

DIVISION 27—COMMUNICATIONS

27 11 00 - Communications Equipment Room Fittings

1.01 MAIN TELECOMMUNICATIONS EQUIPMENT ROOM (ER)

- A. The Main Telecommunications Equipment Room (ER) is the central location in a building where the major telecommunications equipment is located. The ER typically contains the telephone switching system, the data switching equipment with LAN switching equipment, the CATV “head end” distribution equipment, closed circuit TV and security systems, and additional low voltage systems. To minimize both conduit and cable lengths, the ER shall be located as close as practical to the center of the building. ER shall be a minimum of 10’ by 10’. In new construction, the ER shall be sized and provisioned to contain all major voice, data, and video equipment required to support the building, and all other computer based and networked low voltage systems. During renovation or remodeling of existing facilities, every reasonable effort shall be made to co-locate these systems in a common equipment room. Designs that propose locating data switching equipment in buildings other than the main ER must follow the “Approval for Alternative Design Solutions” process described above in section 27 01 00, and must have the written authorization of the Texas State University Director of Telecommunications Services. There are financial implications to Texas State University for the LAN equipment when alternative fiber optic designs are implemented. If the data switching equipment is in a location other than the ER, Texas State University IT must be consulted to design appropriately sized fiber optic cables to route from the ER to the data switching equipment. All interconnections between the data switching equipment backbone and the campus distribution fiber optic backbone shall be in the ER.
- B. ER PLANNING, LAYOUT, AND SIZING
1. The first step in determining the size required for the ER is to identify the systems that will be installed into the ER. In this process, first identify the size of the area that will be served from the ER. Next, identify the quantity, size and variety of systems to be installed to support the area, and the space required for each of the systems. Once the size and quantity of systems are identified, they shall be laid out in a functionally efficient arrangement. Some equipment, such as voice cross connects, LAN switches and patch panels will require regular access, and shall be located where they are easily accessible. Texas State University IT staff must be involved in this process, and must approve the final space requirements and design layout for all equipment and racks as well as conduit paths in ER. When laying out the arrangement of the ER, the following requirements and issues shall be addressed:
 - a. Groups of like equipment types shall be located together; i.e., voice, data for both LAN and video.
 - b. Wall space and equipment rack space must be designated for particular uses by particular people. Set aside specific backboard space and equipment rack space for the service providers demarc, and any associated equipment. Designate specific adjacent areas for each of the various service providers. Keeping all of the service providers on a

common wall and row of equipment racks will limit their access to other areas of the equipment room.

- c. Separate wall and equipment rack space is designated for the termination and cross connection of campus distribution cables, both copper and fiber optic. These areas shall be located adjacent to the equipment providing the services, such as the PBX, routers, and switches.
- d. Careful design planning must be performed to ensure that all telecommunications cabling has the minimum setback distanced from all potential sources of electromagnetic interference (EMI) or radio frequency interference (RFI), such as electric motors, power transformers, etc. Incorrect planning can result in expensive changes at a later date.
- e. Equipment racks and rack mounted equipment must have a minimum of three (3) feet of unrestricted clearance in front and back for technician access. In smaller installations, wall mounted swing-out equipment racks can be used to save space, but must have three (3)-feet clearance to the front of the rack. Note that some LAN equipment may be large, or may require clearance at both the front and back, and wall mounted swing-out racks may not be appropriate.
- f. Once an acceptable equipment layout is developed, the size of the equipment room can be calculated. Always provide a minimum of 25% spare space for future growth. With the size determined, the location of the equipment room can be selected.

C. EQUIPMENT ROOM CHARACTERISTICS

1. The characteristics of the ER have a significant impact on all other aspects of telecommunications design. Next to insuring adequate size, selecting a suitable location is the most critical step in planning the ER. The major factors that must be considered when planning and locating the ER are:
 - a. Access for delivery and installation of large equipment into the ER.
 - b. Access by Texas State University and service provider maintenance personnel.
 - c. Restrictions on unauthorized access.
 - d. Close proximity to electrical service.
 - e. The ER must be dedicated to the telecommunications and information technology function. Shared use of boiler rooms, washrooms, janitor closets, electrical closets, or storage rooms is not allowed.
 - f. The floor, walls, and ceiling shall be sealed to reduce dust. Finishes shall be light in color to enhance room lighting. Flooring materials having antistatic properties shall be selected.
 - g. The room must be free of plumbing and electrical utilities not directly required to support the telecommunications functions.

