University Telecommunication Infrastructure Planning (UTIP) Standards

Introduction

California Polytechnic State University, San Luis Obispo relies heavily on its technology infrastructure to support learning, research, and the business operations of the University. The Cal Poly Information Technology Services (ITS) is committed to the growth, management and long-term viability of this infrastructure that includes telephone, data, cable television and radio communications operations, infrastructure and maintenance.

This document establishes the criteria by which the technology infrastructure shall be designed, installed, managed and maintained. The technical material incorporated in this document is intended for use by facility planners, architects, information technology managers, designers as well as construction planners, project managers, and inspectors for the design and technical integration of the information and communications technology system, pathways, and spaces.

Nothing in this document is intended to relieve design and construction consultants of their basic professional and contractual obligations for careful project analysis, strict adherence to sound design principles, building codes and best practices as well as their responsibilities regarding the oversight of construction and installation activities.

As technology evolves and the University's needs change, the Telecommunications Standards Document will be updated to reflect the best practices for Cal Poly. The most current version of this document is available online and can be found on the Cal Poly Construction Standards WEB site: https://afd.calpoly.edu/facilities/planning-capital-projects/construction-standard/

Telecommunications Standards Document Objectives:

1. Provide a universal framework for intra- and inter-building infrastructure design, development and deployment at Cal Poly.

2. Define minimum standards for spaces, pathways and telecommunications-related infrastructure that must be programmed into either new building construction or remodeling projects.

3. Outline specific media selection and design criteria.

4. Establish technical standards that shall be incorporated into campus design, procurement, construction scheduling and system/product testing processes.

5. Delineate methods and procedures for installing, testing and documenting cable and related infrastructure.

6. Provide direction and support to project management and inspectors of record when overseeing, approving for payment and accepting telecommunications work product.

The content in this document is based on national standards and guidelines for telecommunications systems, including those developed by the California State University Telecommunications Infrastructure

Planning Standards (TIP), the Electronic Industry Association (EIA), Telecommunications Industry Association (TIA), Institute of Electrical and Electronic Engineers (IEEE) and Building Industry Consulting Services International (BICSI). Great emphasis is placed herein on the idea that taking guidance from such sources is generally more desirable than using specific manufacturer's proprietary designs which may quickly become outdated or may be incompatible with other needed equipment.

To better clarify guidance, should a conflict between documents arise, the order of precedence shall be as follows:

1. Cal Poly ITS, University Telecommunications Infrastructure Planning (UTIP) Standards
2. CSU's "Telecommunications Infrastructure Planning Standards" document (TIP)
3. Electronic Industry Association (EIA), Telecommunications Industry Association (TIA), Institute of Electrical and Electronic Engineers (IEEE)
4. Building Industry Consulting Services International (BICSI)

The precedence can be overridden in the case where an item is disallowed by an applicable building code and/or with the approval in writing of the Cal Poly Designated Telecommunications Representative.

Referenced Individuals in this Document

Following is a list of the individuals referenced in this document

1. **University**: California Polytechnic State University
2. **Design team**: The facility planners, architects, consultants, information technology managers, or designers who are working on this project to develop the telecommunications design, drawings, and specifications.
3. **Cal Poly Facilities Project Manager**: The project manager who is assigned to this project by the Cal Poly Facilities Management and Development Department.
4. **Contractor**: The general contractor and all subcontractors working for the general contractor on this project.
5. **Cal Poly ITS Telecom Group**: The Cal Poly Information Technology Services department that will oversee all aspects of the telecommunications infrastructure included in this project.
6. **Cal Poly Designated Telecommunications Representative**: The individual that is assigned by the Cal Poly ITS Telecom Group to oversee and approve all aspects of this project. This is the only authorized person who can approve the Contractor's work. Approvals by another person is not allowed without written consent by the Cal Poly Designated Telecommunications Representative or written replacement of the Cal Poly Designated Telecommunications Representative by the Cal Poly ITS Telecom Group.

Acronyms and Glossary Used in this Document

Following is a list of the acronyms and glossary used in this document:

AFF	= Above Finished Floor
AHJ	= Authority Having Jurisdiction
Drop	= A wall plate with cables terminated in it (Average is 3 cables per drop)
Faceplate	= A wall plate with cables terminated in it (Average is 3 cables per faceplate)
ISP	= Inside Plant
IDF	= Intermediate Distribution Frame, a TR within a building connected to the MDF
Jack	= The individual modular outlet where a data or coaxial cable is terminated
MDF	= Main Distribution Frame, the TR of a building with connections to campus
MTGB	= Main Telecommunications Grounding Busbar
OSP	= Outside Plant
SDF	= Supplemental Distribution Frame, a small IDF for a classroom or lab area
TGB	= Telecommunications Grounding Busbar
TR	= a General term for a Telecommunication Room, could be a MDF, IDF, or SDF
WA	= Work Area where staff reside

Authorized Manufacturers and Material

All authorized manufacturers and material are detailed in the Division 27 specification 27 06 00.

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Document Flow

This document is arranged from an outside-in perspective. We start with the outside plant infrastructure that connects from existing campus infrastructure to the building the Design Team is work on. Then we continue to the main telecommunication room and through to the intermediate telecommunication rooms. Lastly, we will detail the station cabling to the desktops and devices.

Exterior Communication Pathways

Outside Plant Conduit

A new campus building will require added outside plant (OSP) infrastructure. This new OSP will consist of added conduit pathways and maintenance holes that connect to existing campus infrastructure. The Design Team will need to collaborate with the Cal Poly Designated Telecommunications Representative to determine the most efficient connections and pathways to the existing campus infrastructure.

The number of four-inch conduits entering a campus building will vary depending upon building size, location, intended mission, and the size and type of cables expected to be used long-term. The design goal is to always have a conduit open to provide a pathway for cable reinforcement (growth or replacement). Even a small campus building of 2-4,000 square feet needs a minimum of two four-inch conduits. The following table shows the minimum quantity of conduits and fiber innerducts based on the size of the building:

Building Gross Square Footage	Minimum Number of 4" Conduits	Number of Conduits with Four 1-1/4" Fiber Innerducts
Minimum	2	1
10,000 – 30,000	4	1
30,000 – 50,000	6	2
50,000 – 75,000	8	2
Over 75,000	12	3

Other outside plant considerations and requirements:

- When designing outside plant conduit, consider redundant pathways into a new building if that building houses essential services or serves as a networking point for other buildings in the area.
- Conduits that protrude through the floor of the MDF shall extend a minimum of 3-inches above the sealed or tiled floor surface.
- Install pull cord (conduits <2") or tape (conduits >2") in all individual conduit runs.
- Conduits shall not be routed across the MDF backboards.

- Conduits shall be designed in a manor to prevent water intrusion.
- All ducts and conduits shall be installed with a minimum pitch of 4” per 100 ft. and shall drain away from the building towards manholes.
- Only manufactured elbows shall be used for stub ups at building entrances or equipment. Manufactured long sweep bends with a minimum radius of 6 feet both vertically and horizontally shall be used at all other locations
- All conduits shall be sealed at their endpoints and at any other open points underground.

Entrance Conduit for Telecom Ground

All underground entrance conduits shall be accompanied by a common ground system.

This ground shall be bare 2/0 copper conductor in a dedicated 1-¼” conduit. The ground shall attach to the PBB in the MDF and connect to the reinforcing bar of the duct bank and, to the existing grounding infrastructure in the vault system.

Maintenance holes

Only precast interlocking mating sections complete with cover shall be used. Cast in openings shall be included for known requirements. Knockouts to equal 25% spare capacity shall be provided.

Manhole cover shall be labeled “COMMUNICATIONS”

Pull Boxes

Pull boxes rather than manholes may be used only when the maximum number of conduits in that run is never expected to exceed 2- 4” conduits.

Pull box covers shall be labeled “COMMUNICATIONS”

Hand Holes

Hand holes shall be used only when the maximum number of conduits in that run is never expected to exceed a single 2” conduit. Hand holes shall only be used to serve isolated endpoints and shall never be used for backbone cabling. Hand holes shall have 6” of clearance between pathways and lid.

Hand hole covers shall be labeled “COMMUNICATIONS”

Interbuilding Backbone Cabling

Fiber Backbone

Install one OSP, dielectric, loose tube Single-Mode fiber from the nearest existing main campus MDF Facility to the MDF in the building or project.

Terminate the single mode fiber inside fiber termination enclosure using duplex LC connectors.

Mount fiber enclosure in top position of rack 1 in the 19" rack.

The following table shows the minimum quantity of Single-Mode fiber strands to install based on the size of the building:

Building Gross Square Footage	Minimum Single-Mode Strand Count for the Building
Minimum	24
10,000 – 30,000	24
30,000 – 50,000	48
50,000 – 75,000	96
Over 75,000	96

Service Loops

Service loops shall be provided for all copper and fiber runs for the purpose of possible relocation or for splicing if necessary. A minimum cable service loop of 50 feet shall be required at each end of a cable. Fiber cable slack shall be coiled and mounted to backboard and copper cable slack routed around the room using ladder racking. Inside all pull boxes and manholes, the slack loop should be “once around the walls of the manhole/box” before exiting. All service loops shall be labeled according to DIV 27 specifications.

Exhibit 1 - Fiber Service Loop in a Manhole

Copper Backbone

Copper tie cables shall be installed from the nearest existing main campus MDF to the MDF in a multi-building project or MDF of an individual building.

