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SECTION 270000 – COMMUNICATIONS GENERAL

PART 1 – GENERAL

Contractors shall purchase and/or provide all materials, products, permits, services; labor and equipment specified or needed to complete all Division 27 work.

1.1 PURPOSE

A. Division 27 Specifications are established to define the standards, criteria, and assumptions to be used to bid, plan, furnish, install, test, and document information transport pathways and systems for the University of Missouri - Kansas City (UMKC). These Specifications shall form the basis for implementation of the design, installation, inspection, and close-out process.

B. Division 27 is based on NFPA 70 (NEC), National Electrical Safety Code (NESC), Institute of Electronic and Electrical Engineers IEEE, ANSI/TIA/EIA Telecommunication Standards, and BICSI methodologies. The requirements within those documents are not superseded herein unless specifically stated. As required, NEC and NESC code requirements cannot be superseded by this document at any time. ANSI/TIA/EIA standards and BICSI methodologies may be superseded, as specified, or may be made stricter by this document. The absence of a specific reference to an element of these codes, standards, and methodologies does not relieve all parties of compliance with them.

C. Within this document use of the word “shall” marks mandatory requirements. Use of the word “may” or “should” suggests optional elements. All conflicts within this document shall be resolved by the University of Missouri - Kansas City (UMKC) Campus Facilities Management in consultation with UMKC Networking & Telecommunications prior to application of the specification by a Contractor.

D. UMKC Networking & Telecommunications must approve any deviation from the specifications and guidelines in this document. All communications, correspondence, and approvals must come be conveyed through the official project contacts of record such as the Architect and Construction Manager.

E. Unauthorized deviations from these Specifications may result in re-design, reconstruction, or re-installation of physical communications elements at the contractor’s expense. Contractors shall obtain formal written approval prior to bidding and prior to installation in order to deviate from these Specifications or from ANSI/TIA/EIA standards and BICSI methodologies. Contractors shall not deviate from NEC and NESC requirements.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Section 270500 – Common Work Results for Communications C.

Section 270526 – Grounding and Bonding for Communications D.

Section 270528 – Pathways for Communications

E. Section 270553 – Identification for Communications Systems

F. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures

G. Section 271119 – Communications Termination Blocks and Patch Panels

H. Section 271123 – Communications Cable Management and Cable Runway

I. Section 271313 – Communications Copper Backbone Cabling
J. Section 271323 – Communications Optical Fiber Backbone Cabling

K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling

L. Section 271543 – Communications Faceplates and Connectors

M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire

N. Section 273223 – Voice Communications Elevator Telephones

1.3 GENERAL SCOPE OF WORK

A. Division 27 Specifications address information transport pathways, systems, spaces, media, grounding, identification, testing, and documentation requirements in support of multiple information transport infrastructures.

B. It is the intent of the Project Drawings and Specifications to provide complete and workable Division 27 communication systems, ready for operation and use by the Owner. Any item, not specifically shown in the Project Drawings or called for in the project Specifications but normally required for a fully functional system, is to be considered a part of this contract.

C. Specific responsibilities of Division 27 Contractor include, but are not limited to:
   1. Verification of all dimensions at the site and be responsible for their accuracy.
   2. Identification of the interbuilding pathways, cabling, and space requirements necessary to connect the subject building(s) to the campus service facilities.
   3. Identification of the intrabuilding pathways, cabling, and space requirements necessary to house the data/voice/video cables and associated electronic information transport equipment. Pathways and spaces shall be designed and installed to support the known systems and cabling requirements, as well as best effort provisions for those that may be required in the future.
   4. Installation of new horizontal station cables, jacks, face plates, optical fiber riser cables, copper riser, distribution frame hardware, cable terminations and splicing, labeling, grounding and bonding, firestopping, and conformance testing of the installation.
   5. Additions to, and connection of, the communications grounding backbone furnished and installed by Division 26.
   6. Understanding the definition of and establishment of administration and labeling schemes, conforming to Owner’s requirements.
   7. Securing all necessary permits and licenses, payment of all fees, and provision of all construction work notifications.
   8. Submitting tickets to Missouri One Call System 1-800-DIG-RITE or www.MO1Call.com for all digging, boring, trenching or excavating of any kind.
   9. Compliance with all applicable laws, ordinances, rules, and regulations.
  10. Mandatory Project Manager attendance at a weekly project status meeting, with the General Contractor or Construction Manager

D. Contractor shall provide cable support hardware above suspended ceilings from sleeve through corridor wall to vertical secondary pathway at outlet location.
   1. Staples may NEVER be used in the support, attaching or holding of any telecommunications or other low voltage cables.