- h. Close proximity to service entrances for telecommunications and power.
- i. Close proximity and centralized to the campus telecommunications distribution pathways (conduits and/or aerial distribution) to minimize the backbone cable lengths.

D. EQUIPMENT ROOM LOCATIONS

1. Unacceptable Room Locations: Any areas subject to water or steam infiltration, particularly basements. A floor drain is required if there is any risk of water entering the ER. Any areas exposed to excessive heat or direct sunlight. Any areas exposed to corrosive atmospheric or environmental conditions. Near or adjacent to any potential sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc welding equipment, or high power radio transmitting antennas. This is a critical consideration, as EMI and RFI can render IT networks totally inoperable. No point within the ER shall be closer than 6 M (20 ft) to power panels or equipment rated at greater than or equal to 480 V that may cause Electrical Interference or equipment which may cause RFI or EMI.

E. ENVIRONMENTAL PROVISIONING

1. The following environmental provisions are required in the Main Telecommunications Equipment Room:
 - a. Heating, ventilation, and air conditioning (HVAC) shall be provided on a 24 hours-per-day, 365 days-per-year basis. If the building system cannot assure continuous operation, a stand-alone unit shall be provided for the ER.
 - b. The temperature and humidity shall be controlled to provide a continuous operating range of 64°F to 75°F, with 30% to 55% relative humidity.
 - c. Lighting shall be a minimum of 50 foot candles, measured three (3) feet above the finished floor in the middle of all aisles between equipment racks and cabinets.
 - d. Minimum clear height in the ER shall be eight (8) feet without obstructions.
 - e. Dry chemical fire suppression systems are preferred in the ER.

F. ELECTRICAL PROVISIONING

1. The following electrical provisions are required for the Main Telecommunications Equipment Room (ER):
 - a. A separate supply circuit serving the room shall be provided and terminated in its own electrical panel located in the ER. This power panel shall be designated as “ER Technical Power.” The ER Technical Power panel shall be used exclusively for supplying power to electronics equipment in the equipment room.
 - b. If emergency generator power is available to the facility, the ER Technical Power panel must be linked to the emergency generator power supply.

- c. Sizing of electrical power is dependent upon the equipment types and equipment load, and must be calculated on a case by case basis, including sufficient spare capacity for future growth. Install NEMA 5-20R and NEMA L5-20 Twist-lock added to set above every rack.
- d. Each equipment rack and all major freestanding equipment shall be provided with two dedicated 20-amp 110VAC electrical circuits from the ER Technical Power panel, each terminated in a quad (4-plex) outlet. Technical power shall be identified with orange colored electrical outlets. These outlets shall be used exclusively for electronics equipment. Do not use Technical Power outlets for general-purpose or utility devices such as electric drills, vacuum cleaners, or coffeepots.
- e. Some IT equipment, such as large LAN switches and routers, are ordered with dual power supplies. The placement of equipment with dual power supplies shall be identified and the appropriate racks must have three, separate, dedicated 20-amp 110VAC electrical circuits from the ER Technical Power panel, each terminated in separate quad (4-plex) outlets, and be appropriately marked to identify the separate circuit breakers.
- f. Some major pieces of telecommunications equipment, such as PBX remote equipment, may require 208 or 220 VAC power. These systems must be identified, and power requirements determined, well in advance of the ER architectural and electrical design.
- g. The ER shall have 20-amp 110VAC general-purpose convenience electrical outlets placed at 6-foot intervals round the room. The general-purpose circuits must not originate from the ER Technical Power panel. The general purpose circuits shall be used for general purpose, utility devices such as power tools or vacuum cleaners. Do not use general purpose outlets for ER electronics equipment. White, gray, or beige colored outlets to match all other general purpose outlets in the building shall identify the general-purpose outlets.
- h. The ER shall be equipped with a power disconnect switch. This switch shall be located near the main door of the ER. The switch shall disconnect power to all electronic equipment in the ER, and is to be used in the event of electrocution or fire in the ER. There shall also be a similar means to disconnect the power to all dedicated HVAC systems serving the ER and cause all required fire/smoke dampers to close. Refer to the National Electrical Code, NFPA 70, and Article 645-10.

