



TEXAS A&M UNIVERSITY

Technology Services

Texas A&M University Network Installation Design Standards

(Commonly referred to as “RedBook - Division 27”)

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Publish update 1/20/2023



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Texas A&M Technology Services, Networking group:

Texas A&M Technology Services, Texas A&M Health Science Center (HSC):

Texas A&M Technology Services, Telecommunications:

Texas A&M Office of Safety and Security:

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Communications

Please Note: Reference Telecommunications Industry Association/U.S. Energy Information Administration (TIA/EIA) for all industry standards. In accordance with the TIA Engineering Manual, two categories of criteria are specified; **mandatory and advisory**. The **mandatory** requirements are designated by the word “shall”; **advisory** requirements are designated with the words “should”, “may”, or “desirable”. The Texas A&M University Network Installation Design Standards follow this same designation. Mandatory designation applies to performance and compatibility requirements. Advisory designation applies to “above minimum” requirements.

Data contractors shall meet the following requirements:

1. All data contractors’ installers shall be Building Industry Consulting Service International (BICSI) Certified Installer Level 2 or higher.
2. The data contractors’ onsite supervisor shall be a BICSI Certified Technician or higher.
3. The data contractor shall have a BICSI Certified Registered Communications Distribution Designer (RCDD) on staff for the duration of the project and said shall be available for consultation and site visits upon request.
4. All certifications shall be current and reside in the project management application (e.g. e-Builder.net).
5. At 100% construction document (CD) completion, all contractors and subcontractors shall be responsible for knowing, following, and implementing the most current Texas A&M University Network Installation Design Standards.

Design Criteria

The following articles set forth the general telecommunications systems’ design criteria for a Texas A&M University (Texas A&M) campus network installation which shall be followed by all project managers and contractors. Adjustments will be necessary to meet the needs of lesser size or specialized installations. Verify all special telecommunications (telephone and data) requirements through the Texas A&M Technology Services.

I. Construction Design Review

A. Data contractors shall:

1. Provide a technical design to the project architect so that the network design can be reviewed by Technology Services at every stage (SD, DD and CD). This shall apply to all projects: new construction and renovation. Each design shall meet the following requirements:
 - a) Include all required notations for Technology Services review.
 - b) Include proposed pathways and entrance facilities for Technology Services review.
 - c) Include all penetrations and entries into all communications rooms for Technology Services review.
 - d) Include model of cable runs showing longest run distance for Technology Services review.

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- e) Include drawings indicating all proposed I/O port and wireless drop locations.
 - f) Provide a port count per communications room following the final 100% CD design approval.
 - g) Provide a technical design set in CAD format to Technology Services for review and approval.
- 2. Provide material submittals to Project Manager and Technology Services for review and final approval prior to procurement.

B. Technology Services shall:

- 1. Review all submitted technical drawings and documents in a timely manner.
- 2. Submit corrections and comments to the project via email, meeting minutes and updates directly to the project through the dedicated project management tool.
- 3. Attend all design meetings and participate in all network discussions.

II. Entrance into Facility

All customer owned cabling shall utilize the underground pathway system (ANSI/TIA-758-B-4.2.1) and entrance point diversity is required (ANSI/TIA-758B-4.3.1).

A. Building Communications Entrance Facilities:

- 1. Data design shall provide a minimum of four, 4-inch (in.), Schedule 40 Polyvinyl chloride (PVC) conduits between the building, primary telecommunications terminal-room, Main Distribution Facility (MDF), and the telecommunications manhole, tunnel or other service point as designated by the assigned project manager, member facilities department, and contracted data design team.
 - a. **Minimum** bending radius for the 4-in. PVC conduits shall be 36 inches.
- 2. Project shall provide steel-reinforced, concrete-encased, underground pathways (ductbanks) for telecommunications cables between pull and splice points on the site and the building entrance facilities (ANSI/TIA-758-B).
 - a. Shall install a **minimum** of four, 4-in. PVC conduits in each ductbank plus spares as requested by the user.
 - b. Shall construct communications ductbanks meeting the same requirements as medium-voltage ductbanks. The concrete shall not be colored. Refer to [Texas A&M University Design Standards](#).
- 3. Project shall provide precast-concrete manholes and handholes for underground telecommunications outside the building.
 - a. Shall provide manholes with **minimum** inside dimensions of 6 feet (ft.) wide, 12 ft. long, and 7 ft. high for cable splicing purposes.
 - b. Shall provide handholes with **minimum** dimensions of 3 ft. wide, 5 ft. long, and 3 ft. high for pulling purposes.
 - c. Shall place handholes not to exceed cable manufacturer's pulling tension by a safety factor of two; and shall limit horizontal and vertical bends to **no more** than 180 degrees between pulls.



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B. Building Primary Terminal Room Facilities (MDF):

1. The primary, terminal room (MDF) shall be the first communications room where fiber enters the building and shall be sized in accordance to [Communications Room Standards](#).
 - a. **This room shall house only fiber and copper service entrance equipment for telecommunications, data, and all necessary wide area network equipment.**
 - b. Project shall provide a **minimum** of 48 strands of single-mode fiber between the building, MDF, and the telecommunications manhole, tunnel or other service point as designated by the assigned project manager, member facilities department, and contracted data design team.
 - i. **IF** building design includes desired path diversity, single-mode strand count shall be divided in half per direction (e.g. Path A = 24 strands terminated in the MDF, Path B = 24 strands terminated in the MDF).
2. Reference ANSI/TIA-607-C for grounding and bonding standards.
 - a. Project/Contractor shall provide line protectors and manufactured labeling for both outside plant cables and intra-building grounding and bonding.

III. Communications Room Standards

A. Communications rooms shall comply with the following LAYOUT requirements:

1. MDF **minimum** room size shall be 10 ft. by 12 ft. Technology Services reserves the right to increase MDF size based on ports installed.
2. Intermediate Distribution Facility (IDF) **minimum** room size shall be 10 ft. by 9 ft. Technology Services reserves the right to increase IDF size based on ports installed.
3. Number of communications rooms shall be based on usable square footage space or horizontal cable length.
 - a. There shall be a **minimum** of one communications room per 10,000 square (sq.) feet (ft.) usable space.
 - b. There shall be a **minimum** of one communications room to support a maximum horizontal copper cable length of 270 ft.
 - c. There shall be a **minimum** of one communications room per floor.
4. It is desirable for all communications rooms to be stacked exactly with the communications room located on the floor above and below.
 - a. A scaled layout of the communications rooms shall be provided at the Preliminary Design review.
5. Communications rooms shall be designed to accommodate a minimum of 50 percent growth in unused rack space beyond the final building user requirements.
6. Communication rooms must be designed so that all four walls stack vertically and NO wall is centered on a structural beam that would interfere with vertical risers.
7. All four inch riser conduits shall be three inches off of the wall, in line, with at least three inch gaps between conduits to allow for grounding fittings.
8. Project shall provide 48-strands, single mode, fiber-optic, backbone cable between the MDF and all IDF rooms in a star configuration.

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- a. Technology Services reserves the right to adjust the number of single mode fiber strands when specified or needed; confirm with Technology Services during data design phase.
 - b. Fiber riser cables from the MDF to the IDF(s) shall be armored, **NO** sub-duct will be permitted.
 - c. All fiber terminations shall be Corning factory made fusion-spliced, (LC) lucent connector pigtail fiber jumpers.
7. Project shall provide an additional 24-strand single mode fiber optic backbone cable between MDF and IDF(s) in a star configuration to support a Distributed Antenna System (DAS), **if requested**.
 - a. The final DAS fiber strand count is dependent on the number of cellular providers and technology required to meet the building occupancy expectations. Additional fiber and copper tie cables may be needed for larger DAS installations.
8. Project shall provide copper tie cables between MDF and all IDF rooms in a star configuration. Each IDF shall have:
 - a. 8 pairs - Two CAT3 4 pair horizontal trunks OR may substitute with two Cat6 Cables.
 - i. Note - No need for CAT6 testing and no max distance limit between MDF and IDF's for these cables ONLY.
 - b. Cable shall be terminated into 110 style RJ45 network patch panels with each pair of trunk cable terminated to the middle jack connectors (blue & white/blue) for each RJ45 port
 - c. MDF/IDF panel size may be 12-port or 24-port. Example:



9. A fire-rated penetration (EZPath) solution shall be required for all fire rated and high density wiring locations. **Technology Services shall be notified of all submittals for approval.**
10. Communications rooms shall be used for telecommunications/data **ONLY**, this includes Technology Services-telecommunications provided cable TV. **No** outside security panels, breaker panels, fire panels, ductwork, audio visual (AV) or other trades shall be allowed.
11. **All** walls shall have 8 ft. covering, starting at 12 in. above finished floor (AFF), of A/C marine-grade plywood and shall be painted **front, back, and all edges** with **two coats** off-white or light-grey, fire-retardant paint with the smooth side facing out.
 - a. Shall leave at least one fire-rated stamp unpainted per sheet.
 - b. Plywood shall be permanently fastened to the wall with wall anchors utilizing galvanized, zinc plated, or stainless steel hardware with flat heads. Finished installation shall have a flush appearance with countersunk screw heads to prevent splitting of plywood. **Drywall screws are not acceptable.**
(ANSI/TIA-569-D-6.3.6.1.1)
12. There shall be **NO** sub-ceiling permitted in communications rooms.



