

# Alamo Colleges

## Telecommunications Infrastructure Standards



A L A M O  
C O L L E G E S

For

New Facility Construction, Renovations or Technology Refreshes

Version 2016.12.15

Prepared By:

true**NORTH**  
consulting group

Austin – Waco - Houston  
512-451-5445  
[www.tncg.com](http://www.tncg.com)

## REVISION LOG

REVISION LOG					UPDATE WITH EACH PUBLICATION	
VERSION	TITLE	OWNER	DIRECTOR OF INFORMATION TECHNOLOGY SERVICES	ASSOCIATE VICE CHANCELLOR OF FACILITIES OPERATION AND CONSTRUCTION MANAGEMENT	SUMMARY OF CHANGES FROM PREVIOUS VERSIONS	DATE PUBLISHED
2016.12.15	Telecommunications Infrastructure Standards	Department of Information Technology Services	Arne Sastrup	John Strybos	<ul style="list-style-type: none"> <li>Original publication to replace all previous versions.</li> </ul>	December, 15 2016

## TABLE OF CONTENTS

PART 1 DOCUMENT PURPOSE.....	4
PART 2 DOCUMENT HISTORY .....	5
PART 3 INDUSTRY STANDARDS .....	5
PART 4 CONTRACTOR QUALIFICATIONS .....	7
PART 5 NOMENCLATURE .....	7
PART 6 DISTRICT INFRASTRUCTURE STANDARDS .....	9
PART 7 SUMMARY AND SYNOPSIS OF STANDARDS .....	29
PART 8 TELECOMMUNICATIONS DIAGRAMS .....	35

## **PART 1 DOCUMENT PURPOSE**

- 1.01 The Alamo Colleges Telecommunications Infrastructure Standard is a guideline for structured cabling infrastructure systems and spaces to be applied by the design team for new or renovated facilities. Information herein is applicable to the technical designer, Architect, MEP, and contractors, and shall be taken into account for each project by all team members.
- A. The standard sets forth parameters for the technical system, in addition to the site and building requirements, to facilitate a properly-installed standards-compliant cabling plant, organized as follows:
1. Telecommunications Spaces; Architectural, HVAC, Power, Entrance Pathways and Conduits
  2. Pathways; Cable Management in Telecommunications Spaces, Cable Support in Pathways
  3. System Requirements; Backbone Cabling, Horizontal Cabling, Grounding, Labeling, Testing, and As-Built Documentation.
  4. Telecommunications Diagrams; Backbone, Building MDF/IDF configuration, MFD/IDF layouts & Rack elevations
- 1.02 The standard addresses infrastructure for non-specialty campus buildings and is not intended for the design of data centers or specialty facilities, of which should be considered on a case-by-case basis.
- 1.03 Designers shall not deviate from this standard without explicit written approval from the owner.
- 1.04 Design team shall coordinate and schedule meeting with Alamo College's Technology Department to review the following:
- A. Overall standards document.
  - B. Technology specifications document.
  - C. MDF/IDF layout.
  - D. Horizontal cabling design.
  - E. Backbone and Uplink cabling design.
  - F. Electrical power needs within MDF/IDF spaces.
  - G. HVAC design within MDF/IDF spaces.
  - H. Telecom grounding system design.
- 1.05 Any deviations shall immediately be brought to the attention of the owner's representative in writing for resolution.
- 1.06 Where specific product brands are mentioned, an equal equivalent will be considered following an official submission of product literature and acceptance by the Alamo Colleges Information Technology Services (ITS) Department.

- 1.07 Where means, methods, and best practices are mentioned, contractor shall follow the manufacturers' and owner's requirements, industry standards, or code, whichever is most stringent.
- 1.08 Basic contractor qualifications are set forth, but may be made more stringent as applicable to each project based upon size and scope.

## **PART 2 DOCUMENT HISTORY**

- 2.01 This document supersedes all previous standards which have been fully reevaluated and described herein by the Alamo Colleges Information Technology Services Department, and Facilities Operations and Construction Management Department.
- 2.02 The contents of the standard were derived by the assembly and input from ITS and Facilities Operations and Construction Management members.

## **PART 3 INDUSTRY STANDARDS**

- 3.01 The following industry standards shall be adhered to, unless specifically directed otherwise, by Alamo Colleges. The list is not all-inclusive and does not alleviate compliance with applicable standards, codes, and best practices:
  - A. TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises
  - B. TIA-568-C.1 Commercial Building Telecommunication Cabling Standards – Part 1 General Requirements (2008)
  - C. TIA-568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard (2009)
  - D. TIA-568-C.3 Optical Fiber Cabling Components Standard (2009)
  - E. TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces - (October 2004)
  - F. TIA-598-C Optical Fiber Cable Color Coding - (January 2005)
  - G. TIA/EIA-606-A Administration Standard for Commercial Telecommunications Infrastructure - (May 2002)
  - H. ANSI J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications - (October 2002)
  - I. TIA-758-A Customer-owned Outside Plant Telecommunications Infrastructure Standard - (August 2004)
  - J. TIA-598-C Optical Fiber Cable Color Coding - (January 2005)
  - K. TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7 - (February 2002)
  - L. TIA-526-14-A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – OFSTP-14 - (August 1998)
    1. ADA – Americans with Disabilities Act of 2010  
[www.ada.gov/2010ADASTandards\\_index.htm](http://www.ada.gov/2010ADASTandards_index.htm)

2. AIA – American Institute of Architects  
[www.aia.org](http://www.aia.org)
3. ANSI – American National Standards Institute  
[www.ansi.org](http://www.ansi.org)
4. ASHE – American Society of Healthcare Engineering (delete if not healthcare)  
[www.ashe.org](http://www.ashe.org)
5. ASTM – American Society of Testing and Materials  
[www.astm.org](http://www.astm.org)
6. BICSI – Building Industry Consulting Service International, Inc.  
(RCDD Standards)  
[www.bicsi.org](http://www.bicsi.org)
7. CFR – Code of Federal Regulations  
[www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR](http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR)  
(Available from the Government Printing Office)  
(Material is usually first published in the Federal Register)
8. U.S. Copyright Law, December 2011  
[www.copyright.gov/title17](http://www.copyright.gov/title17)
9. ECIA – Electronic Components Industry Association  
ESC – EIA Standards Council  
[www.eciaonline.org](http://www.eciaonline.org)
10. IACS – International Annealed Copper Standard  
[www.ndt-ed.org/GeneralResources/IACS/IACS.htm](http://www.ndt-ed.org/GeneralResources/IACS/IACS.htm)
11. IEC – International Electrotechnical Commission  
[www.iec.ch](http://www.iec.ch)
12. IEEE – Institute of Electrical and Electronics Engineers  
[standards.ieee.org](http://standards.ieee.org)
13. ISO – International Organization for Standardization  
[www.iso.org](http://www.iso.org)
14. ITU-T – International Telecommunication Union – Telecommunication  
[www.itu.int](http://www.itu.int)
15. NEC – National Electrical Code (NFPA 70)  
maintained by NFPA – National Fire Protection Association  
[www.nfpa.org](http://www.nfpa.org)
16. NECA – National Electrical Contractors Association  
[www.necanet.org](http://www.necanet.org)
17. NEMA – National Electrical Manufacturers' Association  
[www.nema.org](http://www.nema.org)
18. OSHA – Occupational Safety and Health Administration  
(U.S. Department of Labor, OSHA)  
[www.osha.gov](http://www.osha.gov)

19. TIA – Telecommunications Industry Association  
[www.tiaonline.org/standards](http://www.tiaonline.org/standards)

20. UL – Underwriters' Laboratories  
[www.ul.com](http://www.ul.com)

M. Applicable Flame Test: UL 910 (NFPA 262 1990).

#### **PART 4 CONTRACTOR QUALIFICATIONS**

- 4.01 The designer shall include the following Contractor Minimum Qualifications with each project specification:
- A. Contractor shall be certified by the manufacturer of all products to furnish a 15-year performance certification for cabling and connectivity, and applicable manufacturer warranties for the remaining products.
- 4.02 Specific project contractual documents and or requirements developed by the A/E design team for construction shall supersede this standards document.
- 4.03 Company has the required Prior Project Experience: At least 5 years of installation of structured cabling systems. My company can provide a minimum of three (3) project references that have/had a similar scope and each project equal at least 80% of the base bid price for this project.
- 4.04 References must include contact name, phone number, email address, brief description of project, date of completion, and contract amount.
- 4.05 Company meets all of the following minimum qualifications in order to be considered qualified to perform this contract. My company certifies that it:
- A. Maintain installers/technicians, certified in the solution being proposed herein.
  - B. Can respond on-site to standard service calls within 8 hours (business hours) time.  
Can respond on-site to emergency service calls within 4 hours (business hours) time.

#### **PART 5 NOMENCLATURE**

- 5.01 In many cases, industry nomenclature is used, but is blended with district-specific terms to best suit the College's needs.
- A. Industry Specific
    - 1. MDF – Main Distribution Frame, the main point of connection for service providers, houses the backbone terminations and telecommunications equipment for cross-connection and distribution to Intermediate Distribution Frames, and cross-connection to user workstations.
    - 2. IDF – Intermediate Distribution Frame, houses the backbone terminations and telecommunications equipment for cross-connection and distribution to user workstations.
  - B. Alamo Colleges Specific
    - 1. Campus MDF – MDF that serves the entire campus by distributing backbone connections to the first IDF in each other building on campus and to the IDF-2s of the building in which it resides, and cross-connection to user workstations.

2. Building MDF – MDF that distributes backbone cables to the IDF-2s in the building in which it resides, and cross-connection to user workstations. Applies to stand alone single-buildings.
3. IDF-1 – the first IDF in every other campus building that distributes backbone cabling to the IDF-2s of the building in which it resides, and cross connects to user workstations. Does not apply to the building with the Campus MDF or stand-alone single buildings with a Building MDF.
4. IDF-2 – IDFs that are not serving as an IDF-1, receive backbone cabling from the Campus MDF, Building MDF, or IDF-1, and cross connects to user workstations.



## **PART 6 DISTRICT INFRASTRUCTURE STANDARDS**

### 6.01 Telecommunications Spaces

#### A. Campus MDF (does not apply to a stand-alone single-building facility)

##### 1. Description

- a. The Campus MDF is a Telecommunications space that serves a multi-building facility or campus. There is only (1) on each campus.
- b. The Campus MDF houses the entrance conduits, terminations, and cross connections for all incoming inter-building backbone cabling from the IDF-1s in other buildings on the campus and the intra-building backbone cabling from the IDF-2s of the building in which it resides, and cross connects to user workstations.
- c. Wall and floor space shall be reserved for service provider demarcation equipment and incoming infrastructure terminations.
- d. Campus distribution network equipment, servers, and other centralized telecommunications related equipment will reside in the Campus MDF; the Campus MDF is not intended to support academic or district servers, which will reside in separate space.
- e. The Campus MDF may share space with other systems such as security panels, fire alarm panels, paging systems, CATV, and building control panels.
- f. The Campus MDF shall not be used for storage, serve as a mechanical or electrical distribution space, nor shall it have, within its space, main electrical feeds, water or sprinkler main lines.
- g. The layout of racks, cabinets, wall fields, and cable management shall be as indicated on the attached diagrams.

##### 2. Architectural (Campus MDF)

- a. The Campus MDF shall have a minimum of 600 square feet with a minimum clear lineal wall length of at least 30 feet; all walls shall go to deck. Refer to MDF diagram for dimensions as minimum depth and wide are critical to proper front/rear rack clearances.
- b. The floor is not required to be raised; floor finish shall be sealed bare concrete.
- c. The Campus MDF shall not contain windows.
- d. Campus MDF shall have an exterior wall that is within 50 feet of the building exterior, and not be located adjacent to or below restrooms or other water-based facilities, or sources of EMI and mechanical vibration.
- e. All walls of the Campus MDF shall be covered with AC Grade ¾" Fire Retardant Plywood, aligned vertically starting at 18 inches above finished floor extending to 114" above finished floor. The plywood shall be painted, but contractor shall take care to cover fire rating stamps on each piece of plywood. Contractor shall ensure fire-rated stamp is not painted or covered.
- f. The room shall be without a ceiling, if possible, or a lift-out tile ceiling, when required. Cables or devices penetrating the ceiling tiles shall not pass

through a bare ceiling tile but shall be routed through adequately sized bushings. The ceiling shall be a minimum of 24 inches above the highest rack or cable runway; 36 inches is recommended.

- g. Entry to the space shall be through a minimum 42-inch by 80-inch clear door opening that swings outward. Door shall be solid core or steel with no window. The door shall securely lock and access shall only be by Alamo Colleges - approved personnel. The door shall open to an interior hallway or space; it is not recommended that the door open to the exterior of the building.
  - h. When an access control security system is available, the entrance to the Campus MDF shall be equipped with a proximity card reader and electrified door hardware. When a surveillance system is available, the Campus MDF shall be equipped with at least (1) camera.
  - i. Fire suppression for the Campus MDF shall be sprinklers in the MDF when the remainder of the building is equipped with a sprinkler system.
    - i. A pre-action fire suppression system shall be considered by the design team on a case-by-case basis. For each project, the design team (architect, MEP and technology consultant) shall coordinate meeting with the Owner to discuss full MEP design including pre-action fire suppression system needs.
3. HVAC (Campus MDF)
- a. The Campus MDF shall be serviced by a dedicated air conditioning unit that is part of the building's main system and managed and monitored by the building management system. The unit shall maintain a constant 24/7 cooled environment between 68° and 75° F with humidity of 41.9°F Dew Point to 60% RH and 59°F Dew Point, or the current ASHRAE recommendations at the time of construction.
  - b. Typically, the minimum HVAC load shall be designed to displace 20KW of power, or 6 Tons, and shall be designed to load, if the known load is greater at the time of design. For each project, the design team (architect, MEP and technology consultant) shall coordinate a meeting with the Owner to discuss full MEP design including HVAC system needs.
  - c. It is recommended that the Campus MDF maintain the stated temperature and humidity in the event of building power outages or primary HVAC system failure.
  - d. Air delivery shall be aligned in the front of the equipment rows and returns at the rear of the equipment rows.
4. Lighting (Campus MDF)
- a. Fluorescent light fixtures shall be at least 12 inches above the top of the highest rack or cable runway, 18 inches is recommended. Lighting shall be a minimum of 50-foot candles measured at 3 feet above the floor in the entire space.
  - b. The Campus MDF shall be equipped with emergency lighting to keep the space lit during power outages.