Cables shall specifically be gel filled, ALPETH sheathed with aluminum shield, 22-gauge, multi-pair in multiples of 25 pair.

Building Entrance Protector Panel

Building entrance protector panels shall be 489A type, 100 pair with input pig tail and 66 block style output.

Building Entrance Protectors

Building entrance protectors shall be gas discharge type with heat coils and gold-plated connectors, type 4B1EW.

Telecommunications Spaces

There are primarily three types of telecommunications rooms (TR)s that could be installed in a building. Each building has a Main Distribution Frame (MDF) and potentially one or more Intermediate Distribution Frame (IDF) rooms. If the building requires a special purpose TR,

that TR will be called a Supplemental Distribution Frame (SDF). See the comments below for more specific information on each type of TR.

Location of Rooms

The following TR location guides must be followed for locating rooms within a building:

- The MDF and IDFs are (typically) centrally located in a building.
- The MDF is usually located in a lower floor of the building and is positioned so that the MDF shall be nearest the point of entry for conduits entering a building from the underground.
- Entrance cabling shall be terminated on a bearing wall (whenever possible) in the MDF to reduce the possibility of having to relocate the termination space if the building is expanded or altered in the future.
- The MDF can also serve as the IDF for the floor where it is located.
- Unless given a special allowance, each floor of the building will have either the MDF or an IDF.
- IDFs shall be stacked vertically in a fire rated shaft.
- If any of the Structured Cable System (SCS) horizontal cable runs will be longer than 290 feet, a second TR shall be built on the floor and located so that the IDFs can, in an evenly divided and balanced manner, service each floor without exceeding the 290-foot limit.

Restrictions of Use

Restrictions of use for MDFs and IDFs are as follows. MDFs and IDFs shall:

- Be used for telecommunications purposes only.
- Not include Fire Alarm, Elevator or other non-telecom systems located within these rooms.
- Not share space and/or pathways with other building facilities or systems.
- Be dedicated to the telecommunications function and their related support facilities.
- Not contain equipment unrelated to the support of the other systems such as piping, duct work, distribution of building power, HVAC, Building Management Systems, Access Controls, CCTV equipment and fire life safety systems.
- Not have non-telecommunications supporting materials in, or pass through, the room.

Shared Use

The ***MDF or IDF shall not be shared with building or custodial services*** as they may interfere with the telecommunications systems and the MDF or IDF shall be keyed to prohibit general access.

Safety

MDFs or IDFs shall be safely accessible to technicians, free of storage material or other obstructions that could block access to equipment. Access to MDFs or IDFs must allow for rolling lifts or dollies to enter the room without obstruction. MDFs or IDFs located in attic or

basement areas without proper access are not allowed. The MDF or IDF shall be free from moisture, severe temperature conditions, and/or possible submersion in case of flooding.

Main Distribution Frame (MDF) Rooms

Following is important infrastructure aspects of a building MDF. The MDF:

- Serves the entire building. There is only one MDF in a building.
- Shall be accessible from a hallway or other common public area.
- Serves as the telecommunication room where the outside plant (OSP) cables connect (through protection devices and distribution cross-connects) to the building backbone.
- Connects the building-supporting backbone equipment to all other IDFs and SDFs in the building.
- Can also serve as the IDF for the floor on which it is located.
- Must also meet the entire list of requirements for IDFs.
- Also serves the "Service Entrance Facility" Function noted in the TIP standard.
- Houses telecommunications equipment, cabling, environmental control equipment (for the room only), power distribution/conditioners, and uninterruptible power supply (UPS) systems.
- Shall be large enough for equipment installation and/or replacement without interfering with other systems in the same room.
- Shall be large enough to mount equipment racks in straight rows.
- Must be large enough for the plywood backboards with 36 inches of clearance in front of the entrance cross-connects.
- Must have entry conduits installed within 3" of the 66 block-field wall.

MDF Room Size

The Design Team must know both the Gross Square Footage of the building and the quantity of network cable drops[1] to size an MDF. Each building will have one MDF that serves as the connection between everything outside the building and all IDFs and faceplates (or drops) within the building. This is true for all buildings, even unique buildings that are either very small or have some feature in them (such as a pool or gymnasium) that causes unique space concerns.

If the Design Team feels that the space is unique in a way that the design cannot support the standards listed herein, please contact the Cal Poly Designated Telecommunications Representative to discuss options for this unique environment.

[1] Cable Drops are the typical triangle symbol on the design drawings that include staff computer and telephone faceplates as well as cable drops for security cameras, card access, mechanical systems, building automation, digital signage, classroom technology, etc.

Use the greater number of the following parameters to determine the MDF size based on the building gross square footage or number of triangles on plan sets (average 3-cable drops [2]) served within the building by the MDF:

The following list shows the minimum size that should be allocated for each MDF depending on the Gross Square Footage of the building served by the MDF

- 20,000 Building gross sq. ft. or 64 drops = 10 ft. x 11 ft. MDF = (2) Rack MDF
- 40,000 Building gross sq. ft. or 96 drops = 10 ft. x 14 ft. MDF = (3) Rack MDF
- 80,000 Building gross sq. ft. or 128 drops = 10 ft. x 16 ft. MDF = (4) Rack MDF

The following exhibits are shown as examples of approved MDF designs for 2, 3, and 4 rack MDF rooms.

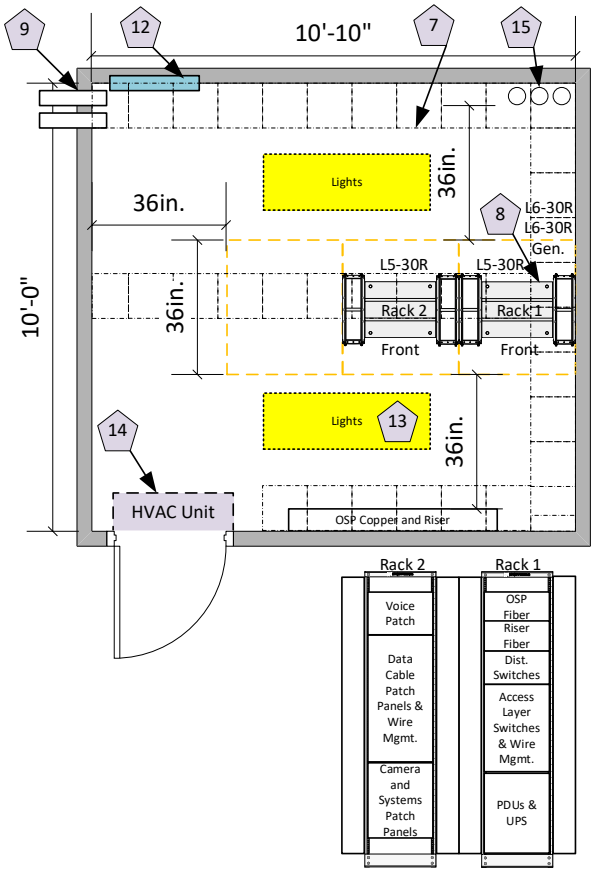
[2] Every data cable drop served by the MDF or IDF must be included in the calculation of the room size.

2 Rack MDF

(2) Rack MDF

Room Highlights:

1) Max. building served = 20,000 Gross Sq. Ft.
2) Max. drops served = 64 drops
3) Duplex convenience receptacles every 6'
4) One L5-30R x 20 AMP 120 volt dedicated branch circuits in quad boxes mounted in an electrical chase above the back of each rack.
5) One L6-30R x 30 AMP 208 volt dedicated circuit in wall box behind rack 1 at 18"AFF.
6) One L6-30R x 30 AMP 208 volt on generator power in wall box behind rack 1 at 18"AFF.
7) Seismic rated ladder rack, 12" wide at 7'6" AFF
8) 2-post open frame racks bolted to floor and seismic braced.
9) Horizontal cable sleeves entering room at 8'0" AFF
10) Walls lined with ¾" fire treated plywood
11) A minimum of 3'0" clearance shall be maintained at one end of the rack row and 3'0" clearance in front and rear of racks.
12) Electrical panel with emergency power (if available)
13) Overhead lights on emergency power (if available)
14) 24x7 HVAC unit dedicated to the room
15) Entrance conduits



Rack Front View

Exhibit 2 - 2 Rack MDF

3 Rack MDF

(3) Rack MDF

Room Highlights:

1) Max. building served = 40,000 Gross Sq. Ft.
2) Max. drops served = 96 drops
3) Duplex convenience receptacles every 6'
4) One L5-30R x 20 AMP 120 volt dedicated branch circuits in quad boxes mounted in an electrical chase above the back of each rack.
5) One L6-30R x 30 AMP 208 volt dedicated circuit in wall box behind rack 1 at 18"AFF.
6) One L6-30R x 30 AMP 208 volt on generator power in wall box behind rack 1 at 18"AFF.
7) Seismic rated ladder rack, 12" wide at 7'6" AFF
8) 2-post open frame racks bolted to floor and seismic braced.
9) Horizontal cable sleeves entering room at 8'0" AFF
10) Walls lined with ¾" fire treated plywood
11) A minimum of 3'0" clearance shall be maintained at one end of the rack row and 3'0" clearance in front and rear of racks.
12) Electrical panel with emergency power (if available)
13) Overhead lights on emergency power (if available)
14) 24x7 HVAC unit dedicated to the room
15) Entrance conduits

