



LSUHSC Computer Services
433 Bolivar Street
New Orleans, LA 70112
Phone 504-568-6130

LSUHSC Enterprise Networking

Structured Cabling System: Design & Installation Standards

Last Revised: Friday, December 11, 2020

Contents

Article I. Revision History5

Article II. Definitions, Acronyms and Units of Measure7

 Section 2.01 Definitions7

 Section 2.02 Acronyms8

 Section 2.03 Units of Measure8

Article III. Design and Installation Standards Overview.....9

 Section 3.01 Purpose9

 Section 3.02 Caveats9

 Section 3.03 Scope9

 Section 3.04 Contractor/Installer Requirements.....9

 Section 3.05 Coordination of Work.....10

Article IV. Applicable Standards.....11

 Section 4.01 Caveats11

 Section 4.02 State of Louisiana Standards11

 Section 4.03 BICSI Standards11

 Section 4.04 ISO Standards.....11

 Section 4.05 ITU Standards.....11

 Section 4.06 NFPA Standards11

 Section 4.07 TIA/EIA Standards.....11

Article V. Underground Excavation.....13

Article VI. Building Entrance Facilities13

Article VII. Cross-Connect Design14

 Section 7.01 General14

 Section 7.02 Caveats14

 Section 7.03 Asbestos Safety14

 Section 7.04 Fire Protection14

 Section 7.05 Entry Door14

 Section 7.06 Access Controls14

 Section 7.07 Location.....15

 Section 7.08 Sizing.....15

 Section 7.09 Ceiling16

 Section 7.10 Walls.....16

 Section 7.11 Flooring17

 Section 7.12 Lighting17

 Section 7.13 Floor Loading17

 Section 7.14 Penetrations17

Section 7.15	HVAC.....	18
Section 7.16	Electrical.....	18
Section 7.17	Electrical Emergency Disconnect.....	18
Section 7.18	Grounding.....	18
Article VIII. Cross-Connect Build-out		19
Section 8.01	General	19
Section 8.02	Caveats	19
Section 8.03	Racks	19
Section 8.04	Vertical Cable Management	19
Section 8.05	Cable Runway Installation.....	20
Section 8.06	Cable Runway Drops.....	20
Article IX. Rack Layout		26
Section 9.01	General	26
Section 9.02	Caveats	26
Section 9.03	Fiber Optic Enclosures	26
Section 9.04	Patch Panels.....	27
Section 9.05	Patch Panel Usage	27
(a)	Data Patch Panels	27
(b)	Special Use Patch Panels	27
(c)	Telephony Cross-Connect Patch Panels	27
Section 9.06	Horizontal Cable Managements	27
Article X. Cable Pathways		30
Section 10.01	General	30
Section 10.02	Caveats	30
Section 10.03	Abandoned Cables.....	30
Section 10.04	Cable Trays.....	30
Section 10.05	Cable Supports	31
Section 10.06	Conduits and Innerduct.....	31
Article XI. Fiber Optic Cabling		33
Section 11.01	General	33
Section 11.02	Caveats	33
Section 11.03	Splice Points	33
Section 11.04	Installation Techniques.....	33
Section 11.05	Service Loops	33
Section 11.06	Inter-building.....	33
Section 11.07	Intra-building.....	34
Section 11.08	Termination	34
Section 11.09	Testing.....	34

Section 11.10	Labeling.....	34
Article XII. UTP Cabling.....		36
Section 12.01	General	36
Section 12.02	Caveats	36
Section 12.03	Penetrations	36
Section 12.04	Horizontal UTP Cables.....	36
Section 12.05	Modular Connectors	36
Section 12.06	Patch Cables	36
Section 12.07	Faceplates	37
Section 12.08	Cable Bindings	39
Section 12.09	Terminations.....	39
Section 12.10	Testing.....	39
Section 12.11	Documentation	39
Section 12.12	Standard Drop.....	40
Section 12.13	Non-Standard Drop	40
Section 12.14	Special Purpose Drops.....	41
(a)	AP Drop	41
(b)	Digital Sign Drop.....	41
(c)	HVAC, Access Control, and Security Appliance Drops.....	42

Article I. Revision History

<u>Date</u>	<u>Area of Change</u>	<u>Scope of Change</u>
1/21/2011	Document	Modified document verbiage to specify strict compliance with all LSUHSC requirements.
1/21/2011	Document	Reorganized document to cover all facets of wiring build-outs.
1/21/2011	Article III, Section 3.04	Added "Contractor/Installer Requirements" section to document.
1/21/2011	Article III, Section 3.05	Added "Coordination of Work" section to document.
1/21/2011	Article IV	Revised list of applicable industry standards
1/21/2011	Article V	Added "Preferred Part Number" section to document.
1/21/2011	Article VI	Added "Before you Dig" section to document.
1/21/2011	Article VII	Added "Building Entrance Facilities" section to document.
1/21/2011	Article VIII, Section 8.06	Added "Access Controls" section to document.
1/21/2011	Article VIII, Section 8.07	Added stipulation for no 1 st Floor HCs in multi-story buildings due to flooding concerns.
1/21/2011	Article VIII, Section 8.17	Added "Electrical Emergency Disconnect" section to document.
1/21/2011	Article VIII, Section 8.19	Added labeling requirements for conduits and innerduct.
1/21/2011	Article VIII, Section 8.19	Added caveats to prevent electrolysis.
1/21/2011	Article IX, Section 9.02	Removed 6" wide vertical cable management at end of racks.
		Increased vertical cable management between racks to 10" wide.
		Specified that all racks must be grounded.
1/21/2011	Article X, Section 10.04	Added "Special Use Patch Panels" section to document.
1/21/2011	Article X, Section 10.05	Modified layout of data patch panels in racks to better utilize vertical management.
1/21/2011	Article X, Section 10.06	Modified layout of voice patch panels in racks to better utilize vertical management.
1/21/2011	Article X, Section 10.07	Modified layout of telephony patch panels in racks to better utilize vertical management.
1/21/2011	Article XI, Section 11.01	Added installation caveat regarding building infrastructure shall not be used to support horizontal cabling.
1/21/2011	Article XI, Section 11.02	Specified that cable trays must be grounded.
1/21/2011	Article XII, Section 12.02	Added "Splice Points" section to document.
1/21/2011	Article XII, Section 12.03	Added "Service Loops" section to document.
1/21/2011	Article XII, Section 12.05	Specified that intra-building fiber must use 50 micron laser optimized fiber (OM4)
1/21/2011	Article XII, Section 12.07	Added labeling requirements for fiber optics.
1/21/2011	Article XII, Section 12.08	Specified that fiber optic terminations must use fusion splices.
1/21/2011	Article XIII, Section 13.02	Updated data/voice cable colors. Data is blue, Voice is Ivory.

1/21/2011	Article XIII, Section 13.02	Added special purpose cable colors. Purple is networking. Orange is building systems.
1/21/2011	Article XIII, Section 13.05	Added labeling requirements for special purpose cabling.
1/21/2011	Article XIII, Section 13.08	Added "Special Purpose Drops" section to document.
1/25/2011	Article 1	Added "Revision History" section to document.
1/26/2011	Article XII, Section 12.01	Added caveat about pulling tension and bend radius.
1/26/2011	Article XIII, Section 13.01	Added caveat about pulling tension and bend radius.
1/31/2011	Article X, Section 10.02	Added caveat regarding patch panel placement in racks.
2/23/2011	Article III, Section 3.06	Added "Removal of Abandoned Cables" section to document
2/23/2011	Article XIII, Section 13.02	Added requirement for spacing between electrical and data outlets.
4/6/2011	Document	Rewrite to comply with R.S 38:2290
7/16/2012	Article XIII, Section 12.06	Added requirement for contractor to provide "special purpose" patch cables in cross-connect.
7/1/2016	Article III, Section 3.06	Added verbiage that contractor shall check with Network/Facilities prior to removal of abandoned cables.
8/9/2016	Article XII, Section 12.10	Added verbiage about marginal passing test results.
5/30/2017	Document	Revised document due to change in definition of a "Standard Drop"
8/7/2019	Article XII, Section 12.06	Added "Green" for Passive Poe Systems
12/11/20	Article XII, Section 12.02	Added caveat regarding cable splicing.

Article II. **Definitions, Acronyms and Units of Measure**

Section 2.01 Definitions

Abandoned Cable: As defined in paragraph 800.2 of the National Electric Code, any communication cable that is not terminated on both ends at a connector or other equipment and not identified for “For Future Use” with a tag.

Backbone: A facility (e.g., pathway, cable or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities and the equipment rooms within or between buildings.

Cable Run: A length of installed media which may include other components along its path.

Drop: An outlet that is capable of supporting data, voice, or video applications.

Faceplate: The covering for a cable outlet usually flush mounted into a wall or a termination box mounted to the surface of a wall or floor. Faceplates typically have openings or insert positions for modular jacks.

Horizontal Cabling: The cabling between and including the telecommunications outlet/connector and the horizontal cross-connect.

Horizontal Cross-connect (HC): A cross-connect of horizontal cabling to other cabling, e.g., horizontal, backbone, equipment.

Main Cross-Connect (MC): A cross-connect for first level backbone cables, entrance cables and equipment cables.

Modular Jack: An 8 position 8 conductor (8P8C) connector commonly used to terminate twisted pair cabling. An 8P8C modular connector has two paired components: the male plug and the female jack.

Pathway: A facility for the placement of telecommunications cable.

Standard Drop: A drop in a work area consisting of two color-coded ports and two color-coded wires. Generally, one drop is used to support VoIP phone and workstation and one drop is available for spare.

Structured Cabling System: A complete system of cabling and associated hardware, which provides a comprehensive telecommunications infrastructure. Installations typically include entrance facilities, equipment rooms, backbone cabling, telecommunication rooms, horizontal cabling, and work areas.

Work Area: A building space where the occupants typically interact with computer equipment.

