

City Colleges of Chicago

Network Cable Plant Standards

Revision4.0 10/26/2020

Cabling Strategy and Topology

The following document contains the City Colleges of Chicago standards for implementing a cabling plant to support their data communications networking and telephone environment. The standards in this document address the cabling plant of a district-wide environment. It will also address the topology, media, termination, testing, and wiring/equipment closets.

Unless noted otherwise, where conflicts between our standards and local codes and ordinances exist, local codes and ordinances will supersede all other requirements.

**City Colleges of Chicago
Network Cable Plant Standards**

Index

SUMMARY OF DOCUMENT CHANGES:	4
1 CABLING PLANT STANDARDS IMPLEMENTATION	6
1.1 SCOPE	6
1.2 TELECOMMUNICATION SYSTEM STANDARDS REFERENCE DOCUMENTS LIST	6
2 CABLING SYSTEM ARCHITECTURE	7
2.1 TERMINOLOGY AND DEFINITIONS	7
2.2 THE STRUCTURED CABLING SYSTEM	9
2.3 BUILDING ENTRANCE / ENTRANCE FACILITIES EF	9
2.4 BACKBONE/VERTICAL CABLING	10
2.5 TELECOMMUNICATION CLOSET TC / IDF	10
2.6 MAIN TELECOMMUNICATION CLOSET MC / MDF	14
2.7 HORIZONTAL CABLING	15
2.8 WORK AREA WA	17
2.9 APPROVED UNSHIELDED TWISTED PAIR (UTP) CABLE TERMINATION AND PATCH CABLES	17
2.10 APPROVED SHIELDED TWISTED PAIR (STP) CABLE TERMINATION AND PATCH CABLES	18
3 APPROVED SHIELDED AND UNSHIELDED TWISTED PAIR CABLE AND PERFORMANCE	19
3.1 SCOPE	19
3.2 SHIELDED AND UNSHIELDED TWISTED PAIR REFERENCE DOCUMENTS	19
3.3 APPLICABLE TESTING STANDARDS	19
3.4 BASELINE SHIELDED AND UNSHIELDED 4 PAIR CABLING STANDARDS	20
3.5 WIRELESS CABLING STANDARDS	20
3.6 SHIELDED AND UNSHIELDED TWISTED PAIR INSTALLATION, CERTIFICATION, AND TESTING	22
4 PREMISE FIBER OPTIC CABLING	22
4.1 SCOPE	22
4.2 FIBER OPTIC CABLING REFERENCE DOCUMENTS	22
4.3 FIBER OPTIC CABLING PERFORMANCE STANDARDS	23
4.4 FIBER OPTIC CABLE INSTALLATION, CERTIFICATION, AND TESTING	26
5 TELEPHONE WIRING STANDARDS AND TERMINATION REQUIREMENTS	26
5.1 SCOPE	26
5.2 NET POP EXTENSION	26
5.3 AT&T NET POP OR EXTENSION TERMINATION	26
5.4 IDF TELEPHONE EXTENSION	27
6 MISCELLANEOUS STANDARDS AND REQUIREMENTS	28
6.1 EQUIPMENT RACKS	28
6.2 REMOVAL OF NON-COMPLIANT CABLING IN THE WORK AREA	29
6.3 LABELING AND WORK AREA TERMINATION	29
6.4 INSPECTION	31
6.5 FIRE-STOPPING AND WALL PENETRATION	31
6.6 RULES OF CONDUCT	31

Summary of Document Changes:

All changes in the original document (Revision 1) have been included in this document. This document includes changes due to changes by the national standards committees and the City Colleges of Chicago's procedures and practices to improve the learning experience of its students.

The pages have been re-indexed to accommodate the above changes.

All new changes will be summarized in the following format:

- Date of change
- Page
- Name of person making the change
- Summary of the change

Date of Change	Page	Name	Summary of Change
10/24/2016		Calvin/Mike G	Updated sections 5 and 6
02/28/2017		Calvin/Mike G./Steve	Updated cable case color and updated usage for CAT6a
10/17/2019	All	Anthony Williams	General review of document
10/26/2020	All	Michael Gudbrandsen	Updated telephone wiring in section 5. Review entire document.
10/26/2020	All	Jaroslav Listopad	Review and provide update on all sections
10/26/2020	All	Frank Alesa	Updated cable labeling in section 6. Review entire document
10/26/2020	All	Daniel Keith	Created new wireless cabling in section 3. Review entire document
10/26/2020	All	Robert LaBon	Proof reader for entire document. Updated section 2
10/26/2020	All	Calvin Adenekan	Updated figures, Added IDF/MDF dimensions. Review document

Reference Drawings

Figure 1 : Structured Cabling Wiring Plant	7
Figure 2 : Horizontal Cabling and Cross Connects	8
Figure 3 : Telecommunication Closet Dimension	10
Figure 4 : Telecommunication closet layout	11
Figure 5 : Telecommunication closet ladder layout	12
Figure 6 : Telecommunication Closet Cross Connects	13
Figure 7 : Main Telecommunication closet layout	14
Figure 8 : Main Telecommunication closet ladder layout	15
Figure 9 : Horizontal Cabling	16
Figure 10 : T568B Eight Position Connector Pin / Pair Assignment	16
Figure 11 : Example of properly dressed cables	18
Figure 12 : Shielded Cable Examples	18
Figure 13 : Pole Mounted Access Point	21
Figure 14 : Wall Mounted Access Point	21
Figure 15 : Waterproof RJ-45 connectors	21
Figure 16 : Fiber Optic Label for MDF	23
Figure 17 : Fiber Optic Label for IDF	24
Figure 18 : Optical Fiber Cable Type	24
Figure 19 : Optical Fiber Cable Reference	25
Figure 20 : Telephone Cabling System	27
Figure 21 : Equipment Rack Grounding and Bounding	28
Figure 22 : Equipment Rack Grounding	29
Figure 23 : Work Areas and Telecommunication Closet Labeling	30

1 Cabling Plant Standards Implementation

1.1 Scope

- All new construction
- Any major renovation
- All new additions
- Exceptions to these standards must be requested and approved in writing.
- Specified Telecommunication Industry Standards and Bulletins must be complied with; with exception to those standards set by City Colleges of Chicago.

1.2 Telecommunication System Standards Reference Documents List

ANSI/EIA/TIA-568-C.0	Generic telecommunications cabling standards for customer premises.
ANSI/EIA/TIA-568-C.1	Commercial building telecommunications cabling standards – part 1: general requirements
ANSI/EIA/TIA-568-C.2	Commercial building telecommunications cabling standards – part 2: Balanced twisted pair cabling components.
ANSI/EIA/TIA-568-C.3	Optical fiber cabling components standards
ANSI/EIA/TIA-569-B	Commercial building standards for telecommunications pathways and spaces.
ANSI/EIA/TIA-570	Residential telecommunications infrastructure standards.
ANSI/EIA/TIA-598	Optical fiber color coding
ANSI/EIA/TIA-606-B	Administration standards for the commercial telecommunications infrastructure.
ANSI-J-STD-607-A	Commercial building grounding (earthing) and bonding for telecommunications.
ANSI/EIA/TIA-758	Customer owned outside plant telecommunications infrastructure requirements.
ANSI/EIA/TIA-526-7	OFSTP-7 Optical power loss measurements of installed single-mode fiber cable plant.
ANSI/EIA/TIA-526-14	OFSTP-14 Optical power loss measurements of installed multi-mode fiber cable plant.
ANSI/EIA/TIA-942	Telecommunications Infrastructure Standards for Data Centers
ANSI/EIA/TIA TSB-140	Additional guidelines for field testing length, loss, and polarity of optical fiber cabling systems.
IEEE 802.3	IEEE standards for Ethernet over various media (copper and fiber).
IEEE 1100	Recommended practice for powering and grounding equipment
ISO 11801	Generic Cabling for Customer Premises (multiple standards)
FCC Title 47 part 15	Regulations regarding unlicensed transmission of radio wave transmissions – Wireless, WIFI, and Bluetooth.
FCC Title 47 part 68	Regulations regarding customer premise wiring connected to the public telephone system.
NEC Article 770	Optical fiber cables
NEC Article 800	Communications circuits
NEC Article 820	Community antenna television and radio distribution systems
NFPA 70-2011	National Electric Code
NFPA 75	Protection of Electronic Computer / Data Processing Equipment
CIS Section 16742	City Colleges of Chicago Data Network Structured Wiring Systems