G. TELECOMMUNICATIONS BACKBOARDS

- 1. All walls of the ER shall be covered with three-quarter inch A-C grade fire retardant plywood, painted with two coats of light colored, non-conductive fire retardant paint. The plywood shall extend from the floor to eight (8) feet above the finished floor, and shall be mounted with the "A" side exposed. Cutouts shall be provided around existing power and telecommunications outlets. In new construction, power and telecommunications outlets, and light switches in the ER shall be surface mounted on the plywood backboard.

H. EQUIPMENT RACKS AND CABINETS

1. Planning of the ER layout must make allowances for proprietary equipment and racks, and allow expansion room for future equipment. Texas State University has standardized on a general purpose open frame 19-inch wide EIA standard equipment rack with channels measuring 16.25". (Please see appendix I Equipment Specifications for rack and components.). Floor standing equipment racks must always be securely bolted to the floor. Use cable ladders to interconnect multiple equipment racks, to brace equipment racks to the wall, and as a means of routing cables to and from the rack. Some IT equipment, such as large LAN switches, will require an equipment rack with both front and rear mounting rails. Provide 36" clear work space front, rear, and at one end of each equipment rack / cabinet line up for floor mounted racks / cabinets leaving sufficient front and rear rack / cabinet footprints for any equipment planned for installation. All cabinets must have a minimum of 20" from the front rail to the wall. All racks must have a minimum of 20" from the front rail to the rear isle workspace. All racks must be equipped with an appropriate number and type of horizontal and vertical wire management modules, both front and rear, with strain relief brackets to insure proper bend radius and strain relief is maintained for all UTP, fiber optic and power cables. In cases of multiply rack installations all fiber optic terminations must be housed in left rack and all UTP terminations housed in right rack. Collaborations between architects, consultants, contractors and Texas State University Telecommunications are necessary in planning and placement of all ER/ TC equipment and components.

I. GROUNDING, BONDING, AND ELECTRICAL PROTECTION

1. A #6 AWG insulated stranded copper cable shall be provided from the ER to the building main electrical service ground electrode. A Telecommunications Main Grounding Busbar (TMGB) shall be installed in the ER. All metallic conduits entering the ER, all equipment racks in the ER, and all exposed non-current carrying metal parts of telecommunications and information technology equipment in the ER must be bonded to the TMGB.

J. SEPARATION FROM POWER

1. OSP conduits and cabling shall be bonded to TMGB in a different location than all inside cabling and conduits.

2.01 TELECOMMUNICATIONS CLOSETS (TC)

- A. The Telecommunications Closet(s) are located in each building, or each floor of a building, where backbone cables transition to horizontal distribution cables. These cables will be both fiber optic and copper, and will support voice, data, video, and other low voltage systems. The TC may also contain certain items of network electronics equipment such as routers or switching equipment. A large building, with large floors, may have multiple TCs on a floor. To minimize both conduit and cable lengths, the TC shall be located as close as practical to the center of the building where it is housed on each floor of the area to be served. TCs should be "stacked" one above the other for multiple floors. Close attention must be given to the maximum length (90m) on LAN copper horizontal distribution cable.

B. TELECOMMUNICATIONS CLOSET PLANNING, LAYOUT, AND SIZING

1. ANSI/TIA/EIA-569-A provides sizing formula for a TC in normal office buildings. The sizing is based on the “usable floor space,” which is the space on a floor that can actually be used for office activities. TC shall be a minimum of 60 square feet. Spaces such as mechanical rooms, janitorial closets, and rest rooms cannot be used for office activities, and are not counted as usable floor space. The sizing formula assumes an average of 100 square feet of floor space for each person, or “work –area.” Many Texas State University buildings are not traditional commercial or office buildings, and the sizing guidelines of ANSI/TIA/EIA-569-A must be adjusted to accommodate these buildings.
2. There shall be a minimum of one TC per building (may be ER). Additional TCs shall be added when the area to be served exceeds 10,000 square feet, or the cable length from the TC patch panel to the farthest work area outlet exceeds 90meters (295 feet). Cable length is not calculated on a straight-line distance. The distance must include the rises, drops, and bends that the cable will follow from the TC to the work area.