Section 2.02 Acronyms

AC	Alternating Current
ANSI	American National Standards Institute
BICSI	Building Industry Consulting Service International
EMI	Electromagnetic interference
HC	Horizontal Cross-Connect
HVAC	Heating, Ventilation and Air Conditioning
ISO/IEC	International Organization for Standards/ International Electrotechnical Commission
ITU	International Telecommunications Union
MC	Main Cross-Connect
NEXT	Near-end Crosstalk
NFPA	National Fire Protection Association
OS1	Optical Single-mode 1
OSI	Open Systems Interconnection
OTDR	Optical Time Domain Reflectometer
PVC	Polyvinyl Chloride
RCDD	Registered Communications Distribution Designers
SC	Subscriber Connector
TGB	Telecommunications Grounding Busbar
TIA/EIA	Telecommunications Industry Association / Electronic Industries Association
UTP	Unshielded Twisted Pair

Section 2.03 Units of Measure

μm	Micrometer or micron
A	Ampere
dB	Decibel
ft	Foot, abbreviated ‘
in	Inch, abbreviated ’’
kPa	KiloPascal
lx	Lux
V	Volt

Article III. Design and Installation Standards Overview

Section 3.01 Purpose

This document is intended to provide a basic framework for the design specifications and requirements for all Structured Cabling System Installations.

All campus renovations projects to existing work areas and new building construction shall include drawings for each Structured Cabling System sub-system (if applicable).

This document details the minimum performance criteria for all components which comprise a Structured Cabling System, including product specifications, design considerations and installation guidelines.

Section 3.02 Caveats

An authorized representative of LSU Health Sciences Center (LSUHSC) Executive Management must approve all deviations from these standards in writing prior to implementation of the deviation.

All Structured Cabling System installations must be coordinated through LSUHSC Enterprise Networking.

All construction projects must be approved by and coordinated through LSUHSC Facility Services.

The contractor is responsible for ensuring that all products selected are mated to interoperate such that the overall performance capability and usefulness of the Structured Cabling System is not degraded.

Section 3.03 Scope

This document applies to all LSUHSC facilities including all new construction and renovations to existing facilities or work areas.

These standards shall apply to all work performed by LSUHSC staff, contractors, sub-contractors and technicians.

Section 3.04 Contractor/Installer Requirements

This document is subject to revisions and modifications as necessary to maintain support and compatibility with changing construction techniques and technological developments.

The contractor/installer shall:

- Verify compliance with the most recent revision of this document and all applicable standards.
- Adhere to all applicable Building, Fire, and/or Life Safety Codes, State Laws and Industry Standards.
- Furnish all labor, supervision, tooling, miscellaneous mounting hardware and consumables for each cabling system installed.
- Remove all trash and debris on a daily basis.
- Submit any and all documentation that is necessary for a manufacturer provided warranty

and/or a contractor/installer provided warranty. The warranty terms and conditions and coverage period shall be clearly stated.

Section 3.05 Coordination of Work

Serving as both an Academic Medical Center and a Healthcare Provider, it is often necessary that installations must be scheduled around daily business activities, such as classes and/or clinics.

Therefore, the contractor is to coordinate with the LSUHSC Enterprise Networking representative so that all necessary work will be accomplished in an orderly and timely manner with a minimal amount of disruption.

Article IV. Applicable Standards

Section 4.01 Caveats

In general, the following standards are to be used as minimum standards.

Compliance with the most current revision and all addenda to each of the applicable standard listed below is required.

In the event of ambiguities regarding requirements, the more stringent standard shall be adhered to. LSUHSC Enterprise Networking will determine the more stringent standard.

Section 4.02 State of Louisiana Standards

State of Louisiana, Division of Administration: Facility, Planning & Control, Guideline Requirements, Specifications and Wiring Diagrams for Communications Cable/Wire and Related Building Facilities

Section 4.03 BICSI Standards

Telecommunications Distribution Methods Manual, 12th edition

Section 4.04 ISO Standards

ISO 9001: Quality Management Systems - Requirements

Section 4.05 ITU Standards

ITU-T G.652.D: Characteristics of a single-mode optical fibre cable

ITU-T G.651: Characteristics of a 50/125 mm multimode graded index optical fibre cable

Section 4.06 NFPA Standards

NFPA 70: National Electric Code

NFPA 75: Standard for the Protection of Information Technology Equipment

NFPA 101: Life Safety Code

Section 4.07 TIA/EIA Standards

TIA/EIA-526-7: OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

TIA/EIA-526-14: Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant

TIA/EIA-568-C.1: Commercial Building Telecommunications Cabling Standard

TIA/EIA-568-C.2: Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components

TIA/EIA-568-C.3: Optical Fiber Cabling Components Standard

TIA/EIA-569-B: Commercial Building Standard for Telecommunications Pathways

TIA/EIA-598-C: Optical Fiber Cable Color Coding

TIA/EIA-606-A: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

ANSI-J-STD-607-A: Commercial Building Grounding and Bonding Requirements for Telecommunications

TIA/EIA-758-A: Customer-Owned Outside Plant Telecommunications Cabling Standard

TIA/EIA-942: Telecommunication Infrastructure Standard for Data Centers

TIA/EIA-1179: Healthcare Facility Telecommunications Infrastructure Standard

Article V. Underground Excavation

All underground excavations shall adhere to Louisiana Revised Statute (RS) 40:1749.11 regarding identification and prevention of damage to existing underground utilities and services.

The Contractor shall be responsible for contacting LA One Call so that utility providers in the area are properly notified and have adequate time to identify services.

All damages caused by the Contractor shall be repaired at Contractor's expense.

Article VI. Building Entrance Facilities

Every building should be constructed to allow for diverse entrance paths for Telecommunication providers and/or inter-building fiber optic connectivity.

Telecommunication provider paths shall consist of a minimum of two 4" rigid metallic conduit pathways, fully populated with innerducts and pull-strings, from a hand-hole located on the property line into the building telecommunications room.

Hand-holes shall be a minimum of 24" wide x 36" length x 24" deep.

All non-rated copper or optical cables (i.e. outdoor cable plant) must transition to indoor rated cables within 50' of building entrance unless they are encapsulated in EMT or rigid conduit.

Pull strings shall be ¼" 500 lb strength pull rope.

No section of conduit shall be longer than 100' or contain more than two 90° bends between pull points or pull boxes.

The Telecommunications room must have 4' x 8' x ¾" fire-rated plywood installed on the wall near the 4" conduit penetrations.

A Telecommunications Grounding Busbar (TGB) with #6 AWG ground wire to the main power ground for the building must be installed.

The actual point of entrance for all cable paths into buildings must be approved by LSUHSC Facility Services.

Article VII. Cross-Connect Design

Section 7.01 General

The Cross-Connect is the room where the horizontal and/or backbone cabling is terminated and network electronics are installed. Depending on function, a cross-connect may serve as a main cross-connect (MC), a horizontal cross-connect (HC) or as both.

TIA/EIA-569-B: Commercial Building Standard for Telecommunications Pathways and Spaces provides a standard for the design and construction of the cross-connect.

Section 7.02 Caveats

All applicable local, state and federal codes shall be observed for the design of the cross-connect.

The cross-connect shall be dedicated to the telecommunications function and related support facilities. The cross-connect shall not be shared with electrical installations other than those for telecommunications. Equipment not related to the support of the cross-connect (e.g., piping, ductwork, pneumatic tubing, etc.) shall not be installed in, pass through, or enter the cross-connect.

Section 7.03 Asbestos Safety

A review of the current location, extent and condition of asbestos will be required. The construction of the cross-connect shall be such that the safety of the occupants of the building is not jeopardized before, during, or after construction.

If asbestos is determined to exist within the open areas of the cross-connect, sufficient notification shall be prominently displayed so that all people entering the room are informed of the risks of doing so.

Section 7.04 Fire Protection

Fire protection of the cross-connect shall be provided as per applicable code. All sprinkler heads shall be provided with wire cages to prevent accidental operation.

Section 7.05 Entry Door

The entry door shall be a minimum of 36" wide and 80" high, without a doorsill and fitted with a lock.

Code permitting, doors shall swing outward. Otherwise, inward door swing will be determined by the door placement such that the swing of the door opens into the nearest wall.

Section 7.06 Access Controls

Access to each cross-connect shall be tightly controlled and each room shall at a minimum be secured with a high security lock.

If additional security is deemed necessary by LSUHSC Executive Management, then the installation of HID Proximity Readers, Electronic Door Strikes and Request-To-Exit PIR Motion Sensors or similar components will be required.

Section 7.07 Location

The cross-connect shall be located in an accessible area on each floor and shall be located as close as possible to the center of the building or the area being serviced.

The cross-connects within multi-story buildings should be vertically stacked.

The cross-connect shall not be located adjacent to any electrical, mechanical, or other areas that are likely to emit Electromagnetic Interference (EMI).

In multi-story buildings, if possible, there should not be a cross-connect located on the 1st floor to limit exposure from flooding.

Section 7.08 Sizing

TIA/EIA-568-C.1: Commercial Building Telecommunications Cabling Standard Part 1: General Requirements provides a standard for the sizing of cross-connects in commercial buildings.

TIA/EIA-1179: Healthcare Facility Telecommunications Infrastructure Standard provides a standard for the sizing of cross-connects in Healthcare Facilities.

Cross-connect sizing is generally based on the square footage of the area being serviced. Additional requirements such as density of drops in the service area or additional equipment that must be located in the cross-connect may however require additional space.

Refer to table 1 below for the TIA/EIA minimum cross-connect size requirements.

Serving Area	Minimum Cross-Connect Size
Ft ²	Ft x Ft
10000	10 x 11
8000	10 x 9
5000	10 x 7
For support of additional services such as AV or Building MC services	10 x 16 or larger
Healthcare	10 x 13 or larger

Table 1: TIA/EIA Minimum Cross-Connect Sizing

If the floor size to be serviced exceeds 10,000 ft² or if distances between the cross-connect and work area exceeds 295', additional cross-connects will be required.

For floor areas smaller than 5000 ft², Annex B Section B.3 of TIA/EIA-569-A provides suggestions for smaller cross-connects which may be considered.

Section 7.09 Ceiling

For maximum flexibility, a false ceiling shall not be installed. The structural ceiling shall be painted white.