5. Power (Campus MDF)

- a. Power for the Campus MDF shall be in two categories: dedicated and convenience.
- b. Dedicated
  - i. The Campus MDF shall be equipped with (2) dedicated 208 volt 3-phase 150 Amp circuits, 4-wire (2PH + N +G), hardwired to the UPS(s). The originating electrical panel will be equipped with (2) 150 AMP breakers. Conductors shall be routed from the panel in conduit to the UPS wiring terminals. Each outlet shall be labeled with circuit and panel.
  - ii. The Campus MDF shall be equipped with a minimum of (1) APC Symmetra LX 16kVA, Scalable to 16kVA N+1 Ext. Run Tower, 208/240V, to provide 30 minutes of run time at full load. An additional circuit and space shall be allocated should the load exceed 16kVA and a second UPS be required.
  - iii. Additional power circuits to be allocated to security, fire alarm, CATV, building controls, and service provider equipment shall be considered and coordinated at the time of building design.
  - iv. Power distribution to the racks and cabinets shall be achieved by installing PDUs which are not within the scope of this document and are to be provided by the Alamo Colleges network department.
  - v. For each project, the design team (architect, MEP, and technology consultant) shall coordinate a meeting with the Owner to discuss full MEP design including HVAC system needs.
- c. Convenience
  - i. The Campus MDF shall be equipped with 20 Amp Duplex NEMA 5-20R receptacles, with maximum (6) receptacles on each circuit. The originating electrical panel shall be equipped with a 20 Amp breaker per circuit.
  - ii. A Duplex receptacle shall be spaced at least 1 foot from an adjacent wall and every 6 feet thereafter. A minimum of (1) Duplex receptacle shall be placed in each wall and be flush mounted to the finished wall surface at 18 inches above finished floor.
  - iii. Refer to MDF layout diagrams for outlet locations.

6. Racks and Cable Management (Campus MDF)

- a. The Campus MDF shall be equipped with four (4) Standard 2-post Equipment Racks.
  - i. Each rack shall be equipped with a vertical cable manager on both sides of the rack. Adjacent racks may share a vertical wire manager between them.
  - ii. Each rack shall be equipped with a horizontal wire manager above and below each horizontal patch panel.
- b. The Campus MDF shall be equipped with (2) Server Cabinets. Cabinets shall be bayed together with removable side panels when mounted adjacently. The fronts of the cabinets shall face the front of the future cabinet row to allow for a hot row cold row configuration.

- i. Space shall be allocated for an additional (7) future Server Cabinets.
      - ii. Space equivalent to (2) Server Cabinets shall be allocated for service provider equipment.
    - c. The Campus MDF shall be equipped with cable runway encircling the room at 86 inches above the finished floor, and crossing the room parallel to the rack rows (3) times.
      - i. Cable runway shall attach to the tops of Standard Equipment Racks utilizing rack-to-runway hardware kits.
      - ii. Cable runway shall suspend above Server Cabinets and be supported overhead by all thread to the building structure utilizing manufacturer-approved hardware and methods.
      - iii. A vertical section of cable runway shall be attached to the wall board to manage backbone and service provider cables as they transition from the entrance conduits to the overhead cable runway.
  - 7. Fiber Routing System
    - a. In each MDF, Design shall include a Fiber Routing System horizontally adjacent to above rack tray system. All fiber cables shall be placed in Fiber Routing System.
    - b. Duct shall be made of 6"x4" yellow PVC material. All straight sections, corners and drop out shall be part of a complete manufactured system.
- B. Building MDF (does not apply to a multi-building campus facility)
- 1. Description
    - a. The Building MDF is a Telecommunications space that serves a single stand-alone building that is not part of a multi-building campus. There is only (1) in each stand-alone building.
    - b. The Building MDF houses the entrance conduits, terminations, and cross connections for all incoming intra-building backbone cabling from the IDF-2s of the building in which it resides, and cross connects to user workstations.
    - c. Wall and floor space shall be reserved for service provider demarcation equipment and incoming infrastructure terminations.
    - d. Building distribution network equipment, servers, and other telecommunications related equipment will reside in the Building MDF.
    - e. The Building MDF may share space with other systems such as security panels, fire alarm panels, paging systems, CATV, and building control panels.
    - f. The Building MDF shall not be used for storage, serve as a mechanical or electrical distribution space, nor shall it have within its space main electrical feeds, water or sprinkler main lines.
    - g. The layout of racks, cabinets, wall fields and cable management shall be as indicated on the attached diagram.

2. Architectural (Building MDF)

- a. The Building MDF shall have a minimum of 400 square feet with a minimum clear linear wall length of at least 25 feet; all walls shall go to deck.
- b. The floor is not required to be raised; floor finish shall be sealed bare concrete.
- c. The Building MDF shall not contain windows.
- d. Building MDF shall have an exterior wall that is within 50 feet of the building exterior, and not be located adjacent to or below restrooms or other water-based facilities, or sources of EMI and mechanical vibration.
- e. Fluorescent light fixtures shall be at least 12 inches above the top of the highest rack or cable runway, 18 inches is recommended. Lighting shall be a minimum of 50-foot candles measured at 3 feet above the floor in the entire space.
- f. The room shall be without a ceiling if possible or a lift-out tile ceiling when required. Cables or devices penetrating the ceiling tiles shall not pass through a bare ceiling tile but shall be routed through adequately sized bushings. The ceiling shall be a minimum of 24 inches above the highest rack or cable runway, 36 inches is recommended.
- g. Entry to the space shall be through a minimum 42-inch by 80-inch clear door opening that swings outward. Door shall be solid core or steel with no window. The door shall securely lock, and access shall only be by Alamo Colleges approved personnel. The door shall open to an interior hallway or space; it is not recommended that the door open to the exterior of the building.
- h. When an access control security system is available, the entrance to the Campus MDF shall be equipped with a proximity card reader and electrified door hardware. When a surveillance system is available, the Building MDF shall be equipped with at least (1) camera.
- i. Fire suppression for the Building MDF shall be sprinklers in the MDF when the remainder of the building is equipped with a sprinkler system.
  - i. A pre-action fire suppression system shall be considered by the design team on a case-by-case basis.

3. HVAC (Building MDF)

- a. The Building MDF shall be serviced by a dedicated unit that is part of the building's main system. The unit shall maintain a constant 24/7 cooled environment between 68° and 75° F with humidity of 41.9°F Dew Point to 60% RH and 59°F Dew Point, or the current ASHRAE recommendations at the time of construction.
- b. The HVAC load shall be designed to displace a minimum of 12KW of power, or 3.5 Tons, and shall be designed to load, if the known load is greater at the time of design.
- c. It is recommended that the Building MDF maintain the stated temperature and humidity in the event of building power outages or primary HVAC system failure.
- d. Air delivery shall be aligned in the front of the equipment rows and returns at

the rear of the equipment rows.

4. Lighting (Building MDF)

- a. Fluorescent light fixtures shall be at least 12 inches above the top of the highest rack or cable runway, 18 inches is recommended. Lighting shall be a minimum of 50-foot candles measured at 3 feet above the floor in the entire space.
- b. The Building MDF shall be equipped with emergency lighting to keep the space lit during power outages.

5. Power (Building MDF)

- a. Power for the Building MDF shall be in two categories: dedicated and convenience.
- b. Dedicated
  - i. The Building MDF shall be equipped with (2) dedicated 208 volt 3-phase 150 Amp circuits, 4-wire (2PH + N +G), hardwired to the UPS(s). The originating electrical panel will be equipped with (2) 150 AMP breakers. Conductors shall be routed from the panel in conduit to the UPS wiring terminals.
  - ii. The Building MDF shall be equipped with a minimum of (1) APC Symmetra LX 16kVA Scalable to 16kVA N+1 Ext. Run Tower, 208/240V, to provide 30 minutes of run time at full load. An additional circuit and space is allocated should the load exceed 16kVA and a second UPS be required.
  - iii. Additional power circuits to be allocated to security, fire alarm, CATV, building controls, and service provider equipment shall be considered and coordinated at the time of building design.
  - iv. Power distribution to the racks and cabinets shall be achieved by installing PDUs which are not within the scope of this document and are to be provided by the Alamo Colleges network department.
- c. Convenience
  - i. The Building MDF shall be equipped with 20 Amp Duplex NEMA 5-20R receptacles, with maximum (6) receptacles on each circuit. The originating electrical panel shall be equipped with a 20 Amp breaker per circuit.
  - ii. A Duplex receptacle shall be spaced at least 1 foot from an adjacent wall and every 6 feet thereafter. A minimum of (1) Duplex receptacle shall be placed in each wall and be flush mounted to the finished wall surface at 18 inches above finished floor.

6. Racks and Cable Management (Building MDF)

- a. The Building MDF shall be equipped with (4) Standard Equipment Racks.
  - i. Each rack shall be equipped with a vertical cable manager on both sides of the rack. Adjacent racks may share a vertical wire manager between them.
  - ii. Each rack shall be equipped with a horizontal wire manager above and below each horizontal patch panel.

- b. The Building MDF shall be equipped with (1) Server Cabinet. The fronts of the cabinets shall face the row of equipment racks.
  - i. Space shall be allocated for an additional (3) future Server Cabinets.
    - a) Cabinets shall be bayed together with sides removed when mounted adjacently.
  - ii. Wall space at the back of the Building MDF shall be allocated for service provider equipment.
- c. The Building MDF shall be equipped with cable runway encircling the room at 86 inches above the finished floor, and crossing the room parallel to the rack rows (2) times.
  - i. Cable runway shall attach to the tops of Standard Equipment Racks utilizing rack-to-runway hardware kits.
  - ii. Cable runway shall suspend above Server Cabinets and be supported overhead by all thread to the building structure utilizing manufacturer-approved hardware and methods.
  - iii. A vertical section of cable runway shall be attached to the wall board to manage backbone and service provider cables as they transition from the entrance conduits to the overhead cable runway.

C. IDF-1 and IDF-2

1. Description

a. IDF-1

- i. An IDF-1 is a Telecommunications space that resides in each building that is part of a multi-building campus. There is only (1) in each building that is part of a multi-building campus (other than the building housing the Campus MDF.)
- ii. An IDF-1 houses the entrance conduits, terminations, and cross connections for all incoming inter-building cabling from the Campus MDF and all intra-building backbone cabling from the IDF-2s of the building in which it resides.
- iii. An IDF-1 houses the terminations and cross connections for the horizontal user workstation cabling in the area of the building that it serves.
- iv. An IDF-1 does not exist in a single stand-alone building.

b. IDF-2

- i. An IDF-2 is a Telecommunications space that resides in each building that requires more than a single closet from which to terminate horizontal workstation cables. There may be multiple IDF-2s in each building as required to maintain horizontal cable distances of 295 feet for the permanent link.
- ii. An IDF-2 houses the terminations, and cross connections for all incoming intra-building cabling from the MDF or IDF-1 of the building in which it resides.
- iii. An IDF-2 houses the terminations and cross connections for the horizontal user workstation cabling in the area of the building that it serves.

- c. Building workstation access network equipment will reside in the IDFs.
  - d. The IDF may share space with other systems such as security panels, CATV cabling, and paging system cabling.
  - e. The IDF shall not be used for storage, serve as a mechanical or electrical distribution space, nor shall it have within its space main electrical feeds, water or main sprinkler lines.
  - f. The layout of racks, wall fields, and cable management shall be as indicated on the attached diagrams.
2. Architectural (IDF-1 and IDF-2s)
- a. The IDF shall be a minimum of 108 square feet with minimum clear lineal wall lengths of at least 9 feet by 12 feet; all walls shall go to deck.
  - b. Floor finish shall be bare concrete.
  - c. Windows are not recommended.
  - d. IDFs shall be arranged in a stacked formation in multi-story buildings, and not be located near sources of EMI and mechanical vibration.
  - e. All walls of the IDF shall be covered with AC Grade  $\frac{3}{4}$ " Fire Retardant Plywood, aligned vertically starting at 12 inches above the finished floor. The plywood shall not be painted. Contractor shall ensure fire-rated stamp is not painted or covered.
  - f. The room shall be without a ceiling.
  - g. Entry to the space shall be through a minimum 36-inch by 80-inch clear door opening that swings outward. Door shall be solid core or steel with shatter-proof window if equipped. The door shall securely lock and access shall only be by Alamo Colleges-approved personnel.
  - h. When an access control security system is available, the entrance to the IDF shall be equipped with a proximity card reader and electrified door hardware. When a surveillance system is available an IDF shall be equipped with at least (1) camera.
3. HVAC (IDF-1 and IDF-2s)
- a. The IDF shall be serviced by the building HVAC system and be equipped with Split DX system through the wall above the door which cools only when the building HVAC is inadequate or not running. The system or unit shall maintain a constant 24/7 cooled environment between 68° and 75° F with a humidity of 40% to 55%.
  - b. The minimum HVAC load shall be designed to displace 2KW of power, or 0.6 of a Ton, and be designed to load if the load is greater and known at the time of design.
4. Lighting (IDF-1 and IDF-2s)
- a. Fluorescent light fixtures shall be at least 12 inches above the top of the highest rack or cable runway, 18 inches is recommended. Lighting shall be a minimum of 40-foot candles at 2 feet above the floor in the entire space.



5. Power (IDF-1 and IDF-2s)
  - a. Power for the IDF shall be in two categories: dedicated and convenience.
  - b. Dedicated
    - i. The IDF shall be equipped with (2) dedicated 120 volt 20 Amp circuits, each with a simplex NEMA L5-20R receptacle. The originating electrical panel will be equipped with 20 AMP breakers. Conductors shall be routed from the panel in conduit along the cable runway to a metallic back box clipped to the rail of the Cable Runway, facing the rear of the racks.
    - ii. The IDF shall be equipped with (1) APC Symmetra SmartUPS 2200 SUA2200R2X106 with a single NEMA L5-20P power cord to provide 5 minutes of run time at full load.
    - iii. Additional power circuits to be allocated to security and CATV shall be considered and coordinated at the time of building design.
    - iv. Power distribution shall be achieved by the installation of PDUs which are outside the scope of this document and furnished by the network department.
  - c. Convenience
    - i. The IDF shall be equipped with 20 Amp Duplex NEMA 5-20R receptacles, maximum (6) per circuit. The originating electrical panel shall be equipped with a 20 Amp breaker per circuit.
    - ii. A Duplex receptacle shall be spaced at least 1 foot from an adjacent wall and every 6 feet thereafter. A minimum of (1) Duplex receptacle shall be placed in each wall and be flush mounted to the finished wall surface at 18 inches above finished floor.
6. Racks and Cable Management (IDF-1 and IDF-2s)
  - a. The IDF shall be equipped with (2) Standard Equipment Racks.
    - i. Each rack shall be equipped with a vertical cable manager on both sides of the rack. Adjacent racks may share a vertical wire manager between them.
    - ii. Each rack shall be equipped with a horizontal wire manager above and below each horizontal patch panel. An equal number of horizontal wire managers shall be furnished for the network switches and installed as directed by the owner.
      - a) Space shall be reserved for an additional rack and vertical wire manager
      - b) A third rack and vertical wire manager shall be installed in IDFs that serve equipment racks located in Lab(s).
  - b. The IDF shall be equipped with cable runway encircling the room at 90 inches above the finished floor, and crossing the room parallel to the rack rows (1) time.
    - i. Cable runway shall attach to the tops of Standard Equipment Racks utilizing rack-to-runway hardware kits.

- ii. A vertical section of cable runway shall be attached to the wall board to manage backbone cables as they transition from floor sleeves to the overhead cable runway.