C. TELECOMMUNICATIONS CLOSET LOCATION

1. The TC in each building is the transition point between backbone cabling and horizontal distribution cabling.
2. The TC must be able to contain telecommunications equipment, cable terminations, and associated cable interconnection apparatus.
3. The TC shall be dedicated to the telecommunications function.
4. The TC shall not be shared with electrical installations other than those necessary for telecommunications.
5. The TC shall be located as close as practical to the center of the area to be served, preferably in the core area of the building, to minimize the cable length. The maximum length of copper horizontal distribution cable is 90 meters (295 ft) from the work station outlet to the TC patch panel, no exceptions. Where this length would be exceeded the designer will add additional TCs as required.
6. Multiple TCs on a floor shall be interconnected by a minimum of three spare conduits. Additional conduits shall be installed as necessary based on the quantity of services supported.
7. All fiber optic backbone cables shall home-run from each individual TC to the main telecommunications Equipment Room, which should be the location of the data switching equipment. Requests for exceptions to this policy must follow the process described in section 27 01 00.
8. TCs shall not be located in or adjacent to areas containing sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc welding equipment, radio transmitting antennas, etc. This is a critical consideration, as EMI and RFI can render IT LAN networks totally inoperable.

9. No point within the TC shall be closer than 6 M (20 ft) to power panels or equipment rated at greater than or equal to 480 V, that may cause electrical interference or equipment which may cause RFI or EMI.

D. TELECOMMUNICATIONS CLOSET SIZING AND LOCATION IN EXISTING FACILITIES.

1. Existing facilities present a unique challenge for sizing and locating the TC. Many buildings were designed and constructed only to support telephones. When planning the size and location of TCs in existing buildings, every reasonable effort shall be made to meet the requirements for telecommunications closets identified above. In certain instances, the only viable alternative will be the use of one or several telecommunications cabinets in lieu of closets.

E. TELECOMMUNICATIONS CABINETS FOR SMALL BUILDINGS WITH LIMITED SERVICES

1. Certain small buildings may not justify a separate room as the telecommunications closet. In existing buildings, sufficient space may not be available for a telecommunications closet. In these instances, a wall or floor mounted telecommunications cabinet may be used as the transition point from backbone cables to horizontal distribution. However, the size of the cabinet and the conduits serving the building must always allow room for future growth, and must always allow room for computer network equipment such as switches or routers. Telecommunications cabinets must provide:
 - a. Physical security to protect the contents and prevent unauthorized access. The cabinets shall be constructed of heavy gauge steel, and be lockable. Any removable panels must have tamper proof screws.
 - b. All power and telecommunications cables for equipment housed within the cabinet are to be contained within the cabinet. No exposed cables are allowed.
 - c. All power and telecommunications cables routed to or from the cabinet must be contained in conduit, surface mounted raceway, or routed within the adjacent wall.
 - d. The cabinet must contain a plywood backboard for mounting telecommunications hardware.
 - e. The cabinet must provide a means of mounting electronics equipment, including a LAN switch. Acceptable means are rails for rack mounting, or adequate space on the plywood backboard for electronics equipment wall mounting brackets.
 - f. The cabinet must have a minimum of one 20-amp 120 VAC quad (4-plex) electrical outlet installed inside the cabinet, on a dedicated circuit breaker from the electrical panel. The outlets shall be colored orange, and identified as Technical Power. An available general purpose power panel may be used to support the telecommunications cabinet power outlet. The power panel shall not be used to supply power to sources of electromagnetic interference such as large electric motors, arc welding, or industrial equipment. The power panel must be located in close proximity to the cabinet.

