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AETC

FIRST 400 FEET STANDARD GUIDANCE

AT

ALL AETC BASES

PREPARED BY

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EXECUTIVE SUMMARY

The purpose of this policy is to provide minimum requirements for intra-building telecommunications wiring in support of Command, Control, Communications, Computer, and Intelligence (C4I) Systems requirements. This intrabuilding wiring is referred to as First 400 feet and includes the internal building media for distributing voice, video and data to include all equipment from the primary telecommunications closet/first patch panel to the end user hardware and software. The First 400 feet requirements may include but are not limited to necessary wiring and equipment supporting the following: local area networks, administrative and non-administrative telephone systems (including Voice Over IP), video, teleconferencing, cable television (CATV), alarms (other than fire), and office automation systems, (e.g., desktop video teleconferencing and educational applications). All require higher performance/throughput, greater network predictability, higher network availability, and enhanced security than is currently available in the existing communications infrastructure.

Due to bandwidth restrictive wiring for facilities at all of our AETC bases, improvement to the First 400 feet (from the hub/switch to the patch panels to the wall plate) as well as elimination of the traditional shared-Ethernet hubs and replacement with switched Ethernet must take place. Currently, the Information Transport System (ITS) component of Combat Information Transport System (CITS) provides only fiber to the majority of facilities on base and high-speed connectivity to the core buildings. However, the ITS does not incorporate upgrades within the buildings' infrastructure. Many buildings on AF bases do not have the right cabling infrastructure to support high-speed access capability. In order to achieve our enterprise end state, these buildings need upgrading to Category (CAT) 6 cabling as well as replacing the traditionally shared Ethernet hubs with switched Ethernet. To date, the First 400 feet and switched upgrade has been accomplished in ad-hoc fashion using wing O&M funds or fall out dollars. The publication of this document does NOT establish a program with central funding to execute structured CAT 6 wiring for the First 400 feet and provide users with switched Ethernet capability across the command, however, should funding become available this document will have the technical guidelines for how to proceed.

The standardized building wiring system should accommodate present communications requirements, support future expansion requirements, and minimize or eliminate building defacement due to future distribution system expansion or retrofit. These factors make the choice and layout of horizontal cable types very important to the design of the building cabling. In addition to satisfying today's telecommunications requirements, the horizontal cabling should facilitate ongoing maintenance and relocation. It should also accommodate future equipment and service changes.

Careful consideration was given to multimode fiber for horizontal wiring; however, based on the current cost of electronics it was deemed cost prohibitive to recommend multimode fiber optic cable for horizontal building interconnects in the near term.

Furthermore, new standards for properly installed copper cable systems support Gigabit Ethernet Standards. However, when facilities have multiple telecommunications rooms (TRs) the backbone data uplinks shall be multimode fiber.

The information presented within this document is a compilation of data from USAF guidance, commercial standards (ANSI/TIA/EIA and others), and actual experience of USAF engineers working with bases and design agencies in planning and designing C4I requirements. The intent of this document is to primarily follow the standards and installation practices from ANSI/TIA/EIA, BICSI and the National Electric Code. Where instances occur that this document exceeds the standards presented in EIA/TIA, BICSI or the NEC this document should be followed.

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1 OVERVIEW

1.1 Scope

This document details the AETC standard for planning, engineering, and installing premise wiring infrastructure for the First 400 Hundred Feet. This document was purposely written to be directive in nature. Statements using words such as ‘shall’ and ‘must’ are required items by all organizations.

The Air Force has a broad spectrum of information technology devices that require connectivity via a common communications infrastructure. A generic-wiring scheme for all facilities is critical to support a mixed environment of equipment, services, and classification levels. Industry-recognized, standards-based installation and management results in uniform wiring across locations, improved management of building space resources and reduced costs for wiring installation, support, and management. A common wiring system also improves network management, trouble-shooting, and isolation of data transmission problems. Careful and proper application of standards can also produce a predictably long-lived cabling system. Specifications are intended for telecommunications installations in the typical office configuration.

Any deviation from the requirements in this document must have prior written authorization from AETC/SC if the standard is less than what is documented in this document.

The information in this document applies to AFI 32-1021, Planning and Programming for MILCON projects, and to AFI 32-1023, Design and Construction Standards and Execution of Facility Construction Projects, or when the need arises for new voice, video and data cabling. This document is not intended to justify wholesale replacement and upgrade of existing premise wiring, facility backbone uplinks, or voice-video-data electronics. However, when the requirement arises for existing facilities to be upgraded that are not in compliance with this guidance the Systems Telecommunication Engineering Manager Base level (STEM-B) is responsible for establishing a technical solution and costing for out year planning to bring the facilities into compliance. Blueprint Implementation Plan (BIP) Elements should be entered in the C4ISR Infrastructure Planning System (CIPS) Base blueprints IAW defined AETC BIP Element templates. The STEM-B and base SCX shall assess the current infrastructure and identify this assessment within the CIPS.

This document follows the guidelines of ANSI/TIA/EIA standards; ANSI/TIA/EIA-568, Commercial Building Standards for Telecommunications Wiring and ANSI/TIA/EIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces, ANSI/TIA/EIA-606A, Administration Standard for Commercial Telecommunications Infrastructure, ANSI/TIA/EIA-607, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications. In addition to these standards, the BICSI-TDM manual is recommended to enhance the understanding of pre-wire design methods and concepts and the 2003 - National Electric Code (NEC)(NFPA-70).

When completing SIPRNet technical solutions, the user's work area (office) should be surveyed to determine if a network drop exists to service the SIPRNet terminal. If a port is available on an existing network jack, this jack may be used to service the cyphertext (black side) of the TACLANE encryption device. The category of facility and user's needs (i.e., 24-hour a day controlled area and number of SIPRNet workstations required) may dictate a different premise wiring scheme to provide the necessary LAN drop configuration. The wing IA office should be an integral part of the survey and development of the premise wiring configurations. Refer to Emission Security Information Message (ESIM) 03-11 and AFMAN 33-214 for further reference.

1.2 Purpose

The purpose of this document is to define standards and architecture for the first four hundred feet. To provide guidance in performing assessments, developing requirements, technical solutions, and costs for a voice and data telecommunications cabling system that will support a multi-product, multi-vendor environment.

This document shall be used by all AETC Bases to plan, design, review, and evaluate telecommunications cabling and distribution systems. Air Force Engineering Technical Letter (ETL) 02-12, requires pre-wiring in all new facility construction, additions, and renovation projects.

1.3 First Four Hundred Feet Definition

The first four hundred feet is defined as the internal building media for distributing voice, video, and data to include all equipment from the facility equipment room to the end user hardware and software.

1.4 Background

New requirements for telecommunications have proliferated rapidly over the past decade. Wiring and building designers are being challenged to better accommodate cable, telecommunications, and electronic systems in a rapidly changing technological environment. In the past, voice systems have had a large influence on building design but today telecommunications systems include voice, data, video, audio, security, and environmental control - all of which are needed in order to transport information throughout modern buildings.

Users are becoming painfully aware that they can no longer use the old voice methodologies because telecommunications and buildings are highly synergistic. Today, facilities and wiring systems must be planned in an integrated manner. The following compilation of telecommunications distribution standards provides state-of-the-art guidelines for effective and adaptable installations.

Proper adherence to these guidelines will reduce long-term building operation costs by providing a better infrastructure that is adaptable to change. The following telecommunications building design standards are intended for building wiring planners, designers and installers as well as architects, engineers, and vendors.

1.5 Document Technical Summary

The following is a summary of the policies established in this document for new construction, Military Construction Projects (MCP), and Restoration and Modernization, as defined in AFI 32-1021 and AFI 32-1023.

- All new premise wiring shall be Category 6 (Cat 6) to support Minimum 100/1000 Mbps to the desktop.
- Plenum rated cable should be used if the cabling is run through a plenum. A plenum is defined as the air return path of a central air handling system, either ductwork or open space over a suspended ceiling. This would also include the area under a raised floor if that area was used for fresh air supply or fresh air return. If unsure if an area is a plenum or not, have the Bio-environmental or base Fire Marshall make a determination.
- All Communications Outlets shall be quad outlets.
- A quad telecommunications outlet or equivalent is required for every 15 linear feet (4.6 meters) of wall space in office areas or 2000 square feet (186 sq meters) for warehouses or hangars.
- When facilities have multiple telecommunications rooms (TR) the backbone cabling shall be multimode fiber. Should the situation arise where a TR requires redundant links to another facility a hybrid single mode and multimode fiber optic cable may be installed.
    - Backbone cable plant shall consist of 62.5/125 or 50/125 12 strands, minimum, multimode graded-index fiber optic cables.
- Minimum of one outlet per quad shall be designated for a voice circuit.
- Voice outlets shall be terminated to Cat 6 patch panels and collocated with their respective data ports.
- Cost of mandatory uninterruptible power supply (UPS) for all telecommunications closets to provide emergency power for communications equipment for a minimum of 60 minutes must be included in the technical solutions for new facilities, renovations or any new 1st 400 feet project.
- Patch cords and cross connect jumpers shall be rated at same performance category as the cabling it connects.
- All new fiber optic patch panels shall be the base standard as defined by the local communications squadron, SC, ST or sub-miniature type connectors, and mounted in 19 inch racks.
- Voice Backbone Cabling shall be Cat 6 multi-pair backbone cable.
- Equipment racks shall be equipped with wire management panels.
- Multistory buildings shall include a minimum of one TR room per floor.
- Label all telecommunication infrastructure and equipment components IAW Labeling Scheme, Appendix C.

- TR designed to ANSI/TIA/EIA 569A for new construction, modified to conform as closely as possible to ANSI/TIA/EIA 569A for facility Restoration and Modernization.
- Cost to remove all abandoned telecommunications cables, voice and data, shall be included in all technical solutions for new cable installations. Reference NEC sections 800.2, 800.52 (B), 800.53 (A), and 800.53 (B)(1).
- Minimum requirements are identified to populate cable records database.
- Drawing package shall be included to accurately depict network configuration and cable plant, reference Appendix E, Drawings.
- Network Hardware installations should support at a minimum 100 Mbps to the desktop and should be SNMP version 2 or higher and IPv6 compliant.

2 FIRST FOUR HUNDRED FEET INFRASTRUCTURE COMPONENTS

The three primary First Four Hundred Feet components are the cabling infrastructure, electronic network equipment, and processing equipment.

2.1 Cabling Infrastructure Designation

Cabling infrastructure generally includes copper and fiber optic cabling within and into AF facilities. Cabling within the facilities may be separated into two types, backbone (also called vertical or riser) and horizontal. Backbone cabling is the distribution from central wiring locations to the Telecommunications Rooms (TRs), while horizontal cabling runs from the TRs to the work areas.

2.2 Networking Equipment Designation

Networking equipment includes routers, shared Ethernet hubs, repeaters, switches, and other electronics equipment not directly associated with a single AF system. Some facilities still have a combination of routers, shared media hubs and older low end switches in place, which supports Ethernet connectivity from various manufacturers. All networking hardware installations must support at a minimum switched 100 Mbps to the desktop with consideration of switched 100/1000 Mbps for high-end bandwidth requirements for servers and applications. Only network equipment that is SNMP version 2 or higher as well as IPv6 compliant should be considered for re-usage or new procurement.

2.3 Processing Equipment Designation

Processing equipment is both AF system-specific and general supplied administrative equipment. Administrative equipment includes personal computers (PCs), servers and printers. Based upon the organizational user located at the site, administrative equipment and PCs associated with specific AF systems will constitute the majority of the processing equipment attached to a facility network. In other words, as networks are activated, a majority of the processors active on the networks will be PCs, either associated with an AF system or used for administration. While this document includes no specific processor or Network Interface Card (NIC) recommendations, the processors are a key part of the overall capability required from the network. The processor data throughput necessary to meet user requirements is the driving force behind the need for faster networking equipment and better transmission media.

3 STRUCTURED CABLING SYSTEM COMPONENTS

The ANSI/TIA/EIA-568-B.1 standard dissects the cabling system into six distinct subsystems:

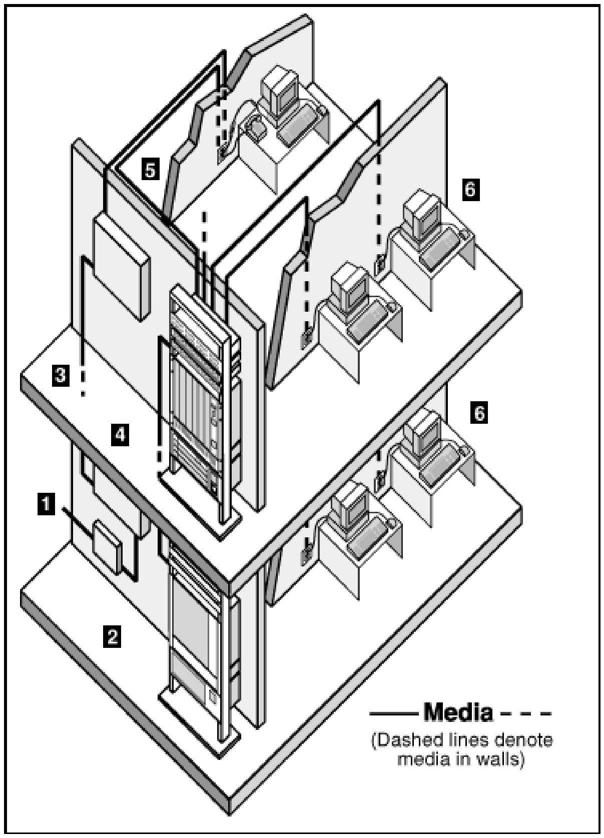


Figure 1 ANSI/TIA/EIA Guidance 6 Subsystems

1. Entrance Facilities
2. Equipment Rooms
3. Backbone Cabling
4. TRs
5. Horizontal Cabling
6. Work Area

3.1 Cabling Infrastructure Designation

3.1.1 Copper Cabling

Air Force facilities still exist that have a mix of 10BaseT (UTP) copper cabling (level 3/4/5) for their networks. ANSI/TIA/EIA-568-B.2 and Addendum 1 is the only recognized cable standard for any new or replacement communication wiring. Therefore, this document only focuses on Cat 6 copper cabling.

Voice cabling is commonly found with a large number of multiple pairs, from 25, 50, or even into the 100's of pairs. Large cable pairings, typically over 25-pair, are used for main distribution, backbone applications, while smaller pairs are used for horizontal distribution runs.

In contrast, data-rated cable is a higher grade and cost of cable. Data-rated cables now come in multiple categories. The only recognized categories designated in ANSI/TIA/EIA Standard 568-B.2, Section 4 are Category 3, Category 5e and Category 6. The cable categories indicate the amount of allowable attenuation over a specified frequency spectrum, with a smaller usable frequency spectrum available for the lower numbered category cables. Based upon the higher rating of the cable, there is more bandwidth potential available from the cable. Currently, Category 3 cable is rated up to 16 megabits per second (Mbps)/ 16 MHz, Category 5e up to 1000 Mbps/100 MHz and Category 6 1000Mbps up to 250MHz. Category 1, 2, 4, and 5 cables are not recognized as part of the referenced standard. Category 5 transmission characteristics, used in "legacy" cabling installations, are provided for reference in annex N of the EIA/TIA Standard. Within each category, multiple pairings of the conductors are provided, depending on the specific cable vendor.