2 Cabling System Architecture

2.1 Terminology and Definitions

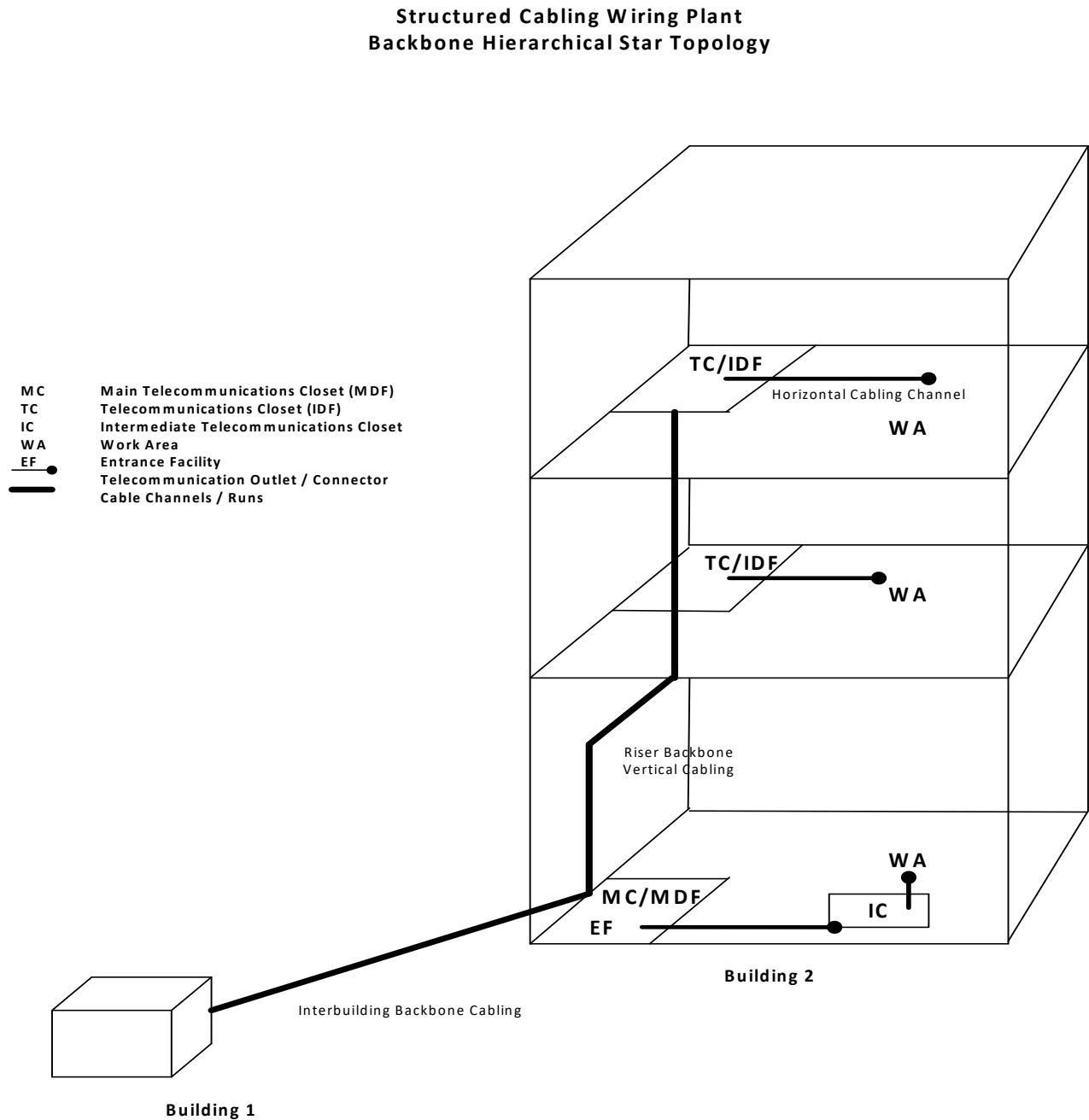
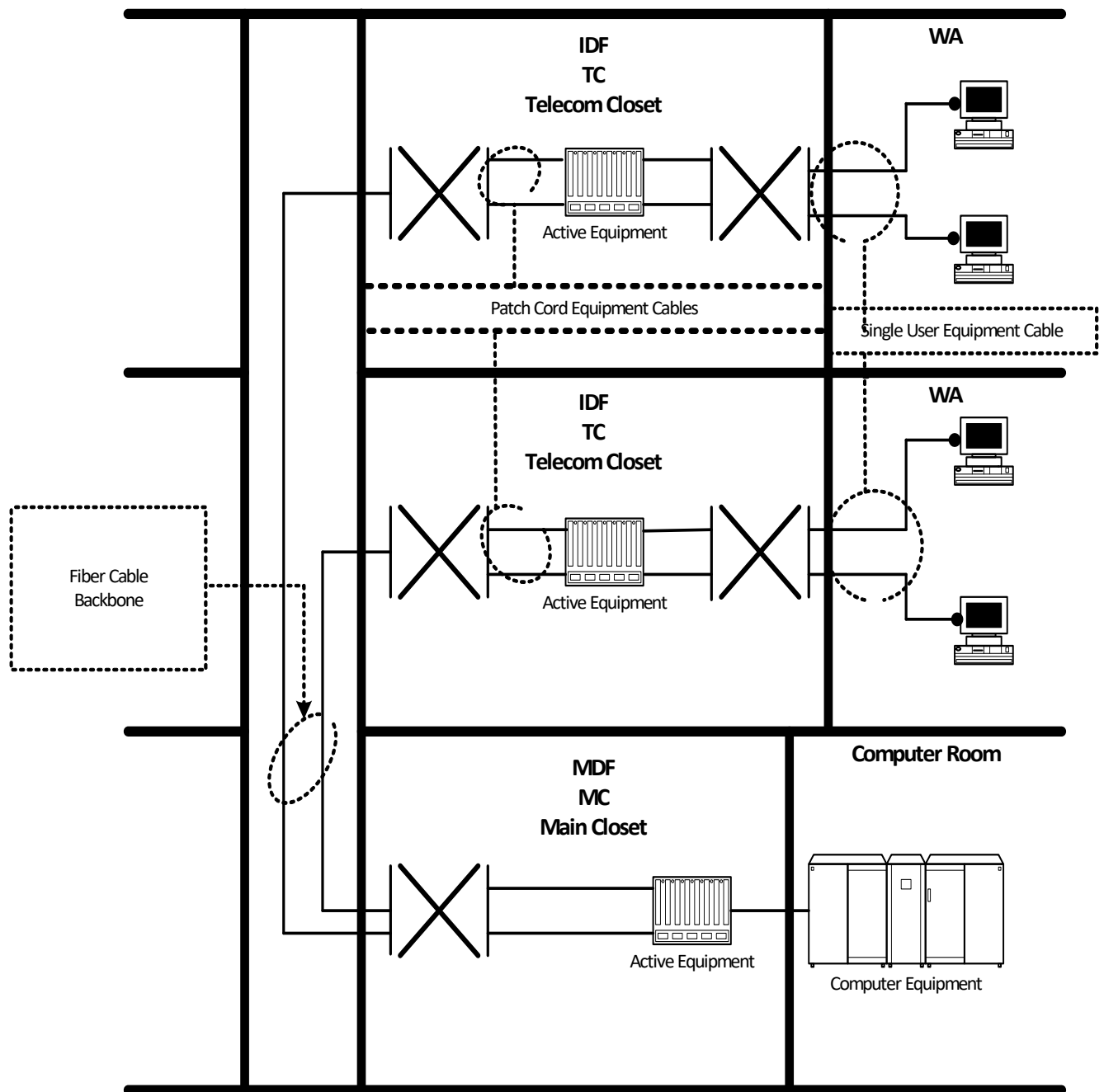


Figure 1 : Structured Cabling Wiring Plant



IXI Cross Connection

Horizontal Cabling and Cross Connects

Figure 2 : Horizontal Cabling and Cross Connects

2.2 The Structured Cabling System

The Structured Cabling System must consist of any or all of the following subsystems in accordance with ANSI/TIA/EIA and BICSI guidelines. It must consist of cable and connecting hardware specified for **ANSI/TIA/EIA Category 6 copper telecommunications cable** and fiber optic cable. For assistance in interpreting any mentioned standard, the services of a **Registered Communications Distribution Designer (RCDD)** certified by the **Building Industry Consulting Services International (BICSI)** is required.

The subsystems of a Structured Cabling System are the **Building Entrance/Entrance Facilities (EF)**, the **Backbone Cabling**, the **Telecommunication Closet (TC or IDF)**, **Main Telecommunication Closet (MC or MDF)**, the **Horizontal Cabling**, and the **Work Area (WA)**.

Refer to figures 1 and 2.

2.3 Building Entrance / Entrance Facilities EF

The entrance facility consists of the telecommunications service entrance into the building, including entrance points through the building walls and continuing to the entrance room or space. It may include the Main Telecommunication Closet. The entrance may contain the backbone pathways that link other buildings in campus situations. Antenna and/or CATV entrances may also constitute part of the entrance facility.

All carriers and telecommunications providers involved in providing service to the building must be contacted to establish their requirements and explore alternatives for delivering service. The location of other utilities such as electrical, water, gas, and sewer must be considered in site selection of the telecommunication entrance facility.

A service entrance pathway must be provided. The basic methods for providing are underground or aerial pathways.

In determining the total number of pathways required, the planner must consider the following:

- Type and use of the building
- Growth
- Difficulty of adding pathways in the future
- Alternate entrance
- Type and size of cables likely to be installed

The entrance room or space (Main Telecommunication Closet) is the component of the entrance facility that provides space for the termination of the entrance campus backbone and/or telecommunication provider cabling. In accordance with NEC Article 800 Section 800-50 exception number 3, the entrance or outside building cable must be terminated and protected on a listed primary protector within 50 feet of entering the building. Where telecommunication equipment is located in the entrance room, the entire room must meet the requirements for an equipment room (Main Telecommunication Closet); as specified in Section 8 of TIA/EIA-569-B.

Access must be made available to independent telecommunications grounding systems specified by ANSI/TIA/EIA-607-A.

TIA/EIA-569-B contains fire stopping requirements, miscellaneous pathways, and telecommunications recommendations of separation from less than 480VAC power lines.

Further information and requirements of entrance rooms can be found in TIA/EIA-569-B and the BICSI Telecommunications Distribution Methods Manuals. These requirements are to be complied with unless directed in writing by The City Colleges of Chicago's Office of Information Systems (OIT) or this document.

2.4 Backbone/Vertical Cabling

The function of the backbone cabling is to provide interconnections between Telecommunications Closets, equipment rooms, and entrance facilities in the telecommunication cabling system structure (Figure 1 and Figure 2). In accordance with TIA/EIA-568-C, the backbone cabling consists of cable (fiber for the network and/or copper for telephony) to intermediate and main cross-connects, mechanical termination, and/or jumpers (patch cords) used for backbone to backbone cross connections and connections between buildings. Sufficient backbone cabling for both copper and fiber media should be installed to accommodate the maximum number of connections either directly or using auxiliary electronic devices.

ANSI/TIA/EIA-569-B specifies separation of the backbone cabling pathways from EMI. Grounding of all metallic shields must also be made to the main telecommunication ground. The mentioned document must also be consulted for pathway and floor penetration and conduit stub heights.

