

Emporia State University

Telecommunications Infrastructure Standards

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3/1/2010

Revision 1.0

Telecommunications Infrastructure Standards

These standards are intended for use by ESU personnel, and all vendors and contractors authorized to perform work in ESU telecommunication spaces and on ESU telecommunication cabling and equipment.

All work performed in ESU telecommunications spaces shall comply with EIA/TIA Telecommunications Building Wiring Standards, the BICSI Telecommunications Distribution Methods Manual, other industry standards as applicable and local building codes.

When a discrepancy arises between the above mentioned standards and the standards contained in this document, it shall be brought to the attention of TCS immediately for resolution. Typically the more stringent of the two guidelines will be implemented.

Bid Documents

It is expected that as a result of the collaboration between TCS and the designer/consultant, a quality bid package will be provided containing commonly accepted and standard language of the industry, such as what is included in the Division 27 standard specifications prepared by the Construction Specifications Institute (MasterFormat) and the American Institute of Architects (MasterSpec).

1. Telecommunications Equipment Rooms

1.1. Definitions

- 1.1.1. The **Main Equipment Room** is the main room in a building into which all outside facilities are routed to and terminate. This room serves as the primary telecommunications room, and may house voice and data telecommunication equipment and/or backbone network-related electronic equipment.
- 1.1.2. **Telecommunications (Telecom) rooms** are the junction between backbone and horizontal pathways, and contain active voice and data telecommunications equipment, termination fields and cross-connect wiring.
- 1.1.3. For the purposes of these standards, main equipment rooms and telecommunications rooms are synonymous.
- 1.1.4. **Contractor** is the organization providing the telecom room construction or renovation, and/or cabling work for the project.

1.2. Physical Requirements

- 1.2.1. Telecom rooms shall be located in common building areas that are readily accessible.
- 1.2.2. Telecom rooms shall be a separate and secure room specifically intended for this purpose.
- 1.2.3. The Telecom rooms shall be sized as follows:

- When serving an area with less than 5,000 square feet, dimensions shall be a minimum of 10' x 7'.
- When serving an area between 5,000 and 8,000 square feet, dimensions shall be a minimum of 10' x 9'.
- When serving an area between 8,000 and 10,000 square feet, dimensions shall be a minimum of 10' x 11'.

- 1.2.4. Ceiling height shall be minimum 8 feet 6 inches.
- 1.2.5. There shall be no dropped ceiling installed in any telecom room.
- 1.2.6. The entrance door shall be a minimum of 36" wide and 80" high, without doorsill, shall swing outward from the room, and shall be fitted with a lock.
- 1.2.7. All telecom rooms in a building shall be keyed to the same key; telecom rooms shall be keyed differently from maintenance closets or other non-maintenance rooms .
- 1.2.8. The room number shall be designated on the door or outside wall.
- 1.2.9. Rooms on adjacent floors should be stacked whenever possible and shall be interconnected by a minimum of three 4" conduits.
- 1.2.10. Multiple interconnected rooms on a floor must be connected by a minimum of two 4" conduits or equivalent
- 1.2.11. Rooms must be cooled year round to maintain a constant temperature between 64 and 75 degrees F with a relative humidity range between 30 and 55 percent.
- 1.2.12. No HVAC ductwork, not related to the cooling of the room, will be run through the room.
- 1.2.13. Environmental monitoring should be used to proactively maintain temperature and humidity.
- 1.2.14. A dust free environment must be maintained; if construction must be done in a telecom room, the dust must be contained and kept away from all equipment.
- 1.2.15. No plumbing will be run through a telecom room.
- 1.2.16. No steam lines will be run through a telecom room.
- 1.2.17. Positive air pressure will be maintained in the room with a minimum of one air change per hour.
- 1.2.18. All walls shall be covered with 8 feet by 4-foot wide by 3/4-inch thick unpainted fire-retardant A-C grade or better plywood backboard, mounted with stainless steel screws with the smooth side out from the floor to a minimum height of 8 feet.
- 1.2.19. Any designs for construction or remodeling of telecommunication rooms shall be approved by TCS networking staff during the design phase.
- 1.2.20. Construction or remodeling of telecommunication rooms shall not be considered complete until after final inspection and signoff by TCS networking staff.

