Structure Cabling System for Telecommunications

Guidelines and Specifications

Information Technology Services

Updated 9/2021
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2. Medical Center

Infrastructure must integrate the Hospital as the center for acute and inpatient care into the broader health care system and should facilitate the seven domains of quality, patient experience, effectiveness, efficiency, timeliness, safety, equity, and sustainability.

Infrastructure includes the built environment and supporting elements:

- equipment
- access
- information technology (IT)
- systems and processes
- sustainability initiatives and staff

Overall, these interwoven facets should enable patients to move seamlessly, with their privacy and dignity always maintained.

Today’s healthcare facilities are encountering many challenges because of the following issues:

- rapid changes in medical technologies
- rapid changes in information technologies
- an aging nursing workforce and patient demographics
- industry initiatives are also a key factor in the need to upgrade or replace the built electronic infrastructure, such as:
  - electronic health records
  - patient portable (personal) health records
  - electronic security
  - clinical and information technology convergence

Today’s modern hospital’s technology infrastructure supports the following:

- medical procedures and clinical processes
- business and enterprise operations
- building and facilities requirements
A Hospital’s main function is to treat the injured, sick, and infirmed, and IT infrastructure must be capable of supporting that mission. This standard is intended primarily for, but not limited to, healthcare facilities, such as:

- hospitals
- skilled nursing facilities (nursing homes)
- rehabilitation centers
- psychiatric facilities
- ambulatory clinics and surgical centers
- outpatient clinics
- acute care facilities

2.1 Purpose

This standard is written for use in the design and implementation of information technology systems used within healthcare facilities. This standard provides a reference of common technology and design practices and is not intended to be used by architects and engineers as their sole reference or as a step-by-step design guide. This standard may also be used to determine design requirements in conjunction with the system owner, occupant, or safety and security consultant.

Healthcare facilities may have many types of electronic systems sharing the same pathways and spaces. The list below is a sampling of those systems but not limited to:

- voice
- data
- overhead paging
- closed circuit security system
- access control
- audio visual
- distributed antenna system
- nurse call system
- intercom system
- integrated operating system
- patient monitoring system
• infant protection system
• patient education/entertainment systems

Each of these and other related systems would have specific dedicated space requirements for maintainability that must be considered when designing the facilities TR, such as:

• size
• location
• quantity

2.2 Substitutions

Substitution Requests

Substitution requests will be considered only if submitted to Owner’s Representative not less than 7 working days prior to project bid date. Acceptance or rejection of proposed substitution is at Owner’s Representatives sole discretion. No exceptions. Requests for substitutions shall be considered not approved unless approval is issued in writing by Owner’s Representative.

Rejection

For equipment, cabling, wiring, materials, and all other products indicated or specified as no substitutions or no alternates, Owner does not expect nor desire requests for substitutions and alternate products other than those specified. Owner reserves right for Owner’s Representative to reject proposed substitution requests and submissions of alternates without review or justification.

2.3 Contact Information:

**IT Services**
Patrick J Hickey, RCDD
pjhickey@uchicago.edu
773.702.3161

**UCMC IT**
Jofel Celicious
jofel.celicious@uchospitals.edu
773.834.0257

Matthew Blackburn
Matthew.Blackburn@uchicagomedicine.org
773.702.4859
2.4 Roles and Responsibilities

The Project will be responsible for all costs associated with the installation of the telecommunications infrastructure. This will include the re-routing of any existing infrastructure necessary to accommodate the project.

The Project will be responsible for the procurement and installation of the following support infrastructure:

All horizontal pathways, including the following:

- conduit
- junction boxes
- drywall rings
- raceway
- cable tray
- pull boxes
- approved fire rated EZ path
- telecommunications rooms (tr) including
  - power
  - lighting
  - HVAC
  - flooring
  - card access
  - vertical infrastructure
  - vertical risers
  - vertical pathways
  - building entrance
  - conduit sleeves
  - pathway to equipment room (er) or telecommunication room (tr)

Outside plant connectivity to existing IT Services infrastructure

Outside plant connectivity for external service providers

IT Services will be responsible for procuring the following:
• material and labor for the installation of all horizontal and vertical communications cable to be used for connecting to the university’s voice or data network
• material and labor to build out the support infrastructure in all communications rooms
• material and labor to build out the copper and fiber optic vertical backbone infrastructure
• material and labor to build out the copper and fiber optic building service infrastructure
• material and labor to remove old communications cabling
• material and labor to reroute existing outside plant cable
• material and labor to reroute existing vertical communications infrastructure
• material and labor to install networking equipment and wireless devices

IT Services will be responsible for selecting and managing the telecommunications preferred contractor and any coordination efforts with the general contractor or their subcontractors. At the conclusion of the project, the material and labor above will be billed back to the project by ITS. On large projects, IT Services will bill the project on an agreed-upon schedule over the duration of the project. All field changes to the original scope of the project will be documented and submitted to the Facilities Services Project Manager for approval before any work is done.

2.4.1 Related Documents and Drawings

A project charter or Statement of Work (SOW) is required for all projects.

General Drawing Specifications

• Detail and elevation drawings shall be D size (24” x 36”) with a minimum scale of 1/4” = 1’0” or larger
• MTR, TR and other enlarged detail floor plan drawings shall be D size (24” x 36”) with a minimum scale of 1/4” = 1’0” or larger.
• Building composite floor plan drawings shall be D size (24” x 36”) with a minimum scale of 1/8” = 1’0”.

Building composite floor plans

• Provide building floor plans showing outlet locations and jack configuration, types of jacks, run distance for each jack cable, and cable routing/locations.
• Identify telecommunication outlets (TO’s) that, according to location and available pathway systems, require cable length greater than allowed by standards.

Telecommunications space plans/elevations
• Include enlarged floor plans of TRs indicating layout of equipment and devices, including receptacles and grounding provisions.
• Submit detailed plan views elevations of telecommunications spaces showing racks, termination blocks, and cable paths.

Logical Drawings
• Provide logical riser or schematic drawings for all systems. Include schematic symbol key.
• The final Construction Documents shall include marked IT locations with the designated IT Services labeling scheme.

3. Communications Infrastructure
Healthcare pathways and spaces require additional space consideration to support systems unique to the healthcare environment. In addition to the supporting systems, the communications infrastructure needs to accommodate other factors, such as:

• Security Considerations
  • physical security of systems which process, transmit, and store data may require special treatment under the
  • Health Insurance Portability and Accountability Act (HIPAA). This should be coordinated with the owner.

• Redundancy Considerations
  • Because of the critical nature of services provided in the healthcare environment, consideration should be given to providing redundant carrier services and entrance facilities serving the facility.

• Pathway Considerations
  • Pathway design and space assignment shall be coordinated with the mechanical, electrical, plumbing, and pneumatic tube systems designers.
3.1 OSP Pathways and Spaces

- The design of outside plant pathways and spaces should be consistent with standards such as ANSI/TIA-758-B and ISO/IEC 14763-2.
- If multiple service pathways are used, they shall have a minimum separation of six (6) m (20 ft.).
- Utility companies installing service via underground conduit should maintain redundant pathways for maintenance purposes. In the case of customer owned outside plant, providing pathways for utility services, then the designer should provide enough space for multiple service providers and maintain redundant pathways for maintenance.
- Diversely routed pathways should be physically separated by at least 20 m (66 ft.) at all points along their routes.

3.2 Entrance Facilities (EF)

The entrance facility (EF) consists of the pathways, spaces, cables, connecting hardware, protection devices, and other passive and active equipment that support the service provider (SP) and access provider (AP). The EF shall be located:

- As close as practicable to communications service entry point.
- Above the highest known flood level.
- Away from exterior curtain walls
- As close as practical to the electrical service ground to minimize bonding conductor lengths between the ICT electrical grounding infrastructures.
- In multi-story buildings, the EF shall not be located on the top or highest floor.
- EF should be located on floors above grade and where possible, above the level known to be at risk for flood.
- EFs should not be located in areas subject to water intrusion from external sources (e.g., fountains, utility services).
- In multi-story buildings, the EF should be located above grade and within the bottom 33% (1/3) of the building.
- If multiple EFs are used, they should have a minimum separation of 15 m (50 ft.).
3.3 Cabling Entrance

- To reduce the risk of injury or damage to the building or its occupants, the maximum length of outside plant cable that may enter the facility is determined by the AHJ and applicable codes. Beyond this length, the cable must be transitioned and connected to cable with an allowed rating and/or placed within an allowed pathway.
- For critical care facilities, multiple entrance points and route diversity shall be provided.
- When the primary data center serving the facility is located remote from the facility, two entrance facilities with redundant communications services shall be provided.
- Diverse entrance cabling pathways should have route separation as great as practical.
- Where not otherwise required, redundant cabling entrance points or an equivalent strategy to provide redundant data services should be provided.
- The EF shall be designed in accordance with the requirements of the standard being followed, such as ANSI/TIA-569-D or ISO/IEC 14763-2.
- If the EF is to support additional systems (e.g., building automation, nurse call, security, CATV, clinical systems), the EF shall be increased in size to provide adequate space for these additional systems.
- If the EF cannot be increased in size, the additional systems shall be installed in the equipment room or telecommunications room.