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13. There shall be **NO** maintenance crawl space access or roof access within the communications rooms.
14. All concrete floors in communications rooms shall be sealed **prior** to rack installations.
15. All penetrations through floors or rated walls shall meet ANSI/TIA-569-D standards and are subject to [Texas A&M Environmental Health and Safety](#) office approval.
16. Access to communication rooms must be from within the building from the corridor system and not through any other space.
17. All entry doors must open outward.
18. **NO** means of liquid conveyance or condensation of any kind (e.g., water lines, sanitary or roof drain pipes, thermal pipes, water pipes, condensation lines, refrigerant lines, etc.) shall be present in communications rooms or within adjoining walls.
 - a. **Exception:** Fire Sprinklers shall be installed in communications rooms per ANSI/TIA-569-D-6.3.7:
 - i. Fire protection shall be provided as per applicable code.
 - ii. Consideration should be given to the installation of pre-action sprinkler or other “dry” fire-suppression system for some applications.
 - iii. If wet pipe sprinklers are installed:
 - a) The heads shall be provided with wire cages to prevent accidental operation.
 - b) Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room.
 - i) **NOTE:** See NFPA 13 regarding pre-action sprinklers, dry fire suppression systems and wet pipe sprinklers.
 - c) NFPA 12 and [Texas A&M Environmental Health and Safety Standards](#) shall be followed for wet pipe sprinklers.
 - i) **Exception:** Piping shall not be placed directly over the equipment. Please contact [Texas A&M Fire and Life Safety](#) and [Technology Services, Networking](#) prior to planning layout.
19. Communications rooms shall be air conditioned via wall-mounted thermostat, 24 hours a day, and 365 days a year to maintain a temperature of 64 to 75 degrees Fahrenheit and maintain a relative humidity of 30 to 55 percent per electronic equipment requirements to maintain warranty.
 - a. **IF** emergency power is available in the communications room, the heating, ventilation and air conditioning (HVAC) system shall use that power source.
 - b. Fan coil units are more desirable than split units. Fan coil units **shall** meet the following criteria:
 - i. Fan coil units, condensation pipes/tubing, refrigerant pipes/tubing, and plumbing shall **not** be located in the communications room.
 - ii. Communications room shall have supply and return only to maintain cooling efficiency.
 - c. Split units are **not desirable**, but if used shall meet the following criteria:
 - i. **NO** more than 6 in. of any plumbing pipes/tubing, including condensation and refrigerant, shall be visible in communications rooms.
 - ii. **All** 6 in. of visible pipes/tubing shall be insulated.
 - iii. Split units shall have a drain pan placed below the units to catch and divert any and all condensation/water to protect the electronic and cable warranties.

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20. Communications rooms shall be secured with Texas A&M keyless access system coordinated through Technology Services, Telecommunications. There shall also be a dedicated IT communications room key assigned through Texas A&M Key control office.
21. Cables or cable basket trays **shall not** be installed above or in close proximity to light fixtures.
 - a. Lighting shall be 30 foot-candles **minimum** at floor.
 - b. Light fixtures shall run parallel with racks, in front and behind. **NO** light fixtures installed perpendicular to rack shall be permitted in communications rooms.
 - c. **Minimum** distance between the top of the rack and base of the light fixture shall be 12 in.

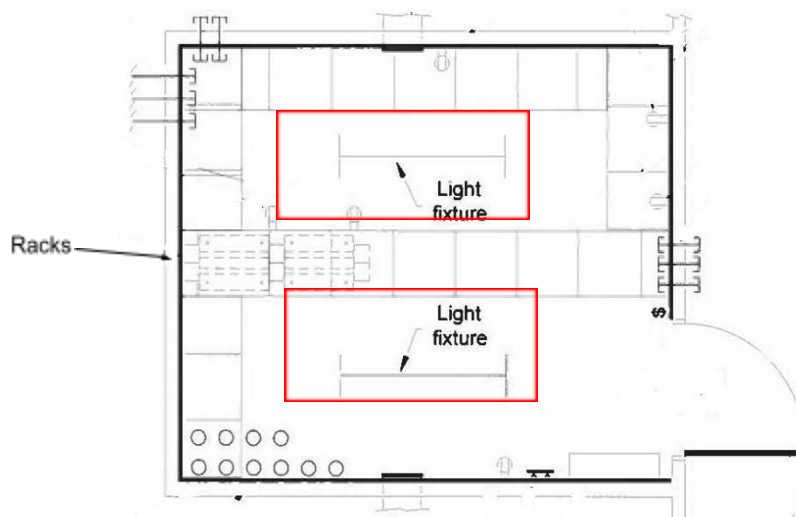


Figure 1. Lighting layout

B. Communications rooms shall comply with the following **POWER** requirements:

1. Contractor shall provide one, 30 Amperes (A), 120 voltage (V) National Electrical Manufacturers Association (NEMA) rated L5-30R on its own dedicated circuit and two (2) NEMA rated 5-20 duplexes, each on their own dedicated circuit, per rack in the **MDF**.
 - a. Technology Services to review and approve any revisions due to any submittal changes.
2. Contractor shall provide one, 30A, 120V NEMA rated L5-30R on its own dedicated circuit and two (2) NEMA rated 5-20 duplexes, each on their own dedicated circuit, to [rack #2](#) in all **IDFs** and two (2) NEMA rated 5-20 duplexes, each on their own dedicated circuits, in the remaining racks in all **IDFs**.
 - a. Technology Services to review and approve any revisions due to any submittal changes.
3. Contractor shall provide one NEMA rated 5-20 duplex on two opposing walls as courtesy outlets.
4. Contractor shall provide one NEMA rated 5-20 duplex on its own circuit mounted 4 ft. AFF to support keyless access control system.