All intra-building (within the building) backbone cabling must meet the appropriate NEC flame and smoke regulations including any local (state, county, and municipality) requirements. These include NEC Article 800 for copper cables and Article 770 for fiber optics. All cables must meet or exceed the electrical specifications of ANSI/TIA/EIA-568-C. All cables must be manufactured by an ISO 9000 compliant company.

2.5 Telecommunication Closet TC / IDF

Telecommunication Closets serve as the home to local communications electronics, cross connects, and termination of backbone and horizontal cables. All Telecommunication Closets are connected by the backbone cabling system to the Main Telecommunication Closet. Backbone and horizontal cables of recognized types are to be terminated in the Telecommunication Closet by compatible connecting hardware specified in this document.

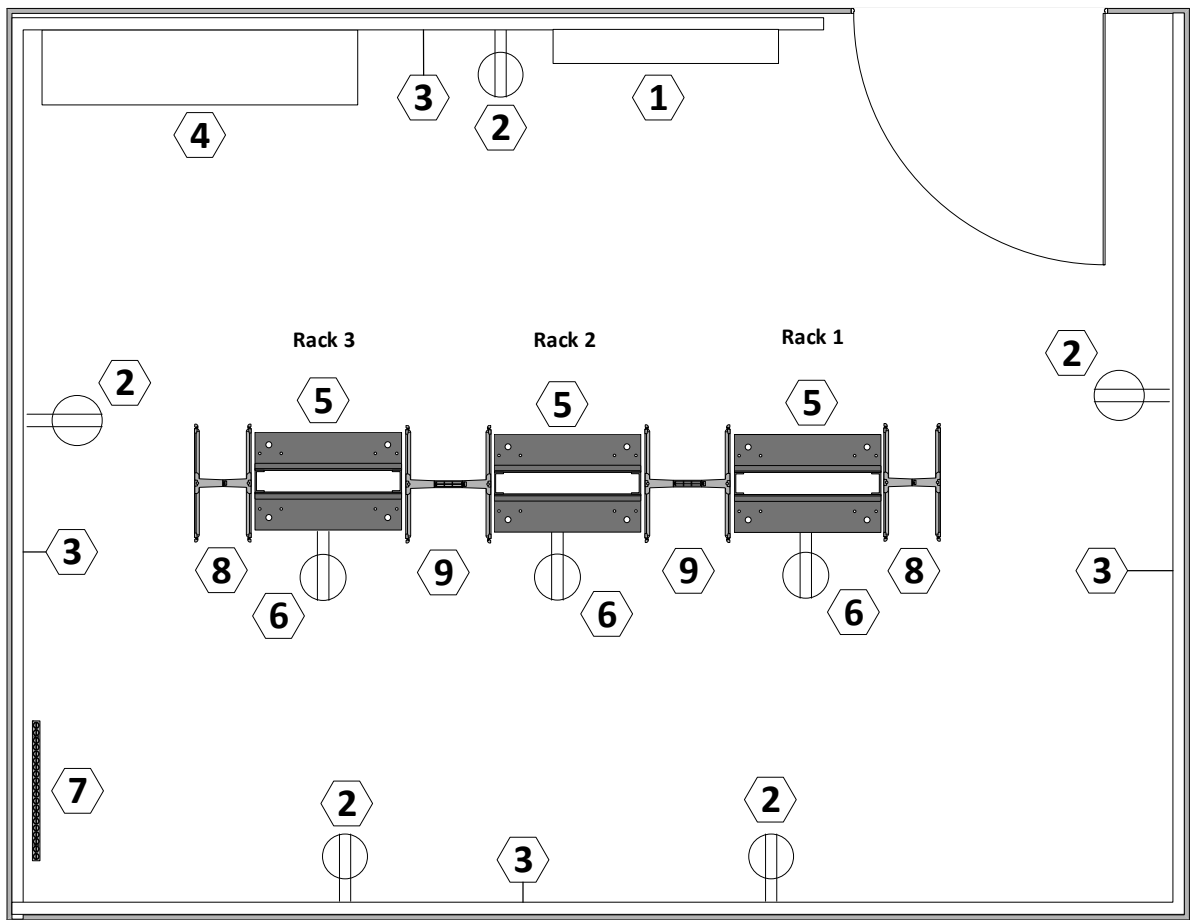
The cross connections of the backbone and horizontal cabling must use jumpers or patch cords to allow for the flexible connectivity when extending various services to telecommunication equipment, outlets, and connectors. Connecting hardware, jumpers, and patch cords used for this purpose are collectively referred to as the "horizontal cross-connect" (Refer to Figure 2).

The Telecommunication Closet may also contain the Main Telecommunication Closet connections for different portions of the backbone cabling system.

For Telecommunication Closet dimensions and requirements, refer to TIA/EIA-569-B section 7 and TIA/EIA 607-A. There shall be sufficient electrical power for the network equipment, UPS battery backup, and power distribution equipment (if required). The closet size shall be such that there is sufficient room for future growth – minimum size 6ft. X 8ft. Refer to Figure 3 for estimated telecommunication closet dimension.

Number of Jacks	Number of Racks	Serving Area	Room Size
361-480	2-3	10000 sq. ft.	10x12
241-360	1-2	8000 sq. ft.	10x10
0-240	1	5000 sq. ft.	10x6

Figure 3 : Telecommunication Closet Dimension



Key Notes:	
1	Copper Backbone wall field
2	(1) Quad 5-20R convenience Receptacle
3	¾" Fire Treated Plywood
4	Cooling unit
5	Equipment Cabinet
6	Dedicated 20AMP Receptacle
7	Ground Busbar
8	6" Vertical wire manager
9	10" Vertical wire manager