3.4 Telecommunications Rooms (TR)

- Where not otherwise specified in this standard, the TR shall be designed in accordance with the requirements of the standards being followed (e.g., NFPA 99, ANSI/TIA-1179-A, ISO/IEC 14763-2, FGI Guidelines)
- A minimum of one TR shall be placed on each floor.
- TRs shall be located outside of surgery suites and other sterile areas (before the “redline”) to allow TR maintenance without requiring personnel to dress out in protective clothing in the sterile areas.
- TRs shall be directly accessible from a corridor without passing through another space (e.g., electric closet, mechanical room).
- A TR may not serve an area exceeding 929 m² (10,000 ft²). TR shall be located as close as practical to the center or the area served.
• The minimum floor dimensions of a TR shall meet the requirements of the AHJ (e.g., NFPA 99). Where AHJ requirements are not present, the minimum floor dimensions shall be 12 ft. × 18 ft.

• A growth factor of 50% of the systems and services being supported by the TR should be considered when determining the final physical size of the TR.

• When placing a TR below grade level, water infiltration issues and mitigation shall be considered during the design, including:
  o Height below surrounding drainage systems
  o Water detection systems
  o Secure and continuous vapor barriers
  o Water and vapor extraction systems
  o Main building systems that might create damage
  o Hazardous materials stored or utilized in the basement
  o Flooding potential during and following severe weather events
  o Working space in front and behind racks, cabinets and equipment shall be at least 0.9 m (3 ft.).

• Entry to TR shall be restricted to authorized personnel.

• In multi-story buildings, TRs on each floor should be located so that the TR’s physical footprint matches or is contained within or encompasses the physical footprint of the TR directly above and below, as applicable. This “stacking” minimizes the length of pathway required to connect TRs on adjacent floors.

• The TR should be located on the same floor as the work areas served. TRs should be located away from MRI rooms and other imaging modalities to minimize electric and magnetic field interference.

• No other equipment should be mounted above the equipment within the TR.

• Entrances to a TR should be controlled through the use of electronic access control (e.g., credential reader).

• MTR’s – camera surveillance should cover interior and exterior doors and equipment rows.

• UPS and critical switch gear rooms - camera surveillance should cover the interior and exterior doors.

• TR’s - camera surveillance should cover the interior and exterior door entrance.
3.5 Hospital Horizontal Distribution System

Install empty raceway system, including underfloor and overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable troughs, service poles, miscellaneous and positioning material to constitute complete system, as indicated for distribution of telecommunications wiring, which includes cables for data, voice, video, audio, security, and future signal requirements.

3.5.1 Corridor Cable Tray System

- IT Services and UCMC IT preferred horizontal distribution system is open cable tray in accessible hallway ceilings.
- Complete wall mounted or suspended aluminum cable tray system and necessary accessories shall be provided as shown on plans. Install entire cable tray system in accordance with manufacturer’s minimum installation practices and all local governing codes.
- Coordinate installation of cable tray with other trades to allow a minimum of 12” above, 12” in front, and 12” below of clearance from piping, conduits, ductwork, etc. Allowance must be provided for access to the tray with reasonable room to work. Obstructions to the tray must be minimized and cannot block more than six feet of the tray at any point in the run.
- Submittal drawings, in the form of 8 ½”x 11” catalog cut sheets, shall be provided for the following items: cable tray, fittings, accessories and load data.
- Cable tray shall not be loaded beyond 60% of manufacturer’s recommended load capacity.
- Where a new cable tray distribution system encounters a fire rated wall, install EZ Path fire rated mechanical sleeves through the wall so the cabling does not exceed 60% fill.
- Where cable tray is exposed below ceiling, install the appropriate solid bottom inserts to conceal the cables.
- Install cable tray dropouts where large quantities of cables exit the distribution system.
- Cable tray or conduit must be sized to facilitate sufficient growth capacity for migration cable plant to coexist in same tray as existing cable plant, wherever possible.
- When using conduit for horizontal pathways the minimum size conduit shall be 4”, a quantity of (1) 4” empty conduit is required for future growth.
• Fittings/Supports: wire mesh cable tray fittings are field fabricated from straight tray sections, in accordance with manufacturer’s instructions. Supports will include the FAS (Fast Assembly System), where possible, so that screws, bolts, and additional tools are not required for cable tray mounting; installation time is reduced; and tray path can adapt to installation obstacles without the need for additional parts. Place supports so that support span does not exceed that shown on the drawings.

• FAS System support methods to mount from ceiling and wall structures with 1/4”, 3/8” or 1/2” threaded rod, if applicable.

• Splices, including those approved for electrical continuity (bonding), as recommended by cable tray manufacturer. Select one of the following splicing methods, if applicable:
  o UL Classified EDRN Fast Splice: No hardware required.
  o UL Classified SWK Splice Washer Kit: Swaged set for splicing, turns, bends, tees
  o UL Classified ED Universal Splice Bar: Cut & bend to fit any configuration
  o Pre-click Splice: Bolted connection optional
  o UL Classified EDT Splice Plate: Bolted connection
  o UL Classified CE 25 & CE 30 Square Splice Washers: Use with EZ BN ¼” Nut & Bolt
  o UL Classified CE 40 Square Splice Washer: Use with EZ BN ¼” to splice trays on bends, adjustable tees
  o FASLock Splice: For sweeps and bends with tray 12” (300mm) and wider.
  o UL Classified EZ T 90 kit: For tees and 90s
  o UL Classified RADT90 kit: For 5-1/2” radius Tees and 90s

Accessories

As required to protect, support, and install a cable tray system. Select from the following accessories, if applicable:

• Equipment Grounding Conductor Function & Grounding

• UL Classified cable trays (including painted tray) may act as Equipment Grounding Conductors.

• Use UL Classified splicing methods to ensure cable tray is electrically continuous and bonded as recommended.

• Ground cable trays at end of continuous run.

• Test cable tray system per NFPA70B, Chapter 18 to verify grounding less than 1 ohm.
• Ground cable trays against fault current, noise, lightning, and electromagnetic interference by mounting grounding wire to each 10’ cable tray section with grounding clamp.

3.6 Telecommunications Outlet (TO) Infrastructure

Telecommunications Outlet (TO) consists of one (1) 4-11/16” square by 2-1/8” deep flush mounted box. Each outlet box shall have a minimum of 1” EMT conduit extended into the hallway cable tray.

Conduit size is as follows:

• For Outlets with 3 or less cables, use a 1” EMT conduit
• For Outlets with 3-6 cables, use a 1.25” EMT conduit
• For all other sizes, calculate fill ratio at 40% for properly sized conduit
• See chart 13.1 on page 41.

The intent of the installation of the TOs, which consist of the raceway, is as follows:

• where ceilings are accessible, the raceway and entrance end fitting shall extend above the ceiling and the conduit installed above the ceiling in the room to the nearest hallway distribution system.

• where ceilings are partially accessible, or if the drawings and/or specifications indicate installation of access panels, the raceway shall extend above the ceiling and the conduit installed above the ceiling in the room to the nearest hallway distribution system.

• where ceilings are inaccessible or no ceilings exist, the raceway shall extend up as close to the ceiling as practical to allow installation of conduit as high as possible to the nearest hallway distribution system.

3.6.1 Station Conduits

• “J-Hooks” are not allowed for self-supporting infrastructure; all station conduit shall be from workstation to basket tray or accessible junction box.

• Station conduit is defined as conduit that originates at the TO and rises within the walls or is exposed from a raceway and extends up into the drop ceiling or over to the hallway distribution system.
• Provide station conduit from TOs to above the drop ceiling or extend over to the hallway distribution systems consisting of 1” EMT minimum or appropriate size as shown on the drawings or as specified herein for installation of telecommunications cables.

• Provide an insulating press fit bushing on all telecommunications conduit, including interconnecting nipples and stub to distribution system.

• To prevent conflicts with other cables or conduit to cable tray, the conduit shall be stubbed not less than 6” above or below conduit/cable tray center line. Where space permits, every effort shall be made to bend station conduit down such that the flow of installed cables promotes the minimum length back to the TR and the fewest bends in the cables. Bushings must be rated to be used in an environmental air handling space (Plenum).