3.1.2 Fiber Optic Cabling

Two types of fiber optic cable exist, multimode and single mode. Mode refers to the path the light takes to travel down the fiber. Multimode has multiple propagation paths, while single mode only has one propagation path. Fiber optic cable has a core, cladding, and buffer, with the fiber optic core being either multimode or single mode. The size of the fiber optic cable is annotated as core/cladding/buffer (sometimes just provided as core/cladding) because each mode of cable has multiple sizes associated with it. For example, multimode fiber optic cable has core sizes of 50 and 62.5 microns; cladding sizes of 125 microns; and buffer sizes of 250 and 900 microns available. Additionally, multimode cable can be purchased as either step-index or graded-index, with graded-index fibers providing longer distance and higher bandwidth capability than step-index fibers. It is also recommended that laser-optimized multimode fiber be purchased when high bandwidth requirements are expected in the future.

Multimode fiber optic cable is normally used for distribution within a building or in a campus environment where the distances are limited to within approximately two kilometers ([km] -i.e., 1.2 miles). Single mode fiber provides the best possible distance and bandwidth capability, and is used for either longer distances or high bandwidth applications that are beyond the range of multimode fiber. Consequently, the electronics equipment attached to single mode fiber is typically more expensive than multimode fiber optic equipment.

4 COMMUNICATIONS ROOMS

4.1 Equipment Room

Equipment Rooms (ERs) are defined in TIA/EIA-568-B.1, Chapter 8. The primary ER for the typical facility is the service entrance for the building's distribution and communications systems. It is the primary location for C4I switching and transmission equipment, main distribution frame(s), and other equipment needed for termination of the building's interior wiring systems and to interface them with the exterior (outside plant) cable system. The ER also provides the primary distribution point for communications cables and wiring within the building and associated cross-connect cable/wiring. The location of the ER should ensure the horizontal cable distance to a user outlet is no more than 90 meters (295 ft) per ANSI/TIA/EIA-568-B.1, paragraph 4.3 Horizontal Distances.

4.1.1 Building Entrance Facilities

The building service entrance provides an entry point for outside plant cable(s) into the building. This is typically located in the ER, however, the entrance facility could be in a Mechanical/Civil Engineering Equipment Room where outside plant fiber optic and copper cables are terminated, then cross connected to the ER. Outside plant cable shall not extend beyond 50 feet unless complying with National Electrical Code (NFPA 70) guidelines and restrictions, 2002 NEC, Section 800-50. Voltage Surge protection shall be IAW ETL 02-12 section 8.3.3.2.5

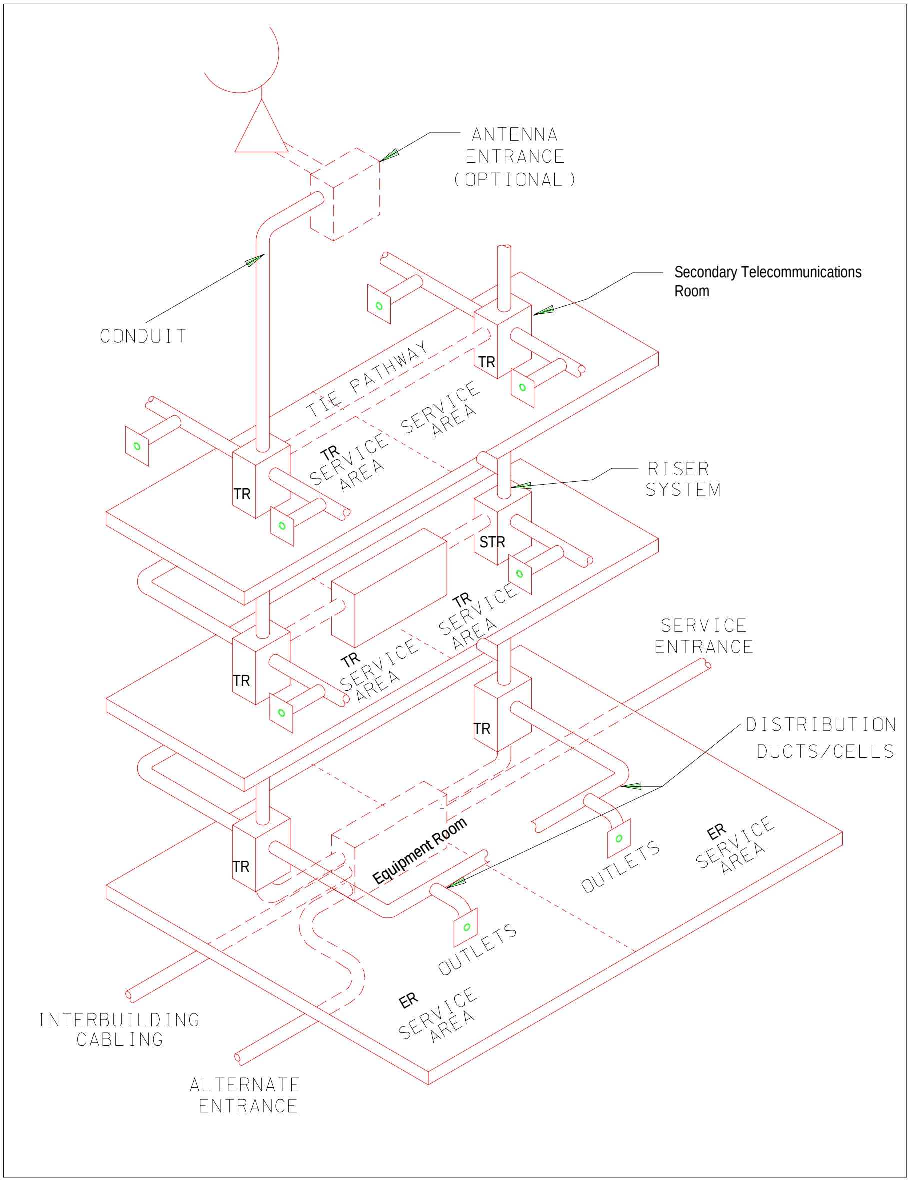


Figure 2 Distribution System, Duct/Cellular Floor

4.1.2 Equipment Room Standard

The general requirements identified in ANSI/TIA/EIA-569A Chapter 8, Equipment Room for structural, lighting, room size, electrical, environment, battery, fire protection, earthquake, and local exchange and call termination services shall be followed and modified as necessary to include the local requirements and building construction codes. Guidance is also available in BICSI TDM Manual, 10th edition, Chapter 8, Equipment Rooms and ETL 02-12.

Physical security measures (e.g. solid walls, solid doors, locks, etc.) are required to secure ER's.

4.2 Telecommunications Room

Telecommunications Rooms (TRs) are an integral part of the distribution system elements (see Figure 2). TRs must have sufficient cross-connect hardware to terminate all distribution pairs to the floor area that the TR serves. TR's provide exclusive space to extend communications services to the workstations. The location of the TR should ensure the horizontal cable distance to a user outlet is no more than 90 meters (295ft) per ANSI/TIA/EIA-568-B.1, paragraph 4.3 Horizontal distances. These TRs are required to supplement the ER with multiple floor or large facilities where distance limitations are a factor.

4.2.1 Telecommunications Room Standard

The general requirements identified in ANSI/TIA/EIA-569B, Chapter 7.11, Equipment Room for structural, lighting, room size, electrical, environment, battery, fire protection, earthquake, and local exchange and call termination services shall be followed and modified as necessary to include the local requirements and building construction codes. Guidance is also available in BICSI TDM manual, 10th edition, Chapter 7, Telecommunications Room Standards and ETL 02-12.

Physical security measures (e.g. solid walls, solid doors, locks, etc.) are required to secure TRs.

4.2.1.1 Multi-Story Buildings

In multi-story buildings, a minimum of one room shall be located on each floor (small facilities, i.e., air traffic control towers, firing ranges, etc., may use one room for the entire facility). Rooms on successive floors should be vertically stacked wherever possible.

4.3 Design Requirements

The following are general design requirements to consider for all TRs.

- **Grounding:** All communications shall be grounded according to ANSI/TIA/EIA-607-A, NEC/NFPA 70, and BICSI TDM Manual, 10th edition, Chapter 10, Grounding, Bonding, and Electrical Protection.
- **Location:** Rooms should be located away from sources of electromagnetic interference. Large electrical distribution panels and transformers shall not be allowed in TRs or anything else not related to telecommunications requirements.
- **Perimeter:** No false ceiling unless an in-floor distribution system is used; all surfaces treated to reduce dust; walls and ceilings painted white or light in color to improve visibility.
- **Limited Access:** Single or double 36" x 80" lockable doors.

- **Other:** No piping, ductwork, mechanical equipment or power cabling should be allowed to pass through the TRs. No unrelated storage.
- **HVAC:** 24 hours/day, 365 days/yr., 64°-75°F (18°-24°C), 30%-55% humidity, and positive pressure with a minimum air change rate of once per hour.
- **Lighting:** 8.5 feet high, providing 50 foot-candles @ 3 feet above floor.
- **Electrical:** A minimum of two dedicated 20A, 120VAC duplex outlets on separate circuits are required. Actual electrical supply requirements shall be based upon UPS electrical requirements. Convenience duplex outlets shall be placed at 6-foot intervals around the perimeter. Emergency power outlets and emergency lighting are a mandatory requirement in TRs. IAW ETL 02-12, if the telecommunications equipment must always remain operational due to mission requirements (i.e. C2 system or major base ITN etc.) then CE shall provide a permanently installed standby power generator (real property installed equipment [RPIE]) to prevent the loss of power to the equipment.
- **Dust:** Less than 100-micrograms/cubic meter/24-hour period. Consider installing tile instead of carpet and treating floors, walls, and ceiling to minimize dust.
- **Fire-stops:** Packing used to re-establish the integrity of fire-rated structures when cables have penetrated these barriers shall meet the standards specifications for UL ratings against NFPA, ASTM and NEC codes. All penetrations created by or utilized by the communications cabling upgrade shall be fire-stopped to original fire rating.
- **Fire-protection:** Per ANSI/TIA/EIA standards, the preference for protecting electronic equipment areas is the use of dry fire protection systems. But, most installations use wet-pipe automatic sprinkler systems. In the case of automatic sprinkler systems, the ANSI/TIA/EIA standards recommend the installation of sprinkler head cages to protect against accidental discharge and the installation of drainage troughs under wet pipes to prevent accidental leakage over electronics.
- **UPS sizing:** UPS shall be sized to support 125% of anticipated load (new and reused electronics) and should support a minimum run time of 60 min. All UPS units purchased or reused shall have SNMP version 2 capability installed or utilized.
- **Equipment Rack Clearance**
  - 3 Feet - Front Rear and Sides

5 BACKBONE CABLING

5.1 Definition

Within a building, the intra-building connectivity for extending the voice, video, and data networks between the entrance facility or equipment room, to a telecommunications room, will be considered backbone cabling. Refer to Figure 3.

The current CITS Baseline Directive has addressed cabling between TRs for Data and states the wiring between TRs within an End Building Node (EBN) or Information Transport Node (ITN) should use fiber optic cable. These links are considered backbone links and are surveyed as such in current CITS Program.

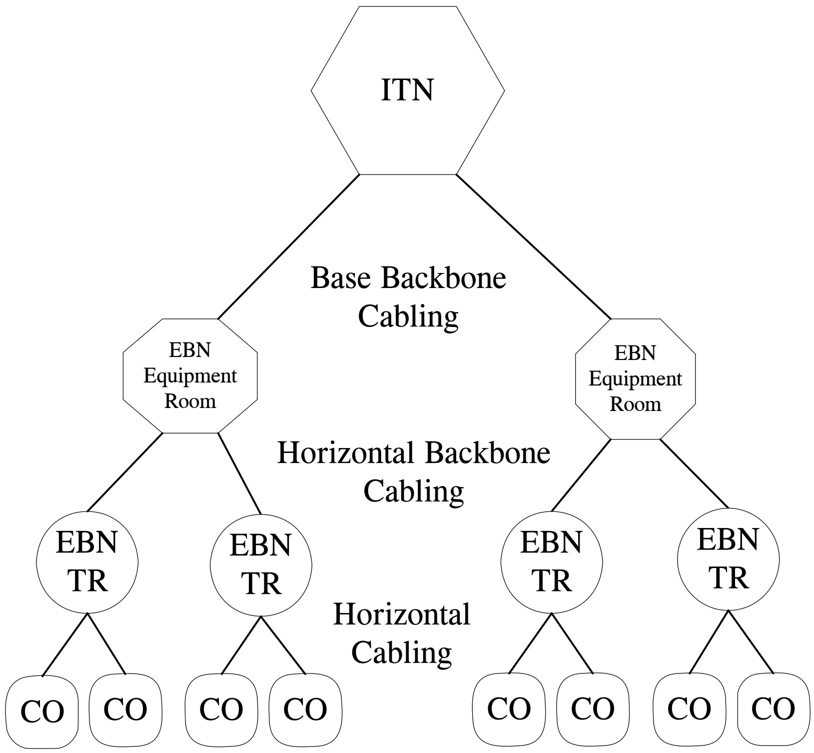


Figure 3 Physical Topology of Structured Cabling System

5.2 Standard for Data

ANSI/TIA/EIA 568-B.1 specifies the use of 50/125-micron or 62.5/125-micron, multimode graded-index fiber as options for backbone runs. Most manufacturers of both 62.5/125 or 50/125-micron optical fiber cabling meets or exceeds all the performance requirements of the existing and known forthcoming national and international cabling standards and will support the most stringent laser- and LED-based applications. This includes IEEE 802.3z Gigabit Ethernet Standard.

Therefore, it is recommended that intra-building wiring be 62.5/125 µm, or 50/125µm (laser optimized) 12 strand multimode graded-index fiber suitable for the installation. It is recommended the decision process be based upon current and planned backbone cabling in the Base Area Network. Plenum rated cable should be used only if the cable is run through the air return of a central air handling system, either ductwork or open space over a suspended ceiling. This would also include the area under a raised floor if that area was used for fresh air supply or fresh air return. Should the situation arise where a TR requires redundant links to another facility a hybrid single mode and multimode fiber optic cable may be installed. All backbone, fiber optic cable shall be terminated in fiber optic enclosures (patch panel) employing the SC type connectors. All new fiber optic patch panels shall be SC type connectors. These enclosures shall be mounted in the standard 19” equipment racks if possible.

All installed fibers shall have a minimum of 20 feet of maintenance loops at each termination location. Maintenance loops shall be neatly dressed and protected on solid/slotted cable trays, ladder racks or other suitable supporting system or enclosure. Fibers shall be adequately supported using cable trays or ladder racks from the maintenance loop location to the fiber optic patch panel. Fiber optic strength members shall be connected to the fiber optic patch panel to protect the fiber.

5.3 Standard for Voice

Voice backbone cabling will consist of house cabling between ER’s and TR’s. It shall be a multi-pair cable with cable jacketing suitable for the installation. The number of pairs for voice cross connect cables should equal 50%, rounded to the next pair count, of the total of the outside plant feeder cable.

5.4 Backbone Pathways

Backbone pathways consist of intra-building pathways. The term backbone is used for riser, house and building-tie terminology. Backbone pathways may be either vertical or horizontal. Intra-building backbone pathways are contained within a building. Suitable ducts, raceways, cable trays, etc. shall be used.

6 HORIZONTAL CABLING

6.1 Horizontal Cabling

ANSI/TIA/EIA 568-B.1-5 defines horizontal cabling as “The portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the telecommunications room. The horizontal cabling includes the horizontal cables, the telecommunications outlet/connector in the work area, the mechanical termination, and patch cords or jumpers located in the telecommunications room”.