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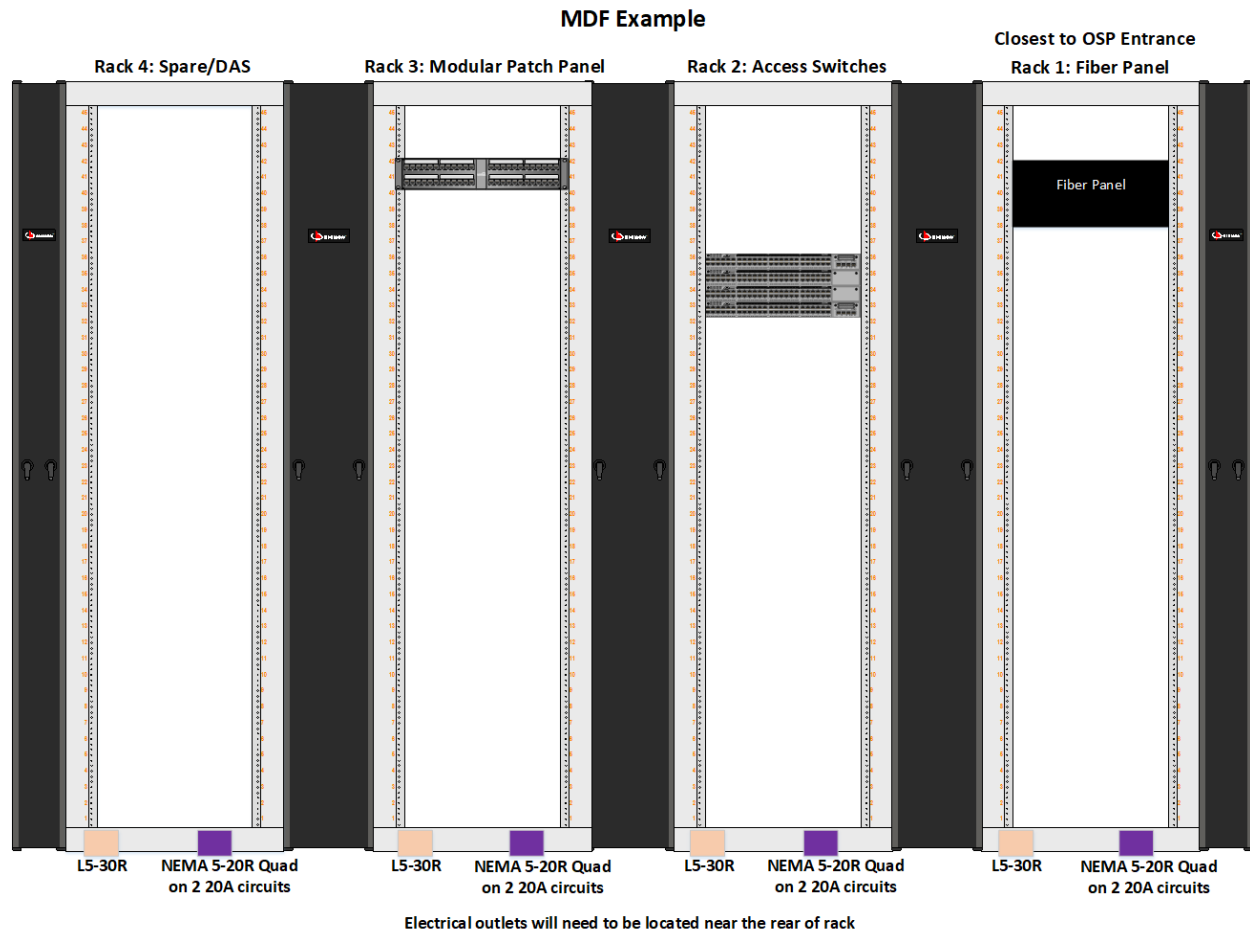
5. All communications rooms shall have dedicated electrical circuits and these circuits **shall not** serve any other load.
 - a. **IF** building emergency generator power is available, electrical circuits shall originate from that source.
 - b. All power requirements shall be reviewed and approved by the Technology Services, Networking **prior to installation**.
6. Each communications room shall have a ground busbar as required by and meeting ANSI/TIA-607-C standards.

C. Communications rooms shall comply with the following **RACK** requirements:

1. Each communications room shall have 8 ft. by 19 in. four-post racks with compatible horizontal and vertical cable management, patch panels, ANSI/TIA standard pre-drilled, 12/24 thread hole spacing with rack unit markings.
 - a. Specifications for racks please see [Appendix A](#).
2. Racks shall be placed to maximize the number of rows that can fit into the communications room and to conserve the available space for future growth and required clearance.
 - a. Racks shall be secured to the floor and the above cable basket tray for stability.
 - b. Clearance around the racks shall comply with ANSI/TIA-569-D.
 - i. A **minimum** of 3 ft. of front clearance shall be provided for installation of equipment. A front clearance of 4 ft. is desirable to accommodate deeper equipment.
 - ii. A **minimum** of 30 in. of rear clearance shall be provided for service access at the rear of racks and cabinets. A rear clearance of 3 ft. is desirable.
3. Typical rack arrangement for communications rooms:
 - a. **MDF**:
 - i. **Rack #1**: (closest to the outside plant (OSP) entrance facility): Fiber panel, power to support uninterrupted power supply (UPS) (NEMA L5-30R), standard NEMA rated 5-20 duplexes, and all copper riser cables.
 - ii. **Rack #2**: Network switches, power to support UPS (NEMA L5-30R), and standard NEMA rated 5-20 duplexes.
 - iii. **Rack #3**: Modular copper patch panels, power to support UPS (NEMA L5-30R), and standard NEMA rated 5-20 duplexes.
 - iv. **Rack #4**: (if required): Spare or used as needed for DAS, power to support UPS (NEMA L5-30R), and standard NEMA rated 5-20 duplexes.



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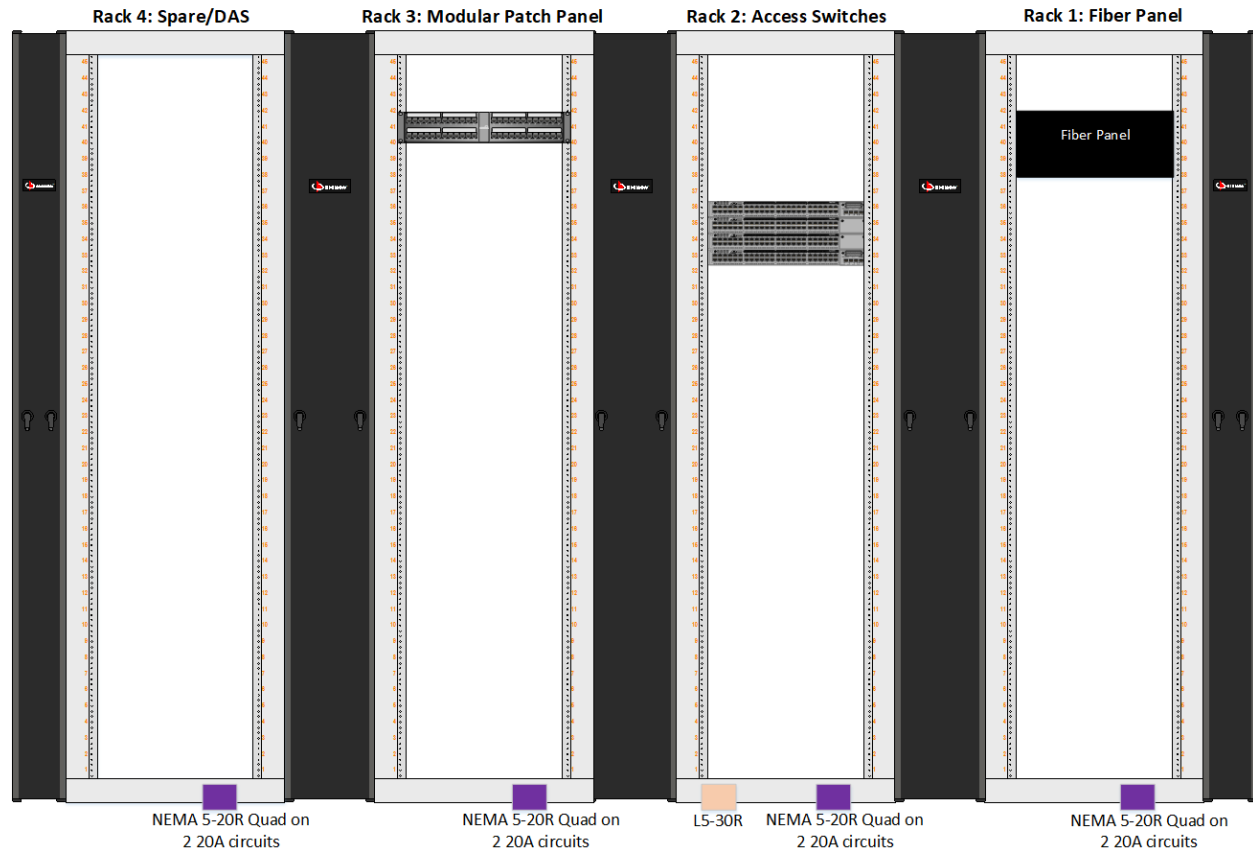
b. **IDF:**

- i. **Rack #1:** shall always be farthest to the left of the room: Fiber panel, all copper riser cables, and standard NEMA rated 5-20 duplexes.
- ii. **Rack #2:** Network switches, power to support UPS (NEMA L5-30R), and standard NEMA rated 5-20 duplexes.
- iii. **Rack #3:** Modular copper patch panels and standard NEMA rated 5-20 duplexes..
- iv. **Rack #4:** (if required): Spare or used as needed for DAS, power to support UPS (NEMA L5-30R), and standard NEMA rated 5-20 duplexes.



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IDF Example



Electrical outlets will need to be located near the rear of rack

4. Finish color for racks, associated patch panels, and vertical and horizontal managers shall be black.
5. Technology Services, Networking shall approve all rack placement **prior to permanent anchoring**.

D. Communications rooms shall comply with the following **COPPER PATCH PANEL** configuration requirements:

1. **ONLY** modular copper patch panels shall be permitted.
 - a. Specifications for modular copper patch panels please see [Appendix B](#).
2. For every modular copper patch panel there shall be a two rack unit width (2U) horizontal manager provided with an additional 2U horizontal manager at the top of each rack.
3. Contractor shall provide a black CAT 6 patch cable per patch panel port.
 - a. Specifications for patch cables please see [Appendix B](#).
4. Label all patch panels, cables, and outlets according to the Texas A&M Network Installation Design labeling standard.
 - a. Specifications for labeling standard please see [Appendix C](#).
5. **NO** angled patch panels.
6. **ALL** modular copper patch panels shall be populated with (like) jacks.

