20
50/125um multi mode OM3 XXXTU4-T4180D20
62.5um OM1 XXXKU4-T4130D20

**Fiber Optic Riser Cable,**

<table>
<thead>
<tr>
<th>Corning MIC DX Armored Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>12) single mode (yellow) OS2 012E81-33131-D1</td>
</tr>
<tr>
<td>12) 50um multi mode (aqua) OM3 012T81-33180-D1</td>
</tr>
<tr>
<td>6) 62.5 um multi mode (orange) OM1 006K81-31130-D1</td>
</tr>
</tbody>
</table>

(Non- armored MIC is accepted when installed in dedicated conduit)

**Coax Horizontal,** Belden 7915A (plenum, CommScope 2275V)

**Riser Coax,** Belden 9011 RG11 (under 300’) or CommScope PIII 500 Plenum (over 300’)

**OSP Coax, Flooded,** CommScope, .PIII 500 JCASS, (under 500’), PIII 750JCASS (over 500’)

OSP Phone CAT3, BSW (Buried Service Wire), Essex or General Cable PE89

**Inner Duct.** MaxCell 3X3, Detectable, color ID, MXD3456

**CONNECTORS**

**CAT5E Jacks,** Hubbell Speedgain, Blue, HXJ5EB

**CAT5E Phone Jacks,** Hubbell Speedgain, White, HXJ5EW

**Cat5e Special Circuit Jacks,** Hubbell, Speedgain, Yellow, HXJ5EY

**CAT6 Jacks,** Hubbell, Nextspeed, Orange, HXJ6OR

**Coax RG6 F-Fittings,** Belden Thomas and Betts FSNS6U (plenum FSNS6PL)

**Coax RG11 Fitting,** Belden Thomas and Betts 716SNS1P11H,

**Coax .500 Fitting,** Gilbert GRS-500-CH-DU-03-T

**Coax .750 Fitting,** Gilbert GRS-750-CH-DU-03-T

**Coax F-81 Jack**
- Student Rooms, (Stainless Steel), Allen Tel, ATBK-81, Pico WP-81SS
- Office/Classroom, only if CATV is in the same WAO as a data drop, Hubbell, SFFEX. Stand alone CATV, Allen Tel, CT-103F or Pico WP-81V

**Fiber Optic Connectors,** Hubbell Proclick SC or Corning Uni-Cam SC
- **Single Mode,** Hubbell FCSC900KSM or Corning 95-200-41, blue
- **Single Mode APC,** Hubbell FCSC900KASM, or Corning 95-200-44 green
- **50um Multi Mode,** Hubbell FCS900K50M or Corning 95-050-41, black
- **62.5um Multi Mode,** Hubbell FCS900K62M or Corning 95-000-41, beige
- **SC Bulkheads Duplex** Use Hubbell in Hubbell Housings and Corning in Corning Housings. Hubbell FSPSCD series, Corning CCH series.

**CROSS CONNECTS**

**CAT5E Patch Panel,** 48 port, Hubbell Speedgain, Black, HP5E48E

**CAT5E Patch Panel,** 24 port, Hubbell Speedgain, Black, HP5E24E

**CAT6 Patch Panel,** 48 port, Hubbell, Nextspeed, Black, HP648A

**CAT6 Patch Panel,** 24 port, Hubbell, Nextspeed, Black HP624A
110 Blocks, Backbone. 5 pair, Hubbell, 110BLK50FTK5

110 Blocks, Horizontal. 4 pair, Hubbell, 110BLK50FTK4

Fiber Optic Connector Housing. Hubbell FCR series or Corning, “CCH” series

Fiber Optic Wall Mount. (Fire Alarm), Hubbell FCW4SP or Corning Wall Panel WCH-02P

UTP Protectors (CAT3) Circa 1880 series, 110 block, 5 pin modules 4B1S-300

CABLE MANAGEMENT

Network Rack with 6” Z-Channels, Black, Hubbell Nextframe CS-1976

Rack Base Insulator Kit. Chatsworth Products, 10605-019

Horizontal Management. Hubbell, HS23C, or HS13C. Check with ITS

Rear Cable Management Bar. Hubbell ECMBR3

Cable Management Rings. Hubbell, MCCPSR4

Cable Management Troughs. (110 blocks), Hubbell, 110TRA

Ladder Tray. (for ER/TR) Hubbell Next Frame, 18”, “HL” Series, or Cooper B-Line SB17U18B

Ladder Tray. (for corridors), Hubbell, “HPW” Series, or Cope I-Beam System

Wire Basket. Hubbell Pre-Galvanized, HBT series (size dependant)

Wire Basket Cutting Tool. Hubbell HBTCUTTOOL (Do Not Use Bolt Cutters)

J-Hooks. (up to 40 cables, CAT5e only), Cooper B-Line / BCH32, Erico CAT425 Adjustable Cable Support

J-Hooks. (up to 10 cables), Panduit J-Pro JP75W-L20 (the only J-hook approved for CAT6)

Equipment Shelf. Hubbell, MCCCCS19P
Work Area Outlet (WAO)
(Coordinate faceplate color with electrical faceplates)

**Office/Classroom Faceplate**, 4 port, Hubbell AFP14EI (Electrical Ivory)

**Office/Classroom Faceplate**, 6 port, Hubbell, IFP16EI (requires 2 gang box, with plaster ring)

**Office/Classroom Faceplate**, 9 port, Hubbell, IFP212EI (requires 2 gang box)

**Student Room Faceplate**, 1 port, Hellerman Tyton FPSINGLELESS, 2 port FPDUALSS

**Student Room CATV Faceplate**, with F-81, (Stainless Steel), Allen Tel, ATBK-81, Pico WP-81SS

**HON Furniture Faceplate**, 2 port, Hubbell FP2BK (black), FP2GY (gray)

**Blank Faceplate inserts**, Hubbell, Electrical Ivory SFBE10

**Blank Faceplate inserts**, Hubbell, Black, SFBB10

**Blank Faceplate inserts**, Hubbell, Gray, SFBG10

**Floor Box Assembly**, In slab concrete, Hubbell HBLCFB301BASE, HBLTCGNTSW Cover, HBL317SGY (3) Jack plates, HBLST302SGY (1) Electrical plate.

**Floor Poke-Through**, Thomas and Betts FPT4-2P-6C, Cover FTP4-CVR, or Hubbell S1PTAL

**Miscellaneous**

**Firestop** Hilti “Moldable Pliable Putty” CP-618. *Tube putty and caulk that cures to an elastomeric solid is not approved in conduit.* Hilti FS-ONE around the conduit. Hilti CP-653 Sleeve.

**Fire Retardant Paint**, Benjamin Moore P59-220 (white), or Sherwin Williams MIL-PRF-24596B (white 27880) up to 2 oz. of tint allowed per gallon. Or approved replacement from State Fire Marshall.

**Telecommunications Grounding Busbar**

**TMGB** Hubbell HBBB14416H, (EF & ER)

**TGB** Hubbell HBBB14210A, (TR)

**Rack Equipment**, Hubbell HBBBHR19KT

See Appendix E-2 for more Bonding and grounding part numbers
**Power strip.** (for network rack), surge protected, Hubbell MCCPSS19TS

**Emergency Phone.** Gai-Tronics, Red 234 Stanchion w/strobe, 397-001 Phone

**Outdoor Courtesy Phone.** Gai-Tronics Red 236 Enclosure, 398-001 Phone.

**Handhole (HH) Pull Box.** Quazite “PG” style, 30X48 PB, 36X60, Splice Box. Lids are to be identified with “Communications” and have pull slots center pins.

**Splice Enclosures.**
For Copper Preformed Line Products, Coyote Series
For Fiber Optics, Corning SCF family

**Duct Seal.** Ideal 31-605 or Gardner Bender GB-DS-110N

**Smart Conduit Body LB.** Conduit Specialties Inc.PVC 4” KBLB401, Aluminum, 4” KBLB400

**CATV AMPLIFIER.** Blonder Tongue BIDA 750-30 or BIDA 750-50 (Check with ITS)

**Raceway for Shared Power and Communications, Dual Channel.** Hubbell PW2ABC7 PB2IND2G In-Line Box KP8 Plate with BR106C 106 frame or Panduit Twin-70 “Pan-Net” office white, T702BIW8 Base with T702CIW8 Cover, Device Bracket T70DB-X

**Metallic Raceway.** Wiremold V2000BC, Base and Cover, or Hubbell HBL2000BCIV Base and Cover

**Detectable Warning Tape.** C.H. Hansen 16626
Appendix B

- 10’X 8’ is the minimum size room. The square footage of service area, number of drops and equipment mounted on walls could require a 10’X 9’ or 10’X 11’ room.
- Must have a minimum of 3’ of clear work space around all sides of racks. Measure a minimum of 5’ from front of rack to rear of room. Do not mount equipment on walls directly in front or rear of racks unless increase size of room to maintain the 3’ clearance.
- 36” door must swing out or increase room size 3’. Door is secured with an Onity card reader system.
- The amount of sleeves needed is dependent on number of drops and 25% growth, 40% fill.
- Sprinklers must have wire cage and be located away from tray and sleeves.
- Equipment not related to the support of the ER/TR shall not be installed or pass through the room.
- No vinyl cable ties, use approved Velcro strips.
- AC Grade plywood, on all 4 walls. Plywood to be fire retardant or have all sides covered with two coats of fire retardant paint.
Appendix C - Standards Variance Form

ETSU Telecommunications Standards Variance Request Form

Complete this form and submit to the ETSU Project Coordinator. ETSU ITS will review the request and either accepts, modifies or denies the variance and will notify the ETSU Project Coordinator.