The horizontal cabling system extends from the work area telecommunications outlet to the TR/ER and consists of the following:

- Horizontal Cabling
- Telecommunications Outlet
- Cable Terminations
- Cross-connections
- Patch Cords

Cable length shall be no more than 100 meters (328 feet) at 250 MHz. This includes the total length of the first patch cord from the switch to the first patch panel or punch down block, the distance to the wall jack, and the patch cord to the host computer. The maximum horizontal run length is 90 meters (295 feet), (five meters (16.405 feet) at each end) for work area and ER/TR patch and jumper cables.

A maximum of two connections per 100 meters (328 feet) is permitted. This means one punch down block in the wiring closet and one wall jack in the office (or cubicle). The term, "home run cabling," describes cabling that extends from the host connection to the wiring closet rack mounted patch panel, with no intermediate connections.

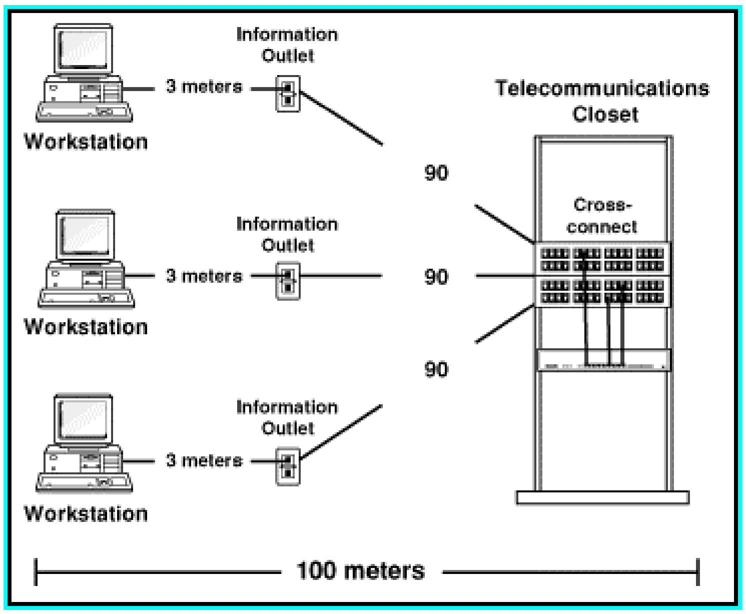


Figure 4 Maximum Distances for Horizontal Cabling

Voice and data telecommunications cabling should not be run adjacent and parallel to power cabling - even along short distances. For low voltage communication cables, a minimum 6-inch (0.12700 meters) distance is required from any fluorescent lighting fixture or power line over 2 KVA; and up to 24 inches (0.60960 meters) from any power line over 5 KVA. In general, telecommunications cabling is routed separately, or several feet away from power cabling. Similarly, telecommunications cabling is routed away from large motors, generators, induction heaters, arc welders, x-ray equipment, and radio frequency, microwave or radar sources.

All horizontal communications cabling shall be terminated on rack mounted Cat 6 modular termination patch panels (24 or 48 port) mounted in a standard 19” (0.48260 meters) lockable equipment cabinet.

All distribution, fiber optic cable shall be terminated in fiber optic enclosures (patch panel) employing the base standard type connectors. All new fiber optic patch panels shall be per the base standard as defined by the local CS. These enclosures shall be mounted in standard 19” equipment racks. All enclosures must be either lockable or in a Communications Squadron controlled space.

Verify that all components comply with Cat 6 or higher ratings. This includes connectors, punch down blocks, wall outlets and patch cords.

The telecommunications outlets and patch panels shall be clearly marked following the ANSI/TIA/EIA-606-A standard and the Network Implementation Plan - Cable Plan for both fiber and copper cabling.

ANSI/TIA/EIA 568-B.1 specifies the use of either 50/125-micron or 62.5/125-micron, multimode graded-index fiber for horizontal runs, although unique user requirements may dictate the use of other types of fibers in special circumstances.

6.1.1 Abandoned Telecommunications Cables

Funding to remove all abandoned telecommunications cables, voice and data shall be included in all technical solutions approved by the CS for new cable installations. Reference NEC sections 800.2, 800.52 (B), 800.53 (A), and 800.53 (B) (1). Abandoned cable shall be defined as cable which is no longer terminated at either end or cable that will not be reused in the future due to age, condition, or any other limitation.

6.2 Recommended Media

The current recommended standard for horizontal wiring is Category 6 UTP, defined by ANSI/TIA/EIA 568-B.2-1 Addendum 1. It is capable of operating at 250 MHZ and supports the IEEE 802.3ab Gigabit Ethernet standard.

Category 7 is available from vendors with claims it will comply with standards when published. As no standards for this category of cable have been published a baseline to verify vendor claims is unavailable, therefore, it is recommended it not be used unless the specifications exceed the current Cat 6 specifications and the manufacturer can provide adequate documentation and verification.

6.3 Fiber to the Desktop

The cost of installation and materials for a fiber to the desktop solution is not that significant of an increase over a copper to the desktop solution. However, the port densities and electronics cost differential still make it cost prohibitive to recommend a fiber to the desktop solution. Fiber to the desktop can also be problematic in environments where office space is frequently reconfigured leading to increased maintenance cost. However, situations will occur when horizontal distribution systems may be better served by utilizing fiber optic cabling, therefore, any major building distribution project should consider both alternatives and the costs. Additionally, exceptions identified by users concerning high volume traffic or security concerns can be expected. In these circumstances, it is recommended that 62.5 or 50µm cores with dual wavelength capability, 850 and 1300 nm, be installed.

An alternate consideration is to replace one run of the Cat 6 with a multimode fiber pair per communication outlet. The fiber pair would remain dark until needed. This would allow for a fiber infrastructure to be in place and would save on re-cabling in the near future for high bandwidth requirements. Copper electronics would be used until fiber electronics are needed. Because the cost differential is associated with fiber electronics, you would not see a significant cost increase in installing a fiber pair for later use. As fiber electronics come down in cost and new standards are implemented for fiber, a fiber to the desktop solution will be an easy migration because you have the fiber in place. SIPRNet drops are a special case where fiber to the desktop may be warranted. Using fiber to feed multiple LAN drops from one central TACLANE can eliminate any TEMPEST concerns.

6.4 Communication Outlets (CO)

The CO is a connecting device in the work area on which the horizontal wiring terminates. It includes the workstation outlet (outlet connector), outlet faceplate and outlet box. It provides the transport interface to information appliances.

COs shall use four-position (Quad) wall plates with labeling positions at the top and bottom of the wall plate.

6.4.1 Communication Outlet Port Density

The desired implementation is to provide sufficient user outlet density so the additions of new equipment and personnel relocations result in minimum disruption. The recommended port density is four ports at each outlet assembly

This quad outlet provides connectivity for data, video, and voice ports as required. One data port could be used for a SIPRNET connection with a Type 1 inline IP encryptor.

6.4.2 Work Area CO Saturation

All administrative facilities and administrative spaces and other types of facilities shall be equipped with one standard CO for each 15 linear feet (4.6 meters) of wall space in office areas. Should an office area not have wall space (ie large open office area with cubicles) then the standard will be one dual outlet per 48 sq feet (4.5 sq m) IAW ETL 02-12 (or a quad equivalent per 96 sq ft). Outlet densities and locations for all special purpose spaces and non-administrative facilities shall be determined by the user and shall follow the guidelines in TIA/EIA-568-B.1, B.2, B.3, 569A and this document. The possibility of future reconfiguration of the office layout should be taken into consideration when designing jack placement.

The CO density presented below is for broad-gauge cost estimates. When specific information is required a detailed engineering solution must be accomplished by a designer who has proven design experience with communications cabling and all applicable standards.

CO – Communication Outlet
NFA – Net Floor Area
GFA – Gross Floor Area

GFA Formula:
GFA = Total square footage of area including hallways, restrooms, conference rooms, fixed walls, equipment rooms, office area, administrative area, etc.
NFA = Total square footage of area less permanent hallways, restrooms, fixed walls, stairwells, closets, elevator shafts, equipment rooms, and other areas unsuitable for occupancy
.8 x GFA = NFA
(NFA/100) = Number of COs

Example using gross square footage:
.8 x GFA = NFA
.8 x 10,000 = 8000
8000/100 = 80 CO

For planning purposes, when actual outlet locations are not known and cannot be determined with available information, reasonably accurate total outlet count estimations can be obtained based on the size and dedicated usage of the space. The following table identifies typical facility spaces and the minimum number of outlets for those spaces.

Facility Space Category	Gross Area per Quad
Laboratory/Technical	100 sq/ft (4.6 sq/m)
Medical/Clinic	100 sq/ft (4.6 sq/m)
Warehouse/Maintenance Hangars	2000 sq/ft (464.5 sq/m)
Clerical	100 sq/ft (4.6 sq/m)
Classroom/Instructional	80 sq/ft (7.4 sq/m)
General Use/Other	500 sq/ft (46.6 sq/m)

Table 1 Typical Spaces and Quad Outlets

6.4.2.1 Outlet Density for Other Services

Density and placement of outlet locations for other services such as CATV, CCTV, VTC, or wall-mounted phones will be determined by user requirements.

6.4.3 Outlet Box

For standard CO use a recess mounted 4-11/16” by 4-11/16” double gang electrical box with the faceplate flush with the wall surface. Double gang electrical boxes should be full depth to provide dedicated space for current and possible future fiber optic cable installation. Single gang mud/reducing rings shall be installed in the double gang electrical box, by the contractor, for use in the installation of the single gang quad outlets specified in this document. For single connector outlets, such as voice, data, CATV or CCTV, use a full depth, double gang, electrical box mounted flush with the wall surface with single gang mud/reducing rings to allow for sufficient cable slack/ maintenance loop required for the cabling installation.

6.4.4 Outlet Faceplate

For standard administrative outlets use a full (double gang) face plate with connector locations for all copper and (if used) fiber optic cable. For double gang outlet boxes equipped with single gang mud rings, use a single gang outlet faceplate with appropriate connector locations and, if required, 630-type wall plate for wall phones.

6.4.5 Maintenance Loops

When cable runs are being installed, additional slack shall be provided at both ends to accommodate future cabling system changes. Although the exact amount of slack required depends on the size and layout of the connecting hardware of the TR and the work area, the recommended amount of slack per standard: Reference; BICSI Telecommunication Distribution Methods Manual 10th Edition, Chapter 5 pages 5-113.

- TR is 3 m (10 ft)
- Outlet is:
  - 1 m (3.3 ft.) for optical fiber cables.
  - 200mm (8 in.) min. for twisted pair cables.

Include the slack in all length calculations to ensure that the horizontal cable does not exceed 90 m (295 ft), copper only.

Only strip back as much cable jacket as required to terminate connecting hardware in order to maintain cable geometry.

Reference: TIA/EIA-570-B; Chapter 6, Installation Requirements.

6.4.6 Outlet Connectors

The following specifications pertain to copper and fiber optic connectors.

6.4.6.1 Copper Connectors

Copper connectors should be ANSI/TIA/EIA enhanced category 6 (Cat 6), 8-pin/8-position insulation displacement terminations wired per T568A or T568B to maintain system configuration uniformity. Copper connectors and plugs should be un-keyed unless the user requires keyed connectors and plugs for security, or other user specified reasons.

6.4.6.2 Fiber Optic Connectors

Fiber optic connectors shall be per the base standard as defined by the local CS, either ANSI/TIA/EIA SC, ST, or subminiature type connectors

6.4.7 Voice Outlets

A minimum of one outlet of the quad Cat 6 drop is designated for voice circuits. Voice outlets shall be terminated to Cat 6 patch panels and collocated with their respective data ports and labeled in accordance with Appendix C. A RJ-45 to 110-type patch cable shall be used to connect the voice ports on the voice/data patch panels to a 110 cross connect block. This is the recommended standard for voice connections to existing telephone switches in the Dial Central Office, DCO. This configuration allows for the option to change voice and data circuit at the CO by simply changing patch cords in the ER/TR and provides an option for Voice over IP (VoIP) at a future date. Refer to, Figure 5 Voice and Data Terminate to Patch Panels.

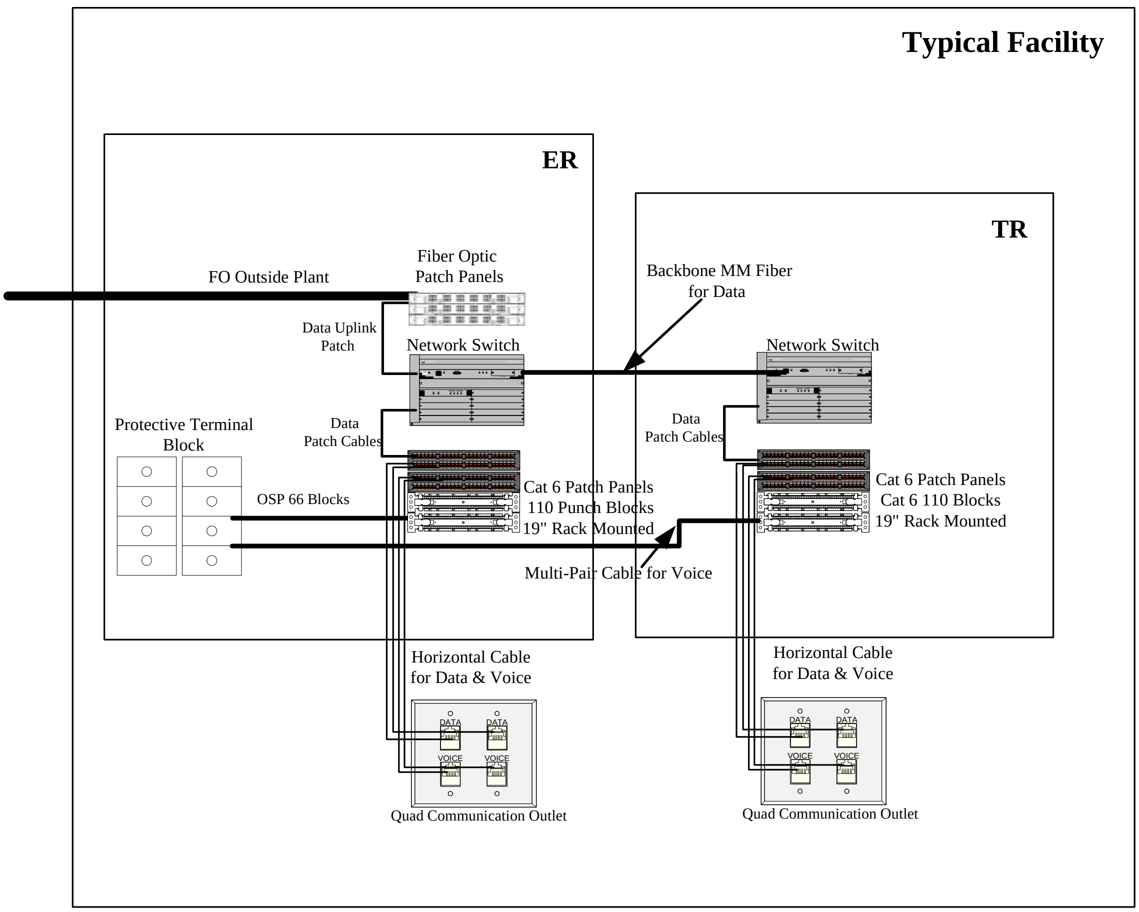


Figure 5 Voice and Data Terminate to Patch Panels

6.5 Cable Types and Specifications

6.5.1 Twisted Pair

The prevailing commercial wiring standard ANSI/TIA/EIA 568-B defines performance specifications for category 6 cable. Cat 6, 4-pair 24 American Wire Gauge (AWG), 100-ohm, solid, UTP cables should be installed to each standard connector outlet. Plenum cables should be specified when required. Plenum rated cables should only be used if the cables run through a plenum. A plenum is an air return path of a central air handling system, either ductwork or open space over a suspended ceiling. This would also include the area under a raised floor it that area was used for fresh air supply or fresh air return. If unsure if an area is a plenum or not, have the Bio-environmental or base Fire Marshall make a determination.