## 6.02 Entrance Pathways and Conduits

### A. Design Principles

1. Pathways and conduits are described herein with regard to capacity, function, and basic design principles and shall be designed by the MEP in accordance with NEC and EIA/TIA-758, Customer Owned Outside Plant Telecommunications Cabling.
2. Telecommunications Conduit Systems shall:
  - a. Contain no more than the equivalent (2) 90 degree bends between pull boxes.
  - b. Maintain a minimum bend radius of 10 times the diameter of the conduit.
  - c. Not exceed 40 percent fill ratio for multiple cables.
  - d. Be placed at a minimum depth of 24 inches from the top of the conduit to the finished grade.
  - e. Be interrupted by an adequately sized pull box at least every 600 feet for sections containing up to (1) 90 degree of bend, and at least every 350 feet for sections with the equivalent of (2) 90 degree bends.
    - i. Pull boxes shall be of adequate depth for conduits to enter from the side of the pull box and not be required to sweep up into the box.
  - f. Stub up into the MDF between 1 and 3 inches above the finished floor.
  - g. Contain a pulling tape, be fitted with bushings, and sealed appropriately at both ends.

### B. Service Provider Conduits

1. Minimum of (4) 4-inch conduits shall route underground from the MDF to the edge of the property Right of Way and terminate as required by the service provider. Additional conduits shall be added as required.
2. Manholes and pull boxes shall be utilized as required for a telecommunications-compliant conduit distribution system.
3. Where the service provider termination location is unidentified at the time of design, the conduits shall route from the MDF to an adequately-sized pull box or manhole at least 30 feet from the building edge.

### C. Campus Serving Conduits

1. Minimum of (2) 4-inch conduits shall route underground from the Campus MDF to the IDF-1 of each additional building on the campus. Additional conduits shall be added as required if fill capacity exceeds 40 percent.
2. Manholes and pull boxes shall be utilized as required for a Telecommunications-compliant conduit distribution system.

3. Where only the first building of a campus is being designed, two (2) 4-inch conduits for each additional future building shall route from the campus MDF to an adequately-sized pull box or manhole at least 30 feet from the building edge.

#### D. Building Entrance for Large Campus

1. For large campuses, the MEP and Structural Engineer shall consider a conduit entrance vault as part of the Campus MDF sub floor.

### 6.03 Cable Management in Telecommunications Spaces

#### A. Racks

1. Racks shall be black aluminum Standard Equipment Racks with EIA 19-inch rails, 84-inch (45 RMU) overall height, 3-inch rail depth, dual floor mounting flanges, and rack mount unit markings engraved on the rails.
2. Racks shall be bolted to the concrete floor and the overhead cable runway utilizing manufacturer-recommended hardware and methods.

#### B. Server Cabinets

1. Server Cabinets shall be 24 inches by 42 inches by 84 inches with adjustable front and rear EIA 19" rail kits, enclosed with ventilated front and rear locking doors, adjustable leveling feet, vertical cable manager for one rail, and grounding kit.
2. Cabinets shall be set directly on the finished floor but not bolted unless set on a raised floor. Adjacent cabinets shall be bayed together with the sides removed.

#### C. Overhead Cable Management

1. Overhead Cable Management shall be 18-inch (MDF) or 12-inch (IDF) Universal Cable Runway made of 3/8" x 1-1/2" x .065" wall rectangular steel tubing with cross members welded at 12-inch intervals.
  - a. Cable Runway shall be installed utilizing appropriate hardware to support, join, or attach sections to structures, and shall be supported at a minimum of 5 foot intervals.

#### D. Vertical Cable Managers

1. Vertical cable managers shall be black double-sided, 6 inches wide, 12.75 inches deep, and 84 inches tall, no doors, and include formed cabling sections, lockable cabling latches at 12-inch intervals, and protective edge guards.
  - a. Bolt vertical cable managers to the racks with included hardware kit.

#### E. Horizontal Cable Managers.

1. Attach horizontal cable managers to the rack rails with included screws.
2. Contractor shall provide managers above and below each patch panel and sufficient managers for additional owner provided LAN Switches. For each horizontal patch panel, the contractor shall provide 1 horizontal cable manager for LAN switches.

## 6.04 Cable Support in Pathways

### A. Main Cable Pathway

1. Main cable pathway shall be designed by the MEP, shown on the electrical drawings, and be installed by the Division 26 electrical contractor. Cable Tray shall be Electro Zinc Wire Mesh Basket Tray, minimum 12 inches wide by 2 inches tall; size shall be scaled to the application not to exceed 40 percent fill ratio.
2. Basket Tray shall be installed utilizing appropriate hardware to support, join, or attach sections to structures, shall be supported at a minimum of 5-foot intervals, and grounded as a single-conductor system. Tray manufacturer recommendations shall be followed.

### B. Sleeves and Penetrations and EZ Path

1. Sleeves and Penetrations are described herein with regard to capacity, function, and basic design principles and shall be designed by the MEP in accordance with NEC and EIA/TIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces.
2. All sleeves shall be equipped with nylon bushings.
3. Scale the quantities of sleeves to maintain a 40 percent fill ratio (or less) in each sleeve.
4. Above MDFs or IDFs install minimum of (4) 4" EMT sleeves through the partition wall between the MDF or IDF overhead space and the main cabling pathway.
5. Between directly aligned vertically stacked MDF and IDFs install minimum of (2) 4" EMT sleeves into bored penetrations through the upper floor structure.
6. Between slightly skewed vertically stacked MDF and IDFs install minimum of (2) continuous 4" EMT conduits from the outside wall of the upper to the outside wall of the lower IDF.
7. Between completely skewed MDFs and IDFs on adjacent floors, install minimum of (2) 4" EMT sleeves through the floor the upper IDF into the accessible ceiling space below and utilize above-ceiling pathways to route cabling into the IDF or MDF on the lower floor.
  - a. Pathways thru Fire rated walls of each MDF & IDF shall be STI EZ Path cable pathway devices shall be used in fire-rated construction for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high-voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the prints. Such devices shall: Meet the hourly fire-rating of fire rated wall and or floor penetrated.
  - b. Be tested for the surrounding construction and cable types involved.
  - c. Have UL Systems permitting cable loads from; "Zero to 100% Visual Fill." This requirement eliminates the need for fill-ratio calculations to be made by cable technicians to ensure cable load is within the maximum allowed by UL System.
  - d. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging potential cable damage or interference.

- e. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
- f. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
- g. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
- h. Cable Pathway Devices passing vertically through floors shall have equal F & T Rating. (See UL System # F-A-3037, Item #4 "EZ-PATH Grid T-Rating Kit" Part # TRK444)
- i. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

C. Workstation Rough-ins and local power

- 1. At each wall-mounted workstation location, install a 4 inch by 4 inch by 2-1/8 inch double-gang back box with double-gang mud ring at 18 inches above the finished floor, at 42 inches for emergency wall phones, 6 inches below the ceiling grid for wireless access points and IP cameras, and at appropriate height for above-counter and millwork locations.
  - a. Install a 1-inch conduit from the rough-in box to the cable tray.
  - b. Terminate the conduit above the edge of the cable tray and install nylon bushings and pull string, the conduit is not required to be bonded to the cable tray.
    - i. Conduit shall be installed in accordance with EIA/TIA-569-B, contain no more than the equivalent of (2) 90 degree bends and or 98.4 feet between pull boxes, and maintain a bend radius of 6 times the diameter of the conduit.
- 2. At floor-mounted workstation locations, install a floor box or poke-thru specifically designed for the application and environment adequately sized to accommodate the quantity of installed horizontal data cables.
  - a. Install (1) 1 inch conduit for every (6) cables from the floor box to the cable tray.
    - i. For poke-thrus, route the conduit to the cable tray in the floor below.
    - ii. Floor-mounted outlets should be avoided and all other possible design solutions shall be considered.
- 3. For modular furniture workstations, a rough-in pathway shall be considered and designed according to the furniture type, quantity of cables, and location as required for each furniture system.
  - a. The use of power poles shall be considered only on a case-by-case basis.
- 4. For above ceiling-mounted outlets such as Wireless Access Points or IP Cameras, no rough-in is required, the data cable will terminate into a surface-mount box secured to the structure above the ceiling grid. Install cable outlet ID on ceiling grid within 3' of the outlet in the ceiling.

5. The electrical engineer shall design at a minimum (1) duplex NEMA 5-15R receptacle within 18" of each workstation outlet location.

## 6.05 Backbone Cabling

### A. Inter-building Backbone Cabling (Campus)

#### 1. Copper

- a. Inter-building Backbone Copper Cabling shall be 50-pair PE-39 24 AWG flooded UTP from the Campus MDF to the IDF-1 in each of the buildings on the campus. Provide a 10-foot service loop at both ends of each cable stored on the wall above or below the cable runway. Provide a 30-foot service loop in each manhole or pull box. Cables shall be secured with Hook-and-loop Velcro tie-wraps in the MDF or IDF.
- b. Inter-building Backbone Copper Cabling shall terminate on UL-listed 50-pair 110 IDC in/out lightning protection panels equipped with UL-listed 5-pin solid state quick-acting protector modules. The secondary side of the panel shall be connected to a 50-Pair 110 Block with legs. Panels and blocks shall be wall mounted.

#### 2. Fiber

- a. Inter-building Backbone Fiber Optic Cabling shall be loose tube outdoor-rated composite 12-Strand Single Mode / 24-Strand 50 micron OM3 (up to 300 meters) or OM4 (over 300 meters) Multi Mode from the Campus MDF to the IDF-1 in each of the buildings on the campus, installed in 1-inch outdoor-rated innerduct, and dressed with fan-out kits as required. Provide a 10-foot service loop at both ends of each cable stored on the wall above or below the cable runway. Provide a 30-foot service loop in each manhole or pull box. Cables shall be secured with Hook-and-loop Velcro tie-wraps in the MDF or IDF.
- b. Terminate all strands of each fiber optic cable on LC connectors. Connect terminated LC connectors to the back of coupler panels placed into 19 inch rack-mounted fiber optic termination housings.

### B. Intra-building Backbone Cabling

#### 1. Copper

- a. Intra-building Backbone Copper Cabling shall be 25-pair Category 3 plenum rated 24 AWG UTP from the MDF or IDF-1 to each of the IDF-2s in the building. Provide a 10-foot service loop at both ends of each cable stored on the wall above or below the cable runway. Cables shall be secured with Hook-and-loop Velcro tie-wraps in the MDF or IDF.
- b. Intra-building Backbone Copper Cabling shall terminate on a 110 Block with legs; blocks shall be wall mounted.

#### 2. Category 6A Network Uplinks

- a. Category 6A network uplinks shall be (2) Category 6A UTP plenum rated blue sheath, between the Special Systems patch panels in MDF and IDFs on adjacent floors that are vertically stacked, and between IDF-2s on the same floor, where the permanent link of the Category 6A cable does not exceed 314 feet (allowing a total of 14' of patch cables while not exceeding a 328' channel length).

3. Fiber

- a. Intra-building Backbone Fiber Optic Cabling shall be tight buffered plenum-rated composite 6-Strand Single Mode / 12-Strand 50 micron OM3 (up to 300 meters) or OM4 (over 300 meters) Multi-Mode, encased in orange interlocking armor. Provide a 10-foot service loop at both ends of each cable stored on the wall above or below the cable runway. Cables shall be secured with Hook-and-loop tie-wraps in the MDF or IDF and in the cable tray.
- b. Terminate all strands of each fiber optic cable on LC connectors. Connect terminated LC connectors to the back of coupler panels placed into 19-inch rack-mounted fiber optic termination housings.

6.06 Horizontal Cabling

A. Workstation Cable

1. Horizontal Data Cabling shall be Category 6/6A UTP, minimum factory sweep tested to 550 MHz, plenum rated, blue sheath, installed from the patch panel in the MDF or IDF to the workstation location not to exceed 295 feet for the permanent link. Provide a 10' service loop in the MDF or IDF, and 1-foot of slack behind the faceplate. Cable bundles shall be secured with Hook-and-loop Velcro tie-wraps in the MDF or IDF and in the cable tray.
2. At the workstation, each Category 6/6A cable shall be terminated in a gray Category 6/6A modular jack insert and snapped into a 2-gang, furniture, floor box or poke-thru faceplate. Faceplates shall be equipped with desi-windows for labeling and blank inserts in unused ports. Wall phone workstations shall be equipped with a studed wall phone faceplate capable of accepting a modular jack insert. All faceplate colors shall be coordinated with the Architect or owner at the time of installation.
3. In the MDF or IDF, each Category 6/6A cable shall be terminated on the back of Category 6/6A 48-port IDC patch panels which are mounted in the 19-inch racks.
4. Category 6/6A cable shall be terminated with the EIA-568B sequence.
5. Horizontal cabling shall be manufactured by:
  - a. BerkTek
  - b. General
  - c. Hitachi

B. Patch Panels

1. Horizontal cables shall be terminated at the MDF/IDF rooms on high-density integrated patch panels incorporating Category 6/6A jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet detailed in the section above.
2. Patch panel configuration shall be 48 ports.
3. Standard Data Cable patch panel shall exceed ANSI/TIA/EIA 568-C.2-1 Category 6/6A component compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.

4. Special Systems (WAP & Uplink) Data Cable patch panel shall exceed ANSI/TIA/EIA 568-C.2-1 Category 6A component compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.
5. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.
6. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.
7. The patch panel shall have color-coded designation strips to identify cable count.
8. Patch panels shall be manufactured by Leviton.

C. Patch Cords

1. In each MDF or IDF, furnish to the owner at the time of final inspection (1) Category 6 modular non-booted patch cord for each terminated horizontal data cable plus 25 percent, 50 percent of the total quantity shall be blue and the other 50 percent shall be green in the following proportions:
  - a. Blue – Cat 6 [Standard data/phone]
    - i) 33% 7-foot
    - ii) 33% 10-foot
    - iii) 33% 14-foot
  - b. Green – Cat 6 [Standard data/phone]
    - i) 33% 7-foot
    - ii) 33% 10-foot
    - iii) 33% 14-foot
  - c. Yellow - Cat 6A [Wireless APs]
    - i) Two (2) 7-foot for each WAPs
  - d. Red – Cat 6 [Fire Alarm or Security Equipment]
    - i) Two (2) 10-foot for each cable installed
  - e. Orange – Cat 6A [Copper Backbone Uplinks]
    - i) Four (4) 7-foot for each IDF
2. For outlets, furnish to the owner at the time of final inspection (1) Category 6 modular non-booted patch cord for each terminated horizontal data cable plus 25 percent, 50 percent of the total quantity shall be blue and the other 50 percent shall be green in the following proportions:
  - a. Blue – Cat 6
    - i) 50% 10-foot
    - ii) 50% 14-foot



- b. Black
    - i) 50% 10-foot
    - ii) 50% 14-foot
  - 3. Fiber optic patch cables shall be furnished by the ITS Network Department.
- D. Workstation Configurations (data outlets)
- 1. Modular Jack
    - a. Data jacks shall be non-keyed 8-pin modular jacks.
    - b. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
    - c. Jacks shall utilize a four-layer printed circuit board to control NEXT.
    - d. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
    - e. Modular jack contacts shall accept 2500 plug insertions.
    - f. Modular jack contacts shall be formed flat for increased surface contact with mated plugs. These contacts shall be arranged on the PC board in two staggered arrays of four to maximize contact spacing and minimize crosstalk.
    - g. Jacks shall terminate 22-26 AWG stranded or solid conductors.
    - h. Jacks shall terminate insulated conductors with outside diameters up to .050".
    - i. Jacks shall be compatible with EIA/TIA 606 color code labeling and accept snap on icons for identification or designation of applications.
    - j. Jacks shall be marked as either T568A or T568B wiring.
  - 2. Category 6/6A jacks shall be manufactured by Leviton.
- E. Office Workstation
- 1. Install (2) Category 6 cables terminated on gray jack inserts into a double gang flush faceplate.
    - a. Furnish a minimum of (1) 2-port workstation on each of (3) walls in each office.
    - b. Modular furniture clusters shall be designed to accommodate the user requirements at the time of construction.
  - 2. Category 6 jacks shall be manufactured by Leviton to match District standards
- F. Classroom Instructor Workstation
- 1. Install (2) Category 6 cables terminated on gray jack inserts into a double gang flush faceplate.
  - 2. Furnish a minimum of (2) 2-port instructor workstations in each classroom oriented in the front and back of each room.
  - 3. Category 6 jacks shall be manufactured by Leviton to match District standards

G. High-Density Workstation

1. Install up to (6) Category 6 cables terminated on gray jack inserts into a double gang flush faceplate.
2. Category 6 jacks shall be manufactured by Leviton to match District standards

H. Emergency Wall-Phone Outlet

1. Install (2) Category 6 cables terminated on a gray jack insert into a double gang faceplate mounted at the Architect's designated height for emergency phones
2. Category 6 jacks shall be manufactured by Leviton to match District standards.