Project Name: _________________________ Date: _________________
Requester: ____________________________
Company: ____________________________
Title: ________________________________
ETSU Project Coordinator: ____________________________

Reason for Variance:
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

Is the variance requested due to (check all that applies?)

Cost____ Amount $_______
Schedule Impact____ Days impacted ______

Suggested Remedy(s):
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

To be completed by ETSU ITS

Comments and or suggestions:
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

This request has been (circle):     Approved         Modified        Denied

Signature _______________________________ Date: ________________
Appendix D

Registration for Installation Warranty

1. Complete the Structured Cabling System Registration Request form.
   - Complete the Certified Installation Company Information section with your company’s information and the names of those who designed the system.
   - Enter the manufacturer and type of cable used under the Warranty Information section. Approved cable manufacturers include Hubbell, Belden, Berk-Tek, CommScope, General Cable, Hitachi, Mohawk and Superior Essex. Check off the appropriate recitals (double click and select “Checked”).
   - Complete the Project Information section with the project name, end user company or organization name, project address, project contact person and his/her phone number and email address. Please note that End Users may refuse to sign warranty documents when this information is incorrect or incomplete, which results in delays in processing.
   - Complete the Products Installed: Part Number and Description section on the second page. Be sure to include the cable manufacturer(s) under Cable Installed.

2. Complete both the Horizontal Schematic and Backbone Schematic forms.

3. Submit Test Results using the following instructions:
   - Test results are to be copied onto a CD/DVD. Send the original raw data tester file(s) only. Do not convert the test results into another format. PDfS, etc. will not be accepted.
     This is applicable for copper cabling from a Level II compliant Category 5 tester, Level IIe compliant Category 5e tester or Level III compliant Category 6 tester.
     - Approved Testers:
       - Fluke OmniScanners
       - Fluke: DTX 1800 and 4000 Series
       - Fluke: DSP 4000 Series
       - Ideal/LANTEK Series
       - Agilent Wirescope Series
       It is recommended that test results software be kept current. Download the most recent software version via the field tester manufacturer’s website.
   - Include all optical fiber test results (if applicable) from a power meter with an accuracy of ± .5 dB or better on the CD/DVD in its original tester format. Do not convert the test results into another format. Test results for Backbone cables should also include the allowable attenuation values calculated using the link attenuation equation.
   - Provide floor plans or as-built drawings on the CD/DVD, showing the location of all telecommunications rooms, equipment rooms, workstation locations and connecting pathways. Any file type is acceptable (i.e. PDF, DWG, JPG, etc.). Please do not submit large original floor plans/drawings.

4. Mail all documentation to:
   Mission Critical Coordinator, Hubbell Premise Wiring, 40 Waterview Drive, Shelton, CT 06484
   Warranty requests sent via email or fax will not be accepted.
Appendix E
Bonding and Grounding

TMGB – Telecommunications Main Grounding Busbar
TGB – Telecommunications Grounding Busbar
EF – Entrance Facility
Appendix E-1

Bonding and Grounding

*All bonding conductors are green-jacketed #6 AWG copper.
Two-hole connection Lug's are required. All labels shall be applied within 2" of lug. Consult ETSU Facilities and OIT prior to groundbar and/or conductor installation.

*For informational purposes only
Appendix E-2

Bonding and Grounding

Bonding part numbers only, see appendix A for 18” ladder rack, cabinets and network racks

All part numbers are Hubbell

| A | HGRKTD9D: Ladder Jumper  |
| B | HGBTEBCBRK110: Ladder Bracket  |
|   | HGBTEBCBRKW10: Wire Basket Bracket  |
| C | HBBB14210A: Busbar for TR  |
|   | HBBB14224B: Busbar for DataCenter  |
|   | HBBB14416H: Busbar for Entrance  |
| D | HGRKTD144DA: 12’ Conductor  |
|   | HGRKTX360D: 30’ Conductor  |
|   | HGRKTX600D: 50’ Conductor  |
| E | HGRKTD60C46: RGB(72”) to C-Tap, 60”  |
| F | HGRKTD60C46: RGB(19”) to C-Tap, 60”  |
| G | HGRKTD60C46: RGB(36”) to C-Tap, 60”  |
| H | HBBBVR76KT: 76” RGB Busbar  |
| I | HBBBH19KT: 19” RGB Busbar  |
| J | HBBBVR36KT: 36” RGB Busbar  |
| K | HGRKTD60DA: 60” Ladder to Busbar  |
Appendix F

Pull Box (PB) / Hand Hole (HH)

1. CONDUITS SHALL ENTER AND EXIT AT THE ENDS OF THE PULLBOX. NO SIDE ENTRY IS PERMITTED.
2. PULLBOX SHALL NOT BE UTILIZED AS A SUBSTITUTE FOR BENDS.
3. ALL PVC CONDUITS SHALL BE SCHEDULE 40 OR SCHEDULE 80 AS DIRECTED BY ETSU I.T.S. STANDARD FOR EACH APPLICATION TYPE (GRASSY AREAS, SIDEWALKS, ETC.). SEE SECTION 2.5 OF ETSU I.T.S. STANDARD FOR MORE INFORMATION.
### Appendix F-1

**OSP Pull Box (PB) / Hand Hole (HH)**

<table>
<thead>
<tr>
<th>Application Tiers</th>
<th>Loading Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TIER 5’</strong>&lt;br&gt;Sidewalk applications with a safety factor for occasional non-deliberate vehicular traffic&lt;br&gt;<strong>Vertical</strong>&lt;br&gt;Design Load: 22.2 kN</td>
<td>Test Load: 33.3 kN</td>
</tr>
<tr>
<td><strong>Lateral</strong>&lt;br&gt;Design Load: 28.7 kPa</td>
<td>Test Load: 43.1 kPa</td>
</tr>
<tr>
<td><strong>TIER 8’</strong>&lt;br&gt;Sidewalk applications with a safety factor for non-deliberate vehicular traffic&lt;br&gt;<strong>Vertical</strong>&lt;br&gt;Design Load: 35.6 kN</td>
<td>Test Load: 53.4 kN</td>
</tr>
<tr>
<td><strong>Lateral</strong>&lt;br&gt;Design Load: 28.7 kPa</td>
<td>Test Load: 43.1 kPa</td>
</tr>
<tr>
<td><strong>TIER 15’</strong>&lt;br&gt;Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic&lt;br&gt;<strong>Vertical</strong>&lt;br&gt;Design Load: 66.7 kN</td>
<td>Test Load: 100.1 kN</td>
</tr>
<tr>
<td><strong>Lateral</strong>&lt;br&gt;Design Load: 38.3 kPa</td>
<td>Test Load: 57.5 kPa</td>
</tr>
<tr>
<td><strong>Tier 22’</strong>&lt;br&gt;Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic&lt;br&gt;<strong>Vertical</strong>&lt;br&gt;Design Load: 106.1 kN</td>
<td>Test Load: 150.1 kN</td>
</tr>
<tr>
<td><strong>Lateral</strong>&lt;br&gt;Design Load: 36.3 kPa</td>
<td>Test Load: 57.5 kPa</td>
</tr>
</tbody>
</table>

---

**AASHTO H-20**

Deliberate vehicular traffic applications ONLY. Quazal does not currently offer any enclosures for this application tier.

