



Los Angeles Community College District Design Standards

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LACCD Facilities Design Standards - Structural Cabling and Telecommunications Room Facilities Ver2

Approved: DTC February 10, 2017

LACCD has developed the following Districtwide standard for IT infrastructure and technology systems to aid in the application of current standards and best practices to the LACCD environment.

Sources of installation practices

- ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises
- ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard
- ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard
- ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard
- ANSI/TIA-568-C.4, Broadband Coaxial Cabling and Components Standard
- ANSI/TIA-569-C, Telecommunications Pathways and Spaces
- ANSI/TIA-598-C, Optical Fiber Cable Color Coding
- ANSI/TIA-606-B, Administration Standard for Telecommunications Infrastructure
- ANSI/TIA-607-B, Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises
- ANSI/TIA-758-B, Customer-Owned Outside Plant Telecommunications Infrastructure Standard
- ANSI/TIA-526-7, Measurement of Optical Power Loss of Installed Single-Mode fiber Cable Plant
- ANSI/TIA -526-14, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- ANSI/TIA-942, Telecommunications Infrastructure Standard for Data Centers
- ASHRAE 9.9, Thermal Guidelines for Data Processing Environments

The cabling system shall include high performance copper Category 6A (UTP, STP, FTP) and optical fiber (MM OM4 and SM) cabling where appropriate and as defined by LACCD. Cables may be routed through conduit, cable trays, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile, and through plenum air-handling spaces above ceiling tile. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

Note: Low voltage vendor should conduct project kickoff with College IT before performing any onsite work.

Cable supports in suspended ceilings

1. Supported off ceiling (code in most jurisdictions)
2. Independent supports (code in most jurisdictions)
3. Support spacing every 48" apart
4. Cable jackets must not be distorted

Avoid sources of EMI

1. Fluorescent light ballasts—noisy on failure
2. Electrical cables—cross at a right angle
3. Electric motors—RFI source
4. Transformers



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Cabling Conditions

1. Horizontal cable length maximum 90 meters or 295'
2. Tie wraps that distort the cable jacket will affect cable performance.
3. Velcro strap shall be utilized to organize cabling
4. 4 pair horizontal cable: 25 lbs. of force maximum pull tension
5. UTP Bend Radius = 4 X Cable OD
6. FTP Bend Radius = 8 X Cable OD

Horizontal Pathways in Conduit

1. Two 90 degree bends maximum between pull points
2. 30 meters (100ft) max
3. Maximum of three work areas served by a single conduit
4. Flexible Conduit 5 meters max / increase one trade size

Conduit Fill Requirements

1. Maximum 40% fill in conduit
2. Trade Size 1 = 4 CAT 6A UTP Cables
3. Trade Size 1.25 = 7 CAT 6A UTP Cables
4. Trade Size 1.5 = 10 CAT 6A UTP Cables
5. Trade Size 2 = 18 CAT 6A UTP Cables

Lightning Protection

Where applicable, Contractor shall furnish and install the appropriate amount of manufacturer's Multipair Protector Panels. Contractor shall install all equipment in accordance with manufacturer's specifications.

Fire stopping

Contractor shall furnish and install all requirements to effectively seal all utilized conduits with an approved conduit sealing kit after splicing, testing and acceptance.

Power Separation

Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:

A. Open or Nonmetal Communications Pathways:

1. 12 inches from electric motors, fluorescent light fixtures, and unshielded power lines carrying up to 3kVA.
2. 36 inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
3. 48 inches from large electrical motors or transformers.



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B. Grounded Metal Conduit Communications Pathways:

1. 2 1/2 inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
2. 6 inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
3. 12 inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
4. 3 inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
5. 6 inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

Test Parameters

All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C.2. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

The field test parameters required by the TIA-568-C.2 standard

1. Wire map
2. Length
3. Insertion loss
4. NEXT (Near-end crosstalk loss)
5. PSNEXT (Power sum near-end crosstalk loss)
6. ACR (Attenuation to Crosstalk)
7. PSACR (Power Sum Attenuation to Crosstalk Ratio)
8. FEXT (Far End Crosstalk)
9. ELFEXT (Equal-level far-end crosstalk)
10. PSELFEXT (Power sum equal-level far-end crosstalk)
11. Return loss
12. Propagation delay
13. Delay skew
14. PS ANEXT (Power Sum Alien Near End Crosstalk)

