Section 27100- TELECOMMUNICATIONS

Part 1 - General

1.1 This specification document covers IT network infrastructure installations in University facilities at the Phoenix Biomedical Campus, on Van Buren/7th St. in Phoenix and does not apply to The University of Arizona Tucson Campus.

1.2 The scope of work performed under the requirements of this specification includes providing all material and labor to install a complete and working IT network physical layer infrastructure. The infrastructure covered includes entrance cables, riser cables, station wiring, telecommunications room build-out, terminations, and termination devices for voice, data, and other telecommunications systems.

1.3 In any case where the specifications or drawings are not perfectly clear to contractors submitting a proposal, it is the responsibility of the contractor to obtain clarification from UITS-Engineering & Estimating. The drawings are diagrammatic and are not complete in every detail. The contractor shall be responsible for determining how to perform all indicated work included in the scope of the project and shall not attempt to bill for any additional charges for any work or material required for a complete installation. The drawings and specifications are complementary, and what is called for on one shall be binding as if called for by both.

1.4 General Requirements

1.4.1 Codes & License Compliance: The completed installation shall be in compliance with all applicable electrical and fire codes and ordinances, the Williams-Steiger Occupational Safety and Health Act of 1970, and University Standards.

1.4.2 Telecommunications contractor must have a current State of Arizona L67 Low Voltage Communications Systems license, and have held the license for a minimum of 4 years, and be a Systimax Certified Business Partner in good standing. Only contractors approved by UITS-Engineering & Estimating will be permitted to perform telecommunications installation work on campus.

1.4.3 New & Listed Materials: All materials shall be new and shall be listed as being suitable for the purpose by Underwriters Laboratories, Inc. or equivalent testing agency known to and approved by the University.

1.4.4 Workmanship: All work shall be executed according to these specifications in a workmanlike manner and shall present a neat mechanical appearance when complete.

1.4.5 Quality Assurance: At least one person directly employed by the prime contractor shall be on site daily to monitor the daily activities of workers to assure the quality of the work performed.

1.4.6 Acceptance Inspection: All work must pass functional and workmanship inspections prior to acceptance. The contractor shall make all required corrections, at no additional cost, before the system is put into service.

1.4.7 Clean up & Repair: Contractor shall be responsible for clean up and repair of job site. Damaged false ceilings, pencil or chalk marks, hand prints, gouges and tool makers, plaster dust, etc. shall be repaired, cleaned, removed, or painted as required. Penetrated fire barriers shall be resealed in an approved manner.

1.4.8 Submittal: (1 electronic copy required). Complete materials lists, manufacturer's literature, required drawings, and other required information shall be submitted for approval no less than 10 working days before such materials are required to be ordered for the work. UITS-Engineering & Estimating must approve submittal prior to starting the installation.

1.4.9 Guarantee: Upon completion of the work and acceptance by the University, the contractor shall submit his warranty effective for one year guaranteeing to replace without additional cost to the University any work or material which is found to be defective within the warranty period.

1.4.10 Structured Cabling System Warranty: Upon request of UITS, contractor shall offer a CommScope 20 Year Extended Warranty Program.

1.4.11 As-Built Drawings & Documents: The contractor shall maintain daily up to date specifications and drawings. The contractor shall submit to UITS-Engineering & Estimating a complete set of As-Built
drawings showing the location and identification number of all jacks installed as part of the project. As-Built drawings shall be submitted in both hard-copy and AutoCAD format.

1.4.12 Changes: No changes shall be made from the work as called for by these specifications and drawings, except by a written order approved by UITS-Engineering & Estimating.

1.4.13 Splicing: All cable splicing must be done by a qualified cable splicer, with a minimum of 5 years experience splicing large pair count copper cables. The cable splicer’s name and qualifications must be submitted to UITS- Engineering & Estimating for verification and approval prior to any splicing work. Provide a minimum of three weeks advance notice to UITS-Engineering & Estimating prior to performing any splicing to existing campus cabling infrastructure.

1.4.14 Grounding for telecommunications systems and equipment shall be provided in accordance with the requirements of the most recent version of the National Electrical Code, and with The University of Arizona DSS Manual Specification Section16450.