"There are no AASHTO design or test provisions for polymer composites. Therefore there is no recognized method of testing for qualification. Applying other material testing methods to polymer composites is not recognized by AASHTO. **BUYER BEWARE!**"
Appendix F-2
Pull Box (PB) / Hand Hole (HH)

Correct
Cables enter and exit in Align fashion

Correct
Bend is outside of PB

WRONG!!
Cables not aligned for pulling
## Appendix G

**Symbol Legend**

<table>
<thead>
<tr>
<th>DEVICE SYMBOL</th>
<th>DESCRIPTIVE TEXT</th>
</tr>
</thead>
<tbody>
<tr>
<td>◊</td>
<td>COMMUNICATIONS WALL OUTLET AT 1/8&quot; AFT, UNO. FOR ADDITIONAL INFORMATION, REFER TO DRAWINGS, SPECIFICATIONS AND/OR DETAILS. W = WALL PHONE AT 48&quot; UNO. EP = EMERGENCY PHONE (CONDUIT ENTRY FROM BOTTOM). SEE APPENDIX &quot;F&quot; FOR PATHWAY TYPES.</td>
</tr>
<tr>
<td>◊</td>
<td>COMMUNICATIONS WORK AREA ROUGH-IN, BOX AT 1 1/8&quot; AFT, UNO (TYPE A OR TYPE B AS NEEDED). SEE APPENDIX &quot;F&quot;</td>
</tr>
<tr>
<td>◊</td>
<td>COMMUNICATIONS FLOOR OUTLET (RECESSED)</td>
</tr>
<tr>
<td>◊</td>
<td>COMMUNICATIONS FLOOR OUTLET ROUGH-IN (RECESSED)</td>
</tr>
<tr>
<td>◊</td>
<td>COMMUNICATIONS OUTLET - CEILING MOUNTED.</td>
</tr>
<tr>
<td>◊</td>
<td>COMMUNICATIONS OUTLET BOX ROUGH-IN - CEILING MOUNTED.</td>
</tr>
<tr>
<td>◊</td>
<td>FURNITURE SYSTEM COMMUNICATIONS OUTLET - MOUNTED PER MANUFACTURERS REQUIREMENTS, UNO.</td>
</tr>
<tr>
<td>◊</td>
<td>WIRELESS ACCESS POINT OUTLET = WIRELESS ACCESS POINT AND PATCHCORD (PROVIDED BY OTHERS). ◊ COMMUNICATIONS OUTLET FOR W.A.P. INSTALL AT LOCATION SPECIFIED.</td>
</tr>
<tr>
<td>◊</td>
<td>TELEVISION OUTLET / DIGITAL SIGNAGE OUTLET</td>
</tr>
<tr>
<td>◊</td>
<td>MULTIMEDIA OUTLET</td>
</tr>
<tr>
<td>◊</td>
<td>MULTIMEDIA FLOORBOX - POKE THRU FROM CEILING BELOW</td>
</tr>
<tr>
<td>◊</td>
<td>MULTIMEDIA FLOORBOX - CAST IN SLAB</td>
</tr>
<tr>
<td>◊</td>
<td>CARD READER</td>
</tr>
<tr>
<td>◊</td>
<td>SURFACE MOUNT RACEWAY - REFER TO DRAWINGS FOR REQUIREMENTS</td>
</tr>
<tr>
<td>◊</td>
<td>VERTICAL SERVICE POLE &quot;PVC&quot; = POWER/VOICE/DATA &quot;VD&quot; = VOICE/DATA</td>
</tr>
<tr>
<td>◊</td>
<td>VIDEO CAMERA, MOUNTING HEIGHT AS SPECIFIED</td>
</tr>
<tr>
<td>◊</td>
<td>1&quot; EMT COMMUNICATIONS CONDUIT FROM WALL OUTLET BOX Stubbed TO ACCESSIBLE CEILING SPACE (UNO). EXTEND CONDUIT TO CABLE TRAY OR J-HOOK, PATHWAY AS SPECIFIED. PROVIDE 4&quot; SQUARE BOX WITH SINGLE-GANG DEVICE RING, UNO. PROVIDE BUSHING ON OPEN END OF CONDUIT. (SEE APPENDIX &quot;F&quot;).</td>
</tr>
<tr>
<td>◊</td>
<td>1&quot; EMT COMMUNICATIONS CONDUIT FROM WALL OUTLET BOX HOMERUN CONTINUOUS TO LOCATION SPECIFIED. PROVIDE 4&quot; SQUARE BOX WITH SINGLE-GANG DEVICE RING, UNO. PROVIDE BUSHING ON OPEN END OF CONDUIT. (SEE APPENDIX &quot;F&quot;).</td>
</tr>
</tbody>
</table>

### Diagrams

- **DEVICE SYMBOL**: EQUIPMENT RACK (FRONT VIEW) WITH VERTICAL CABLE MANAGEMENT
- **DEVICE SYMBOL**: EQUIPMENT RACK (TOP VIEW) WITH VERTICAL CABLE MANAGEMENT
- **DEVICE SYMBOL**: HORIZONTAL CABLE MANAGEMENT
- **DEVICE SYMBOL**: PATCH PANEL (SIZE AS INDICATED)
- **DEVICE SYMBOL**: POWER STRIP (RACK MOUNT)
- **DEVICE SYMBOL**: 110 TERMINATION BLOCK (300pr)
- **DEVICE SYMBOL**: 110 TERMINATION BLOCK (100pr)
- **DEVICE SYMBOL**: RADIUS DROP SUPPORT

**Note**: Not all abbreviations, symbols, details, outlet types, designs and diagrams are necessarily used within this project or set of documents. See drawings and specifications for details on outlets and cable media types.
# Appendix G-1

## Multi-Media Symbol Legend

### J-STD-710 Audio Video Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Device Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>M DO</td>
<td>Speaker</td>
<td>HF-High Frequency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M-Monitor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LAR-Line Array</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P-Powered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LCR-LCR Bar</td>
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<tr>
<td></td>
<td></td>
<td>S-Subwoofer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LR-LR Bar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST-Stereo</td>
</tr>
<tr>
<td>M DO</td>
<td>Video Display</td>
<td>M-Mirror TV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TV-Television</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VM-Video Monitor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WP-Weatherproof TV</td>
</tr>
<tr>
<td>M DO</td>
<td>Video Projector</td>
<td>LCD-Liquid Crystal Display</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DLP-Digital Light Processing</td>
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<tr>
<td></td>
<td></td>
<td>LED-Light Emitting Diode</td>
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<td></td>
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<td>LCOS-Liquid Crystal On Silicon</td>
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<td>M DO</td>
<td>Video Projector</td>
<td>F-Fixed</td>
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<td></td>
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<td>PD-Pull Down</td>
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<td></td>
<td></td>
<td>M-Motorized</td>
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<td></td>
<td></td>
<td>PU-Pull Up</td>
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<td>R-Rear</td>
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<td>MLB-Mobile</td>
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<td>M DO</td>
<td>Video Camera</td>
<td>D-Document</td>
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<td>IP-IP Cam</td>
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<td></td>
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<td>PTZ-Pan/Tilt/PTZ-Zoom</td>
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<td>V-Video Source</td>
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<td>M DO</td>
<td>White Board</td>
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<td></td>
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<td>I-Interactive</td>
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<td></td>
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<td>M DO</td>
<td>Microphone</td>
<td>B-Boundary</td>
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<td></td>
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<td>CLP-Clip</td>
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<td></td>
<td></td>
<td>GNK-Gooseneck</td>
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<td>M DO</td>
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<td>AV-Audio Video</td>
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<td></td>
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<td>D-Data</td>
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<td>J-Junction Box</td>
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<td>WP-Weatherproof</td>
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(ANSI-J-STD-710 is available online, free download pdf.)

Appendix H
Smart Conduit Body – Telecommunications LB
Appendix I

Telecommunications Enclosures

Size and type dependant on serving area and use.
Appendix J

Fire Stop

**FS-ONE Caulk**
Outside/Around Conduit
Permanent

**CP-618 Putty**
Inside Conduit
Removable

OR

**Re-Entry Sleeve CP-653**

**Firestop Labels**
Appendix K

Network Racks

Example of horizontal cables routed left and right.
Appendix K - 2
Network Racks

Example
Example of rack layouts. Copper and fiber counts and type may differ.
Appendix K-3

Rack Layout
### APENDIX L
### SCHEDULE

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<th>Telecom Rm</th>
<th>Panel</th>
<th>Port</th>
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<td>115</td>
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<td>163</td>
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<td>215</td>
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<td>263</td>
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<td>17</td>
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**Telecommunications T-Series Room Schedule**

Room 101 has 3 drops, fed from TR 115

TR115 is 1 of 2 TR on 1st floor

Room 151 is fed from TR 163

TR 163 is 2 of 2 TR's on 1st floor

Telecom Room, Port Number, Room Number, Jack Number

T-Drawings shall list every room and include information shown above for every data and VoIP jack.
APPENDIX M
LABELS
PATCH PANEL / FACEPLATE

PATCH PANEL LABEL (TYP.)
SEQUENTIAL ON EACH RACK
FROM TOP TO BOTTOM

WORK AREA ROOM NUMBER
222-1A-01

TWO-DIGIT PORT NUMBER
ON PATCH PANEL IDENTIFIER IN TR

RACK NUMBER IN TR

ROOM NUMBER OF TR
SERVING WORK AREA

TR-214

222-1A-01
222-1A-03

FACEPLATE LABELING DETAIL

222-1A-02

FOR INFORMATIONAL PURPOSES ONLY
Appendix M - 2
Other Labels and Information

**Faceplate Labels**
Label Type: Banner Landscape
Font Size: 14pt Bold
Tape Size: 3/8” or 1/2” Single Line

**Access Point Labels**
Label Type: Banner Landscape
Font Size: 28pt Bold
Tape Size: 1/2” Single Line

**Patch Panel Port Labels**
Label Type: Patch Panel
Font Size: 14pt Bold
Tape Size: 1/2” Two Lines
Spacing: 0.5” Cat 5, 0.6” Cat 6
# of Ports: Remember to Set

**Wire-Wrap Labels**
Label Type: Wire
Font Size: 14pt Bold
Tape Size: 3/4” up to Two Lines
Size: 1.2”(10-4AWG)

**Patch Panel and Rack Labels**
Label Type: Banner Landscape
Font Size: 28pt Bold
Tape Size: 1/2” Single Line

**Fiber Cable Label**

![Fiber Cable Label Image]

**Detectable underground warning tape**

![Detectable Underground Warning Tape Image]
Appendix N
Risers & Sleeves

Indicate where the penetrations are for floors and walls.
Indicate on drawings, length, degrees of bends, location and size of pull boxes for every conduit / riser.
Appendix O
Outside (OSP) Plant

* FOR INFORMATIONAL PURPOSES ONLY

FINISH GRADE
TOPSOIL
GRASS

85% COMPACTED
SUBSOIL
98% COMPACTED
EARTH FILL

DETECTIBLE WARNING TAPE
AT 12" BELOW FINISH GRADE.
(C. H. HANSEN #16626 "BURIED FIBER OPTIC")

4" PVC CONDUITS,
QUANTITY AS REQUIRED.
ONE CONDUIT CONTAINING TWO (2)
DETECTABLE MAXCELL 3X3 INNERDUCTS.
ONE CONDUIT CONTAINING PULLROPE.
ALL OPTICAL FIBER CABLES SHALL BE
INSTALLED TOGETHER IN A SINGLE
INNERDUCT CELL. TOP OF CONDUITS
AT 24' BELOW FINISH GRADE.