E. Contractor shall coordinate with Owner for installation of cables and outlets in modular furniture panels.

F. Contractor shall coordinate with Owner for through floor and wall installations which require new penetrations.

G. Contractor shall coordinate with installation of surface raceway to provide installation of cables prior to installation of covers panels.

H. Contractor shall provide fire stopping of conduits installed for use of telecommunications wiring.

I. Contractor shall provide secondary pathways as indicated on Project Drawings or as needed to support and protect cables installed under this contract.
J. Contractor shall disconnect and remove all existing cable and termination hardware left unused though the
    course of work under this contract.

K. Contractor shall coordinate removals with the Owner.

L. Unless otherwise indicated, all cutover for activation voice, data and video services shall be provide by the
    Owner. No work to provide cutover is required.

1.4 QUALITY ASSURANCE

A. All Division 27 design services shall be directly performed by a BICSI (Building Industry Consulting
    Service) RCDD (Registered Communications Distribution Designer) having a minimum of five (5) years active
    design experience under this credential. Specific duties assigned to the RCDD shall include, but not be limited to,
    the following: all aspects of structured cabling, rack elevations, pathways, entrances, grounding and
    bonding, etc. The Architect/Designer shall be responsible to assure that other MEP functions do not interfere
    with, or otherwise infringe upon, critical elements of the design.

B. The Contractor shall be a CSV Belden/CDT-IBDN certified company. The Telecommunication Technicians
    employed shall be Belden/CDT-IBDN certified, fully trained and qualified in the installation and testing of the
    equipment to be installed. Evidence that the contractor is qualified to install this equipment shall be included with
    shop drawing submittals. The Contractor shall have as an employee at least one BICSI RCDD on staff. The following firms are qualified to install voice and data cables at the University of Missouri at Kansas City:
    1. Cablecom, Inc. - 800 East 3rd Street - Wichita, KS 67202
    2. Capital Electric Construction Company, Inc. - 1428 W. 9th Street - Kansas City, MO 64141
    3. Computer Cable Connection, Inc. - 2810 Harlan Drive - Bellevue, NE 68005
    4. Decker Electric, Inc - 4500 West Harry - Wichita, KS 67209
    5. Envision Tech - 11227 Strang Line Rd. - Lenexa, KS 66215
    6. Faith Technologies, Inc. - 110806 Strang line Rd. - Lenexa, Kansas 66215
    7. Heartland Electric - 947 Locust Hill Circle - Belton, MO 64012
    8. LAN-Tel Communications - 520 North MO Highway 7 - Independence, MO 64056
    9. Network Services - P.O. Box 12, 123 S. Main St. - Ottawa, KS 66067
    10. Prime Communications, Inc. - PO Box 131, 322 S. 2240 N. Main St. - Elkhorn, NE 68022
    12. Shaw Electric Company - 3600 Fuller - Kansas City, Missouri 64129
    13. Staco Electric Construction Co. Inc. - 3920 East 137th Terrace - Grandview, MO 64030
    15. Wachter Electric Co. - 16001 West 99th St. - Lenexa, KS 66219

C. The contractor shall accept complete responsibility for installation, certification, and support of cabling
    system. Contractor must show proof the vendor has the certifying manufacturer’s support on all of these
    issues with shop drawing submittals

D. Cabling Contractor shall provide with bid an RCDD and Installer-level BICSI Certification. A minimum of
    one (1) permanent crew member shall be BICSI Installer Level II as well as manufacturer certified.
    Twenty-five percent (25%) of installation force shall be BICSI Installer or manufacturer certified. Work
    crew, not involved in installing cable elements (e.g. laborers delivering/moving materials, installing grounding
    by an electrician, or workers installing pathway elements) do not require BICSI or manufacturer certification.

E. Cabling Contractor shall provide with bid a Manufacturer Certification for the system solution bid, issued
    directly in the bidder’s company name, valid for the time frame in which the installation will be completed.

F. Cabling Contractor shall provide with bid a minimum of five (5) reference accounts at which similar work, both
    in scope and design, have been completed by this Contractor within the last three (3) years. Three (3) of
    the provided references shall relate directly to the higher educational environment.