Section 7.10 Walls

A minimum of three walls shall be covered with rigidly fixed 3/4" A-C plywood, preferably void free, 8' high, capable of supporting attached equipment.

Plywood shall be either fire-rated and/or covered with two coats of fire retardant paint and shall be installed in a horizontal orientation beginning 48" from the floor.

All walls shall be painted white to enhance room lighting.

Section 7.11 Flooring

Flooring shall consist of vinyl composition tile, off-white in color.

Section 7.12 Lighting

Fluorescent Lighting shall be a minimum of 500 lx (50 foot candles) mounted a minimum of 8.5' above finished floor.

Lighting fixtures should not be powered from the same electrical distribution panel as the network electronics installed in the cross-connect.

Dimmer switches shall not be used.

To prevent EMI, lighting fixtures shall be kept a minimum of 18" away from cable pathways.

Emergency lighting and signs shall be properly placed such that an absence of light will not hamper emergency exit.

Section 7.13 Floor Loading

The cross-connect shall be located on floor areas designed with a minimum floor loading of 2.4 kPa (50 lbf/ft²).

Contractor shall verify that concentrations of proposed equipment do not exceed the floor loading limit.

If unusually heavy equipment is anticipated, these specifications may have to be increased.

Section 7.14 Penetrations

All penetrations through fire or smoke rated barriers shall be sealed with a fire stopping compound complying with National Fire Protection Association and State Fire Marshal requirements.

There shall be a minimum of four 4" slab penetrations per cross-connect in order to reach cross-connects on lower floors. In buildings without a cross-connect on the 1st floor, additional penetrations may be required in the 2nd floor cross-connect to accommodate drops from the 1st floor.

All penetrations shall be placed such that

- Where a slot is used, it shall have a minimum 1" curb around the top of the slot.
- Where a sleeve is used, it shall extend 1" - 3" above the floor.

All penetrations must be free of sharp edges so that cables will not be damaged.

Horizontal penetrations shall be sufficient to allow access to the main horizontal distribution pathway.

Section 7.15 HVAC

Planning for continuous HVAC (24 hours per day and 365 days per year) shall be included in the initial design.

HVAC shall be designed to maintain the cross-connects temperature the same as the adjacent office area. Ambient room temperature should be between 68° – 72° F.

A positive pressure shall be maintained with a minimum of one air change per hour, or as required by applicable code. When active devices (heat producing equipment) are present, a sufficient number of air changes should be provided to dissipate the heat. LSUHSC Enterprise Networking will provide the necessary heat dissipation information for all electronics that will be installed in the cross-connect to determine cooling requirements.

If a standby power source is available in the building, the HVAC system serving the cross-connect should be connected to the standby supply.

Section 7.16 Electrical

As electrical requirements vary by installation, LSUHSC Enterprise Networking will provide the electrical circuit requirements including voltage, receptacle types and locations within each cross-connect prior to construction.

If standby power will be available, automatic switchover of power should be provided. Outlet faceplates to designate emergency power shall be red in color.

Outlet faceplates to designate building power shall be gray in color.

Section 7.17 Electrical Emergency Disconnect

Each cross-connect shall have a properly sized non-fusible safety switch disconnect installed, configured such that all outlets within the room are isolated when switched off.

The electrical emergency disconnect shall be mounted on the wall immediately inside of the door such that it is reachable without entering the cross-connect.

Section 7.18 Grounding

As per TIA/EIA-607: Commercial Building Grounding and Bonding Requirements for Telecommunications, each cross-connect shall contain a TGB.

The TGB shall be located inside the cross-connect and be insulated from its support; a 2” separation is recommended.

The TGB shall be located so as to provide the greatest flexibility and accessibility for telecommunications system grounding.

Multiple TGBs may be installed within the same closet to aid in minimizing bonding conductor lengths and terminating space.

Article VIII. Cross-Connect Build-out

Section 8.01 General

The specifications detailed in the following section are the general design requirements for each cross-connect.

Refer to figures 1 through 5 for an overhead, front, and side view showing an example of a typical MC or HC build-out.

Section 8.02 Caveats

Typical designs may need to be modified due to the room orientation, room dimensions, cable entrances facilities, drop density and/or voice and video requirements. LSUHSC Enterprise Networking will provide a to-scale drawing for each cross-connect.

Section 8.03 Racks

Racks shall be 7' in height and shall support 19" rack-mount widths.

Rack Units (RU) should be clearly marked on the racks.

A minimum of three racks shall be installed in each HC.

A minimum of four racks shall be installed in the MC.

Racks shall be installed and secured as per the manufacturer's installation instructions.

Racks shall be positioned within the cross-connect to allow access to both the front and rear of all racks. When planning access to the rear of the racks, consideration should be made for the fact that equipment mounted in the rack will often extend at least 24 –30" behind the rack. As such, adequate allowance shall be made to the rear of the rack to allow for access behind the racks even after equipment is permanently installed.

All racks shall be properly grounded.

Section 8.04 Vertical Cable Management

Vertical Managements shall be a minimum of 10" wide.

Vertical Managements shall be double-sided to allow routing of cables front and rear. Both front and rear vertical managements shall have hinged doors to hide cables.

A vertical management shall be installed between each rack in the cross-connect.

All vertical managements shall be installed and secured as per the manufacturer's installation instructions.

Section 8.05 Cable Runway Installation

Cable runway shall be a minimum of 18” wide and black in color.

All Cable runways shall be installed and secured as per the manufacturer’s installation instructions.

All Cable runways crossing above racks shall be secured to and supported above each rack using a Cable Runway Standoff Support.

All cable runways shall be properly grounded.

Section 8.06 Cable Runway Drops

Cable Runway drops shall be installed to accommodate the cable bend radius in order to transition cable routing from horizontal cable runways and into each of the vertical cable managements.

Cable Runway drops shall be mated for 18” cable runway.

All Cable runway drops shall be installed and secured as per the manufacturer’s installation instructions.

