

1. OVERVIEW

- 1.1. The purpose of this document is to define the work standards for Lehigh University Telecommunications Room (TR) construction and cable installation, and to identify all products and their part numbers. These guidelines apply to all installation and maintenance personnel.
- 1.2. This standard applies primarily to large renovations and new buildings. Many renovations occur in locations where the current infrastructure (TRs and pathways) will not support our current standard of category 6a cabling. The university will confirm what type of cable shall be used and will provide a separate component list for non-6a cable if needed.
- 1.3. Unless otherwise specified in the project scope of work, contractor will furnish and install wire, cable, devices, equipment, and accessories for a complete system of telecommunications wiring for voice and data transmission from the Telecommunications Room (TR) to each voice/data outlet in the building. Every aspect of the EIA/TIA and BICSI standards must be followed for the duration of the project.
- 1.4. Cabling systems must be designed and engineered by a University selected engineering firm.
- 1.5. Library and Technology Services (LTS) personnel are responsible for furnishing and installing network electronics and for installing patch cords to activate fiber links, phone and network connections.

2. TELECOMMUNICATIONS ROOMS (TRs)

2.1. General

- 2.1.1. Telecommunications rooms (TRs) are special-purpose rooms that house voice and data communications equipment and wiring. These rooms have specific requirements due to the nature, size and complexity of the equipment and wiring housed in the room.
- 2.1.2. The TR shall house all and only the equipment directly related to the communications systems and associated environmental support systems. Electrical panels, other than those exclusively servicing the TR in which it is located, are strictly prohibited in TRs. Services that are not communications-related shall also be prohibited in these rooms. This includes, but is not limited to, janitorial services, supply storage, departmental storage, etc.
- 2.1.3. TRs shall be located above any threat of flooding.
- 2.1.4. Special attention must be paid to TR locations to comply with distance limitations. The total distance of the conduit path, from outlet to the TR, shall not exceed 295 feet (90 meters) including termination loss.
- 2.1.5. To facilitate the proper installation, routing and placement of cables, wires, premise equipment and terminal fields, TRs shall be located on each floor, as close as possible to the middle of the building and stacked one above the other, unless otherwise instructed or approved by Library and Technology Services. In very large buildings, multiple TRs may be required per floor. The rule of thumb shall be that one TR is needed for every 10,000 square feet of useable space.
- 2.1.6. All work shall comply with the National Electrical Code, local building codes, and Lehigh University Facilities Services standards.

2.2. Dimensions

- 2.2.1. The preferable minimum size for a TR is 120 square feet and the preferable dimensions for this room are 10'x12'. In no case shall this room be less than 120 square feet, with the minimum dimension of any side being 10 feet. This room may be shared with telephone equipment and data network equipment and racks. Library and Technology Services shall be contacted for final dimension approval. NOTE: TRs may vary according to the size of the building, number of floors and services required. Consideration to the future needs of the facility and the end users is a necessity.
- 2.2.2. Doorways shall be designed with minimum measurements of 3'-0" by 6'-8" and shall open outward into the corridor.
- 2.2.3. The recommended ceiling height is minimum 8'-6". Finished ceilings are not required in TRs.

2.3. Construction Specifications

- 2.3.1. No plumbing, HVAC, or electrical conduit shall pass through or be directly above any TR.
- 2.3.2. Fire rated plywood, 3/4 inch thick, must be mechanically fastened to the walls. The fire rated plywood must be fastened in a way that is easily removable. The fire rated plywood is to begin at four (4) inches AFF (above finished floor) and end at 8'-4" AFF.
- 2.3.3. Floors shall be sealed concrete or tile. Carpet is prohibited.
- 2.3.4. A minimum of 4 (four) 4 inch sleeves will be installed between TRs, with sleeves extended 4 (four) inches AFF. Buildings taller than 4 stories shall require an increase in the minimum number of sleeves, to be determined by LTS.
- 2.3.5. All TR doors are to be keyed to Telecom Master II, number 60-336652.
- 2.3.6. Doors shall have signs identifying the space as a TR, followed by the Lehigh room number and the ANSI/TIA-606-B identifier on the line below – i.e.

TR 100
1B

2.4. Environmental Controls and HVAC Design

- 2.4.1. All TRs shall be environmentally controlled to maintain the room environment at a temperature range of 65 to 75 degrees Fahrenheit.
- 2.4.2. Contractor shall calculate expected heat output on TR equipment and shall install appropriate cooling dedicated to the TR.
- 2.4.3. HVAC equipment shall not be located overhead within the TR. If this is unavoidable, the HVAC equipment shall be located as far away as possible from the communications rack(s) and shall be equipped with a drip tray that includes a condensate alarm. Under no circumstances should the HVAC equipment be located directly over the rack(s).