Figure 4 : Telecommunication closet layout

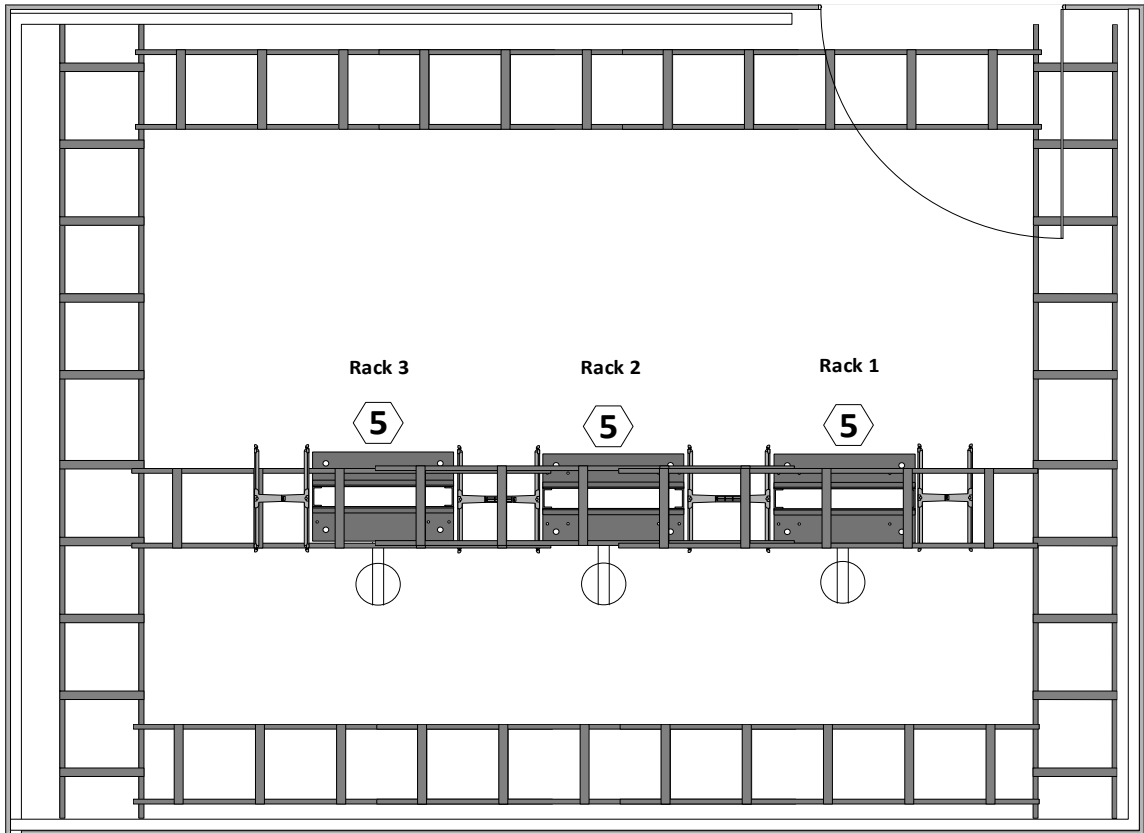


Figure 5 : Telecommunication closet ladder layout

Horizontal Cross-Connect

Telecommunication Closet

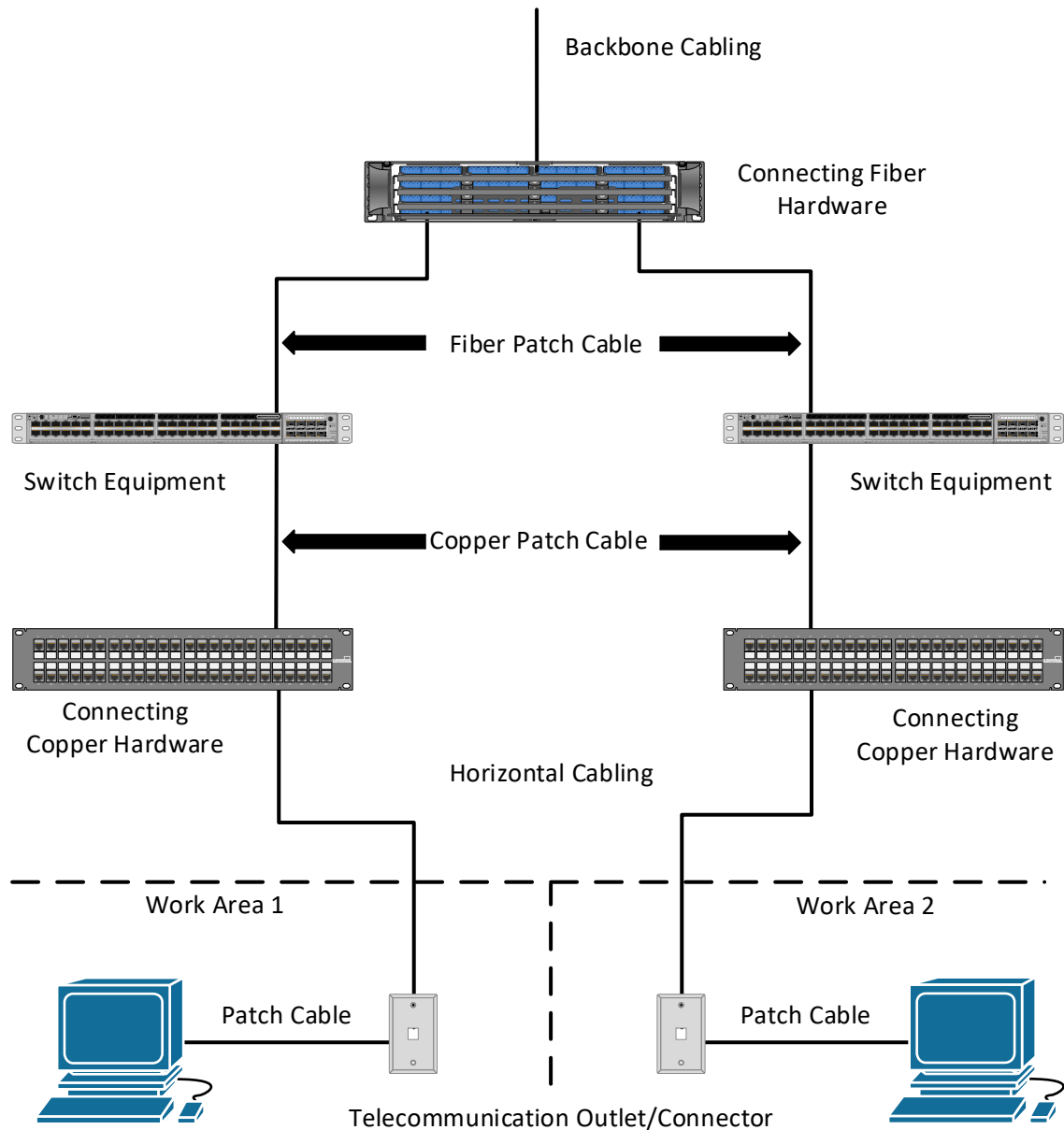


Figure 6 : Telecommunication Closet Cross Connects

Utilized Janitorial closets should not be used as IDF Closets.

2.6 Main Telecommunication Closet MC / MDF

All telecommunication closets within the office or building are connected to the Main Telecommunication Closet (MC/MDF) via backbone cables (fiber or copper). For new construction, the Main Telecommunication Closet will also contain the demarcation points for the campus backbone and any outside telephone equipment or connections necessary to support the data-communications network. For existing Main Telecommunication Closet or new construction there could be a separate build out from the main demarcation site via an extended net pop.

There should be only one Main Telecommunication Closet, unless some type of physical constraint make this impossible.

For Main Telecommunication Closet dimensions and requirements, refer to TIA/EIA-569-B section 7 and TIA/EIA 607-A.

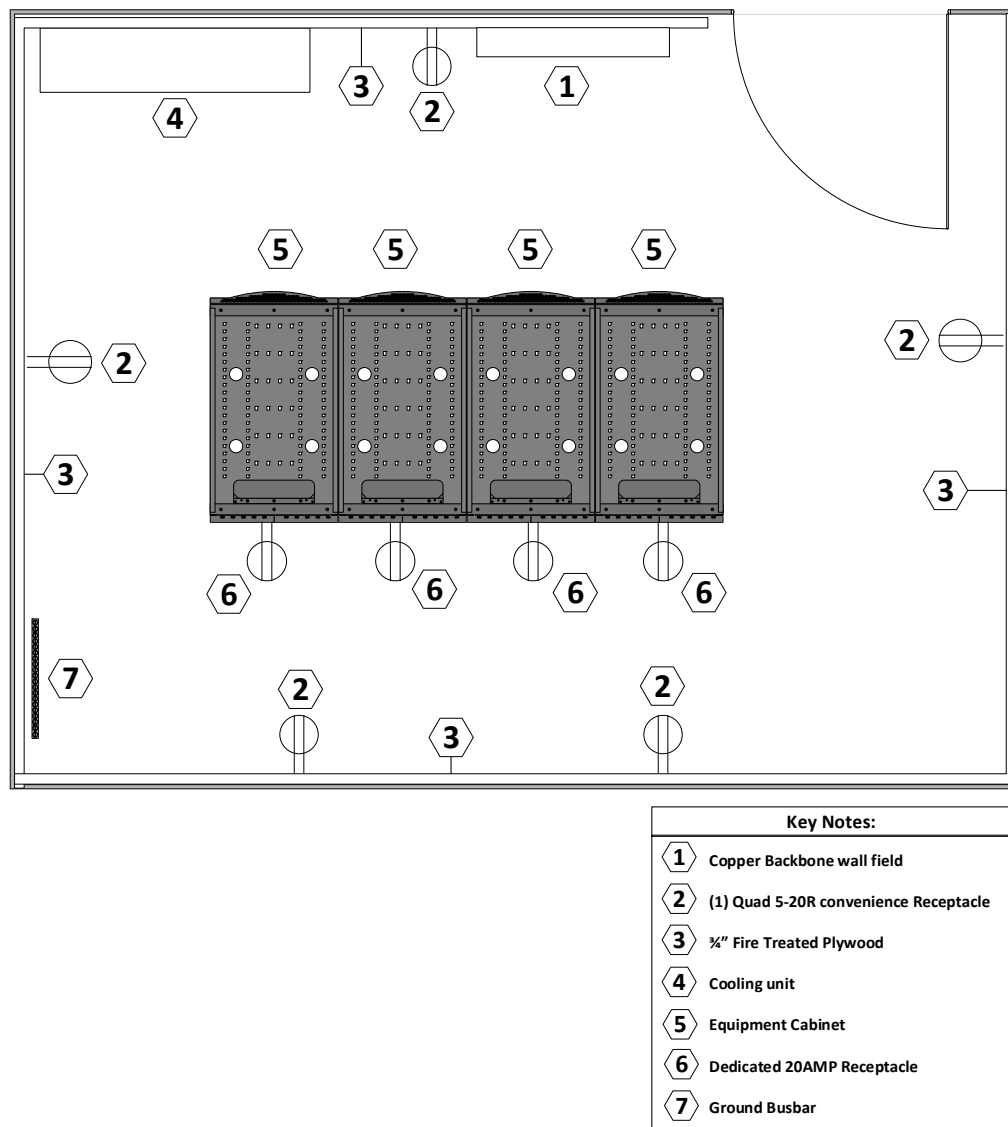


Figure 7 : Main Telecommunication closet layout

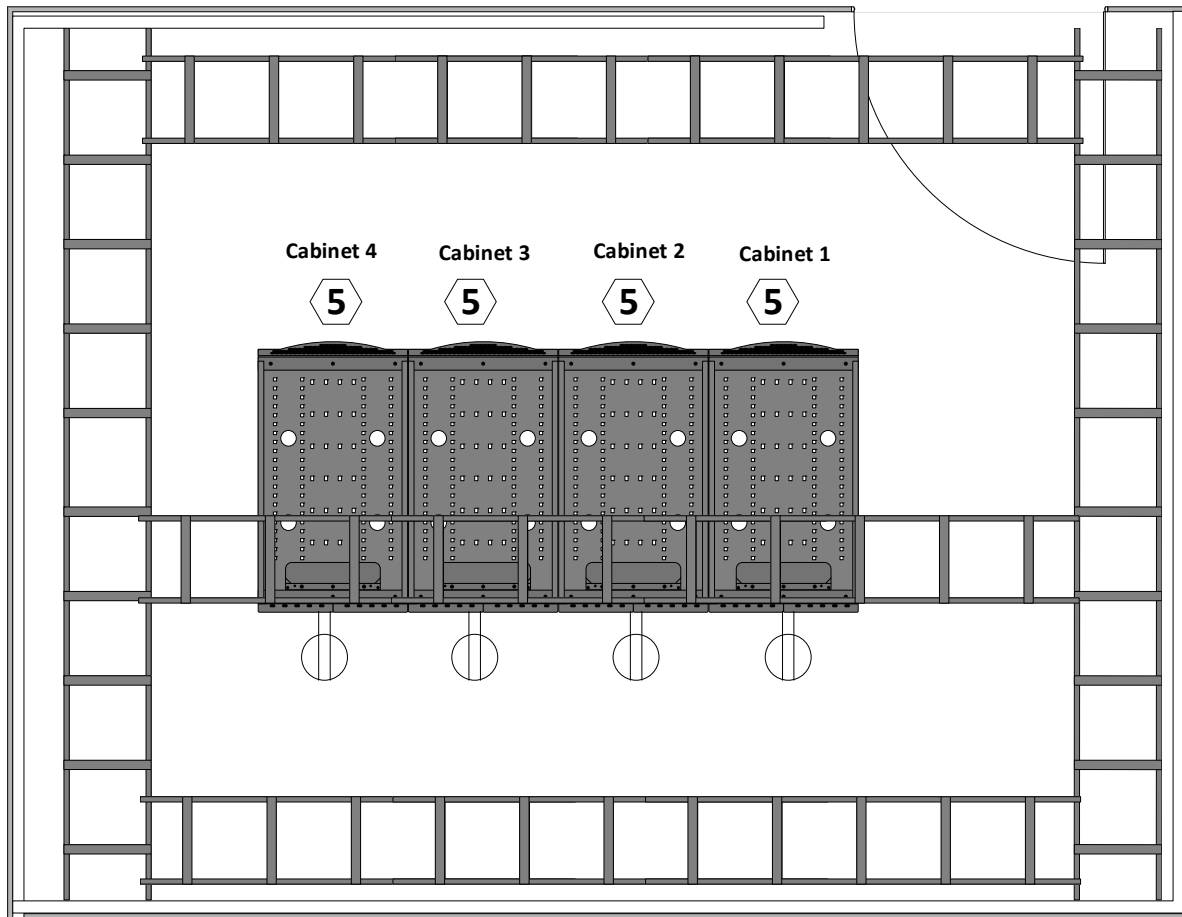


Figure 8 : Main Telecommunication closet ladder layout

2.7 Horizontal Cabling

Horizontal cabling is the cabling system from the Telecommunication Closet (TC / IDF) to the Work Area (WA). It will include the following:

- ◆ Horizontal Cabling
- ◆ Telecommunication outlet / connector at the Work Area (WA)
- ◆ Cable termination and cross connects in the Telecommunication Closet (TC / IDF)

All cables must meet the appropriate NEC and local fire and smoke regulations.