1.4.15 Equipment shall be installed in such a manner that it does not impede the spray pattern of fire sprinkler heads.

Part 2 - Description of Work

2.1 Telecom Room Build-Out:

2.1.1 Vertical cable runs are to be supported at a maximum of 5 ft. centers. Horizontal cable runs are to be supported at a maximum of 3 ft. centers.

2.1.2 Horizontal station cable terminations shall be marked with final University room numbers. Obtain entry cable and riser cable pair count information from UITS – Engineering & Estimating.

2.1.3 Metal closed loop D-rings (2, 4, and 6 inch as required) shall be installed in quantities sufficient to produce an orderly quality cable and wire installation for vertical runs within telecommunications rooms (note that D-rings are not an acceptable means of horizontal cable support). Distributing posts are not acceptable.

2.1.4 Cables shall be routed in such a way as to minimize interference with cross connect wiring and future equipment additions. D-rings shall be utilized to route cable away from the top and bottom of the terminal blocks. Entrance cable shall be routed to and terminated to the bottom group of termination blocks. Horizontal distribution cables shall be routed to and terminated to the top group of termination blocks.

2.1.5 Cable management D-rings, brackets, and horizontal and vertical cable managers shall be installed to maintain an orderly appearance for cable or wires running between backboards or to common equipment.

2.1.6 Riser cable splice cases are not considered part of a TTB, and shall be located so as not to interfere with backboards or common equipment.

2.1.7 All wall mounted equipment shall be securely fastened to the TTB/DTB. Suspension by connection to other equipment is not acceptable.

2.1.8 Complete telecommunication room layout drawings shall be included as part of the project submittal. Layout shall be designed to allow all four walls of the telecommunications room to be used for mounting telecommunications equipment.

2.1.9 Equipment racks, cable runway and other conductive equipment shall be grounded with a minimum #6 AWG connection to the ground bus in each telecom room.

2.1.10 When ceiling distribution systems are used, design the closets with adequate conduit or openings through beams or other obstructions into the accessible ceiling space.

2.1.11 Provide a No. 6 AWG minimum ground wire in each closet. Terminate ground wire to a 6 inch copper buss bar which has provisions for additional ground connections. Terminate ground wire to a 6 inch copper buss bar which has provisions for additional ground connections.

2.1.12 Line all walls with 3/4 inch, 4 ft. X 8 ft. A-C grade plywood. Plywood shall be treated on all sides with at least two coats of fire resistant paint (white).

2.1.13 Provide fire stops for cable tray system and riser system as required by code. Putty type fire stop material is to be used as required for all conduits and sleeves. Pillow type fire stops are only acceptable for cable tray penetrations.

2.2 Entrance Cabling:
2.2.1 Copper entrance cabling shall be PE-39, Type ANMW, ASP, filled, direct burial, 24 AWG solid conductor, with REA color code.

2.2.1.1 Splice cases and/or closures shall be provided as required, with prior-approval by submittal required. Provide transition splice to non-filled cable prior to building entrance termination.

2.2.1.2 Copper entrance cabling shall be provided with station protectors installed in accordance with NEC 800 requirements.

2.2.1.3 Ground entrance cable shields to an approved provable ground as close to the entrance as possible in accordance with NEC requirements.

2.2.1.4 Terminal blocks shall be permanently marked with pair count numbers for entry cable terminations.

2.2.2 Optical Fiber Entrance Cable: Entrance cables shall be loose tube gel-free, interlocking armored cables, indoor/outdoor riser rated, singlemode 8.2/125 Micron, 900 Micron buffered with a minimum LED bandwidth 1500/500 MHz\*km. Entrance fiber shall be terminated on a rack mount enclosure. Strand count shall be as specified in the project plans/specifications.

2.2.3 Outside plant optical fiber backbone cables shall be single armor, double jacket, gel-free, with strand count and type as specified in the project plans and/or specifications.

2.2.3.1 Ground entrance cable shield to an approved provable ground as close to the entrance as possible in accordance with NEC requirements.