G. Cabling Contractor shall provide with bid the experience profile of the RCDD responsible to manage the
    contract. Should the RCDD assigned to this project change during the installation, the replacement RCDD
    profile shall be re-submitted to the Architect, Technology Consultant, General Contractor or Construction
    Manager, and University of Missouri - Kansas City for review and approval.
H. Upon request, the contractor shall arrange a visit and consultation to referenced installations. No contractor personnel shall be present during discussions with references.

I. The contractor shall be knowledgeable in local, state, regional, and national codes and regulations. All work shall comply with the latest revision of codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall apply.

J. Only installers trained and certified by the proposed manufacturer shall be allowed to install products. Installers must possess the highest level of certification available by the manufacturer for the specific copper cabling solution being installed.

K. Only installers trained and certified by the proposed manufacturer shall be allowed to install firestop products.

L. Only installers trained and certified by the proposed manufacturer shall be allowed to terminate and test optical fiber. Others specified above may pull/place optical fiber cable under the supervision of an installer trained and certified by the manufacturer.

M. The Contractor may provide proof of registration/certification of planned installers in bid documents. If not included in the bid documents, the Contractor shall provide a narrative on the levels of registration/certification of their installers within the bid documents. The Contractor shall provide proof of registration/certification for the final list of installers prior to the start of work.

N. University of Missouri - Kansas City Campus Facilities Management and Networking & Telecommunications reserve the right to reject any unregistered or uncertified installers performing work for which they are not registered/certified. The Contractor shall be responsible for any loss of work, delays in schedules, or extra cost as a result of the use of unregistered/uncertified workers. Additional effort on the part of the Contractor to maintain the installation schedule as a result of the above mentioned loss time shall be the Contractor's responsibility and at the Contractor's additional expense.

O. The Contractor shall provide to University of Missouri - Kansas City Campus Facilities Management and Networking & Telecommunications the above required documentation for any worker on this project brought in after the submittal of initial documentation on installers. Owner may periodically check installer identification and registrations/certifications during the installation.

1.5 DESCRIPTION OF REQUIRED SPACES AND COMMUNICATIONS CABBING ELEMENTS

A. Entrance Facility (EF)

1. The entrance facility of each building is the location where campus cables (inter-building) and intra-building services interconnect. The space shall be identified on the Project Drawings.
2. The entrance facility shall house the new copper building feeder cable protection hardware. The entrance facility does not always house the main cross connect frame (MC).
3. The entrance facility may house communications electronics which shall be installed and activated by the Owner.
4. The EF shall be equipped with electrical power110 VAC and 208 VAC L6 30 R, plywood backboard, lighting, floor covering, paint, and HVAC.
5. The EF shall be connected to all MC’s, TR’s, and ER’s via the appropriate trade size conduit or sleeve system if units are stacked. Maintaining proper fill capacity.
6. The EF shall be equipped with a minimum of 2-4" conduits, to the property line or OSP feed location in new construction. (UMKC-N&T for the details)
7. All conduits installed, both inside and outside the building will include pull strings or mule tape.

B. Main Cross connect (MC)

1. Copper and fiber backbone cables extend from the MC to telecommunication closets as shown on the Project Drawings. The MC also serves as a Telecommunications Room for services to the work areas.
2. The MC includes termination hardware, equipment racks, patch panels, cable management hardware, and network electronics.
3. The MC shall house the telecommunications main grounding busbar (TMGB). The bonding backbone
cables shall extend from the TMGB to each of the Telecommunications Rooms as shown on the Project Drawings.

4. The MC shall be connected to the EF, TR’s, and ER’s via the appropriate trade size conduit or sleeve system, if units are stacked. Maintaining proper fill capacity.

C. Telecommunication Room (TR)

1. The TR is the location for cross-connecting the backbone cable and horizontal station cable.
2. The space houses the new distribution frames for the horizontal cross-connect (HC). Horizontal station cables are home-run from the work area to the distribution frame. TR locations and serving boundaries are shown on the Project Drawings.
3. The TR shall be equipped with electrical power 110 VAC and 208 VAC L6-30 R, plywood backboard, lighting, floor covering, paint, and HVAC.
4. The TR will house communications electronics which shall be installed and activated by the Owner.
5. The TR shall house a telecommunications grounding busbar (TGB).
6. The TR includes equipment racks, cable management hardware, termination hardware and labeling.
7. The TR shall be connected to the EF, MC, TR’s and ER’s via the appropriate trade size conduit or sleeve system, if units are stacked. Maintaining proper fill capacity.
   a. All conduits must include pull strings or mule tape.