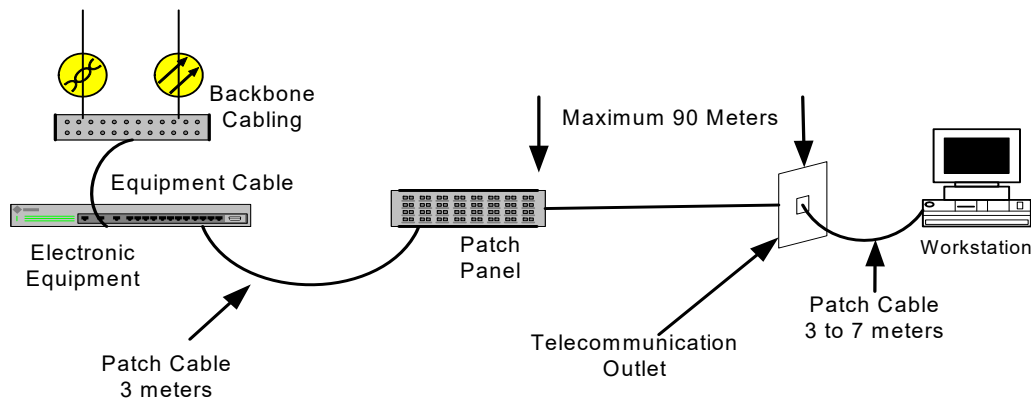
NEC Article 800 for copper cabling systems

NEC Article 770 for optical fiber cabling systems

Maximum horizontal cable length from the mechanical termination of the copper cable in the Telecommunication Closet to the Work Area outlet connector is 90 meters; independent of media type. Total channel length must not exceed 100 meters.

Only one transition point is allowed in the horizontal cabling into the designated Work Area.

It is suggested that the maximum equipment cable (patch cable) length from the telecommunication outlet to the work area equipment be limited to 7 meters. It is also suggested that the maximum equipment cable length for jumpers and patch cables in the Telecommunication Closet be limited to 3 meters. Refer to Figure 9.



Horizontal Cabling System

Figure 9 : Horizontal Cabling

All copper cabling connectors and outlets in the Main Telecommunication Closet, Telecommunication Closets, and Work Areas must conform to the T568B pin out for the 8 position Category 6 modular jacks referred to in Figure 10.

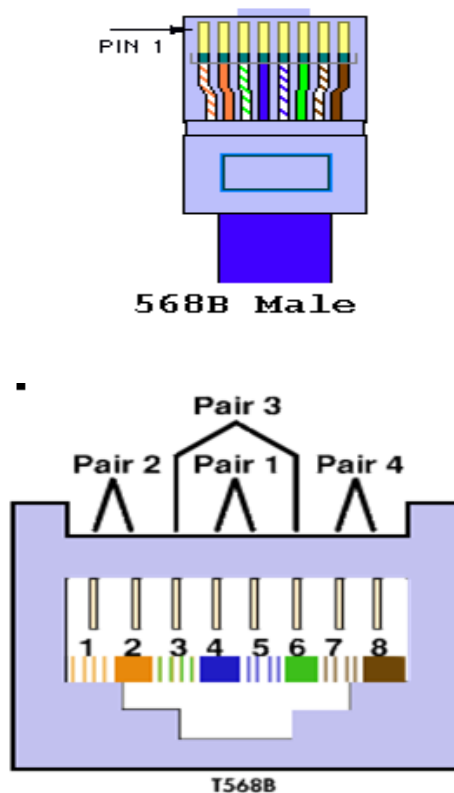


Figure 10 : T568B Eight Position Connector Pin / Pair Assignment

2.8 Work Area WA

Work Area components extend from the telecommunication outlet / connector end of the horizontal cabling system to the station equipment. All adapters, baluns, etc. must be external to the telecommunication outlet / connector and connected to the station equipment by a patch cable. Refer to Figure 6 and Figure 9.

All telecommunications outlets / connectors in the Work Area must conform to T568 B standards (Figure 10) and will consist of two data and one voice unless otherwise specified by the scope of work.

All patch cables (equipment cables) must meet or exceed ANSI/TIA/EIA standards set for 4 pair Category 6 cabling designated as the horizontal or backbone cable

2.9 Approved Unshielded Twisted Pair (UTP) Cable Termination and Patch Cables

All telecommunication patch cables will be Category 6 and terminated in accordance to ANSI/TIA/EIA- 568-C using the T568B model in Figure 10. The following connector color codes will be used correspondingly at both ends.

No connectors should be wired using the T568A standard, unless explicitly specified otherwise. When there are no particular specifications, always use the T568B wiring standard.

Work Area and Telecommunications Closets (RJ45) Patch Panel Connectors (keystone jacks both ends)

Green	Access Points
Blue	Primary LAN Data/ Digital Signage
White	Secondary LAN Data/VoIP Telephone
Orange	Security Equipment (DVRs, security cameras, access control)

Work Area and Telecommunications Closets (RJ45) Patch Cables

Green	Access Points
Blue	LAN Data/ Digital Signage
White	Telephone
Orange	Security Equipment (DVRs, security cameras, access control)

The scope of the work will determine the total number of drops and the connector color mix. Unless otherwise specified by the scope of work, the normal work area configuration will be two data (blue / yellow) and one telephone (white) drops.

Patch cables may be any color requested with the exception of red. **Red patch cables are to be wired as cross over cables and used only in network equipment inter-connectivity.**

Patch panels mounted in the telecommunication closet rack must be of the modular design. In all cases, unless otherwise stated in the project's scope of work, will be of the 48 port design and consistent with the modular connector color code.

Exposed cables in the telecommunication closets must be properly dressed and bundled using either Velcro or nylon tie wraps. Nylon tie wraps should only be hand tight and never tightened in such a manner as to cause a blemish on the cables outer casing. The only exception to properly dressing and bundled cables would be if rack mounted cable management is provided. Ladder (overhead or under the floor) racks will always have cables to and from the telecommunication closet properly dressed and bundled.



Figure 11 : Example of properly dressed cables

2.10 Approved Shielded Twisted Pair (STP) Cable Termination and Patch Cables

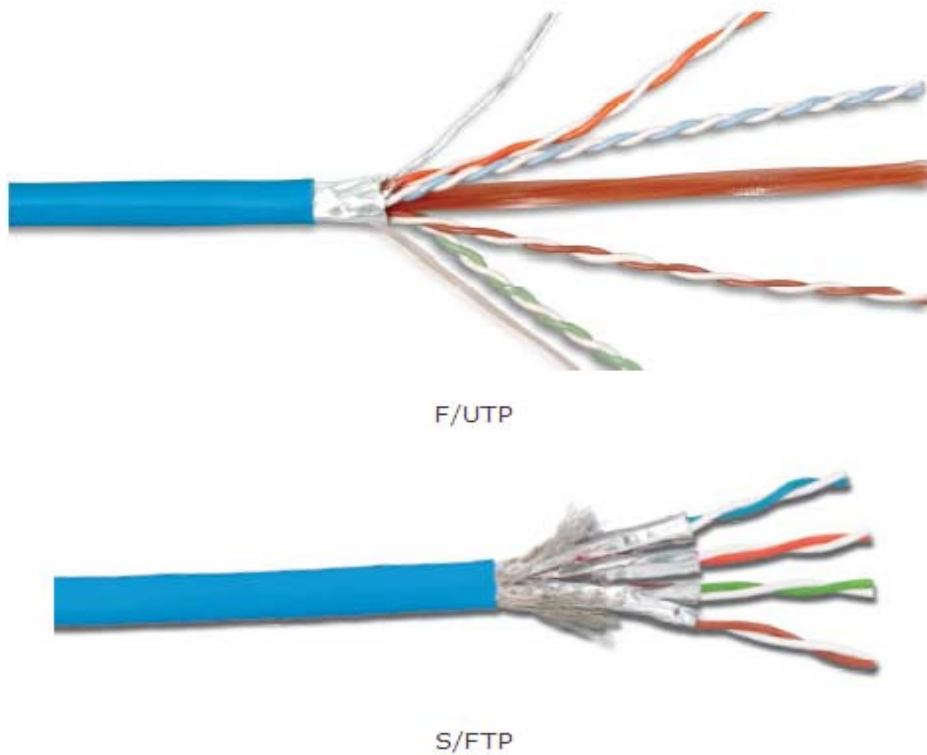


Figure 12 : Shielded Cable Examples

Shield twisted pair cable is to be used in areas of high radio frequency interference (RFI) and/or electrical magnetic interference (EMI) such as, but not exclusive to high voltage equipment, elevators, electrical motors, etc.....).