• Provide measured pull line in 12” increments in each empty conduit to hallway distribution system.

• Indelibly mark station conduit at hallway distribution end with Room number that the conduit serves.

• The use of 90-degree electrical pulling elbows is prohibited.

• Do not include more than two 90-degree bends between pulling points when installing station conduit runs. If the path of the station conduit requires more than 180 degrees of total bends, installation of an appropriately sized junction box is required.

• Place an appropriately sized junction box in each individual station conduit run that exceeds 100 feet in length.

• The use of a third bend in a conduit is only acceptable if:
  o the total conduit run is reduced by 15%  
  o the conduit size is increased to the next trade size  
  o one of the bends is located within 12” of the cable feed end

3.6.2 Junction Box Requirements for Station Conduit

• If the station conduit route exceeds the 180 degree of total bends limitation, an appropriately sized junction box is required within a straight section of the conduit run.
• A junction box shall not be used in place of a bend. All junction boxes in station conduit paths shall be installed within a straight section of the conduit run.

3.6.3 Wire Mold Solution

A metallic or plastic raceway providing telecommunication and electrical connectivity to the workstation planning and design shall consider the following guidelines:

• The shared raceway shall provide a divided channel to separate telecommunication and electrical cabling from EMI.
• The project shall provide all faceplates for the installed raceway.
• In cases that Legrand / Wire mold 4000 series brand is installed, faceplate shall be 4047C-1 series faceplate, single gang device.
• The number and type of telecommunication outlets will determine the size and number of horizontal pathways needed to service the installed raceway.
• The raceway and horizontal pathways shall not exceed the manufacture 40% fill ratio.
• All 90-degree bends shall be sweeping bends, no sharp corners accepted.
• All wire mold locations shall be reviewed and approved by IT Services before installation.

3.7 Plenum Ceilings

• Plenum rated communication and low voltage cable does not meet the City of Chicago fire code. The following specifications will default to plenum with presence at any point in any project.
• All cable shall be installed in conduit with plastic bushings. Cable tray shall be replaced with a conduit and pull box infrastructure.
• TO conduit must be home run from each TR to an accessible pull box with no more than two (3) 90-degree bends.
• Larger conduit shall be installed based on the 40 percent fill factor from the pull box to the IDF.
• Conduit system shall be designed to accommodate future growth.
• Pull boxes shall meet or exceed NEC standards and must be accessible in the ceiling.
• Conduit from the pull boxed to the IDF must be sized appropriately and are not to exceed more than 40% of capacity, [refer to the conduit fill chart 13.1 on page 41].
3.8 Drywall Ceiling

- The conduit shall be home run from each TO all the way to the basket tray / pull box accessible in the corridor.
- Basket tray shall not be installed in Dry wall ceilings.
- No conduit shall continue more than 100 feet without a pull box.

4. Telecommunication Room Design and Specifications

4.1 Types of Telecommunication Rooms:

- Entrance Facility (EF)
- Main Telecommunications Room (MTR)
- Telecommunications Room (TR)
- The Entrance Facility (EF)

4.2 The Entrance Facility (EFF)

The **EF room** is for entities providing internet services and or access to the Internet. In most cases, Internet service is provided by IT Services or UCM IT, and the rooms are combined; in some rare cases (such as shared buildings, laboratories, and hospitals), it requires separate rooms.

- The EF room shall be adjacent to the MTR.
- Conduit to ISP provider’s infrastructure shall be routed to ISP outdoor infrastructure from this room.
- A minimum of two (2) 4” conduit shall be stubbed and capped out of the building to the property line near the closest third-party communications service provider for future use. Exact location shall be coordinated and approved with IT Services and UCM IT.

Major design factors of location and size of ISP include the following:

- Space required for equipment
- Future expansion
- Access for both deliveries and installation
- Proximity to electrical source and EMI
- Access and proximity to telecommunication cabling pathways
- Floor loading
- Project Manager

- The IT Services Project Manager shall supply the number and location of communication racks and panels during the design phase of the project.
- The door shall be a minimum of 36” wide and 84” high. The door shall be secured through the building access control system where available. If the building access control system is not available, then the room shall be keyed with the IT Services standard Medeco cylinder.
- To permit flexibility and accessibility of cabling pathways, suspended ceilings are not required in telecommunication spaces unless needed per NEC standards.
- Minimum ceiling height shall be 8’6”.
- Coordinate the lighting layout with the rack equipment layout to ensure that lighting from the light fixtures is not obstructed. Exact location shall be coordinated and approved with an IT Services Project Manager.
- 4x8 ¾” fire rated plywood shall be installed on one wall. Exact location shall be coordinated and approved with an IT Services Project Manager.
- Floor shall be tiled or sealed per IT Services approval.
- Grounding bus detail rated at 100 amps with a minimum of five termination points and attached to the building ground. For further details, see the section on Grounding and Bonding.
- A dedicated 20-amp quad electrical outlet is required at the communication racks, exact location to be coordinated with the IT Project Manager.
- A dedicated 30-amp L530 outlet is required at the communication racks, exact location to be coordinated with an IT Project Manager.
- 20-amp convenience outlets are required on each wall within the ISP.
- All electrical outlets and panels shall be labeled with panel ID and circuit number; handwritten labels will not be accepted.
- ISP room shall have a HVAC source to maintain continuous temperature 24 hours a day, 365 days a year.
The temperature inside the telecommunications rooms shall be maintained at 73+/-3F. The operating range of the room is between 70F and 80F. The relative humidity range shall be between 30% and 55%.

The HVAC system will be installed by the project and maintained by Facilities Services. Minimum requirements vary due to room size and amount of equipment installed in the room. Coordinate size of HVAC with an IT Services Project Manager.

The HVAC system shall be monitored by the BAS system of the building.

Minimum of four (4) 4” conduit or EZ Path fire rated sleeves shall be installed between each ISP and the MTR.

No water or other liquid-carrying piping shall be present in the ER. Examples include, but are not limited to:
- plumbing, including both supply and drain lines of any type.
- steam lines (this is an absolute must not)
- chilled water
- HVAC condensate lines
- HVAC Duct work

The room directly above the ISP cannot have any substantial plumbing or equipment that could potentially cause the flooding or water damage of the ISP. Examples include, but are not limited to:
- restrooms
- mechanical rooms
- Main Telecommunications Room (MTR)

4.3 Main Telecommunications Room (MTR)

The MTR is the telecommunications building service entrance. It is the area where the demarcation between intra-building and inter-building cabling are connected. In most cases, the MTR and the entrance facility (EF) are combined, provided the room shall be sized for both functions.

The MTR shall meet the following requirements:
- Major design factors of location and size of MTR:
- MTR shall NOT be located a basement or sub level of any building
• Space required for equipment
• Future expansion
• Access for both deliveries and installation
• Proximity to electrical source and EMI
• Access and proximity to telecommunication cabling pathways.
• Floor loading
• Construction of the MTR must be completed before the installation of the communications cable can be started.
• A clear space with a minimum size of 20’ x 20’, sized according to the number of TR’s and the building’s square footage. Larger rooms may be required where the MTR, EF and third-party service providers share the space.
• The IT Project Manager shall supply the number and location of communication racks and panels during the design phase of the project. At minimum designs shall be:
  o Quantity of (12) 19” aluminum racks
  o Quantity of (14) 10” vertical managers
  o between each rack
  o At the end of each rack.
  o A clear and accessible path of a minimum of 36” shall be in the front, rear and side of the installed racks.
  o The door shall be a minimum of 36” wide and 84” high.
  o The door shall be secured through the building access control system and the door shall be keyed with the IT Services standard Medeco cylinder.
  o To permit flexibility and accessibility of cabling pathways, suspended ceilings are not required in Telecommunication spaces unless needed per NEC standards.
  o Minimum ceiling height shall be 8’6”.
• Coordinate the lighting layout with the rack equipment layout to ensure that lighting from the light fixtures is not obstructed. Exact location shall be coordinated and approved with an IT Services Project Manager.
• Floor shall be tiled or sealed per IT Services approval.
• Grounding bus detail rated at 100 amps with a minimum of five (5) termination points and attached to the building ground. For further detail see the section on Grounding and Bonding.
- MTR rooms shall have a dedicated HVAC source to maintain continuous temperature 24 hours a day 365 days a year.
  - The temperature inside the telecommunications rooms shall be maintained at a minimum 73+/−3F.
  - The operating range of the room is between 70F and 80F.
  - The relative humidity range shall be between 30% and 55%.
  - The HVAC system will be installed by the project and maintained by Facilities Services.
  - Minimum requirements vary due to room size and amount of equipment installed in the room. Coordinate size of HVAC with IT Services Project Manager.
- The HVAC system shall be monitored by the BAS system of the building.
- Minimum of four (4) 4” conduit or EZ Path fire rated sleeves shall be installed between each MTR and the TR.
- If the MTR is not serving as the entrance facility (EF), four (4) 4” conduit or EZ Path fire rated sleeves shall be installed connecting the entrance facility and the MTR.
- No water or other liquid-carrying piping shall be present in the MTR. Examples include but are not limited to:
  - Plumbing including both supply and drain lines of any type.
  - Steam lines (this is an absolute must not)
  - Chilled Water
  - HVAC condensate lines
  - HVAC Duct work
- The room directly above the MTR cannot have any substantial plumbing or equipment that could potentially cause the flooding or water damage of the MTR. Examples include, but are not limited to:
  - Rest rooms
  - Mechanical rooms

4.4 Telecommunication Room (TR)

The TR provides the connection between Telecommunication Outlet (TO) and the building backbone distribution pathway. The TR serves as a demarcation point for voice, data, video, DAS (Distributed Antenna System), clinical engineering equipment, and voice and fiber backbone.
• Systems such as BAS, security, access control, fire alarm, security NVR appliances, emergency responder radio, synchronized clock, and any other system requiring head end controls shall be located in a separate room.