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E. Communications rooms shall comply with the following **CABLE BASKET TRAY SYSTEM** requirements:

1. Cable basket tray shall be used in the communications rooms and shall be sized appropriately for cabling capacity at a fill rate of no more than 40 percent.
 - a. Specifications for cable basket tray please see [Appendix A](#).
2. Cable basket tray shall be installed around the full perimeter of the communications rooms.
3. Cable basket tray shall be mounted 6 in. above racks and 12 in. below lighting. **DO NOT** install cable basket trays above light fixtures.
 - a. Please see [Figure 1. Lighting layout](#).
4. Ladder racks shall only be used for vertical risers in the communications rooms. All other locations and horizontal cable runs shall use appropriately sized cable basket trays.
5. All modular components of the cable basket tray system shall match the system. All transitions shall be supported by system manufactured components, including supports, curves, vertical transitions and assembly components to meet grounding and bonding codes.
6. **ALL** cut edges of the cable basket tray shall be ground smooth, prior to pulling cable.

F. Communications rooms shall comply with the following **FIBER PATCH CABLE** configuration requirements:

1. All fiber runs shall be terminated in a fiber patch panel and shall be fusion spliced with Corning glass LC/UPC single mode fiber pigtails.
2. Single-mode fiber patch cables shall be yellow, UPC polished, factory made, and individually bagged with test results on each package in the following amounts:

| 3 meters (m) | |
|----------------|------------|
| LC/UPC-LC/UPC: | 50 percent |

| 5 m | |
|----------------|------------|
| LC/UPC-LC/UPC: | 50 percent |



Figure 2: Fiber patch cable

3. Corning glass required. **NO** substitutions shall be permitted.
4. Label all patch panels, cables, and outlets according to the Texas A&M Network Installation Design labeling standard, [Appendix C](#).



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G. Communications rooms shall comply with the following for **ALL DATA INSTALLATION** requirements:

1. Copper and fiber cable shall meet the following installation industry standards: ANSI/TIA 568-B, 568-C.2-1, 568-C.2-2, 596-D, and 598-D.
2. Cabling shall be installed without kinks, visible damage, or damage caused by exposure to the following: water, paint, sheetrock mud, construction compounds, cleaning solvents, etc. **Damaged cables shall be replaced at NO cost to Texas A&M.**
3. Longest path routing in wiring closets should be used to provide additional cable for an equivalent service loop of at least 2 meters.
4. When dressing cables in the communications rooms, bundling cables in the cable basket tray **shall not be permitted**. In vertical cable management, bundles shall not exceed 12 cables per grouping and shall be secured using Velcro/hook and loop cable ties **ONLY**.
5. Data cables shall **NEVER** share path with other trades' low voltage cable or electrical.
6. Contractor shall meet the following requirements per each type of media installation:
 - a. Copper Cable requirements:
 - i. Cable shall be of a fire-retardant, "open air plenum" type; meeting all federal and state fire codes.
 - ii. Cable manufacturer shall be: Panduit. There **shall be no substitutions** unless approved by Technology Services, Networking.
 - iii. The cable shall be four pair, 23 American wire gauge (AWG) above minimal compliance CAT 6 or CAT 6A cable.
 - iv. Cable quality shall exceed base level CAT 6 and shall be sweep tested to a minimum of 550 megahertz (MHz).
 - v. Cable shall have sequential foot markers along the entire spool.
 - vi. Twisted-pair cables shall have a minimum bend radius of four times the cable diameter for unshielded twisted pair (UTP) construction and eight times the cable diameter for screened construction, at a temperature of -20 degrees Celsius +/- 1 degree Celsius, without jacket, insulation, or shield (if applicable) cracking, when tested in accordance with the American Society for Testing and Materials (ASTM) D4565 Wire and Cable Bending Test. (ANSI/TIA-568-C.2-5.3.6)
 - vii. Cables shall be laid flat, not bundled in cable basket trays.
 - viii. Technology Services shall approve all proprietary connectivity systems.
 - ix. Cable entry into communications rooms shall be routed through a fire-rated penetration (EZPath) and shall take longest path around the room plus an additional 2 m for service loop.
 - b. Fiber Cable requirements:
 - i. Cable shall be of a fire-retardant, "open air plenum" type and armored clad; meeting all federal and state fire codes.
 - ii. Cable shall be Corning Glass **ONLY**.
 - iii. Cable color shall be yellow.
 - iv. All fiber strands shall be terminated using ANSI/TIA-598-D color code.
 - v. All fiber strands shall be terminated, labeled, and installed in [rack #1](#).
7. Shall follow the Texas A&M Network Installation Design labeling standard, [Appendix C](#).



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IV. Outside of the Communications Rooms

A. Horizontal cable run requirements:

1. Contractor shall only use approved cable basket tray for all primary horizontal cable runs.
 - a. Submittals to be approved by Technology Services, Networking.
2. Cable basket tray shall be sized appropriately for cabling capacity at a fill rate of no more than 40 percent.
3. Cable basket tray shall meet the requirements referenced in [Appendix A](#).
4. Data cables shall **NEVER** share path with other trades' low voltage cable or electrical.
5. Cable installations in solid ceilings shall have access panels every 10 ft. or cable runs shall be routed through electrical metallic tubing (EMT) 4-in. conduit to the point of accessible areas.
 - a. EMT 4-in. cable capacity shall not exceed 40 percent.
 - b. All empty conduit shall have a pull cord/jet line installed.
 - c. All conduit penetrating into a fire rated space will require a fire rated sleeve or mechanical fire suppression solution.
6. All input/output (I/O) cable runs shall be in EMT 1-in. conduit back to cable basket tray.
7. There shall be an 18 in. service loop between the end of the EMT 1-in. conduit and the cable basket tray.
 - a. Service loop shall be coiled or left in a figure 8 per minimum bend radius and attached with Velcro or hook and loop to the outside of the cable basket tray. **Do not** leave cable slack in cable basket tray.
8. All conduit shall have plastic bushings at both ends to protect cable.
9. J-hooks are acceptable **ONLY** on a case-by-case basis and must be reviewed and approved by the Technology Services, Networking.
10. Horizontal cable jacket color shall be blue.
11. Contractor shall follow the Texas A&M Network Installation Design labeling standard, [Appendix C](#).
 - a. Every cross-connect point along the horizontal cable run shall have a manufactured label denoting same cable number placed 6 to 8 in. from termination end. Please see [Figure 3: Horizontal run label](#).

B. Copper cable requirements:

1. Please refer to the [Copper Cable Requirements](#) section in the Texas A&M University Network Installation Design Standards.

C. Fiber Cable requirements:

1. Please refer to the [Fiber Cable Requirements](#) section in the Texas A&M University Network Installation Design Standards.

D. I/O installation requirements:

1. Each I/O outlet shall have a three-and-a-half-inch deep dual gang box with the appropriate sized faceplate.
 - a. Two EMT 1-in. conduits shall run from the outlet box to the nearest cable basket tray.
 - b. Outlet box shall be located a minimum of 12 in. from the nearest power outlet.
2. A typical office with a single occupant shall have a minimum two CAT 6 cables.
 - a. Contractors shall use the following parts to terminate the I/O port:
 - i. Panduit part number: [NK688MIW](#) (off white color)/[NK688MWH](#) (white color).
 - ii. Matching manufacture components shall be ordered to complete terminations.

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- iii. All unused spaces shall be filled with modular blanks.
- iv. Deviations from the above part requirements, shall be approved by the Technology Services, Networking.
- 3. Contractor shall follow ANSI/TIA-568-B color code standard.
- 4. Contractor shall provide a black CAT 6 patch cable per I/O port.
 - a. Specifications for patch cables please see [Appendix B](#).
- 5. I/O ports shall have a manufactured label denoting same cable number on faceplate above termination port. Please see **Figure 4: I/O ports labeling**.