I. Ceiling-mounted Projector Outlet

1. Install (2) Category 6 cables terminated on a gray jack insert into a single gang faceplate at the projector plate.
2. Category 6 jacks shall be manufactured by Leviton to match District standards

J. Wireless Access Point Outlet

1. Install (2) Category 6A cables with 20-foot slack loops at each workstation, terminated on gray jack inserts into a double gang flush faceplate or surface mount box secured to the building structure when mounted above the ceiling.
2. When a Wireless Access Point workstation is installed above the ceiling grid, a label identical to the label on the surface mount box shall be permanently attached to the ceiling grid directly below the surface mount box.
3. At the time of construction, the designer shall take into account the user requirements for wireless coverage and include a sufficient quantity of WAP workstations to enable said coverage.

K. IP Camera Outlet

1. Install (2) Category 6 cable with 20-foot slack loop at each workstation, terminated on a gray jack insert into a double gang flush faceplate or surface mount box when mounted above the ceiling.
2. When a Wireless Access Point workstation is installed above the ceiling grid, a label identical to the label on the surface mount box shall be permanently attached to the ceiling grid directly below the surface mount box.
3. The designer shall coordinate with the security engineer to determine quantities and locations of IP Cameras.

L. Emergency Stanchion (Blue Light/Phone)

1. Install (1) Category 6 4-pair voice-grade PE-39 flooded 22 AWG UTP cable from the closest MDF or IDF to each stanchion-mounted blue light phone location. Terminate the cable on a 4-pair lighting protection module at each end.

6.07 Grounding

- A. Grounding shall be designed and installed in accordance with ANSI-J-STD-607-A.
- B. Install a Telecommunications Main Grounding Busbar (TMGB) (per building) in the MDF and IDF-1s, and a Telecommunications Grounding Busbar (TGB) in each IDF-2.

- C. Install a Telecommunications Bonding Backbone (TBB), #3/0 AWG stranded green insulated copper conductor in a star topology between the TMGB and each TGB in each building. When IDFs are stacked a single TBB can be daisy-chained between TGBs back to the TMGB.
- D. Install an Equipment Bonding Conductor (EBC), #6 AWG green insulated conductor from the TMGB or TGB as applicable to each cable runway system, equipment rack, cabinet, lightning protector, or multi-pair cable with a metallic element.
  - 1. Install a #3/0 AWG stranded green insulated copper conductor from the TMGB to the main building electrical service ground in each building.
  - 2. In a metal frame (structural steel) building, where the steel framework is readily accessible within or external to the room; each TGB and TMGB shall be bonded to the vertical steel metal frame using a minimum #6 AWG conductor. The connection to building steel does not eliminate the requirement for the TBB or BC to the service ground.
- E. Install a Grounding Equalizer Conductor, #3/0 AWG stranded green insulated copper conductor to interconnect multiple TBBs on the top floor and every 3rd floor when required by ANSI J-STD-607-A.
- F. When exceeding 13 feet the conductors shall be sized at 2 kcmil per linear foot of conductor length up to a maximum of 3/0 AWG.

#### 6.08 Labeling

- A. Verify room numbers and confirm the final room numbering scheme prior to generating labels.
- B. Backbone Fiber and Copper Cables shall be labeled within 12 inches of the visible end of the jacket.
- C. Fiber Innerduct shall be labeled within 12 inches of the point of entry of the fiber optic enclosure.
- D. Cables shall be labeled identically at both ends.
- E. MDFs and IDFs Room shall be labeled (signage) with the permanent room designations that match the final building signage for cable labeling.
- F. Equipment racks in each MDF or IDF shall be labeled in sequential numeric order. Labels shall be centered on the top front of the equipment rack.
- G. Fiber optic backbone cable labels shall contain the cable origin room number, the cable destination room number, fiber strand numbers, and type (i.e. MDFA150-IDFC126-50MM001-024/SM001-012).
- H. Fiber optic enclosures shall be labeled alpha-numeric starting with the 1st fiber optic enclosure in the top of the 1st equipment rack. A label for each terminated strand shall be securely placed inside each fiber optic enclosure.
- I. Fiber optic couplers panels in fiber enclosures shall be labeled at each end by strand denoting MDF and/or IDF the cable comes from, and Strand number to and from respectively (i.e. IDFC126-50MM001-012).
- J. Copper backbone cable labels shall contain the cable origin room number, the cable destination room number, and cable pairs (i.e. MDFA150-IDFC126/001-025).

- K. Patch panels in each closet shall be uniquely alphabetically labeled sequentially starting with the first Patch Panel in the top of the first equipment rack (i.e. A, B, C, D, E, etc.). Each MDF or IDF starts with A and shall not repeat a letter. Any MDF/IDF room with more than 26 patch panels shall start with AA, BB, CC...
- L. 110-type blocks shall contain the origin room number, destination room number, and pair numbers, under each pair termination. (i.e. MDFA150-IDFC126-PR 1-25). 110-type block labels shall be printed on product-specific label strips and placed into label holders.
- M. Workstation Faceplates shall be labeled denoting origin MDF/IDF Room Number, patch panel, and port number (i.e. IDFC126-B5).
  - 1. When a Wireless Access Point or IP Camera workstation is installed above the ceiling grid, a label identical to the label on the surface mount box shall be permanently attached to the ceiling grid directly below the surface mount box.

#### 6.09 Testing

- A. Terminated fiber optic strands shall be tested bi-directionally end to end and certified in accordance with applicable industry standards with a light meter and OTDR field tester(s) that are within their calibration period.
- B. Terminated backbone copper cable links shall be tested in accordance with applicable industry standards for attenuation, continuity, and pin-mapping with approved field tester(s) that are within their calibration period.
- C. Terminated Category 6/6A UTP cable shall be tested as a Permanent Link in accordance with applicable industry standards for Category 6 compliance with approved field tester(s) that are within their calibration period.

#### 6.10 As-Built Documentation

- A. Produce drawings depicting the condition of the Structured Cabling System as installed produced in AutoCAD 2007 or higher and provided in hardcopy, electronically in .DWG and .PDF format, and a laminated set in each MDF or IDF-1. Include the exact dimensions and locations of MDF and IDF layouts, wall elevations, equipment rack elevations, cable runways, cable tray, sleeves, backbone and horizontal cable pathways, workstation locations, and numbering and labeling scheme.
- B. Produce cable records for the Structured Cabling System as installed to include a list of all horizontal and backbone cables produced in an Excel format and provided in hardcopy and electronic format indicating cable number, unique cable label, cable type, origin and destination, length, termination method, and pass/fail result.
- C. Produce (3) hard copies of all test results for each cable, to include technician's name and date stamp, a list of tested cables, and the individual results for each cable tested. Test results shall be furnished on CD ROM to include native file format and .PDF format.

**PART 7 SUMMARY and SYNOPSIS OF STANDARDS**

7.01 Summary

- A. All aspects of this Alamo Colleges Telecommunications Infrastructure Standards shall be applied to the design process for both new and renovated facilities.
- B. A Division 27 10 00 specification and T-Series drawings shall be commissioned and issued by the Architect during the design phases for each facility or project.

REMAINDER OF PAGE INTENTIONALLY BLANK

C. Facility Standards

SPACE	CAMPUS MDF	BUILDING MDF	IDF-1 AND IDF-2
<p><b>ARCHITECTURAL</b></p>	<ul style="list-style-type: none"> <li>Minimum of 600 square feet, minimum clear lineal wall length 30 feet, walls to deck, floor sealed bare concrete, no windows, exterior wall within 50 feet of building exterior, not be located adjacent to or below restrooms or other water-based facilities, or sources of EMI and mechanical vibration, all walls covered with plywood, without a ceiling or a lift-out tile ceiling, minimum 42-inch by 80-inch clear door opening, door not open to the exterior of the building, proximity card reader and electrified door hardware, sprinkler system, consider pre-action.</li> </ul>	<ul style="list-style-type: none"> <li>Minimum of 400 square feet, minimum clear lineal wall length 25 feet, all walls to deck, floor sealed bare concrete, no windows, exterior wall that is within 50 feet of the building exterior, not be located adjacent or below restrooms or other water-based facilities, or sources of EMI and mechanical vibration, all walls covered with plywood, without a ceiling or a lift-out tile ceiling, minimum 42-inch by 80-inch clear door opening, door not open to the exterior of the building, proximity card reader and electrified door hardware, sprinkler system, consider pre-action.</li> </ul>	<ul style="list-style-type: none"> <li>Minimum of 108 square feet, minimum clear lineal wall lengths of at least 9 feet by 12 feet, all walls to deck, floor sealed bare concrete, windows are not recommended, IDFs shall be arranged in a stacked formation in multi-story buildings, and not be located near sources of EMI and mechanical vibration, all walls covered with plywood, the room shall be without a ceiling, minimum 36-inch by 80-inch clear door, proximity card reader and electrified door hardware.</li> </ul>
<p><b>HVAC</b></p>	<ul style="list-style-type: none"> <li>Dedicated unit that is part of the building's main system, maintain a constant 24/7 cooled environment between 68° and 75° F with humidity of 41.9°F Dew Point to 60% RH and 59°F Dew Point, minimum HVAC load shall be designed to displace 20KW of power, or 6 Tons, maintain temp and humidity in the event of building power outages or main unit failure.</li> </ul>	<ul style="list-style-type: none"> <li>Dedicated unit that is part of the building's main system, maintain a constant 24/7 cooled environment between 68° and 75° F with humidity of 41.9°F Dew Point to 60% RH and 59°F Dew Point, minimum HVAC load shall be designed to displace 12KW of power, or 3.5 Tons, maintains temp and humidity in the event of building power outages or main unit failure.</li> </ul>	<ul style="list-style-type: none"> <li>Serviced by the building HVAC system and equipped with Split DX system that cools only when the building HVAC is inadequate, maintain a constant 24/7 cooled environment between 68° and 75° F with humidity of 40% to 55%, minimum HVAC load shall be designed to displace 2KW of power, or 0.6 of a Ton.</li> </ul>
<p><b>LIGHTING</b></p>	<ul style="list-style-type: none"> <li>Minimum of 50 foot candles at 2 feet above the floor in the entire space. Equipped <b>with emergency lighting</b> to keep the space lit during power outages, fixtures 18 inches above top of the highest rack or cable runway.</li> </ul>	<ul style="list-style-type: none"> <li>Minimum of 50 foot candles at 2 feet above the floor in the entire space. <b>Equipped with emergency lighting</b> to keep the space lit during power outages, fixtures 18 inches above top of the highest rack or cable runway.</li> </ul>	<ul style="list-style-type: none"> <li>Minimum of 40 foot candles at 2 feet above the floor, fixtures 18 inches above top of the highest rack or cable runway. Equipped <b>with emergency lighting</b>.</li> </ul>
<p><b>POWER</b></p>	<ul style="list-style-type: none"> <li>(2) dedicated 208 volt 3-phase 150 Amp circuits, 4-wire (2PH + N +G), hardwired to the UPS(s), originating electrical panel will be equipped with (2) 150 AMP breakers, minimum of (1) APC Symmetra LX 16kVA Scalable to 16kVA N+1 Ext. Run Tower, 208/240V, to provide 30 minutes of run time at full load.</li> </ul>	<ul style="list-style-type: none"> <li>(2) dedicated 208 volt 3-phase 150 Amp circuits, 4-wire (2PH + N +G), hardwired to the UPS(s). The originating electrical panel will be equipped with (2) 150 AMP breakers, minimum of (1) APC Symmetra LX 16kVA Scalable to 16kVA N+1 Ext. Run Tower, 208/240V, to</li> </ul>	<ul style="list-style-type: none"> <li>(2) dedicated 120 volt 20 Amp circuits, each with a simplex NEMA L5-20R receptacle. The originating electrical panel will be equipped with 20 AMP breakers. Conductors shall be routed from the panel in conduit along the cable runway to a metallic back box clipped to the rail of</li> </ul>

	<ul style="list-style-type: none"> <li>• A Duplex receptacle shall be spaced at least 1 foot from an adjacent wall and every 6 feet thereafter, minimum of (1) Duplex receptacle shall be placed in each wall.</li> </ul>	<p>provide 30 minutes of run time at full load.</p> <ul style="list-style-type: none"> <li>• A Duplex receptacle shall be spaced at least 1 foot from an adjacent wall and every 6 feet thereafter, minimum of (1) Duplex receptacle shall be placed in each wall.</li> </ul>	<p>the Cable Runway, facing the rear of the racks, minimum (1) APC Symmetra SmartUPS 2200 SUA2200R2X106 with a single NEMA L5-20P power cord to provide 5 minutes of run time at full load.</p> <ul style="list-style-type: none"> <li>• A Duplex receptacle shall be spaced at least 1 foot from an adjacent wall and every 6 feet thereafter, minimum of (1) Duplex receptacle shall be placed in each wall.</li> </ul>
<p><b>RACKS AND CABLE MANAGEMENT</b></p>	<ul style="list-style-type: none"> <li>• (4) Standard Equipment Racks, vertical cable manager on both sides of the rack, horizontal wire manager above and below each horizontal patch panel.</li> <li>• (2) Server Cabinets, space shall be allocated for an additional (7) future Server Cabinets.</li> <li>• Space equivalent to (2) Server Cabinets shall be allocated for service provider equipment.</li> <li>• Cable runway encircling the room at 86 inches above the finished floor, and crossing the room parallel to the rack rows (3) times, vertical section of cable runway from the entrance conduits to the overhead cable runway.</li> </ul>	<ul style="list-style-type: none"> <li>• (4) Standard Equipment Racks, vertical cable manager on both sides of the rack, horizontal wire manager above and below each horizontal patch panel.</li> <li>• (1) Server Cabinet, space shall be allocated for an additional (3) future Server Cabinets.</li> <li>• Wall space at the back of the Building MDF shall be allocated for service provider equipment.</li> <li>• Cable runway encircling the room at 86 inches above the finished floor, and crossing the room parallel to the rack rows (2) times, vertical section of cable runway from the entrance conduits to the overhead cable runway.</li> </ul>	<ul style="list-style-type: none"> <li>• (2) Standard Equipment Racks, vertical cable manager on both sides of the rack, horizontal wire manager above and below each horizontal patch panel, an equal number of horizontal wire managers shall be furnished for the network switches.</li> <li>• Space reserved for additional rack and vertical wire manager, a third rack and vertical wire manager IDFs that serve equipment racks located in Lab(s).</li> <li>• Cable runway encircling the room at 84-86 inches above the finished floor, and crossing the room parallel to the rack rows (1) time, vertical section of cable runway from floor sleeves to the overhead cable runway.</li> </ul>