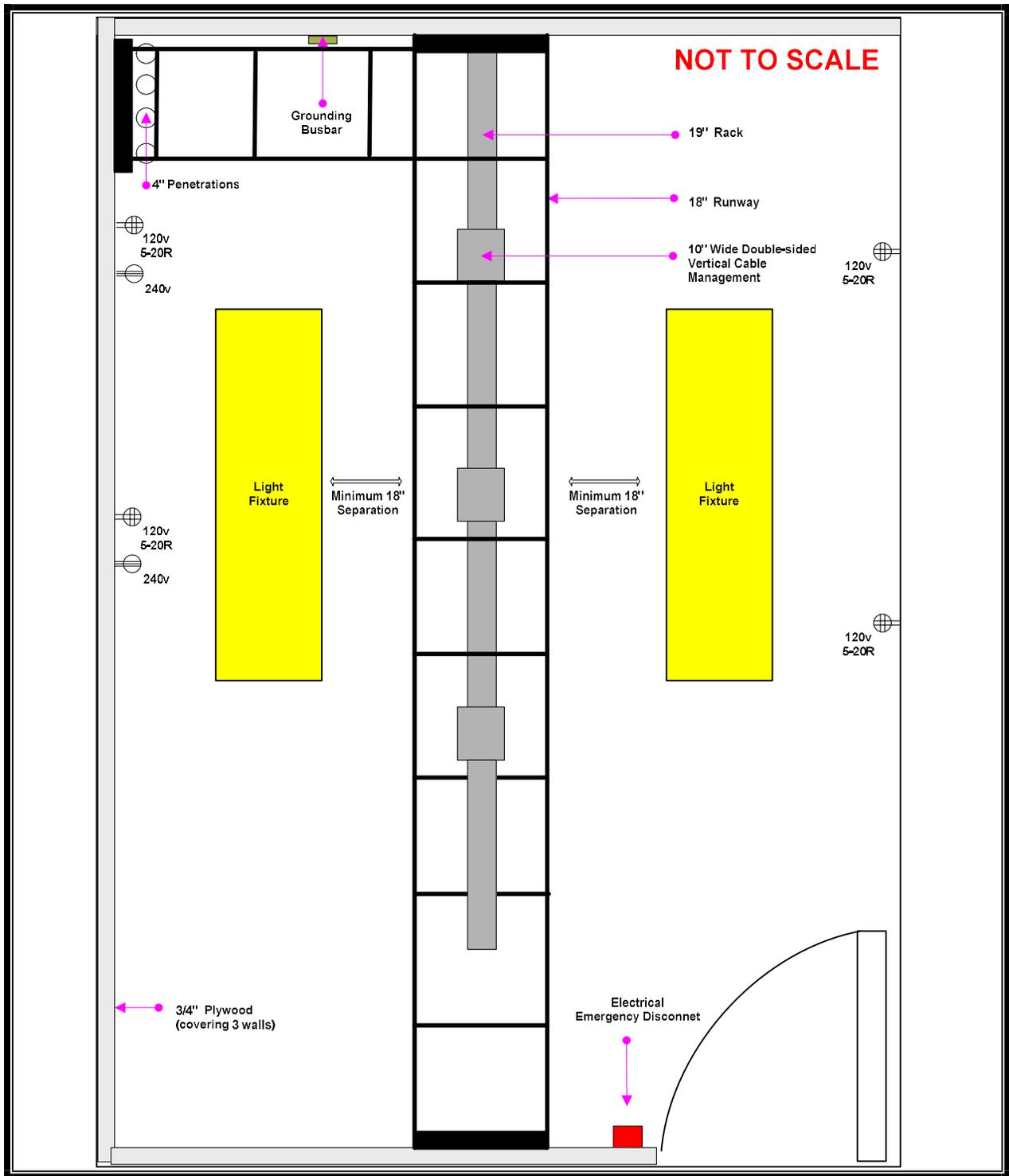


Figure 1: Main Cross-Connect Overhead View

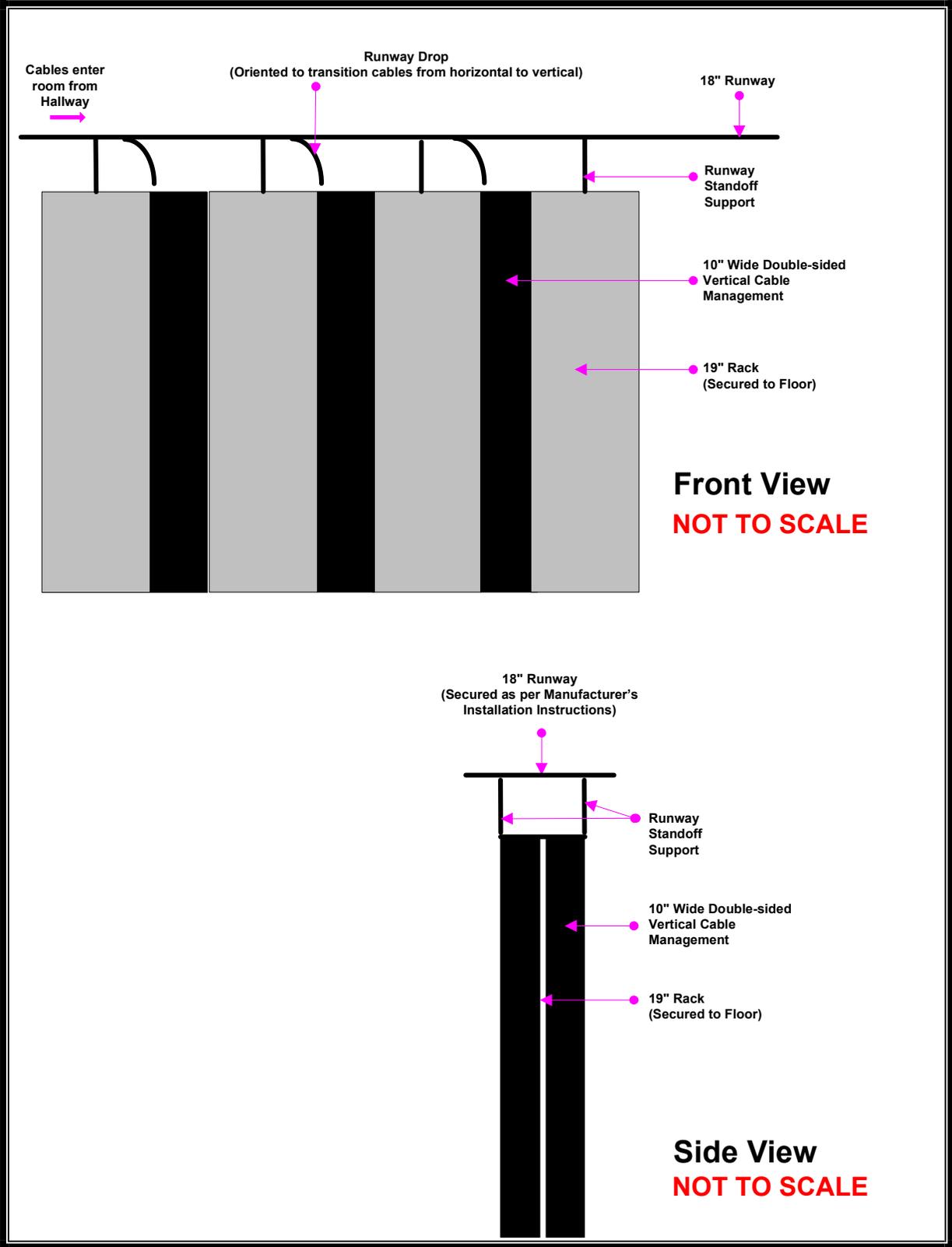


Figure 2: Main Cross-Connect Front and Side View

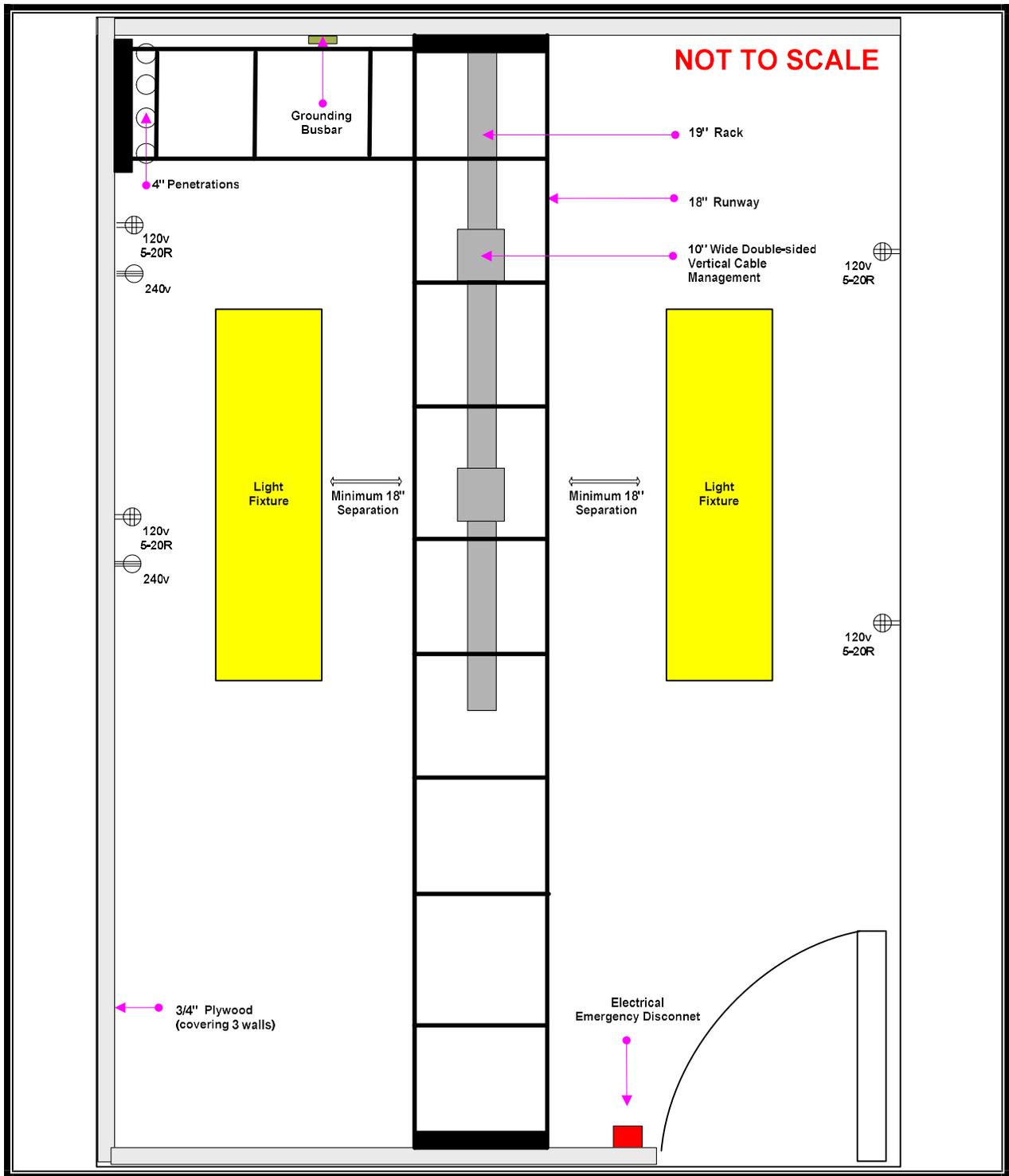


Figure 3: Horizontal Cross-Connect Overhead View

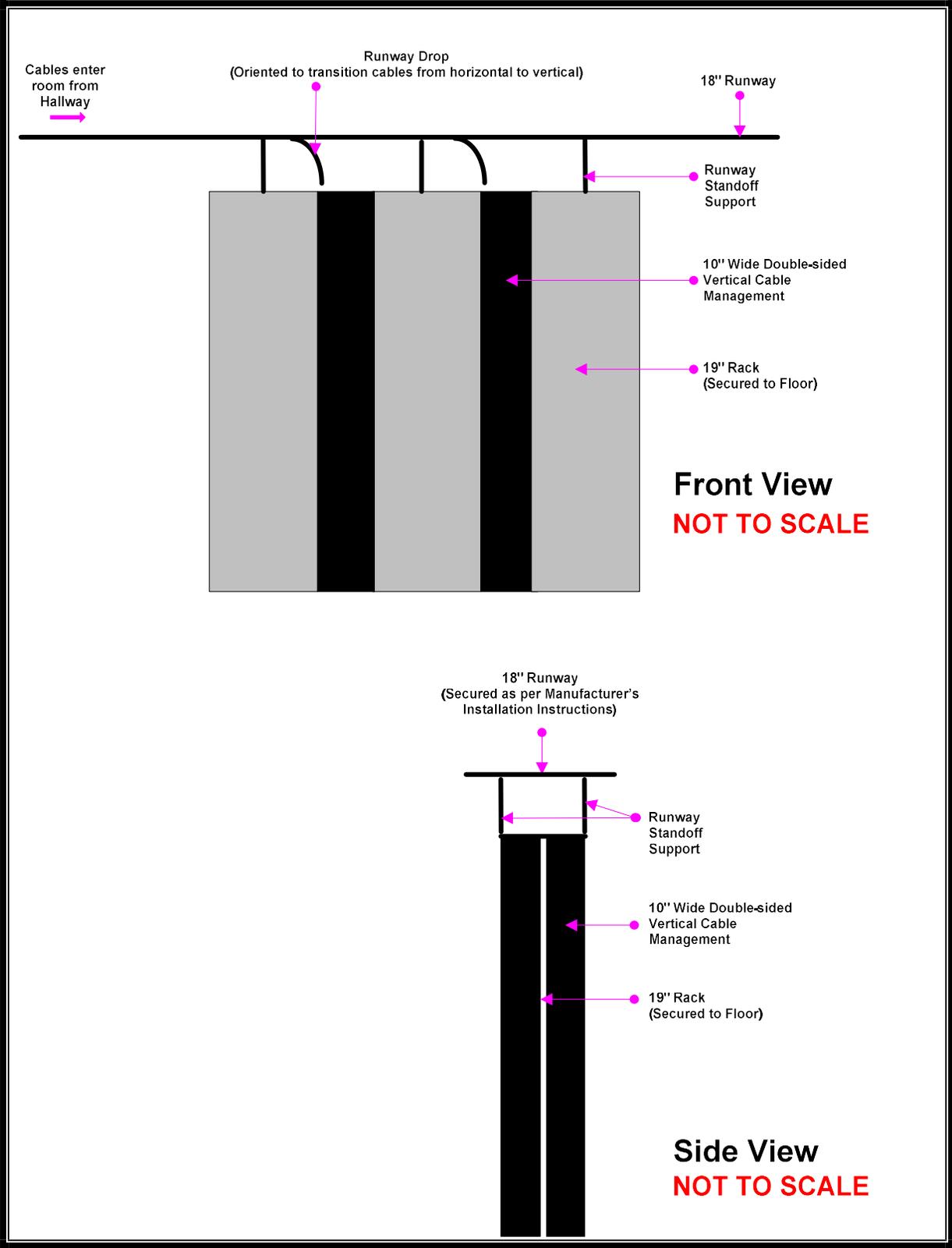


Figure 4: Horizontal Cross-Connect Front and Side View Rack Layout

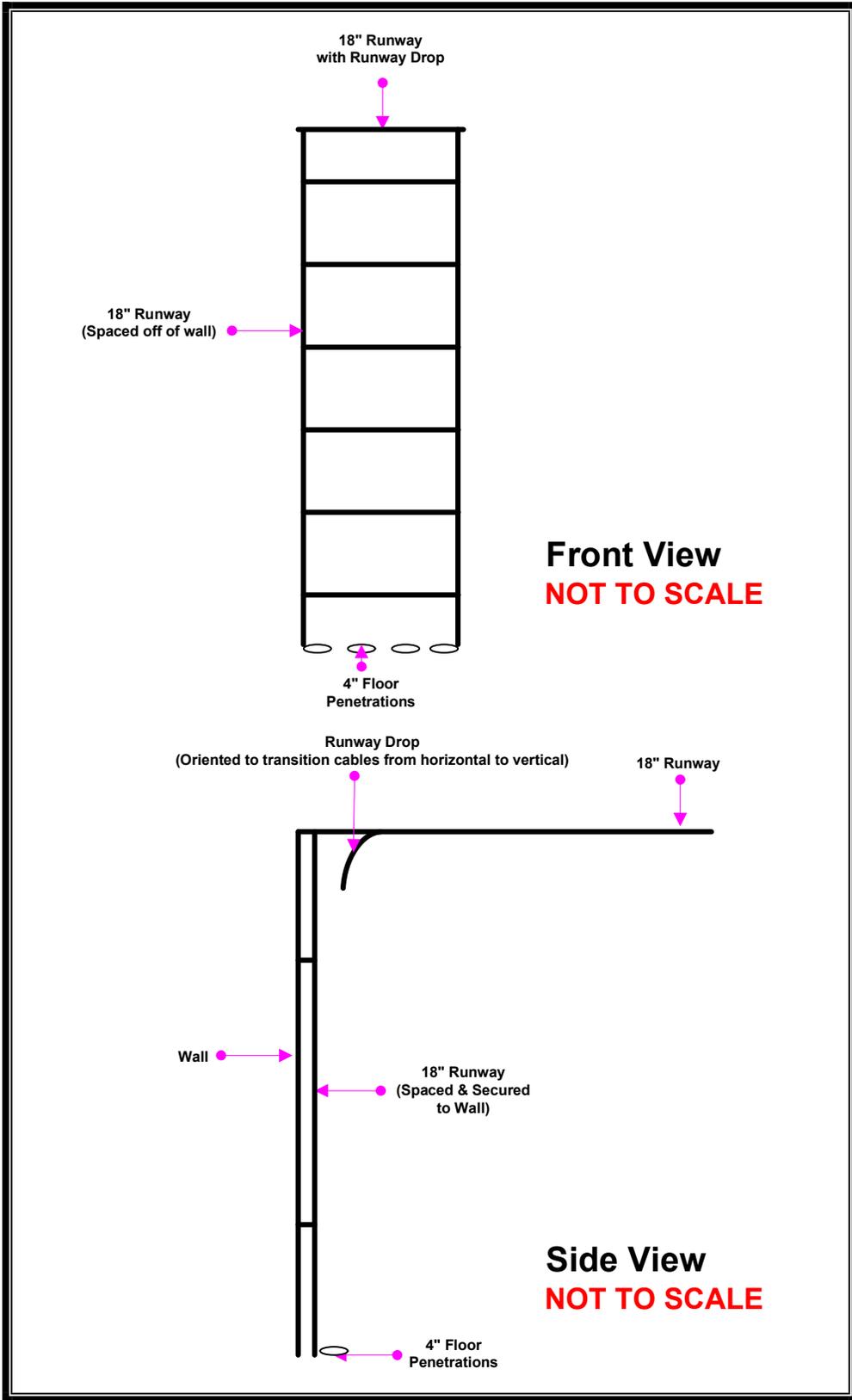


Figure 5: Vertical Cable Management

Article IX. **Rack Layout**

Section 9.01 General

Each HC build-out consists of a three rack system.

When facing the front of the racks,

- The left most rack is designated as Data Rack 1.
- The middle rack is designated as the Network Rack.
- The right most rack is designated as Data Rack 2.

In addition to the HC racks, the MC shall have an additional rack positioned left of the HC racks that will be designated as the Core Network Rack.

Refer to the figure 6 for a typical MC rack layout and to figure 7 for a typical HC rack layout.

Section 9.02 Caveats

Typical rack layouts may need to be modified due to the drop types and density. LSUHSC Enterprise Networking will provide the necessary guidance to installers for the rack layout.

Section 9.03 Fiber Optic Enclosures

All fiber optic enclosures shall be 19” rack mountable and shall accommodate fiber optic termination capacity for a minimum of 24 strands of fiber optics.

Fiber optic enclosures shall be black in color.

In the HC, install a fiber optic enclosure for the intra-building fiber optics at the top of the Core Network Rack.

In the MC, install fiber optic enclosures for inter-building and intra-building fiber optics beginning at the top of the Core Network Rack. Inter-building fiber optics shall be housed in a separate enclosure from Intra-building fiber optics.

If multiple fiber optic enclosures are utilized in the MC for intra-building fiber, fiber optic enclosures should be arranged such that room numbers appear in a descending order from top to bottom.

All fiber optic enclosures shall be labeled with a machine etched hard plastic label.

Labels for fiber optic enclosures supporting intra-building fiber shall specify at a minimum the remote room number where the fiber optics terminates.