2.2.4 All fiber optic connectors shall be duplex LC.

2.2.5 All fiber optic cable splicing shall be done using the fusion splice method.

2.3 Riser Cabling:

2.3.1 Fiber Optic Riser Cable shall be OFNR or OFNP, tight buffered. Multimode shall be 50/125 micron, laser optimized OM3 with minimum guaranteed 10 gigabit Ethernet performance distance of 300m. Singlemode shall be 8.2/125 micron, 900 micron, with maximum attenuation of 0.70dB/km. Terminate on a rack mounted enclosure.

2.3.2 Multi-pair copper riser cable shall be shielded, type ARMM, 24AWG, solid conductor, Cat. 3 rated, terminated on Systimax Visi-Patch360 blocks.

2.4 Station Wiring:

2.4.1 Provide a quad faceplate for each outlet, with blank inserts provided for unused openings. HORIZONTAL STATION WIRING MUST BE IN COMPLIANCE WITH EIA/TIA-568B HORIZONTAL WIRING DISTANCE SPECIFICATIONS. The maximum horizontal cable length shall be 90 meters (295 ft). This is the cable length from the mechanical termination of the media in the telecommunications closet to the telecommunications outlet in the work area. The distance maximum includes all wiring that is part of the horizontal wiring. Provide 12 in. of cable slack at each outlet, plus an additional 10 ft. of slack in the telecommunications room, neatly arranged in a loop above (not on) the TTB.

2.4.2 Station wiring and termination equipment shall be rated Category 6.

2.4.3 Station cable shall be 4 pair, solid conductor, REA color code, plenum rated, UL Listed type “CMP" w/FEP insulation. Cable must comply with EIA/TIA 568B.

2.4.4 Outlet jack shall be an eight position modular jack meeting the specifications of FCC Regulations Part 68.500. All jacks shall be wired according to the T568B wiring schematic.

2.4.5 Station cable must not be spliced. Cable runs are to be direct home runs to the IDF and shall not pass through any other station outlet box. The cable bend radius for station cabling shall not be less than four times the outside diameter of the cable.

2.4.6 Install cables in conduit, and raceways as specified and supplied and installed by the electrical contractor. All conduits and sleeves shall have insulated bushings installed to protect wire and cables from damage. Installed cables shall not be bundled together.

2.4.7 Station cable and wiring shall comply with EIA/TIA 568B, standards. (UTP Category 6)
2.4.8 Install and terminate fiber optic cable station cabling where specifically indicated in the project plans and/or specifications.

2.5 Wiring Practices:

2.5.1 Station cables shall terminate on a rack mounted patch panel, in a single unified field (no separate voice and data fields).

2.5.2 Cable and wire above ceiling shall be run parallel or perpendicular to the walls. Diagonal runs will not be accepted. Riser cables shall be run parallel to riser system. Do not install cables in close proximity to fixtures or equipment that may cause RFI or EMI. To reduce the effects of EMI, the following minimum distances shall be adhered to:
   5” from power lines of 2kVA or less.
   18” from high voltage lighting (including fluorescent).
   39” from transformers, motors, and power lines of 5kVA or greater.

2.5.3 Cables and wire shall not be attached to conduit, pipes, ceiling grid/hanger wire, light fixture hangers, HVAC duct work, etc.

2.5.4 All horizontal UTP cable shall be pulled by hand. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of raceway entry and exit, as well as the point at which cable is “payed out” from the box or reel, and around corners.

2.5.5 Pull cables in accordance with manufacturer's recommendations and ANSI/IEEE C2 Standards. Manufacturer recommendations shall be part of cable submittal. Recommended pulling tensions and bend radius shall not be exceeded. Any cables bent or kinked to radius less than recommended dimensions are not allowed and shall be replaced at no expense to the owner.

2.5.6 Cables that show signs of being bent or kinked beyond recommendations then straightened are also not allowed and shall be replaced at no expense to the owner.