D. Technical Standards

TECHNOLOGY	STANDARDS
<p><b>ENTRANCE PATHWAYS AND CONDUITS</b></p>	<ul style="list-style-type: none"> <li>• Service Provider Conduits; Minimum of (4) 4-inch conduits from the MDF to the edge of the property Right of Way.</li> <li>• Campus Serving Conduits: Minimum of (2) 4-inch conduits shall route underground from the Campus MDF to the IDF-1 of each additional building on the campus.</li> <li>• Building Entrance for Large Campus: MEP and Structural Engineer shall consider a conduit entrance vault.</li> </ul>
<p><b>CABLE MANAGEMENT IN TELECOM SPACES</b></p>	<ul style="list-style-type: none"> <li>• Racks black aluminum Standard Equipment Racks with EIA 19-inch rails, 84-inch (45 RMU) overall height, 3-inch rail depth, dual floor mounting flanges, and rack mount unit markings engraved on the rails.</li> <li>• Server Cabinets 24 inches by 42 inches by 84 inches with adjustable front and rear EIA 19" rail kits, enclosed with ventilated front and rear locking doors, adjustable leveling feet, vertical cable manager for one rail, and grounding kit.</li> <li>• Overhead Cable Management 18-inch (MDF) or 12-inch (IDF) Universal Cable Runway made of 3/8" x 1-1/2" x .065" wall rectangular steel tubing with cross members welded at 12 inch intervals.</li> <li>• Vertical cable managers black double-sided, 6 inches wide, 12.75 inches deep, and 84 inches tall, no doors, and include formed cabling sections, lockable cabling latches at 12-inch intervals, and protective edge guards.</li> <li>• Horizontal cable managers black double-sided, 19 inches wide, 11.73 inches deep, and 2 RMU, cable guide fingers at 1.75" intervals, flanged pass-through slots, and snap-on, hinged door/cover.</li> </ul>
<p><b>CABLE SUPPORT IN PATHWAYS AND LOCAL POWER</b></p>	<ul style="list-style-type: none"> <li>• Main cable pathway support shall be Electro Zinc Wire Mesh Basket Tray</li> <li>• Above MDFs or IDFs install minimum of (4) 4" EMT sleeves through the partition wall.</li> <li>• Between MDF and IDFs install minimum of (2) 4" EMT sleeves</li> <li>• Wall-mounted workstation location, double-gang back box with double-gang mud ring, 1-inch conduit from the rough-in box to the cable tray, terminate the conduit above the edge of the cable tray, conduit not required to be bonded to the tray.</li> <li>• At floor-mounted workstation locations (1) 1 inch conduit for every (6) cables from the floor box to the cable tray. For poke-thrus, route the conduit to the cable tray in the floor below. For modular furniture workstations, a rough-in pathway shall be considered and designed according to the furniture type, quantity of cables, and location as required for each furniture system.</li> <li>• The electrical engineer shall design a duplex NEMA 5-15R receptacle within 18" of each workstation outlet location.</li> <li>• EZ Path Sleeves or Fire rated cable pathway devices shall be used in fire-rated construction for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high-voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the prints</li> </ul>
<p><b>INTER-BUILDING BACKBONE CABLING</b></p>	<ul style="list-style-type: none"> <li>• Copper Cabling 50-pair PE-39 24 AWG flooded UTP from the Campus MDF to the IDF-1 in each of the buildings on the campus, terminate on lightning protection and 110 blocks</li> <li>• Fiber Optic Cabling loose tube outdoor-rated composite 12-Strand Single Mode / 24-Strand 50 micron OM3 Multi Mode from the Campus MDF to the IDF-1 in each of the buildings on the campus, installed in 1-inch outdoor-rated innerduct, terminate with LC connectors.</li> </ul>
<p><b>INTRA-BUILDING BACKBONE CABLING</b></p>	<ul style="list-style-type: none"> <li>• Copper Cabling 25-pair Category 3 plenum rated 24 AWG UTP from the MDF or IDF-1 to each of the IDF-2s in the building, terminate on 110 blocks.</li> <li>• Category 6A network uplinks (2) Category 6 UTP plenum rated blue sheath, between the Special Systems patch panels in MDF and IDFs on adjacent floors that are vertically stacked, and between IDF-2s on the same floor, where the permanent link of the Category 6A cable does not exceed 328 feet.</li> <li>• Fiber Optic Cabling shall be tight buffered plenum-rated composite 6-Strand Single Mode / 12-Strand 50 micron OM3 or OM4 Multi Mode, encased in orange interlocking armor, terminate with LC connectors.</li> </ul>
<p><b>HORIZONTAL CABLING</b></p>	<ul style="list-style-type: none"> <li>• Horizontal Data Cabling shall be Category 6/6A UTP Berktek, General Cables, Hitachi or approved equal, minimum factory sweep tested to 550 MHz, plenum rated, blue sheath, terminated in a gray Category 6/6A modular jack insert and snapped into a 2-gang, furniture, floor box or poke-thru faceplate, terminated on Category 6/6A 48-port IDC patch panels with the EIA-568B sequence, Category 6/6A modular non-booted patch cords.</li> <li>• Category 6/6A jacks shall be manufactured by Leviton</li> </ul>

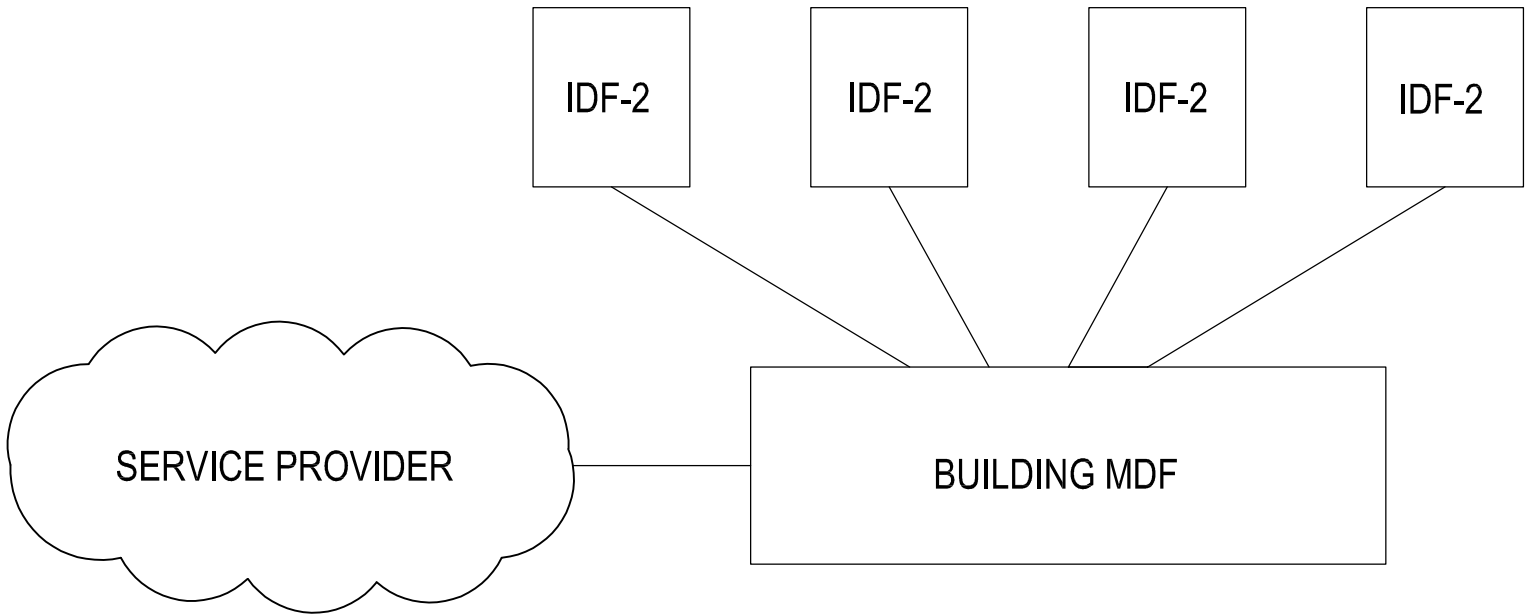


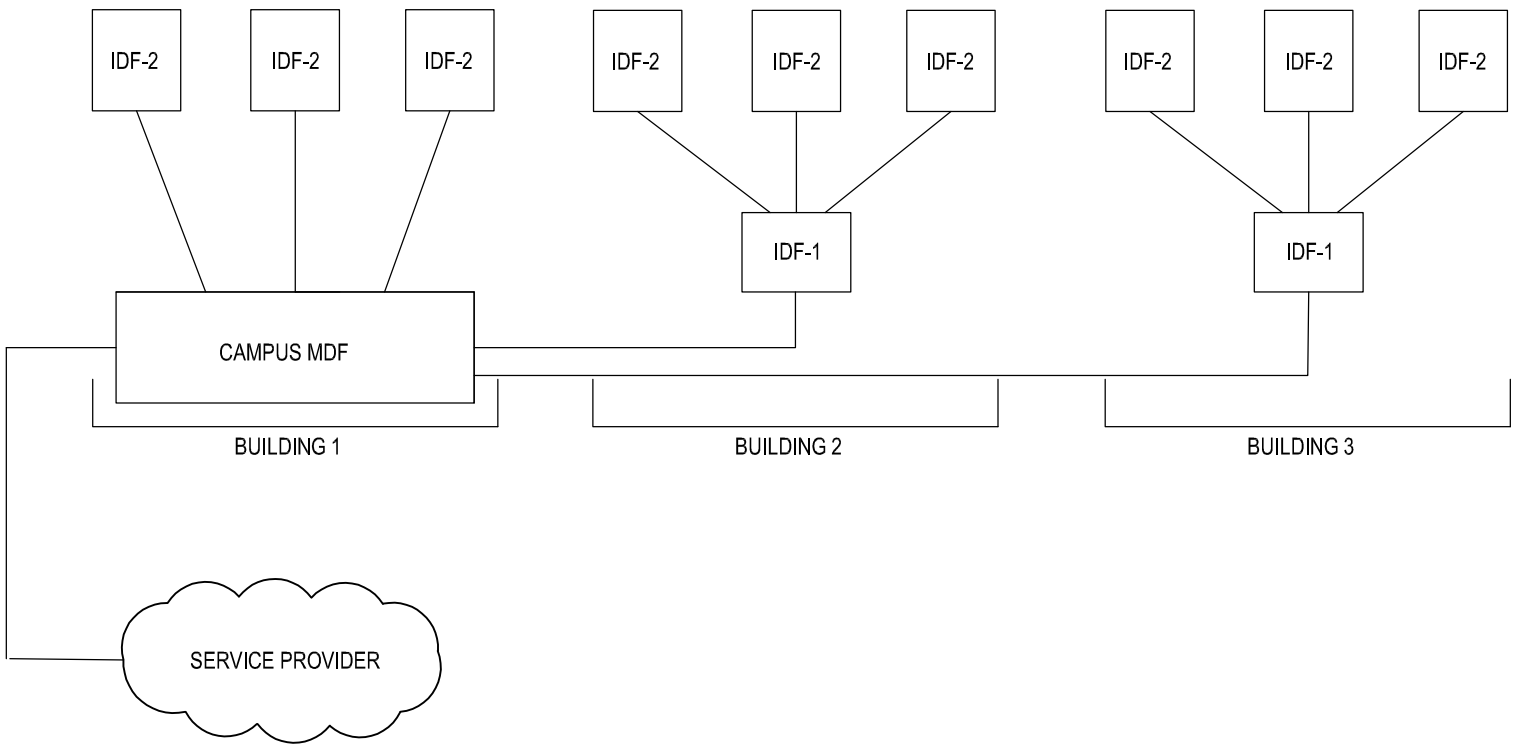
<p><b>HORIZONTAL CABLING</b></p>	<ul style="list-style-type: none"> <li>• Office Workstation: (2) Category 6 cables terminated on gray jack inserts into a double gang flush faceplate.</li> <li>• Classroom Instructor Workstation: (2) Category 6 cables terminated on gray jack inserts into a double gang flush faceplate.</li> <li>• High-Density Workstation: up to (6) Category 6 cables terminated on gray jack inserts into a double gang flush faceplate.</li> <li>• Emergency Wall-Phone Outlet: (2) Category 6 cables terminated on a gray Leviton jack insert into a double gang faceplate.</li> <li>• Ceiling-mounted Projector Outlet: (2) Category 6 cables terminated on a gray Leviton jack insert into a single gang faceplate.</li> <li>• Wireless Access Point Outlet: (2) <u>Category 6A</u> cables with 20-foot slack loops at each workstation, terminated on gray jack inserts into a double gang flush faceplate or surface mount box when mounted above the ceiling.</li> <li>• IP Camera Outlet: (2) Category 6 cable with 20-foot slack loop at each workstation, terminated on a gray jack insert into a double gang flush faceplate or surface mount box when mounted above the ceiling. IP Camera cabling shall be on separate Category 6 patch panels in each MDF/IDF.</li> <li>• Emergency Stanchion (Blue Light/Phone): (1) Category 6 4-pair voice-grade PE-39 flooded 22 AWG UTP cable from the closest MDF or IDF to each stanchion-mounted blue light phone location. Terminate the cable on a 4-pair lighting protection module at each end.</li> </ul>
<p><b>GROUNDING</b></p>	<ul style="list-style-type: none"> <li>• Grounding shall be designed and installed in accordance with ANSI-J-STD-607-A.</li> <li>• Install a Telecommunications Main Grounding Busbar (TMGB) (per building) in the MDF and IDF-1s, and a Telecommunications Grounding Busbar (TGB) in each IDF-2.</li> <li>• Install a Telecommunications Bonding Backbone (TBB), #3/0 AWG stranded green insulated copper conductor in a star topology between the TMGB and each TGB in each building. When IDFs are stacked a single TBB can be daisy-chained between TGBs back to the TMGB.</li> <li>• Install an Equipment Bonding Conductor (EBC), #6 AWG green insulated conductor from the TMGB or TGB as applicable to each cable runway system, equipment rack, cabinet, lightning protector, or multi-pair cable with a metallic element.</li> <li>• Install a #3/0 AWG stranded green insulated copper conductor from the TMGB to the main building electrical service ground in each building.</li> <li>• In a metal frame (structural steel) building, where the steel framework is readily accessible within or external to the room; each TGB and TMGB shall be bonded to the vertical steel metal frame using a minimum #6 AWG conductor.</li> <li>• Install a Grounding Equalizer Conductor, #3/0 AWG stranded green insulated copper conductor to interconnect multiple TBBs on the top floor and every 3rd floor when required by ANSI J-STD-607-A.</li> </ul>
<p><b>LABELING</b></p>	<ul style="list-style-type: none"> <li>• Verify room numbers and confirm the final room numbering scheme prior to generating labels.</li> <li>• Backbone Fiber and Copper Cables shall be labeled within 12 inches of the visible end of the jacket.</li> <li>• Fiber Innerduct shall be labeled within 12 inches of the point of entry of the fiber optic enclosure.</li> <li>• Cables shall be labeled identically at both ends.</li> <li>• MDFs and IDFs Room shall be labeled (signage) with the permanent room designations that match the final building signage for cable labeling.</li> <li>• Equipment racks in each MDF or IDF shall be labeled in sequential numeric order. Labels shall be centered on the top front of the equipment rack.</li> <li>• Fiber optic backbone cable labels shall contain the cable origin room number, the cable destination room number, fiber strand numbers, and type (i.e. MDFA150-IDFC126-50MM001-024/SM001-012).</li> <li>• Fiber optic enclosures shall be labeled alpha-numeric starting with the 1st fiber optic enclosure in the top of the 1st equipment rack. A label for each terminated strand shall be securely placed inside each fiber optic enclosure.</li> <li>• Fiber optic couplers panels in fiber enclosures shall be labeled at each end by strand denoting MDF and/or IDF the cable comes from, and Strand number to and from respectively (i.e. IDFC126-50MM001-012).</li> <li>• Copper backbone cable labels shall contain the cable origin room number, the cable destination room number, and cable pairs (i.e. MDFA150-IDFC126/001-025).</li> <li>• Patch panels in each closet shall be uniquely alphabetically labeled sequentially starting with the first Patch Panel in the top of the first equipment rack (i.e. A, B, C, D, E, etc.). Each MDF or IDF starts with A and shall not repeat a letter. Any MDF/IDF room with more than 26 patch panels shall start with AA, BB, CC...</li> <li>• 110-type blocks shall contain the origin room number, destination room number, and pair numbers, under each pair termination. (i.e. MDFA150-IDFC126-PR 1-25). 110-type block labels shall be printed on product-specific label strips and placed into label holders.</li> </ul>