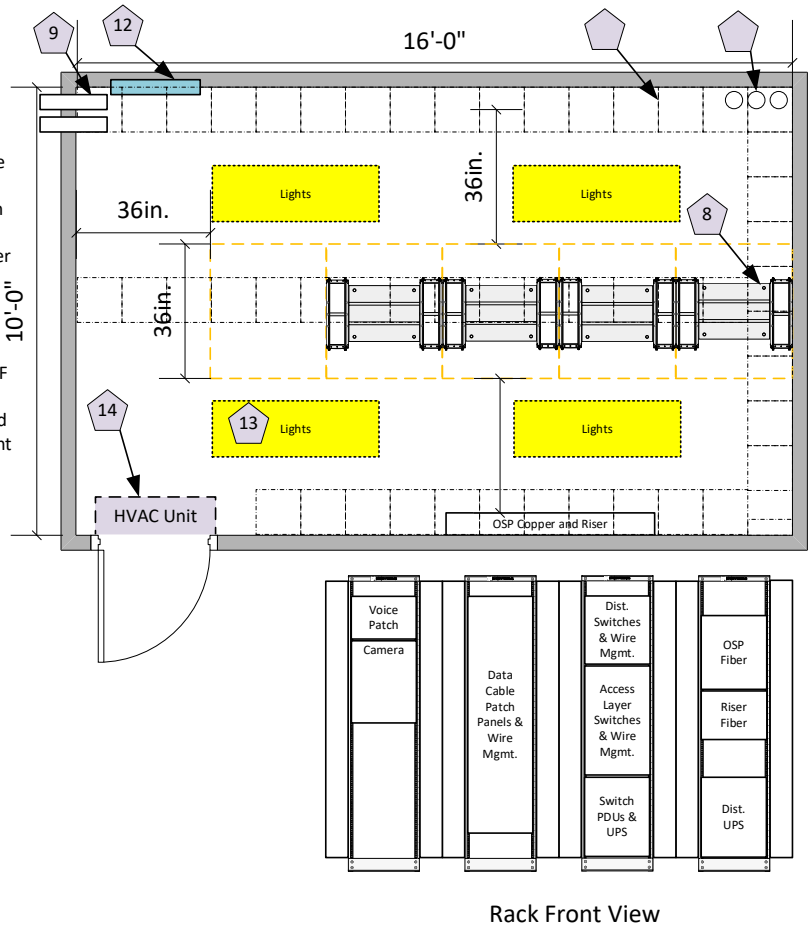
Rack Front View

Exhibit 3 - 3 Rack MDF

4 Rack MDF

(4) Rack MDF

Room Highlights:
1) Max. building served = 80,000 Gross Sq. Ft.
2) Max. drops served = 128 drops
3) Duplex convenience receptacles every 6'
4) One L5-30R x 20 AMP 120 volt dedicated branch circuits in quad boxes mounted in an electrical chase above the back of each rack.
5) One L6-30R x 30 AMP 208 volt dedicated circuit in wall box behind rack 1 at 18"AFF.
6) One L6-30R x 30 AMP 208 volt on generator power in wall box behind rack 1 at 18"AFF.
7) Seismic rated ladder rack, 12" wide at 7'6" AFF
8) 2-post open frame racks bolted to floor and seismic braced.
9) Horizontal cable sleeves entering room at 8'0" AFF
10) Walls lined with ¾" fire treated plywood
11) A minimum of 3'0" clearance shall be maintained at one end of the rack row and 3'0" clearance in front and rear of racks.
12) Electrical panel with emergency power (if available)
13) Overhead lights on emergency power (if available)
14) 24x7 HVAC unit dedicated to the room
15) Entrance conduits



Rack Front View

Exhibit 4 - 4 Rack MDF

Intermediate Distribution Frame (IDF) Rooms

Following is important infrastructure aspects of each IDF. The IDF:

- Differs from MDFs in that they are generally considered to be ***floor*** serving (as opposed to ***building*** serving).
- Must be an enclosed room with its own environmental system.
- Shall be accessible from a hallway or other common public area.
- Should not serve more than one floor of a building.
- Usually serves no more than 10,000 gross square feet (GSF) of building floor space.
- Could serve more than 10,000 GSF, however, the IDF must also be no farther than 290 feet/90m (cable pathway distance) from the most distant cable drop. A good rule of thumb is the planned average distance should be 150 feet or less.
- If cable runs are found to be longer than 290 feet, a second IDF shall be built on the floor and located so that the IDFs can, in an evenly divided and balanced manner, service each floor without exceeding the 290-foot limit.
- Shall be located such that infrastructure can enter the space from all four sides. IDFs shall not be directly adjacent to elevator shafts, electrical or mechanical spaces, stairs, kitchens, or restroom facilities. Locations that are specifically unsatisfactory include those with sources of excessive electromagnetic interference, hydraulic equipment or other heavy machinery that causes vibration or voltage spikes.

IDF Room Size

The following list shows the minimum size that should be allocated for each IDF depending on the Usable Square Footage of the floorspace served by the IDF

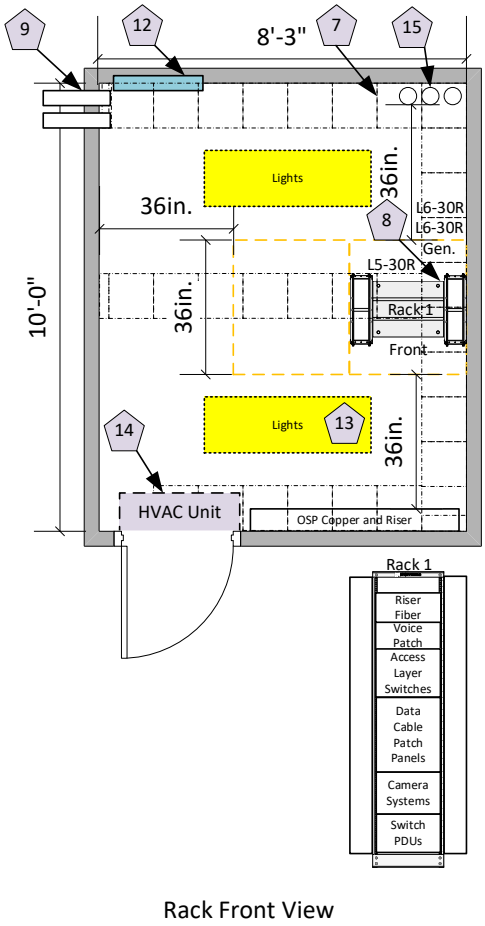
- 4,000 usable sq. ft. coverage area or 32 drops = 10 ft. x 8 ft. IDF = (1) Rack IDF
- 7,000 usable sq. ft. coverage area or 64 drops = 10 ft. x 11 ft. IDF = (2) Rack IDF
- 12,000 usable sq. ft. coverage area or 96 drops = 10 ft. x 14 ft. IDF = (3) Rack IDF
- 16,000 usable sq. ft. coverage area or 160 drops = 10 ft. x 16 ft. IDF = (4) Rack IDF

The following exhibits are shown as examples of approved IDF designs for 1, 2, 3, and 4 rack IDF rooms.

1 Rack IDF

(1) Rack IDF

Room Highlights:
1) Max. Sq. Ft. served = 4,000 Assignable Sq. Ft.
2) Max. drops served = 32 drops
3) Duplex convenience receptacles every 6'
4) One L5-30R x 20 AMP 120 volt dedicated branch circuits in quad boxes mounted in an electrical chase above the back of each rack.
5) One L6-30R x 30 AMP 208 volt dedicated circuit in wall box behind rack 1 at 18"AFF.
6) One L6-30R x 30 AMP 208 volt on generator power in wall box behind rack 1 at 18"AFF.
7) Seismic rated ladder rack, 12" wide at 7'6" AFF
8) 2-post open frame racks bolted to floor and seismic braced.
9) Horizontal cable sleeves entering room at 8'0" AFF
10) Walls lined with ¾" fire treated plywood
11) A minimum of 3'0" clearance shall be maintained at one end of the rack row and 3'0" clearance in front and rear of racks.
12) Electrical panel with emergency power (if available)
13) Overhead lights on emergency power (if available)
14) 24x7 HVAC unit dedicated to the room
15) Entrance conduits