Labels for fiber optic enclosures supporting inter-building fiber shall specify at a minimum the remote building name and room number where the fiber optics terminate.

Section 9.04 Patch Panels

Patch panels shall be 19” rack mountable.

Patch panels shall have a 24 or 48-port capacity and support modular jacks. Jacks shall be populated in a left to right fashion.

In high density environments, angled patch panels shall be utilized.

When possible, cables should be installed in the patch panels in sequence number order to simplify locating specific ports.

Patch panels shall have machine printed labels with plastic label covers. Labeling shall be identical to the respective faceplate in the work area.

Section 9.05 Patch Panel Usage

LSUHSC Enterprise Networking will specify the organization of the modular jacks across the various patch panels listed below:

(a) Data Patch Panels

Data Patch Panels shall be positioned beginning in the upper portion of Data Rack 1 and 2.

Drops shall be split equally between Data Rack 1 and 2.

(b) Special Use Patch Panels

In the Network Rack, below the network electronics, a minimum of two 48-port patch panels shall be installed.

One patch panel will support modular jack terminations for special Network Systems, such as Access Points and Digital Signage while the second patch panel will support terminations for Building & Security systems, such as HVAC Monitoring, Access Control Systems, IP Video Cameras, etc.

(c) Telephony Cross-Connect Patch Panels

A minimum of one 48-port patch panels to support the Analog telephone infrastructure will be installed in the Network Rack below the special use patch panels.

Details for cross-connect instructions to connect to the telephone infrastructure is outside the scope of this document. Consult the Telephony Standards for details on the installation and labeling requirements.

Section 9.06 Horizontal Cable Managements

Horizontal Cable Managements shall be 19” rack mountable.

Horizontal Cable Managements for the purpose of managing patch cable shall have hinged covers where managements for horizontal cable will require D rings.

Horizontal Cable Managements shall be properly sized for the number of cables to be managed.

Horizontal Cable Managements shall be installed between all flat patch panels.

Horizontal Cable Management is not required if utilizing angled patch panels.