E. Wireless local area network (WLAN) installation requirements:

- 1. Indoor wireless requirements:
 - a. Reference Telecommunications Systems Bulletin TIA-162-A for topology, design, installation, and testing of WLAN cabling infrastructure, in compliance with ANSI/TIA-568-C.0 and ANSI/TIA-569-C, for supporting WLANs.
 - b. Install two cables to each location designated for a single wireless access point (WAP). Minimum cable type shall be no less than CAT 6A.
 - i. Specifications for patch cables please see [Appendix B](#).
 - c. WAP placement during design phase shall be based on a pre-cable grid with 40 ft. square cells.
 - d. For above ceiling locations, install each cable with a 20 ft. service loop at the access point end.
 - e. Contractor shall terminate the cables with a registered jack RJ-45 connector and install the cables in a standard 1900 4" electrical box with a single gang $\frac{5}{8}$ " raised mud ring, mounted flush with the ceiling material and made accessible to Technology Services Installers without removing tiles or ceiling components.
 - f. WAP shall not be located in ceilings above 21 ft. In locations with ceilings exceeding 21 ft., a standard 1900 4" electrical box with a single gang $\frac{5}{8}$ " raised mud ring for access points shall be required and located no more than 18 ft. AFF.
 - g. All WAP locations shall be labeled clearly for installation identification.
 - h. Desired wireless access point density
 - i. Residence halls: one WAP per suite with a minimum of one WAP per 1600 ft.²; access points shall not be placed directly above nor below one another.
 - ii. Other typical buildings: one WAP per 1600 ft.²; access points shall not be placed directly above nor below one another.
 - iii. Places of assembly (e.g., large classrooms, cafeterias, gymnasiums, conference rooms): estimate the number of access points based upon expected occupancy as shown in Table 2.

| Expected Occupancy | Number of WAPs |
|---|------------------|
| Up to 125 | 5 ^{1,2} |
| 126 - 200 | 9 ² |
| 201 - 300 | 14 ² |
| 301 - 400 | 18 ² |
| 401 - 500 | 21 ² |
| ¹ One WAP per 25 people | |
| ² Calculation is based on an algorithm accounting for three Bring Your Own Device (BYOD) per individual. | |

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Table 2: Placement Estimate Table

Outdoor wireless requirements:

- a. All outdoor wireless locations and equipment are to be approved by the [Office of the University Architect](#) during the design phase of the project, and again prior to installation.
- b. Outdoor wet locations are to use a 2.75-3 in. single gang deep weatherproof box with a 1-Gang, 3-Hole, weatherproof, cluster cover with half inch outlets. Locations in damp areas should be protected by an overhanging eave or roof whenever possible and must be listed for damp locations. The system must be listed by Underwriters Laboratories (UL) as an entire system or assembled from individual components that are listed. Two CAT 6A, minimum, cables are to be terminated with keystone jacks in the box. Mounting location is to be 18 ft. to 21 ft. AFF.
- c. All solutions requiring external antenna systems shall require a lightning arrest bonding point. Consult current building codes for acceptable lightning protection systems.

V. Testing

A. Copper cable testing:

1. Contractor shall test and certify the data and telephone wiring systems for conformance with the ANSI/TIA-568-C.2-2 CAT 6 or CAT 6A wiring standards.
2. Contractor shall provide complete test results, from a level IV test unit in PDF and Linkware file format.
 - a. Linkware is the proprietary software for Fluke testers.
 - b. Include the following information in the test documentation: I/O number, room number, cable lengths and test results for each station cable.
3. Contractor shall provide laminated, half-size, as-built drawing per communications room indicating each outlet location, final room number and outlet number. **Framed poster print out shall not be permitted.**
4. Warranty: It is the intent that the complete cabling system be installed to satisfy a 20-year minimum manufacturer's warranty.

B. Fiber cable testing:

- a. Contractor shall test and certify the data, DAS, and telephone fiber systems for conformance with the ANSI/TIA-568.3-D for single mode fiber connectivity.
- b. Contractor shall provide complete test results, from OTDS test unit in PDF and Linkware file format.
 - i. Linkware is the proprietary software for Fluke testers.
 - ii. Patch panel number, strand number, cross connect information and test results for each fiber.
- c. Warranty: It is the intent that the complete cabling system be installed to satisfy a 20-year minimum manufacturer's warranty.

VI. Texas A&M Technology Services, Telecommunications Services requirements

A. Intercom and audio visual systems (Code Maroon):

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1. Coordinate all requirements for intercom, video, and audio equipment with telecommunications, as designated by the assigned project manager, member facilities department, and contracted data design team.
 - a. Provide power outlets, conduit, wire and grounding as required.
 - b. Provide a cable television distribution system.
 - i. As a minimum, provide a complete sound system including The Americans with Disabilities Act/tool-assisted superplay (ADA/TAS) hearing assistance system and all reasonable infrastructure for audio-visual equipment and appurtenances for all classrooms, meeting rooms and auditoriums whose seating capacity exceeds 50 seats.
 - c. Code Maroon (Paging Amp Installation)
 - i. Project shall provide pathway and conduit with pull string from Siemens Fire Panel to nearest MDF/IDF.

B. Cable television systems:

1. Provide all cabling, radio frequency (RF) Amplifiers, RF Passives and all appropriate accessories for a complete and operating RF distribution system capable of delivering distortion free video, audio and data signals.
2. The RF distribution system shall be capable of delivering Community Antenna Television (CATV) Channels 2 through 135.
 - a. The RF distribution system begins at the centralized demarcation point in the MDF Room and ends at the wall outlet locations.
3. The RF distribution system shall be two-way compatible with the ability to transmit all frequencies between 5 and 40 MHz from the wall plate back to the demarcation point.
4. Locate all amplifiers, splitters and multiport directional couplers in a telecommunications room.
 - a. Homerun all cables between the telecom room and wall outlets with cable lengths not to exceed 270 feet.
5. All forward amplifiers shall have a minimum of 30 decibel (dB) gain and a minimum bandwidth of 54 to 862 MHz with a flat frequency response no greater than 1.5 dB.
6. All cables between the demarcation point, amplifiers, splitters and multiport directional coupler locations shall be plenum rated, bonded-foil, tri-shield construction Type RG-11 coaxial cable or plenum P3 500 Hardline Cable.
7. All cables between multiport directional coupler locations and wall outlets shall be plenum rated, bonded-foil, tri-shield construction Type RG-6 coaxial cable.
8. All splitters used to divide trunk runs and multiport directional couplers used to feed wall outlets shall be 5 MHz to 1 gigahertz (GHz), 130 dB, Radio Frequency Interference (RFI) shielding and solder-sealed precision machined F ports.
9. Connectors shall be F-type and designed to be used with the installed cable.
10. Non-locking 75 ohms (Ω) terminators shall be installed on all unused ports on splitters and multiport directional couplers.
11. The forward signal level at each wall outlet shall have no greater than a 10 dB tilt across the bandwidth of the distribution system, 54 to 862 MHz.

C. Emergency telephones:

1. Emergency Telephones shall be installed outside of new campus buildings as specified by the Texas A&M Campus Safety Committee.



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- a. Where requested the telephones will be provided and installed by the contractor.
2. Manufacturer to be RamTel with the following features:
PLC8 Stainless Steel Column Light (TOWER ONLY - NO KEYPAD)
1 - GBF-2 Glass bead Finish
1 500-1179 J Bolts and Template
3. Infrastructure shall include a 20 in. by 20 in. by 3 ft. 6 in. deep footing with four J-hooks inserted.
 - a. A template for the slab and J-hooks shall be provided by Texas A&M Technology Services, Telecommunications group.
4. The project shall also provide a 20A, 120V emergency power circuit from the building to the slab installed in conduit and a one inch vacant conduit for communications wiring.
5. Manufacturer for cellular call box to be AdvanceTec Industries INC.
 - a. AdvanceCall Box Part #AT8564A - When ordering, please specify Texas A&M design specs.
 - b. Contact information:
Gil Ron
(O) 305-623-3939 (C) 305-586-6867
gron@advancetec.com
Angel Cortes
(O) 800-881-8211 x107 (C) 305-216-0651
acortes@advancetec.com
6. Project shall also provide a 110v GFI protected electrical outlet inside the base of the tower.

D. Area of Refuge and Elevator Call Box Requirements:

1. For area of refuge main control device and/or each elevator call box, contractor SHALL
 - a. Install a CAT6 data drop from the main control device to the nearest building IDF.
 - b. Shall follow the Texas A&M Network Installation Design labeling standard, [Appendix C](#).
2. This CAT6 cable shall be used to provide a POTS line (analog phone service) to the main device control point.
3. Contractor shall be responsible for all device and call programming.
4. The device shall call the Texas A&M Radio Room only when activated via the dial string '70010'.
5. Project manager (FP&C, CPDC, SSC or private PM) shall complete a [Telecommunications work order](#) to request new analog phone service and a phone line activation.
*For device manufacturer and model requirements, contact TAMU Environmental Health & Safety (<https://ehs.tamu.edu>)

E. Distributed antenna system (DAS):

1. Provisions shall be made for new buildings constructed on campus to accommodate a DAS to enhance wireless communications (e.g., cell phones) within the building area.
 - a. The roof-mounted communications equipment for the DAS shall be provided by the communications service carrier, typically after the building has been constructed.