FIBER OPTIC CABLE

Contractor shall furnish and install all requirements to place the fiber optic cable in accordance to LACCD's installation standards for riser or OSP cable and shall not exceed 90% of the manufacturer's installation tensile load. Contractor shall furnish and install all requirements to route the fiber cables to the entrance point on the fiber distribution frames



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OTDR Test Results

Contractor shall furnish on disc with application software, electronic strip charts and/or tracer recordings on each and every fiber strand in each and every cable in one direction for both Multimode and Singlemode fiber with the following information:

1. Date of test
2. Name of test personnel
3. Test wavelength
4. Pulse duration(s) and scale range(s)
5. Index of refraction
6. Fiber cable type and part number
7. Fiber tube and/or fiber strand number
8. Direction of test
9. Overall distance in meters
10. Attenuation in dB or dBm

Power Meter Test Results

1. Date of test
2. Name of test personnel
3. Fiber cable type and part number
4. Fiber number
5. TX wavelength
6. TX location
7. RX location
8. TX model and serial number
9. RX model and serial number
10. Attenuation dB or dBm

Warranty

The Telecommunications contractor must be an approved certified contractor. The telecommunications contractor is responsible for workmanship and installation practices in accordance with the certified installer program. For copper cabling Category 6a system, the telecommunications contractor shall provide labor, materials and documentation according to requirements necessary to ensure that the owner will be furnished with a Manufacturer's Warranty of 25 years in length. The warranty shall guarantee 25 years for the product and 25 years on installation/labor (no pro-rated labor for entirety of 25 years). A resellers warranty is not applicable. The 25 year warranty shall guarantee the following performance on Cat 6a cable.



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Frequency (MHz)	Insertion Loss (dB)	NEXT Loss (dB)	PS NEXT Loss (dB)	ACR (dB)	PSACR (dB)	ACRF (dB)	PS ACR-F (dB)	Return Loss (dB)	Propagation Delay (ns)
1.0	2.1	74.3	72.3	72.2	70.2	67.8	64.8	20.0	570
4.0	3.8	65.3	63.3	61.5	59.5	55.7	52.7	23.0	552
10.0	5.9	59.3	57.3	53.4	51.4	47.8	44.8	25.0	545
16.0	7.5	56.2	54.2	48.8	46.8	43.7	40.7	25.0	543
20.0	8.4	54.8	52.8	46.4	44.4	41.7	38.7	25.0	542
31.25	10.5	51.9	49.9	41.4	39.4	37.9	34.9	23.6	540
62.5	15.0	47.4	45.4	32.4	30.4	31.8	28.8	21.5	539
100.0	19.1	44.3	42.3	25.2	23.2	27.8	24.8	20.1	538
200.0	27.6	39.8	37.8	12.2	10.2	21.7	18.7	18.0	537
250.0	31.1	38.3	36.3	7.3	5.3	19.8	16.8	17.3	536
300.0	34.3	37.1	35.1	2.9	0.9	18.2	15.2	16.8	536
350.0	37.2	36.1	34.1	-1.1	-3.1	16.9	13.9	16.3	535
400.0	40.1	35.3	33.3	-4.8	-6.8	15.7	12.7	15.9	535
500.0	45.3	33.8	31.8	-11.4	-13.4	13.8	10.8	15.2	536
625.0*	51.2	32.4	30.4	-18.8	-20.8	11.8	8.8	14.5	535
750.0*	56.7	31.2	29.2	-25.5	-27.5	10.3	7.3	14.0	535

For the fiber optic system, the telecommunications contractor shall provide labor, materials and documentation according to requirements necessary to insure that the owner will be furnished with a Warranty of 20 years in length.