There are two types of shield twisted pair cables and either maybe be used in compliance of our standards to eliminate an RFI or EMI problem. These cables are described as foiled screened with unshielded twisted pair cable (F/UTP) and foil shielded twisted pair cable (S/FTP).

The cable requirements for performance must be consistent with those of unshielded twisted pair Cat6 cable and terminated using shielded twisted pair connectors.

Grounding of the RJ45 patch panel must be to the equipment rack and to the telecommunication grounding bus bar in compliance the following standard:

ANSI-J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements

3 Approved Shielded and Unshielded Twisted Pair Cable and Performance

3.1 Scope

This specification applies to solid Unshielded Twisted Pair (UTP) communications cables and stranded patch cables – NEC types CM, CMG, CMR, MP, MPG, MPR, and MPP, and where applicable, CSA FT-4 and FT-6. Zero Halogen constructions are also included.

3.2 Shielded and Unshielded Twisted Pair Reference Documents

The latest edition of referenced standards (the most current available draft in the case of the purposed standards) must be used as the controlling document. Where standards seem to be in conflict, the most stringent ones must be applicable. Any questions regarding construction should be directed to The City Colleges of Chicago District Office Facilities Engineering Department and the District Office's Office of Information Technology Deputy CIO for the most up to date documents, local code compliance, and revisions.

- ANSI/ICEA S-90-661
- UL 444
- ANSI/TIA/EIA-568-C
- ISO/IEC 11801
- CENELEC EN50173: 1995
- NEC, NFPA70
- NEMA WC-63/66

3.3 Applicable Testing Standards

The most current standards for testing applicable copper (UTP) cabling must be complied with. Testing must be in accordance with following standards:

ASTM D 4566-94	Standard Test Method for Electrical Performance Properties of Insulation and Jackets for Telecommunications Wire and Cable
ANSI/TIA/EIA-568-C	Commercial Building Telecommunications Standards

3.4 Baseline Shielded and Unshielded 4 Pair Cabling Standards

This document provides a minimum baseline specification standard for STP and/or UTP cabling. These are intended for reference only and the most current standards must be complied with.

Specification	Category 6	Category 6a	Category 7	Category 8
Frequency Range	250 MHz	500 MHz	600 MHz	2000 MHz
Max. Data Rate	1000 Mbps	10 Gbps	10 Gbps	25 or 40 Gbps
Attenuation	21.7 dB	20.9 dB	20.8 dB	----
NEXT	39.9 dB	39.9 dB	62.1 dB	----
Power Sum NEXT	37.1 dB	37.1 dB	59.1 dB	----
ACR	18.6 dB	18.6 dB	----	----
Power Sum ACR	15.8 dB	15.8 dB	----	----
ELFEXT	23.3 dB	23.3 dB	----	----
Power Sum ELFEXT	20.3 dB	20.3 dB	----	----
Return Loss	12 dB	12.0 dB	14.1 dB	----
Propagation Delay	548 ns	548 ns	----	----
Delay Skew	50 ns	50 ns	20 ns	5 ns
Max. Cable Length	100 m	100 m	100 m	30 m

3.5 Wireless Cabling Standards

Only indoor access points will require dual (two runs) Category 6 (CAT6) will be used on all wireless access point installations. Outdoor access points requires single Category 6 (CAT6) cabling. All cabling must be terminated to a patch panel in the Telecommunication/IDF and keystone housing at the location of the access point.

Category 6a (CAT6a) and Category 7 (CAT7) cable should only be used upon special request from the City Colleges of Chicago OIT and in an environment requiring data speeds of 10GBASE-T and 100GBASE-T.

Mount outdoor access point

The two examples should be used as guides. If mounting an outdoor access point using a pole, you securely mount the access point onto either a fixed pole. Refer to Figure 13.

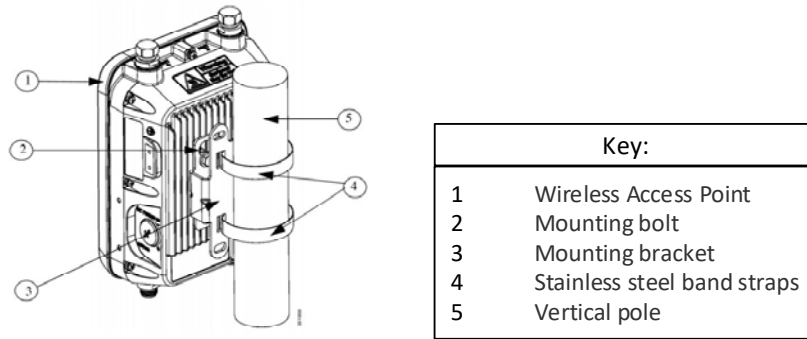


Figure 13 : Pole Mounted Access Point

If attaching the access point using a flexible mounting bracket pole, ensure the device is secured using the proper pole mounting equipment. See Figure 14.

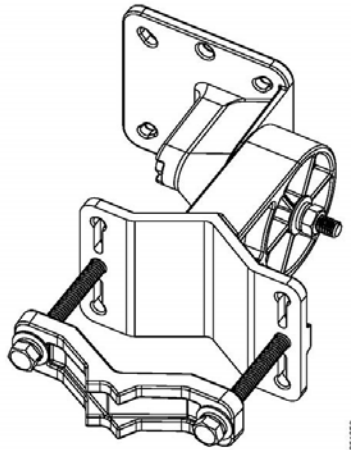


Figure 14 : Wall Mounted Access Point

The recommended wiring is with Shielded CAT6 and using waterproof RJ-45 connectors (Figure 15). All outdoor wiring needs to be properly grounded to protect the switch from lightning strikes.



Figure 15 : Waterproof RJ-45 connectors

3.6 Shielded and Unshielded Twisted Pair Installation, Certification, and Testing

Installation of the structured cabling plant must be done by technicians certified by the cabling solution vendor, the Building Industry Consulting Service International (BICSI), and/or a National Electric Code (NEC) compliant apprenticeship certification program for low voltage cabling. **The installation is to include all cables, cable runs, components, connector termination, and mounting. All data and telephone terminations must be made to the existing patch panels, telephone blocks, and racks unless specified by the City Colleges of Chicago OIT department in writing.**

Installation of the structured cabling plant must meet the cabling solution manufacturer's warranty requirements and must be maintained in accordance to those requirements. **A mandatory minimum 5 years warranty is to be provided by the installation vendor to include all installed cable runs, hangers, and connecting components.**

Certification, As-builds and testing of the installed structured cabling plant must be done using cable testing equipment capable of complying with the most current TIA/EIA standards, bulletins, and addendums for the installed cabling solution. **Continuity and/or data pass through tests are not acceptable final testing procedures.**

Certification

A printed and/or electronic copy of the graphical test results (showing compliance to the TIA/EIA standards, bulletins, and addendums) must be presented to the City Colleges of Chicago OIT assigned Project Manager. It will be filed in the OIT files and at the facilities where the cabling was installed and/or tested. The installation **will not be considered complete** until the testing documents have been received by the City Colleges of Chicago OIT Project Manager and the IT Director of the college associated with the project.

As-Builds

Upon completion of termination and testing, as built drawing of newly installed copper cabling shall be provided within seven business days after work is completed. The as built drawings shall be provided in AutoCAD or format requested by OIT.

4 Premise Fiber Optic Cabling

4.1 Scope

This specification applies to multimode fiber optic cabling used in the backbone and horizontal premise cabling plant. It allows for the use of OM4, 50/125 laser-optimized fiber optic cable in applications of 1 or 40 Gigabit connectivity. **OM2 and below is no longer support and should not be installed within CCC environment in new or existing infrastructure.** Single mode fiber cabling should be used for connecting to Internet or WAN providers. **Single mode installation requires approval from OIT Infrastructure department.**

4.2 Fiber Optic Cabling Reference Documents

The latest edition of referenced standards must be used as the controlling document. Where standards seem to be in conflict, the most stringent ones must be applicable.

ANSI/TIA/EIA 568-C.3 Optical Fiber Cabling Components Standards

ANSI/TIA/EIA 598 Optical Fiber Color Coding

4.3 Fiber Optic Cabling Performance Standards

The primary fiber optic cable used for the backbone and/or horizontal cabling must be 50/125 micron, laser-optimized fiber optic cable in all 1 Gigabit and higher applications, unless specified by City Colleges of Chicago OIT. All fiber optic cable must meet or exceed the electronic equipment manufacture's requirements and standards set by ANSI/TIA/EIA 568-C.3.

All fiber optic cable runs (backbone and horizontal) must contain a minimum of 12 individual fiber optic strands within the primary cable.

All fiber optic cables must be terminated in a multi-media tray, drawer mounted on the equipment rack, or enclosed fiber optic patch panel unless otherwise specified by City Colleges of Chicago OIT.

All fiber optic cable must be terminated with LC simplex adapters or those specified by City Colleges of Chicago OIT. Refer Figure 18

All fiber optic cable must be labelled on fiber module and fiber tray face cover to identify the remote termination location. Label should identify the port range and room number of the remote location. Refer to Figure 16 and Figure 17.