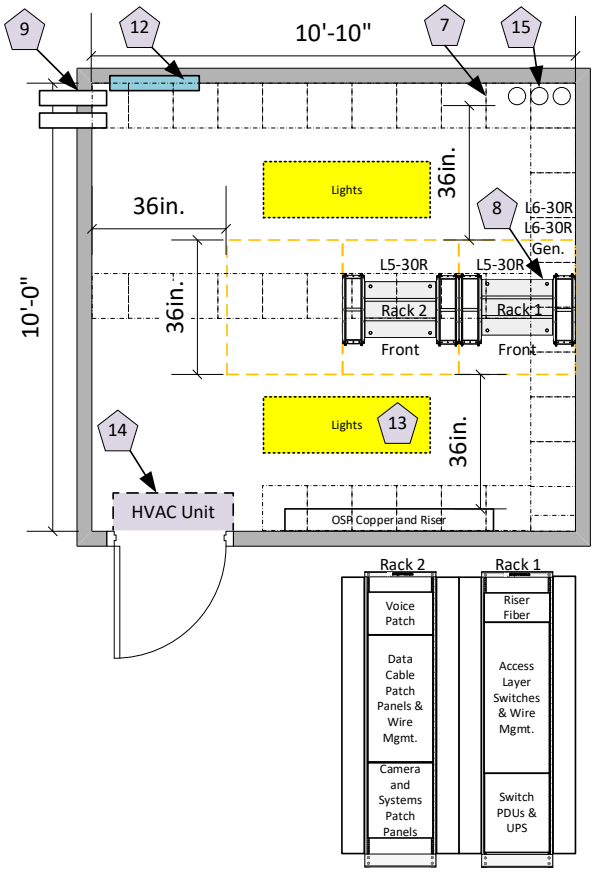
Rack Front View

Exhibit 5 - 1 Rack IDF

2 Rack IDF

(2) Rack IDF

Room Highlights:
1) Max. Sq. Ft. served = 7,000 Assignable Sq. Ft.
2) Max. drops served = 64 drops
3) Duplex convenience receptacles every 6'
4) One L5-30R x 20 AMP 120 volt dedicated branch circuits in quad boxes mounted in an electrical chase above the back of each rack.
5) One L6-30R x 30 AMP 208 volt dedicated circuit in wall box behind rack 1 at 18"AFF.
6) One L6-30R x 30 AMP 208 volt on generator power in wall box behind rack 1 at 18"AFF.
7) Seismic rated ladder rack, 12" wide at 7'6" AFF
8) 2-post open frame racks bolted to floor and seismic braced.
9) Horizontal cable sleeves entering room at 8'0" AFF
10) Walls lined with ¾" fire treated plywood
11) A minimum of 3'0" clearance shall be maintained at one end of the rack row and 3'0" clearance in front and rear of racks.
12) Electrical panel with emergency power (if available)
13) Overhead lights on emergency power (if available)
14) 24x7 HVAC unit dedicated to the room
15) Entrance conduits



Rack Front View

Exhibit 6 - 2 Rack IDF

3 Rack IDF

(3) Rack IDF

Room Highlights:
1) Max. Sq. Ft. served = 12,000 Assignable Sq. Ft.
2) Max. drops served = 96 drops
3) Duplex convenience receptacles every 6'
4) One L5-30R x 20 AMP 120 volt dedicated branch circuits in quad boxes mounted in an electrical chase above the back of each rack.
5) One L6-30R x 30 AMP 208 volt dedicated circuit in wall box behind rack 1 at 18"AFF.
6) One L6-30R x 30 AMP 208 volt on generator power in wall box behind rack 1 at 18"AFF.
7) Seismic rated ladder rack, 12" wide at 7'6" AFF
8) 2-post open frame racks bolted to floor and seismic braced.
9) Horizontal cable sleeves entering room at 8'0" AFF
10) Walls lined with ¾" fire treated plywood
11) A minimum of 3'0" clearance shall be maintained at one end of the rack row and 3'0" clearance in front and rear of racks.
12) Electrical panel with emergency power (if available)
13) Overhead lights on emergency power (if available)
14) 24x7 HVAC unit dedicated to the room
15) Entrance conduits

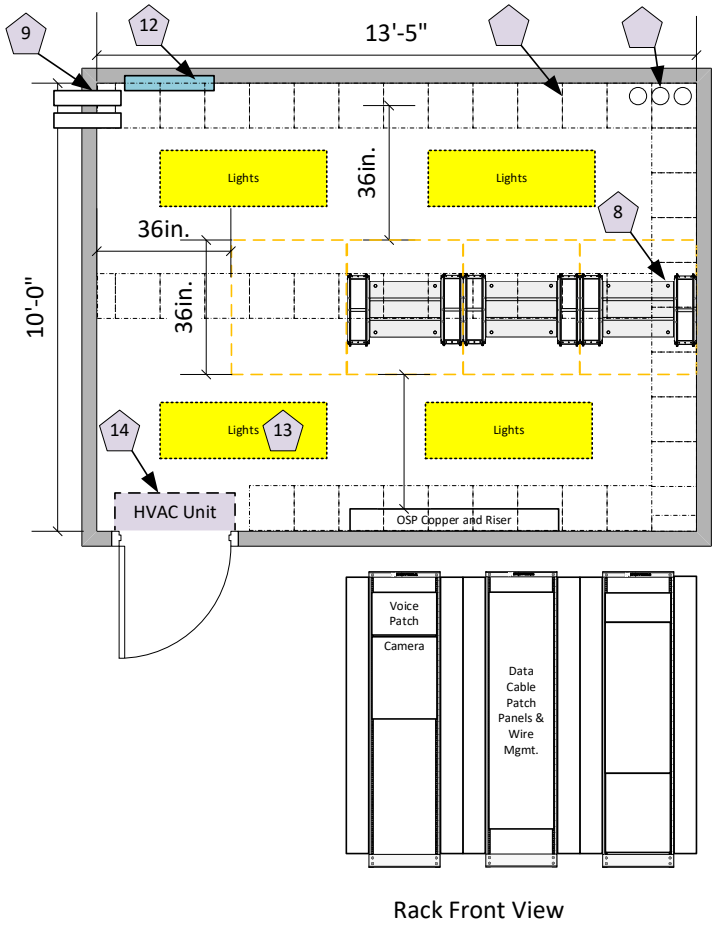


Exhibit 7 - 3 Rack IDF

4 Rack IDF

(4) Rack IDF

Room Highlights:
1) Max. Sq. Ft. served = 16,000 Assignable Sq. Ft.
2) Max. drops served = 160 drops
3) Duplex convenience receptacles every 6'
4) One L5-30R x 20 AMP 120 volt dedicated branch circuits in quad boxes mounted in an electrical chase above the back of each rack.
5) One L6-30R x 30 AMP 208 volt dedicated circuit in wall box behind rack 1 at 18"AFF.
6) One L6-30R x 30 AMP 208 volt on generator power in wall box behind rack 1 at 18"AFF.
7) Seismic rated ladder rack, 12" wide at 7'6" AFF
8) 2-post open frame racks bolted to floor and seismic braced.
9) Horizontal cable sleeves entering room at 8'0" AFF
10) Walls lined with ¾" fire treated plywood
11) A minimum of 3'0" clearance shall be maintained at one end of the rack row and 3'0" clearance in front and rear of racks.
12) Electrical panel with emergency power (if available)
13) Overhead lights on emergency power (if available)
14) 24x7 HVAC unit dedicated to the room
15) Entrance conduits

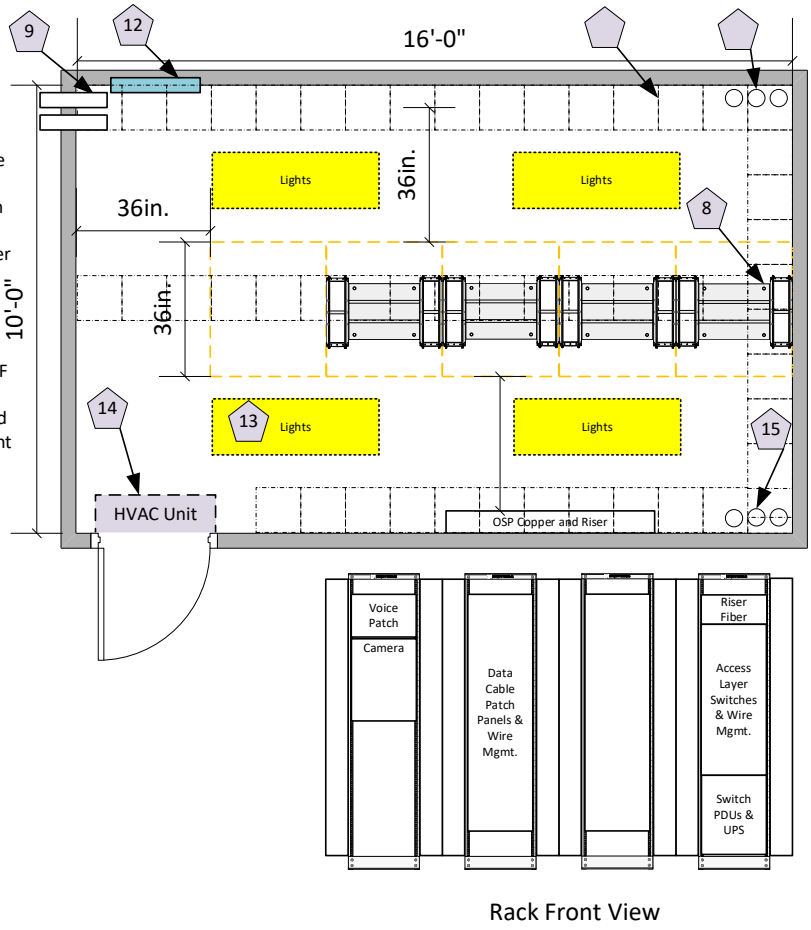


Exhibit 8 - 4 Rack IDF

Supplemental Distribution Frame (SDF)

Supplemental Distribution Frames are special purposes spaces where the following conditions could apply. The SDF:

- Serves a very small number of cable drops (usually less than 32 cable drops).
- Serves a special building like a pool building, mechanical building, or athletic field building that could not support a typical MDF.
- Is used to reduce long cabling runs into a specific room like a computer lab.

The Design Team must collaborate with the Cal Poly Designated Telecommunications Representative to determine if an SDF is permitted and (if so) how the SDF would be designed at that location.