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- b. Contractor shall provide an additional 24-strand single mode fiber optic backbone cable between MDF room and all IDF rooms in a star configuration to support DAS, **if requested.**
- c. Contractor shall provide the following equipment, wiring, and raceways at selected location(s) on the roof of the building to support the communications equipment:
 - i. One 100A, 120V, 12-circuit panelboard with main circuit breaker in a NEMA rated 3R enclosure. Supply the panelboard from the nearest electrical room or point of available power in the building.
- d. Contractor shall provide a dry-type, step-down transformer in a NEMA rated 3R enclosure at the location of the panelboard as may be required to reduce voltage drop and minimize the length of the 100A supply circuit to the panelboard. If a transformer is determined to be needed, consider specifying a combination transformer/panelboard assembly such as the “Mini Power-Zone” product manufactured by Schneider Electric.
- e. One 20 in. by 20 in. by 6 in. or larger NEMA rated 4 enclosure for communications cabling, located adjacent to the roof-mounted power equipment.
- f. One 1.5 in. empty conduit with pull string from the nearest IDF room to the communications enclosure for fiber cable to be furnished and terminated by the communications service carrier.
- g. If possible, coordinate the above requirements with the campus DAS communications service carrier prior to installation, as these may change depending on the carrier’s equipment specifications.

F. Metering and building automation communications:

- 1. All buildings shall have meters installed that record consumption. The WAGES panel will require a category 6 Ethernet cable. The project shall provide a dedicated Ethernet network connection between the WAGES panel and the Campus Metering Software. The BAS Contractor is responsible for coordinating the network drop (s) required for integration to the Campus Metering Software and will not receive final payment for the project until the Metering system is fully integrated and accepted by TAMU Utilities & Energy Services (UES). Prior to any Commodity being energized or supplied to the project, the metering must be in place, set up, integrated into the UES metering software, and logging correct consumption data in Version 3.0.2019 Utility Metering the UES metering software database. All meter connections, and set up configuration, must be approved and documented by a UES metering representative.
- 2. **There shall be no meters or panels for these systems installed or located in the MDF of IDFs. Utilities and Energy Management does not have access to these areas without authorized escorts.**

VII. Communications Room Pre-Substantial Completion Checklist

- ☐ All approved water conveyance, condensation, and refrigerant lines in the communications rooms shall meet the specifications in the [Communications Room Standards](#).
- ☐ All walls shall meet the specifications in the [Communications Room Standards](#).
- ☐ Shall have permanent doors to the communications rooms installed and cored to the Technology Services, Networking key.

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- ❑ Shall have racks, cable basket tray, horizontal and vertical cable management secured and grounded.
- ❑ Shall have power installed and active in the communications rooms and at the base of each rack.
- ❑ Communications rooms shall be climate controlled (cooling between 65 and 72 degrees, humidity 30 to 50 percent).
- ❑ Communications rooms shall be clean and dust free.
- ❑ All horizontal cables shall be inspected and shall be free of paint, construction debris or chemicals.
- ❑ All copper and fiber cables shall be installed, terminated and labeled per the Texas A&M Network Installation Design labeling standard, [Appendix C](#).
- ❑ All installed fiber and copper cables shall be certified and test results shall be transmitted to the Technology Services, Networking per the [Testing standard](#).
- ❑ Patch cables shall be on site before the switches are racked.

VIII. Project Pre-Substantial Completion Checklist

Project/Contractors are responsible for coordinating the following:

- ❑ Keyless access installation questions shall be directed to [Texas A&M Office of Safety and Security-Building Access](#) (Key Control).
- ❑ Shall coordinate communications room door cores through the [Texas A&M Office of Safety and Security - Building Access](#) (Key Control).
- ❑ Shall coordinate VoIP requirements and requests through [Technology Services, Telecommunications](#).
- ❑ Shall coordinate HSC VoIP requirements and requests through [HSC OIT Networking](#)
- ❑ Communications rooms shall be in a complete state per Texas A&M University Network Installation Design Standards.
- ❑ Installation, labeling, and testing of copper and fiber cabling shall be complete and results transmitted to Technology Services, Networking.
- ❑ One half size laminated communications room "as built" shop drawing shall be displayed on the wall in each corresponding communications room.
- ❑ HVAC shall be installed, operating, and maintaining proper temperature and humidity.
- ❑ Proper electrical power to communications rooms and racks per Texas A&M University Network Installation Design Standards.
- ❑ Communications rooms shall be in a **DUST FREE** state of completion and all debris shall be removed.
- ❑ Shall request fiber circuit(s) or active copper connections for life safety testing by emailing request@tamu.edu five business days prior to the "needed by" date. The request will require the following information: Contractor technician contact information, date needed by, location of fire alarm panel, and account number to bill.

IX. Project Handoff Requirements

The listed items below shall be completed per the Texas A&M University Network Installation Design Standards:

- ❑ All pre-substantial completion items shall be finalized and approved by the Technology Services.

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- Doors shall be cored to Technology Services, Networking key, keyless Matrix system and locked.
- Building shall be in a **DUST FREE** state of completion before permanent building network equipment shall be installed.

X. Contact Information

A. Texas A&M Technology Services, Networking:

1. Construction Project Team
tamu-it-networking-projects@tamu.edu
2. Jason Demshar, Associate Director
Construction Project Team Supervisor
j-demshar@tamu.edu
979-845-3781
3. Scott Hranicky, Enterprise IT Technologist
scott-h@tamu.edu
979-458-0657
4. Jason Wade, Lead Network Engineer
jwade@tamu.edu
979-458-3144

B. Texas A&M Technology Services, Texas A&M Health Science Center (HSC):

1. Texas A&M Health - OIT Networking
oitnetworking@tamu.edu
2. Barry Collins, Senior Network Manager IV
bcollins1977@tamu.edu

C. Texas A&M Technology Services, Telecommunications group:

1. Telecommunications
 - a. Work Order Requests/Inquiries: tcom-request@tamu.edu
 - b. Web Pages:
u.tamu.edu/telecommunications
[Keyless Entry and Badge/Card Access Request System \(BARS\) | IT.tamu.edu](http://u.tamu.edu/telecommunications/Keyless%20Entry%20and%20Badge/Card%20Access%20Request%20System%20(BARS).htm)
2. William Posey, Director, Information Technology
Line of Business: All Telecommunications
wcposey@tamu.edu
979-847-7383
3. Chris Norton, Enterprise IT Technologist
Line of Business: Distributed Antenna Systems (DAS)
chris.norton@tamu.edu
979-458-5454
4. Patrick Moore, Network Engineer II
Line of Business: Keyless Card Access
pmoore@tamu.edu
979-458-3564
5. Cardell Lenford, IT Manager I

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Line of Business: Cable TV, Duress/Panic button, Emergency Phones, Keyless Access, Code Maroon (paging amp installation)

clenford@tamu.edu

979-862-5195

6. Sean Alexander, Chief Voice Engineer

Line of Business: Telephony, IPTV

seanalexander@tamu.edu

979-458-0238

7. Jennifer Keller, IT Manager I (Operation Service Support Manager)

Line of Business: In-take of Inquires/Service Order Requests for Telecommunications

jenniferk@tamu.edu

979-845-8300

C. Texas A&M Office of Safety and Security:

1. Contact Information:

979-845-1207

Email: ba-office@exchange.tamu.edu

Appendix A: Specifications for Racks, Cable Management, Cable Basket Tray System, and Grounding Busbar

Approved manufacturers are **Flextray** and **CPI**

I. Racks

A. 4-post frame rack specifications:



Figure 3: 4-Post Frame Rack

1. Measurements shall be:

Height: 8 ft.; 51U

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Width: 19 in.

Depth: 29 in.

2. Shall be a 4-post frame with the strength and stability of a cabinet in an open mounting system.
 - a. Rack shall provide easy access to equipment and cabling.
 - b. All substitutions shall be approved by the Technology Services prior to procurement.
 - c. Equipment mounting locations shall be marked and numbered on the mounting channel.
 - d. Rack shall have #12-24 threaded mounting holes.
 - e. Rack shall be able to support large equipment on heavy-duty four-post fixed and sliding shelves.
 - f. Rack shall bay together to create multi-frame configurations.
 - g. Rack shall have unrestricted air flow for cooling and heat dissipation.
3. Rack shall have a finish/color of black and the material shall be aluminum.
4. Rack shall have an equipment load rating of 2000 lb.