- g. There shall be at least one 20-amp 110VAC general purpose convenience outlet located within 6 feet of the cabinet. White, gray, or beige colored outlets to match all other general-purpose outlets in the building shall identify the general-purpose outlet. The general purpose outlet shall not be used to power electronics equipment.
 - h. Any cabinet containing electronics equipment must have cooling fans installed in the cabinet.
 - i. The cabinet must have a telecommunications grounding busbar installed in accordance with the requirements listed in these guidelines.
 - j. The cabinet shall not be located in or adjacent to areas containing sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc welding equipment, radio transmitting antennas, etc. This is a critical consideration, as EMI and RFI can render IT WAN and LAN networks totally inoperable.
 - k. Standard EIA 19-inch open frame equipment racks as approved for use in the Main Telecommunications Equipment Room may be used in the TC (Please see appendix I Equipment Specifications for rack and components.). Floor standing racks must be securely bolted to the floor, and must be braced to the wall with cable ladder racking. Multiple racks in the same TC shall be interconnected with cable ladder racks.
 - l. Some IT equipment, such as large LAN switches, require an equipment rack with both front and rear mounting rails. Where space or equipment is limited, an open frame wall mounted equipment rack or enclosed equipment cabinet may be used. Wall mounted racks and cabinets must have two “swing-gates”: one for the front access panel and a second for rear access. Provide 36” clear work space front, rear, and at one end of each equipment rack / cabinet line up for floor mounted racks / cabinets leaving sufficient front and rear rack / cabinet footprints for any equipment planned for installation. All cabinets must have a minimum of 20” from the front rail to the wall; racks must have a minimum of 20” from the front rail to the rear isle workspace. All racks must be equipped with an appropriate number and type of horizontal and vertical wire management modules both front and rear with strain relief brackets to insure proper bend radius and that strain relief is maintained for all cables.
- F. ENVIRONMENTAL PROVISIONING FOR TELE-COMMUNICATIONS CLOSETS
- 1. Walls and ceiling shall be treated and sealed to eliminate dust. Finishes shall be light in color to enhance room lighting. The floors in all low voltage equipment rooms will be; light colored, fire retardant, slip resistant, and provide protection from electrostatic discharge (ESD). In TCs that contain active electronics equipment (routers, switches, etc.), an HVAC system shall be provided on a 24 hours-per-day, 365 days-per-year basis. If the building system cannot assure continuous operation, a stand-alone unit shall be provided for the TC. The temperature and humidity shall be controlled to provide a continuous operating range of 64°F to 75°F, with 30% to 55% relative humidity. Lighting shall be a minimum of 50-foot candles measures 3 feet above the finished floor in the middle of all aisles between

equipment racks and cabinets. Minimum clear height in the TC shall be 8 feet without obstructions. Fire suppression sprinklers shall be equipped with wire cages under the sprinkler heads to prevent accidental discharge. Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room.

G. ELECTRICAL PROVISIONING FOR TELECOMMUNICATIONS CLOSETS

1. Each TC shall be equipped with a minimum of two 20-amp, 110VAC quad (4-plex) electrical outlets, each on its own dedicated circuit breaker. The outlets shall be colored orange, and identified as Technical Power. These outlets shall be used exclusively for electronics equipment. Do not use Technical Power outlets for general-purpose or utility devices such as electric drills, vacuum cleaners, or coffeepots.
2. The Technical Power circuits should originate from a dedicated power panel serving the TC. However, in small buildings where this may not be cost effective, an available general purpose power panel may be used. The power panel shall not be used to supply power to sources of electromagnetic interference such as large electric motors, arc welding, or industrial equipment. The power panel must be located in the TC, or in close proximity to the TC.
3. Some IT equipment, such as large LAN switches and routers, are ordered with dual power supplies. The placement of equipment with dual power supplies shall be identified and the appropriate racks must have three, separate, dedicated 20-amp 110VAC electrical circuits from the ER Technical Power panel, each terminated in separate quad (4-plex) outlets, and be appropriately marked to identify the separate circuit breakers.
4. The TC shall have 20-amp 110VAC convenience outlets placed at 6-foot intervals around the room. White, gray, or beige colored outlets to match all other general purpose outlets in the building shall identify general purpose outlets. These outlets shall not be used to power electronics equipment.