Requirements for all MDF and IDF Rooms

Floor

All MDFs and IDFs shall have either a sealed concrete floor and/or the floor shall be tiled or covered to provide project appropriate dust, dirt and moisture protection.

Walls

All MDFs and IDFs walls shall extend to the structural ceiling above. The walls shall meet all requirements of the AHJ. All penetrations of fire rated MDF or IDF walls or floors by any construction discipline shall be fire stopped.

Ceiling

The MDF or IDF must have a ceiling with a minimum ceiling height of 9-feet above the finished floor. The MDF or IDF cannot have a false or suspended ceiling.

Doors

The door to the MDF or IDF shall be 3 feet wide (minimum), opening fully (180 degrees on flat wall, 90 degrees in the corner). Doors shall be fitted with a sweep when not opening into an interior public space to insulate the room from contaminants typically found in outside public spaces.

The MDF or IDF door shall open outward into a public space.

Access Control

If the building is being designed with a Card Access system, then each MDF or IDF shall have card access for the doors. Also, each MDF or IDF shall have a Campus lock with the proper and unique ITS series lockset to allow only Cal Poly ITS Telecomm Group staff and other authorized Personnel to enter.

Windows

MDF or IDFs shall not have windows.

Backboards

Each MDF or IDF shall have all walls covered from one foot above finished floor to the deck above with ¾ inch x 4-foot x 8-foot plywood panels securely fastened to the wall framing members. The screw heads must be flush with the plywood face. The plywood is to be sanded smooth (not rough), void-free and both fire-rated and painted with white intumescent paint, two coats on all sides (front, back and edges***). The Fire Rating Stamp shall remain visible on all plywood backboards at all times.***

Exhibit 9 - Fire Rated Stamp

Environmental Service

Any MDF or IDF housing active communications equipment shall have dedicated refrigerated air conditioning providing positive air flow. Temperature control shall be maintained independently for each space and run continuously set to 70F to 80F, 24 hours a day, 365 days a year.

Fire Protection

All MDFs and IDFs shall be provided with a portable CO2 fire extinguisher with current certification.

All MDFs or IDFs shall be provided with a smoke detector tied into the building's fire alarm system.

For an MDF that houses network equipment that supports campus core or multiple campus buildings, the Designer should consider a dry (pre-action or gas) fire suppression system be provided along with installing wire cages to prevent accidental operation of sprinkler heads. Activation of the suppression system should be linked to the MDF electrical panel to disconnect power in the event of activation.

Sprinkler systems

- If codes require fire protection sprinkler system heads within a MDF or IDF, the sprinkler heads shall be the high heat type and shall be protected with a wire cage to prevent accidental discharge.
- Sprinklers shall not be installed directly above the equipment racks.
- For MDF rooms, consider installing a standalone dry pipe sprinkler system due to the importance of the whole-building or even whole-campus-area supporting equipment in the room.

Lighting

Lighting shall be installed; a minimum equivalent of 500 lux (50 foot-candles) measured 1 m (3-feet) above the finished floor, at both the front and rear of the populated rack(s) and mounted above the rack(s), off-set from the rack centerline, to avoid shadowing.

Light switches shall be located for easy access upon entry.

Locate light fixtures a minimum of 9-feet above the finished floor. All light fixtures or lamps shall be caged or sleeved to provide shatter protection.

At least one light shall be on emergency power or battery backed-up.

Light ballasts shall not be installed within 1' of telecommunications cable, and the light fixture itself shall not be mounted within 5". *This is typically an issue around the telecom ladder and cable trays used to route telecom cable.*

A typical MDF or IDF shall include at least two 8' light fixture rows, placed parallel to the racks to illuminate the wall wiring as well as the front and rear of all equipment in the racks.

Duct Sealing

Any conduits that enter a MDF or IDF from outside must be sealed at both ends with a re-enterable product specifically listed for that application. ***Any conduits that allow or cause water to enter a MDF or IDF shall be immediately repaired or replaced.***

Equipment Racks

Floor Mount

Use standard 19-inch by 7-foot, two post racks separated by and flanked with vertical cable management on both sides.

- ***There shall be a 3-foot working clearance in front and behind the furthest extending equipment in a rack to allow technicians the ability to work on the communications equipment mounted in the racks (National Electrical Code, Section 110-26***).
- ***Racks shall always be installed in straight rows***. ***Each rack shall always include a minimum of three (2U or 3 1/2") horizontal wire managers.***

- ***One horizontal wire manager shall be installed at the top of each rack and one under each installed patch panel.***

Vertical Wire Management

Each MDF or IDF rack shall be provided with vertical wire management on both sides of every rack. There shall be 6" vertical wire management on the outside rail of the first and last rack in a row and two 6" vertical wire management side by side between each rack.

Horizontal Wire Management

A minimum of three horizontal wire managers per rack shall be provided. Additional wire management shall be provided as the rack becomes more populated.

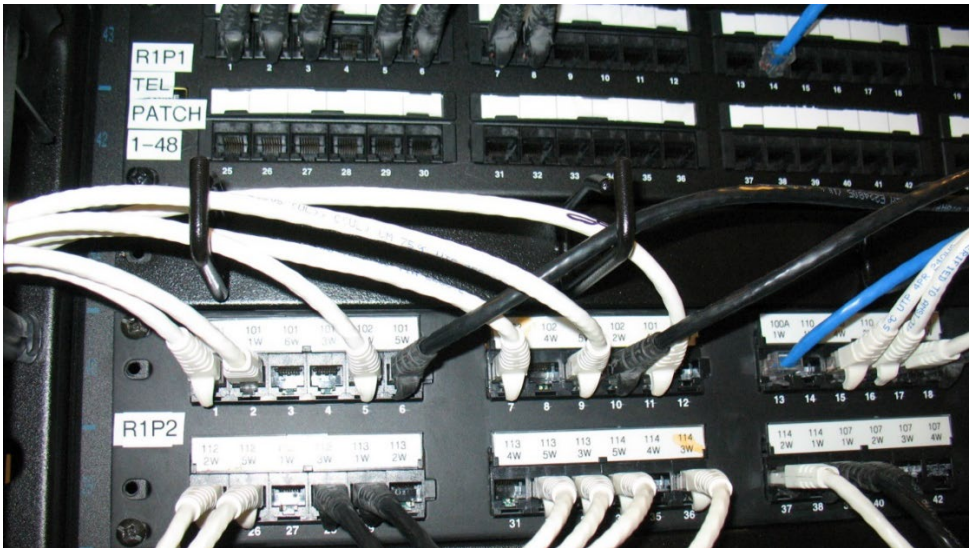


Exhibit 10 - Horizontal Wire Management

Attachment

The bottom of the rack shall be attached (bolted) to the floor meeting Seismic Zone 4 requirements. The top of the rack shall be attached to an adequately sized cable path (12" to 18" ladder rack) that shall run from the MDF or IDF ladder racking attached to all walls, across the top of the rack(s), and securely attached to the ladder racking at both ends. Ladder rack shall be attached to the top of racks with a minimum 6" riser.

Power

Distribution Panels

Provide a separate power panel in all communications facilities with planned equipment installations per the CSU, TIP Standards. Distribution panels that serve MDFs or IDFs shall be dedicated for that purpose only and located in that room.

The electrical panel serving a telecommunications space shall be grounded to that facility's TMGB or TGB as well as directly to the main building electrical grounding

busbar. If the building is equipped with a generator, electrical panels serving MDFs or IDFs shall be included in all generator power back-up schemes and shall be connected to emergency power via an auto transfer-switch.

Communications Equipment circuits (minimum):

All AC power outlets shall be identified and marked by use of machine generated labels, both on the faceplate and in the electrical breaker panel.

Behind Rack 1 – Attached to one wall of the MDF or IDF:

- One L6-30R x 30 AMP 208-volt dedicated circuit in wall box behind rack 1 at 18"AFF.
- One L6-30R x 30 AMP 208 volt on generator power in wall box behind rack 1 at 18"AFF, if the building has a generator.

Above each rack in the MDF or IDF:

- One L5-30R x 20 AMP 120-volt dedicated branch circuits in quad boxes mounted to the overhead ladder rack above the back of each rack.

Exhibit 11 - Electrical Over Racks

Convenience outlets (for tools, test sets, etc.)

Install duplex, protected 3-wire, 120-volt, 20 amp, NEMA 20R non-switched circuits, embedded and recessed in the plywood back panel mounted to each wall at standard outlet height AFF and placed at 6-ft intervals around the perimeter walls. Convenience outlets shall be identified and marked as such by machine generated labels, both on the faceplate and in the electrical breaker panel.

No conduit for electrical circuits shall be mounted on top of plywood backboards; it shall be routed around or behind the backboard (inside the wall).

Grounding

All MDFs or IDFs shall be provided with a Telecommunication Primary Bonding Busbar in accordance with NEC Article 250, ANSI/EIA/TIA-607, as well as any other grounding protection codes or specifications.

The electrical panel serving a telecommunications space shall be grounded to that facility's Primary Bonding Busbar (PBB). The PBB shall also be directly and substantially grounded to the building main electrical grounding busbar assembly.

PBB/TBB shall be mounted at elevation of 6' 9" max to top of busbar.

All equipment, racks, metal conduit, cable tray and cable shields shall be properly bonded to the* PBB *~~as~~ appropriate.