2.5.7 Cables that show damage to the jacket in any manner shall be replaced at no expense to the owner.

2.5.8 Cable and wire above ceiling shall be suspended from approved hangers as required and be routed as close to upper ceiling as practical. Supports shall be installed at a maximum of 3 ft. centers using metal “J” hooks or other supports meeting or exceeding Category 5e installation requirements. “D” rings or bridle rings shall not be installed as a means of horizontal cable support.

2.5.9 Cables shall not be installed in a manner such that they rest upon ceiling tiles, mechanical equipment, sprinkler piping, etc. and shall not be tie-wrapped to conduit or piping.

2.6 Raceway Requirements:

2.6.1 Conduit fill: In new installations, conduit fill shall not exceed 50%. In retrofit installations, conduit fill may exceed 50% provided that the necessary pulling tension does not exceed the cable rating, and that compression of the cable jacket does not occur.

2.6.2 All conduits and sleeves must have UL approved insulated end bushings installed prior to installation of cables or station wire.

2.6.3 All riser sleeves/conduits and penetrations of fire rated partitions shall be fire stopped using approved methods and materials.

2.6.4 All cables shall be installed in compliance with manufacturers pull tension and bend radius specifications.

2.6.5 Station cable (voice & data), shall have individual pair twists preserved to point of termination. Cable jacket and inter-pair twists shall be continuous to within ¼” of termination. Cables should not be routed in tightly cinched bundles. Avoid over-tensioning or twisting cable during installation.

2.6.6 Wall boxes shall be flush mounted, standard metal 4 inch square, deep type, with a single gang plaster ring. Conduit from the wall box shall be concealed and stubbed out above accessible ceiling, to riser closet, or to the telecommunications cable tray. Conduit shall be 1” minimum. Conduit end shall be fitted with a UL approved insulated bushing.

2.6.7 Any additional service requirements that will not operate over the standard University building telephone/data wiring shall use a completely separate conduit and wall outlet.

2.7 Cable Tray
2.7.1 Cable trays are for the containment of telecommunications cables and shall be installed in accordance with applicable electrical codes. Cable tray shall be bonded to ground.
2.7.2 System shall be designed and installed to allow accessibility for adds, moves, and changes.
2.7.3 Cable trays shall be wire basket type, welded steel, with 2” minimum sidewalls.
2.7.4 Trays may be supported by cantilever brackets, trapeze, or individual rod suspension. Supports shall be installed on five foot centers maximum. A support shall be placed within two feet on each side of any connection to a fitting. Center hung supports shall be used only with prior approval from UITS – Engineering & Estimating.
2.7.5 The cable tray shall be free of burrs, sharp edges, and projections that can damage cable insulation.
2.7.6 A minimum of 12 inch access headroom shall be provided and maintained above the complete cable tray system. Cable trays must have adequate side access for initial cable installation and for future cable adds, moves, and changes.
2.7.7 Cable tray “tees” and 90’s shall have wide radius junctions.
2.7.8 Care should be taken to ensure that other building components do not restrict access to the cable tray.
2.7.9 Cable tray shall be level and have supports if required to prevent horizontal movement.
2.7.10 System shall be designed and installed to allow compliance with EIA/TIA-568B horizontal wiring distance standards.

2.8 Labeling:

2.8.1 All labels shall be machine generated (printer or handheld label machine.
2.8.2 All cables shall be permanently identified at both ends.
2.8.3 Labeling for cabling, pathways, and hardware shall conform to TIA 606-A.
2.8.4 Outlet labeling shall be in accordance with the diagram below:

![Diagram of faceplate labeling scheme sample]

- **FLOOR OF TR**
  - LOWER LEVEL = 0
  - FIRST LEVEL = 1
  - SECOND LEVEL = 3

- **TR#**
  - SINGLE DIGIT FORMAT

- **CABLE I.D.**
  - 001-999
2.8.5 Copper and optical fiber risers shall be labeled in accordance with the existing labeling scheme used at the PBC. This labeling scheme consists of the building number/sequential cable number/pair (or strand) range. Copper termination blocks shall be labeled with the pair counts and cable identifier. Optical fiber enclosures shall be labeled with an enclosure identification, the strand counts, and cable identifier.