II. Cable Management

Note: If using CAT 6A, all cable management shall be 6A certified.

A. Combination cabling system (CCS) vertical managers:



Figure 4: Vertical manager

1. Measurements shall be:

Height: 8 ft.
Width: 10 in.
Depth: 14.61 in.
2. Cable management shall be double-sided cabling section with the front side plastic cable guides. Back side shall retain the classic vertical cabling section (VCS) design.
 - a. Shall have 1U and/or 2U cable guides on the front for fanning and managing patch cords..
 - b. Cable management shall have an open cabling section on the rear to provide easy access and route cable bundles into the back of patch panels.
 - c. Cable management shall have edge-protected pass through.
 - d. All plastic cable guides shall meet UL 94V-O flame resistant standards.
 - e. Front of the door/cover should easily open from the right or left and can be removed so that cable does not have to thread through guides.



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- f. Cable management shall be able to attach to Standard Racks, Universal Racks, QuadraRack or Adjustable QuadraRack frames.
- g. All mounting hardware and doors shall be included.
- 3. Cable management shall have a finish/color of black and material shall be aluminum and plastic constructed with rivets and bolts.
- 4. Orientation shall be vertical, combination double-sided.

B. 1.75 in. (1U) velocity cable management, single-sided horizontal managers:



Figure 5: 1.75 in. (1U) horizontal manager

- 1. Measurements shall be:
 - Height: 1.75 in. (1U)
 - Width: 19 in.
 - a. Cable management shall have a snap together assembly.
 - b. Cable management shall include snap-on covers.
 - c. Each manager shall include:
 - i. One 19 in. wide EIA rack-mount cable manager with t-shaped cable guides.
 - ii. One cover that snaps onto the t-shaped cable guides.
 - iii. Four #12-24 x 1 in. rack-mount screws and four M6 x 25 mm rack-mount screws.
- 2. Cable management shall have a finish/color shall of black and material shall be plastic.
- 3. Orientation shall be horizontal.

C. 3.5 in. (2U) velocity cable management, single-sided horizontal managers:



Figure 6: 3.5 in. (2U) horizontal manager

- 1. Measurements shall be:
 - Height: 3.5 in. (2U)
 - Width: 19 in.
 - a. Cable management shall have a snap together assembly.
 - b. Cable management shall include snap-on covers.
 - c. Each manager shall include:
 - i. One 19 in. wide rack-mount cable manager with t-shaped cable guides.
 - ii. One cover that snaps onto the t-shaped cable guides.
 - iii. Four #12-24 x 1 in. rack-mount screws and four M6 x 25 mm rack-mount screws.
- 2. Cable management shall have a finish/color shall of black and material shall be plastic.

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3. Orientation shall be horizontal.

III. Specifications for Cable Basket Tray System

Approved manufacturers are OnTrac and Flextray

Note: All modular components of the cable basket tray system shall match the system. All transitions shall be supported by system manufactured components, including supports, curves, vertical transitions and assembly components to meet grounding and bonding codes.

A. Cable basket tray:



Figure 7: Wire mesh cable basket tray

1. ONTRAC or FLEXTRAY are approved Wire Mesh Cable Tray Systems. If using a different cable basket tray system, all submittals shall be approved by the Technology Services - Networking **PRIOR** to purchase.
2. Shall be an easy to use pathway solution that supports large quantities of network cables.
3. Shall be cut and formed to create smooth curved transitions around obstacles.
4. Shall be easy to splice and bond together.
 - a. **ALL** cut edges of the cable basket tray shall be ground smooth, prior to pulling cable.
5. Shall have an open top design.
6. Shall be available in multiple widths and depths to match cable fill requirements.
7. Shall be supported from the ceiling, wall or the tops of racks and cabinets.
8. Shall be pre-Galvanized finish and shall be UL classified.

B. Cable basket tray system components

1. Cable basket tray triangle support:

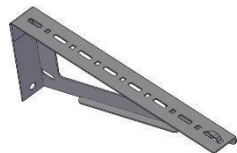


Figure 8: Cable basket tray triangle support bracket

- a. Heavy-duty triangle support bracket shall be the same width as the cable basket tray, and shall be used to support the cable basket tray pathway along the wall.
- b. Contractor shall use the following for the cable basket tray triangle support bracket installation:



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- i. Two 3/8 in. lag bolts and two flat washers for plywood backer boards.
 - ii. Two 1/4 in. hex cap bolts, two flat washers, and two appropriate anchors for concrete wall.
- c. Shall be attached to the cable basket tray with two splice washers or shall use the fold-over tab at the end of the bracket to secure the tray.
- d. Shall have a finish/color of black and material shall be steel.
- e. Shall be Restriction of Hazardous Substance (RoHS) compliant.
2. Cable basket tray radius drop (waterfall or fiber bend radii):



Figure 9: Wire mesh cable basket tray radius drop

- a. Shall be used to properly support cables as they enter or exit cable basket tray pathways.
 - b. Shall use the appropriate size to fit the cable basket tray size.
 - c. Shall provide a 3 in. bend radius.
 - d. Shall attach to the bottom or side of the tray with two splice washers.
 - e. Shall secure cables through slots in the radius drop with Velcro or hook and loop ties only.
 - f. Material shall be steel and color shall be black.
3. Cable basket tray vertical radius bracket:

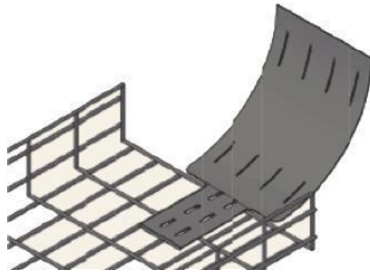


Figure 10: Cable basket tray vertical radius bracket

- a. Shall be used to provide support for the cable exiting tray vertically.
 - b. Shall use the appropriate size to fit the cable basket tray size.
 - c. Shall attach to the bottom of the tray with bendable tabs or with two splice washers.
 - d. Shall secure cables through slots in the vertical radius bracket with Velcro or hook and loop ties only.
 - e. Material shall be steel and color shall be black.
4. Cable basket tray elevation kit:

Texas A&M University Network Installation Design Standards

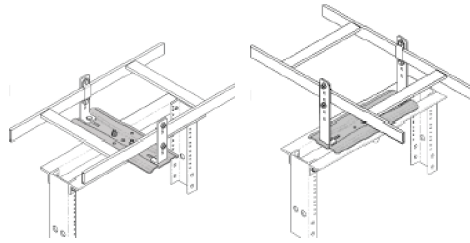


Figure 11: Cable basket tray elevation kit

- a. Shall be used with a mounting plate.
 - b. Shall be used to mount the cable basket tray 6 in. above racks.
 - c. Should be mounted perpendicular or parallel.
 - d. Shall attach directly to the top of the racks.
 - e. Mounts and assembly hardware shall be compatible with the cable basket tray system.
 - f. Shall have a finish/color of black and material shall be steel.
 - g. Shall be RoHS compliant.
5. Rack to cable basket tray mounting plate:

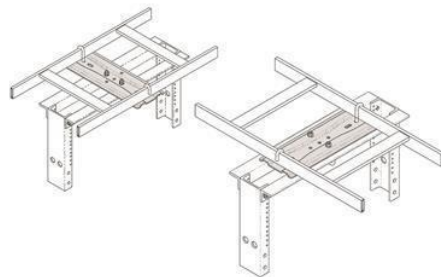


Figure 12: Cable basket tray mounting plate

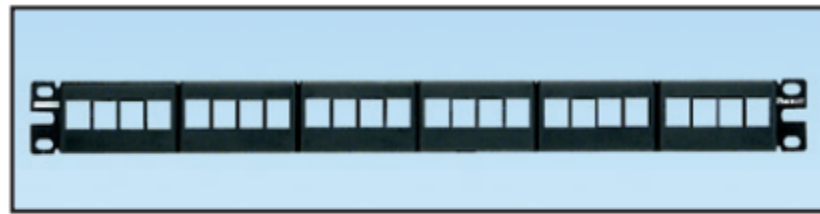
- a. Shall be used to mount cable basket tray elevation kit to racks.
- b. Mounts and assembly hardware shall be compatible with the cable basket tray system.
- c. Shall use the appropriate size to fit the cable basket tray and rack size.
- d. Installation shall consist of using J-bolts, hex nuts, and split lock washers.
- e. Shall have a finish/color of black and material shall be steel.