6.5.1.1 Twisted Pair Performance

Refer to ANSI/TIA/EIA-568B-2, Addendum 6 for Cat 6 performance specifications.

6.5.2 Optical Fiber

There are two general classes of optical fiber: multimode and single mode. The primary differentiating characteristic is the diameter of the inner core of the fiber strand. Single mode fiber has a core diameter on the order of eight microns and physically constrains the coupled light to a single mode (i.e. the light propagating through the fiber essentially "all" follows a single path "straight" along the axis of the core). Multimode fiber has a much larger core diameter.

It is important that the same core diameter be used throughout a multimode fiber implementation. For this reason a recommended multimode fiber is not defined, either 50/125µm or 62.5/125µm, with dual wavelength capabilities, 850 and 1300 nm, may be used to the CO to provide overall base system uniformity. Using 1300-nm lasers in electronic equipment will allow Gigabit Ethernet to be transmitted up to 550 meters using 62.5/125µm fiber, and although more expensive the overall uniformity of the complete system, outside plant to the desktop, may justify the increased cost.

Other media such as single mode fiber can be considered when advantageous to support specified mission needs.

6.5.2.1 Multimode Optical Fiber Performance

Two primary factors must be considered in fiber selection and system design: maximum system length and maximum channel attenuation. The first factor of maximum supported system length is based on bandwidth, transmitter and receiver specifications, propagation delay, jitter and numerous other factors. The second factor is maximum channel attenuation. The maximum channel attenuation is established by the minimum transmitter output, maximum receiver sensitivity and any power penalties established. The number of connections and splices, the cable length, the wavelength of operation and loss values of components also affects channel attenuation. Attenuation readings with an LED source will be higher than that of a laser such as those used with Gigabit Ethernet, ATM, and Sonnet.

Bandwidth, or information-carrying capacity, is specified as a bandwidth-distance relationship with units of MHz-km. The bandwidth needed to support an application depends on the data rate of transmission. As the data rate goes up (MHz), the distance that rate can be transmitted (km) goes down. So, a higher fiber bandwidth can enable you to transmit at higher data rates or for longer distances. This means a multimode cable rated at 500 MHz-km will propagate a 500 MHz signal one kilometer, a 1 GHz signal one/half kilometer, etc., before becoming indistinguishable.

For 850-nm Gigabit Ethernet, which uses VCSELs, the standard FDDI 62.5-micron fiber support link lengths of at least 220 meters and 550 meters over 50-micron fiber, refer to

Table 2 **Multimode Fiber Specification**.

Fiber Type	**62.5/125µm**		**50/125µm Fiber**		
Wavelength	**850 nm**	**1300 nm**	**850 nm**	**850 nm**	**1300 nm**
Attenuation	3.5 dB/km	1.5 dB/km	3.5 dB/km	3.5 dB/km	1.5 dB/km
Modal Bandwidth (MHz/km)	160 MHz·km	500 MHz·km	400 MHz·km	500 MHz·km	500 MHz·km
Distance Gigabit Ethernet	220 m (SX)	550 m (LX)	500M (SX) 550M (LX)	550 m (SX)	550 m (LX)

Table 2 Multimode Fiber Specification

ANSI/TIA/EIA-568B.3, Optical Fiber Cabling Components Standard

NOTE - When mixing 62.5/125 and 50/125µm cable plant, an average power db loss is expected to be 3.5 to 4.7 dB.

6.5.3 Patch Cords

Patch cords are a critical part of any installation. Cat 6 supports Gigabit Ethernet however, simply specifying a quality cable and installation is not sufficient. Quality patch cords are required as well.

Patch cords and Cross-Connect Jumpers are as critical to transmission performance as the permanent horizontal cable. These cables must be rated at the same or higher performance category as the cabling to which it connects and must meet the requirements described in ANSI/TIA/EIA-568-B.1.

6.5.4 Horizontal Pathways

Horizontal pathways extend between TRs and the CO. These pathways can be cable ladder (solid bottom), J-Hook, or conduit systems. The horizontal distribution system must be designed to handle all types of communications cabling (i.e., UTP, STP, and Fiber Optic). When determining the type, size and routing of the cable pathway, the quantity, size and type of the cables that the pathway is intended to house must be considered. Bend radii allowable for copper is not allowable for fiber therefore, pathway design must take into consideration all types of media. It is recommended multi-channel ducts and conduits be installed to allow for future expansion, cable upgrades or where required to support multi-classification environments.

Use one-inch (0.0254 meters) electrical metallic tubing (EMT) for the pathway run from the outlet box to the overhead/under floor communications duct/ladder system or directly to the TR/ER.

- Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations.
- Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations.
- Pathways shall not have exposed sharp edges that may come into contact with telecommunications cables.
- The number of cables placed in a pathway shall not exceed manufacture specifications, nor, will the geometric shape of a cable be affected.
- Pathways shall not be located in elevator shafts.
- Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
- In open ceiling cabling, cable supports shall be provided by means that is structurally independent of the suspended ceiling, its framework, or supports.
- These supports shall be spaced no more than 1.5m (5 ft) apart.
- All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.
- The number of horizontal cables placed in a cable support or pathway shall be limited to a number of cables that will not cause a change in the geometric shape of the cables.
- Maximum pathway capacity shall not exceed a 40% fill ratio.
- Horizontal distribution cables shall not be exposed in the work area or other locations with public access.
- Cables routed in a suspended ceiling shall not be draped across the ceiling tiles.

- Cable supports shall be mounted a minimum of 75mm (3 in) above the ceiling grid supporting the tiles.

6.5.4.1 Ceiling Distribution System

Ceiling distribution systems can only be installed in false ceilings. Cables may be supported by cable ladders, rings or hooks suspended from the ceiling or wall structure. Ceiling support wires or rods shall not be used to support cables. If ceiling air space is being used as the air return path for HVAC systems, plenum cable must be used as defined in NEC and applicable TIA/EIA standards.

6.5.4.1.1 Cable Ladder

Cable ladders should be supported by brackets or rods every 129cm (5ft). Cable ladder runs shall be designed using perpendicular paths; 90-degree turns shall be accomplished using two 45-degree bends. A minimum of 31cm (12in) clearance is required above the cable ladder over its entire route. Coordination with electrical and HVAC engineers is required to avoid conflicts over space allocation. Only solid bottom cable ladders shall be used to prevent excessive weight from damaging or crimping lower layers of cable.

6.5.4.1.2 Rings and Hooks

Ring and hook cable support devices must be located on 1.3m to 1.7m (4ft to 6ft) centers. Cable sag should be minimized to reduce stress on cabling. To avoid interference with the removal of ceiling tiles a separation of 152mm to 305mm (6in to 12in) must be retained between the sag and the ceiling support.

6.5.4.2 Under Floor Distribution Systems

Under floor duct systems should be metallic, solid bottom, be accurately aligned and leveled. Junction boxes and duct lines shall be located to clear permanent and future nonpermanent partitions and foundations for equipment. Duct system installation shall comply with the requirements of NFPA 70.

Metal duct supports shall be located as close as practicable to duct joints, elbows, bends, terminations; and within 30 inches on each side of junction boxes and elsewhere at intervals of not over 5 feet.

7 INSTALLATION STANDARDS

Cabling installations aimed at gigabit speeds require at minimum adhering to standards. Of course, that in itself is a change, given the corner-cutting nature of many cabling projects. High-performance networks provide less of a margin for error and require greater installation care than in the past. To support high-speed networks in the gigabit and beyond range simply purchasing a quality cable, then installing the cable self help, with an uncertified electrician, or Cat 2 level installer must end. Pulling tensions, bend diameters, fill ratios, separation from power circuits, grounding, termination techniques, and many other skills must be studied, practiced, and mastered. A quality installation team with certification from BICSI, certified training from a reputable manufacturer, or reputable organization with a proven past performance must be specified. The installers must then be required to follow the installation and testing standards specified within this document, in the referenced standards and as specified by the chosen vendors products.

Components of the cable infrastructure shall be installed in a neat, orderly manner consistent with the best telephone and data installation practices.

7.1 Color Codes

Wiring color codes shall be strictly observed and termination shall be uniform throughout. Identification marking and systems shall be uniform, permanent and readable and in accordance with ANSI/TIA/EIA-606 standards and this document.

7.1.1 Mixed Classification Environments

Red, green, orange, blue and yellow cables are often used to identify different classifications in mixed classification environments. In these environments the color code scheme from ANSI/TIA/EIA-606 should not be used.
The following cable color code scheme is recommended for mixed classification environments. It follows the standard ADP Media Classification Label colors.

- **SF-706 Top Secret Label (Orange)**
  The SF-706 is used to identify and protect automated data processing media and other media that contain Top Secret information.
- **SF-707 Secret Label (Red)**
  The SF-707 is used to identify and protect automated data processing media and other media that contain Secret information.
- **SF-708 Confidential Label (Blue)**
  The SF-708 is used to identify and protect automated data processing media and other media that contain Confidential information.
- **SF-710 Unclassified Label (Green)**
  In a mixed environment in which classified and unclassified information are being processed or stored, SF 710 is used to identify automated data processing media and other media that contain unclassified information.
- **SF-712 SCI Label (Yellow)**
  The SF-712 is used to identify and protect automated data processing media and other media that contain SCI information.

7.2 Infrastructure Installation

Infrastructure installation shall be managed by an experienced project management staff and performed by engineers, functional area specialists, skilled technicians, and support staff. In house, “blue suit”, maintenance personnel must be trained on current installation standards and be required to follow them. All maintenance activities should obtain and maintain a current copy of the applicable TIA/EIA standards, the BICSI TDM manual, and the National Electric Code, NFPA 70.

7.2.1 Install Backbone (Riser) Subsystem

The purpose of this section is to outline the specific requirements for the Backbone (Riser) subsystem. All fiber cable terminations shall be installed internally within a building. Each fiber cable run shall be installed in plenum rated inner-duct for protection. All terminations shall be labeled. All fiber optic cable installation shall conform to applicable TIA/EIA Standards.

- Installation Procedures

  The Backbone (Riser) cable plant shall consist of 62.5/125 µm, or 50/125µm 12 strand multimode graded-index fiber optic cables and a hybrid cable where applicable. The specified fiber optic cables shall interconnect each ER with the TR except as otherwise noted in the final design. All fiber optic cables to be run in riser rated inner-duct along the cable trays, ladder racks or secured to the ceiling. All fiber optic cable, along with the associated inner-duct, shall terminate in open bay racks or wall mounted fixtures within the rooms on fiber patch panels. The fiber optic cables installed, as part of the backbone subsystem shall not exceed the maximum bend radius. The fiber optic cables installed, as part of the backbone subsystem shall not exceed the maximum tensile loads.

7.2.2 Install Horizontal (Drops) Subsystem

The contractor or engineering team (whichever is applicable) shall install cable drops using certified Cat 6 UTP cable, with a maximum running length of 295 feet (89.916 meters) including maintenance loops at the communications room termination points and the user outlet termination points. Where construction permits, drops shall be flush mounted in the walls with cable routed inside the wall. In facilities where construction prevents flush mounting of user drops, drops shall be surface mounted. Surface mount installations shall incorporate the use of surface raceway between room entry points and drop outlet.

7.2.2.1 Installation Procedures

This section outlines the installation guidelines, procedures, and requirements for all components of the horizontal (drops) subsystem.

7.2.2.1.1 ER/TR Terminations

The installation team, contractor or Air Force organic team, shall install all ER/TR termination hardware. This shall include the supply and installation of all ER/TR termination fixtures including but not limited to:

- EIA 19 inch (0.48260 meters) Equipment Racks
- Wall mounted 19 inch (0.48260 meters) swing out mounting enclosures
- 110-type IDC/RJ45 Modular Patch Panels
- Fiber Optic Patch Panels
- Wire Management Panels
- Wire Management Rings
- Velcro Cable Management Ties

- D Rings

All new fiber optic patch panels shall be per the base standard as defined by the local CS. These enclosures shall be mounted in standard 19” equipment racks. All enclosures must be either lockable or in a Communications Squadron controlled space.

UTP horizontal cable in a given zone shall terminate in the TR serving that zone. UTP horizontal cable shall leave the distribution hooks and enter the ER’s via existing or newly installed ladder racking.

UTP horizontal cable shall terminate in fields in the TRs. The contractor or engineering team (whichever is applicable) shall create a field for A, B, C and D jacks. All voice and data horizontal UTP cable shall terminate on the specified modular patch panels. The lowest number “A” field shall start on the panels located at the top of the left (facing the front of the rack) hand rack or wall mounted fixture with other fields installed to the right of the “A” field. Installation shall follow a flow of lowest number “A” field followed by the lowest number “B” field etc., see (Figure 13 Example Patch Panel Numbering Scheme).

All cables shall be neatly dressed and secured to cable trays, ladder racks or equipment racks with cable ties or other appropriate fastening device without changing the geometric shape of the installed cable.

All UTP cables shall be tied together or tied in bundles as it leaves the ladder racks, traverses to either side (or both sides) of the racks and terminate behind the panels.

7.2.2.1.2 Untwisted Pairs

All Category 6 UTP terminations on IDC-type CO’s and connecting hardware specified in the Horizontal Subsystem shall be made in such a way as to minimize the extent to which each twisted pair is unraveled at the point of its physical termination. Specifically, no more than 0.5in. (0.01270 meters) of exposed untwisted or unjacketed pairs should be present at these locations.

7.2.2.1.3 Equipment Racks

Floor mounted equipment racks shall be bolted securely to the floor of the TR using four (4) fasteners appropriate for use in concrete.

All racks shall be properly grounded and bonded to the Telecommunications Main Grounding Busbar per TIA/EIA 607 Commercial Building Grounding and Bonding Requirements for Telecommunications, Section 5.4, The Telecommunications Main Grounding Busbar (TMGB).

In addition, the top of all racks shall be secured by means of a bracket or other attachment to the nearest wall to prevent movement.

7.2.2.1.4 Wall Mounted Enclosures

Wall mounted swing out enclosures shall be mounted as indicated on the final design.

7.2.2.1.5 Wire Management Panels

Each rack that will terminate horizontal cables shall be equipped with wire management panels, on the top and bottom of each patch panel, as necessary to present organized and clear accesses. All patch cable shall use Velcro type ties for cable management purposes.

7.2.2.1.6 Category 6 Modular Patch Panels

Category 6 modular patch panels shall be installed in the equipment racks as indicated in the final design. Each panel shall be securely attached to the rack using a minimum of four (4) screws.

7.2.2.1.7 Category 6 Patch Cord (Patch Panels)

Each patch cord used shall be tested and certified per CAT-6 UTP specifications using an RJ-45 to RJ-45 patch cord. Voice applications may use a patch cord tested and certified per Cat 6 UTP specifications, but still be configured as one or two-pair 110-type to 110-type connection or as one or two pair 110-type to RJ45 connection. If the voice application requires a fully certified Cat 6 installation, use the RJ-45 to RJ-45 patch cord.

7.2.2.1.8 D-Rings

Where D-rings are required, rings of between 4 and 6 inches (0.10160 and 0.15240 meters) in height and a minimum of three inches (0.07620 meters) in depth shall be used. All rings shall be constructed of a non-ferrous metal.