2.5. Lighting and Electrical Power

- 2.5.1. Lighting shall be four-foot fluorescent type and provide a minimum of 50 FC at 3 feet above the floor and be connected to the emergency generator when available.
- 2.5.2. A minimum of four AC outlets (2 wall outlets, 2 overhead to feed the communications racks) must be provided to power computer interfaces, network electronics and other communications requirements. Each duplex outlet shall be connected to a dedicated circuit breaker.

- 2.5.2.1. Wall outlets: These circuits shall be 20-amp, 110V, 60Hz that support two duplex outlets with standard receptacles (convenience outlets). Locations will be specified during the project design stage. Outlets must be flush when cut through plywood.
- 2.5.2.2. Overhead: These shall be 30-amp, 250V, 60Hz, terminating in two outlets (one circuit per outlet) with L6-30R receptacles. These will be installed overhead to support racked network equipment.
- 2.5.2.3. One of the 30-amp L6-30R duplex outlets shall be tied to an emergency generator when available. The other will run on normal power.
- 2.5.3. If generator power is available, LTS will furnish Uninterruptible Power Supply (UPS) units to support the network equipment in each rack. Sizing may vary depending upon the network equipment specified for the space.
- 2.5.4. All outlets shall be labeled with panel and circuit location.
- 2.5.5. All breaker panels are to be labeled and identified to avoid being turned off in error. breakers serving the TR shall be equipped with locking devices to prevent turn off.

2.6. Grounding

- 2.6.1. All TRs shall have a grounding bar 18 inches long by 4 inches wide by 1/4 inch thick with pre drilled NEMA bolt hole sizing and spacing. This bar shall be attached to the main building grounding system with a wire not smaller than #6 AWG copper.
- 2.6.2. The ground wire shall not share the cable tray with communications cabling. It may be installed in a separate conduit, which may be attached to the outside of the communications cabling cable tray.
- 2.6.3. Each distribution point shall be grounded to the main building ground, NEC and EIA/TIA 607 requirement shall be followed.

3. PRODUCTS

3.1. Cabling and Components

| F/UTP CABLING AND COMPONENTS - DESCRIPTION | MANUFACTURER | PART NUMBER |
|---|-----------------------|--------------------|
| Siemon-10G 6A F/UTP CMP Cable - (White Jacket) | THE SIEMON COMPANY | 9A6P4-A5-02-R1A |
| 10G 6A F/UTP Screened Z Max Module - Hybrid (Use in Patch Panel and Select Locations) | THE SIEMON COMPANY | Z6A-S01 |
| Two Port Single Gang 10G Faceplate For Max Modules | THE SIEMON COMPANY | 10GMX-FPS02-(XX) |
| Four Port Single Gang 10G Faceplate For Max Modules | THE SIEMON COMPANY | 10GMX-FPS04-(XX) |
| Six Port Dual Gang 10G Faceplate For Max Modules | THE SIEMON COMPANY | 10GMX-FPD06-02 |
| Two Port Surface Mount Box - (With/ Multimedia Bezel) | THE SIEMON COMPANY | MX-SMZ2-(XX) |

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|---|-----------------------|----------------|
| Four Port Surface Mount Box - (With/ Multimedia Bezel) | THE SIEMON COMPANY | MX-SMZ4-(XX) |
| Six Port Surface Mount Box - (With/ Multimedia Bezel) | THE SIEMON COMPANY | MX-SMZ6-(XX) |
| Two Port Multimedia Bezel For Surface Mounted Boxes | THE SIEMON COMPANY | MX-SMB-MM |
| Stainless Steel Wallphone Faceplate with Jack | THE SIEMON COMPANY | MX-WP-KU3-SS |
| 24 Port 1U Angled Tera Max Panel Unloaded - (Must Supply ZMAX Hybrid Jacks) | THE SIEMON COMPANY | TM-PNLZA-24-01 |
| 24 Port RJ45 To 110 Rack Mount Patch Panel | THE SIEMON COMPANY | S110DB5-24RJP |
| 300 Pair 110 Block W/Legs | THE SIEMON COMPANY | S110AA2-300FT |
| 110 Cross-Connect Trough W/Legs | THE SIEMON COMPANY | S110A1RMS |
| Color Coding Clip For Patch Cord Identification | THE SIEMON COMPANY | CLIP-(XX) |
| Color Icons For Port Differentiation | THE SIEMON COMPANY | CT-ICON-(XX) |
| 3-foot 6A patch cord – white | THE SIEMON COMPANY | ZM6A-S03-02 |
| 5-foot 6A patch cord – white | THE SIEMON COMPANY | ZM6A-S05-02 |
| 7-foot 6A patch cord - white | THE SIEMON COMPANY | ZM6A-S07-02 |