2.8.6 Prior approval of final labeling scheme must be received from UITS – Engineering & Estimating. Labels shall be applied at the time of cable acceptance testing.

Part 3 - Products

3.1 Materials List:

All items not specifically covered in these specifications must have the concurrence of the University UITS-Engineering & Estimating before placement or implementation. The structured cabling system shall be a Systimax GigaSpeed (Copper), LazrSPEED OM4 and TeraSPEED OS2 (optical fiber) product solution.

3.1.1 Four pair UTP cable shall be plenum rated, with blue jacket, Cat 6 Systimax #2071E BL 4/23 W1000 or Cat 6A Systimax #2091B BL 4/23 W1000.

3.1.2 Copper Riser Termination blocks: rack mount, high density, Systimax VisiPatch 360, VP360-4U-32P or VP360-12U-96P.

3.1.3 Patch panels for station cabling shall be 48 port angled modular patch panels, Cat6 Systimax 360-IPR-1100A-E-GS3-2U-48 or Cat6A 360-IPR-1100A-E-GS6-2U-48.

3.2.1 Telephone/Data jacks: Cat. 6, Systimax #MGS400-262 or Cat 6A, Systimax #MGS600-262
3.2.2 Faceplate: Systimax L-Type, M10L-262 (simplex), M12L-262 (duplex), M13L-262 (triplex), M14L-262 (quadraplex). Note: the specified part numbers are for white faceplates. If faceplate colors used for adjacent outlets are a different color, the color for new faceplates shall match the color used in the adjacent areas. Provide Systimax M20AP series dust covers as blanks for unused openings in faceplates, or for jacks that are not activated. Dust covers used as blanks shall match faceplate color. Dust covers used for inactive outlets shall be black in color.
3.2.3 Surface mount jack enclosure- use for blue light emergency phone jacks, wireless access points: Systimax M202SMB-262.

3.3.1 Fire Stop – sleeves shall be STI EZ-Path, Wiremold FlameStopper, or prior approved equivalent. Caulks and sealants shall be as manufactured by STI, 3M, Nelson, or approved equivalent.
3.3.2 Cable shield connector: 3M Scotchlock #4460, 4460-S
3.3.3 Bonding & Ground cable/wire: Ground Wire - No.6 AWG minimum, Bonding Cable - No.6 AWG rated Flexible braid shall have insulation that is green in color.
3.3.4 Splice case filling compound, re-enterable type: 3M 4442.
3.3.5 Heat Shrink Tubing: Highly Flame Resistant, semi rigid, polyvinylidene fluoride (Kynar).
3.3.6 Cable Ties: Plenum type where required by code – Panduit hook and loop type.

3.4.1 Fiber Optic enclosures: Systimax G2 Mod Shelves Series. All associated hardware shall be provided, including ground clamp, labels, vertical troughs, horizontal troughs, connector panels, blank panels, etc.
3.4.2 Fiber Optic Connector: fusion splice pigtail with Ceramix tip, LC Duplex: Systimax 360G2 Cartridge 12-LC-LS-AQ-Pigtails (multimode OM4), 12-LC-SM-BL-Pigtails (singlemode).
3.4.3 Rack mount optical fiber enclosures for entrance cable applications shall be Systimax G2 Optical Fiber Shelves, with duplex LC adapter panels.
3.4.4 Optical fiber riser cable shall be CommScope LazrSPEED 550 (multimode), CommScope TeraSPEED (singlemode).
3.4.5 Optical fiber outside plant cable installed in tunnels, duct banks, or aerial construction shall be gel free, armored, loose tube, Systimax TeraSpeed.

3.4.6 Optical fiber building entrance cable shall be riser rated, gel free with interlocking armor, tight buffered, Systimax TeraSPEED.

3.5.1 Surface raceway: Steel or aluminum only. Wiremold 2400 or approved equal is the minimum size acceptable; larger sizes may be required based on the size and number of cable and jacks to be accommodated.

3.5.2 "D" Rings: Lucent 13A (2 in.), 13B (4 inc.), 13C (6 in.) Note: for use in telecom rooms for vertical cable management only.