7.2.2.1.9 Cable Support

The contractor or installation team shall install all cable support system hardware. This shall include the installation of all cable support fixtures including but not limited to:

- Hangers or hooks spaced 36 to 60 inches (0.914 to 1.52 meters) apart, not to exceed 60 inches, or as appropriate, for proper cable support.
- All cables and inner-duct shall be properly supported within the ceiling spaces. At no time shall cables or inner-duct use drop ceiling grids or tiles for support.

7.2.2.1.10 Cable Bends and Pulling Tensions

Reference EIA/TIA 568-B.1 Addendum 1 and Chapter 10 section 10.2.2 for pulling tensions and bend radii for copper and fiber optic cable. Additional reference is BICSI Chapter 4 Section - Cabling Management-Horizontal and Backbone Cable Management. Beyond the above recommended practices always follow vendor specific guidance on bend radii and pulling tensions or a maximum tension of 110N (25 ibf) shall be used for 4 pair 24 AWG UTP cable. The minimum size pathway must not force the cable bend radius to be less than 25 mm (1 in) under conditions of maximum cable fill.

7.2.2.1.11 Separation from Sources of Electromagnetic Interference (EMI)

Co-installation of telecommunications cable and power cable is governed by applicable electrical code for safety. For minimum separation requirements of telecommunications cable from typical branch circuits (120/240V, 20A), reference article 800-52 of ANSI/NFPA 70 (Ref D.3), and EIA/TIA 569 Chapter 10.

7.2.2.1.12 Routing

Whenever possible, cabling shall be installed over corridor areas or along lines that are parallel to the contours of buildings. Fiber optic backbone (riser) cables shall be routed to the appropriate the TR via diverse routes if required for mission support.

7.2.2.1.13 Grounding and Bonding

All applicable regulations for grounding and bonding as defined by National Electric Code, local building codes for electrical materials, TIA/EIA-607, and construction methods shall be strictly adhered to. The local Civil Engineer group shall provide a ground system that is connected to the facility electrical entrance ground point to each TR as well as in the TRs for the grounding of equipment racks. The installed ground system shall then be terminated by the installation team on project supplied grounding bus bars.

7.2.2.1.14 Cores and Sleeves

The Contractor or Organic Installation Team (whichever is applicable) shall install all specified cores and sleeves. All cores/sleeves shall be of 4.5-inch (0.1143 meters) outside diameter. Sleeves shall protrude a minimum of one-inch (0.0254 meters) and a maximum of three-inches (0.762 meters) above the finished floor, wall or ceiling. Cores must be installed a minimum of 1 inch (0.0254 meters) and a maximum of 6 inches (0.1524 meters) away from the wall. If possible, cores should be positioned to avoid blocking access to backboard space. All core/sleeves shall be fire stopped in accordance with the next section.

7.2.2.1.15 Fire Stopping

All conduits, inner-duct, sleeves, and penetrations shall be fire stopped in accordance with ANSI/TIA/EIA-569-A Annex A and all applicable local codes.

7.2.2.1.16 Horizontal Outlets

The Contractor or Organic Installation Team (whichever is applicable) shall install all workstation-end termination hardware. Although there are variations in cable counts that must be supplied to each faceplate as well as variations in the specified mounting height of face plates, all workstation-end horizontal wiring shall terminate on one of the following devices:

- Flush mounted information outlet
- Surface-mounted information outlet

The specific configuration of each faceplate shall be indicated by a symbol on the plan. Information outlets vary in configuration because of the specific mounting height and cable count requirements. The standard outlet configuration for most projects is mounted at 18 inches (0.4572 meters) above the finished floor (AFF) and contains four Cat 6, RJ-45 Modular jacks that serve as the termination points for installed Cat 6, 4-pair horizontal cables. The standard outlet noted above may be surface or flush mounted depending upon field conditions.

The standard mounting height is 18 inches (0.4572 meters) AFF as noted above, however, there are three distinct mounting heights associated with information outlets. Alternate faceplate mounting heights are 36 (0.9144 meters) and 48 inches (1.21920 meters) AFF.

All surface-mounted information outlets and surface raceway shall be fastened to the wall surface with an appropriate mechanical fastener.

Flush-mounted information outlets shall be attached to the wall surface with a mounting collar or ring that firmly anchors the faceplate to the wall.

8 ADMINISTRATION DOCUMENTATION

8.1 Approach

Cable management is the planning, designing and accounting of cables routed throughout the building. Good cable management must be applied in all facilities, regardless of the types of cabling systems and numbers of user outlets required. Management of twisted pair and telecommunications cabling systems from the ER to the user outlets is extremely important, especially in large building systems. Placement of any cable system in the building should follow a well organized and well designed cable management plan. By keeping a record of cable pair counts and assignments and the routing of riser, tie, and distribution cables, future rearrangements or alterations to the wiring system will be easier. Cable management records must be kept current throughout the life of the building. The overall cable management should be implemented in accordance with ANSI/TIA/EIA-606 (Administration Standard for the Telecommunications Infrastructure of Commercial Buildings).

8.1.1 Considerations

Communications distribution facilities discussed in Section 3 inherently provide for good cable management; however, some floor distribution systems and cabling systems permit random and unorganized placement of cable. These include the raised access floor and ceiling plenum floor distribution systems and the on-floor wiring system. Considerations for managing cable and wiring in these systems are discussed in the paragraphs below. A system should be implemented for identifying, labeling, and recording pathways and spaces in accordance with ANSI/TIA/EIA-606.

8.1.2 Labeling

Label all telecommunications infrastructure and equipment components. All installed UTP and Fiber Optic cabling, outlets and UTP/Fiber Patch panels shall be numbered following a site cable plan and documented in as-built drawings and documentation. Labeling and color coding systems should conform to the ANSI/TIA/EIA-606 standard.

8.1.2.1 Cable Identification

Cabling systems installed in any type of floor distribution system can be managed and accounted for by number and alphabetical coding of cables and hardware. The coding should indicate which TR or ER the cable originates from and what floor area it serves. This can be accomplished by tags, markings, stickers, etc. See Appendix C for recommended numbering schemes.

8.1.2.2 Communication Outlets

As a minimum, a unique identifier shall be marked on each outlet to identify it as connecting hardware. Outlet and patch panel labeling shall show the TR number serving the outlet and the outlet circuit number. The outlet number should reflect its relative physical location in the building. See Appendix C for recommended numbering schemes.

8.1.2.3 Racks, Panels, Blocks

A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware. See Appendix C for recommended numbering schemes.

8.1.2.4 Network Equipment

The labeling scheme for network equipment will depend on manufacturer and slot/port configuration of the device. See Appendix C for recommended numbering schemes. Refer to BICSI Telecommunication Distributions Method Manual, Ch - 13, for additional guidance.

8.1.3 Building Cable Record Database

All records shall be created by the installation contractor or engineering team and turned over at the completion of work. The format shall be computer based and both soft copies and hard copies shall be part of the as-built package. The minimum requirements include:

- Cable Identifier
- Cable type
- Termination Position at both ends
- Splice Data
- Damaged Pairs/Conductors
- Connecting Hardware and Position
- Reference to cable identifier attached to connecting hardware

Test documentation on all cable types shall be included as part of the As-built package.

8.1.4 Building Drawings

The building architect should furnish a set of drawings to the AF which includes the planned installation of the telecommunication wiring system before construction of the building begins. After the building is built, the contractor/architect must furnish a set of drawings, in both paper and electronic media, to the AF which reflect the actual "as built" set of drawings that includes all of the dynamic changes that were made during the construction of the building, including the changes in the telecommunications wiring system. Copies of the electronic and paper drawing files must be provided to the base Communications and Information Systems Installation Records (CSIRs) manager to facilitate the updating of the CSIR records IAW AETC CSIR policy. The only acceptable electronic formats for CSIR drawings are Microstation (V7 or V8) or AutoCAD 2003 or less. The following URL provides specific EDSC instructions and policy on providing electronic updates to drawings: https://wwwmil.tinker.af.mil/38eig/edsc/. It is not acceptable to have the drawings only on paper. All new infrastructure-drawing packages shall include drawings that accurately depict the network configuration and the cable plant. As-built drawings and management records shall show location of all outlets, equipment, and cabling to include down to the individual network jack and how each telecommunications room is connected.

Reference Appendix D, Drawings, for additional drawing requirements. Note: The AETC policy memorandum on CSIR management provides very detailed and specific instructions, and will be incorporated into the new AETC supplement to AFI 21-404.

9 TESTING

All UTP and fiber optic cabling shall be tested end-to-end and certified to meet performance TIA/EIA standards. All equipment shall be tested to meet contract specifications. All test results and certifications shall be provided to the BCSI responsible for system operations and maintenance.

Testing shall verify basic electrical and optical parameters as well as the performance of the cable plant as installed. All tests shall be conducted inclusive of all connecting hardware and patch cables. Testing shall verify the electrical and optical performance characteristics of the cable plant from the communication outlet to the TR terminations with all patch cords in place. This includes, but is not limited to the communication outlet, horizontal wiring, patch panel, patch cords and backbone wiring.

If testing reveals any cable plant component to be outside of the acceptable level of performance described in this plan, that component shall be repaired or replaced and retested for compliance.

10 CABLE TV

10.1.1 Coaxial Cable

When CATV or CCTV requirements are identified, either a 75-ohm broadband coaxial cable or single mode fiber optic cable system should be installed. When a coaxial system is installed, care should be taken to ensure the correct cable is used. The designer should coordinate with the cable service provider where franchised agreements are in place. Plenum cables should be specified when required. The table below lists cable type with corresponding distance limitation. This table is derived from vendor specifications (Anixter) for coaxial cable.

Cable	Distance
RG-6	<=250 feet
RG-11	<=400 feet

Table 3 Coaxial Cable Distance Limits

APPENDIX A
Applicable Standards/References

1 Government

ETL 02-12

CITS ITS Baseline Directive (current year release)

AFI 32-1021, Military Construction Projects

AFI 32-1023**,** Restoration and Modernization Projects

AFI 33-103, Requirements Development and Processing

AFI 33-112, Computer Systems Management

AFI 33-201, Communications Security (COMSEC)

AFI 33-202, Computer Security

AFI 33-203, Emission Security

AFI 32-1032, Planning and Programming Appropriated Funded Maintenance, Repair, and Construction Projects

AFMAN 33-223, Identification and Authentication

FIPS Pubs 140-1, Security Requirements for Cryptographic Modules

1.1 FIPS Pubs 140-2, Advanced Encryption Standard (AES) Commercial Technical and Design Standards

The following lists of standards and supplements are applicable to this effort. However, other standards may apply.

ANSI/TIA/EIA standards shall be the primary governing standards for all telecommunications cabling plant designs, testing and installations. The primary ANSI/TIA/EIA standards applicable to this infrastructure program are 568-B, Commercial Building Telecommunications Cabling Standard, and 569-B, Commercial Building Standard for Telecommunications Pathways and Spaces. These standards establish the minimum requirements for telecommunications cabling within an office environment. They recommend topology and maximum performance distance for various topologies. They establish media parameters, which determine network performance distance for various topologies. They specify connector and pin assignments to ensure inter-connectivity. Moreover, they establish the useful life of telecommunications cabling systems as being a minimum of ten years. Designers and installation teams are responsible for adhering to these accepted industry standards. More stringent standards can be adopted, however, care must be exercised to ensure the more stringent characteristics are followed for the complete horizontal cabling system including connecting hardware, patch cords, equipment cords, work areas cords, and cross-connect wiring.

Although this document discusses many of the pertinent aspects of the ANSI/TIA/EIA standards, it is recommended that persons and organizations responsible for supervising or monitoring network infrastructure installation obtain copies of standards documents. These documents may be obtained through Global Engineering Documents, 1-800-854-7179.

2 Industry

2.1 TIA/EIA-526-7

Measurement of Optical Power Loss of Installed Single mode Fiber Cable Plant – OFSTP-7 (February 2002)

2.2 TIA/EIA-526-14

Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – TIA/EIA-526-14-A (February 2002)

2.3 ANSI/TIA/EIA-568-B.1

Commercial Building Telecommunications Cabling Standard (May 2001)
(Replaced ANSI/TIA/EIA-568-A October 1995)

This standard defines a generic telecommunications wiring system for commercial buildings that will support a multi-product, multi-vendor environment. It also provides direction for the design of telecommunications products for commercial enterprises.
The purpose of this standard is to enable the planning and installation of building wiring with little knowledge of the telecommunications products that subsequently will be installed. Installation of wiring systems during building construction or renovation is significantly less expensive and less disruptive than after the building is occupied. This standard establishes performance and technical criteria for various wiring system configurations for interfacing and connecting their respective elements. In order to attain a multi-product wiring system, a review of the performance requirements for most telecommunications services was conducted.

The diversity of services currently available coupled with the continual addition of new services means that there might be cases where limitations to desired performance occur. The user is advised to consult standards associated with the desired services to understand any such limitations.

2.3.1 Supporting References ANSI/TIA/EIA-568-B.1

The following references and standards were updated and incorporated into or used as reference to develop the ANSI/TIA/EIA-568-B.1 standard.

2.3.1.1 ANSI/TIA/EIA-569-B and Addendums A 1-7

Commercial Building Standard for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-B) (October 2004)

The purpose of this standard is to standardize specific design and construction practices within and between (primarily commercial) buildings that are in support of telecommunications media and equipment. Standards are given for rooms or areas and pathways into and through which telecommunications equipment and media are installed. Part of the expected usefulness of this standard is that it be referenced in documents such as bid requests, specifications and contracts leading up to the construction of facilities. ANSI/TIA/EIA-569 should also prove useful to the team that is responsible for delivering a well-designed facility to the owner - the architects, communications installers, engineers, and the construction industry. ANSI/TIA/EIA-569 is the result of a joint Canadian and United States effort done by the Canadian Standards Association (CSA) and the Electronic Industries Alliance (EIA). Development of the standard in the U.S. was carried out with the support of the American Institute of Architects and the Construction Specifications Institute because the standard influences both the design and construction of commercial buildings.

2.3.1.2 ANSI/TIA/EIA-570 and Addendums A 1-3

Residential Telecommunication Cabling Standard (ANSI/TIA/EIA-570-B) (April 2004)

This standard describes a premise wiring system intended for connecting one to four exchange access lines to various types of customer premises equipment. Some requirements, especially those on wire and wiring topology, are new to the industry in anticipation of new telecommunication services. Technical criteria are given for installers and manufacturers in the appendices. This standard is intended to be used by a broad range of persons having an interest in telecommunications wiring such as local exchange carriers, equipment designers and manufacturers, building owners and contractors, and companies involved in the sale, installation, and maintenance of telecommunications equipment and services. This standard was developed by telecommunications industry representatives with the help of other industry organizations involved in telecommunications. This standard is intended to be implemented on new construction of, and additions to, residential and light commercial buildings, and their subsequent rearrangement.

2.3.1.3 ANSI/TIA/EIA-606

Administration Standard for the Telecommunications Infrastructure of Commercial Buildings (ANSI/TIA/EIA-606-A) (May, 2002)

The purpose and intent of this standard is to provide a uniform administration scheme that is independent of applications, which may change several times throughout the life of a building. This standard establishes guidelines for owners, end users, manufacturers, consultants, contractors, designers, installers, and facilities administrators involved in the administration of the telecommunications infrastructure or related administration system.