LABELING

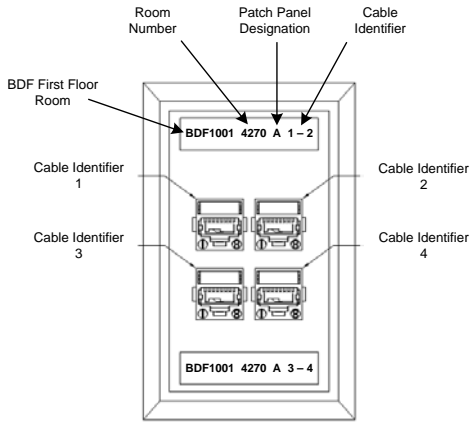
1. All copper horizontal cables are to be labeled using a machine printed label at each end of the cable at approximately 4 to 12 inches of the termination point. Handwritten labels shall not be used.
2. All patch panel ports and telecommunication outlet ports shall be labeled with the cable identifier. Owner may provide specific labeling requirements coordinate with owner.
3. Note all labeling information on the as-built drawings.
4. Contractor shall furnish and install self-laminating type labels to the unitized spur cable's overall jacket, six (6) inches from the fiber storage panel strain relief, with the BDF/IDF number and fiber number in numerical sequence.
5. All fiber cabling shall be labeled in the front of each fiber termination shelf with the labels furnished with such shelf, using LACCD's approved scheme.
6. Present a mockup of a faceplate to verify the labeling scheme matches the campus standard.



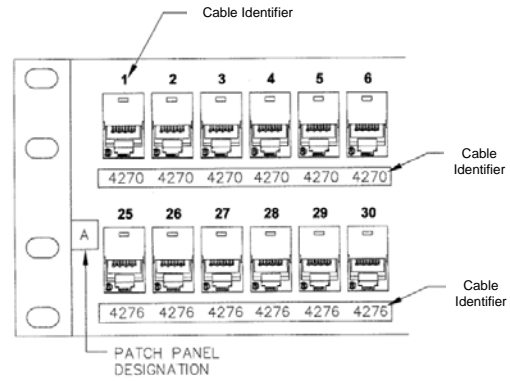
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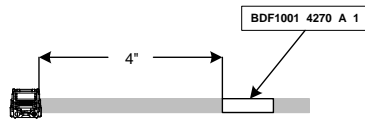
Faceplate – Patch Panel – Cable Labeling



(4) Category 6a Cables/Outlets With 4-Port Faceplate



Patch Panel Designations



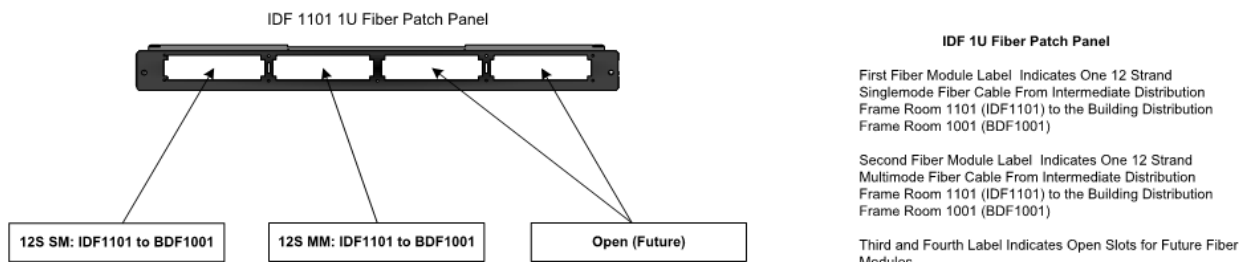
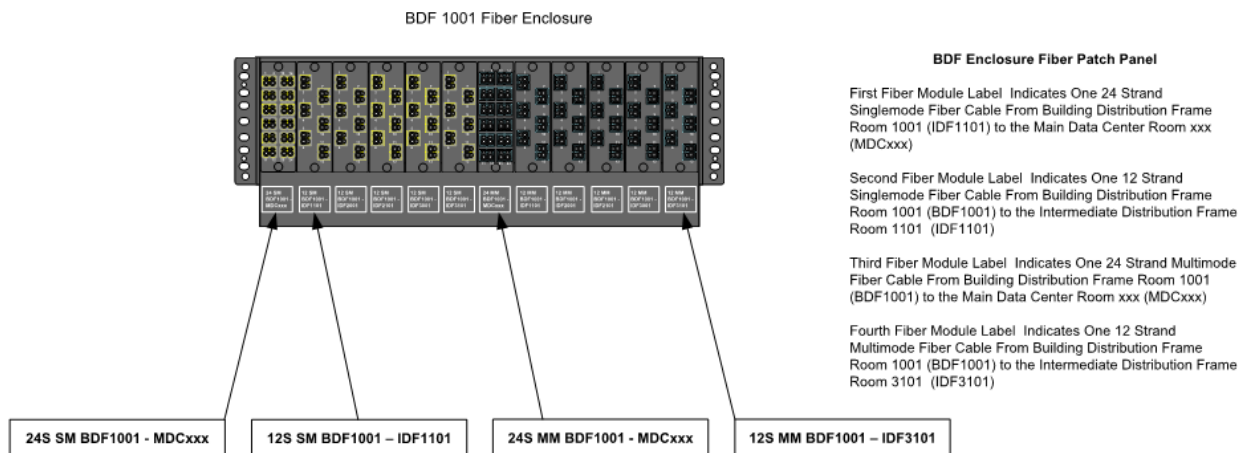
Cable Labeling
Label cable 4" away from each termination with a wrap around machined typed label