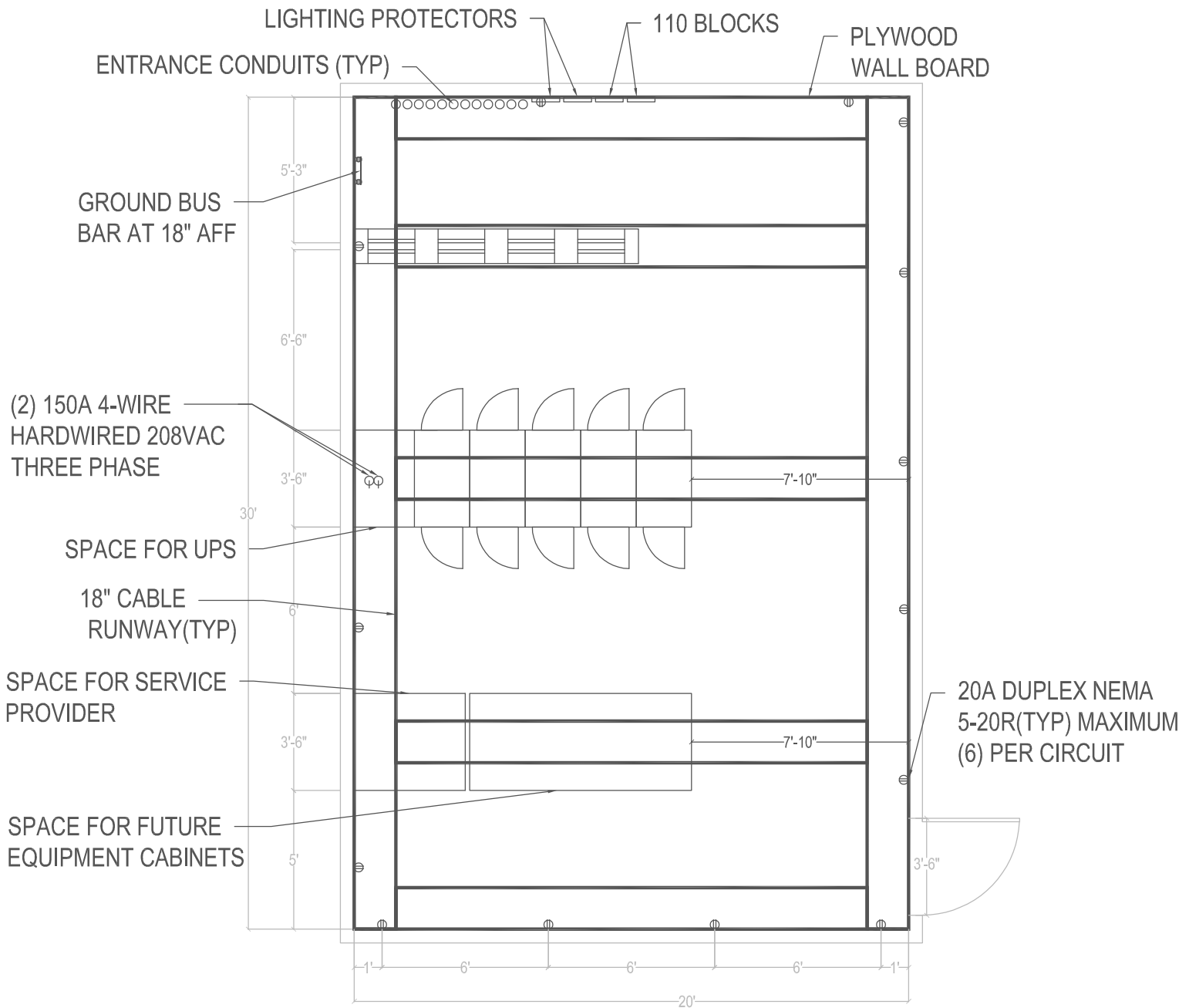
<b>LABELING</b>	<ul style="list-style-type: none"><li>• Workstation Faceplates shall be labeled denoting origin MDF/IDF Room Number, patch panel, and port number (i.e. IDFC126-B5).</li><li>• When a Wireless Access Point or IP Camera workstation is installed above the ceiling grid, a label identical to the label on the surface mount box shall be permanently attached to the ceiling grid directly below the surface mount box.</li></ul>
<b>TESTING</b>	<ul style="list-style-type: none"><li>• Terminated fiber optic strands shall be tested bi-directionally end to end and certified in accordance with applicable industry standards with a light meter and OTDR field tester(s) that are within their calibration period.</li><li>• Terminated backbone copper cable links shall be tested in accordance with applicable industry standards for attenuation, continuity, and pin-mapping with approved field tester(s) that are within their calibration period.</li><li>• Terminated Category 6/6A UTP cable shall be tested as a Permanent Link in accordance with applicable industry standards for Category 6/6A compliance with approved field tester(s) that are within their calibration period.</li></ul>

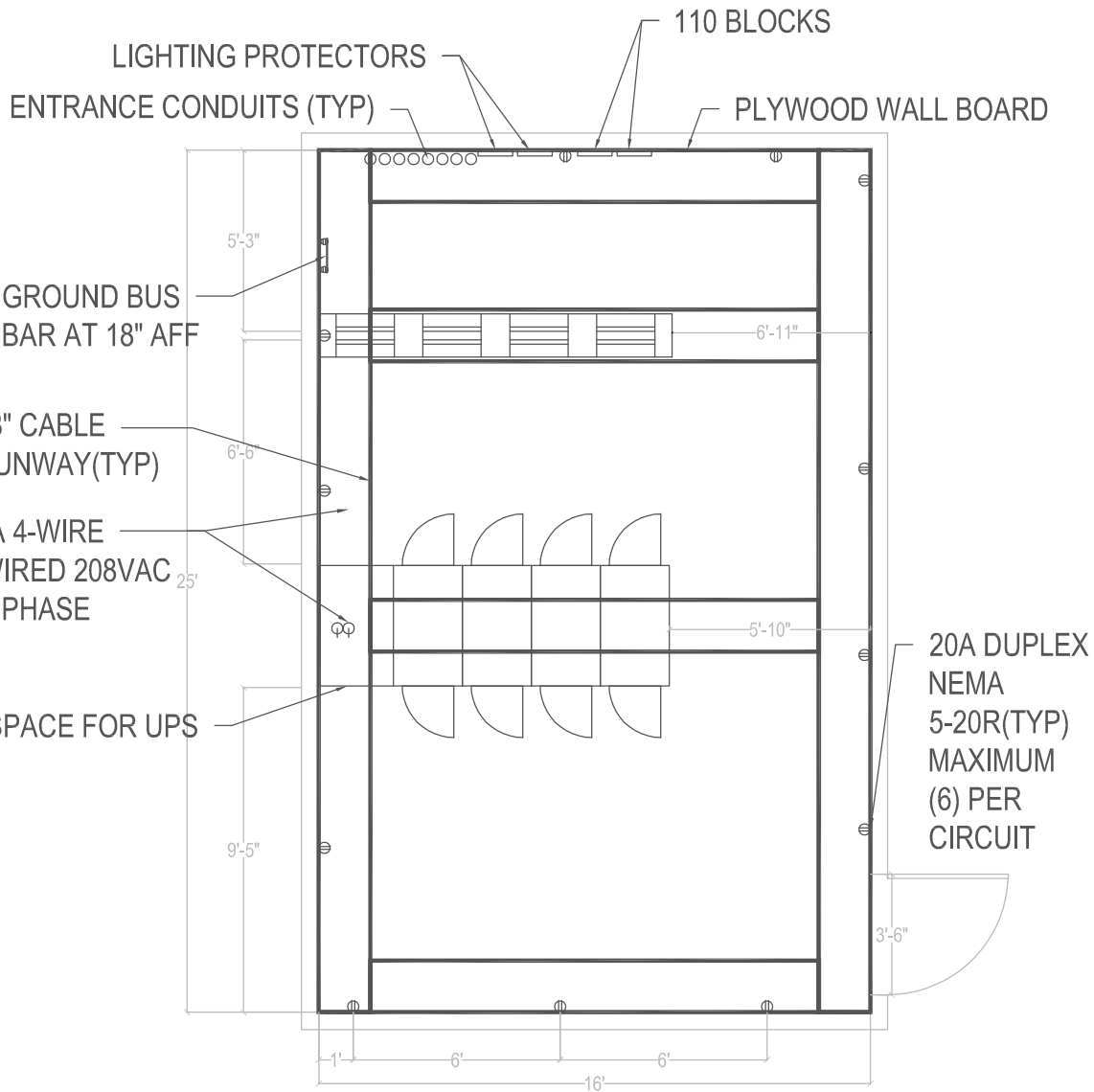
## **PART 8 TELECOMMUNICATIONS DIAGRAMS**