2.3.1.4 ANSI/TIA/EIA-607

Commercial Building Grounding and Bonding Requirements for Telecommunications (ANSI/TIA/EIA-607-A) (October 2002)

"Commercial Building Grounding and Bonding Requirements for Telecommunications," also known as ANSI/TIA/EIA-607, can be utilized with or without prior knowledge of the telecommunications systems installed in the building. This Standard supports a multi-vendor, multi-product environment, as well as the grounding practices for various systems that may be installed on customer premises. ANSI/TIA/EIA-607 will be useful to manufacturers of telecommunications equipment, purchasers, installers, or operators of equipment and devices for specifying the exact interface points between the building grounding systems and the telecommunications equipment grounding configuration, and for specifying building grounding configurations needed to support this equipment.

ANSI/TIA/EIA-607 will also help building owners and developers who want to build an advanced technology structure that is compatible with modern telecommunications equipment.

2.3.1.5 ANSI/TIA/EIA-758

Customer Owned Outside Plant Telecommunications Cabling Standard (ANSI/TIA/EIA-758-A) (August, 2004)

This standard provides requirements used in the design of the telecommunication pathways and spaces, and the cabling installed between buildings or points in a customer-owned campus environment. Customer-owned campus facilities are typically termed "outside plant" (OSP). For the purpose of this standard, they are termed "customer-owned OSP”.

2.3.1.6 ASTM D 4566-05

American Society for Testing and Materials. Test Method D4566-98 Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable (1998).

These test methods cover procedures for electrical testing of thermoplastic insulations and jackets used on telecommunications wire and cable and for the testing of electrical characteristics of completed products. To determine the procedure to be used on the particular insulation or jacket compound, or on the end product, reference should be made to the specification for that product.

2.4 ANSI/TIA/EIA 568-B.2

Commercial Building Telecommunications Cabling Standard
Part 2: Balanced Twisted-Pair Cabling Components (May 2001)
(Replaced ANSI/TIA/EIA-568-A October 1995)

This standard specifies cabling components, transmission performance, systems models and the measurement procedures needed for verification of balanced twisted pair cabling.

Requirements for four-pair balanced cabling systems are provided. This standard also specifies field test instruments and applicable reference measurements procedures for all transmission parameters.

The transmission performance for a cabling system depends upon the characteristics of the horizontal cable, connecting hardware, patch cords, equipments cords, work areas cords, cross-connect wiring, the total number of connections, and the care with which they are installed and maintained. The development of high-speed applications requires that cabling systems be characterized by transmission parameters such as insertion loss, near-end crosstalk (NEXT), power sum near-end crosstalk (PSNEXT) loss, structural return loss (SRL), and power sum equal-level far-end crosstalk (PSELFEXT). System designers use these performance criteria to develop applications that utilize all four pairs in a cabling system for simultaneous, bi-directional transmission. This standard provides minimum cabling component performance criteria as well as procedures for component and cabling performance validation.

2.5 ANSI/TIA/EIA-568-B.2-1

Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Components - Addendum 1 - Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling (ANSI/TIA/EIA-568-B.2-1-2002)

This document specifies requirements for insertion loss, near-end crosstalk (NEXT) loss, equal level far-end crosstalk (ELFEXT), return loss, propagation delay, and delay skew requirements for 100 Ohm 4-pair category 6 cabling, cables, and connecting hardware.

2.5.1 Supporting References ANSI/TIA/EIA-568-B.2

The following references were incorporated into 568-B.2. They are noted here for additional reference.

2.5.1.1 ANSI/TIA/EIA-568-A-1

Propagation Delay and Delay Skew Specifications for 100Ω 4-pair Cable (August 20, 1997)

This document specifies propagation delay for 100Ω 4-pair cables for all recognized cabling categories. The document also specifies the delay skew for 4-pair cables for all recognized cabling categories. Related to these two specifications, this addendum will specify the variability permitted within the operating range of temperature. Laboratory measurement methods and computation algorithms used within the specified frequency range are included in these specifications. Field testing requirements are not covered in this document.

2.5.1.2 ANSI/TIA/EIA-568-B

Transmission Performance Specifications for Field Testing Of Unshielded Twisted-Pair Cabling Systems (October 1995)

2.6 ANSI/TIA/EIA-568-B.3

Optical Fiber Cabling Components Standard (April 2000)
(Replaced ANSI/TIA/EIA-568-A October 1995)
This standard specifies the component and transmission requirements for an optical fiber cabling system (e.g., cable, connectors), 50/125µm and 62.5/125µm multimode, and single mode optical fiber cables.

2.7 ANSI/TIA/EIA 569-B

Commercial Building Standard for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-B) (October 2004)
The purpose of this standard is to standardize specific design and construction practices within and between (primarily commercial) buildings that are in support of telecommunications media and equipment. Standards are given for rooms or area and pathways into and through which telecommunications equipment and media are installed. Part of the expected usefulness of this standard is that it be referenced in documents such as bid requests, specifications and contracts leading up to the construction of facilities. ANSI/TIA/EIA-569 should also prove useful to the team that is responsible for delivering a well-designed facility to the owner - the architects, engineers, and the construction industry. ANSI/TIA/EIA-569 is the result of a joint Canadian and United States effort done by the Canadian Standards Association (CSA) and the Electronic Industries Alliance (EIA). Development of the standard in the U.S. was carried out with the support of the American Institute of Architects and the Construction Specifications Institute because the Standard influences both the design and construction of commercial buildings.

2.8 BICSI

Building Industry Consulting Service, International Inc. (BICSI) Telecommunications Distribution Methods Manual; published by: Inch Cape Testing Services, Testmark, 629 Massachusetts Avenue, Foxboro, Massachusetts 01719, attention: BICSI.

2.9 National Electric Code 2002 – NFPA70

The purpose of this publication is to circulate information and opinion among those concerned for fire and electrical safety and related subjects.

APPENDIX B
Definitions and Acronyms

1 Definitions.

The following terms are used extensively in defining building communications and distribution systems. Not all of these terms are used in this technical bulletin but may appear in other documents, contractor designs, project books, and industry standards. Note that several terms are synonymous

Access floor - a floor distribution system consisting of completely removable and interchangeable floor panels supported by adjustable pedestals or stringers (or both) to allow access to the area beneath

Access unit - a device that allows access to a duct, cell or air space (e.g., a floor panel in an access floor)

Air plenum - any bounded space used to direct air movement for environmental purposes

Alternate entrance - a supplementary building service entrance using a different route through a different wall

Blank duct - standard or large size duct with no inserts; used only as a feeder duct

Building core - an area of a building where unusable floor space exists, such as restrooms, stairwells, elevators, maintenance rooms, etc.; usually centrally located on each floor

Building service entrance - the facilities provided for bringing cable into the building

Cable riser - facilities provided in the building for vertical distribution of cable from lower floors to higher floors

Cable system - the collection of all communication cables installed to provide communications within a building

Coaxial cable - a cable consisting of two concentric conductors separated uniformly by a dielectric media. Typically an inner wire and an outer braided sleeve are the two concentric conductors

Ceiling distribution system - a distribution system that uses the air space above a false ceiling or a ceiling air plenum for the placement of cable

Ceiling drop pole - a metallic pole extending from a ceiling distribution system to the floor used to conceal cables distributed to the user location

Cellular floor - a floor structure of prefabricated concrete or metallic load-bearing units composed of a series of longitudinal cells

Cellular floor distribution - the use of a cellular floor as part of a floor distribution system for the placement of cables

Conduit - a raceway of circular cross-sections

Connecting block - a device on which cable pairs are terminated, cross-connected, bridged, etc.; usually 50 pair per block

Cross-connect closet - a small room provided for connecting communications circuits between the building's cables or lines

Data communications equipment - equipment used for the transmission of data over a transmission medium such as twisted pair, twinax, coax, or optical fiber. Usually refers to equipment that has a digital interface for a modem or printer connection

Data terminal equipment - equipment which displays data and/or allows users to enter data to a computer

Demarcation point - a place designated within the building to distinguish between the terminal blocks in the communications ER where building cable pairs are connected to the building feeder cable), or a location where a change in ownership, responsibility, technical specifications, etc., takes place

Distribution cabinet - a small flush or surface mounted cabinet for distribution of inside wiring cable pairs for a particular floor

Distribution duct - an under-floor duct of rectangular cross-section provided with inserts to enable access to distribution cable

Distribution frame - wall or frame mounted connectors located in the Equipment Room (ER) or a Telecommunications Room (TR) for terminating and cross-connecting cable pairs

Distribution system - the collection of all provisions made and installed to accommodate the cabling system in a building

Emergency power - a stand-alone electrical supply source not dependent upon the primary electrical source (e.g., uninterruptible power source)

Equipment Room (ER) - a room providing communications services to the building; such as terminating outside plant feeder cables, housing switching and transmission equipments, terminating building riser and horizontal cables, providing the building service entrances, etc. Synonymous with telecommunication equipment room

Feeder cable - outside plant cable providing pair requirements to the building from the base distribution system

Feeder duct - an under-floor duct of rectangular cross-section used to distribute inside wiring cable from the ER to the distribution ducts or cells

Fill - the ratio of the combined cross-sectional area of all cables within a raceway to the interior cross-sectional area of the raceway

Fire stop - a material, device, or assembly of parts installed in a cable system in a fire-rated wall or floor to prevent passage of flame, smoke, or gases through the rated barrier (e.g., between rooms)

Floor distribution - any of the methods for distributing inside wiring cable from the Telecommunications Rooms (TRs) to the user outlet

Flush duct - a type of under-floor duct whose top and inserts are flush with the finished floor; (as opposed to other under-floor duct which is completely encased in the floor)

Grounding electrode - a conductor, usually a rod, pipe, or plate (or group of conductors) that provides a low impedance, direct connection to the earth

Horizontal cable - communications cable installed between telecommunications rooms (TRs) and work areas in a building

Infinite access floor - access floor, also called "raised floor"

Insert - a hole in the top of a distribution duct for installing an access unit

Insert duct - a duct with inserts; distribution duct

Inside wiring cable – multi-pair cable used for distributing communications services within a building

Integrated services digital network - a digital transmission and switching network providing or supporting a range of different telecommunications services

Jack - a female connector

Lateral duct - in an under-floor duct system, the duct interconnecting the ends of distribution duct runs; usually around the perimeter of a building

Modular furniture - office furniture comprised of self-supporting desks and partitions designed to house and conceal inside wiring cable

Modular outlet - an access unit housing modular jacks for connection of user equipment

Module lines - grid lines used by the architect to layout the building design; all columns, interior walls, mullions are located on module lines

On floor distribution - a type of floor distribution system using under carpet (flat) cable

Overhead distribution - a type of distribution system that uses the ceiling area

Perimeter duct - lateral duct

Plenum - a space that handles return environmental air in an un-ducted fashion

Plenum cable - cable rated by UL for use in plenums; low smoke producing and high flame resistance

Plug - a male connector

Pre-wiring - the installation of telecommunications cables during the construction of the building

Raceway - pipe, conduit, under-floor duct, floor cells, overhead duct and any other channel designed solely to hold wires and cables

Raised floor - access floor

Raised floor distribution - use of the air space created by an access floor to distribute cable from the Telecommunications Room (TR) to the user outlet

Riser cable - cable used to provide pair requirements from the primary communications ER to the various other floors above the communications ER

Riser conduit - conduit used to house riser cable

Riser shaft - a series of communications rooms vertically aligned with the communications equipment room; cable can be passed between floors by floor slots and conduit sleeves

Riser system - the method of distributing riser cable from the communications ER to the various upper level communications closets

Riser telecommunications closet - an ER that has direct access to the building riser system. See also definitions for TR and riser system

Service access unit - a device installed upon an under-floor duct insert to allow access to cable

Service fitting - an outlet box to house the connections for telecommunications services at the user workstation

Sleeve - an opening, usually circular, through the wall, ceiling, or floor to allow the passage of cables and wires

Slot - an opening through a wall, floor, or ceiling, usually rectangular, to allow the passage of cables and wires

Suspended ceiling - a ceiling that creates an area or space between ceiling material and the structure above. Synonyms: drop ceiling, false ceiling

Systems furniture - a type of modular office furniture used to distribute communications systems cabling within its integral raceway

Telecommunications cable - metallic and optical cable providing the transmission medium between information systems

Telecommunications Room - a small room that extends communications services to each workstation on a floor. Also known as a TR, riser room, apparatus room, cross-connect room, or a communications ER

Telecommunication service entrance - the point where telecommunication cables enter or leave a building

Tie cable - cable used to provide connectivity between communications rooms on the same floor or cable connecting communications rooms to the communications ER located on the same floor as the communications ER

Tie conduit - conduit used to connect communications rooms on the same floor or connect communications rooms to the communications ER located on the same floor

Under-floor distribution - a type of floor distribution system using ducts installed in the structural floor

Usable floor space - floor space within the building used exclusively for offices, workstations, etc.; used to determine the number of user outlets given a specified outlet density; (typically 80 percent of total floor space)

Utility column - a raceway placed between the ceiling and floor in conjunction with ceiling distribution systems. It is used for the concealment of telecommunication and electrical wiring from the ceiling space to the work area. Synonyms: ceiling drop pole, power pole

2 Acronyms

AF	Air Force
AFCA	Air Force Communications Agency
AFI	Air Force Instruction
ANSI	American National Standards Institute
ATM	Asynchronous Transfer Mode
BCE	Base Civil Engineer
BICSI	Building Industry Consulting Service International
NCC	Network Control Center
C4I	Command, Control, Communications, Computer and Intelligence Systems
CADD	Computer-Aided Design
CATV	Cable Television
CCTV	Closed Circuit Television
CITS	Combat Information Transport System
CO	Communication Outlet
CSIR	Communications & Information System Installation Records
DCO	Dial Central Office
DOD	Department of Defense
EA	Executive Agent
EBN	End Building Node
EDSC	Engineering Data Service Center
EIA	Electronic Industries Alliance
EIG	Engineering Installation Group
EMT	Electrical Metallic Tubing
ER	Equipment Room
ETL	Engineering Technical Letter
GFA	Gross Floor Area
HVAC	Heating, Ventilation, and Air Conditioning
ICEA	Insulated Cable Engineers Association
ICDMS	Interior Cable Distribution and Management System
IEEE	Institute of Electrical and Electronic Engineers
ITN	Information Transfer Node

IWC	Inside Wiring Cable
KVA	Kilovolt Ampere
LAN	Local Area Network
LED	Light-Emitting Diode
MAC	Medium Access Control
MCP	Military Construction Project
NEC	National Electrical Code
NEXT	Near-End Crosstalk
NFPA	National Fire Protection Association
NSA	National Security Agency
OSP	Outside Plant
PC	Personal Computer
O&M	Operations and Maintenance
PDA	Personal Digital Assistant
PHY	Physical Layer
PSELFEXT	Power Sum Equal Level Far-End Crosstalk
PSNEXT	Power Sum Near-End Crosstalk
R&M	Restoration and Modernization
RF	Radio Frequency
SFFC	Small-Form-Factor Connectors
SNMP	Simple Network Management Protocol
SSID	Service Set Identifier
SSAA	System Security Authorization Agreement
TR	Telecommunications Room
TDM	Telecommunications Distribution Methods
TIA	Telecommunications Industry Association
UL	Underwriters Laboratory
UTP	Unshielded Twisted Pair
VCSEL	Vertical Cavity Surface-Emitting Lasers
VPN	Virtual Private Network
VTC	Video Teleconferencing
WEP	Wired Equivalent Privacy

APPENDIX C
Labeling and Numbering Schemes of Telecommunications Components

1 Purpose

The purpose of this Appendix is to establish basic labeling and numbering schemes for telecommunications components. The numbering schemes used to identify components are not standardized. The schemes described in this Appendix are recommendations. An overall labeling and numbering scheme should be adhered to for base wide consistency. An effective labeling and numbering scheme will ensure administration tasks are simplified, to include, moves, adds and changes can be carried out with little guesswork, unused capacity can be easily identified and failed components can easily and quickly be identified during troubleshooting and repair activities.