1.3. Electrical Requirements

- 1.3.1. Contractor shall provide two dedicated 20 Amp circuits with quad NEMA R5-20 receptacles per equipment rack to allow for redundant power supplies. Receptacles shall be mounted on the wall behind the rack. Receptacle location should be verified with ESU TCS Network team before installation.
- 1.3.2. Equipment rack circuits for all rooms should go to a central, dedicated panel for the building, to allow for future addition of central UPS or generator for all the telecom rooms in the building.
- 1.3.3. Contractor shall provide spare conduit from the central panel to the telecom room, sufficiently sized for two additional 20-amp circuits.
- 1.3.4. Breakers for equipment rack circuits shall be clearly marked with the telecom room number and the receptacle number.
- 1.3.5. Receptacles for equipment rack circuits shall be clearly labeled "Telecom Equipment Only" and must include the circuit number and panel of origin.
- 1.3.6. Contractor shall provide at least one duplex convenience outlet per every 6 feet of floor perimeter; these outlets will not be on the same circuit as the outlets for the equipment, and may be served by the same panel as adjacent office areas. No more than three receptacles shall be connected per branch circuit.
- 1.3.7. Contractor shall provide a Telecommunications Grounding Busbar (TGB) 12"x2"x ¼" as close as possible to the rack location, and shall be bonded with a minimum #6 AWG ground to building steel, the building protectors for the telephone entrance cable, and the racks. Wherever possible, all telecom closets in a building should be bonded together, and also bonded to building steel and to the building service ground.

1.4. Fire Protection

- 1.4.1. A fire extinguisher shall be mounted outside each telecom room door.
- 1.4.2. Each telecom room shall be fitted with a smoke detector, integrated with the University's fire alarm system.
- 1.4.3. Non-water automatic fire suppression systems should be installed and are preferred over water-based sprinkler systems. Water-based automatic fire suppression sprinkler systems should be installed in telecom rooms only when required by local, state, or national codes.

1.5. Equipment

- 1.5.1. All network equipment will be specified and provisioned by TCS Networking staff
- 1.5.2. Network equipment shall be installed in the rack, powered, and configured by TCS Networking staff only.
- 1.5.3. No network equipment will be disconnected, turned off, removed from the rack, or relocated in the rack except by TCS networking staff.

- 1.5.4. Contractor shall terminate horizontal cabling at work area jack and patch panel. TCS networking staff will perform cross connection of patch cords from patch panels to active networking equipment.
- 1.5.5. TCS Networking staff will install network equipment at the top of the rack, below the fiber trays. Switches with connections to the campus or building backbone will be installed on top, with the other switches installed below that switch.
- 1.5.6. TCS Networking staff shall specify and provision UPS or surge protection equipment.

1.6. Patch Panels

- 1.6.1. Patch Panels must accept Panduit Mini-Com jacks.
- 1.6.2. Patch panels shall contain 48 ports. Jacks will be Panduit Mini-Com jacks, CJ688TGIW.
- 1.6.3. Contractor shall provide fiber trays at the top of the rack. Fiber trays will be 2 RU, have slide splice trays (either to the front or to the rear), and must accept a minimum of 6 inserts/bulkheads.
- 1.6.4. Install copper patch panels for room jacks in the bottom of the rack, starting above any UPS or power equipment. Reserve 4 rack units in the rack for UPS or power equipment.