• Multiple TR’s are required if the cable length between the TR and TO exceeds 90 meters, 295 feet, or if the usable floor space to be served exceeds 929 square meters, or 10,000 square feet.

• In multi-story buildings, TRs on each floor should be located so that the TR’s physical footprint matches or is contained within or encompasses the physical footprint of the TR directly above and below, as applicable. This “stacking” minimizes the length of pathway required to connect TRs on adjacent floors.

• Construction of the TR must be completed before the installation of the communications cable can be started.

• The TR shall be a minimum size of 12’x18’, coordination between the Facilities Services Project Manager and IT Services will be required to lay out the space.

• Final size and requirements may require a larger space based on the occupants requirements.

• The IT Services Project Manager shall supply the number and location of communication racks and panels during the design phase of the project. At minimum, designs hall be:
  o Quantity of (5) 19” aluminum racks
  o Quantity of (6) 10” vertical managers
  o between each rack
  o At the end of each rack.

• A clear and accessible path of a minimum of 36” shall be in the front, rear and side of the installed racks.

• All TR locations are subject to IT Services approval.

• All TRs shall be accessible from a main hallway.

• TRs on adjacent floors shall be stacked above one another.

• The amount of equipment and racks will be determined by the quantity of information outlets and the square footage the TR is serving.

• The number of telecommunications outlets (TO) shall determine the quantity of EZ Path fire rated sleeves.

• A minimum of (2) empty 4” EZ Path sleeves are required for future growth.
• One TR can service 600 active data jacks; a larger TR will be required for larger quantity of active ports.

• The maximum distance between the TR and the information outlet shall not exceed 295’ as measured per the pathway.

• Additional TRs may be required for those locations exceeding the 295’ limit.

• Minimum of two (4) 4” conduit ITS-approved fire rated system shall connect the MTR and the TR.

• The door shall be a minimum of 36” wide and 84” high.

• The door shall be secured through the building access control system the door shall be keyed to the IT Services standard Medeco cylinder.

• To permit flexibility and accessibility of cabling pathways, suspended ceilings are not required in Telecommunication spaces unless needed per NEC standards.

• Minimum ceiling height shall be 8’6” and no ceiling is to be installed.

• Coordinate the lighting layout with the rack equipment layout to ensure that lighting from the light fixtures is not obstructed. Exact location shall be coordinated and approved with IT Services Project Manager.

• Floor shall be tiled or sealed per IT Services approval.

• Grounding bus detail rated at 100 amps with a minimum of 5 termination points and attached to the building ground. For further detail see the section on Grounding and Bonding.

• Telecommunication rooms shall have HVAC source to maintain continuous temperature 24 hours a day 365 days a year. The temperature inside the telecommunications rooms shall be maintained at 73+/-.3F. The operating range of the room is between 70F and 80F. The relative humidity range shall be between 30% and 55%. The HVAC system will be installed by the project and maintained by the University of Chicago Facilities Services. Minimum requirements vary due to room size and amount of equipment installed in the room. Coordinate size of HVAC with IT SERVICES Project Manager.

• The HVAC system shall be monitored by the building BAS system.

• No water or other liquid-carrying piping can be present in the TR. Examples include but are not limited to:
  o Plumbing, including both supply and drain lines of any type.
  o Steam lines (this is an absolute must not)
  o Chilled Water
• HVAC condensate lines
• HVAC Duct work

• The room directly above the TR cannot have any substantial plumbing or equipment that could potentially cause the flooding of the TR. Examples include, but are not limited to:
  • Rest rooms
  • Mechanical rooms

5. Hospital Structure Cable System

Structure Cable System (SCS) system supporting telecommunications systems shall comply with detailed specifications in this section and shall consist of cabling that may include data backbone optical fiber cables, data backbone copper cables, voice backbone copper cables, patch panels, connecting hardware, horizontal data copper cables, and jacks at TOs for voice, data, and telecommunications system services. Locations of equipment shall be as indicated on drawings, unless directed otherwise by Owner’s Representative.

• The high demands on uptime and reliability in the data and voice networks that support healthcare facilities today creates a need for equipment redundancy. This need can be met internally within the hardware itself or by providing additional backbone cabling installed in a redundant method. The latter will require a designed series of redundant pathways consisting of conduits, sleeves, cable trays and other supports.

• Some basic redundancy options for spaces and connecting pathways. Depending on the site location or other specific needs, implementing redundancy may be more complex or be achieved by other pathway configurations and connectivity methods than what is displayed.

5.1 Manufacturers

• The basis for the design specifications defined within this document is the primarily the CommScope Systimax family of products. The approved model numbers, along with any approved equivalent are listed in tables in Appendix 3. Any deviation or substitutions offered as part of this specification must be pre-approved by the owner or owner’s representative. Any submittals in response to any part of this specification that do not meet the product requirements as defined, may be rejected without further consideration, or may cause monetary charges to be incurred by the submitter.
• The SCS shall provide a certified system will support the applications for which it is designed, during the 25-year warrantee of the certified system by CommScope.

5.2 General Requirements:
• Provide installation testing of equipment where required by manufacturer’s installation instructions.
• Provide complete end-to-end testing for all copper and fiber optic systems/channels based on latest applicable standards. Document all testing and submit with final as-built submittal package.
• For all controls and operating equipment, submit equipment/systems to at least three complete operational sequences, in which all equipment operations are tested, observed, and verified.
• For all controls and operating equipment, submit equipment/systems to at least three complete operational sequences, in which all equipment operations are tested, observed, and verified.

5.3 Copper Cabling System
Copper cabling shall be tested and certified after installation as follows and as required for cable manufacturer’s warranty.
• Twisted-pair copper cable channels shall be tested for continuity as specified below, presence of ac/dc voltage, and performance.
• All cabling shall be tested for conformance to horizontal cable specifications as outlined herein and shall be tested according to test set manufacturer’s instructions utilizing latest firmware and software.
• Testing shall include all electrical parameters as specified under Product. All cables and termination hardware shall be 100 percent tested by installation contractor for defects in installation and to verify cable performance under installed conditions.
  o Contractor shall verify all conductors of each installed cable useable prior to system acceptance. All cables shall be tested according to contract documents, manufacturer’s warranty provisions, and best industry practices.
  o If any of these are in conflict, Contractor shall comply with the most stringent requirements.
All defects in cabling system installation shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed, at no additional cost to Owner.

5.4 Telecommunication Outlet (TO)

The installation telecommunication outlet (TO) be mandatory for all new and renovated University buildings to comply with industry standards and to provide the University with a consistent and sustainable infrastructure.

5.4.1 Telecommunications Outlet standards

IT Services has chosen Category 6A cable as the standard for Telecommunication Outlets (TO) and Cat 6A for wireless access point locations.