NOTE: ALL PVC CONDUITS SHALL BE
SCHEDULE 40 OR SCHEDULE 80 AS
DIRECTED BY ETSU I.T.S. STANDARD
FOR EACH APPLICATION TYPE (GRASSY
AREAS, SIDEWALKS, ETC.).
SEE SECTION 2.5 OF ETSU I.T.S.
STANDARD FOR MORE INFORMATION.

OSP CROSS SECTION
COMMUNICATIONS CONDUIT
NOT TO SCALE

NOTE:
IF CABLING IS TO BE INSTALLED
INSIDE INNERDUCT, CONTRACTOR
SHALL INSTALL CABLE IN CENTER
CELL OF INNERDUCT FIRST.
Appendix P

WAO work area outlet

COMMUNICATIONS CONDUIT ROUGH-IN (TYPE 'A')
IN-WALL

PROVIDE PULL STRING IN EACH EMPTY CONDUIT

NYLON BUSHING (REQUIRED)

STUBBED INTO CEILING AREA ABOVE A.C.T.
CONDUIT TURNED AS SPECIFIED INTO ROOM
(1" EMT, MIN)

KNOCKOUTS

4" OR 4 1/16" SQUARE
BOX 1 1/2" DEEP, MIN

GROUND SCREW LOCATION

SQUARE DEVICE COVER,
SINGLE DEVICE, FOR DRYWALL
OR CMU CONSTRUCTION.
PROVIDE BLANK COVER.

COMMUNICATIONS RACEWAY ROUGH-IN (TYPE 'B')
SURFACE-MOUNT WALL RACEWAY

PROVIDE PULL STRING IN EACH EMPTY RACEWAY

PROVIDE ENTRANCE END FITTING AS SHOWN

2000 SERIES RACEWAY BY WIREMOLD
(2000B - BASE AND 2000C - COVER)
EXTEND INTO ACCESSIBLE CEILING
AS SPECIFIED USING APPROVED METHODS
AND MATERIALS

WIREMOLD #V2048
SINGLE GANG
DEVICE BOX

NOTE: IF CABLEING IS INSTALLED IN RACEWAY/CONDUIT, A ONE METER SERVICE LOOP OF CABLE SLACK IS TO BE LEFT COILED ABOVE TOP OF CONDUIT/RACEWAY ABOVE A.C.T. (APPLIES TO BOTH TYPES ABOVE)

* FOR INFORMATIONAL PURPOSES ONLY
Appendix Q
Multi Media Classroom

MULTIMEDIA WALL CHASE (TYP.)
NOT TO SCALE

MULTIMEDIA WALL BOX CONSTRUCTION INSIDE WALL (TYP.)
NOT TO SCALE

* FOR INFORMATIONAL PURPOSES ONLY
Appendix Q-1

FLOOR POKE-THRU ASSEMBLY DETAIL

THOMAS AND BETTS #PT4-2P-6C INSTALLED WITH #PT4-CVR
INSTALL COMM CABLING THRU OPENING UNDER ASSEMBLY (FREEWIRE)
CONNECTION TO ELECTRICAL CIRCUIT IN CONDUIT

NOTE: USE EXISTING KNOCKOUTS WHERE PRACTICAL AND PROVIDE PULL STRINGS IN ALL CONDUITS

HUBBELL RECESSED FLOOR BOX (#HBLCFB30) BASE INCLUDE THE FOLLOWING COMPONENTS:
(1) HUBBELL BOX COVER #1315G3T5W
(2) HUBBELL DATA PLATE #HBL3175G7
(3) HUBBELL DIPLEX PLATE #HBL573033G0

MULTIMEDIA WALL BOX DETAIL

2" EMT CONDUIT Stubbed UP TO ACCESSIBLE CEILING SPACE ABOVE A.C.T. (4" MINIMUM)
NYPXAN #455X5X4 SCREW COVER TYPE ONE FULLBOX
HOFFMAN #455X5X4 SCREW COVER TYPE ONE FULLBOX

TAP FOR 10-32 SCREWS TYPICAL FOR ALL 4 INSTALL WITH COVER AND SCREW HOLES FACING ROOM

RECESSED FLOOR BOX DETAIL

1" EMT CONDUIT FOR COMM CABLING Stubbed UP TO ACCESSIBLE CEILING SPACE ABOVE A.C.T. (4" MINIMUM)
1" OR 3/4" EMT CONDUIT FOR DUPLEX POWER RECEPTACLE

(2) 1" EMT CONDUITS RUN TO BOTTOM OF MULTIMEDIA BOX IN WALL

FOr INFORMATIONAL PURPOSES ONLY
Appendix R
Field Service Loop

OSP ENCLOSURE, TYPICAL

"D" RINGS IN RADIAL PATTERN
AS SHOWN TO SUPPORT CABLE
SERVICE LOOP.
INSTALL SERVICE LOOP WITH
BEND RADIUS AT LEAST 10
TIMES THE OUTSIDE DIAMETER
OF CABLEING