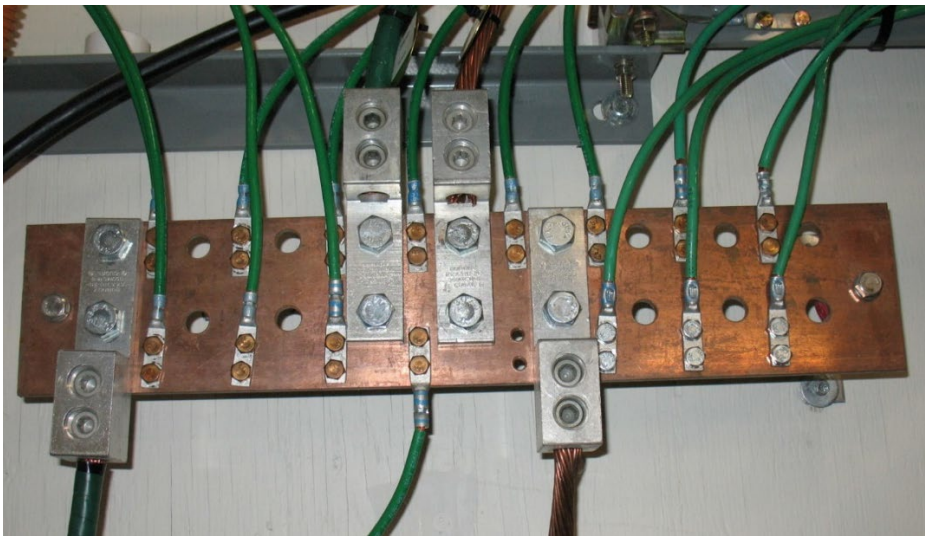


Exhibit 12 – Primary Bonding Busbar

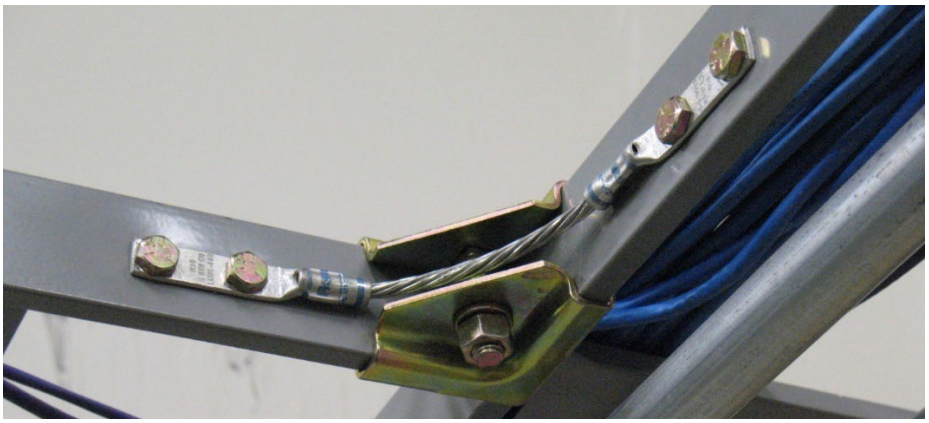


Exhibit 13 - Cable Tray Grounding

Cable routing inside the TR

Cables that are to be terminated on a backboard shall be routed on the ladder rack around the perimeter (creating the slack loop) to a point directly above the termination hardware.

Cable will not be run along the floor or across a workspace in the MDF or IDF. All cable, including grounding wire, will approach the equipment rack from above via cable pathway or conduit.

Firestopping

All firewall penetrations into a telecommunications space shall be metal sleeved and fire stopped. All firestopping shall match the specific fire rating of the wall that is penetrated. Products used to seal conduits shall be reusable/re-enterable to allow for additional cabling and maintenance.

Inside Plant Riser Conduit

For backbone (riser) pathways, the starting point is three (3) four-inch conduits or sleeves, with one (1) additional conduit added for each 10,000 square feet of space above a base 10,000 assignable square feet (ASF). For example, a six-story building with 20,000 ASF per floor needs a minimum of three conduits serving each telecommunications room, plus two additional conduits for pass-through, and a dedicated conduit to serve future wireless or satellite systems on the roof. Due to the need to interconnect components on different floors, the number of conduits should remain constant from the top to the bottom of the building.

Labeling

A. Inside structured cables (including all ground wires) must be labeled on each end using machine generated 1” white with black lettering cable labels. Handwritten labels shall not be allowed.

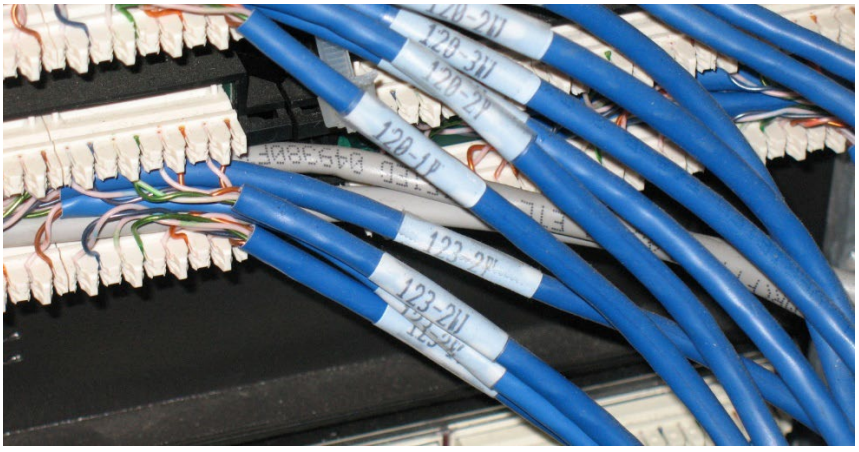


Exhibit 14 - Structured Cable Labeling

B. Backbone and riser cables (including all ground wires) must be labeled on each end using 1" white nylon labels with black lettering.

C. Faceplates shall be labeled using machine printed "window inserts".

D. Outdoor cables must be labeled using outdoor rated 1" wide nylon labels with black lettering at each endpoint and in each manhole or pull box.

E. Inside and outside of all pull boxes, manholes, terminating cabinets, and telecommunications facilities shall: be labeled inside by using an appropriate stencil with black or white paint depending on background; be appropriate for the surface type; and utilize letters and numbers ranging in size from 2" to 6" high as approved by the Cal Poly Designated Telecommunications Representative. Outside labeling shall conform to the Project Labeling Standards used for all other project labels. Submit all proposed labeling for approval to the Cal Poly Designated Telecommunications Representative.

F. All backbone cables shall also be labeled with the next point of access and previous point of access. (E.G. in SPH2: label shall read SPH1 to SPH3).

G. All interior racks, cabinets and panels must be labeled using machine generated 1" white permanent material with black lettering.

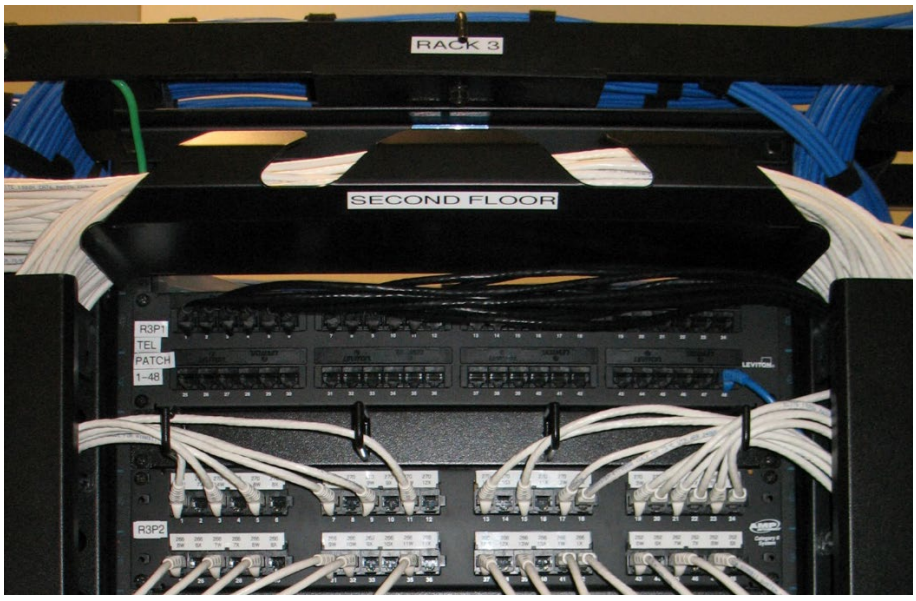


Exhibit 15 - Rack and Panel Labeling

Testing & Inspection

All installed equipment and/or materials, be they copper wire, coax, fiber optic cable, jacks, plugs, connectors, splices, cable tray, conduits, equipment racks, consolidations, taps, splitters, WAPs, phones, and complete systems require Inspection and acceptance by Cal Poly Designated Telecommunications Representative. After inspection of an item has been completed by the Cal Poly Designated Telecommunications Representative, the Cal Poly Facilities Project Manager and/or Contractor shall be advised in writing as to the acceptability of the item(s) inspected. If

approved, the Contractor shall proceed with testing the item and/or system in accordance with all the Standards listed or referred to as part of this document. In all cases, if testing requirements are not fully understood by the Contractor, it shall be the Contractor's responsibility to submit an RFI (Request for Information), through the proper channels, requesting additional information and clarification. If the Contractor does not make any requests, the Cal Poly ITS Telecomm group shall assume that the Contractor fully understands what test data is expected and the format and number of copies that constitutes full compliance.