1.7. Racks

- 1.7.1. Racks shall be 19" two post Telecom racks, 84" high, using 12-24 screws, such as Panduit CMR19X84 .
- 1.7.2. Racks shall be securely bolted to the floor, and braced from the top of the rack to the wall with ladder tray.
- 1.7.3. Contractor shall install ladder tray around the perimeter of the room.
- 1.7.4. Racks shall be bonded to the telecom grounding busbar using a #6 AWG stranded copper conductor with a green jacket.
- 1.7.5. Racks shall be located within the room as not to block access to any existing equipment or backboard space. The rack shall be located so that there will be a minimum of 36 inches of access to both the front and rear of the rack (after loaded with equipment).

1.8. Cable Management

- 1.8.1. Contractor shall provide and utilize cable management that provides management for cabling both front and rear.
- 1.8.2. Contractor shall provide covered front & rear vertical cable management, minimum 6" wide, such as Panduit WMPV45E, on both sides of the rack
- 1.8.3. Contractor shall provide covered front & rear horizontal cable management, such as Panduit WMPH2E, below each patch panel or piece of equipment. Horizontal cable management must be at minimum two rack units high.

2. Pathways

2.1. Installation

- 2.1.1. Fire stop must be installed when penetrating firewalls and labeled with name, company and date in accordance with NFPA standards and local building codes.
- 2.1.2. Cable must be protected to avoid sharp edges, kinks, etc.
- 2.1.3. If a cable is damaged during or after installation, TCS must be notified to inspect the damage and determine the appropriate remediation.
- 2.1.4. Bend radius shall comply with cable manufacturer's specifications. Cable should be installed with a 5-foot service loop on the work area end and a 10-foot service loop on the telecom room end. Work area service loop should be above the ceiling. If no ceiling is available, position the service loop as close as possible to the workstation outlet.
- 2.1.5. Horizontal copper paths cannot exceed 90 meters
- 2.1.6. Horizontal multi-mode Fiber paths (if present) cannot exceed 300 meters.
- 2.1.7. Building backbone multi-mode fiber paths cannot exceed 300 meters.

2.2. Backbone and Vertical Pathways

- 2.2.1. Cable pathways between closets should be as short and direct as possible, with no more than two 90-degree bends between pull boxes / points..
- 2.2.2. All vertical cable must be communication riser cable.

2.3. Horizontal Pathways

- 2.3.1. Both ends of horizontal paths must be on the same floor, all efforts should be made to keep the entire pathway on the same floor.
- 2.3.2. Cable will be properly supported along the entire horizontal path, preference is for cable trays, but J Hooks, spaced no greater than 48" on center, may be used. Bridle rings are not acceptable.
- 2.3.3. Metal cable trays must be bonded to a telecommunications grounding busbar.
- 2.3.4. Copper cable will be run no more than 12 per bundle.
- 2.3.5. Non-Armored fiber (ie. 2 strand zip line or patch cables) and copper cables must be run in separate trays, or if in the same tray, must be separated by a divider or innerduct. Copper and fiber must not be run together in J-hooks. Power cables shall never be run in the same pathways as communication cable.
- 2.3.6. There shall be sufficient space maintained around cable trays to allow adequate access for installing and maintaining the cables and cable trays shall be exposed and accessible. Adequate room should be provided around the cable tray to allow for the set-up of cable pulling equipment and to provide easy access for the installation of or removal of cables. Where cable trays are installed one above another, allow 12 to 18 inches between cable trays and between the top tray and the ceiling.

- 2.3.7. Hook and loop cable ties shall be used where necessary to keep cables in the tray or maintain required spacing between cables. Cable ties shall not be so tight as to indent the cable shielding, and must be plenum rated.
- 2.3.8. Planned fill of cable trays may not exceed 40%, and will at no time exceed the maximum fill recommended by the manufacturer.
- 2.3.9. Planned fill of J-Hooks may not exceed 40% and will be loaded with no more than 25 cables.
- 2.3.10. All horizontal cable must be plenum rated.