3.5.3 Cable hangers: Caddy CableCat wide base “J” hangers.

3.5.4 Approved wire basket type cable trays are Cablofil EZTray and GS Metals Flextray.

3.5.5 Cable runway: gray tubular steel, 12” minimum width, with associated mounting, support, junction, and splice hardware. Chatsworth Products Inc. #10250-12 or equal.

3.6.1 Two post equipment racks shall be 7 ft. x 19” freestanding equipment rack, with 6” channel, black in color, Systimax, Chatsworth, or approved equal.

3.6.2 Vertical cable managers: freestanding equipment racks shall be provided with 7’ high, 10” double-sided cable mangers, Chatsworth MCS Series, or approved equal.

3.6.3 Horizontal cable managers shall be provided as shown on the drawings. High capacity cable managers shall be 4 RU, Panduit #NCMHAEF4 or equal. Standard size cable managers shall be 1 RU, Panduit #NCMH2 or equal. Small cable managers shall be 1 RU, Panduit #NCMHF1 or equal.

3.6.4 Blank filler plates for equipment racks shall be angled, Panduit #CPAF1BLY or equivalent, provided where indicated on project drawings or specifications.

Part 4 - Acceptance Testing

4.1 End-to-end testing of all cable pairs, optical fiber strands, and coax cables shall be performed after completion of installation and termination. UTP Category 6 station wiring shall be in compliance with the EIA/TIA 568B standard. Cat. 6 systems shall be tested to Level III accuracy. Labels shall be applied at the time acceptance testing is performed.

4.2 Cable testing shall be performed using Fluke DTX series test equipment.

4.3 Copper station cable tests shall be “Permanent Link” tests, performed with the appropriate test adapters/cords. “Basic Link” and “Channel” tests are not acceptable.

4.4 End-to-end attenuation testing of each optical fiber strand shall be made using an optical power meter and optical light source. Multimode fibers shall be tested at 850 and 1300nm. Singlemode fibers shall be tested at 1310 and 1550nm. Attenuation tests shall be performed in both directions.

4.5 UITS-Engineering & Estimating must approve test documentation. Documentation shall be submitted in Fluke LinkWare Database electronic format.

4.6 Test result documentation shall indicate the final cable/outlet number assigned to each item tested, as well as identify the project and the telecommunications room serving each item tested. The test result submittal shall be organized by telecommunications room, with the test results in sequential order based on jack id. Test results that are incomplete or that are not organized in sequential order will not be accepted.

Part 5 – Demolition

5.1 All abandoned telecommunications cables within a project’s boundaries shall be completely removed back to the termination block, including multi-pair cabling, coaxial cabling, and station cabling.

5.2 Tele/data outlets shown on demolition drawings to be removed shall be removed completely including outlet and wiring to the originating IDF termination point. Termination labels shall be revised to reflect all changes.

5.3 Provide blank cover plates over any abandoned telecommunications outlet boxes or cut-in rings. Cover plates shall match the existing style and color of faceplates in adjacent areas.


**TELECOMMUNICATIONS GROUNDING SYSTEM**

1. **TO ADDITIONAL IDF'S AS REQ'D**
2. **BOND SECTIONS OF CABLE RUNWAY (TYP.)**

**2nd FLOOR IDF**

**1st FLOOR BET/IDF**

**CONNECT TO ELECTRICAL SERVICE ENTRANCE GROUND**

**KEYNOTES**

1. **TELECOMMUNICATIONS BONDING BACKBONE. SIZE PER ANSI J-STD-607A: #4 AWG MINIMUM.**
2. **BOND TO EQUIPMENT RACKS, CABLE RUNWAY, CABLE TRAY, SHIELDED CABLE, ETC. #6 AWG MINIMUM, TYP. OF ALL IDF'S AND BET**

**NOTE:**

GROUNDING AND BONDING SHALL BE IN ACCORDANCE WITH ANSI/EIA/TIA-607 AND NEC 250 REQUIREMENTS.

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**THE UNIVERSITY OF ARIZONA**
**UIT-S INFRASTRUCTURE SERVICES**
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