2 Telecommunication Cables

2.1 Optical Fiber Cable Tagging

Fiber optic cable tag format shall be as identified in Figure 6 **Cable Tag Format**.

For Single Cable

1 2 3 4 5 6

A12L8.3F

For Hybrid Cable

1 2 3 4 5 6

A12L10/30L62.5F

1. A = ARMORED SHEATH
   B = BLOWN FIBER
   F = INDOOR/OUTDOOR FIBER
   OTHERWISE LEAVE BLANK
2. FIBER COUNT
3. L = LOOSE TUBE BUFFER
   T = TIGHT TUBE BUFFER
4. 8.3, 9.2 OR 10 = SINGLE MODE *
   50 OR 62.5 = MULTIMODE **
5. F = FILLED CORE OR LEAVE BLANK
   D = DRY CABLE

* When Single Mode Fiber is unknown replace numeric value with 'S'
** When Multi Mode Fiber is unknown replace numeric value with 'M'

OPTION 1
FO 1234 -5678,1-12
FO= FIBER OPTIC CABLE
1234 - 5678 = FROM - TO BUILDING NUMBERS

OPTION 2
FO 02,1-12
FO=FIBER OPTIC CABLE
02=LOCALLY ASSIGNED CABLE NUMBER
1-12=CABLE COUNT

Figure 6 Cable Tag Format

2.2 UTP Cable Tagging

Copper cable tagging will be addressed in future revisions.

3 Communication Outlets

Each CO should have a unique identifying number. In the TR, this unique identifying number should be associated with the position on the patch panel or cross connect to which the outlet is connected. Each horizontal cable should be labeled both at the outlet and patch panel or cross-connect position in the communications closet.

Wall plate combinations can include copper only, fiber only, or a combination. Wall plates may be flat or slopped, site conditions and user preference shall be the determining factor. Wall plates shall be marked IAW the site cable plan. Below are recommendations for new installations however it is not the intent of this document to require re-labeling of existing horizontal cabling to conform to this document.

Combination UTP and Fiber-Optic wall plates shall use a four position-1 gang plate that shall be configured to support three UTP and, one Fiber Pair.

In cases of higher fiber-optic density requirements, a separate wall plate, single gang or larger shall be used. The separated wall plate shall be located adjacent to the UTP wall plate. The preferred wall plate for combination installations shall be a 12-position multi-media wall plate. The 12-positon multi-media wall plate shall support a combination of UTP and base standard fiber connectors to support the requirement.

Figure 7 Four-Position Wall Plate Numbering Scheme and Figure 9 Five-Position Wall Plate Numbering Scheme are the specified typical configurations. The additional examples are included for reference should these situations arise.

Note: In areas that have multiple wall plates, wall plates shall be numbered left to right starting at drawing North on the floor plans and going in a clockwise direction.

3.1 Four Position UTP Wall Plate

The top position of the four-position UTP wall plate shall be marked with the following information. See

Figure 7 Four-Position Wall Plate Numbering Scheme.

In existing facilities with no Telecom Room numbers the TR room identifier shall be floor number, room number where room number starts with the letter A with additional TR labeled B, C etc.

TR	Actual TR or ER where the end of the wall plate cables terminate.
RACK #	Actual Rack number that contains the patch panel where the cable terminates.
PATCH PANEL #	Actual patch panel number.
PORT #'s	Actual port numbers in the patch panel, (in existing installations often the port number are not sequential, i.e. patch panel port numbers 1,3,4,5)

The bottom position of the UTP wall plate shall be marked with the Room Number that the wall plate is installed. This information is reflected in the site cable plan.

Top Position Example:
110-1-1-1 = TR 110
Rack # 1
Patch Panel # 1
Port #'s 1,2,3,4 (On the patch panel)

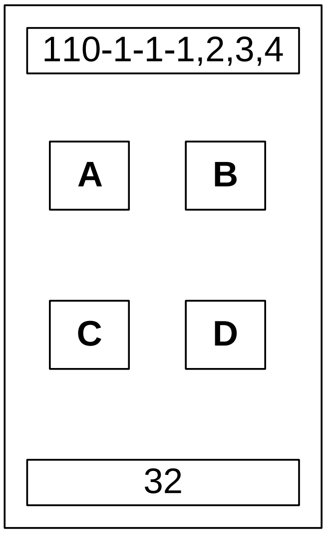
Bottom Position Example:

32 = Room Number (Actual room # from the cable plan and facility drawings at time of design)

Top Position Example: (no comm. room identifier)

1A-1-1-1 = TR 1A
Rack # 1
Patch Panel # 1
Port #'s 1,2,3,4 (On the patch panel)

Example of a Single Quad Data Outlet Located in room 32 and terminating in TR 110, Rack # 1, Patch Panel # 1 and starting in port # 1 of the patch panel.



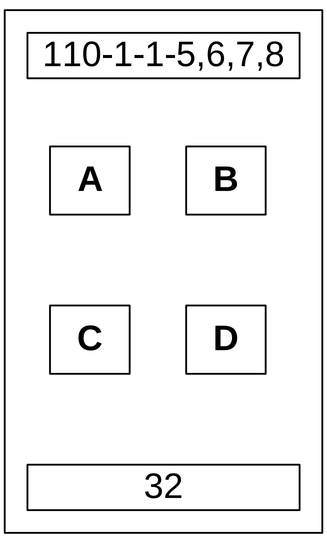
TR 110
RACK 1
PATCH PANEL 1
PORT #s 1,2,3,4

DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)

A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Outlet - Green

ROOM NUMBER (Actual room number from site cable plan and facility drawings at time of network infrastructure site cable plan development.)

Example of a Second Quad Data Outlet Located in room 32 and terminating in TR 110, Rack # 1, Patch Panel # 1 and starting in port # 5 of the patch panel.



TR 110
RACK 1
PATCH PANEL 1
STARTING PORT # 5,6,7,8

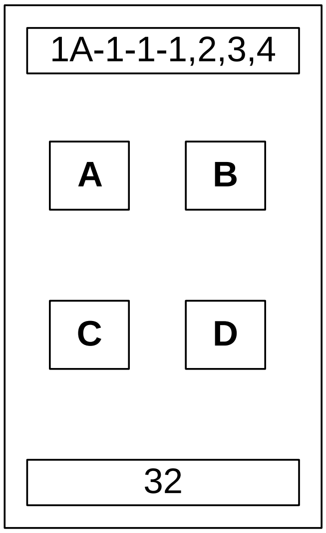
DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)

A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Outlet - Green

ROOM NUMBER (Actual room number from site cable plan and facility drawings at time of network infrastructure site cable plan development.)

Figure 7 Four-Position Wall Plate Numbering Scheme

Example of a Single Quad Data Outlet Located in room 32 and terminating in TR 1A, Rack # 1, Patch Panel # 1 and starting in port # 1 of the patch panel.



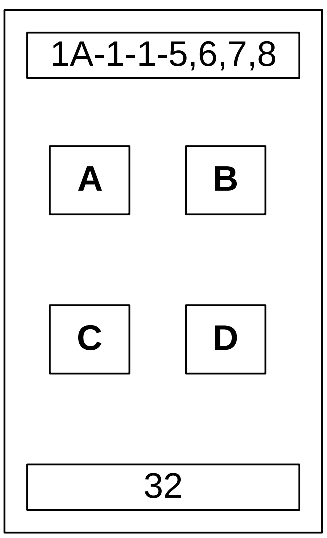
TR	1A
RACK	1
PATCH PANEL	1
PORT #s	1,2,3,4

DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)

A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Outlet - Green

ROOM NUMBER (Actual room number from site cable plan and facility drawings at time of network infrastructure site cable plan development.)

Example of a Second Quad Data Outlet Located in room 32 and terminating in TR 1A, Rack # 1, Patch Panel # 1 and starting in port # 5 of the patch panel.



TR	1A
RACK	1
PATCH PANEL	1
STARTING PORT #	5,6,7,8

DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)

A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Outlet - Green

ROOM NUMBER (Actual room number from site cable plan and facility drawings at time of network infrastructure site cable plan development.)

Figure 8 Four-Position Wall Plate Numbering Scheme (no TR room number)

3.2 Five Position UTP and Fiber Wall Plate

The five position wall plate consists of three UTP and one duplex SC fiber connector. The wall plate shall be marked with the following information. See Figure 9 Five-Position Wall Plate Numbering Scheme.

The top position of the wall plate shall be marked with the Room Number that the wall plate is installed.

TR	Actual TR or ER where the end of the wall plate cables terminate.
RACK #	Actual Rack number that contains the patch panel where the cable terminates.
PATCH PANEL #	Actual patch panel number.
PORT #'s	Port numbers in the patch panel.

The middle position of the wall plate shall be marked with the Room Number that the wall plate is installed. This information is reflected in the site cable plan.

The bottom position, duplex SC connector, of the wall plate shall be marked with the following information.

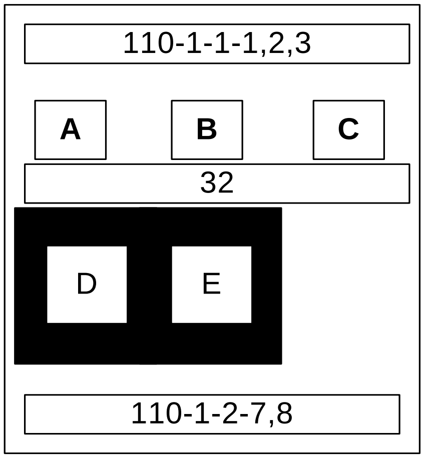
TR	Actual TR or ER where the end of the wall plate cables terminate.
RACK #	Actual Rack number that contains the fiber patch panel where the cable terminates
PATCH PANEL #	Actual fiber patch panel number
PORT #'s	Port numbers in the fiber patch panel
ROOM NUMBER	Actual room # from the cable plan and facility drawings at time of design

Top Position Example:
110-1-1-1,2,3 = TR 110
Rack # 1
Patch Panel # 1
Ports # 1,2,3 (On the patch panel)

Middle Position Example:
32 = Room Number (Actual room # from the cable plan and facility drawings at time of design)

Bottom Position Example:
110-1-2-7,8 = TR 110
Rack # 1
Patch Panel # 2 (Fiber)
Ports # 7,8 (On the fiber patch panel)

Example of a Single Five Position UTP and Fiber-Optic Data Outlet Located in room 32 with UTP terminating in TR110, Rack # 1, Patch Panel # 1 and starting in port # 1 of the patch panel and Fiber terminating in TR 110, Rack # 1, Patch Panel # 2 and starting in port # 7 of the patch panel.



UTP Section

TR	110
RACK	1
PATCH PANEL	1
PORT #	1,2,3

DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)

A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Not Used

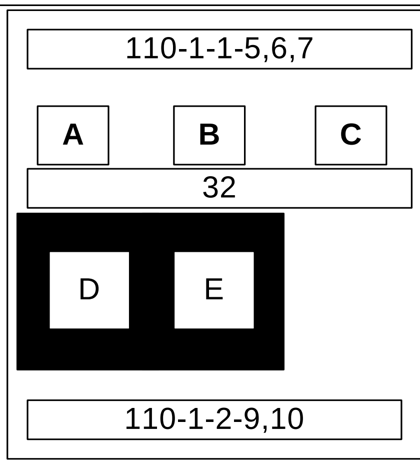
Fiber-Optic Section

TR	110
RACK	1
PATCH PANEL	2
PORT #s	7,8

FIBER DATA OUTLETS
D - E Outlets - Fiber Pair # 1

ROOM NUMBER	32

Example of a Second Five Position UTP and Fiber-Optic Data Outlet Located in room 32 with UTP terminating in TR 110, Rack # 1, Patch Panel # 1 and starting in port # 5 of the patch panel and Fiber terminating in TR 110, Rack # 1, Patch Panel # 2 and starting in port # 9 of the patch panel.



UTP Section

TR	110
RACK	1
PATCH PANEL	1
PORT #	5,6,7

DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)

A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Not Used

Fiber-Optic Section

TR	110
RACK	1
PATCH PANEL	2
PORT #	9,10

FIBER DATA OUTLETS
D - E Outlets - Fiber Pair # 1

ROOM NUMBER	32

Figure 9 Five-Position Wall Plate Numbering Scheme

3.3 Six Position UTP and Fiber-Optic Wall Plate

The six position wall plate consists of four UTP and one duplex SC fiber connector. The wall plate shall be marked with the following information; (See Figure 10 Six-Position Wall Plate Numbering Scheme.)

The top position of the combination UTP and Fiber-Optic 6-Position 2 gang (Four UTP and One fiber Pair) wall plate shall be marked with the following information.

TR	Actual TR or ER where the end of the wall plate cables terminate.
RACK #	Actual Rack number that contains the patch panel where the cable terminates
PATCH PANEL #	Actual patch panel number
PORT #'s	Port numbers in the patch panel
ROOM NUMBER	Actual room # from the cable plan and facility drawings at time of design

The middle position of the wall plate shall be marked with the Room Number that the wall plate is installed. This information is reflected in the site cable plan.

The bottom position of the combination UTP and Fiber-Optic 6-Position (Four UTP and One fiber Pair) wall plate shall be marked with the following information IAW the cable plan.

TR	Actual TR or ER where the end of the wall plate cables terminate.
RACK #	Actual Rack number that contains the fiber patch panel where the cable terminates
PATCH PANEL #	Actual fiber patch panel number
PORT #'s	Port numbers in the fiber patch panel
ROOM NUMBER	Actual room # from the cable plan and facility drawings at time of design

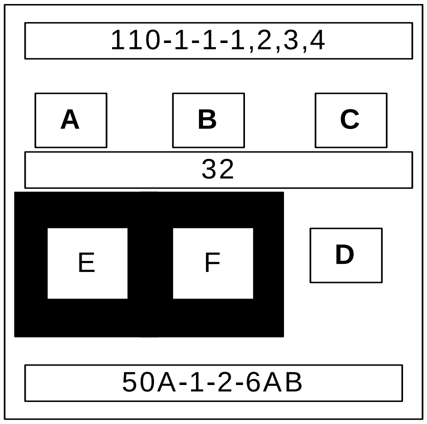
Top Position Example:
110-1-1-1,2,3,4 = TR 110
Rack # 1
Patch Panel # 1
Port # 1,2,3,4 (On the patch panel)

Middle Position Example:
32 = Room Number (Actual room # from the cable plan and facility drawings at time of design)

Bottom Position Example:
110-1-2-7 = TR 110
Rack # 1
Patch Panel # 2 (Fiber)

Port # 6AB (On the fiber patch panel)

Example of a Single Six Position UTP and Fiber-Optic Data Outlet Located in room 32 with UTP terminating in TR 110, Rack # 1, Patch Panel # 1 and port # 1,2,3,4 of the patch panel and Fiber terminating in TR 110, Rack # 1, Patch Panel # 2 and port # 6AB of the patch panel.