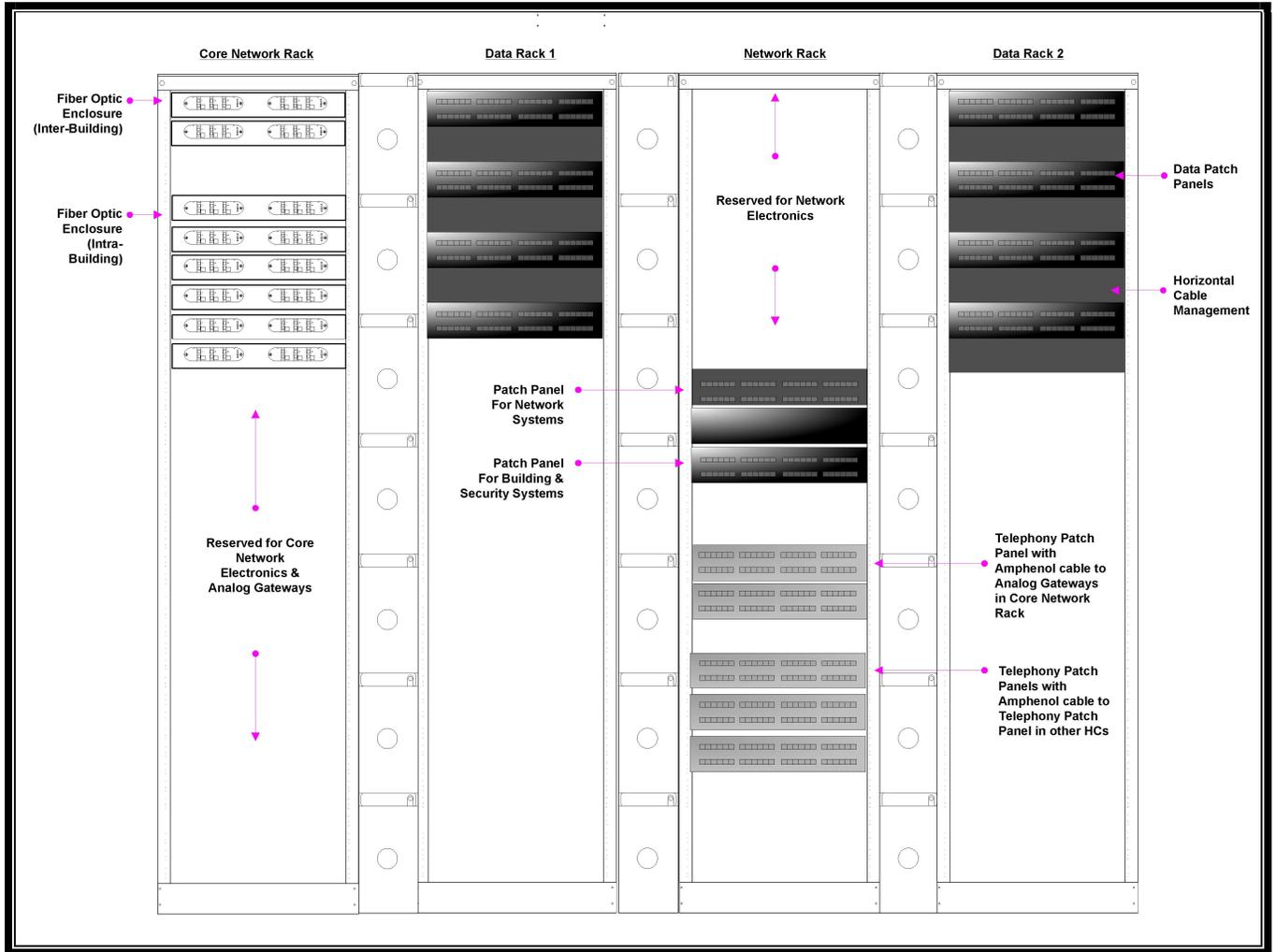


Figure 6: Sample MC Rack Layout

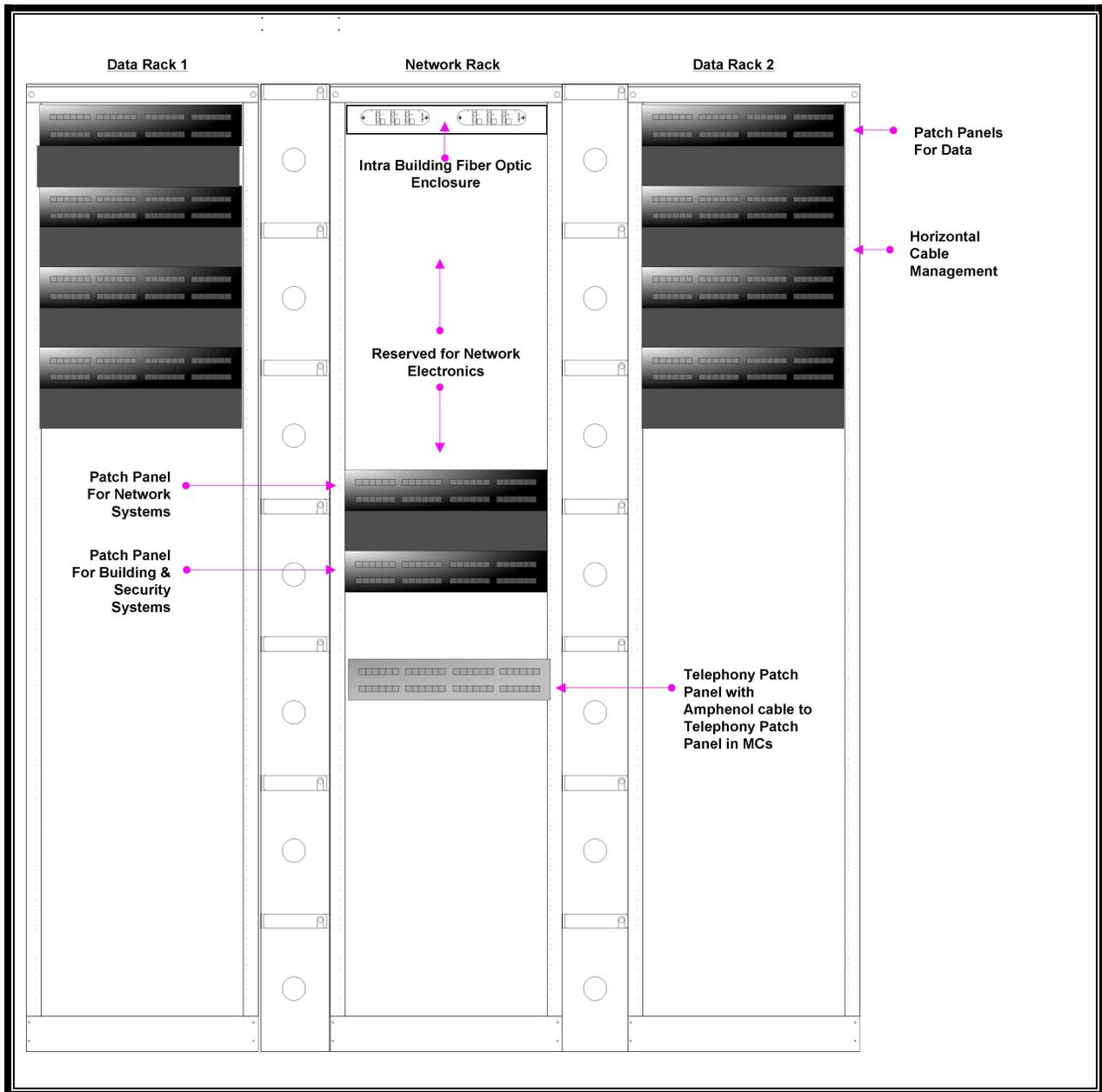


Figure 7: Sample HC Rack Layout

Article X. Cable Pathways

Section 10.01 General

All cable pathways and spaces must be in compliance with TIA/EIA-568-C.1: Commercial Building Telecommunications Cabling Standard Part 1: General Requirements and TIA/EIA-569: Commercial Building Standard for Telecommunications Pathways and Spaces.

Cable paths shall consist of a primary path above the main hallways of the building with individual drops exiting the main pathways at right angles and suspended by J hooks towards the top of the wall above the intended drop/faceplate location.

In areas with suspended ceiling tiles, all cabling and support structures should be installed above the ceiling tiles in such a way that will not interfere with the moving or removal of ceiling tiles.

Specific attention should be paid to issues such as:

- Distance requirements for separation from EMI emitting devices and electrical equipment such as fluorescent lighting and power supplies.
- Proper supporting of cables within cable paths to prevent the weight of cables from damaging cable or other equipment.
- Proper conditioning of floor and wall penetrations to prevent damage to cable jackets while installing the cable and throughout the cable life.
- Segregation and separation of cabling in cable trays by media type and then by color of jackets for like media.

Section 10.02 Caveats

All penetrations through fire or smoke rated barriers shall be sealed with a fire stopping compound complying with National Fire Protection Association and state Fire Marshal requirements.

In no cases shall any cabling be permitted to utilize building infrastructure for support or to aid in the cables suspension. Only systems installed specifically for the purpose of routing and managing cabling shall be utilized.

Section 10.03 Abandoned Cables

Abandoned cables increase fire loading unnecessarily and if installed in plenums, it can affect airflow. Therefore, as per paragraph 800.25 of the National Electric Code, the accessible portion of all abandoned communication cables shall be removed.

Prior to removal of any cables, the contractor shall coordinate with the LSUHSC Enterprise Networking and Facility Services representatives to ensure that cables will not be repurposed and shall be removed.

Section 10.04 Cable Trays

Cable tray shall be installed in all primary pathways (i.e. hallways).

Cable trays shall be of a wire mesh construction and be a minimum of 4" deep and 12" wide. Fill rates should not exceed 60%.

All cable trays shall be properly grounded.

All cable trays shall be installed and secured as per the manufacturer's installation instructions.

No component of the cable tray system or support structure should be mounted to the suspended ceiling support wires.

Section 10.05 Cable Supports

J-hooks shall be installed in areas where the installation of cable trays is not possible or to support cables between cable trays and user work areas.

The minimum J-hook size shall be 2". Larger sizes if necessary shall be determined based on manufacturer's recommendations for the number of cables to be supported.

All J-Hooks shall have cable retaining clips installed.

In main hallways, where possible, J-hooks shall be mounted to the wall and spaced every 4'. The distance between J-hooks in overhead areas shall not exceed 5'.

All J-Hooks shall be installed and secured as per the manufacturer's installation instructions.

Section 10.06 Conduits and Innerduct

For conduit and innerduct installations, the following best practices should be adhered to:

- Innerduct should be cut and securely fastened at all conduit junction boxes
- All conduits shall use sweeping bends for directional changes
- All conduits, tubings and innerducts shall be securely terminated on both ends with appropriate termination hardware and junction boxes
- Transitions between different types of tubing, conduit and innerduct shall be made with a junction box unless a special adapter designed for such purpose is available
- All empty innerducts and unfilled conduits shall contain pull strings to assist with future cable installations
- Conduit shall have a maximum fill capacity of 50%
- Innerduct may be filled to any capacity that can be achieved with a single pull without damaging the integrity of the cables being installed
- Conduit and tubing shall terminate in junction boxes appropriately sized for the type and quantity of cable being installed
- When using conduit greater than 2" inner diameter, innerduct shall be used within the entire length of the conduit unless a shielded cable is used
- When 4" conduit is installed, it should be completely filled with innerduct

Conduits and Innerducts shall be clearly labeled on the exterior surface, at least every 50'.