D. Intermediate Cross Connect (ICC)

1. The ICC is a remote distribution frame dedicated to a specific area within a building.
2. Communications outlets in the defined area shall be cabled back to the ICC rather than the local TR (Telecommunications Room).
3. Verify with Owner those outlets which shall be cabled from an ICC.
4. Refer to Project Drawings for construction of ICC and the service areas.

E. Backbone Riser Cable

1. Hybrid and composite cables shall not be installed under this contract.

F. Copper Entrance Cable

1. Install all the copper entrance cable, termination hardware, protection hardware, labeling and provide splice cases, and testing for the building as shown on Project Drawings.

G. Copper Riser Cable

1. New copper riser cables are home-run from the MC to each TR in a star topology.
2. Copper riser cables shall be a minimum of 25 pair.
3. Install copper riser cable, termination hardware, labeling and provide testing for the copper riser system as shown on the Project Drawings.

H. Optical Fiber Riser Cable

1. The optical fiber riser cables shall extend from the MC to the TR in both a ring and a star topology.
2. Install optical fiber riser cables from the MC to each TR. Refer to the Project Drawings.
3. Optical fiber riser cables shall be a minimum of 12 strands.
4. Install termination hardware, enclosures, labeling and testing for the optical fiber riser system as shown on the Project Drawings.
5. Hybrid cables, single mode /multimode optical fiber cables are only used if specified.

I. Coaxial Riser Cable

1. The video riser cables shall extend from the MC to the TRs in a trunk and tap topology.
2. Provide coaxial riser cable from the MC to each TR. Refer to the Project Drawings.
J. Horizontal Station Cable and Work Area Outlets

1. Horizontal station cable distribution follows a star topology. Each station cable is home-run from the outlet location in the work area to the distribution frame serving that area. Serving area boundaries are shown on the Project Drawings.
2. The type of cable to be provided to each outlet varies and is indicated on the Project Drawings.
3. Install horizontal station cables, termination hardware, labeling, provide testing and documentation.
4. Horizontal station cable installations shall be tested. Refer to Section 17961.
5. The location of outlets shall not be changed in the field without Owner’s approval.
6. The quantity of cables to each outlet and the work at each outlet location is keyed to the outlet symbol. Unless otherwise noted, each outlet location shown on the Project Drawings will receive new cable. The following description of work applies unless otherwise noted.
7. For each new communications outlet, install new cable, jacks, faceplate, icons, blank inserts, and termination hardware at both cable ends. Label both cable ends and test the installation. In the TR, terminate cables on the appropriate frame for voice, data, or video services. Refer to Project Drawings.
8. At each wall-mount communications outlet, install specified, wall-phone mounting plate with telephone mounting lugs and jack. Terminate first 4-pair group on wall plate jack. Coil unused 4-pair cable in outlet box. Label and test the installation. In the TR, terminate the UTP cable on the voice frame. Refer to Project Drawings. Terminate cable pairs to provide appropriate pair-pin assignments.
9. Contractor shall route cables through built-in raceway system in modular furniture when available.
10. Contractor shall route cables through cable management as per manufacturer’s instructions.
11. Contractor shall coordinate installation of cables for connection to specific systems such as elevator phones, HVAC controllers, security alarms, door lock controllers, etc. with Owner and Others.

K. Primary Pathways

1. Primary pathways are major pathways for cable routed floor-to-floor, through corridors, and pathways that carry cables feeding multiple areas which are likely to be used to support growth in those areas. Primary pathways carry cable to secondary pathways.
2. Contractor shall provide fire stopping of conduit and sleeves installed for use of telecommunications wiring.
3. Contractor shall provide primary pathways as indicated on Project Drawings.

L. Secondary Pathways

1. Secondary pathways extend from the primary pathway to the communication outlet box. Secondary pathways carry cable from the primary pathway to the communication outlet box.
2. Contractor shall provide firestopping of conduits installed for use of telecommunications wiring.
3. Contractor shall provide secondary pathways as indicated on Project Drawings or as needed to support and protect cables installed under this contract.

1.6 COORDINATION

A. The buildings on the campus of the University of Missouri at Kansas City house ongoing activities and active network connections which shall not be interrupted without strict coordination with the Owner and occupant. Coordinate and schedule all construction work with the Owner and occupant prior to beginning work.

B. Coordinate with Owner to identify the location where existing facilities can be accessed to provide interconnection between new and existing cables. These spaces shall be identified on the Project Drawings.