Interior Communication Pathways

Ceiling Cable Pathways (cable trays, conduit, etc.)

Horizontal pathways shall follow building lines as much as possible. Horizontal cables shall feed from rooms/offices via individual conduits to a hallway or other common space where they shall transit to the cable tray and then proceed to the MDF or IDF. ***Structured Cabling and associated pathways shall be separated/protected from all water, waste, fire sprinklers, hung ceiling and other threats to the greatest extent possible.***

Cable Hangers

No cable hangers (J-Hooks, Bridle Rings, Bat Wings, Etc.) shall be allowed. (Unless specifically designed for the cable type and quantity and approved by the Cal Poly Designated Telecommunications Representative) If structured cable receives approval to be supported using hangers, the cable shall not touch hung ceiling cables and/or ceiling tiles.

Cable Tray

Cable tray shall be aluminum with solid corrugated flooring. Minimum width for cable tray is 12". Minimum load rating should be 100 lb./ft. When cable tray meets a penetrated wall, the number and size of the penetrations shall approximate the capacity of the tray feeding them.

Conduit

All conduits shall be home run back to a cable tray or the MDF or IDF.

All conduits shall be boned in accordance with National Electric Code in the MDF or IDF. All conduit terminations shall be equipped with bushings or grounding bushings as necessary.

Horizontal cabling conduit runs shall not be installed below slab in any building. They may, however, be installed within the slab.

Cable Pull Force

The maximum allowable pulling force on a 4-pair Structured Cable or bundle of cables is 25 lbs. *Over-filled conduit, long conduit runs, and bends increase the pulling force required to pull the cable.*

Conduit Bends

There shall be no more than two 90-degree bends (or combination of bends equaling 180 degrees) between pull points or pull boxes.

For reverse bends (between 100 and 180 degree), Insert a pull box at each bend. The recommended 90-degree bend radius for conduit is 6 times the internal diameter of the conduit (10 times the internal diameter if conduit larger than 2 inches).

Conduit Fill (4 pair UTP, plenum rated)

Conduit fill ratios shall not exceed CSU TIP standards or NEC for the appropriate Structured Cable diameter and future growth. Recommended conduit sizes are based ~~CAT~~ 6A (OR HIGHER) Plenum cable which is approximately .26" in diameter.

Conduit Size	Sleeve Less than 2'	Straight Less than 100'	2x 90 Degree Bends Greater than 100'
3/4"	Not Allowed	Not Allowed	Not Allowed
1"	Not Allowed	Not Allowed	Not Allowed
1 1/4"	12	8	6
2"	30	20	14
4"	120	80	56

Conduit length

Conduit runs shall contain no continuous sections longer than 100 ft. without a pull box.

Firestopping

All firewall penetrations shall be adequate in number, metal sleeved and firestopped. ***When cable tray meets a penetrated wall, the number and size of the penetrations shall approximate the capacity of the tray feeding them.***

All conduits (empty, partly filled or full) terminating in a telecommunications space shall be firestopped or sealed.

Pull Boxes

Pull boxes shall not be used in lieu of a 90-degree bend, and conduits shall be aligned (whenever possible) such that pulls are straight through with no jogs.

Pull boxes shall be located such that conduit runs do not exceed 100 feet. Minimum size for pull boxes; length shall be 8x diameter of the largest entering conduit; width shall be 4x the diameter of the largest entering conduit.

Walls

All conduits shall be placed within the interior of a wall.

Ladder Racking

Ladder racking shall be made of 3/8” x 1- 1/2” x .065” wall rectangular steel tubing with cross members welded at 12” intervals. Minimum width required shall be 18”. Finish shall be grey powder coated. Ladder racking shall only be used within MDFs and IDFs.

Faceplates (sometimes called Cable Drops)

Each work area (electrical, mechanical janitorial, etc.) shall be provided with a minimum of one faceplate location with a minimum of three CAT 6A (OR HIGHER) station cables.

Typical faceplate found in non-Housing locations

Typical faceplate found in Campus Housing

Exhibit 16 - Faceplate or Cable Drop

In-Wall Mounted Faceplates

The "standard" wall faceplate shall consist of a 4 11/16-inch square back box, 2 ¼ inch deep, equipped with a single gang mud ring. Each faceplate shall be served by a dedicated 1¼-inch conduit (minimum) with no more than a total of 180 degrees of bend between pull-points.

Telecommunications faceplate back boxes shall never be daisy-chained or mounted back-to-back using a common feeder conduit.

Floor Mounted Modular Jacks

If flush-mounted floor boxes are required, the Design Team shall place a dual use (signal & power) preset floor box in the floor surface and feed the conduits (1¼" for signal only) through the floor slab to the nearest wall and immediately into a pull box before continuing to a cable tray or telecommunications space. Flush- mount units shall provide a space for telecommunications connections comparable to the standard NEMA back box.

If a large number of such modular jacks are required, cast-in-place floor boxes with feeder duct shall be used. They shall be served by multiple two-inch conduits back to an MDF, IDF, or cable tray.

Single Surface Mount Faceplate

When a single surface mount faceplate is specified, it shall be a steel raceway 7/8” x 1 29/32”. Back boxes should be 2¾” deep, and all surface mount pathways shall have fiber rated fittings.

Multiple Surface Mount Modular Jacks

In some laboratories, work areas, and/or counter spaces, wall-mounted raceway may be utilized to distribute power and signal to a variety of user locations. This raceway shall be metal, grounded, and at a minimum be 4.75" wide by 3.56" high. The communications portion of the raceway shall be fitted with standard single gang knockouts for mounting the communications jacks. The Design Team shall provide for multiple access points into the raceway, and ***place a minimum of two 1¼” conduits or appropriate surface mount raceway feeder into every eight feet of raceway section.***

All surface mount pathways shall use fiber rated fittings.

Intrabuilding Backbone Cabling

Fiber Riser

Riser rated; Single-Mode fiber shall be installed from the MDF to all other IDFs in the building.

Terminate the single-mode fiber inside fiber termination panels using duplex LC connectors. Mount fiber patch panels in top position in the 19" rack. ***(See the Cal Poly ITS Labeling, Design & Syntax Standard)***

Fiber Service Loop

All fiber runs shall require a service loop so that they can be relocated or spliced in the future if necessary. A minimum of **30 feet of cable**, forming the service loop, shall be provided at each end of a fiber riser cable. Fiber cable slack shall be coiled and mounted to backboard or routed around the MDF or IDF using ladder racking.

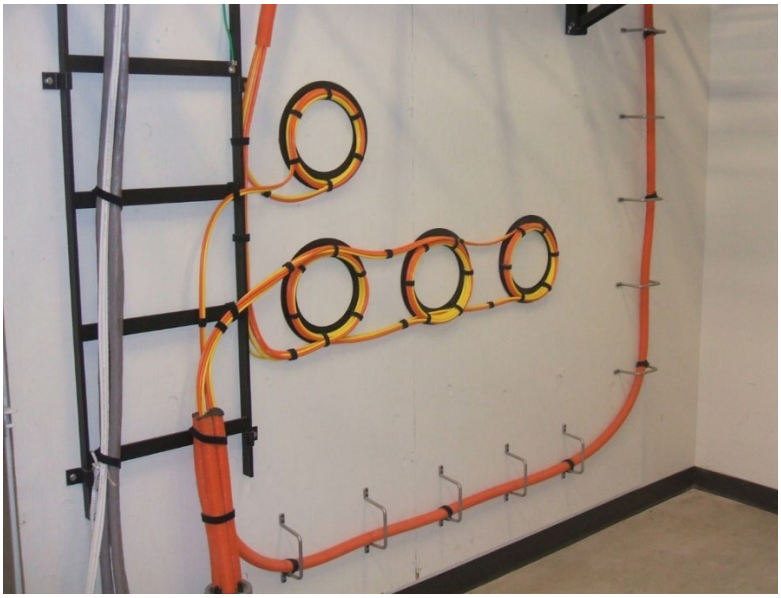


Exhibit 17 - Fiber Service Loops

Copper Riser

Copper riser cables shall be installed from the MDF to all other IDFs in the building.

Cables shall be ARMM, aluminum shielded, 22-gauge, multi-pair cables in multiples of 25 pair.

Copper riser cable will be terminated on 66 blocks along the front wall of an MDF or IDF.

Copper Service Loop

All copper runs shall require a service loop so that they can be relocated or spliced in the future if necessary. The service loop shall consist of one lap around the MDF or IDF in the ladder racking or coiled and mounted to all walls. Any deviation from this standard must be approved in writing by the Cal Poly Designated Telecommunications Representative.

Voice Patch Panels

Copper voice cables will be terminated on the opposite side of the 66 blocks that contain the copper riser cable. The other end of the copper voice cable will then be terminated in the equipment racks on RJ45 48 port patch panels. This will allow patching of analog voice circuits to the horizontal cabling.

Horizontal Cabling

Each horizontal cable run shall be continuous, between the telecommunications space and the station faceplates, without any joints or splices.

Cable Types

Horizontal UTP Station Cable

All staff locations or WiFi UTP Station Cable shall be blue (or project specific color coded) CAT 6A (OR HIGHER), and Plenum Rated. For system specific cabling requirements, refer to the table in section System Specific End Device/Location Requirements (IP Based Ethernet Only) starting on page 37.