3. Cable

3.1. Fiber

- 3.1.1. Single-Mode(OS1) fiber will be used for all paths greater than 300 meters. Jacket shall be yellow.
- 3.1.2. Laser enhanced 50 micron multimode (OM3) fiber with Aqua jacket color will be used for all vertical risers in a building, provided that the path is less than 300 meters.
- 3.1.3. 62.5 micron multimode (OM1) fiber will only be used when connecting to legacy fiber.
- 3.1.4. All fiber will be terminated with LC connectors.
- 3.1.5. A minimum of a 12 strand bundle will be run between buildings.
- 3.1.6. A minimum of a 6 strand bundle will be run as vertical risers inside a building.
- 3.1.7. All fiber will be Plenum rated and armored with interlocking armor, preference for Corning MIC Interlocking Armored Plenum Cable, 006T88-31180-A3. Direct burial fiber will be used in all buried conduits.
- 3.1.8. Colors
 - OS1 fiber will be Yellow.
 - OM1 fiber will be Orange
 - OM3 fiber will be Aqua
 - All direct burial fiber will be Black

3.2. Copper

- 3.2.1. All cabling will be UTP Category 6 rated or better, BerkTek LANmark 1000 is preferred.
- 3.2.2. Cable & Jack solution will carry a minimum 15 year manufacturer's warranty.
- 3.2.3. Colors
 - Copper Patch Cables
 - 3.2.3..1. Yellow will be used for straight through patch cables.
 - 3.2.3..2. Green will be used for cross-over patch cables.

- 3.2.3.3. White will be used for Wireless Access Points.
- 3.2.3.4. Orange will be used for non-standard configurations.
- 3.2.3.5. Gray will be used for phone.

- Copper Horizontal Paths

- 3.2.2.6. White will be used for horizontal cabling.

4. Outlets & Workstations

- 4.1. Jacks will be Panduit Mini-Com jacks, part number CJ688TGIW.
- 4.2. Faceplates must accept Panduit Mini-Com jacks.
- 4.3. Outlets for wireless access points will be located within 1 meter of the location specified by the wireless site survey.
- 4.4. Any couplers, splitters, or other wiring modifications required to accommodate additional or other types of service must be accomplished outside the workstation outlet
- 4.5. Jacks shall be terminated to T568B specifications.
- 4.6. The far end of each communications cable shall be terminated in the nearest telecom room on the same floor.

5. Cleanliness

- 5.1. A dust free environment shall be maintained while working in telecom rooms and pathways; if construction must be done in a telecom room, the dust must be contained and kept away from all equipment.
- 5.2. All work areas shall be swept clean at the end of each day, and tools and materials neatly stored.
- 5.3. All tools, materials, and debris shall be removed at the end of the job.

6. Administration

6.1. Labeling

- 6.1.1. Labels shall be printed, never hand written.
- 6.1.2. Telecom rooms shall be labeled with the floor number and a sequential alpha character. For example, the first basement telecom room would be labeled 0A, and the second telecom room on the first floor would be labeled 1B.
- 6.1.3. Patch panels shall be labeled with an alpha character, beginning with the lowest patch panel in the rack. For example, the lowest patch panel in a rack would be labeled "A", the next one higher would be "B".
- 6.1.4. IDC (punch block) connecting hardware or other wall-mounted connecting hardware shall be labeled "Z"
- 6.1.5. Each port on a patch panel shall be labeled with a sequential number.

- 6.1.6. Each grouping of IDC terminations terminating a 4-pair horizontal cable shall be labeled with a sequential number.
- 6.1.7. In addition to the sequential number, each patch panel port or grouping of IDC terminations shall be labeled with the room number corresponding to the opposite end of the horizontal cable terminated in that port or IDC grouping.
- 6.1.8. Each horizontal cable shall be labeled within 12 inches of both ends with the cable identifier. The cable identifier consists of the telecom room label, a dash, the patch panel or IDC alpha character, and the sequential number of the port or IDC termination grouping. For example, a horizontal cable in telecom room 1A, in patch panel A, port 23 would be labeled as 1A-A23.
- 6.1.9. The cable identifier for a cable (such as backbone fiber) that terminates in two different buildings, shall be formatted to include the identifiers for both buildings. For example, a cable terminating in Plumb Hall and the Memorial Union would be labeled like: PH-0A-E04/MU-0B-E03 where PH and MU are the building codes, 0A and 0B are the telecom rooms, and E04 and E03 are the patch panel and port of each end. See Appendix A for a list of building codes.
- 6.1.10. Each jack in a workstation faceplate must be labeled with the cable identifier.
- 6.1.11. Labeling shall follow the same format in all ESU facilities.