C. All Division 27 Contractor Project Managers shall schedule and conduct a coordination meeting with UMKC Networking & Telecommunications to confirm and coordinate scope of work requirements prior to commencement of work whether project is new construction, renovation, or retrofit. Project meetings shall be scheduled through the General Contractor, Construction Manager, or UMKC Campus Facilities Management depending upon how the project management process is structured in each instance.
D. The Contractor shall submit a work schedule before any work begins. This schedule shall identify the major phases of the installation. The Architect or Construction Manager shall review the schedule with UMKC Networking & Telecommunications and UMKC Facilities representatives, identify inspection requirements based on phasing and request any required modifications to the installation schedule. When the installation plan is finalized and approved, work may begin.

1.7 CUTOVER

A. Unless otherwise indicated, all cutover for activation voice, data and video services shall be provide by the owner. No work to provide cutover is required.

B. Contractor shall provide all documentation, test results, label schedules, and as-built information no less than 14 days in advance of the scheduled cutover date.

C. The following are required for cutover to commence:

D. Two week (14 days) prior to scheduled cutover date the following work shall be 100% complete:
   1. All work in the entrance facility and Telecommunications Rooms including punch list items. Owner will install equipment during this period.
   2. Installation, termination, labeling, and testing of all optical fiber cables.

E. Two week 14 days) prior to scheduled cutover date the owner shall receive from the contractor the following:
   1. Printed copper station cable performance test results.
   2. Printed optical fiber test results.
   3. Completed Copper Station Cable Recording Documents
   4. Completed Fiber Label Recording Documents (refer to Section 17111).
   5. Marked-up set of drawings showing field changes.

F. Cutover date shall start owner’s technicians testing of jacks, cables, fibers, and riser cables. Found defects will be repaired by owner’s technicians at a rate of $75.00 per hour. Total cost of repair to be charged to General Contractor

1.8 SUBMITTALS

A. Refer to Division 1 and the General Provisions of the Contract for exact submittal procedures.

B. Work shall not proceed without UMKC and Technology Consultant approval of all submitted items.

C. Shop drawings shall be submitted in advance of construction so as to cause no delay in other Contractors’ work. Shop drawings shall be submitted at such time to allow the Engineer reasonable time to review shop drawings to make necessary corrections.

D. It will be assumed that the Contractor has examined the shop drawings and equipment brochures prior to submission and that materials and equipment depicted will readily fit into the construction. Contractor shall also review all completed work related to materials or equipment depicted to ensure that it has been properly installed.

E. No materials or equipment subject to prior review by the Engineer shall be fabricated or installed by the Contractor, without such review and approval. The Engineer’s review of such drawings and brochures shall not relieve the Contractor of responsibility for deviations from the requirements of the drawings and specifications, unless he has notified the Engineer in writing

F. The Division 27 Contractor shall provide for review, without exception prior to material acquisition and installation, multiple copies of the following items, quantity as required by the General Contractor or Construction Manager, as applicable. Specific requirements shall be listed and described within each Division 27 section. Failure to submit required items shall disqualify the bidder.
   1. Product Data Sheets (Catalog Cuts)
   2. Backbone/Riser/Cabling Diagrams
   3. System Schematics
   4. Specification Sheets for Test Equipment
5. Bill of Materials
6. Contracting Firm Qualifications and Certifications
7. Installation Team Qualifications by Individual
8. Current Manufacturer Certifications

G. The Division 27 Contractor shall provide Coordination Drawings for review, without exception prior to material acquisition and installation for approval to proceed. Coordination Drawings shall consist of floor plans and building sections, drawn to scale. Include scaled Cable Tray/Runway layout and relationships between components and adjacent structural and mechanical elements. Show the following:
1. Vertical and horizontal offsets and transitions.
2. Clearances for access above and to the side of Cable Tray/Runways.
3. Vertical elevation of Cable Tray/Runways above floor or bottom of ceiling structure.

H. Provide throughout installation:
1. Material samples, if requested by the Architect, Technology Consultant, General Contractor, or Construction Manager.
2. Periodic field quality control reports.
3. Periodic cable test reports.

I. Provide prior to completion:
1. Actual samples of the component labeling scheme to be applied to cabling components, to be approved by the Architect, Technology Consultant, General Contractor, or Construction Manager.
2. Draft cable administration drawings, as requested to assist UMKC in the planning process. Drawings will be requested prior to final documentation and as Xerox reproductions of handwritten field copies.