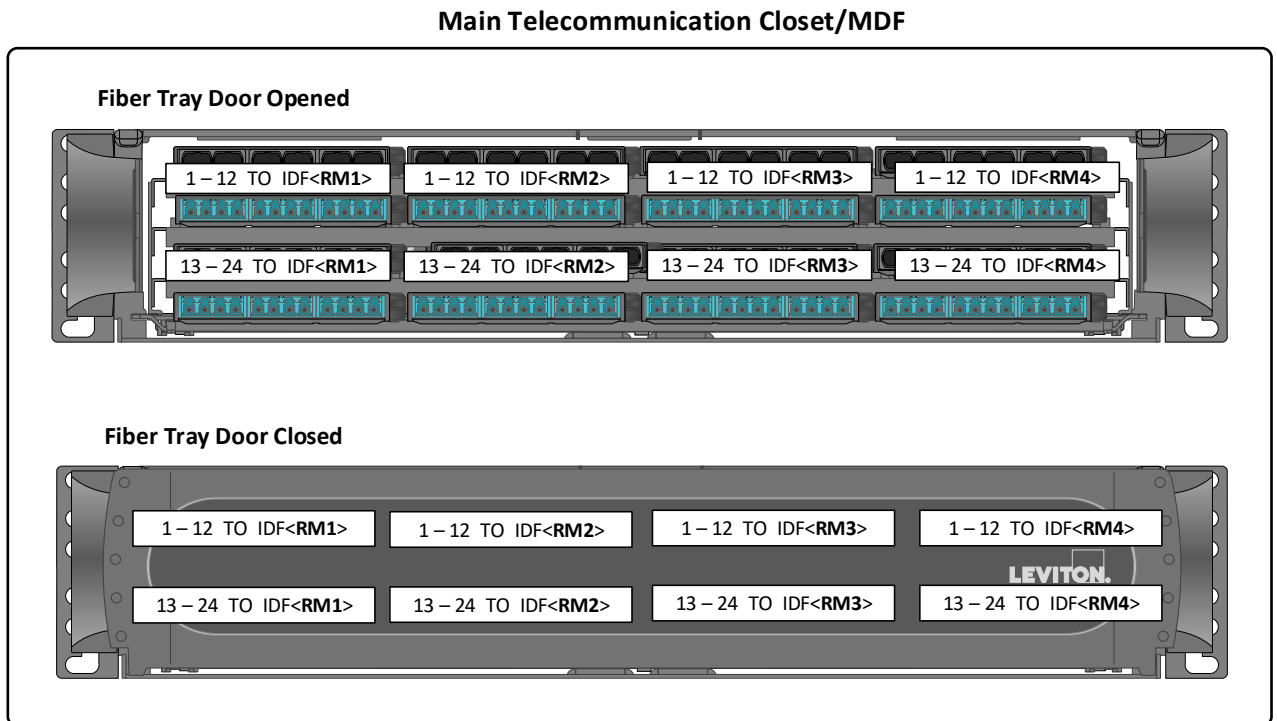


Figure 16 : Fiber Optic Label for MDF

Telecommunication Closet/IDF

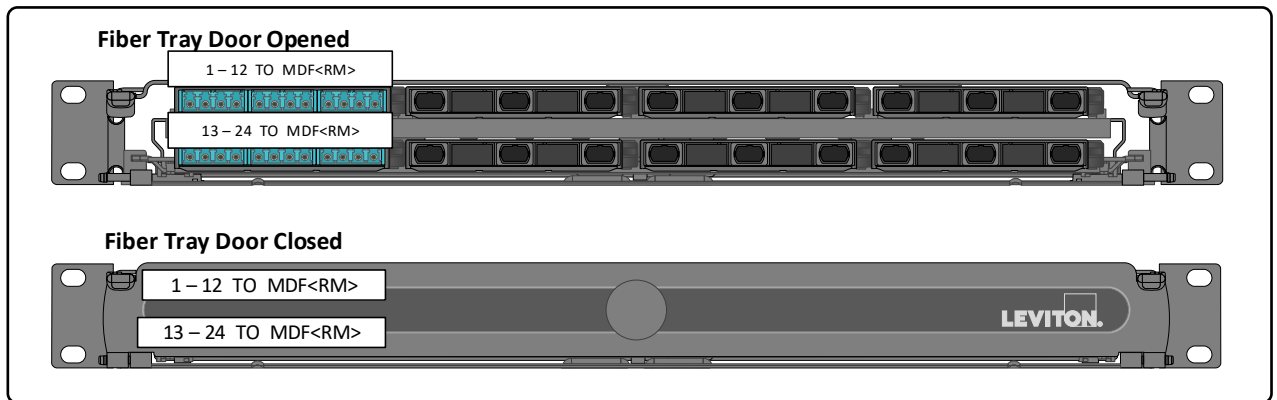


Figure 17 : Fiber Optic Label for IDF

Fiber Optic Connectors must have a FOCIS document (Fiber Optic Connector Intermateability Standards) and meet all standards set by ANSI/TIA/EIA 568-C.3.

Only qualified technicians with the proper tools can run the fiber optic cable, install the connectors, and test the completed installation.

Fiber Optic Patch Cable Types


Configuration	Type	9/125um Single- mode OS1/2	62.5/12 5um Multi- mode OM1	50/125um Multi-mode OM2	10Gb » 300m 50/125um Multi-mode OM3	10Gb » 550m 50/125um Multi-mode OM4
 LC-LC	Duplex	LC-LC	-	-	LC-LC	LC-LC

Figure 18 : Optical Fiber Cable Type

Single mode fiber

Single mode Fiber Optic Cable Type Specifications					
Type	Application	Diameter	Jacket Color	Ethernet Speed	Max Distance
OS1	Indoor	9/125um	Yellow	1-10Gb	2km
OS2	Outdoor	9/125um	Yellow	1-10Gb	10km

Multi-mode fiber

Multimode Fiber Optic Cable Type Specifications							
Type	Diameter	Jacket Color	100Mb Distance	1Gb Distance	10Gb Distance	40Gb Distance	100Gb Distance
OM1	62.5/125um	Orange	2000m	275m	33m	-	-
OM2	50/125um	Orange	2000m	550m	82m	-	-
OM3	50/125um	Aqua	2000m	550m	300m	100m	100m
OM4	50/125um	Aqua	2000m	1000m	550m	150m	150m

Figure 19 : Optical Fiber Cable Reference

All fiber optic patch cables must be of the same fiber type as the fiber optic backbone or horizontal cable it is attached.

Fiber Optic Patch cable termination will be determined by City Colleges of Chicago OIT and/or the electronic equipment manufacture's specifications.

All fiber optic cables must be contained within a protective channel throughout their transition between terminating points.

4.4 Fiber Optic Cable Installation, Certification, and Testing

Installation of the fiber optic backbone and/or horizontal cabling solution must be done by technicians certified by the fiber optic cable manufacture, the Building Industry Consulting Service International (BICSI), and/or a certified apprenticeship program.

Installation of the fiber optic cable must meet the cable manufacturer's warranty requirements and must be maintained in accordance to those requirements.

Certification and testing of the installed fiber optic cabling must be done in accordance with the most current TIA/EIA standards, bulletins, and addendums. In addition, graphical OLTS (Optical Loss Test Set) bidirectional testing results must be provided for each terminated fiber strand.

Certification

A printed and/or electronic copy of the test results (showing compliance to the TIA/EIA standards, bulletins, and addendums) must be presented to the City Colleges of Chicago OIT Project Manager and the IT Director of the college associated with the project to be filed in the OIT files and at the facilities where the cabling was installed and/or tested. **No fiber optic cable installation will be considered complete unless these requirements are met and the testing documents are received by the City Colleges of Chicago OIT Project Manager and the IT Director of the college associated with the project.**

As-Builds

Upon completion of termination and testing, as built drawing of newly installed copper cabling shall be provided within seven business days after work is completed. The as built drawings shall be provided in AutoCAD or format requested by OIT.

5 Telephone Wiring Standards and Termination Requirements

5.1 Scope

This specification section applies only to phones, faxes, elevators or other devices that require a connection to a POTs line, Centrex line or an ATA (analog telephone adapter) device.

5.2 Net POP Extension

If the extension of AT&T Centrex or POTs lines from an existing phone room to a new Net POP is required, the extension should use an Amphenol cable with a 66 block(s) on each end. Number of pairs dependent on requirement.

5.3 AT&T Net POP or Extension Termination

All AT&T or Extension Termination equipment must be mounted on existing plywood mounting surface (meeting local fire codes) or telco mounting panel. If new plywood is required, it must be a ¾ inch 4x8 sheets meeting the local fire codes. A smaller sheet of plywood maybe used because of space or other City Colleges of Chicago requirements with City Colleges of Chicago OIT approval only. The plywood will be mounted to the wall studs after approval by the local facility's maintenance engineers. Also all AT&T Net POP or other equipment should be grounded to closest grounding bar.

ATA's for the new building will be placed in the Net POP unless distances exceed 1000 feet. Size and quantity of ATAs will be determined by requirement. Each 24 Port ATAs should use a 25 pair Amphenol cable connected to a 24 port RJ45 patch panel with one pair per port (pins 4 and 5) for cross-connecting to IDF patch panel. ATAs or ATA patch panels should be placed in or close to racks used for IDF patch panels

5.4 IDF Telephone Extension

Each IDF will be connected to the Net POP by a 25 pair Amphenol cable with a 24 port patch panel with one pair per port (inside pair on pins 4 and 5) on each end



6 Miscellaneous Standards and Requirements

6.1 Equipment Racks

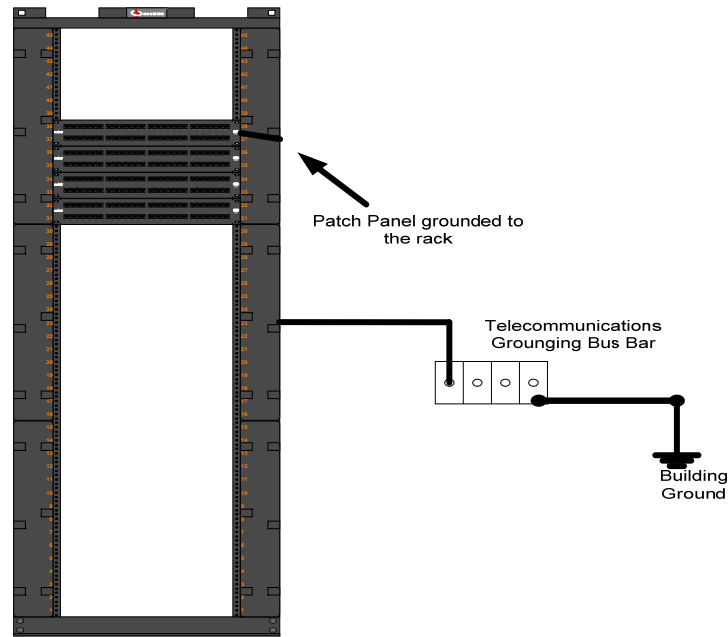


Figure 21 : Equipment Rack Grounding and Bonding

Equipment racks used in the telecommunication closets must be a 19 inch wide frame black rack, unless otherwise specified by City Colleges of Chicago OIT in writing.