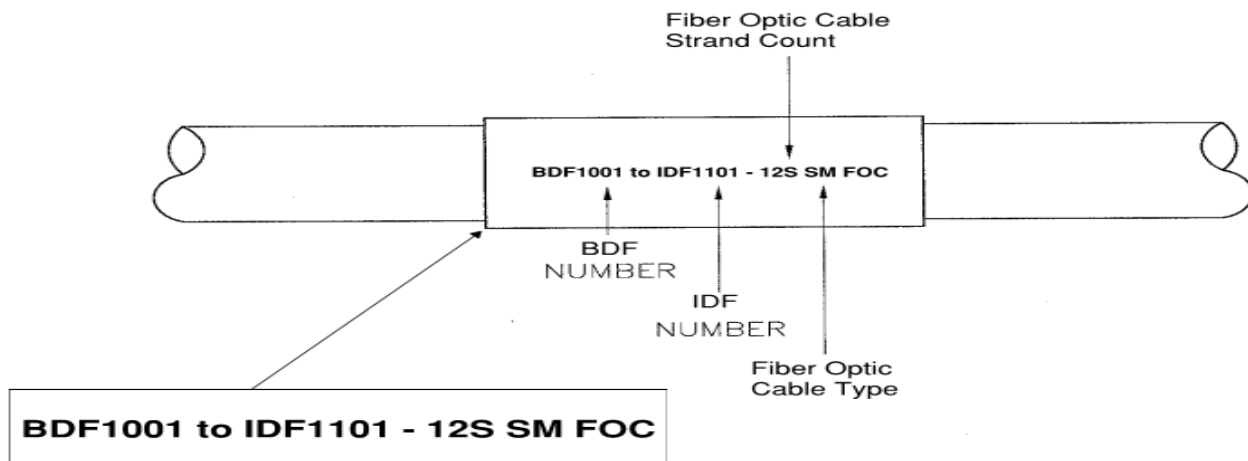
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Fiber Labeling Layout



Fiber Optic Cabling Label





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Telecommunications Room Design Layout