Horizontal Station Coaxial Cable

Cable shall be white (or project specific color coded) RG 6QS, Plenum Rated, Quad Shielded cable.

Horizontal Copper UTP OSP Station Cable

Cable shall be Category 6A (or higher) UTP Cable, outdoor, flooded gel, black jacket, 4 pair count.

Horizontal Fiber OSP Station Cable

Cable shall be, single mode, Single Jacket, All-Dielectric Outdoor Cable, Arid-Core Construction, Stranded and Loose Tube

Copper Cable Length

The cabling between, including the horizontal cross-connect (in the MDF or IDF) and the interconnect cable going to the voice/data/video equipment/patch panels, shall not to exceed 290 feet in length. This includes not only the horizontal distance between the MDF or IDF and associated work area, but also the service loop, routing of the cable along the walls, inside the pathways, and vertical distances (up the wall inside conduit, etc.).

Horizontal UTP Cables

Copper horizontal cables are not to exceed 290 feet in length from the patch panel termination in the telecommunications space to the faceplate on the wall and ***shall always remain a minimum of 12" from any surface in excess of 104 F degrees.***

User Space Fiber Cable

Provide a minimum 36-inch service loop for stripped fiber at work area locations. Provide a minimum 10-foot-long fiber loop for sheathed fiber that shall be located in the telecommunications room on the backboard, or on the ladder racking in a lap around the room.

Station Faceplates & Jacks (Copper)

Faceplates and jacks shall be ivory or white in color and coordinated with finished color of electrical outlets. Faceplates shall be flush mount with windowed insets and clear covers to protect the labels.

Blank module inserts shall be installed in all unused module locations.

Telecommunications Space Cable Termination

Telecommunications space shall provide adequate 19" equipment racking to house the necessary number of 48 port CAT 6A (OR HIGHER) modular patch panels, to ***terminate/land the cables in the racks to the EIA/TIA 568A Wiring Standard.***

Entrance protectors for Horizontal Copper UTP OSP Station Cable

A single cable entrance protector module shall be provided for each OSP cable end that extends beyond the drip line of the building.

Warranty

Guarantee in writing the Structured Cabling System (SCS) (materials, equipment, and workmanship) for a period of not less than one (1) year from date of acceptance by the owner.

Field Quality Control

Employ a job superintendent and a project manager during the course of the installation to provide coordination of work of this specification and of other trades and provide technical information when requested by other trades. These persons shall have substantial IT/Telecomm/CATV infrastructure installation experience and shall be responsible for quality control during installation, equipment set-up, and testing and provide the Cal Poly Designated Telecommunications Representative with AS-BUILT drawings at project conclusion.

System Specific End Device/Location Requirements (IP Based Ethernet Only)

The following table shows the pathway, number of cables, cable color, and rack termination location in a MDF or IDF. If the design calls for a location not listed in this table, then assume that location will be connected as a "Typical Staff office or cable drop".

End Device Type	Pathway to MDF or IDF	Number of CAT 6A (or Higher) Cables	Cable Color[3]	MDF or IDF Rack Termination Location
Typical Staff office or cable drop	Typical[4]	3	Blue	Data cable patch panels

[3] This table lists the cable colors for a new building. If the Design Team is developing infrastructure for a remodeling project, collaborate with the Cal Poly Designated Telecommunications Representative to confirm cable colors required for the specific project.
[4] Typical = A single 1¼" conduit, homerun directly to the MDF or IDF or to a cable tray that routes to the MDF or IDF.

End Device Type	Pathway to MDF or IDF	Number of CAT 6A (or Higher) Cables	Cable Color[3]	MDF or IDF Rack Termination Location
Wireless Access Points[5]	Typical	2	Blue	Data cable patch panels
Any IP Based Controller - The Cal Poly Designated Telecommunications Representative shall approve the drawing showing each installation of an IP based controller prior to purchasing or installing any equipment.	Typical	3	White	Camera and Systems patch panels
Emergency Telephones (Placement and 120 volt electrical must be coordinated with University Police.)	Typical	1	White	55 blocks on the wall
Indoor Public Safety Cameras - Each location shall have a 2 gang, 4 11/16" deep box terminating the conduit	Typical	1	Violet	Camera and Systems patch panels
Outdoor Public Safety Cameras - Each location shall have a 4 11/16" deep, 4 gang boxes on the inside of the building terminating the conduit, and then a separate conduit connecting through the wall to the camera.	Typical	1	Violet	Camera and Systems patch panels
Distributed Antenna System (DAS) Devices	Typical	2	Yellow	Camera and Systems patch panels
Access Control Box (Key Box) (IP based only)	Typical	1	White	Camera and Systems patch panels
Building Automation System Control Station (BMS/EMS) (IP based only)	Typical	2	Yellow	Camera and Systems patch panels
Building Generator (IP based only)	Typical	1	Yellow	Camera and Systems patch panels
Card Access Control Panel (Card Swipe) (IP based only)	Typical	1	Yellow	Camera and Systems patch panels
Electrical Room (not for direct connection of electrical equipment)	Typical	3	White	Camera and Systems patch panels
Elevator Control Room (IP based only)	Typical	3	White	Camera and Systems patch panels
Building Main Fire Alarm Control Panel (Note: Some panels also require fiber optic cable)	Homerun	2	White	Camera and Systems patch panels
Gate Controller (IP based only) (Pathway to each gate)	Typical	1	Yellow	Camera and Systems patch panels
HVAC Control Panel (IP based only)	Typical	3	Yellow	Camera and Systems patch panels

[5] Connection methodology of wireless access points (WAP) to the campus IT infrastructure can vary based on location and other circumstances. A detailed drawing/plan indicating the specific location of each WAP shall be submitted to the Cal Poly Designated Telecommunications Representative for approval prior to purchasing or installing any WAP.

End Device Type	Pathway to MDF or IDF	Number of CAT 6A (or Higher) Cables	Cable Color[3]	MDF or IDF Rack Termination Location
HVAC Devices (IP based only)	Typical	1	Yellow	Camera and Systems patch panels
Building Main Intrusion Alarm Control Panel (IP based only)	Typical	3	White	Camera and Systems patch panels
Building Irrigation Control Panel (IP based only)	Typical	1	White	Camera and Systems patch panels
Any Parking Permit Dispenser (IP based only)	Typical	1	White	Camera and Systems patch panels

Codes & Standards – Specific References

Design, manufacture, test, and install telecommunications cabling networks per manufacturer's Structured Cabling System requirements and in accordance with NFPA-70 (National Electrical Code®), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:

• ANSI/TIA/EIA-526	Standard Test Procedures for Fiber Optic Systems
• ANSI/TIA/EIA-568-C	Standard for Installing Commercial Building Telecommunications Cabling
• ANSI/TIA/EIA-569-B	Commercial Building Standards for Telecommunications Pathways and Spaces
• ANSI/TIA/EIA-570-B	Residential and Light Commercial Telecommunications Wiring Standard
• ANSI/TIA/EIA-598-C	Optical Fiber Cable Color Coding
• ANSI/TIA/EIA-604	Fiber Optic Connector Intermateability Standard
• ANSI/TIA/EIA-606-A	The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
• ANSI/TIA/EIA-607-A	Commercial Building Grounding and Bonding Requirements for Telecommunications
• ANSI/TIA/EIA-758-A	Customer-owned Outside Plant Telecommunications Cabling Standard
• ANSI/TIA/EIA-854	Full Duplex Ethernet Specification for 1000Mbis/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling
• ANSI/TIA/EIA-862	Building Automation Cabling Standard for Commercial Buildings
• NFPA 70	National Electrical Code – 2016
• NFPA 72	National Fire Alarm & Signaling Code - 2022
• ANSI/IEEE C2	IEEE's National Electrical Safety Code
• CEC 2010	California Electrical Code (Title 24, Part3) - 2010
• ***CSU TIP STANDARDS***	California State University's Telecommunications Standards Infrastructure Planning Standards (Edition 5.1) – March 2022

Codes & Standards - Organizations

Following are codes and standards organizations that the University follows. If the contractor should note items on the drawings or the specifications, construction of which would be a code violation, they shall be promptly brought to the attention of the owner's representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the most restrictive specifications shall apply.

- ADA Americans with Disabilities Act
- ANSI American National Standards Institute
- ASCII American Standard Code for Information Interchange
- ASTM American Society for Testing Materials
- BICSI Telecommunications Distribution Methods Manual 11th Edition
- CEC California Electrical Code
- ISO International Standards Organization
- IEC International Electrotechnical Commission
- UL Underwriters Laboratories Cable Certification and
- Follow Up Program, UL Testing Bulletin
- NEMA National Electrical Manufacturers Association
- IEEE Institute of Electrical and Electronic Engineers
- NFPA National Fire Protection Association
- ASIS American Society for Industrial Security
- UTIP University Telecommunications Infrastructure Planning Standards
- Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached

DOCUMENT REVISION CONTROL

DATE	AUTHOR	REASON
02/20/2013	R. Volk	DOCUMENT DEVELOPMENT – Revision 0
02/20/2013	DW & MH	DOCUMENT REVIEW
03/17/2021	IPSO team	Document update
05/11/2017	IPSO team	Document update
11/29/2022	Standards Engagement	Document update with WTC Consulting, Inc.