UTP Section

TR	110
RACK	1
PATCH PANEL	1
PORT #	1,2,3,4

DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)

A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Outlet - Green (not used in triple outlet)

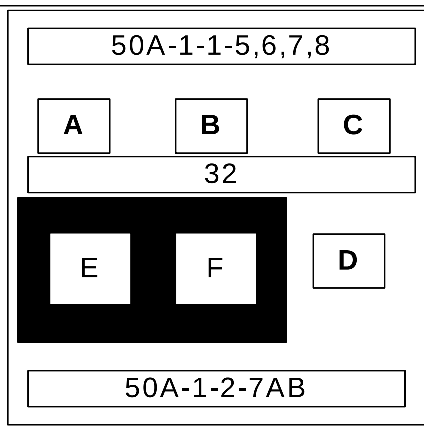
Fiber-Optic Section

TR	110
RACK	1
PATCH PANEL	2
PORT #	6AB

FIBER DATA OUTLETS
E - F Outlets - Fiber Pair # 1

ROOM NUMBER 32

Example of a Second Six Position UTP and Fiber-Optic Data Outlet Located in room 32 with UTP terminating in TR 110, Rack # 1, Patch Panel # 1 and port # 5,6,7,8 of the patch panel and Fiber terminating in TR 110, Rack # 1, Patch Panel # 2 and port # 7AB of the patch panel.



UTP Section

TR	110
RACK	1
PATCH PANEL	1
PORT #	5,6,7,8

DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)

A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Outlet - Green (not used in triple outlet)

Fiber-Optic Section

TR	110
RACK	1
PATCH PANEL	2
PORT #	7AB

FIBER DATA OUTLETS
E - F Outlets - Fiber Pair # 1

ROOM NUMBER 32

Figure 10 Six-Position Wall Plate Numbering Scheme

3.4 Four Position Fiber-Optic Wall Plate

The four position fiber wall plate consists of two duplex SC fiber connectors. The wall plate shall be marked with the following information; See;

Figure 11 Four-Position Fiber-Optic Wall Plate Numbering Scheme)

The top position of the four-position Fiber-Optic wall plate shall be marked with the following information;

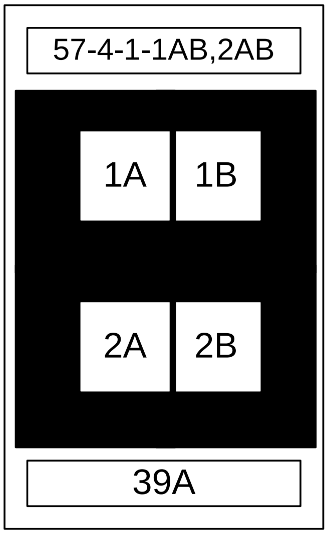
TR	Actual TR or ER where the end of the wall plate cables terminate.
RACK #	Actual Rack number that contains the patch panel where the cable terminates
PATCH PANEL #	Actual patch panel number
PORT #'s	Port numbers in the patch panel

The bottom position of the fiber wall plate shall be marked with the Room Number that the wall plate is installed. This information is reflected in the site cable plan. (See example wall plate layout in this section.)

Top Position Example:
57-4-1-1 = TR 57
Rack # 4
Patch Panel # 1
Port # 1 AB, 2AB (On the patch panel)

Bottom Position Example:
39A = Room Number (Actual room # from the cable plan and facility drawings at time of design)

Example of a Single Four Position Fiber-Optic Data Outlet Located in room 39A and terminating in TR 57, Rack # 4, Patch Panel # 1 and SC port # 1 fiber AB and SC port 2 fiber AB of the patch panel.



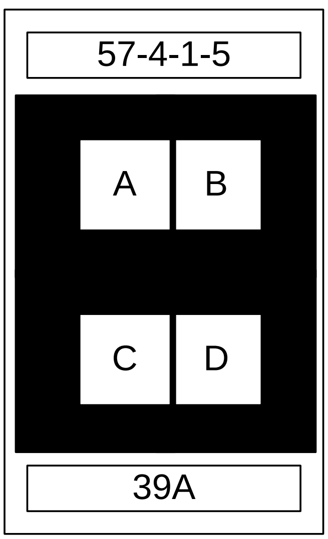
TR 57
RACK 4
PATCH PANEL 1
PORT # 1AB,2AB

FIBER DATA OUTLETS

A -B Outlets - Fiber Pair # 1
C - D Outlet - Fiber Pair # 2

ROOM NUMBER (Actual room number from site cable plan and facility drawings at time of network infrastructure site cable plan development.)

Example of a Single Four Position Fiber-Optic Data Outlet Located in room 39A and terminating in TR 57, Rack # 4, Patch Panel # 1 and SC port # 1 fiber AB and SC port 2 fiber AB of the patch panel.



TR 57
RACK 4
PATCH PANEL 1
STARTING PORT # 5

FIBER DATA OUTLETS

A -B Outlets - Fiber Pair # 1

C - D Outlet - Fiber Pair # 2

ROOM NUMBER (Actual room number from site cable plan and facility drawings at time of network infrastructure site cable plan development.)

Figure 11 Four-Position Fiber-Optic Wall Plate Numbering Scheme

3.5 Ten Position UTP and Fiber-Optic Wall Plate

The four position fiber wall plate consists of four UTP and three duplex SC fiber connectors; See Figure 12 Ten-Position Fiber-Optic Wall Plate Numbering Scheme.

The top position of the wall plate shall be marked with the following information; IAW the cable plan;

TR Actual TR or ER where the end of the wall plate cables terminate.
RACK # Actual Rack number that contains the UTP patch panel where the cable terminates.
PATCH PANEL # Actual UTP patch panel number
PORT # Actual starting port number in the UTP patch panel
ROOM NUMBER Actual room # from the cable plan and facility drawings at time of design

The bottom position of the combination UTP and Fiber-Optic 10-Position (Four UTP and Three Fiber Pairs) wall plate shall be marked with the following information IAW the cable plan (See example wall plate layout in this section.)

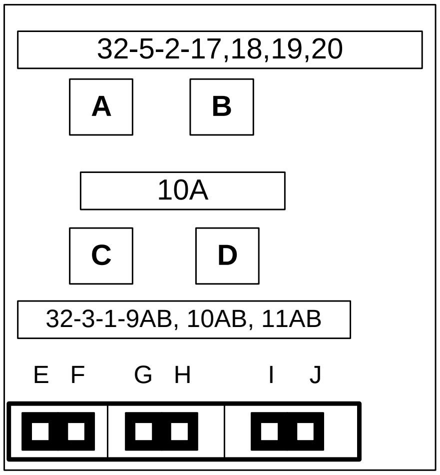
TR Actual TR or ER where the end of the wall plate, fiber terminates.
RACK # Actual Rack number that contains the fiber patch panel where the cable terminates.
PATCH PANEL # Actual fiber patch panel number
PORT # Actual starting port number in the fiber patch panel
ROOM NUMBER Actual room # from the cable plan and facility drawings at time of design

Top Position Example:
32-5-2-17 = TR 32
Rack # 5
Patch Panel # 2 (UTP)
Port # 17,18,19,20 (On the UTP patch panel)

Middle Position Example:
10A = Room Number (Actual room # from the cable plan and facility drawing at time of design)

Bottom Position Example:
32-5-2-20 = TR 32
Rack # 5
Patch Panel # 2 (Fiber)
Port # 9AB, 10AB, 11AB (On the Fiber patch panel)

Example of a Single Ten Position UTP and Fiber-Optic Data Outlet Located in room 32 with UTP terminating in TR 32, Rack # 5, Patch Panel # 2 and port # 17,18,19,20 of the patch panel and Fiber terminating in TR 32, Rack # 3, Patch Panel # 1 and starting in port # 9AB, 10AB, 11AB of the patch panel.



UTP Section

TR	32
RACK	5
PATCH PANEL	2
PORT #	17,18,19,20

DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)
A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Outlet - Green (not used in triple outlet)

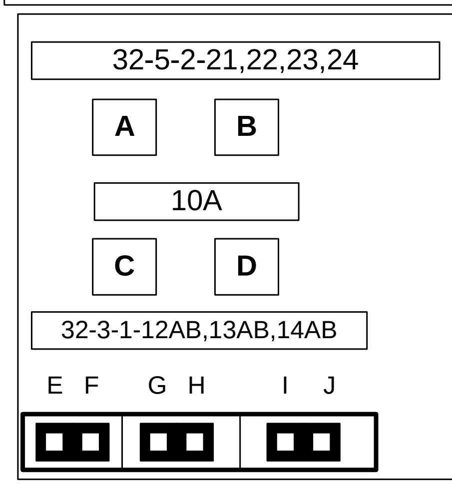
Fiber-Optic Section

TR	32
RACK	3
PATCH PANEL	1
PORT #	9,AB,10,AB,11AB

FIBER DATA OUTLETS
E - F Outlets - Fiber Pair # 1
G - H Outlets - Fiber Pair # 2
I - J Outlets - Fiber Pair # 3

ROOM NUMBER 10A

Example of a Second Ten Position UTP and Fiber-Optic Data Outlet Located in room 10A with UTP terminating in TR 32, Rack # 5, Patch Panel # 2 and starting in port # 20 of the patch panel and Fiber terminating in STR 32, Rack # 3, Patch Panel # 1 and starting in port # 15 of the patch panel.



UTP Section

TR	32
RACK	5
PATCH PANEL	2
PORT #	21,22,23,24

DATA OUTLETS (Color Coded. Site Specific Colors may be used in lieu of standard colors)
A - Outlet - White
B - Outlet - Blue
C - Outlet - Yellow
D - Outlet - Green (not used in triple outlet)

Fiber-Optic Section

TR	32
RACK	3
PATCH PANEL	1
PORT #	12AB, 13AB,14AB

FIBER DATA OUTLETS
E - F Outlets - Fiber Pair # 1
G - H Outlets - Fiber Pair # 2
I - J Outlets - Fiber Pair # 3

ROOM NUMBER 10A

Figure 12 Ten-Position Fiber-Optic Wall Plate Numbering Scheme

4 UTP/Fiber Patch Panels

4.1 UTP Patch Panel Markings and Numbering

UTP Patch Panels shall be marked IAW the site cable plan. Labels shall be used to identify the patch panel information and labels shall be used to identify the respective jacks and their related wall plates.

- All references should be to cable destination
- Mechanically printed labels shall be affixed on the UTP patch panel immediately below or above the data jacks depending on the position of the manufactures jack numbers on the UTP patch panel.
    - If the manufacturer’s jack numbers are located above, the data jacks place the labels under the jacks without obscuring the next row of manufacturers jack numbers.
    - If the manufacturer’s jack numbers are located below, the data jacks place the labels above the jacks without obscuring the next row of manufacturers jack numbers.
    - All jack labels shall reference the distance end wall plate. All marking shall be IAW the site cable plan. Labels shall be placed under clear plastic label protectors on the patch panels if available.

Example of a 48 port UTP patch panel with manufacturers jack numbers located above the data jacks. This UTP patch panel supports the following data jacks located in the following areas:

110 2 Quad Outlet 110-1 A B C D, 110-2 A B C D
111 1 Quad Outlet 111-1 A B C D
112 1 Quad Outlet 112-1 A B C D
113 5 Quad Outlet 113-1 A B C D, 113-2 A B C D, 113-3 A B C D, 113-4 A B C D, 113-5 A B C D
114 1 Quad Outlet 114-1 A B C D
114A 1 Quad Outlet 114A-1 A B C D
115 1 Quad Outlet 115-1 A B C D

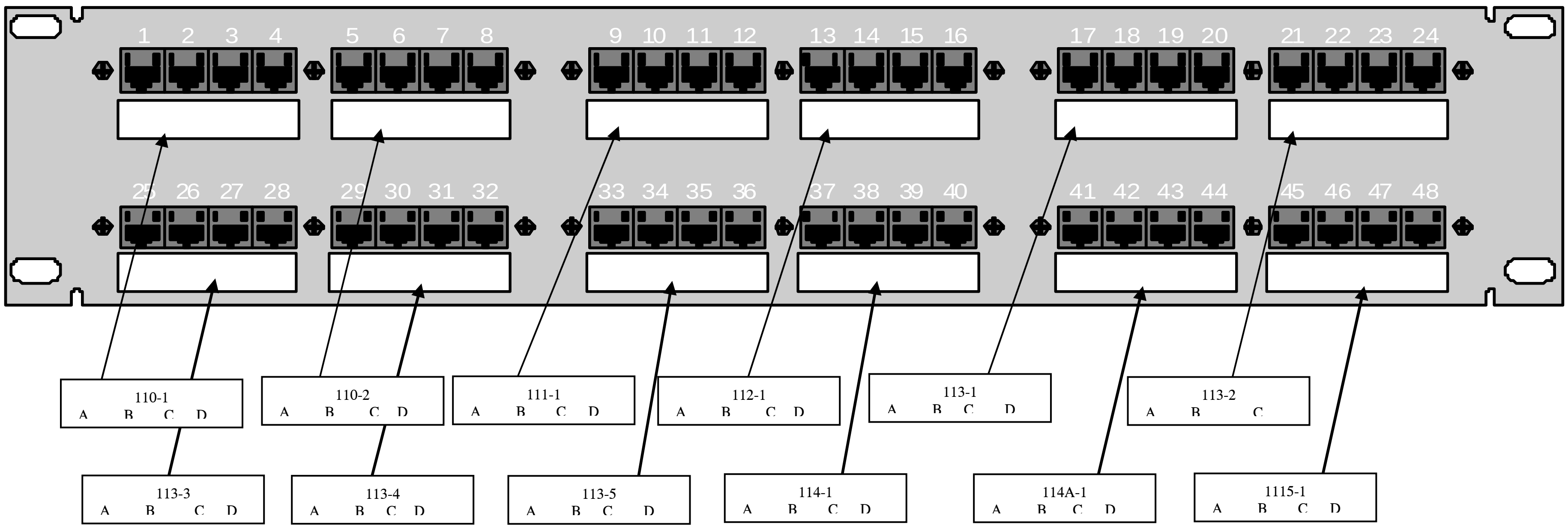


Figure 13 Example Patch Panel Numbering Scheme

4.2 Fiber Optic Cable Patch Panel Markings and Numbering

Fiber Optic Patch Panels shall be marked IAW the site cable plan. Labels shall be used to identify the patch panel information and labels shall be used to identify the respective jacks and their related wall plates or other Fiber Optic Patch Panels.

- All references should be to cable destination
- Mechanically printed labels shall be affixed on the front left hand side of the Fiber Optic Patch Panel Door.
- All Fiber Optic jacks shall be marked following the site cable plan. The Fiber Optic Patch Panel manufactures label card shall be filed out and installed in the Fiber Optic Patch Panel in a location that is easily readable or reachable when the door is opened. The preferred location is attached to the door with the data readable.
- Labels shall be placed under clear plastic label protectors on the patch panels if available.
- Fiber Optic enclosures shall be marked within their respected room number, rack numbers and patch panel number starting with the number 1. Each sub-panel in the enclosure shall be marked starting with the letter "A", going left to right and ports shall be numbered starting with the # 1 going top to bottom in each sub-panel.

***	-	***	-	***	-	**
Building No.		Room No		Enclosure		Port No. Designation

EXAMPLE: If a cable is marked: **204-313-02A-12**

This represents the destination of the cable, Building 204, Room 313, Enclosure 02A and port 12

5 Network Equipment

See BICSI Telecommunication Distributions Method Manual, Ch 14 PG 8-11 "Telecommunications Equipment Identification".

Appendix D
Drawing Records

1 Drawings

Drawing packages shall include drawings that accurately depict the network configuration, cable plant and telecommunication rooms. Architectural quality CAD drawings with polylines shall be used for physical layout drawings.

The Engineering Data Service Center (EDSC) at the 38 EIG is responsible for maintaining Drawings. A policy letter was published May 03 to all CISR monitors. In accordance with AFI 21-404, this policy details drawing formats and is inserted below with its relevant attachments;

EDSC Electronic Submittals.pdf

EDSC Electronics Submittals Att 1.pdf

EDSC Electronic Submittals Attach 3.pdf