All equipment racks must be grounded in accordance with NEC and ANSI/TIA/EIA-607-A standards. A telecommunication main grounding busbar (TMGB) must be provided in all telecommunication closets. Do not daisy chain grounding wires. All grounding wires must connect to a rack mounted bus bar or earthing terminals and grounded to the telecommunications grounding bus bar.

Cable trays must be used in the transition between the walls and the electronics equipment racks. Cable trays will also be used in all horizontal cabling runs throughout the Work Area. **No cable runs will ever be attached to ceiling supports or thrown across ceiling tiles.**

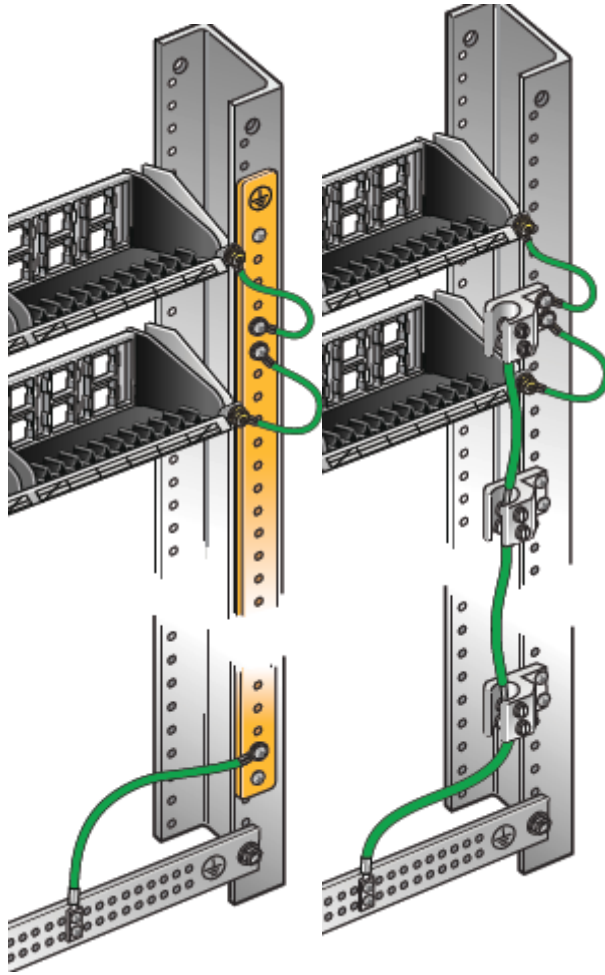


Figure 22 : Equipment Rack Grounding

6.2 Removal of Non-Compliant Cabling in the Work Area

In any new build or renovation, any and all non-compliant network and/or telephony cable and connecting hardware shall not be reused and must be removed. It must be removed completely from the work area and patch panel. Care must be taken as to not cut structured cabling (compliant or non-compliant) from working areas not in the scope of work. If the scope of work does not require the reuse of the existing conduit and outlet box, the removed cabling wall plate must be replaced with a blank plate.

6.3 Labeling and Work Area Termination

All Work Area termination and connectors must be labeled in accordance with the City Colleges of Chicago OIT requirements for that location. In most cases, the drop (termination connector label) number will correspond to the building drawing (map) of the work area. See Figure 23, each face plate will be labeled in accordance with the schema shown in Figure 23.

A document (map) must be provided showing the location and labeling of all backbone and horizontal cabling termination and connectors of the network cabling plant to the City Colleges of Chicago's OIT Project Manager and the IT Director of the college associated with the project.

Using Pencils, Ink pen, Sharpie, etc. for labeling patch panels or face plates will not be accepted. Only machine printed, fade resistance labels will be accepted.

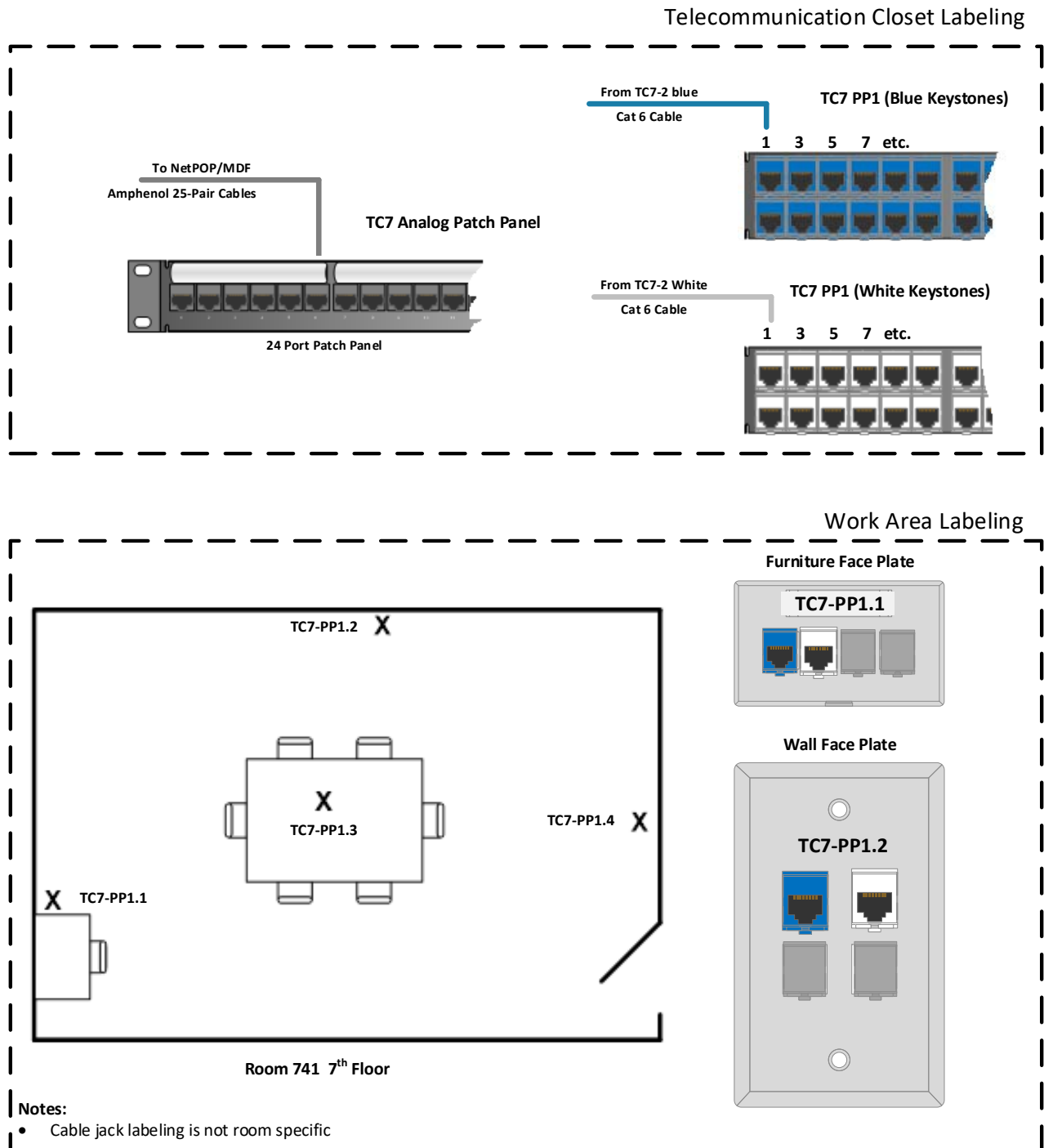


Figure 23 : Work Areas and Telecommunication Closet Labeling

6.4 Inspection

On-going inspections must be performed, during the network cabling plant construction, by City Colleges of Chicago OIT Project Manager, the IT Director of the college associated with the project, and the Project Manager of the assigned installation provider

The inspection must include:

1. Work area safety procedures
2. Compliance with the City Colleges of Chicago Wiring Standards Document
3. Cleanliness of the area being worked in and after completion of the work

6.5 Fire-stopping and Wall Penetration

All penetration or core holing through floors, walls, or fire-walls must be properly fire-stopped in accordance to National Electrical Code (NEC), National Fire Protection Association (NFPA), and all or any local ordinances.

Any transition between walls (solid or fire-wall) using conduit, sleeve, or penetration must be fire-stopped with the approved material to restore the fire rating of the wall before the penetration was made.

No wall or floor penetration shall be done without first contacting the local building facilities department, the City Colleges of Chicago OIT Project Manager, the IT Director of the college associated with the project, and room's occupant. This also applies to moving furniture and equipment within your work area to facilitate any work.

6.6 Rules of Conduct

All vendors and contractors working at or representing the City Colleges of Chicago must comply with all rules of conduct expected of any City Colleges of Chicago employee:

- Require to communicate through email to inform campus Security, IT and engineering of planned visit.
- Publication of work schedule to campus for the campus.
- Consult with campus engineering before any drilling/coring.
- Consult with campus IT for any cable and/or fiber patching.
- Entering classroom or making loud noises while class is in session is prohibited unless approved by campus.

Failure to do so will result in immediate removal from the site.