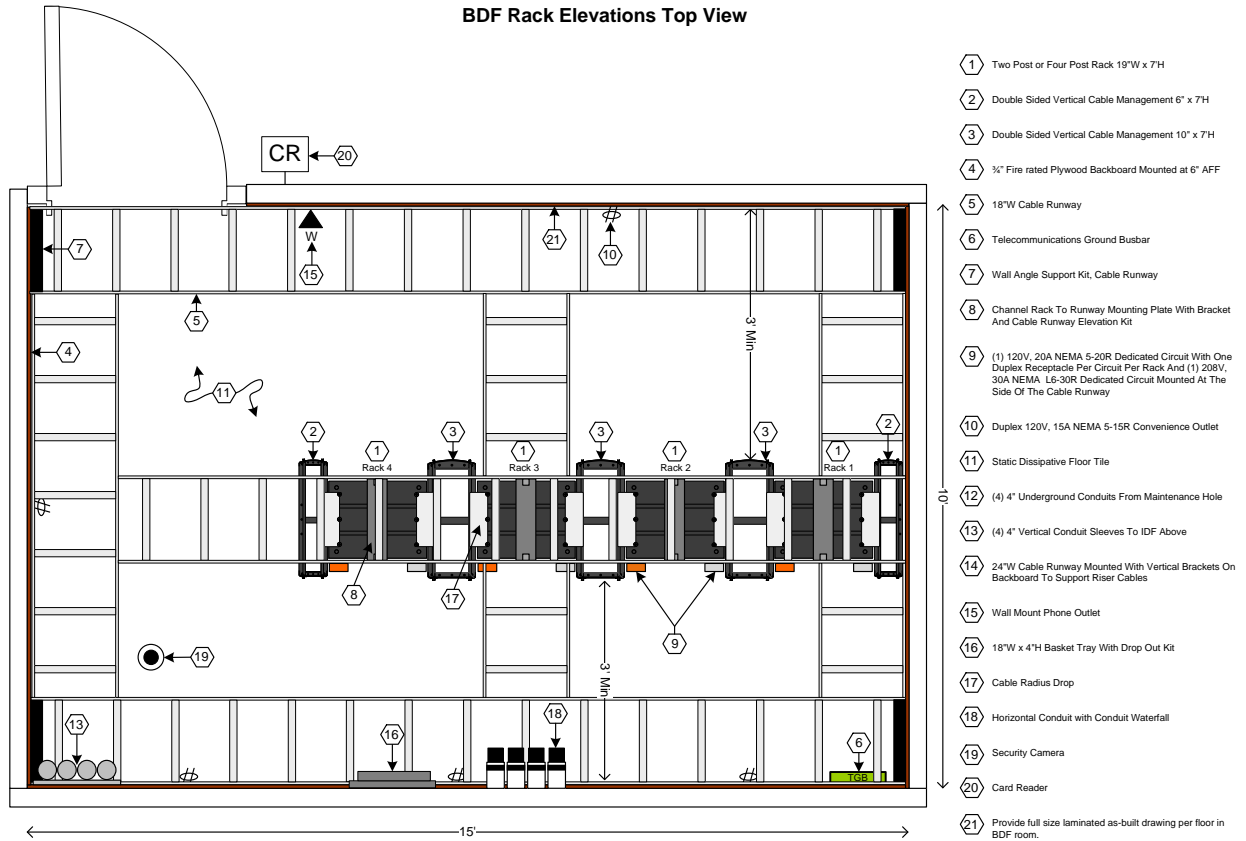
BDF Architectural Requirements

1. The minimum space allocated to the BDF shall be 150 sq. ft. with a minimum dimension of 15 ft. in one direction. (Any space reduction requests by designers need to be presented and determined by college representatives).
2. Do not locate BDFs in any place that may be subject to water infiltration, steam infiltration, humidity from nearby water or steam, heat (e. g., direct sunlight) or any other corrosive atmospheric or adverse environmental conditions.
3. BDFs and IDFs shall be stacked in multistory buildings.
4. Locate the BDF far enough away from sources of EMI to reduce interference with telecommunications cabling, including EMI from electrical power supply transformers, motors, generators, radio transmitters, radar transmitters, and induction heating devices.
5. Minimum ceiling height shall be 10'.
6. BDF doors shall be lockable that at least 3' – 6" wide.
7. Provide AC grade $\frac{3}{4}$ " thick fire-rated plywood 6" AFF on each wall with stamp visible.
8. Provide HVAC that will maintain continuous and dedicated environmental control (24 hours per day, 365 days per year). Maintain positive pressure with a minimum of one air change per hour in the IDF. Provide:
 - Temperature 70 degrees F +/- 10 degrees
 - Relative humidity 50% +/- 20%
9. Provide adequate and uniform LED lighting that provides a minimum equivalent of 50 foot-candles when measured 3 ft. above the finished floor level. Coordinate lighting layout with the equipment cabinet layout, especially overhead cable trays, to ensure that light is not obstructed.