J. Provide at completion of each construction/testing phase or area, as defined by the General Contractor or Construction Manager:
1. Cable test and certification reports; summary hard copy or full test results on compact disc when requested by the General Contractor or Construction Manager, UMKC Networking & Telecommunications, or the Technology Consultant. Reports shall be submitted to the requesting party within thirty (30) working days of completion for each phase.
2. One (1) full size set of final drawings of the actual installation for the Division 27 systems. Drawings shall be given as D or E size originals and on disc in AutoCAD format.

K. Provide after the installation is complete
1. One (1) copy of each approved submittal.
2. Cable test and certification reports; summary hard copy and full test results on disc.
   a. All test data, including documentation of failed tests, the corrective procedures performed, and the results of re-tests are to be documented and submitted in both hard copy and ASCII format on CD-ROM disc.
   b. Handwritten test reports shall not be accepted.
   c. All actions required to correct failed tests shall be documented to include the cable identifier, tests that were failed, and actions performed to correct the problem.
3. Instruction manuals including equipment and cable schedules, operating instructions, and manufacturer's instructions.
4. Manufacturer Warranty Certificate.
5. Warranty contacts including but not limited to: names, telephone numbers (office and mobile).

1.9 CODES & STANDARDS

A. All work shall be in compliance with the following codes and agencies. Nothing contained within these Specifications shall be misconstrued to permit work not in conformance with the most stringent of applicable codes and standards. It is assumed that bidders have access to, and specific knowledge of, the listed reference materials in order to ensure conformity with them.
1. National Electrical Code (NEC)
3. National Fire Protection Association (NFPA)
5. National Electronic Manufacturer’s Association (NEMA)
6. Institute of Electronic and Electrical Engineers (IEEE)
7. American National Standards Institute/Electronic Industries Association/Telecommunication Industries Association (ANSI/EIA/TIA)
8. Occupational Safety & Health Administration (OSHA)

B. All new materials, equipment, and installation practices shall meet or exceed the requirements of the following standards, unless specifically instructed otherwise by the Technology Consultant.
   5. ANSI/NECA/BICSI-568-2006 Standard for Installing Commercial Building Telecommunications Cabling
   6. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard 2009, or most recent edition
   7. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard 2009, or most recent edition
   8. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard 2009, or most recent edition
   9. ANSI/TIA/EIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces
   10. ANSI/TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure
   11. ANSI J-STD-607-A, Commercial Building Grounding and Bonding Requirements for Telecommunications
   12. ANSI/NECA/BICSI-568-2006 Standard for Installing Commercial Building Telecommunications Cabling
   13. ANSI/TIA/EIA-758-A, Customer Owned Outside Plant Telecommunications Infrastructure Standard
   14. TIA TSB-162, Telecommunications Cabling Guidelines for Wireless Access Points
   15. NFPA 70-2005 National Electrical Code (NEC), or most current edition
      a. With special emphasis on Articles 770 and 800
   17. IEEE Std 1100 (IEEE Emerald Book)
   18. IEEE Project 802.3af, Remote Powering via MDI/RJ-45
   20. IEEE Project 802.3an-2006, 10GBASE-T Ethernet
   22. UL 1459 Underwriters Laboratories Standard for Safety – Telephone Equipment
   23. UL 1863 Underwriters Laboratories Standard for Safety – Communications Circuit Accessories
   24. UL 467-2004 Grounding and Bonding Equipment
   25. UL 50 Electrical Cabinets and Boxes
   26. UL 1076 Security Systems
   27. UL 294 Access Control
   28. NEMA 250
   29. OSHA CFR Standards-29, Section 1910 or most current edition.
      a. 1910.268 Telecommunications
      b. 1910.146 Permit-Required Confined Spaces
   30. FCC Part 68 Code of Federal Regulations, Title 47 Telecommunications
   31. FCC 47 CFR 68
   32. ADA Americans with Disabilities Act
1.10 DEFINITIONS

A. **Amplifier:** (CATV) A device that boosts the strength of a CATV signal.

B. **APC:** Angle Physical Connector – An optical fiber connector that is polished at an angle of 8 to 10 degrees to reduce the back reflection of the signal.

C. **A-Side:** A term referring to backbone cabling associated with the primary backbone/riser system originating at “MC-A” (Main Cross-Connect A). The A-Side functions as a fully independent and redundant system in comparison to the B-Side.