3.2 Backbone Cabling and Components

| <u>BACKBONE CABLING AND COMPONENTS - DESCRIPTION</u> | MANUFACTURER | PART NUMBER |
|---|---------------------|--------------------|
| 24 - Fiber FREEDM fiber cable | CORNING | 373-COR8.3LTD-24 |
| 48 - Fiber FREEDM fiber cable | CORNING | 373-COR8.3LTD-48 |
| Anaerobic SC Fiber Connector (Single Mode) | CORNING | 95-201-41-SP |
| Blank Panels | CORNING | CCH-BLNK |
| 12 Strand Coupler Panels (Single Mode) | CORNING | CCH-CP12-3C |
| 2U Fiber Enclosure | CORNING | CCH-02U |
| 4U Fiber Enclosure | CORNING | CCH-04U |
| 25 Pair Category 3 CMP UTP Cable | BERK-TEK | 10032111 |
| 100 Pair Category 3 CMP UTP Cable | BERK-TEK | 10032113 |

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|---|-----------------------|----------------|
| 110 Rack Mount Panel 200 Pair | THE SIEMON COMPANY | 110DA1-100RFT |
| 110 Wall Mount Panel 300 Pair | THE SIEMON COMPANY | 110AB2-300RFT |
| 100 Pair Building Entrance Protector - Stub in/110 Out | PORTA SYSTEMS | 25100-ST-M110C |
| Solid State Protector Modules With Heat Coil 240V 5-Pin | PORTA SYSTEMS | 115SCG-240 |
| Labeling System For Each End Of Riser Cabling | ALMETEK | MINI-TAG |

3.3 Racks, Pathway and Delivery Systems

| <u>RACKS, PATHWAY AND DELIVERY SYSTEMS - DESCRIPTION</u> | MANUFACTURER | PART NUMBER |
|---|-----------------------|-----------------------|
| Siemon RS Rack System | THE SIEMON COMPANY | RS-07E |
| Single Sided Vertical Patching Channel With Cover - 6" Wide | THE SIEMON COMPANY | VPCA-6 |
| Horizontal Cable Manager | THE SIEMON COMPANY | WM-145-5 |
| S110/S210 Horizontal Cable Managers | THE SIEMON COMPANY | S110-RWM-01 |
| Mounting Hardware | ORTRONICS | SCREW-1224 |
| 2U Rack Mounted Equipment Drawer | MIDDLE ATLANTIC | UD3 |
| 1U Rack Mounted Sliding Shelf | MIDDLE ATLANTIC | SS |
| 2" CP653 Speed Sleeve | HILTI | 236323 |
| 4" CP653 Speed Sleeve | HILTI | 236324 |
| 4" Fire Barrier Pass-Through Device | 3M | PT4SD |
| 2.5" Fire Barrier Pass-Through Device | 3M | PT25SD |
| 2.0" Plenum Innerduct | PYRAMID | PLM200T |
| Large J-Hooks For Routing Of Innerduct | CADDY | CAT64 |
| Miscellaneous EMT Conduit And Fittings | ANY | ANY |
| 18" Wide Aluminum Redi Rail Cable Tray - 6" Load Depth | B-LINE | H17AR-06-18-120 |
| 18" Wide 3 Way Bend - Aluminum Finish | B-LINE | H17AR-18-HT-18 |
| 18" Wide Horizontal Bend - Aluminum Finish | B-LINE | H17AR-18-90-HB- 18 |
| Universal Splice Plates - Aluminum Finish | B-LINE | 9A-R007 |
| Universal Bonding Jumper Connection | B-LINE | 99-30 |
| Bend Radius Waterfall - Aluminum Finish | B-LINE | 9A-R104-18 |

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|---|-----------------------|---------------|
| Telecommunications Grounding Busbar 2 X 12" | PANDUIT | GB2B0306TPI-1 |
| Telecommunications Grounding Busbar 4 X 12" | PANDUIT | GB2B0312TPI-1 |
| Paint Percing Grounding Washer Kit | PANDUIT | RGW |
| Rack Grounding Strap | PANDUIT | RGS |
| Equipment Grounding Jumper Kit | PANDUIT | RGEJ |
| #6 AWG Ground Wire | ANY | ANY |
| #6 Two Hole Ground Lug | ANY | ANY |
| 3/0 Telecommunications Bonding Backbone | ANY | ANY |
| 3/0 Two Hole Ground Lug | ANY | ANY |
| Velcro Cable Tie 6' (Pkg 25) | THE SIEMON COMPANY | VCM-250-06-01 |
| Velcro Cable Tie 12" (Pkg 250) | THE SIEMON COMPANY | VCM-250-12-02 |
| Velcro Cable Tie 18" (Pkg 250) | THE SIEMON COMPANY | VCM-250-18-03 |