10. Provide (1) 120V, 20A NEMA 5-20R Dedicated Circuit With One Duplex Receptacle Per Circuit Per Rack And (1) 208V, 30A NEMA L6-30R Dedicated Circuit Mounted At The Side Of The Cable Runway.
11. Provide separate duplex 120 V, 15A convenience outlets (NEMA 5-15R) for tools, test sets, etc., located at least 18 in. above the finished floor, placed at approximately 6 ft. intervals around perimeter walls and identified and marked as such.
12. 4 post racks shall be constructed of steel, include adjustable depths, and include cage nut mounting rails. Must meet 2000lb static load rating, evenly distributed. Aluminum racks are not acceptable. Threaded rails are not acceptable.
13. BDFs shall have a connection to a backup generator if included as part of the scope of the project.
14. Provide a copper signal ground busbar in each BDF. The ground conductor shall be a 1/0 copper cable, cad-welded directly to the Ufer Ground or Main Building Entrance Ground, or building steel.
15. Fire Suppression: Provide a pre-action system.
16. Rack layouts require signoff from IT Managers in design phase and secondary signoff prior to installation.
 - Patch cables shall be augmented category 6 component compliant out to 250MHz with operational bandwidth to 500 MHz
 - Be factory assembled and 100% transmission tested with laboratory grade network analyzers for proper performance up to 500MHz
 - Manufacturer will be able to supply any length patch required (custom) from 6" – 20' at no additional charge.
17. Small diameter patch cables shall be the standard for all BDF's and IDF's (28AWG or less).
18. A laminated floorplan shall be mounted in each BDF/IDF identifying all outlets being served.



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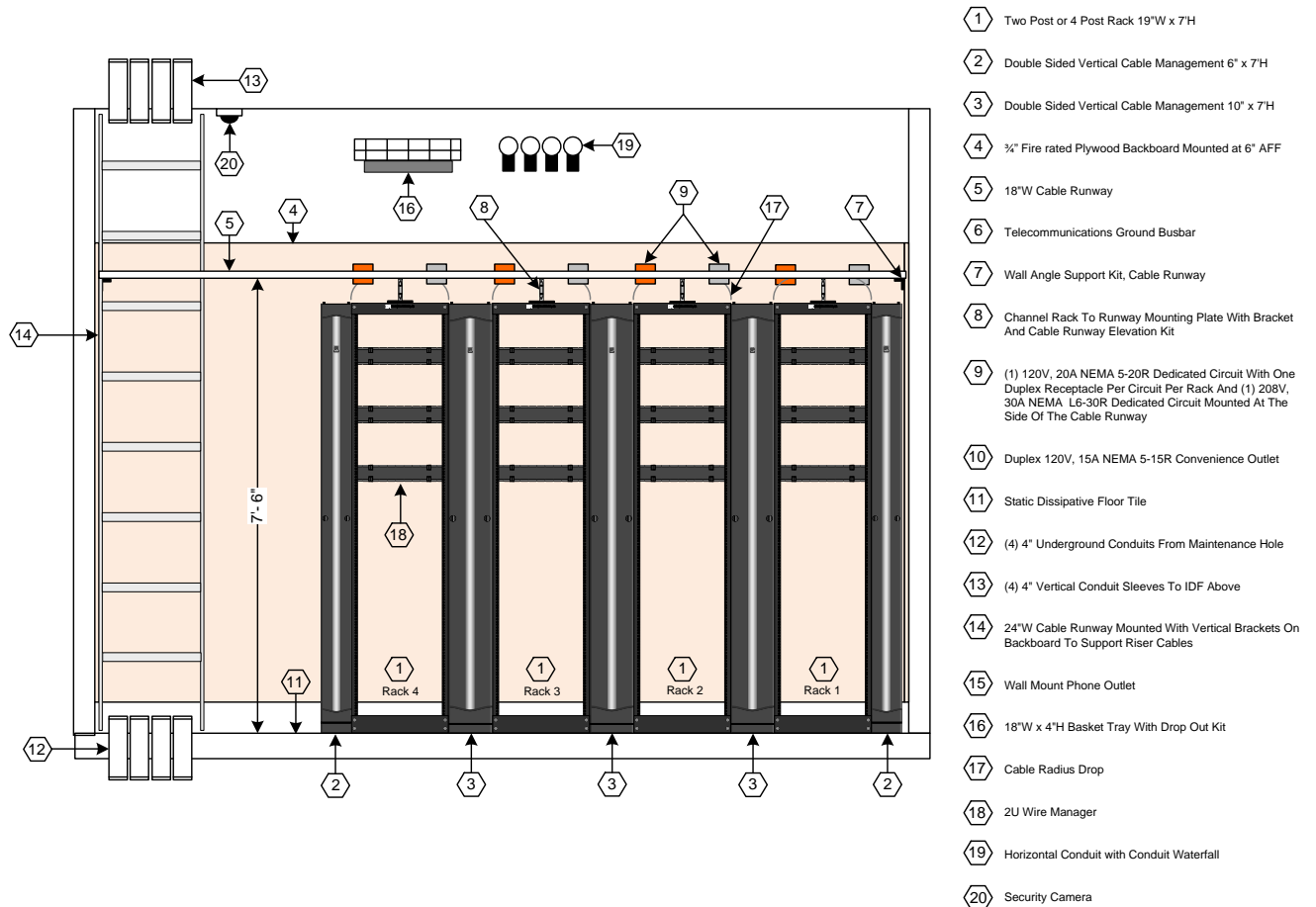