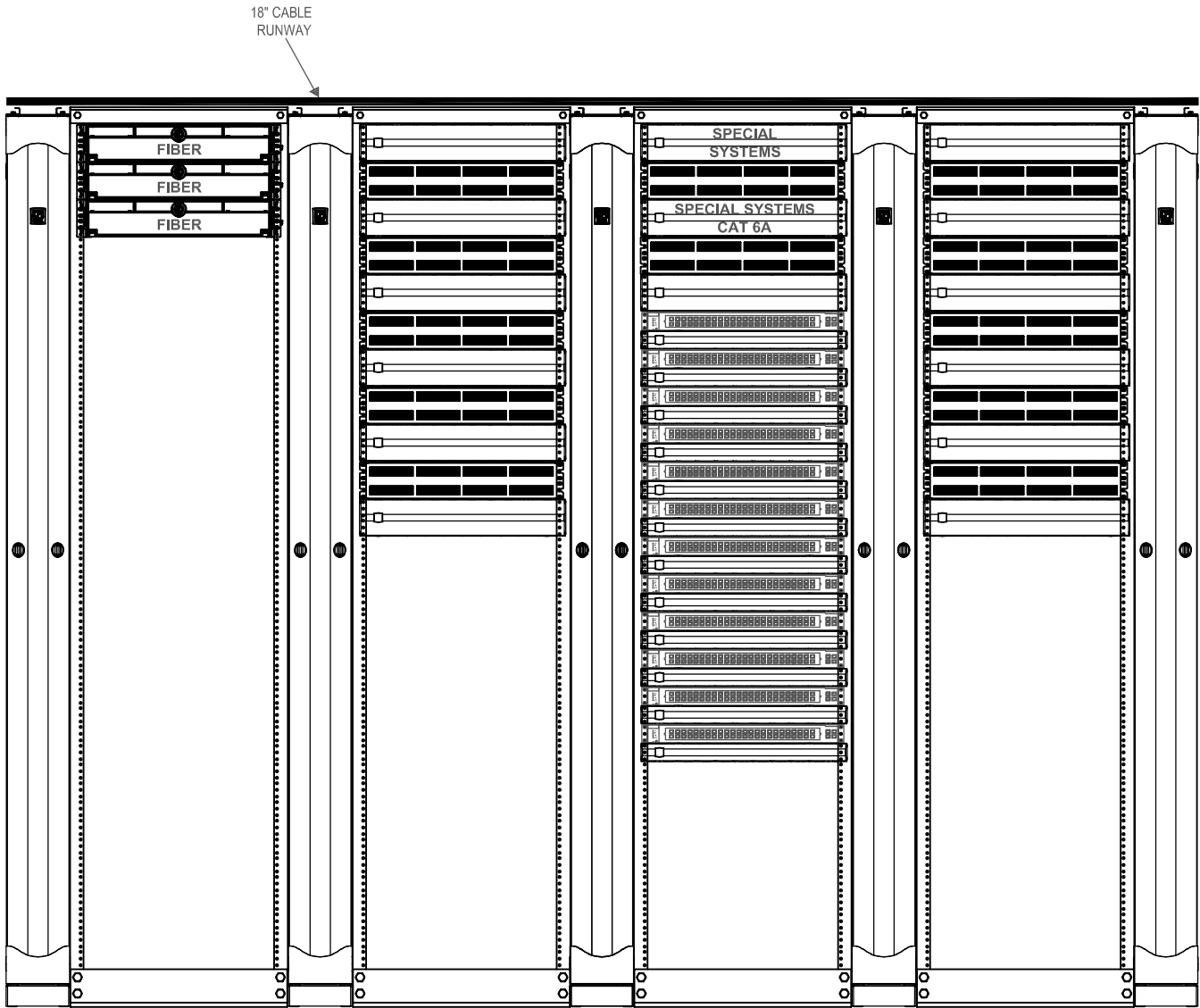
PAGE INTENTIONALLY BLANK





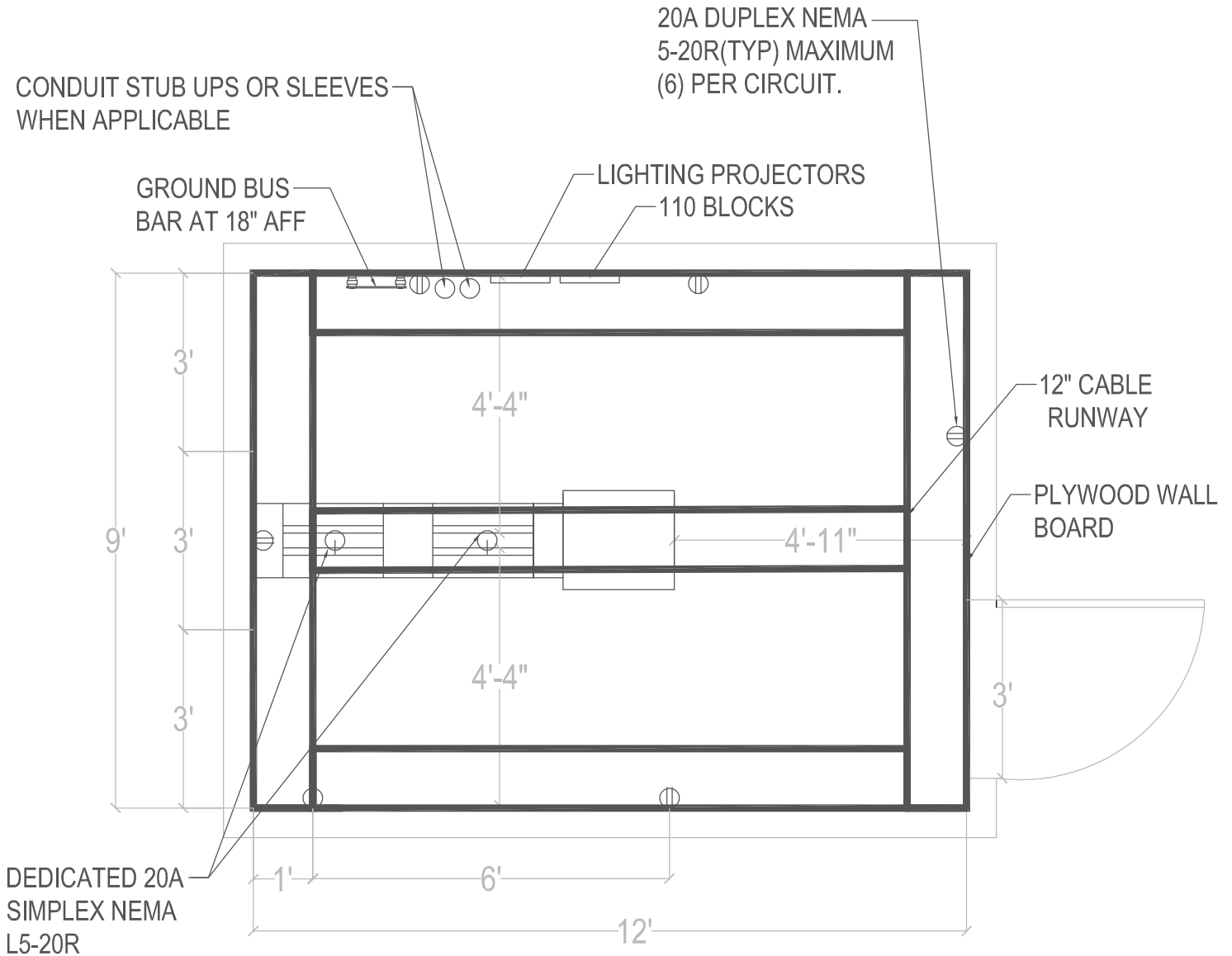




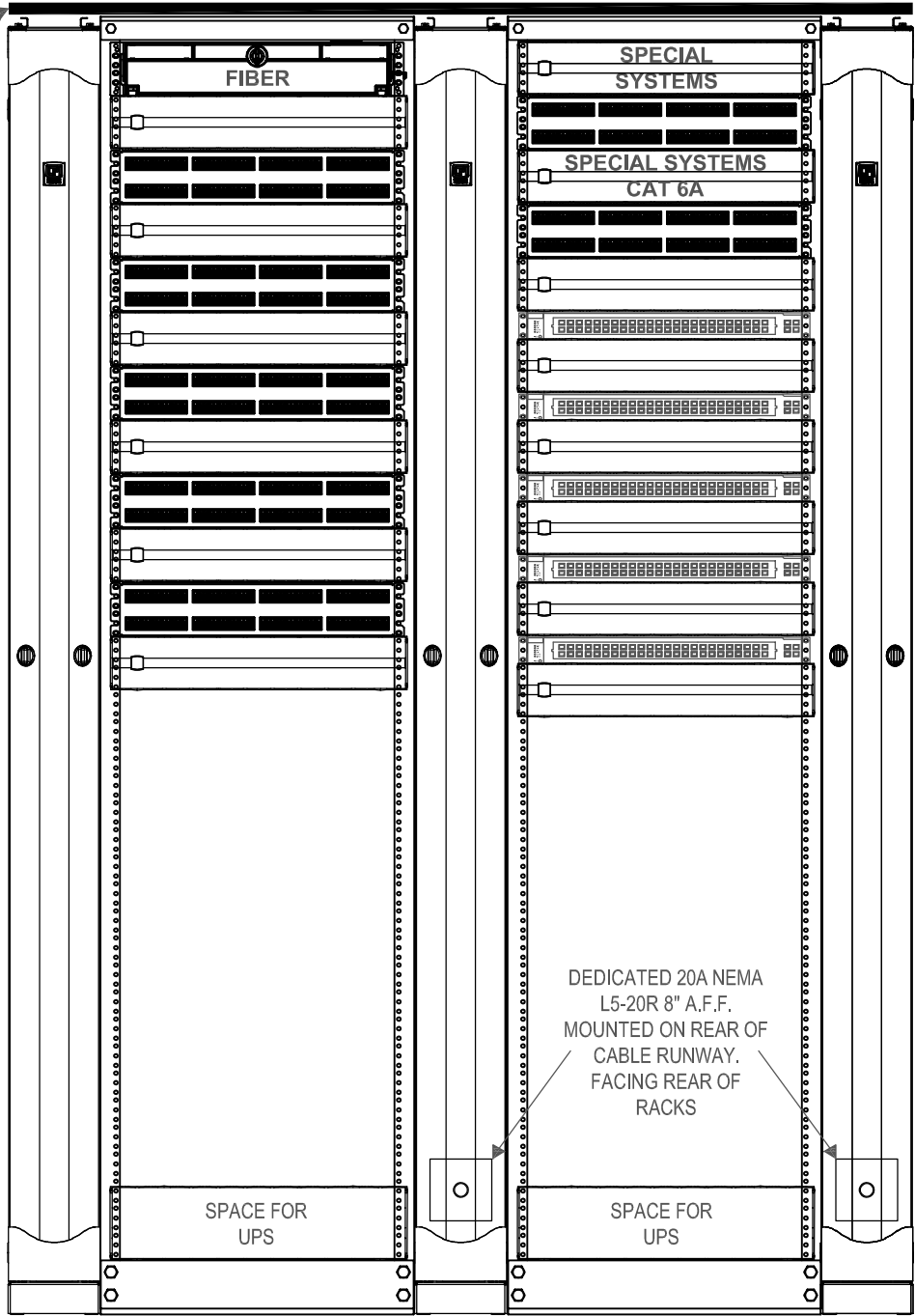


NOTE: 1. SPECIAL SYSTEM SECURITY, BMS, AV, CAMERAS, HVAC, FIRE ALARM, DIGITAL SIGNAGE  
 2. SPECIAL SYSTEM CAT 6A WAPS,UPLINK

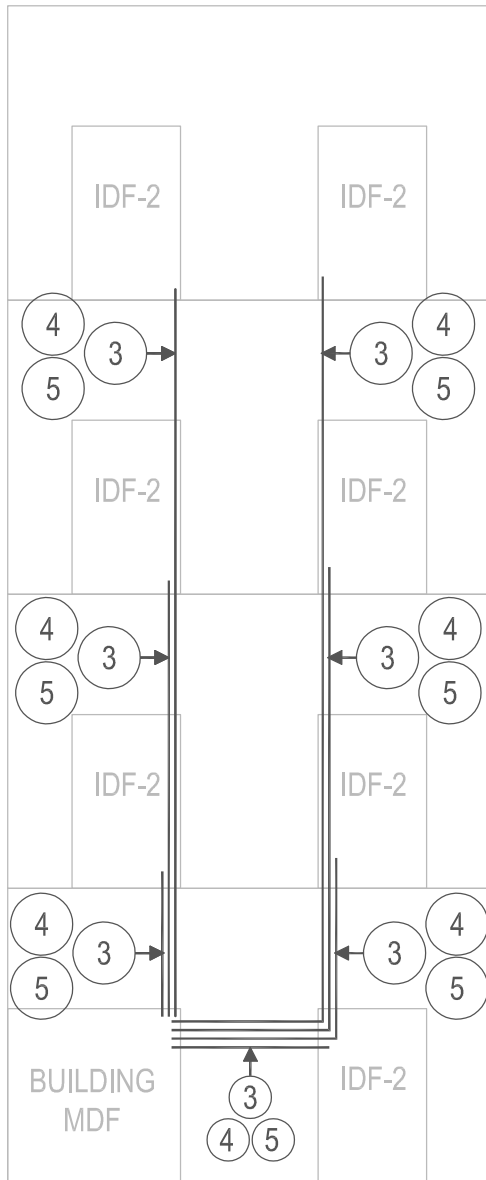




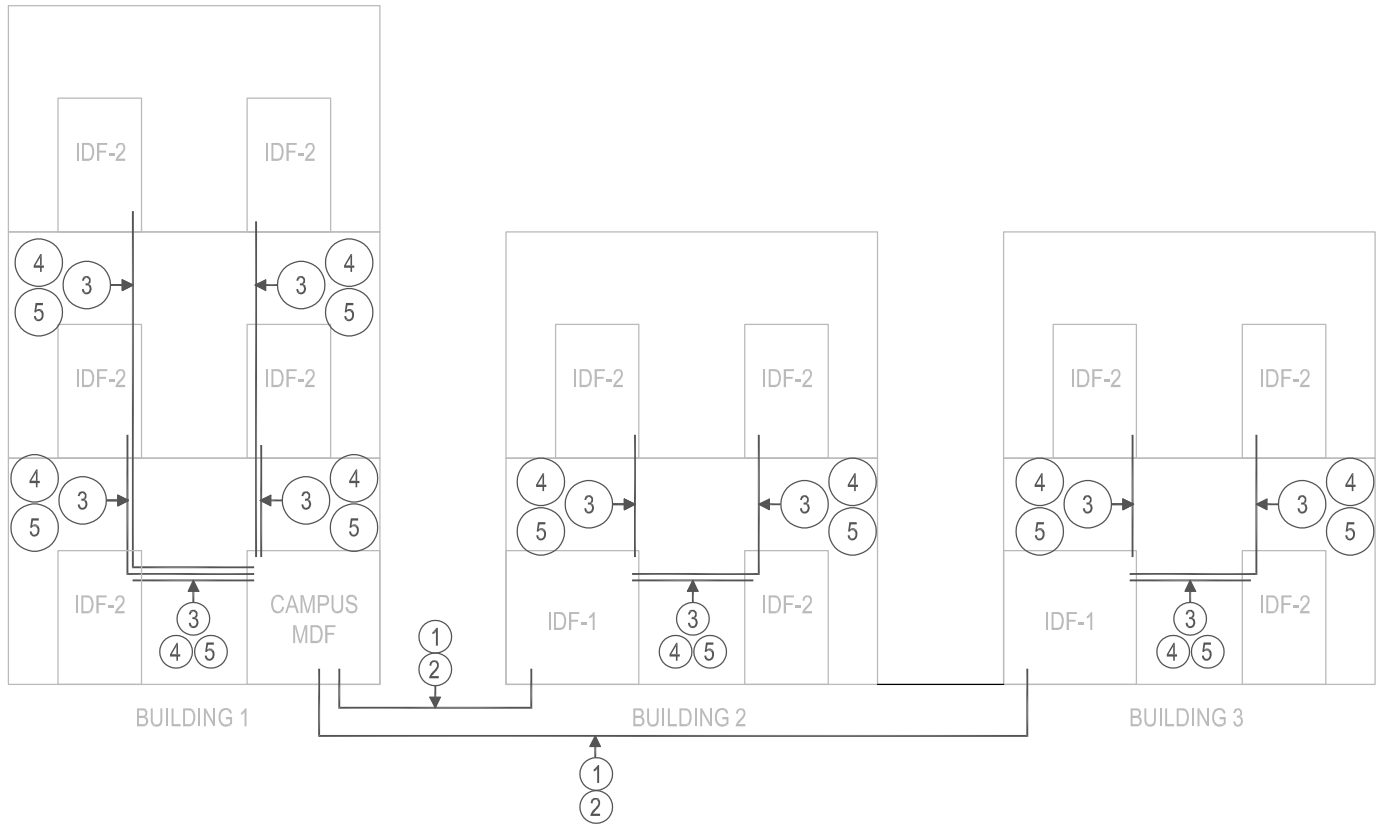
12" CABLE RUNWAY



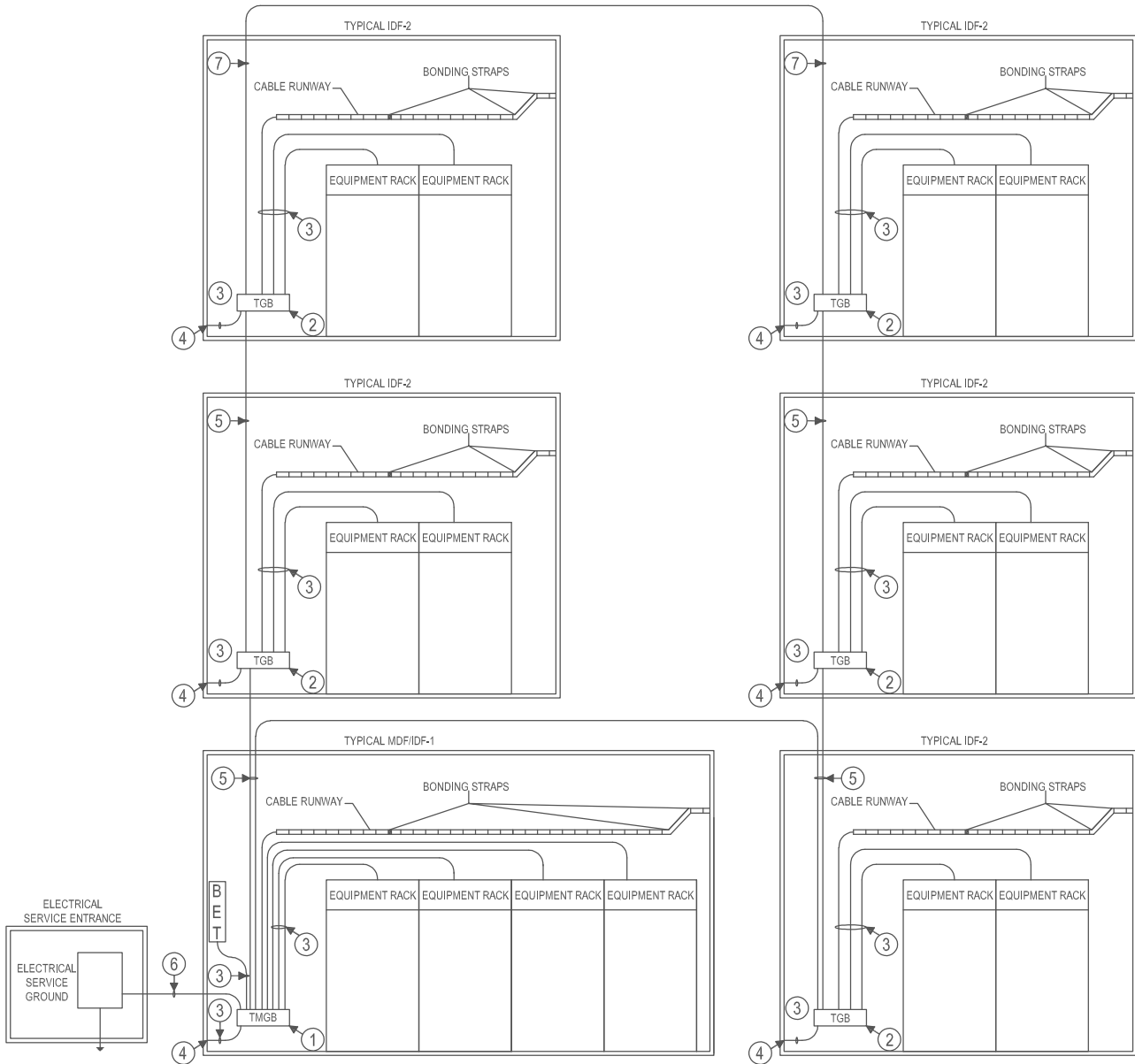
NOTE: 1. SPECIAL SYSTEM SECURITY, BMS, AV, CAMERAS, HVAC, FIRE ALARM, DIGITAL SIGNAGE  
 2. SPECIAL SYSTEM CAT 6A WAPS, UPLINK