IT Services cable color code for each system is as follows:

- **Workstation outlets**: (2) white cables - 760107144 and 1091B WHT C6A 4/23 U/UTP W1000
- **Wireless access points**: (2) yellow 6A cables - 760107151 and 1091B YEL C6A 4/23 U/UTP W1000
- **Security cabling**, such as cameras and control equipment: (2) blue cables - 760107094 and 1091B BLU C6A 4/23 U/UTP W1000
- **BAS control equipment**: (2) blue cables - 760107094 and 1091B BLU C6A 4/23 U/UTP W1000
- **Nurse call control equipment**: (2) blue cables - 760107094 and 1091B BLU C6A 4/23 U/UTP W1000
- **Philips’s station and wireless**: (2) orange cables - 760107078 and 1091B SLT C6A 4/23 U/UTP W1000
  - Philips shielded cable shall be orange - (2) 6A cables 760107078 and 1091B SLT C6A 4/23 U/UTP W1000
- **DAS cabling shall be (2) yellow 6A cables - 760107151 and 1091B YEL C6A 4/23 U/UTP W1000**
• CommScope SYSTIMAX Cat 6A 1091B WHT C6A 4/23 Category 6A U/UTP, non-plenum, 4 pair cable .285 OD. 760107144 | 1091B WHT C6A 4/23 U/UTP W1000
• Category 6A telecommunication outlet shall be terminated on Systimax category 6A 8 position 568B/ RJ45 jacks, gray in color, 760092429 | MGS600-262
• Category 6A telecommunications outlet faceplate shall be White 2 port, unless otherwise stated by design team to match décor. 108168469 | M12L-262
• Category 6A telecommunication Room (TR) end will be terminated on a category 6A RJ45 CommScope patch panel. 760152595 | 360-IPR-1100-E-GS6-2U-48

5.5 Wireless Access Point Outlet
• Each wireless information outlet shall have two (2) category 6A cables installed.
• Category 6A telecommunication outlet shall have two (2) category 6A cables installed.
  o Both cables shall be yellow in color - 760107151 and 1091B YEL C6A 4/23 U/UTP W1000
• Category 6A telecommunication outlet shall be terminated on Systimax category 6A 8 position 568B/ RJ45 jacks, yellow in color, 760107151 | 1091B YEL C6A 4/23 U/UTP W1000
• Category 6A telecommunication Room (TR) end will be terminated on a category 6A RJ45 CommScope patch panel. 760152595 | 360-IPR-1100-E-GS6-2U-48
• All station cable will be secured and dressed in Velcro strapping; no cable ties allowed.
• Do not install compressed, kinked, scored, deformed, or abraded cable, or allow such damage to occur.

6. Communications Backbone cabling

6.1 Copper Backbone:

6.2 Intra-Building Copper Backbone for Analog/Voice only
• All cable shall be listed for use per the National Electrical Code (NFPA-70).
• Cable shall meet one of the following, per bid document:
• UL-listed CMR cable: Solid copper conductors with high-density polyolefin insulation and overall low smoke PVC jacket to achieve riser (i.e., non-plenum) rating by UL standards
• UL-listed CMP cable: Solid copper conductors with FEP insulation and overall low smoke PVC jacket to achieve plenum rating by UL standards
• Cable shall meet the requirement of ANSI/TIA-568 series Standards for Category 3 performance.
• All TR’s shall have a minimum of (1) 50 pair ARMM from the building MTR
• TR’s service patient rooms that require analog phones larger copper backbone cable will be required; the number of patient rooms the TR is serving shall determine the size of the backbone cable.
• Approved Manufacturer: CommScope: 50/24 ARMM riser rated 9-57242-1 | 1010A SLT C3 25/24 U/UTP R1000
• Inter-Building Copper Backbone for Analog/Voice only
• All cable shall be manufactured and constructed for use in the Outside Plant Environment.
• Cable shall meet the requirement of TIA-568 series Standards for Category 3 performance
  o Approved Manufacturer: CommScope: 50/24 ARMM riser rated 9-57242-1 | 1010A SLT C3 25/24 U/UTP R1000
• Building entrance protection for copper cabling shall be installed utilizing a two (2) foot fuse link between outside plant cable plant splice and the protector module with IDC-type input and output terminals, 100 pair-pair capacity and female mounting base, equipped with 230-volt solid-state protector modules. Sufficient protector modules shall be provided to completely populate all building entrance terminals.
• Voice backbone cables shall have a minimum 10-foot service loop when terminated in the MTR and TR, and at any splice points in telecommunications manholes.

6.3 Fiber Optic Backbone Cable:
• Cables shall be designed for Point-to-Point applications and shall provide a high level of protection for optical fiber installed in building applications.

Intra Building Backbone, Inside Plant (ISP)
• All TRs shall be services with a minimum of (2) 24 strand Single-mode Armored fiber optic cable and shall route point to point to building MTR with no splices.
• All TRs shall be serviced with fully redundant fiber optic backbone cables.
• Indoor Armored Riser Rated Tight Buffer - UL-listed OFCR: Tight buffer optical fibers, aramid strength yarn, a riser-rated jacket, aluminum interlocking armor with an overall riser-rated sheath jacket to provide additional protection and security. Armored fiber shall be installed to CommScope Armored Fiber Installation and Grounding requirements.

• **Approved manufacturers:** CommScope: 760127373 and R-024-DZ-8W-FSUYL

**Inter Building Stranded Backbone (OSP)**

Indoor/Outdoor Cables - All cable shall be listed for use indoors per the National Electrical Code (NFPA-70) and shall meet both of the following, per bid document:

- **Indoor Riser Rated Tight Buffer - UL-listed OFNR:** Tight buffer optical fibers, aramid strength yarn, and riser-rated outer jacket.

- **Indoor Low Smoke/Zero Halogen Riser Rated Tight Buffer UL-listed OFN(LS) cable:** Solid copper conductors with non-halogen HDPE insulation and low smoke, zero halogen, compound jacket to achieve LSZH rating.

All inter-building fiber optic cables shall be 48-strand single mode fiber, point to point, with no splices from the building MTR to IT Services main network distribution. IT Services project management team shall determine exact locations.

• **Approved manufacture:** CommScope: 760090309 | Z-048-DS-8W-FMUBK/C

**Installation**

**General - Inter and Intra Building Fiber Backbone Cable**

Contractor shall not exceed the maximum pulling tension or the minimum bending radius for fiber cables per manufacturer’s specifications.

**All installations shall comply with:**

- ANSI/TIA-569 Telecommunications Pathways and Spaces.
- ANSI-J-STD-607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
6.4 Backbone Cable Testing

- For all Fiber Optic cables installed, complete end-to-end test results are required.
- All fiber optic cable must be visually inspected and optically tested on the reel upon delivery to the installation site.
- All fibers shall be tested for continuity and attenuation using an Optical Time Domain Reflectometer (OTDR), an access jumper with like fiber, a pigtail, and a mechanical splice.
- Testing for continuity and attenuation on the reel must confirm factory specifications to ensure that the fiber optic cable was not damaged during shipment. The test results must match the results of the factory-attached tag on the reel, or the fiber shall not be used. Reel data sheet must be provided showing test results.
- End to end (bi-directional) test measurements shall be provided for single-mode and multimode fibers (two wavelengths per test are required). Test results must be submitted for review as part of the installation inspection requirements. Test results shall be in paper form and electronic form and must contain the names and signatures of the technicians performing the tests.
- Testing shall be performed on 100% of the fibers in the completed end-to-end system. TIA-568 provides the technical criteria and formulae to be used in fiber optic testing.

**Note:** all UH fiber must be tested, rated, and guaranteed for Ethernet GigaSPEED 1000B-X performance.

- All fiber optic cable links must pass all installation and performance tests both recommended and mandated by the cable manufacturer.
- The Owner is to be notified at least 24 hours prior to testing to allow observation at the Owner's discretion. If the Owner confirms his intention to observe, a reasonable starting time shall be agreed upon. Should the Owner not be present at the scheduled commencement time, the Contractor may begin testing as scheduled.
- Testing Format:
Test Results must be submitted in two (2) formats. The first must be original file(s) downloaded from the tester. The second file must be cohesively placed in Excel format with the following fields:

- ER/TR RM # / RM # of drop / Port # / all relevant test information in as many fields as necessary.

All test results are to be recorded and submitted to the Owner.

6.5 Backbone Terminations

All copper backbone cables shall be terminated on one of the following approved termination blocks:

- Commscope 24 port patch panel: 760182907 | 1100-U-PS-24
- Commscope 48 port patch panel: 760182915 | 1100-U-PS-48
- CommScope 110Connect XC System Copper Wiring Block Kit, UTP term., 100-pair, 5-pair connecting blocks 569440-1
- **The termination style depends on each building requirements specified by the IT project manager shall specify the termination style for each building.**
- All fiber optic termination shall be fusion splices.
- All fiber optic termination shall be SC APC (angle polish).