4. INSTALLATION GUIDELINES

- 4.1. Contractor shall provide all necessary cable, supports, pathways, and hardware for a complete and operable Telecommunications system, unless otherwise noted.
- 4.2. Contractor shall observe all manufacturer installation guidelines including: termination position/jacket removal; bend radius for UTP and optical fiber; recommended pulling tensions
- 4.3. All through penetrations shall have a HILTI or 3M firestop assembly matching the rating of the penetrated element or as detailed on the Telecommunications drawings.
- 4.4. All twisted pair cable shall be installed in a neat and orderly fashion as deemed by the owner and owner's representatives. If cable rework is required, it shall be at the contractor's expense.
- 4.5. Per EIA/TIA standards, no cable may exceed 90 meters in length, including slack required to dress cables in the TR.
- 4.6. Where cable tray is not present, all horizontal cable must be properly and independently supported every 4 feet. No cable will be allowed to be connected to ceiling grid wires.
- 4.7. Final placement of horizontal cable will not be allowed to come in contact with any other building utility.
- 4.8. Under no circumstances should paint be applied to cables.
- 4.9. Exact cable counts per jack will be indicated on the floor plans.
- 4.10. All station cable in the TR must be routed through the back side of the horizontal wire managers.

5. LABELING

- 5.1. Two sets of identifiers are associated with each cable: the patch panel ID (aka cable ID and ANSI/TIA-606-B identifier) and a Lehigh jack identifier (the Lehigh room number and individual connector code - i.e. C305-A1).
- 5.2. If Lehigh jack identifiers are not provided on the installation plans, use the following guidelines to establish them. Jack locations are to be identified starting with A at the location closest to the door going clockwise around the room (i.e. C305-A, C305B, etc.). Wireless access points are identified as room- WfX (i.e. C305-WF1, C305WF2 etc.). Access control connections are identified as room-ACx (i.e. C305-AC1).
- 5.3. Each cable will be labeled at both ends with the patch panel ID in the form CL-PAPT, where CL is closet identifier, PA is patch panel number and PT is port.
- 5.4. In the TR, each port on the patch panels will be labeled with the Lehigh room number and individual connector code - i.e. C305-A1.
- 5.5. At the jack location, each individual connector in the jack will be labeled with its associated patch panel ID. The jack will have a "super label" at the top with the Lehigh jack identifier - i.e. C305-A. There is no need to label each individual connector in the jack with the Lehigh identifier - the patch panel ID is sufficient as long as the numbering scheme is standard left to right, top to bottom.
- 5.6. Each patch cord in the closet will be labeled with the associated switch and port number.

6. TESTING

6.1. Copper

6.1.1. Each copper cable shall be tested with a scanner capable of testing to EIA/TIA standards for Category 6a cabling. The results of these tests shall be provided to the Telecom and Network Infrastructure Manager before acceptance and payment of the job. 100% of all placed cables must pass testing; no fails will be accepted.

6.1.2. Each riser and feeder cable pair shall be tested for continuity and the results provided to the Telecom and Network Infrastructure Manager before acceptance.

6.2. Fiber

6.2.1. Each fiber optic strand shall be tested with an OTDR. Light loss will be -3 or better and reflectance will be -40 or better. All fiber must be tested with both wavelengths and in both directions for each fiber and a hard copy of the traces provided to LTS before acceptance.

6.2.2. All fiber must be tested with power meters to verify continuity. The results of this test shall be provided to the LTS before acceptance.

7. MANUFACTURER'S WARRANTY FOR CATEGORY 6A INSTALLS

- 7.1. For all category 6a cable installs, contractor must provide 20 year system applications assurance warranty (The Siemon Company).

7.2. Communications contractor must be a Siemon certified installer and must submit pre-registration paperwork prior to installation start.

7.3. Warranty paperwork and complete test results must be submitted to manufacturer prior to payment of final invoice.

8. AS-BUILT DRAWINGS

8.1. As-Builts shall be submitted by the project contractor to LTS prior to acceptance. Contractor shall provide one paper and two digital copies (CAD and PDF).