D. **Attenuation:** The decrease in power of a signal, light beam, or lightwave, either absolutely or as a fraction of a reference value. Attenuation is the opposite of gain and is measured in decibels (dB).

E. **Backbone System:** The cabling and connecting hardware that provides interconnection between Telecommunications Rooms, Equipment Room, and entrance facilities.

F. **BCT:** Bonding Conductor for Telecommunications – A conductor that interconnects the building’s service equipment (power ground) to the telecommunications grounding system.

G. **BET:** Building Entrance Terminal - Cable termination equipment used to terminate outside plant (OSP) cables at or near the point of building entry.

H. **B-Side:** A term referring to backbone cabling associated with the secondary back-bone/riser system originating at ‘MC-B’ (Main Cross-Connect B). The B-Side functions as a fully independent and redundant system in comparison to the A-Side.

I. **CBN:** Common Bonding Network – The principal means for effective bonding and grounding inside a telecommunications facility or data center. The CBN has a mesh topology and is connected to the grounding electrode system.

J. **Coaxial Cable:** A cable composed of an insulated central conducting wire wrapped in another cylindrical conducting wire and then wrapped in another insulating layer and an outer protecting layer.

K. **Conduit Chase Pipe:** Short section of bushed EMT conduit with sufficient size and capacity to support horizontal cabling bundles from ceiling space, through ceiling tile, onto the cable runway system connecting wall to rack or cabinet.

L. **Construction Area:** Those areas identified on drawings, specifications, and contract documents as well as areas affected by the work including all areas of the building.

M. **dBmV:** (CATV) A signal measurement whereby 0 dBmV equals 1000 microvolts across 75 ohms. A recommended signal level for a TV to receive is 10 dBmV.

N. **Distribution Amplifier:** (CATV) A device that provides several isolated outputs from one looping or bridging input, and has a sufficiently high input impedance and input-to-output isolation to prevent loading of the input source.

O. **EDA:** Equipment Distribution Area - The Data Center space occupied by equipment racks or cabinets.

P. **Entrance Facility:** The entrance facility of each building is the location where campus cables (inter-building) and intra-building services interconnect.

Q. **ER:** Equipment Room – A centralized space designed for telecommunications equipment that serves the occupants of a building. Equipment therein is considered distinct from a TR (Telecommunications Room) because of its nature or complexity. Also frequently referred to as MDF.
R. **F-Connector:** (CATV) The final piece of hardware on a cable designed for CATV or DBS or other signal distribution applications. It is cylindrical with a center pin protruding out, that plugs into the set-top box, cable ready TV, satellite receiver, or VCR.

S. **Fusion Splicing:** An optical fiber splicing method that consists of two clean (stripped of coating) cleaved fibers then joining them and fusing the ends together with an electric arc.

T. **GE:** Grounding Equalizer – A conductor that interconnects elements of the telecommunications grounding infrastructure (formerly Telecommunications Bonding Backbone Inter-connecting Bonding Conductor).

U. **HC:** Horizontal Cross-Connect – A group of connectors, such as patch panel or punchdown block, that allows equipment and backbone cabling to be cross-connected with patch cords or jumpers. Floor Distributor (FD) is the international term for HC. Also frequently referred to as TR or IDF (legacy term).

V. **Headend:** (CATV) A CATV systems control center where incoming signals from satellites and other sources are fed into a distribution system. The originating point of a signal in CATV systems.

W. **Horizontal System:** The cabling between, and including, the TO (Telecommunications Outlet) connector and the HC (Horizontal Cross-connect) in the Telecommunications Room.

X. **HDA:** Horizontal Distribution Area – A space within the Data Center where a Horizontal Cross-Connect is located that may include LAN switches, SAN switches and KVM switches for the end equipment located in the EDA (Equipment Distribution Area).

Y. **ICC:** The ICC is a remote distribution frame dedicated to a specific area within a building.

Z. **IDF:** Intermediate Distribution Frame – An enclosed space designed for housing telecommunications equipment, cable terminations, and cross-connects. The room is the recognized cross-connect between the Backbone and Horizontal Systems. Also frequently referred to as TR.

AA. **J-Hook:** A supporting device for horizontal cables that is shaped like a “J”. It is attached to some building structures. Horizontal cables are laid in the opening formed by the “J” to provide support for cables.

BB. **LC:** Lucent Connector - A small form factor (SFF) single fiber, optical fiber connector used for the termination of both multimode and single mode optical fiber cables. The housing mechanism of the LC connector (simplex and duplex) is a push-pull type connection.