**Approved fiber optic terminations and houses are:**

- CommScope TeraSPEED® Splicing cassette, 12LC APC, 900μm: G2 SPLICE CASSETTES 760245960 | G2-SP-12LAG-PT
- EPX 4U sliding panel, accepts (16) G2 style splice cassettes, modules or adapter packs, providing up to 192 duplex LC ports 760251048 | EPX-4U-MOD-ENC
- CEPX 1U sliding panel, accepts (4) G2 style splice cassettes, modules or adapter packs, providing up to 48 duplex LC ports 760249998 | EPX-1U-MOD-ENC

**7. Communication Rooms Fittings**

This section includes the minimum requirements for the equipment and cable installations in communications equipment rooms (Telecommunications Closets). Included in this section are the minimum composition requirements and installation methods for the following:
Communication Racks and Rack Cable Management

7.1 Racks

- Racks shall be manufactured from aluminum and/or steel extrusion.
- Each rack will have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack will assemble with nut and bolt hardware. The base angles will be pre-punched for attachment to the floor.
- Equipment mounting channels will be punched on the front and rear flange with the EIA-310 Universal Mounting hole pattern.
- Aluminum Racks will be threaded with 12-24 roll-formed threads and will include 40 each combination pan head, pilot point mounting screws.
- The rack will include assembly and equipment-mounting hardware.
- The rack will be rated:
  - Two Post Racks: 1,000 lb. (453.6 kg) of equipment
  - Four Post Racks: 2,000 lb. (907.2 kg) of equipment
- The rack will be UL Listed
- When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19” EIA rack-mount equipment.
- 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm)

  - Equipment Rack
    - Rack is to provide 45 rack-mount spaces in a “7-foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
    - For the "7-foot rack", the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 15" (381 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
    - Finish shall epoxy-polyester hybrid powder coat in the color as specified below.
    - **Approved Manufacturer:** IMS Amco Titan TCMR-45U-16

  - Rack Cable Management
    - **Vertical cable management** shall have doors that are lightweight, sturdy, and be available in different sizes to allow flexibility in design.
    - The cable management system shall have a C-Channel bracket that allows for easy access to the cable trough.
- The vertical cable management system shall allow tool-less installation of Cable Spool.
- Doors shall come standard with on all cable management and be available in both single and double-sided configurations.
- The door shall have dual hinge design that can be opened to the right or left.
- The door latching mechanism shall have an easy closing feature.
- The door shall have one point removal and installation process for door.
- Horizontal wire managers shall have horizontal cover hinges up or down and be lockable into position with cylindrical finger ends for easy snap on installation.
- The door shall have a recessed handle to eliminate snag potential for clothes and arms.
- **The Horizontal cable management system** shall have an open back on 2U and 3U horizontal troughs for easy pass-through of cables.

**Vertical Managers:**
- The vertical cable management kits are installed on the side of a 19-inch.
- The door(s) shall be designed to provide a concealed vertical space for organizing patch cables.
- Cable spools shall be used to organize longer patch cable lengths.
- Cable managers are to be matched to the cable rack and shall be double-sided 10” wide with doors.
- Approved Manufacturer: IMS Amco Titan: TCMR-xxU-10

**Horizontal Cable Management for Racks**
- The horizontal cable management kits are installed on a 19-inch (483 mm) wide industry standard rack above or below panels to organize patch cables.
- The kit shall be available in a single-sided and double-sided configuration, and in a 2U- and 3U-height.
- The unit shall include covers that can be opened from the top, the bottom, or removed altogether.
- The cover hinges shall be designed to hold the cover open from the top or bottom to facilitate faster cabling.
- The 2U and 3U cable managers shall have a pass-through feature allowing access to and from the rear for additional cable routing.
- The depth of the unit shall be 5-1/2 inches (140 mm) deep from front to back with the cover closed.
- Approved Manufacturer: CommScope HTK-19-SS-2U (760072959) 2RU
- Horizontal Cable Management

8. Fire Stopping

- All data, video, and communications cable bundles shall utilize an enclosed fire rated pathway device wherever said cables penetrate rated walls.
- The fire-rated pathway shall contain a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated.
- The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to adjust, remove, or reinstall fire stop materials.
- The pathway shall be UL Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479).
- The University of Chicago approved system that meets these specifications is Specified Technologies Inc. | EZ-Path system http://www.stifirestop.com

Fire Rated Wiring Device System

- All cable penetrations through floors or fire rated walls shall utilize fire rated device systems that shall be approved by IT Services.
- All devices shall be heavy-duty specification grade an in tumescent insert material allowing for 0 to 100% visual fill of conductors.
- Fire rated devices shall bear the UL Classification marking.
- Cables penetrating through fire rated floors or walls shall utilize fire rated pathway devices capable of providing an (F) rating equal to the rating of the barrier in which the device is installed.
- Wiring devices shall be capable of allowing a 0 to 100% fill of cables.
- The installed device shall require no maintenance and accommodate future cable changes without mechanical adjustment and/or removal or replacement of protective materials.
- Conduit sleeve as means of fire stopping is not to be utilized in any IT Services project. Any exceptions must be approved by IT Services.
• All penetrations that do not meet the above specifications must be fire stopped with an appropriate system.
• Any conduit or other penetrations that a fire stopping system cannot accommodate must be fire stopped with a UL approved system that meets the City of Chicago fire code and is approval by IT Services.

9. Grounding and Bonding for Communications Systems

• All cable and equipment shall be installed in a neat and skillful manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative.
• Equipment and materials shall be of the quality and manufacture indicated.
• The equipment specified is based upon the acceptable manufacturers listed.
• Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
• Strictly adhere to all Building Industry Consulting Service International (BICSI) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
• Material and work specified herein shall comply with the applicable requirements of the current revision of the following:
  o ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
  o ANSI/TIA-569 Telecommunications Pathways and Spaces
  o ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure
  o BICSI – Telecommunications Distribution Methods Manual
  o TIA-607-D Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
  o NFPA 70 – National Electric Code

Grounding Electrode System

When required the Grounding Electrode System shall meet the following:

• Active grounding system constantly replenishing moisture into the soil
• Provide low resistance to ground
• Provide season to season stability
• Be maintenance-free for 30 years
• Contain no hazardous materials or chemicals
• Telecommunications Main Grounding Bus bar (TMGB)
  • Telecommunications Main Grounding bus bar (TMGB) shall be constructed of .25” (6.4 mm) thick solid copper bar.
  • The bus bar shall be 4” (100 mm) high and 20” (510 mm) long and shall have 30 attachment points (two rows of 15 each) for two-hole grounding lugs.
  • The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 27 lugs with 5/8” (15.8 mm) hole centers and 3 lugs with 1” (25.4 mm) hole centers.
  • The bus bar shall include wall-mount standoff brackets, assembly screws and insulators creating a 4” (100 mm) standoff from the wall.
  • The bus bar shall be UL Listed as grounding and bonding equipment.
• Telecommunications Grounding bus bar (TGB)
  • Telecommunications Grounding bus bar (TGB) shall be constructed of .25” (6.4 mm) thick solid copper bar.
  • The bus bar shall be 2” (50 mm) high and 12” (300 mm) long and shall have nine attachment points (one row) for two-hole grounding lugs.
  • The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 6 lugs with 5/8” (15.8 mm) hole centers and 3 lugs with 1” (25.4 mm) hole centers.
  • The bus bar shall include wall-mount standoff brackets, assembly screws and insulators creating a 4” (100 mm) standoff from the wall.
  • The bus bar shall be UL Listed as grounding and bonding equipment.

Installation

• Outdoor grounding and bonding connections
  • All outdoor grounding and bonding (earthing) connections shall be accomplished using exothermic welding.
• Wall-Mount Bus bars
  • Attach bus bars to the wall with appropriate hardware according to the manufacturer’s installation instructions.
• Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit the bus bar and the conductors.
• Each lug shall be attached with stainless steel hardware after preparing the bond per manufacturer recommendations and treating the bonding surface on the bus bar with antioxidant to help prevent corrosion at the bond.
• The wall-mount bus bar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.
• Rack-Mount Bus Bars and Ground Bars
• When a rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring a ground connection, add a rack-mount horizontal or vertical bus bar or ground bar to the rack or cabinet. The rack-mount bus bar or ground bar provides multiple bonding points on the rack for rack and rack-mount equipment.
• Attach rack-mount bus bars and ground bars to racks or cabinets per the manufacturer’s installation instructions.
• Bond the rack-mount bus bar or ground bar to the room’s TMGB or TGB with appropriately sized hardware and conductor.
• Ground Terminal Block
• Every rack and cabinet shall be bonded to the TMGB or TGB.
• Minimum bonding connection to racks and cabinets shall be made with a rackmount two-hole ground terminal block sized to fit the conductor and rack and installed per manufacturer recommendations.
• Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

10. Electrical Power Requirements
• All electrical power requirements shall be verified and coordinated with University of Chicago Hospital network team prior to design and installation.
• A designer should consider the power requirements of all the equipment involved. This may entail uninterruptible power supply (UPS) systems that will generate 120/240 VAC at 50/60 Hz, battery rectifiers that will operate the equipment as well as recharge the battery banks after a power failure, and wind and solar power generation systems for remote areas.
• Power requirements for equipment located outside of the equipment room (e.g., amplifiers used within distributed antenna systems) should also be included.