Conduits and Innerduct labels shall include a unique ID that identifies the origination and destination, such as RCB719-LEC230-1 signifying the 1st conduit originating in the Resource Center Building, room 719, and terminating in room 230 in the Lions Eye Center.

Labeling shall consist of black letters, at least 1.5" – 2" high, on a white or yellow background. Labels should be self-adhesive labels suitable for indoor and outdoor installations.

Conduit sizing shall be based on cable capacity as per the manufacturer's recommendations.

Conduit installations in areas where the presence of an electrolyte, such as water or moisture containing small amounts of acid are likely to be present, appropriate measures shall be taken to ensure that dissimilar metals do not come in contact with one another in order to prevent corrosion of metals.

Refer to the table 2 below regarding metals that corrode when in the presence of an electrolytic and in contact with another metal.

The Galvanic Series			
1	Aluminum	7	Tin
2	Zinc	8	Lead
3	Steel	9	Brass
4	Iron	10	Copper
5	Nickel	11	Bronze
6	Stainless Steel 400 Series	12	Stainless Steel 300 Series

Table 2: The Galvanic Series

Article XI. Fiber Optic Cabling

Section 11.01 General

All fiber optic backbone cabling shall be installed in a star topology in compliance with TIA/EIA-568-C.1: Commercial Building Telecommunications Cabling Standard Part 1: General Requirements.

Fiber installation must also comply with TIA/EIA-568-C.3: Optical Fiber Cabling Components Standard.

Section 11.02 Caveats

All fiber optic cables must be installed, handled, routed and terminated as per the manufacturer's installation instructions. Special attention shall be paid to the pulling tension and bend radius limitations for each cable.

Section 11.03 Splice Points

LSUHSC has established two splice points on the downtown campus, each having available single-mode fiber optics, to the Resource Center Building which acts as the hub in the downtown campus star topology.

Splice points are established in the following locations:

- East end of Walk-to-Wellness
- West end of Walk-to-Wellness

All new building construction on the downtown campus shall attempt to utilize these existing resources.

Section 11.04 Installation Techniques

Fiber optic cabling must be completely encapsulated for the entire length of the cable run. Acceptable encapsulation types are aluminum armor cladding, innerduct, rigid metallic conduit, electrical metallic tubing, flexible metallic tubing, or other suitable enclosure that meets the requirements of the installation.

Different types of encapsulation materials may be required in different areas to accommodate intra-building, inter-building, or plenum space requirements.

Grounding requirements shall be adhered to for each applicable encapsulation type.

Section 11.05 Service Loops

All cables shall be provided with a 25' long service loop per end for a total of 50' per cable.

Service loops shall be securely mounted to the wall in the cross-connects.

Section 11.06 Inter-building

All new inter-building backbone cabling shall consist of a minimum of 24-strands of single-mode fiber optic cabling.

Inter-building fiber shall be indoor/outdoor rated fiber.

Depending upon the geographic location of the building being served, as well as its logical relationship to the campus environment, the number and type of strands may be increased.

Section 11.07 Intra-building

All new intra-building riser cabling shall consist of a minimum of 24 strands of laser optimized OM4.

Section 11.08 Termination

All single-mode and multimode terminations shall have SC connectors.

Section 11.09 Testing

Each fiber strand shall be tested with an OTDR to verify installed cable length and all points of dB loss.

OTDR must have been calibrated within past year by an ISO 9001:2008 accredited lab or by the original equipment manufacturer. Certification of last calibration date shall be made available upon request.

Fusion splice loss shall not exceed 0.2 dB and connector loss shall not exceed 0.5 dB.

Testing shall be performed in both directions on each strand.

Section 11.10 Labeling

All Fiber Optic Cables shall have a self-laminating plastic fiber optic cable tag affixed with tie wraps (plenum or non-plenum as necessary) every 50' unless it the cable is encapsulated in a conduit or innerduct.

All fiber Optic Cables shall have a cable tag affixed before the cable enters any conduit or innerduct and within any pull box, junction box, or hand-hole where the fiber is exposed.

Fiber Optic cable tags shall include a unique identifier (ID) neatly printed in a permanent marker.

This ID shall be constructed in such a way as to easily identify the type of fiber optic cable, strand count and origination cross-connect and destination cross-connect. Refer to Figure 8 for a sample fiber optic identifier.

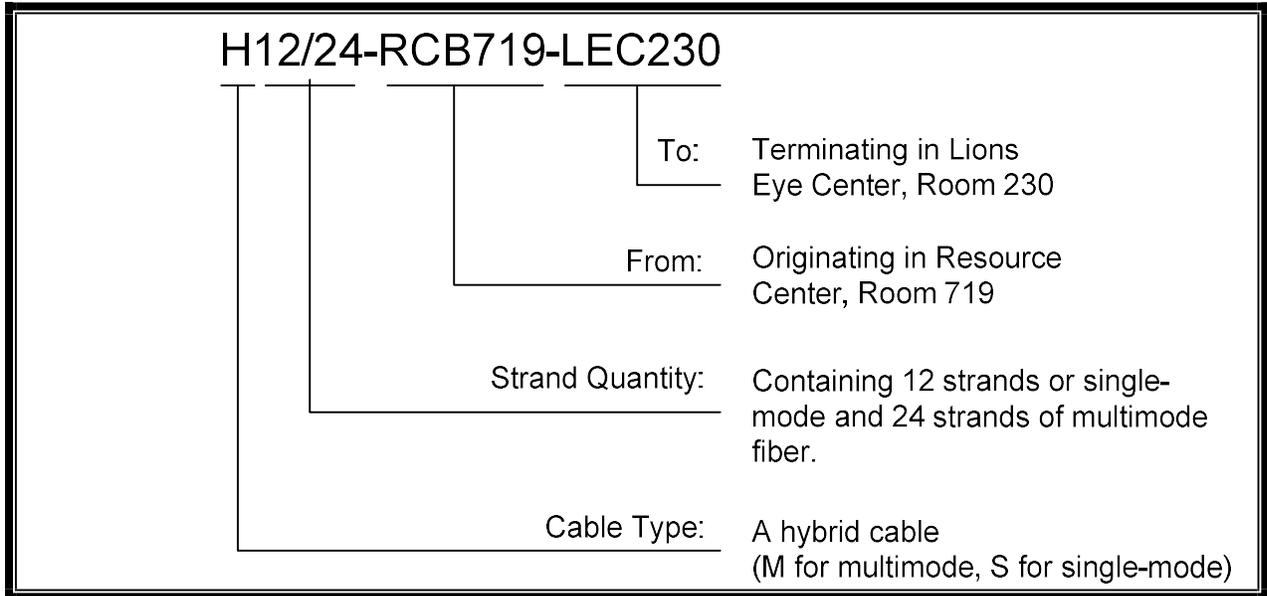


Figure 8: Fiber Optic Identifier

Article XII. UTP Cabling

Section 12.01 General

All UTP cabling components, including cables, connectors, and patch cables, must exceed the ANSI/TIA Category 6 standard.

TIA/EIA 1179 recommends that Healthcare Facilities install Category 6a.

Standard colors for UTP Cabling have been adopted to easily identify cable usage.

Section 12.02 Caveats

All UTP cables must be installed, handled, routed and terminated as per the manufacturer's installation instructions. Special attention shall be paid to the pulling tension and bend radius limitations for each cable.

UTP Cabling shall not be painted (oil or water based) or be installed in the presence of water.

UTP cables shall not be spliced.

Section 12.03 Penetrations

All penetrations through fire or smoke rated barriers shall be sealed with a fire stopping compound complying with National Fire Protection Association and state Fire Marshal requirements.

If conduit is not provided to the outlet box location, all penetrations through office wall top plates should have a collar or similar device installed to prevent damage to the UTP cable jacket.

Section 12.04 Horizontal UTP Cables

The maximum length of a horizontal UTP cable, between the faceplate in the work area and patch panel in the HC, shall not exceed 295'.

All cables should terminate at a patch panel in the cross-connect and at a faceplate on the same floor as the work area being served.

UTP Cables shall be colored to easily identify usage as specified in Table 3.

Section 12.05 Modular Connectors

Modular connectors shall (as close as possible) match the color of the UTP cable as specified in Table 3.

Section 12.06 Patch Cables

The maximum length of a patch cable in the work area shall not exceed 16'.

The Contractor shall provide appropriately sized patch cable for all cross-connect drops. Patch cables shall be sized to minimize excess cable length in the vertical managements.

The patch cables shall (as close as possible) match the color of the modular connector as specified in Table 3.

UTP Cable / Modular Connector / Patch Cable	Usage
Blue / Blue / Blue	Primary Data
Blue / Blue / Blue	Spare Data
Violet / Violet / Violet	Special Purpose – Networking
Orange / Orange / Orange	Special Purpose – Building Systems
Green / Green / Green	Special Purpose – Passive PoE

Table 3: UTP Cable / Modular Connector and Patch Cable Color Code

Section 12.07 Faceplates

The color of the faceplates shall match wall colors and shall support a minimum of four modular jacks.

Faceplates mounted on walls shall utilize recessed insert and non-shuttered jacks, installed in a downward facing orientation to prevent the accumulations of dust and debris within the modular jack and on the pin contacts. Installations shall be such that the bottom of the faceplate is parallel to the floor surface and the sides of the faceplate are perpendicular to the floor surface.

All unused Faceplate ports shall have blank inserts installed.

Faceplates mounted on horizontal surfaces shall include shuttered modular jacks to prevent the accumulation of dust and debris within the jack and on the pin contacts.

Faceplates shall be separated from Electrical outlets by a minimum of 6”.

Faceplates shall have machine printed labels and plastic label covers. Labels shall be in compliance with TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, Section 8, Labeling and Color Coding.

Faceplates in work areas shall be labeled with the room number, jack number, and the jack position. Refer to Figure 9 for jack positions. If multiple faceplates exist within the same room, faceplates jack numbers shall be sequentially numbered in a clockwise manner. This should begin with the first faceplate to the left of the main doorway as you enter the room. The main doorway is the one that provides access to a common area, such as a hallway or lobby.