MAXCELL INNERDUCT
(INNERDUCT IN CONDUIT ONLY)
OSP CABLEING

CONDUIT TO
ENCLOSURE

*FOR INFORMATIONAL PURPOSES ONLY
# ABBREVIATIONS

<table>
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<tr>
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<th>Description</th>
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<td>ac</td>
<td>alternating current</td>
</tr>
<tr>
<td>ACR</td>
<td>attenuation-to-crosstalk ratio</td>
</tr>
<tr>
<td>ADA</td>
<td>Americans with Disabilities Act</td>
</tr>
<tr>
<td>ADO</td>
<td>auxiliary disconnect outlet</td>
</tr>
<tr>
<td>ADSL</td>
<td>asynchronous digital subscriber line</td>
</tr>
<tr>
<td>AHJ</td>
<td>authority having jurisdiction</td>
</tr>
<tr>
<td>AIA</td>
<td>American Institute of Architects</td>
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<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>AP</td>
<td>access provider</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<td>ATIS</td>
<td>Alliance for Telecommunications Industry Solutions</td>
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<tr>
<td>ATM</td>
<td>asynchronous transfer mode</td>
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<td>AWG</td>
<td>American Wire Gauge</td>
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<td>BAS</td>
<td>building automation system</td>
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<td>BC</td>
<td>bonding conductor</td>
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<td>backbone conduit</td>
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<td>BER</td>
<td>bit error rate</td>
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<td>CCTV</td>
<td>closed-circuit television</td>
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<td>CCA</td>
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<td>CCS</td>
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<td>dual inline package</td>
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<td>DSS</td>
<td>digital satellite system</td>
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<td>digital signal cross-connect</td>
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<td>data terminal equipment</td>
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<td>device under test</td>
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<td>digital versatile disc</td>
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<td>electrical nonmetallic tubing</td>
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<td>multi-user telecommunications outlet assembly</td>
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<td>national recognized testing laboratory</td>
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<td>outside plant</td>
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<tr>
<td>PCB</td>
<td>printed circuit board</td>
</tr>
<tr>
<td>PD</td>
<td>power device</td>
</tr>
<tr>
<td>PDU</td>
<td>power distribution unit</td>
</tr>
<tr>
<td>PSACR</td>
<td>power sum attenuation-to-crosstalk ratio</td>
</tr>
<tr>
<td>PSE</td>
<td>power source equipment</td>
</tr>
<tr>
<td>PSELFEXT</td>
<td>power sum equal level far-end crosstalk</td>
</tr>
<tr>
<td>PSFEXT</td>
<td>power sum far-end crosstalk</td>
</tr>
<tr>
<td>PSNEXT</td>
<td>power sum near-end crosstalk</td>
</tr>
<tr>
<td>PVC</td>
<td>polyvinyl chloride</td>
</tr>
<tr>
<td>REA</td>
<td>Rural Electrification Administration</td>
</tr>
<tr>
<td>RF</td>
<td>radio frequency</td>
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<tr>
<td>RFI</td>
<td>radio frequency interference</td>
</tr>
<tr>
<td>RH</td>
<td>relative humidity</td>
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<tr>
<td>RJ</td>
<td>registered jack</td>
</tr>
<tr>
<td>rms</td>
<td>root mean square</td>
</tr>
<tr>
<td>SAN</td>
<td>storage area network</td>
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<tr>
<td>SCC</td>
<td>Standards Council of Canada</td>
</tr>
<tr>
<td>SCTE</td>
<td>Society of Cable Telecommunications Engineers</td>
</tr>
<tr>
<td>ScTP</td>
<td>screened twisted-pair</td>
</tr>
<tr>
<td>SDH</td>
<td>synchronous digital hierarchy</td>
</tr>
<tr>
<td>SFF</td>
<td>small form factor</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
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<tr>
<td>SIP IC</td>
<td>Single Inline Package Integrated Circuit</td>
</tr>
<tr>
<td>SONET</td>
<td>synchronous optical network</td>
</tr>
<tr>
<td>SP</td>
<td>service provider</td>
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<td>SRL</td>
<td>structural return loss</td>
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<td>STM</td>
<td>synchronous transport model</td>
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<tr>
<td>STP</td>
<td>shielded twisted-pair</td>
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<tr>
<td>SSTP</td>
<td>screened and shielded twisted-pair</td>
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<tr>
<td>TBB</td>
<td>telecommunications bonding backbone</td>
</tr>
<tr>
<td>TCL</td>
<td>transverse conversion loss</td>
</tr>
<tr>
<td>TE</td>
<td>telecommunications enclosure</td>
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<tr>
<td>TEF</td>
<td>telecommunications entrance facility</td>
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<tr>
<td>TGB</td>
<td>telecommunications grounding busbar</td>
</tr>
<tr>
<td>TIA</td>
<td>Telecommunications Industry Association</td>
</tr>
<tr>
<td>TMGB</td>
<td>telecommunications main grounding busbar</td>
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<tr>
<td>TP</td>
<td>transition point</td>
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<td>TR</td>
<td>telecommunications room</td>
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<tr>
<td>TS</td>
<td>telecommunications space</td>
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<tr>
<td>TSB</td>
<td>Telecommunications System Bulletin</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratories Inc</td>
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<tr>
<td>ULC</td>
<td>Underwriters Laboratories of Canada</td>
</tr>
<tr>
<td>UNO</td>
<td>unless noted otherwise</td>
</tr>
<tr>
<td>UPC</td>
<td>universal product code</td>
</tr>
<tr>
<td>UPS</td>
<td>uninterruptible power supply</td>
</tr>
<tr>
<td>UTP</td>
<td>unshielded twisted-pair</td>
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<tr>
<td>WA</td>
<td>work area</td>
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<tr>
<td>WAN</td>
<td>wide area network</td>
</tr>
<tr>
<td>ZDA</td>
<td>zone distribution area</td>
</tr>
<tr>
<td>WP</td>
<td>waterproof outlet box</td>
</tr>
<tr>
<td>X</td>
<td>cross-connect</td>
</tr>
</tbody>
</table>
## Units of measure

- A  Ampere
- dB  decibel
- °C  degrees Celsius
- °F  degrees Fahrenheit
- ft  feet, foot
- g  acceleration of gravity (shown in Helvetica oblique for English measure)
- g  gram
- Gb/s  gigabit per second
- GHz  gigahertz
- Hz  hertz
- in  inch
- J  joule
- kb/s  kilobit per second
- kg  kilogram
- kHz  kilohertz
- km  kilometer
- kN  kilonewton
- kPa  kilopascal
- kV  kilovolt
- kVA  kilovoltamp
- kW  kilowatt
- lbf  pound-force
- lx  lux
- m  meter
- mA  milliampere
- m/s²  acceleration of gravity in SI (1g = 9.7536 m/s²)
- Mb/s  megabit(s) per second
- MHz  megahertz
- mm  millimeter
- N  Newton
- nF  nanofarad
- nm  nanometer
- ns  nanosecond
- pF  picofarad
- ppm  parts per million
- sq in  square inch
- sq mm  square millimeter
- V  volt
- Vac  volts alternating current
- Vdc  volts direct current
- V rms  volts root mean square
- W  Watt
- µg  microgram
- µm  micrometer or micron
- Ω  Ohm
GLOSSARY

ablative: The development of a hard char that resists the erosion of fire and flames; a characteristic of a firestop when exposed to fire.

access floor: A system consisting of completely removable and interchangeable floor panels that are supported on adjustable pedestals or stringers (or both) to allow access to the area beneath.

access line: A telecommunications circuit provided by a service provider at the demarcation point.

access provider: The operator of any facility that is used to convey telecommunications signals to and from a customer premises.

access unit: A location that allows entry into the pathway system.

activation unit: A floor system device that contains all components necessary to provide service access.

active cross-connect: A facility enabling the termination of cable elements and their interconnection or cross-connection by electronic means.

adapter: A device that enables any or all of the following:
   (1) different sizes or types of plugs to mate with one another or to fit into a telecommunications outlet,
   (2) the rearrangement of leads,
   (3) large cables with numerous conductors to fan out into smaller groups of conductors, and
   (4) interconnection between cables.

adapter; optical fiber duplex: A mechanical device designed to align and join two duplex optical fiber connectors (plugs) to form an optical duplex connection.

administration: The method for labeling, identification, documentation and usage needed to implement moves, additions and changes of the telecommunications infrastructure.

aerial cable: Telecommunications cable installed on aerial supporting structures such as poles, sides of buildings, and other structures.

alternate entrance: A supplementary entrance facility into a building using a different routing to provide diversity of service and for assurance of service continuity.

alternate route: See alternate entrance.

antenna entrance: A pathway facility from the antenna to the associated equipment.

approved ground: See ground.

architectural assemblies: Walls, partitions, or other barriers that are not load bearing.

architectural structures: Walls, floors, floor/ceilings and roof/ceilings that are load bearing.

as-built: see record drawing

attenuation: The decrease in magnitude of transmission signal strength between points, expressed in dB as the ratio of output to input signal level.
auxiliary disconnect outlet: A device usually located within the tenant or living unit used to terminate the ADO or backbone cable. See DEMARC.

auxiliary disconnect outlet cable: In residential applications, the cable from the auxiliary telecommunications disconnect outlet/connector or the distribution device in a customer's premises to the backbone facility or the point of demarcation.

backbone: 1) A facility (e.g., pathway, cable or conductors) between any of the following spaces: telecommunications rooms, telecommunications enclosures, common telecommunications rooms, floor serving terminals, entrance facilities, equipment rooms, and common equipment rooms. 2) In a data center, a facility (e.g. pathway, cable or conductors) between any of the following spaces: entrance rooms or spaces, main distribution areas, horizontal distribution areas, telecommunications rooms.

backbone bonding conductor: A copper conductor extending from the telecommunications main grounding busbar to the farthest floor telecommunications grounding busbar.

backbone cable: See backbone.

backbone raceway: That portion of the pathway system that permits the placing of main and high-volume cables between the entrance location and all cross-connect points within a building and between buildings.

balance: Balance is the ratio of the differential signal output at either end of any pair to a common mode signal input, at either end of the same or a different pair, and vice versa, under specified termination conditions.

barrier (architectural): Architectural structures or assemblies.

bearing wall: A wall supporting a load other than its own weight.

binder group: One of two or more bound collections of pairs or fibers within a cable.

blank cell: The hollow space of a cellular metal or cellular concrete floor unit without factory installed fittings.

blended floor system: A combination of cellular floor units with raceway capability and other floor units with raceway capability, systematically arranged in a modular pattern.

bonding: The permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed.

bonding conductor for telecommunications: A conductor that interconnects the telecommunications bonding infrastructure to the buildings service equipment (power) ground.