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BDF Rack Elevations Front View



IDF Architectural Requirements



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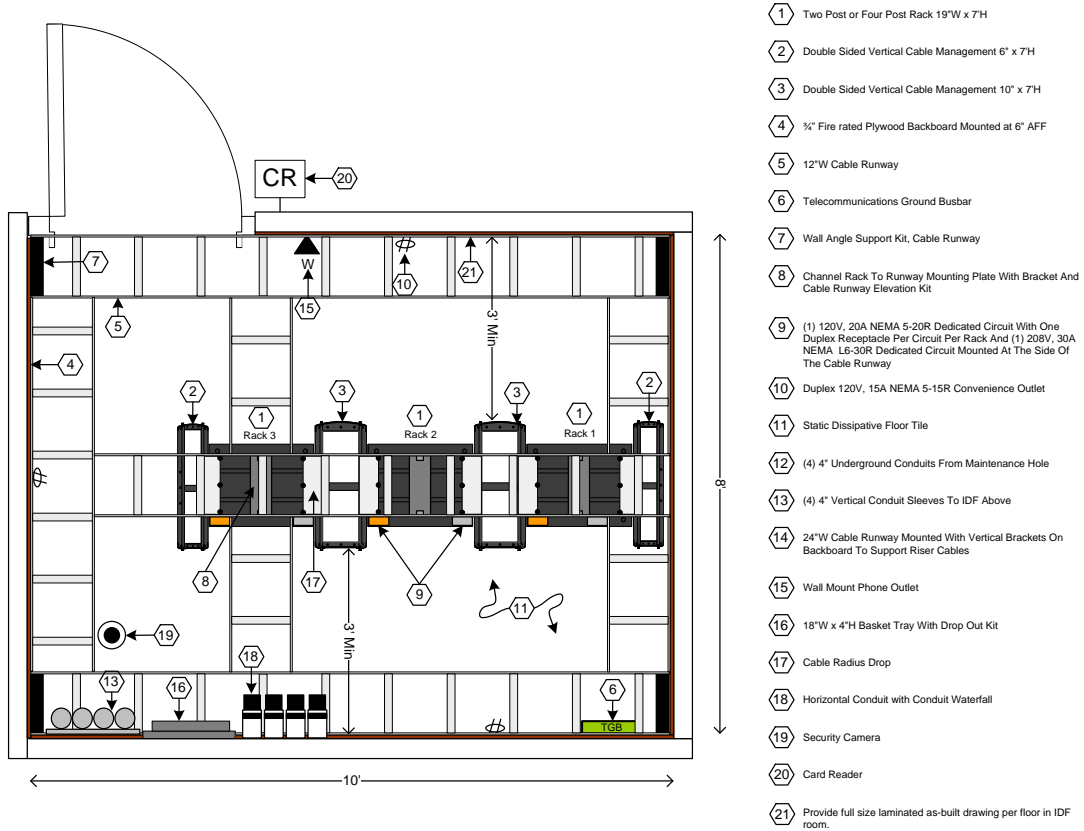
1. At a minimum, the IDFs shall be 8' X 10', with a minimum clear dimension of 8 ft. in one direction. (Any space reduction requests by designers need to be presented and determined by college representatives).
2. Do not locate IDFs in any place that may be subject to water infiltration, steam infiltration, humidity from nearby water or steam, heat (e. g., direct sunlight) or any other corrosive atmospheric or adverse environmental conditions.
3. BDFs and IDFs shall be stacked in multistory buildings.
4. Locate the IDF far enough away from sources of EMI to reduce interference with telecommunications cabling, including EMI from electrical power supply transformers, motors, generators, radio transmitters, radar transmitters, and induction heating devices.
5. The minimum ceiling height shall be 10' above the finished floor.
6. IDFs shall have lockable doors that are at least 3.0 ft. wide.
7. Provide AC grade $\frac{3}{4}$ " thick fire-rated plywood 6" AFF on each wall with stamp visible.
8. Provide HVAC that will maintain continuous and dedicated environmental control (24 hours per day, 365 days per year). Maintain positive pressure with a minimum of one air change per hour in the IDF. Provide:
 - Temperature 70 degrees F +/- 10 degrees
 - Relative humidity 50% +/- 20%
9. Provide adequate and uniform LED lighting that provides a minimum equivalent of 50 foot-candles when measured 3 ft. above the finished floor level. Coordinate lighting layout with the equipment cabinet layout, especially overhead cable trays, to ensure that light is not obstructed.
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13. IDFs shall have a connection to a backup generator if included as part of the scope of the project.
14. Provide a copper signal ground busbar in each BDF. The ground conductor shall be a 1/0 copper cable, cad-welded directly to the Ufer Ground or Main Building Entrance Ground, or building steel.
15. Fire Suppression: Provide a pre-action system.
16. Rack layouts require signoff from IT Managers in design phase and secondary signoff prior to installation.
17. Patch cables shall be augmented category 6 component compliant out to 250MHz with operational bandwidth to 500MHz
 - Be factory assembled and 100% transmission tested with laboratory grade network analyzers for proper performance up to 500MHz
 - Manufacturer will be able to supply any length patch required (custom) from 6" – 20' at no additional charge.
18. Small diameter patch cables shall be the standard for all BDF's and IDF's (28AWG or less).
19. A laminated floorplan shall be mounted in each BDF/IDF identifying all outlets being served.