Faceplate labels in office work areas shall be white with black lettering. Faceplate labels in public areas (i.e. auditoriums, conference rooms, etc) shall be green with black lettering. LSUHSC Enterprise Networking shall determine areas that are to be considered public areas for the purpose of labeling.

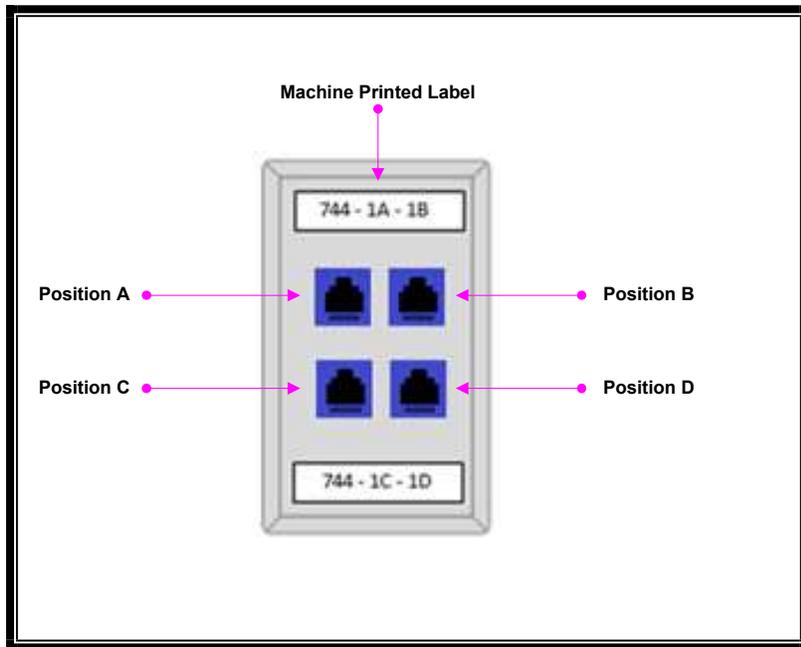


Figure 9: Faceplate Jack Positions

Faceplates for Special Systems shall be labeled with the room number, system code and jack number. Refer to Table 4 for defined system codes

Name of System	Abbreviation
Access Points	AP
Digital Signs	DS
Environmental Monitoring Systems	ENV
Access Controls	AC
Security Systems (Cameras, DVR, etc)	SEC

Table 4: System Codes

Section 12.08 Cable Bindings

Cable bindings (straps, tie wraps, etc) should be irregularly spaced and should be loosely fitted (easily moveable).

Section 12.09 Terminations

All UTP cable runs should be terminated using modular connectors on both ends.

Eight position jack pin/pair assignments will comply with T568A designation identified in TIA/EIA-568-C.2 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components

Section 12.10 Testing

All testing shall be in compliance with TIA/EIA-568-C.2 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components

All UTP cables shall be tested to meet or exceed Category 6 requirements, including Attenuation, Near End Cross Talk, Power Sum NEXT, Equal Level Far End Cross Talk (ELFEXT), Power Sum ELFEXT and Return Loss.

All test result must PASS.

A MARGINAL PASS test result is not acceptable.

Certification of last date and time of calibration to manufacturer's requirements for all test instruments shall be made available upon request.

Any test instrument utilized must be compliant and shall not allow marginal results to be hidden.

Test results shall be saved and submitted electronically to the building owner and LSUHSC Office of Computer Services upon completion of the installation. Format for electronic submission of test results shall be in a file format mutually agreed to by the contractor and LSUHSC Office of Computer Services.

Section 12.11 Documentation

Documentation shall be submitted in mutually compatible electronic format and must include:

- As-built drawings depicting the path of all backbone and vertical cabling as well as the primary path cable trays for horizontal cabling.
- As-built documentation of all floor plans for HCs including physical location of racks, trays and penetrations.
- A logical representation of each patch panel including the corresponding labeling.
- Test results for every fiber optic and UTP cable installed. The test results shall be submitted in a mutually agreeable electronic format.

Section 12.12 Standard Drop

A standard drop shall consist of two blue Category 6 cables. Corresponding faceplate shall have two blue modular jacks oriented as follows:

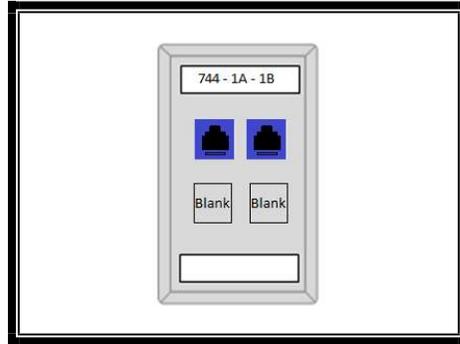


Figure 10: Standard Drop

Section 12.13 Non-Standard Drop

A non-standard drop in a typical office area may consist of one or as many as four blue Category 6 cables. Corresponding faceplates shall have the corresponding number of blue modular jacks oriented as follows:

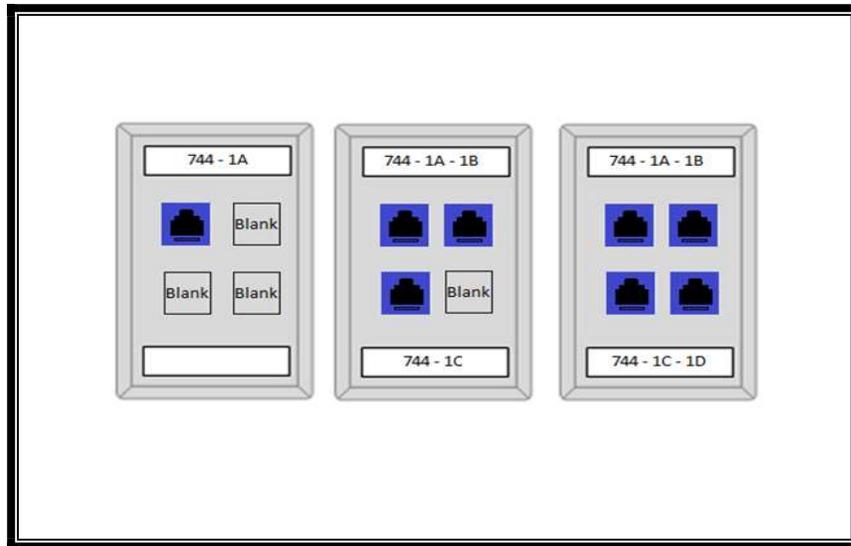


Figure 11: Non-Standard Drop Options

Section 12.14 Special Purpose Drops

The following special purpose drops have been identified:

(a) AP Drop

An AP drop shall consist of one purple Category 6 cable. Corresponding faceplates will have one purple modular jack color oriented as follows:

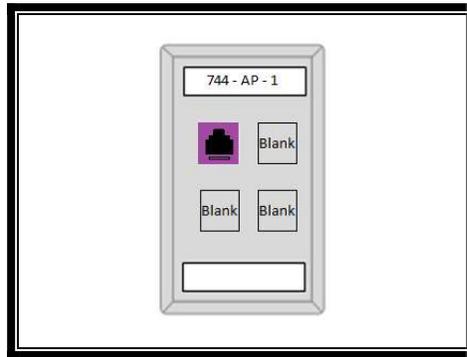


Figure 12: AP Drop

(b) Digital Sign Drop

A Digital Sign drop shall consist of three purple Category 6 cables. Corresponding faceplates will have three purple modular jacks oriented as follows:

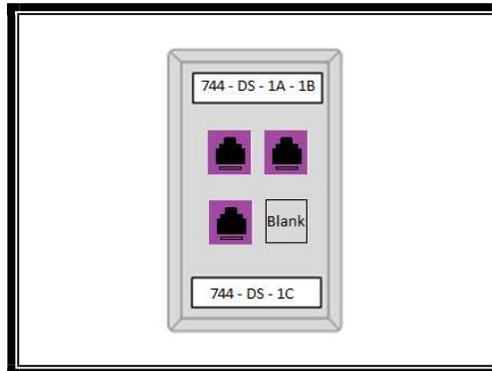


Figure 13: Digital Sign Drop

(c) HVAC, Access Control, and Security Appliance Drops

All HVAC Environment Monitoring Drops, Access Control System Drops and Security Camera/DVR drops shall consist of a minimum of one orange Category 6 cable. Corresponding faceplates will have one orange modular jack oriented as follows:

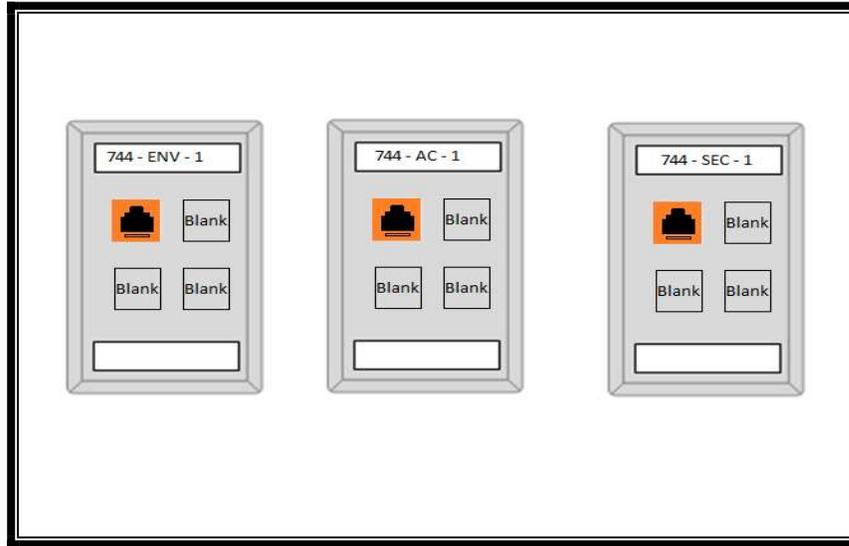


Figure 16: HVAC, Access Control and Security Appliance Drops