Bonding conductor: A conductor that interconnects the screened twisted-pair horizontal cabling infrastructure to the telecommunications grounding busbar.

braid: A group of non-insulated conductors interwoven to surround one or more insulated conductors.

bridged jack: A dual position modular female jack where all pins of one jack are permanently bridged to the other jack in the same order.

bridged tap: A connection that enables multiple appearances of the same cable pair at several distribution points.

building automation system: Equipment and telecommunications infrastructure that supports monitoring, control, operation and management of building services.

building backbone: Pathways or cabling between telecommunications service entrance rooms, equipment rooms, telecommunications rooms, or telecommunications enclosures within a building.
building core: A three-dimensional space permeating one or more floors of the building and used for the extension and distribution of utility services (e.g., elevators, washrooms, stairwells, mechanical and electrical systems, and telecommunications) throughout the building.

building entrance area: See entrance room or space (telecommunications).

building module: The standard selected as the dimensional coordination for the design of the building, e.g., a multiple of 100 mm (4 in), since the international standards have established a 100 mm (4 in) basic module.

bundled cable: An assembly of two or more cables continuously bound together to form a single unit.

buried cable: A cable installed under the surface of the ground in such a manner that it cannot be removed without disturbing the soil.

cabinet: A container that may enclose connection devices, terminations, apparatus, wiring, and equipment.

cabinet (telecommunications): An enclosure with a hinged cover used for terminating telecommunications cables, wiring and connection devices.

cable: An assembly of one or more insulated conductors or optical fibers, within an enveloping sheath.

cable run: A length of installed media, which may include other components along its path.

cable sheath: A covering over the optical fiber or conductor assembly that may include one or more metallic members, strength members, or jackets.

cabling: A combination of all cables, jumpers, cords, and connecting hardware.

campus: The buildings and grounds having legal contiguous interconnection.

campus backbone: Cabling for interconnecting telecommunications spaces between buildings.

cavity wall: A wall built of solid masonry units arranged to provide air space within the wall.

ceiling distribution system: A distribution system that utilizes the space between a suspended or false ceiling and the structural surface above.

cell: A single raceway of a cellular or underfloor duct system.

cellular floor: A floor distribution method in which cables pass through floor cells, constructed of steel or concrete to provide a ready-made raceway for distribution of power and telecommunications cables.

cellular floor raceway: An assembly of hollow, longitudinal units constituting part of a floor, and systematically placed for the distribution of cables.

cementitious firestop: A firestopping material that is mixed with water, similar in appearance to mortar. See firestopping.

centralized cabling: A cabling configuration from the work area to a centralized cross-connect using pull through cables, an interconnect, or splice in the telecommunications room or telecommunications enclosure.

channel: The end-to-end transmission path between two points at which application-specific equipment is connected.

commercial building: A building or portion thereof that is intended for office use.
common equipment room (telecommunications): An enclosed space used for equipment and backbone interconnections for more than one tenant in a building or campus.

common telecommunications room: An enclosed space used for backbone interconnections for more than one tenant in a building, which may also house equipment.

computer room: An architectural space whose primary function is to accommodate data processing equipment.

cement fill: A minimal-depth concrete pour to encase single-level underfloor duct.

conduit: (1) A raceway of circular cross-section. (2) A structure containing one or more ducts.

Editorial note - For the purposes of these Standards the term conduit includes electrical metallic tubing (EMT) or electrical non-metallic tubing (ENT)

conduit system: Any combination of ducts, conduits, maintenance holes, handholes and vaults joined to form an integrated whole.

connecting hardware: A device providing mechanical cable terminations.

connector (plug), duplex; optical fiber: A remateable device that terminates two fibers and mates with a duplex receptacle.

connector, small form factor: An optical fiber duplex connector with a size approximating that of an 8-position modular outlet/connector typically used for terminating 4-pair copper cable.

consolidation point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

contractor: A licensed and qualified company charged with the execution of a scope of work by the Owner. Contractors include but are not limited to equipment installers/vendors, cable contractors, project managers, and all other private entities performing related work for the owner.

core area: See building core.

core wall: A wall that runs between structural floor and structural ceiling to separate stairwells, elevators, etc. from the rest of the building.

cord (telecommunications): A cable using stranded conductors for flexibility, as in distribution cords or line cords.

NOTE - Line cords can also use tinsel conductors.

coverage area: the area served by a device.

coverage area cable/cord: A cable or cord connecting the building automation system outlet or horizontal connection point to a building automation system device.

cross-connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

cross-connection: A connection scheme between cabling runs, subsystems, and equipment using patch cords or jumpers that attach to connecting hardware on each end.

crossover: The junction unit at the point of intersection of two cable trays, raceways, or conduit (pathways) on different planes.

customer premises: Building(s), grounds and appurtenances (belongings) under the control of the customer.

customer premises equipment: Telecommunications equipment located on the customer's premises.

delay skew: The difference in propagation delay between any two pairs within the same cable sheath.
**DEMARC or demarcation point:** A point where the operational control or ownership changes.

**data:** Electronically encoded information.

**data center:** a building or portion of a building whose primary function is to house a computer room and its support areas.

**direct-buried cable:** A telecommunications cable designed to be installed under the surface of the earth, in direct contact with the soil.

**distribution device:** A facility located within the dwelling unit for interconnection or cross connection.

**distribution device cord:** A telecommunications cord that extends between the distribution device and the auxiliary disconnect outlet.

**distribution duct:** A raceway of rectangular cross-section placed within or just below the finished floor and used to extend the wires or cables to a specific work area.

**distribution frame:** A structure with terminations for connecting the cabling of a facility in such a manner that interconnection or cross-connections may be readily made.

1. **main:** When the structure is located at the entrance facility or main cross-connect and serving the building or campus.
2. **intermediate:** When the structure is located between the main cross-connect and the telecommunications room.

**double pour:** The pouring of a concrete floor in two stages.

**drain wire:** A non-insulated conductor placed in electrical contact with a shield.

**duct:** (1) A single enclosed raceway for conductors or cables. See also conduit, raceway. (2) A single enclosed raceway for wires or cables usually used in soil or concrete. (3) An enclosure in which air is moved. Generally part of the HVAC system of a building.

**ductbank:** An arrangement of ducts, for wires or cables, in tiers.

**earth:** See ground.

**earthing:** See grounding.

**effectively grounded:** For a definition see the NEC.

**elastomeric firestop:** A firestopping material resembling rubber (See also firestopping).

**electrical closet:** Floor-serving facility for housing electrical equipment, panelboards, and controls.

**electrical service equipment:** That portion of the electrical power installation, the service enclosure or its equivalent, up to and including the point at which the supply authority makes connection.

**electromagnetic compatibility:** The ability of electronic systems to operate in their intended electromagnetic environment without suffering performance degradation and without causing performance degradation in other equipment.

**electromagnetic interference:** Radiated or conducted electromagnetic energy that has an undesirable effect on electronic equipment or signal transmissions.
**embedded duct**: A duct fully enclosed inside a floor or a wall.

**emergency power**: A stand-alone secondary electrical supply source not dependent upon the primary electrical source.

**EMI segregation**: Isolation of the telecommunications signal from electromagnetic interference.

**enclosure, telecommunications**: A case or housing that may contain telecommunications equipment, cable terminations, or horizontal cross-connect cabling.

**endpoint PSE**: A power-sourcing device located in networking equipment.

**end user**: The owner or user of the premises cabling system.

**entrance bridge**: A terminal strip that is an optional component in a network interface device and is provided for the connection of ADO cable.

**entrance facility (telecommunications)**: An entrance to a building for both public and private network service cables (including wireless) including the entrance point of the building and continuing to the entrance room or space.

**entrance point (telecommunications)**: The point of emergence for telecommunications cabling through an exterior wall, a floor, or from a conduit.

**entrance room or space (telecommunications)**: A space in which the joining of inter or intra building telecommunications backbone facilities takes place.

  Editorial note - An entrance room may also serve as an equipment room.

**equal level far-end crosstalk**: A measure of the unwanted signal coupling from a transmitter at the near-end into another pair measured at the far-end, and relative to the received signal level.

**equipment cable; cord**: A cable or cable assembly used to connect telecommunications equipment to horizontal or backbone cabling.

**Equipment distribution area**: the computer room space occupied by equipment racks or cabinets.

**equipment room (telecommunications)**: An environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate cross-connect.

**exothermic weld**: A method of permanently bonding two metals together by a controlled heat reaction resulting in a molecular bond.

**false ceiling**: See suspended ceiling.

**far-end crosstalk loss**: A measure of the unwanted signal coupling from a transmitter at the near end into another pair measured at the far end, and relative to the transmitted signal level.

  Note -- This term is also known as input/output far end crosstalk loss.

**feeder duct**: See header duct.

**fiber optic**: See optical fiber.

**field wiring**: An electrical connection intended to be made at the time of installation, in the field, as opposed to factory wired.
fire break: A fire-rated material, device, or assembly of parts installed along a cable, other than at a cable penetration of a fire-rated barrier, to prevent the spread of fire along a cable.

fire resistance rating: The time in hours or fraction thereof that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria.

fire shield: A fire-rated material, device, or assembly of parts between pathways to prevent propagation of flames from one pathway to an adjacent pathway.

firestop: A fire-rated material, device, or assembly of parts installed in a penetration of a fire-rated barrier.

firestop seals: See Firestop system.

firestop system: A specific construction consisting of the material(s) (firestop penetration seals) that fill the opening in the wall or floor assembly and any items that penetrate the wall or floor, such as cables, cable trays, conduit, ducts, pipes, and any termination devices, such as electrical outlet boxes, along with their means of support.

firestopping: The process of installing listed, fire-rated materials into penetrations in fire-rated barriers to reestablish the fire-resistance rating of the barrier.

fixed devices: Any low-voltage device permanently affixed to a surface for purposes of security, fire detection or other control, data, or entertainment applications.

floor above grade: All floors above ground level.

floor serving terminal: See terminal.

floor slab: That part of a reinforced concrete floor which is carried on beams below.

flush duct: A duct accessible by a cover that is even with the surface it is mounted in.

furniture cluster: A contiguous group of work areas, typically including space divisions, work surfaces, storage, and seating.