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IDF Rack Elevations Top View



- 1 Two Post or Four Post Rack 19"W x 7"H
- 2 Double Sided Vertical Cable Management 6" x 7"H
- 3 Double Sided Vertical Cable Management 10" x 7"H
- 4 3/4" Fire rated Plywood Backboard Mounted at 6" AFF
- 5 12"W Cable Runway
- 6 Telecommunications Ground Busbar
- 7 Wall Angle Support Kit, Cable Runway
- 8 Channel Rack To Runway Mounting Plate With Bracket And Cable Runway Elevation Kit
- 9 (1) 120V, 20A NEMA 5-20R Dedicated Circuit With One Duplex Receptacle Per Circuit Per Rack And (1) 208V, 30A NEMA L6-30R Dedicated Circuit Mounted At The Side Of The Cable Runway
- 10 Duplex 120V, 15A NEMA 5-15R Convenience Outlet
- 11 Static Dissipative Floor Tile
- 12 (4) 4" Underground Conduits From Maintenance Hole
- 13 (4) 4" Vertical Conduit Sleeves To IDF Above
- 14 24"W Cable Runway Mounted With Vertical Brackets On Backboard To Support Riser Cables
- 15 Wall Mount Phone Outlet
- 16 18"W x 4"H Basket Tray With Drop Out Kit
- 17 Cable Radius Drop
- 18 Horizontal Conduit with Conduit Waterfall
- 19 Security Camera
- 20 Card Reader
- 21 Provide full size laminated as-built drawing per floor in IDF room.



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IDF Rack Elevations Front View