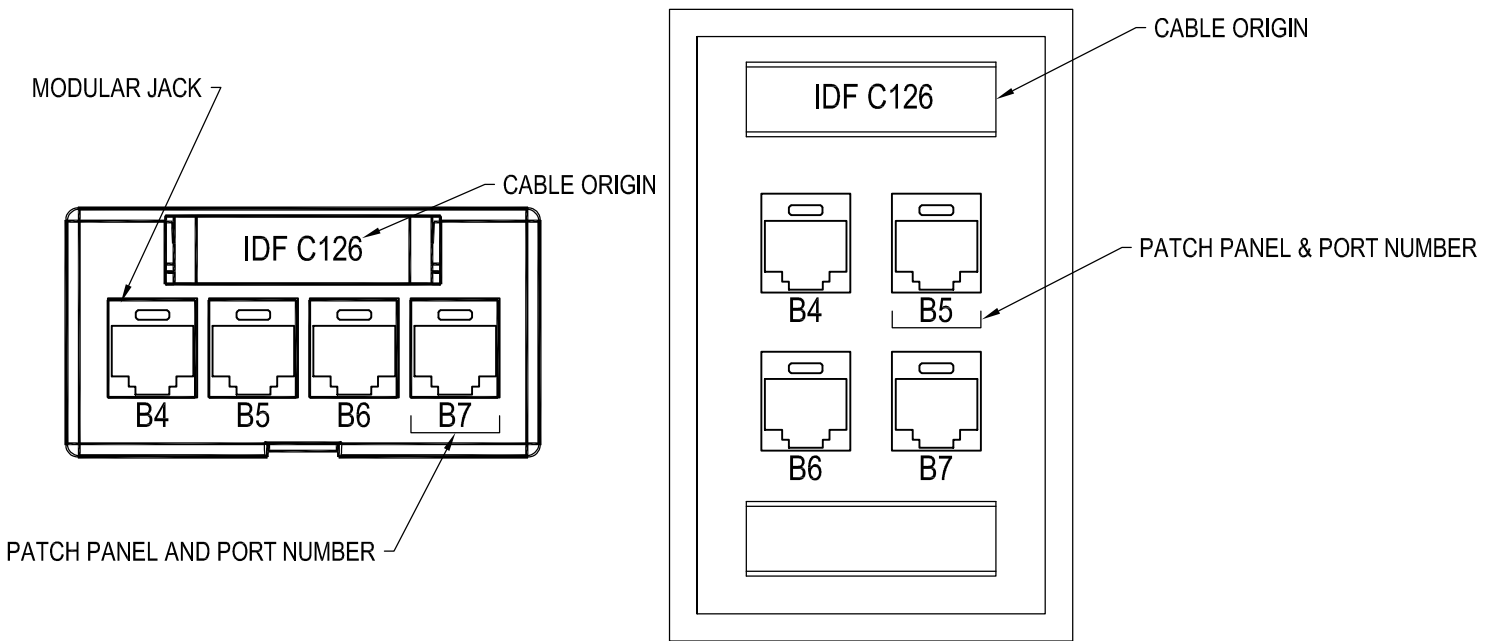
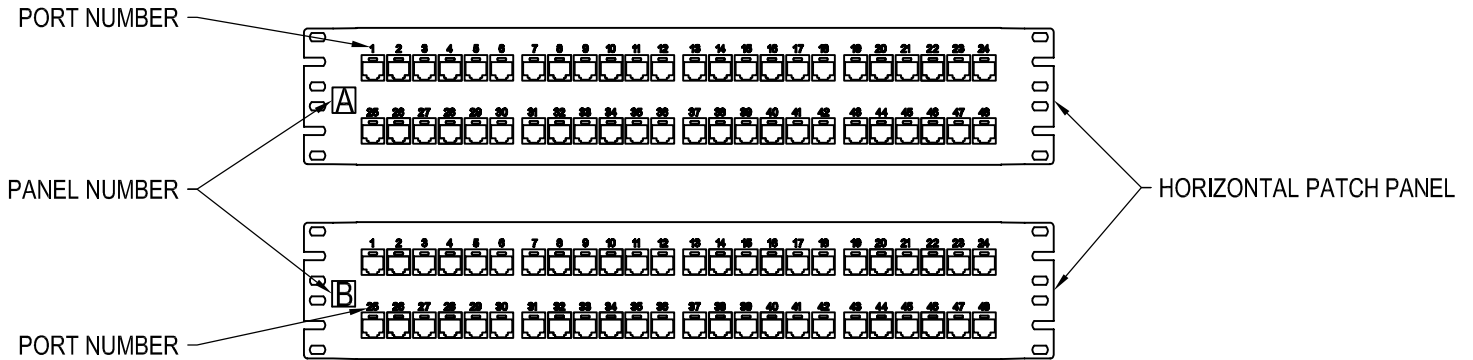
- ① 24-STR 50 MICRON OM3 MULTI-MODE/12-STR 9 MICRON SINGLE MODE FIBER
- ② 50-PAIR PE-39 OSP COPPER UTP
- ③ 12-STR 50 MICRON OM3 MULTI-MODE/6-STR 9 MICRON SINGLE MODE ARMORED
- ④ 25-PAIR CATEGORY 3 UTP
- ⑤ (2) CATEGORY 6A UTP, PATCH PANEL TO PATCH PANEL



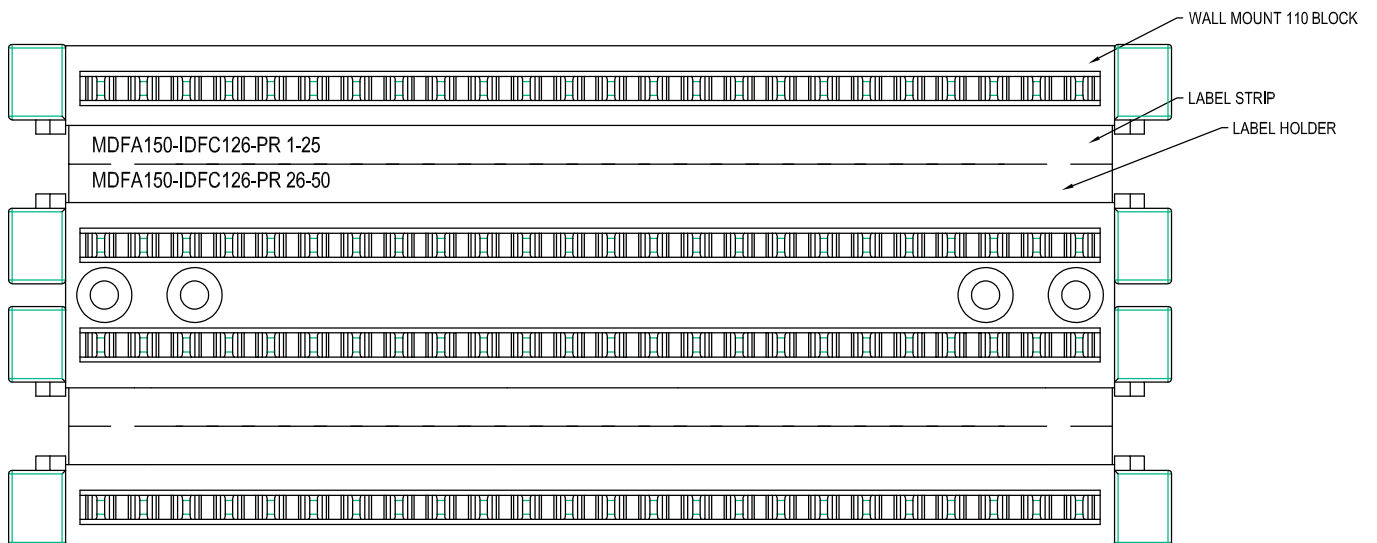
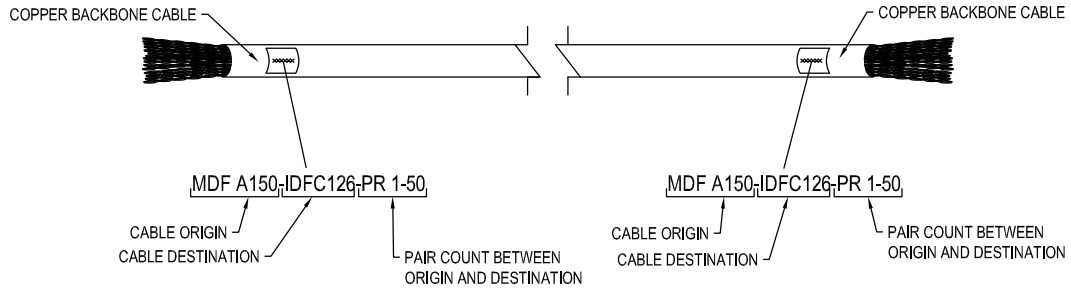
- ① 24-STR 50 MICRON OM3 MULTI-MODE/12-STR 9 MICRON SINGLE MODE FIBER
- ② 50-PAIR PE-39 OSP COPPER UTP
- ③ 12-STR 50 MICRON OM3 MULTI-MODE/6-STR 9 MICRON SINGLE MODE ARMORED
- ④ 25-PAIR CATEGORY 3 UTP
- ⑤ (2) CATEGORY 6A UTP, PATCH PANEL TO PATCH PANEL



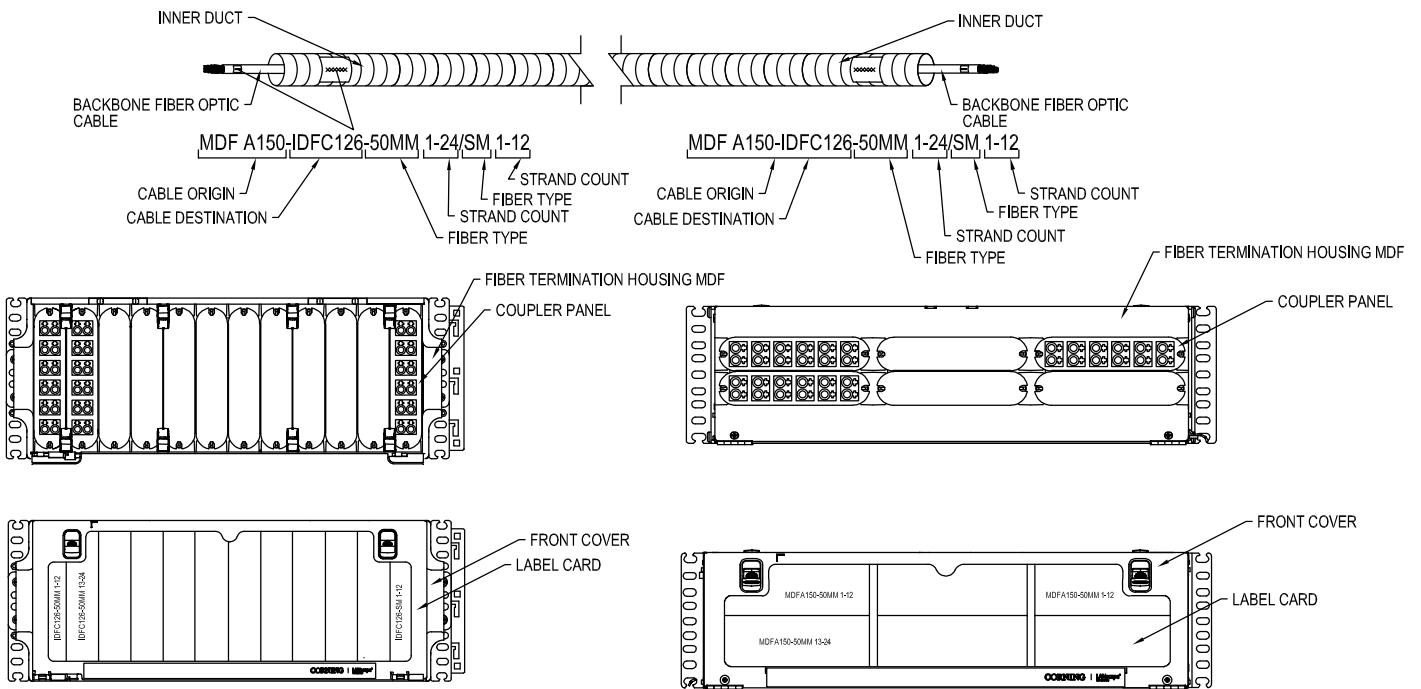
- ① TELECOMMUNICATIONS MAIN GROUNDING BUS BAR (TMGB)
- ② TELECOMMUNICATIONS GROUNDING BUS BAR (TGB)
- ③ TELECOMMUNICATIONS BONDING CONDUCTOR (TBC) #6 AWG
- ④ CONNECT TO GROUNDED BUILDING STEEL WHEN EXPOSED IN ROOM.
- ⑤ TELECOMMUNICATIONS BONDING BACKBONE (TBC) #3/0 AWG
- ⑥ TELECOMMUNICATIONS BONDING CONDUCTOR (TBC) #3/0 AWG BY ELECTRICAL CONTRACTOR
- ⑦ GROUNDING EQUALIZER CONDUCTOR (GEC) #3/0 AWG



- NOTE: 1) CABLE SHALL HAVE IDENTICAL LABEL AT BOTH ENDS  
 2) EACH PATCH PANEL SHALL BE UNIQUELY LABELED ALPHABETICALLY IN EACH MDF OR IDF



NOTE: 1) CABLE AND 110 BLOCK SHALL HAVE IDENTICAL LABEL AT BOTH ENDS



NOTE: 1) CABLE AND INNERDUCT SHALL HAVE IDENTICAL LABEL AT BOTH ENDS