H. TELECOMMUNICATIONS BACKBOARDS

1. All walls of the TC shall be covered with three-quarter inch A-C grade fire retardant plywood, painted with two coats light colored, non conductive fire retardant paint prior to mounting anything on the backboard. The plywood shall extend from the floor to eight (8) feet above the finished floor, and shall be mounted with the "A" side exposed. Cutouts shall be provided around any existing power and telecommunications outlets. In new construction, power and telecommunications outlets, and light switches in the TC should be surface mounted on the plywood backboard.

I. EQUIPMENT RACKS AND CABINETS

1. Standard EIA 19-inch open frame equipment racks as approved for use in the Main Telecommunications Equipment Room shall be used in the TC. Floor standing racks must be securely bolted to the floor, and must be braced to the wall with cable ladder racking. Multiple racks in the same TC shall be interconnected with cable ladder racks. Some IT equipment, such as large LAN switches, require an equipment rack with both front and rear

mounting rails. Where space or equipment is limited, an open frame wall mounted equipment rack or enclosed equipment cabinet may be used. Wall mounted racks and cabinets must have two “swing-gates”: one for the front access panel and a second for rear access. Provide 36” clear work space front, rear, and at one end of each equipment rack / cabinet line up for floor mounted racks / cabinets leaving sufficient front and rear rack / cabinet footprints for any equipment planned for installation. All cabinets must have a minimum of 20” from the front rail to the wall; racks must have a minimum of 20” from front rail to the rear isle workspace. All racks must be equipped with an appropriate number and type of horizontal and vertical wire management modules both front and rear with strain relief brackets to insure proper bend radius and that strain relief is maintained for all cables.

J. GROUNDING, BONDING, AND ELECTRICAL PROTECTION

1. A #6 AWG insulated stranded copper cable shall be provided from the ER to the building main electrical service ground electrode. A Telecommunications Main Grounding Busbar (TMGB) shall be installed in the ER. All metallic conduits entering the ER, all equipment racks in the ER, and all exposed non-current carrying metal parts of telecommunications and information technology equipment in the ER must be bonded to the TMGB.

3.01 TELECOMMUNICATIONS INFRASTRUCTURE

- A. The telecommunications infrastructure is the cable and connecting hardware necessary to support the signaling between telecommunications devices. The infrastructure must be designed to support the known present, and reasonably certain future requirements of the telecommunications systems. ANSI/TIA/EIA-568-A provides the standards to be applied when designing and installing the telecommunications infrastructure. Texas State University utilizes the Ethernet LAN protocol at all facilities. Backbone Cabling cables are the major service cables that interconnect various buildings on a campus, connect equipment rooms to telecommunications closets within a building, or connect one telecommunications closet to another within the same building. Backbone cables are typically large capacity (high pair count) copper cables, or fiber optic cables. (Please see Appendix I Equipment Specifications for cable and connecting hardware.)
- B. Modular Information Outlet Mounting Faceplates, Frames, and Boxes
- C. (Please see Appendix I Equipment Specification for appropriate faceplates, frames and boxes).
- D. Eight-Position Jack Pin/Pair Assignments
 1. The preferred pin/pair assignment is the T568A configuration. In new construction at a new facility, the T568A pin/pair assignment shall be used.

4.01 CABLE SERVICE LOOPS

- A. Horizontal distribution cables shall be installed with a service loop at one or both ends. The service loop shall have at least 10 feet of slack cable coiled in a 7” diameter circumference. Care must be exercised so that the service loop does not add excessive length to a cable run beyond

the 295-foot distance limitation for horizontal distribution cable, or exceed the bending radius of the cable. The service loop shall be located in the most efficient location for future service depending on the type of cable raceway used. The necessary slack provided by a service loop can be achieved in several aesthetically pleasing methods, including but not limited to:

1. Routing cables the long way around a backboard or equipment rack.
2. Placing a service loop in the pull box of a closed conduit system.
3. Placing the service loop above the false ceiling before dropping down to the outlet location.

5.01 TERMINATION HARDWARE TO SUPPORT OTHER LOW VOLTAGE SYSTEM

- A. When other low voltage systems utilize the common structured cabling system, approved termination hardware shall be used for those systems. All fiber optic products shall fully comply with Texas State University standards. Copper cables shall fully comply in applications that can utilize Giga SPEED cable.

END OF SECTION 27 11 00