6.2. Testing

- 6.2.1. Every cabling link in the installation shall be tested in accordance with ANSI/TIA/EIA/568-B.1.
- 6.2.2. Detailed test results must include the following parameters:
 - Wire map
 - Length
 - Insertion Loss
 - Near-end Cross Talk (NEXT)
 - Power Sum Near-End Cross Talk (PSNEXT)
 - Equal-Level Far End Crosstalk (ELFEXT)
 - Power Sum Equal-Level Far-End Cross Talk (PSELFEXT)
 - Return Loss
 - Propagation delay
 - Delay skew
- 6.2.3. Any cable segment that fails shall be re-terminated and tested again. If the cable does not meet specifications after re-termination, the cable shall be replaced, terminated, and tested again.
- 6.2.4. Testing will be performed on all cables using a standards compliant test set.
- 6.2.5. All test results will be provided to TCS on a CD-ROM, DVD-ROM, USB drive, email attachment, download or other previously authorized electronic format, along with any software tools required to view, inspect, and print any selection of test reports.

6.2.6. Testing shall verify that the final termination of all cabling is operational at the level which is the current standard and meets the operational specifications for each type of wiring.

6.3. Documentation

6.3.1. TCS will maintain a central documentation database which includes at least the cable label, its location, and the test results. For telecom rooms, TCS shall be provided with complete as-built floor plans in paper and either high density JPG or PDF generated directly from CAD that contain at least the following information.:

- Architectural floor plans with finalized room names and numbers
- Location and identification of all voice, data, and fiber optic outlets
- Cable routing legend on the plans to readily identify voice, data, and fiber optic cables
- Conduit sizes and routing for all cables installed in conduit
- Cable tray routing and locations
- Bonding and grounding locations
- Large-scale drawing of all telecom rooms that indicate elevation views and plan views of, including but not limited to, all termination blocks, equipment racks, patch panels, and fiber optic enclosures
- Terminal backboard layout with labeling and pair identification

6.4. Exceptions

6.4.1. Requests for exceptions must be requested in writing, indicating the name and contact information of the person requesting the exception, and a description of the exception being requested. Requests should be sent to the TCS Director of Infrastructure and Operations. (See Appendix B)

6.4.2. Requests for exceptions will be reviewed at the regularly scheduled weekly TCS Networks Team meeting.

6.4.3. Exceptions must be authorized or denied in writing by the TCS Director of Infrastructure and Operations.

Appendix A – ESU Building Codes

AA – Art Annex

AN – Anderson Library, 1220 C of E Drive

BC – Butcher Education Center

BH – Beach Hall

BL – Brighton Lecture Hall

CH – Cremer Hall

CM – Cora Miller Hall, Newman Division of Nursing, 1127 Chestnut

EC – The Earl Center, 1601 State Street

KI – King Hall

MC – Morse Hall Complex

MLC – Metro Learning Center, 8400 West 110th Street, Suite 150, Overland Park, KS

MU – Memorial Union

PE – Physical Education

PH – Plumb Hall

RC – Recreation Center (Student)

RH – Roosevelt Hall

SA – Sauder Alumni Center

SH – Science Hall

SM – Stormont Maintenance Center

SS – Police & Safety

TC – Twin Towers Complex

VH – Visser Hall

WL – White Library

WS – Welch Stadium

Appendix B

Request for Telecommunications Infrastructure Standards Exception

Name _____

Email _____

Company _____

Address _____

Description of Standards Exception Requested:

Approved __

Denied __

Denied explanation:

Director of Infrastructure and Operations

Date