While there are different types of UPS systems, a static UPS is commonly used within ICT and building systems. A static UPS unit is a solid-state device designed to protect critical loads from most types of power fluctuations. There are three primary types of static UPS units, as listed below:

10.1 MTR, TR and Entrance Facility Requirements

• Goal is to achieve Class A Tier III (99.982% uptime), up to 1.6 hours of downtime per year.
• Tier three allows maintenance and repairs to be performed on critical components without taking the power system offline. As compared to tier one and two data centers, tier three data centers offer a level of reliability that is far superior. Naturally, this makes tier three data centers a clear choice for businesses or institutions which prioritize reliability. Tier three data centers are often the choice of law enforcement departments, fire departments, healthcare facilities, and any company that wishes to gain a reputation for reliable and dependable service. It is often chosen as a compromise between performance and affordability.
• Requirements:
  • Dual (A and B) Central Building three phase UPS.
  • Dedicated IT Rooms (not to be shared with BAS, Security, EVS, general storage, or for any other purpose). **Note:** security and BAS servers are exceptions and may reside in the MTR.
  • Dedicated IT Rooms will have sufficient cooling, on separate thermostat zones and cooling must be available in all weather (including below 0 degrees).
  • Resilient Cooling Capacity needed for the MTR.
  • TR’s and Entrance facility does not need resilient cooling capacity.
  • Emergency Generator Power for extended utility outages to keep critical network and other building systems operating.
• N+1 generator design and parallel redundant, sized appropriately for initial load and expansion.
• MTR, TR, and Entrance Facility to physical access to be controlled via card reader system.
• Access generally reserved for IT, Facilities, Security staff, and associated vendors.
• Physical key to match FM3 UCM Standard.
• Video surveillance cameras to be installed to cover entrances, exits and interior of each IT room.
• Access provisions for select IT staff to view cameras covering critical IT areas.
• Dual Utility Feed (either dual feeds and transformers or dual feeds connected via ATS or ATO).
• ATS for emergency power to include bypass and closed transition.
• UPS design needs to include remote monitoring and land on current Schneider Electric ExoStruxure software in place (UPS, PDU, ATS, Generator and critical cooling Status).
• Power distribution

UPS design can vary based on space and other requirements:

• UPS Input 480 volts, output 480 volts, utilizing stepdown transformers (installed in PDU’s) to 208/120v.
• UPS with internal step-down transformers can be considered to save on space.
• UPS to have external Bypass.
• Starline Buss system preferred in MTR.
• TR and Entrance Facility rooms can utilize Panel Board & outlet distribution (A & B connected feeds).
• Dual Rack mount PDUs for each equipment rack.
• MTR and TR outlets to be installed at top of rack, along cable tray, including A & B connected feeds.
• standard 3phase, 30 amp / APC AP8865, one connected to A side UPS, the other connected to B side UPS.
• Other outlets may need to be installed for special situations (NEMA L6-20’s, NEMA 5-20's, ...).

11. Labeling

The purpose of this section is to clearly define the labeling nomenclature to be implemented within new construction and renovation projects at both client jack locations as well as TR patch panels. This is to allow clear and concise labeling templates for installers.

Client Location Jack Labeling

Diagram 1 - Vertical Orientation

![Diagram 1 - Vertical Orientation](image1)

Diagram 2 - Horizontal Orientation

![Diagram 2 - Horizontal Orientation](image2)
"U" upper label compartment

- Used to identify a standard jack ID room, direction, type, and cardinality. All labels will be machine printed, centered, and in bold typeface at the highest point size that can fit all characters legibly. All upper labeling should follow the following template:
  
  <Room number><direction><type><cardinality>

- <Room number> will be obtained from the current set of drawing provided by the project. If the main room has adjacent suites, this additional criterion is captured at the room number level.

- <Hall> in some instances, a jack will be located in the halls or corridor. For these instances, the word "hall" is placed as per the below template within the upper labeling compartment:
  
  <Room number (of closest room)><hall><direction><type><cardinality>

- <w> in some instances jacks are allocated for "wall phone" positions. For these instances, a “W” is placed as per the below template within the upper labeling compartment:
  
  <Room number (of closest room)><direction><type><w><cardinality>

- <direction> will be “N”, “S”, “E”, “W”, “CF”, “CC”
  
  o N-North
  o S-South
- E-East
- W-West
- CF-Center Floor
- CC-Center Ceiling

- `<Type>` will be “B” for baseboard jacks
- `<Cardinality>` will be the number of the wall plate on the wall, such as “1”, “2”, etc.
  Numbering will start on the left end of the wall and proceed clockwise until wall ends
  *

  *There may be more or less data on some specialty jacks.*

**“L” lower label compartment**

- Used to identify the room number of the TR for which the wall-plate is pulled. This is particularly important in the middle of each floor, where some areas will have cabling that terminates in both TRs due to cabling length restrictions. All lower labeling should follow the following template:
  - `<TR> <TR number>`
  - `<TR> First type the characters “TR”`

  `<TR number>` will be the actual room number of the relevant TR

**Sample Scenarios**

- Room: 122 Direction: West
- Cardinality 1st jack position (left side jack on west wall)
- U: 122WB1
- L: TR 125
TR Location Panel Labeling

- All labels will be machine printed, centered, and in bold typeface at the highest point size that can fit all characters legibly.
- Panel labeling should use the following template (template better depicted in Diagram 3 – Patch Panel Visio Diagram)

  `<Room number><direction><type><cardinality>`

- `<Room number>` will be obtained from the current set of projects provided drawings. If the main room has adjacent suites, this additional criterion is captured at the room number level.
- `<Hall>` in some instances, a jack will be located in the halls or corridor. For these instances, the word “hall” is placed as per the below template within the upper labeling compartment:

  `<Room number (of closest room)><hall><direction><type><cardinality>`
12. Emergency Blue Light Phones

This section includes the preferred Manufacture of emergency phone tower, pedestal, wall mount enclosures.

12.1 Basic Installation of CB 1-S

- Approved Manufacture: Code Blue
- Approved enclosures: CB 1-S
- Height: 9 feet tall
- Color: Standard color is Gloss White
- Custom colors available: Dark Bronze, Gloss Black, Safety Blue, Red, Safety Yellow, Bright Silver
- Power: 12-24v AC/DC; 120 voltage
- POE
- Communications: Hardwired POE; IP5000 speaker phone
- Lighting: Dual Strobe/ Beacon; LED faceplate light; Area light
- Options: Public address speakers, Overhead camera mount, CB 2-A
- Wall mount
- Height 30”
- Width 12”
- Depth 4”
- Color: Standard is stainless steel; custom colors: Dark Bronze, Gloss White, Gloss Black, Safety Blue, Safety Red, Safety Yellow, Bright Silver
- Lighting: LED faceplate light; Beacon/ strobe
- Power: 120 voltage; 12-24V AC/DC
- Communications: P5000 Speaker phone

12.1 Basic installation of CB 1-S

- EIA/TIA, ANSI, CSA and BICSI cabling or similar standards shall be adhered to for proper operation of Code Blue communication devices connected to copper or fiber infrastructures. **Communications cable and electrical cable in the same conduit is not an acceptable installation and shall not be supported.** Analog phones require a minimum of 23mA for proper operation (26-29mA recommended).
- Each analog speakerphone requires its own phone line or PBX extension. Multiple units shall not be supported.
• Speakerphones require programming before operation.
• Consult the User Guide or Administrator Guide enclosed with the unit or visit www.codeblue.com > Support > Downloads to read or download manuals.
• If you are installing IP speakerphones, please read the appropriate manuals and consult with your Network Administrator.
• Size electrical wiring based on length of run.
• Consult the enclosed document packet for internal wiring instructions.

13. Special Applications

This section is for non-standard installations, out of distance devices, such as Emergency Phones, cameras, and wireless access points. All special applications must be approved by IT Services or UCM IT prior to design and installation.

The IT Services standard to support POE networked devices that exceed the maximum of 90 meters for copper cabling is powered fiber optic cable. This cable has 4 strands of single mode fiber and (2) 12 AWG copper cables for power.