Generic cabling: A structured telecommunications cabling system, capable of supporting a wide range of applications. Generic cabling can be installed without prior knowledge of the required applications. Application specific hardware is not a part of generic cabling.

ground: A conducting connection, whether intentional or accidental, between an electrical circuit (e.g., telecommunications) or equipment and the earth, or to some conducting body that serves in place of earth.

grounding: The act of creating a ground.

grounding conductor: A conductor used to connect the grounding electrode to the building’s main grounding busbar.

grounding electrode: A conductor, usually a rod, pipe or plate (or group of conductors) in direct contact with the earth for the purpose of providing a low-impedance connection to the earth.

grounding electrode conductor: The conductor used to connect the grounding electrode to the equipment grounding conductor, or to the grounded conductor of the circuit at the service equipment, or at the source of a separately derived system.

grounding electrode system: For a definition use the terminology as specified in NEC, Article 250 Part H.

grounding mat: An extensive system of bare conductors, buried below the surface of the earth, intended to provide a low resistance connection to earth and to equalize the potential within the area covered.
handhole: A structure similar to a small maintenance hole in which it is expected that a person cannot enter to perform work.

hard-line trunk: A rigid coaxial cable, typically used for backbone cabling.

hard sheath cable: A cable or wire contained within a continuous inner or outer metal sheath.

header duct (trenchduct, feeder duct): A raceway of rectangular cross-section placed within the floor to tie distribution duct(s) or cell(s) to the telecommunications room.

high-order mode transient losses: Losses in power caused by the attenuation of weakly-guided high-order modes within multimode optical fiber.

home runs: A pathway or cable between two locations without a point of access in between.

horizontal cabling: 1) The cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. 2) The cabling between and including the building automation system outlet or the first mechanical termination of the horizontal connection point and the horizontal cross-connect. 3) In a data center, horizontal cabling is the cabling from the horizontal cross-connect (in the main distribution area or horizontal distribution area) to the outlet in the equipment distribution area or zone distribution area.

horizontal connection point: A location for connections between horizontal cables that extend from building pathways and horizontal cables that extend to building automation systems devices and equipment.

horizontal cross-connect: A cross-connect of horizontal cabling to other cabling, e.g., horizontal, backbone, equipment.

horizontal distribution area: A space in a computer room where a horizontal cross-connect is located.

hybrid cable: An assembly of two or more cables, of the same or different types or categories, covered by one overall sheath.

hybrid optical fiber cable: An optical fiber cable containing two or more fiber types (e.g., multimode and singlemode).

identifier: An item of information that links a specific element of the telecommunications infrastructure with its corresponding record.

in floor pathway: A raceway within a floor structure.

industrial building/structure: A building or structure or portion thereof intended for uses such as transportation, manufacturing, warehousing, processing, refining, or drilling.

infrastructure (telecommunications): A collection of those telecommunications components, excluding equipment, that together provide the basic support for the distribution of all information within a building or campus.

innerduct: A nonmetallic raceway, usually circular, placed within a larger raceway.

insert: An opening into the distribution duct or cell, from which the wires or cables emerge.

insert, afterset: An insert installed after the installation of the concrete floor slab or other flooring material.

insert, preset: An insert installed prior to the installation of the concrete floor slab or other flooring material.
**insertion loss**: The signal loss resulting from the insertion of a component, or link, or channel, between a transmitter and receiver (often referred to as attenuation).

**insertion loss deviation**: The difference between the actual insertion loss as measured on a permanent link or channel and the insertion loss as determined by adding the component losses.

**insulation displacement connection**: An electrical connection made by inserting an insulated wire into a metallic slot.

**insulation displacement contact**: See insulation displacement termination.

**insulation displacement connection, accessible**: An ID connection in which it is possible to access test points for carrying out mechanical tests and electrical measurements without deactivation of any design feature intended to establish or maintain the insulation displacement connection.

**insulation displacement connection, non-accessible**: An ID connection in which it is not possible to access test points for carrying out mechanical tests and electrical measurements without deactivation of any design feature.

**insulation displacement termination**: A contact suitable for making an electrical connection with a insulated conductor.

**insulation piercing connection**: An electrical connection made by piercing an insulated wire with a metallic element.

**insulation piercing contact**: An electrical connection made by piercing an insulated wire with a metallic element.

**interconnection**: A connection scheme that employs connecting hardware for the direct connection of a cable to another cable without a patch cord or jumper.

**interconnecting bonding conductor**: A conductor that interconnects the telecommunications bonding backbones.

**intermediate cross-connect**: A cross-connect between first level and second level backbone cabling.

**intermediate distribution frame**: See distribution frame.

**intrabuilding telecommunications backbone**: This term is out dated.aic term. See building backbone.

**intumescent firestop**: A firestopping material that expands under the influence of heat.

**jack contact**: The current carrying metallic member in a modular jack.

**jack header**: A raceway similar to a header duct, usually provided in short lengths to connect a quantity of distribution ducts together.

**jumper**: 1) An assembly of twisted-pairs without connectors, used to join telecommunications circuits/links at the cross-connect. 2) A length of optical fiber cable with a connector plug on each end.

**junction box**: A location in the pathway system that allows transition of pathways and access to cables.

**keying**: The mechanical feature of a connector system that guarantees correct orientation of a connection, or prevents the connection to a jack, or to an optical fiber adapter of the same type intended for another purpose.

**light commercial building**: A building or portion thereof that is intended for use with one to four non-residential exchange access lines per tenant.
**link:** A transmission path between two points, not including terminal equipment, work area cables, and equipment cables.

**linkage:** A connection between a record and an identifier or between records.

**listed:** Equipment included in a list published by an organization, acceptable to the authority having jurisdiction, that maintains periodic inspection of production of listed equipment, and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

**local exchange carrier:** The telecommunications company that provides public switched network access service.

**longitudinal conversion loss:** A ratio, expressed in dB, of measured differential voltage relative to the common mode voltage on the same conductor pair applied at the same end.

**longitudinal conversion transfer loss:** A ratio, expressed in dB, of measured differential voltage at one end of a conductor pair relative to the common mode voltage applied on any pair at the opposite end or on any other pair on the same end.

**main cross-connect:** A cross-connect for first level backbone cables, entrance cables, and equipment cables.

**main distribution area:** The space in a computer room where the main cross-connect is located.

**main distribution frame:** See distribution frame.

**main terminal room:** See main terminal space.

**main terminal space:** The location of the cross-connect point of incoming cables from the telecommunications external network and the premises cable system (See also common equipment room).

**maintenance hole (telecommunications):** A vault located in the ground or earth as part of an underground duct system and used to facilitate placing, connectorization, and maintenance of cables as well as the placing of associated equipment, in which it is expected that a person will enter to perform work.

**mechanical room:** An enclosed space serving the needs of mechanical building systems.

**media (telecommunications):** Wire, cable, or conductors used for telecommunications.

**membrane penetration:** An opening through only one surface or side of a barrier.

**midspan PSE:** A power-sourcing device located in a component within a channel.

**minimum point of entry:** Either the closest practicable point to where the carrier facilities cross the property line or the closest practicable point to where the cabling enters a multi-unit building or buildings.

**mode:** A path of light in an optical fiber.

**modular jack:** A female telecommunications connector that may be keyed or unkeyed and may have 6 or 8 contact positions, but not all the positions need be equipped with jack contacts.

**modular plug:** A male telecommunications connector for cable or cords that may be keyed or unkeyed and may have 6 or 8 contact positions, but not all the positions need be equipped with contacts.

**modular plug cord:** A length of cable with a modular plug on both ends.

**monolithic pour:** The single, continuous pouring of a concrete floor or columns of any given floor of a building structure.
monolithic slab: The result of a monolithic pour.

multimedia: (1) An application that communicates to more than one of the human sensory receptors. (2) Applications that communicate information by more than one means.

multimode optical fiber: An optical fiber that carries many paths of light.

multipair cable: A cable having more than four pairs.

multipoint bus: An open sequence of connected devices.

multipoint ring: A closed sequence of connected devices.

multi-user telecommunications outlet assembly: A grouping in one location of several telecommunications outlet/connectors.

network interface device: The point of connection between networks.

network termination equipment: See network interface device.

open office: A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

optical fiber: Any filament made of dielectric materials that guides light.

optical fiber cable: An assembly consisting of one or more optical fibers.

optical fiber duplex connection: A mated assembly of two duplex connectors and a duplex adapter.

outlet (telecommunications): A designated location containing one or more telecommunications outlet/connectors.

outlet/connector (telecommunications): A connecting device in the work area or living space on which horizontal cable or outlet cable terminates.

outlet box (telecommunications): A housing used to hold telecommunications outlet/connectors.

outlet cable: A cable placed in a residential unit extending directly between the telecommunications outlet/connector and the distribution device.

outlet/connector (telecommunications): A connecting device in the work area on which horizontal cable or outlet cable terminates.

outlet/connector (building automation system): A connecting device between a horizontal cable and coverage area cable/cord.

outside plant: Telecommunications infrastructure designed for installation exterior to buildings.

passive cross-connect: A facility enabling the termination of cable elements and their interconnection or cross-connection by means of jumpers or patchcords.