Appendix B: Specifications for Modular Copper Patch Panel and Patch Cable Quantities

Approved manufacturer is Panduit

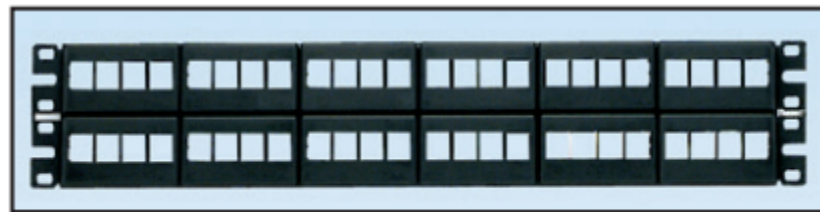
I. Specifications for Modular Copper Patch Panel

Texas A&M University Network Installation Design Standards



NKFP24Y

Figure 13: 24 port patch panel



NKFP48Y

Figure 14: 48 port patch panel

A. CAT 6 connectors:



Figure 15: NetKey connector type

1. Connectors shall be Panduit NetKey CAT 6 or 6A UTP type.
2. Shall meet or exceed the requirements for CAT 6 described in ANSI/TIA-568-C.2 as well as the Class E requirements described in ISO/IEC-11801.
3. Shall have the ability to allow for single port replacement of connectors.
4. Shall be a craft-friendly installation.

II. Patch Cable Quantities

A. Needed for communications room(s) Cat 6 installation:

1. Black small diameter CAT 6 patch cables = number of patch panel ports
 80 percent = 7 ft. (Panduit UTP28SP7BL)
 20 percent = 10 ft. (Panduit UTP28SP10BL)

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B. Needed for communications room(s) Cat 6A installation:

- Black small diameter CAT 6A patch cables = number of patch panel ports (ex.
 80 percent = 7 ft. (Panduit UTP28X7BL)
 20 percent = 10 ft. (Panduit UTP28X10BL)

C. Needed for I/O ports:

- Black CAT 6 patch cables = number of I/O data outlets.
 90 percent = 10 ft. (Panduit UTP28SP10BL)
 10 percent = 20 ft. (Panduit UTP28SP20BL)

D. Needed for wireless installation:

- Black CAT 6A patch cables = number of Access Points (AP)
 100 Percent = 3 ft. (Panduit UTP28X3BL)

Appendix C: Labeling Standard

I. Copper Data Cable

- Each communications room within a building is assigned a sequential number in increments of one thousand, beginning with the number 1000 (e.g. 1000, 2000, 3000, etc.).
 - Each I/O cable pulled to a communications room is assigned an identification number that is a combination of the communications room number and a three-digit sequential number beginning with 001; which indicates its location relative to the first position on the first data patch panel.
- Example:** Number 1001 would be the id number of the cable terminated on the first position of the modular copper patch panel in communications room 1000. Number 2085 would be the ID number of the cable terminated on the 85th position of the modular copper patch panel in communications room 2000.
- Labeling requirements for modular copper patch panels in communications rooms:
 - Front of the modular copper patch panel shall have port number and room number of the I/O location. Jacks shall be placed in empty spaces.

Shall have port number and room number of the I/O location.



Jacks shall be placed in empty spaces.

Figure 14: Front patch panel labeling

Texas A&M University Network Installation Design Standards

2. Cables entering back of the modular copper patch panel shall have a manufactured label denoting same cable number placed 6 to 8 in. from termination end (**NO** handwritten labels shall be permitted).

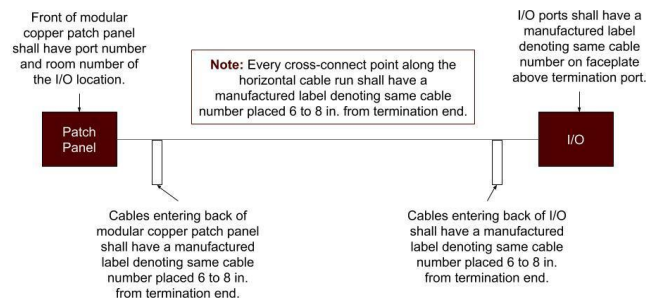


Figure 15: Horizontal run labeling

- D. Copper tie cables pulled to the IDF communications rooms from the MDF communications room are assigned an identification number with a format of BBXYYY, where X is the number of the **MDF** communications room, and YYY is a three-digit sequential number beginning with 001 indicating its location relative to the first position on the first backbone patch panel in the MDF communications room.
 1. **Example:** BB1001 would be the ID number of the first backbone cable terminated on the first position of the backbone patch panel in a building where the 1000 ID number indicates the primary communications room/MDF.
- E. Each cable shall be clearly labeled with the cable id using a permanent, manufactured label on the cable sheath 6 to 8 in. from each termination end.
- F. I/O ports shall have a manufactured label denoting the same cable number on the faceplate above termination port.

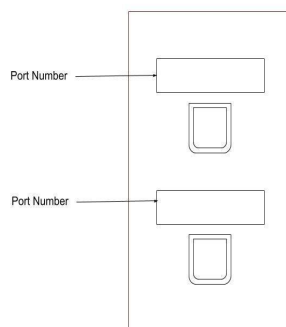


Figure 19: I/O ports labeling

II. Intra-Building Fiber Cable

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A. Single-mode fiber backbone data cables pulled to the IDF communications rooms from the MDF communications room shall be assigned an identification number in the following format:

1. The backbone patch panels shall have label designation strips that indicate the remote communications room ID number, IDF room number, and the cable ID.

a. **MDF Example:**

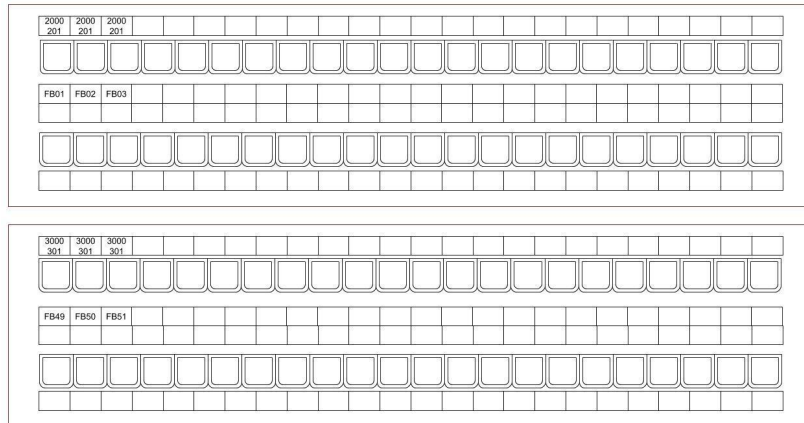


Figure 20: Backbone patch panels labeling

2. IDF backbone cables shall have a label indicating cable ID with a format of FB and matching MDF sequential number. **Example:** FB01.

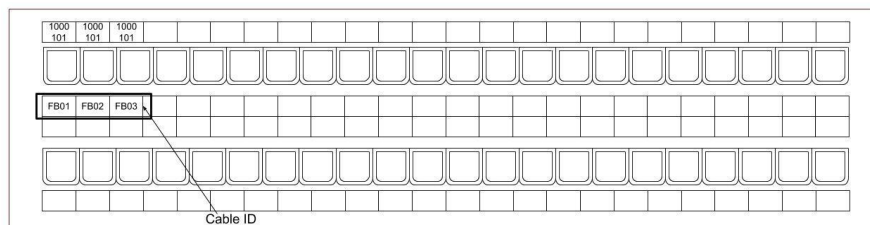


Figure 21: 2000 IDF fiber labeling

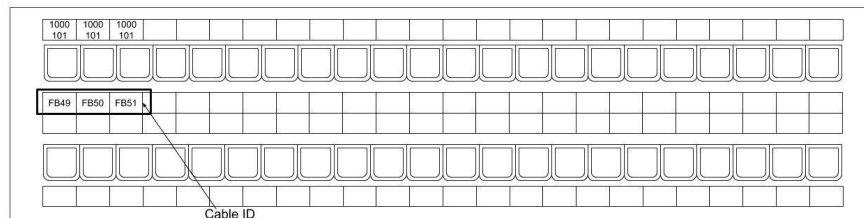


Figure 22: 3000 IDF fiber labeling

- B. Each fiber cable shall be clearly labeled with the cable ID using a permanent, manufactured label on the cable sheath at both ends; ANSI/TIA-598.
- C. Each strand of fiber is identified by its position in the intra-building fiber enclosure.



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1. Example: If there are two 96-position fiber enclosures, the 25th strand of fiber in the second intra-building fiber enclosure is identified with the number 121 ($96 + 25$).