The IT Services standard is:

• 4 strand single mode fiber optic cable with (2) 12 AWG copper cables
• 2 port POE extenders at the end device.
• For 4 or less devices (1) Altronix 4 port Midspan unit shall be installed in the TR
• For 12 or more devices (1) rectifier and power shelf with 8 port modules shall be used in the TR.
• LC QWIK 2 connectors at the end device
• Fiber terminations in TR shall be fusion splice with SC APC splice cassettes
• SM SFP optics shall be installed in the POE extender at the end device location.
14. Charts and Diagrams

14.1 Conduit and cable tray fill charts

**Conduit Fill Capacity**

<table>
<thead>
<tr>
<th>Conduit size</th>
<th>Category 6</th>
<th>Category 6A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2&quot;</td>
<td>22</td>
<td>17</td>
</tr>
<tr>
<td>3&quot;</td>
<td>49</td>
<td>37</td>
</tr>
<tr>
<td>4&quot;</td>
<td>83</td>
<td>64</td>
</tr>
</tbody>
</table>

**Cable tray fill chart**

<table>
<thead>
<tr>
<th>Tray size</th>
<th>Category 6 fill</th>
<th>Category 6A fill</th>
</tr>
</thead>
<tbody>
<tr>
<td>4x12</td>
<td>626</td>
<td>248</td>
</tr>
<tr>
<td>4x16</td>
<td>839</td>
<td>331</td>
</tr>
<tr>
<td>4x18</td>
<td>944</td>
<td>337</td>
</tr>
<tr>
<td>4x20</td>
<td>1049</td>
<td>414</td>
</tr>
<tr>
<td>4x24</td>
<td>1259</td>
<td>497</td>
</tr>
</tbody>
</table>
14.2 Typical TR layout:

14.3 Typical 5 Rack Layout:

Typical 5 rack and 6 vertical manager layout
(5) 19"x45Ux19" deep IMS Amco Titan TCMR-45U-16
(6) 10" wide vertical managers IMS Amco Titan TCMR-xxU-10
14.4 Fiber and Copper Back Bone Infrastructure Diagram

14.5 Buildings Grounding and Bonding:
14.6 Equipment Rack Grounding and Bonding:

Example A

Example B

Example C

TYPICAL
Individual bonding conductors

ITS Sample Equipment Rack Grounding and Bonding
14.7 Emergency Blue Light Phone tower installation CB 1-S
14.8 Emergency Blue Light Phone tower installation CB 1-S
14.9 Construction As-Built Labeling example:
15. Approved Manufacture and Material List

Category 6A SYSTIMAX Solutions:

Cable:
- All Cat 6A cable shall be X10D U/UTP, 4 pair.
- Blue: 1091B BL 4/23 W1000 ID# 760107094
- White: 1091B WH 4/23 W1000 ID# 760107144
- Yellow: 1091B YL 4/23 W1000 ID# 760107151
- Gray: 1091B SL 4/23 W1000 ID# 7601070
- Orange: 1091B OR 4/23 W1000 ID# 760107128

Jacks:
- Gray: MGS600-270 Material ID# 760092437
- Patch Panels
- SYSTIMAX 360 Gigaspeedx10D 1100GS6 Evolve U/UTP IMVISON READY
- 24 port: 360-IPR-1100-E-GS6-1U-24 ID# 760152587
- 48 port: 360-IPR-1100-E-GS6-2U-48 ID# 760152595
- 24 port Angled: 360-IPR-1100A-E-GS6-1U-24 ID# 760151324
- 48 port Angled: 360-IPR-1100A-E-GS6-2U-48 ID# 760151779

Approved Fiber Optic Material: Cable
- All cables shall be manufactured by SYSTIMAX
- All cables shall be single mode
- All Indoor cables shall be Riser rated and Armored
- All Outdoor cables shall be indoor/outdoor Gel free UV rated Riser
- Indoor 24 Strand: R-024-DZ-8W-FSUYL ID# 760127373
- Indoor 48 Strand: R-048-DZ-8W-FMUYL ID# 760127340
- Indoor 144 Strand: R-144-DZ-8W-FMUYL ID# 760127480
- Outdoor 48 Strand: Z-048-DS-8W-FMUBK ID# 760090309
- Outdoor 144 Strand: R-144-LN-8W-F12BK/25D ID# 760086652

Enclosures:
- 1U rack mount: EPX-1U-MOD-ENC ID# 760249998
- 2U rack mount: EPX-2U-MOD-ENC ID# 760251044
- 4U rack mount: EPX-4U-MOD-ENC ID# 760251048
• 1 Module Wall Mount: WB2-EMT-BK-1P-MOD ID# 760248900
• 2 Module Wall Mount: WB2-EMT-BK-2P-MOD ID# 760248901
• 4 Module Wall Mount: WB2-EMT-BK-4P-MOD ID# 760248902
• 8 Module Wall Mount: WB2-EMT-BK-8P-MOD ID# 760248903

• Splice Module/ Cassettes:
  • Single Mode 12 LC APC: 12 LC, Tera SPEED® SM OS2; APC, G2-SP-12LAG-PT ID# 760245960
  • Single Mode 24 LC APC: 24 LC, Tera SPEED® SM OS2; APC, G2-SP-24LAG-PT ID# 760245961

Faceplates:
• All faceplates shall have a label holder
• Stainless Steel:
  • Single-Gang 1-Port M11SP-L 760072074
  • Single-Gang 2-Port M12SP-L 760072181
  • Single-Gang 3-Port M13SP-L 760072199
  • Single-Gang 4-Port M14SP-L 760072207
  • Single-Gang 6-Port M16SP-L 760072215
  • Double-Gang 4-Port M24SP-L N/A
  • Double-Gang 8-Port M28SP-L 760100883
• White Single Gang with Label Window:
  • Single port: M10L-262 108258427
  • 2 Port: M12L-262 108168469
  • 3 Port: M13L-262 108168501
  • 4 Port: M14L-262 108168543
  • 6 Port: M16L-262 108168584
• White Double Gang with Label window
  • 8 port: M28L-262 108685025
• Blank Inserts:
  • M20AP-262 107067928
  • Colors available: Black, Ivory, Gray, Pro white
• Surface Mount Boxes:
• 1 Port: M101SMB-B-262 107984015
• 2 Port: M102SMB-B-262 107984056
• 4 Port: M104SMB-A-262 107952459
• 6 Port: M106SMB-262 107431538
• Modular Furniture Faceplate (M-Series)
  • Opening size 4.09”x1.38”: White M13C-262 106650898
  • Opening size 4.09”x2.20”: White M14CE-E-262 N/A
  • Opening Size 3.358”x1.609”: White M14C-262 N/A
  • Opening Size adjustable 2.792-4.125”x1.7-2.79”: White M4CA-26 700191588
• Colors available: Black, Ivory, Gray
• M106 (M-Series)
  • 2 Port: White M106FR2-262 106622251
  • 4 Port: White M106FR4-262 106622285
• Colors available: Black, Ivory, Gray
• M108 Decora:
  • 3 Ports: White M108FR3-262 108265455
• Colors available: Ivory, Pro White, Gray, Black, Almond

**Horizontal Management:**
• All horizontal Managers shall be SYSTIMAX single sided Black
• 1U: HTK-19-SS-1U 760072942
• 2U: HTK-19-SS-2U 760072959
• 3U: HTK-19-SS-3U 760072967

**Relay Racks:**
• All TR racks shall be Amco Titan Cable Management
• All racks shall be 19” wide for network equipment mounting
• All racks shall be a standard of 45 RU tall
• 19”x16” Black in color: TCMR-45U-16
• 19”x30” Black in color: TCMR-45U-30
• Other colors available: white
• 51 RU racks are available

**Vertical Cable Managers:**
• All vertical managers shall be Amco Titan Cable Management
• All vertical managers shall be double sided
- All vertical managers shall have front and back doors
- All vertical managers shall be 45RU tall
- All managers shall be Black in color
- Standard is 10": TCMFD-45U-116
- 51 RU is available

**Powered Fiber Material:**

- All powered fiber cable shall be single mode indoor outdoor rated
- All powered fiber shall be a minimum of 4 strands
- Copper electrical gauge size is determined by the distance of the installation sizes available are:
  - 12 AWG
  - 16 AWG
  - 4 strand SM with 12 AWG: PFC-S04L12
  - 2 port 60-Watt POE extender: PFU-P-C-O-060-02
  - OSP cat 6A patch cord: PCOSP-6AU-BK CO15582-01Fxxx
  - Liquid tight cord grips: Heyco® M4344GBH
  - Power Express Shelf: PFP-PX-S1
  - 8 port module: PFP-PX-8M
  - 1 RU Rectifier: PFP-SPS-S1 42Vdc to 58Vdc output
  - Rectifier power cords: 110 L5-20P plug or 220 L6-20P plug
  - Controller: PFP-SPS-C1
  - 4 Port Fiber Trans/ Midspan 1RU: Altronix NetwaysP4P