patch cord: A length of cable with a plug on one or both ends.

patch panel: A connecting hardware system that facilitates cable termination and cabling administration using patch cords.
pathway: A facility for the placement of telecommunications cable.

penetration: An opening in a fire-rated barrier.

penetration seals: See firestop system.

permanent link: A test configuration for a link excluding test cords and patch cords.

position bonding terminal: A device located in the work area that electrically bonds cabling or cabling and equipment to ground.

pigtails: one or more conductors or fibers with only one end terminated.

plaster ring: A metal or plastic plate that attaches to wallboard or a wall stud for the purpose of mounting a telecommunications faceplate.

plenum: A closed compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system. May also be referred to as a return-air system.

poke-thru device: An assembly that allows through-penetration of floor decking with telecommunication cables, or power, or both, while maintaining the fire-rating integrity of the floor.

poke-thru system: A poke-thru device installed in a penetration through a fire-resistant floor structure.

post-tensioned concrete: A type of reinforced concrete construction in which the embedded steel members are first put under tension, the concrete poured and allowed to harden, and the tension of the steel members released causing compression of the concrete.

power sum attenuation-to-crosstalk ratio: A ratio in dB, determined by subtracting the insertion loss from the power sum near-end crosstalk loss.

power sum equal level far-end crosstalk: A computation of the unwanted signal coupling from multiple transmitters at the near-end into a pair measured at the far-end, and normalized to the received signal level.

power sum near-end crosstalk loss: A computation of the unwanted signal coupling from multiple transmitters at the near-end into a pair measured at the near-end.

prewiring: (1) Wiring installed before walls are enclosed or finished. (2) Wiring installed in anticipation of future use or need.

private branch exchange: A private telecommunications switching system.

propagation delay: The time required for a signal to travel from one end of the transmission path to the other end.

pull box: A housing located in a pathway run used to facilitate the placing of wire or cables.

pull cord; pullwire: A cord or wire placed within a raceway and used to pull wire and cable through the raceway.

pull strength: See pull tension.

pull tension: The pulling force that can be applied to a cable.

raceway: Any enclosed channel designed for holding wires or cables.

radio frequency interference: Electromagnetic interference within the frequency band for radio transmission.

rearrangement: An action taken to replace, add, adapt or remove existing premises wiring system components.
record: A collection of detailed information related to a specific element of the telecommunications infrastructure.

record drawing (as-built): A plan, on paper, that graphically documents and illustrates the installed telecommunications infrastructure in a building, or portion thereof.

reinforced concrete: A type of construction in which steel (reinforcement) and concrete are combined, with the steel-resisting tension and the concrete-resisting compression.

report: A presentation of a collection of information from the various records.

resident: The individual responsible and accountable for the telecommunications services provided to the premises who may reside on the premises or, in the case of a rental unit, be the owner or property manager.

residential gateway: A device that enables communication among networks in the residence and between residential networks and service providers’ networks.

return loss: A ratio expressed in dB of the power of the outgoing signal to the power of the reflected signal.

saddle: A device for establishing the position of the raceway or raceways within the concrete relative to the screed line, and for maintaining the spacing between the raceways.

screed line: The line to which poured concrete is leveled.

screen: An element of a cable formed by a shield.

screened twisted-pair (ScTP): A balanced cable with an overall screen.

service entrance: See entrance facility (telecommunications).

service equipment (power): The necessary equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors to a building or other structure, or an otherwise defined area, and intended to constitute the main control and means of cutoff of the electrical supply.

service fitting: An outlet box to house the connections for telecommunications at the user work area. See also insert.

service provider: The operator of any service that furnishes telecommunications content (transmissions) delivered over access provider facilities.

sheath: See cable sheath.

shield: A metallic layer placed around a conductor or group of conductors.

shielded enclosure cabinet: A metal electronics cabinet, constructed with welded seams and conductive gaskets on the doors that serve as an effective shield against electromagnetic radiation.

singlemode optical fiber: An optical fiber that carries only one path of light.

slab on grade: Concrete floor placed directly on soil, without basement or crawlspace.

sleeve: An opening, usually circular, through the wall, ceiling, or floor to allow the passage of cables.

slip sleeve: An oversized conduit that moves easily along an inner conduit and covers a gap or missing part of the smaller conduit.

slot: An opening through a wall, floor, or ceiling, usually rectangular, to allow the passage of cables.
small form factor connector: See connector, small form factor.

space (telecommunications): An area used for housing the installation and termination of telecommunications equipment and cable, e.g., common equipment rooms, equipment rooms, common telecommunications rooms, telecommunications rooms, telecommunications enclosures, work areas, and maintenance holes/handholes.

splice: A joining of conductors, meant to be permanent.

splice box: An enclosed space between pathways intended to house a cable splice.

splice closure: A device used to protect a splice.

star topology: A topology in which telecommunications cables are distributed from a central point.

station conductor: A wire that terminates at the equipment side of the protector.

support strand (messenger): A strength element used to carry the weight of the telecommunications cable.

suspended ceiling: A ceiling that creates an area or space between the ceiling material and the structure above.

telecommunications: Any transmission, emission, and reception of signs, signals, writings, images, and sounds, that is, information of any nature by cable, radio, optical, or other electromagnetic systems.

telecommunications bonding backbone: A conductor that interconnects the telecommunications main grounding busbar (TMGB) to the telecommunications grounding busbar (TGB).

telecommunications closet: See telecommunications room

telecommunications enclosure: See enclosure, telecommunications

telecommunications entrance facility: See entrance facility (telecommunications).

telecommunications entrance point: See entrance point (telecommunications).

telecommunications entrance room or space: See entrance room or space (telecommunications).

telecommunications equipment room: See equipment room (telecommunications).

telecommunications grounding busbar: A common point of connection for telecommunications system and equipment bonding to ground, and located in the telecommunications room or equipment room.

telecommunications infrastructure: See infrastructure (telecommunications).

telecommunications main grounding busbar: A busbar place in a convenient and accessible location and bonded, by means of the bonding conductor for telecommunications, to the buildings service equipment (power) ground.

telecommunications media: See media (telecommunications).

telecommunications outlet: See outlet/connector (telecommunications).

telecommunications room: An enclosed architectural space designed to contain telecommunications equipment, cable terminations, or cross-connect cabling.

telecommunications service entrance: See entrance facility (telecommunications).

telecommunications space: See space (telecommunications).
**terminal:** (1) a point at which information may enter or leave a communications network. (2) The input-output associated equipment. (3) A device by means of which wires may be connected to each other.

**termination:** This term is outmoded. See connecting hardware.

**termination hardware:** This term is outmoded. See connecting hardware.

**termination position:** A discrete element of connecting hardware where telecommunications conductors are terminated.

**through penetration:** A continuous opening that passes through both surfaces of a fire-rated barrier.

**topology:** The physical or logical arrangement of a telecommunications system.

**transfer impedance:** A measure of shielding performance determined by the ratio of the voltage on the conductors enclosed by a shield to the surface currents on the outside of the shield.

**transition point:** A location in the horizontal cabling where flat undercarpet cable connects to round cable.

**transverse conversion loss:** A ratio, expressed in dB, of the measured common mode voltage on a pair relative to the differential mode voltage on the same pair applied at the same end.

**trenchduct:** See header duct.

**trough:** A pathway for the containment of cable, typically provided with a removable cover.

**two-level duct:** An underfloor raceway system installed with the header raceways and the distribution raceways on two different planes.

**underground cable:** A telecommunications cable designed to be installed under the surface of the earth in a trough or duct that isolates the cable from direct contact with the soil.

**underfloor raceway:** A pathway placed within the floor and from which wires and cables emerge to a specific floor area.

**uninterruptible power supply:** A buffer between utility power or other power source and a load that requires continuous precise power.

**usable floor space:** Floor space which is capable of being used as a work area.

**User code:** A unique designation assigned to a person who is expected to use the circuit, equipment, service etc. serving a particular work area (e.g.: telephone number, a name, a circuit number, telecommunications outlet/connector, or a logical address).

**utility column:** An enclosed pathway extending from the ceiling to furniture or to the floor, that forms a pathway for electrical wiring, telecommunications cable, or both.

**utility tunnel:** An enclosed passageway, usually placed between buildings, for the distribution of utility services.

**vendor:** See contractor

**wire:** An individually insulated solid or stranded metallic conductor.

**wireless:** The use of radiated electromagnetic energy (e.g., radio frequency and microwave signals, light) traveling through space to convey information.
wire run: See cable run.

work area: A building space where the occupants interact with telecommunications terminal equipment.

work area cable (cord): A cable connecting the telecommunications outlet/connector to the terminal equipment.

zone box: An enclosure used to house one or more of the following; a) a consolidation point, b) a horizontal connection point, c) building automation system outlets.

Zone distribution area: the space in the data center where the zone outlet is located.

Zone distribution area: a space in a computer room where a zone outlet or a consolidation point is located.

Zone outlet: a connecting device in the zone distribution area terminating the horizontal cable enabling equipment cable connections to the equipment distribution area.