CC. **Line Amplifier:** (CATV) An amplifier for audio or video signals that feeds a transmission line; also called program amplifier.

DD. **MC:** Main Cross-Connect – The Cross-Connect normally located in the EF, MDF, or ER for cross-connection and interconnection of entrance cables, first-level backbone cables, and equipment cables. Campus distributor is the international term for MC. Also frequently referred to as MDF.

EE. **MDA:** Main Distribution Area – The space in the Data Center where the Main Cross-Connect is located.

FF. **Minor Pathway Support Hardware:** Anchors, support brackets, clamps, clips, cable ties, D-rings, rack screws, velcro straps and etc. used to dress and secure cabling, conduits and surface raceways.

GG. **Modulator:** (CATV) The electronic equipment required to combine video and audio signals and convert them to TV radio frequencies (RF) for distribution to other equipment (including televisions) on a CATV system.

HH. **MTP:** Multi-Fiber Termination Push-On Connector – an optical fiber connector built upon the MTP ferrule with (12) fibers or (6) duplex channels.

II. **Multimode Optical Fiber:** Optical fiber with a core diameter of 50 or 62.5 micron (micrometer) and a cladding diameter of 125 micron; lightwave propagation allows many modes within multimode fiber. Also abbreviated as MM or FOMM.

JJ. **Networking & Telecommunications:** The University of Missouri - Kansas City entity responsible for all information transport infrastructure defined within Division 27. Also referred to as IT.
KK. **Optical Loss Test Set (OLTS):** A tool, consisting of a stabilized light source and optical power meter, that directly measures loss by computing the difference between the optical power entering a fiber element/strand and the optical power exiting it. Required functionality for Tier 1 testing.

LL. **Optical Time Domain Reflectometer (OTDR):** An instrument that measures transmission characteristics by sending a series of short light pulses down an optical fiber element/strand and provides a graphic representation of the backscattered light. Required functionality for Tier 2 testing.

MM. **Primary Pathway:** Primary pathways are major pathways for cable routed floor-to-floor, through corridors, and pathways that carry cables feeding multiple areas which are likely to be used to support growth in those areas. Primary pathways carry cable to secondary pathways.

NN. **Primary Protector:** A device that limits voltage between telecommunications conductors and ground (usually between 215 volt direct current [VDC] to 350 VDC). 2. A protective device placed on telecommunications conductors in accordance with codes and standards such as NFPA 70.

OO. **Radio Frequency (RF):** The area (or band) of the electromagnetic spectrum where most radio communication takes place, typically from 100 KHz to 100 GHz. A frequency at which coherent electromagnetic radiation of energy is useful for communication purposes. Analog electrical signals sent on cable or over the air. Conventional (broadcast) television and radio, as well as cable TV, deliver RF signals to your television/radio.

PP. **SC:** Subscriber Connector – An “full-size” optical fiber connector used for the termination of both multimode and single mode optical fiber cables (both simplex and duplex), having a square front profile with push-pull latching mechanism.

QQ. **Secondary Pathway:** Secondary pathways extend from the primary pathway to the communication outlet box. Secondary pathways carry cable from the primary pathway to the communication outlet box.

RR. **Secondary Protector:** A secondary voltage protector installed in series with the indoor communications wire and cable between the primary protector and the equipment. The secondary protector provides overcurrent protection that will safely fuse at currents less than the current-carrying capacity of the device that it is intended to protect.

SS. **SE:** Service Entrance - An entrance to a building for both public and private network service cables. A facility that provides all necessary mechanical and electrical services for the entry of telecommunications cables into a building and that complies with all relevant regulations.

TT. **Single Mode Optical Fiber:** Optical fiber with a relatively small core diameter of 8–9 micron (micrometer) and a cladding diameter of 125 micron; lightwave propagation is restricted to a single path, or mode, in single mode optical fiber. Also abbreviated as SM or FOSM.

UU. **Splice:** A joining of conductors meant to be permanent. 2. A device that joins conducting or transmitting media. Also referred to as straight splice.

VV. **Splice Case:** A metal or plastic housing with a semi-cylindrical cavity used to clamp around a cable splice, providing a closure.

WW. **Splitter**: (CATV) A passive device that takes a signal and splits it into two or more lower-level output signals.

XX. **Tap:** (CATV) A device used on community antenna television cables for matching impedance and connecting service drops.

YY. **TBB:** Telecommunications Bonding Backbone - A copper conductor used to connect the Telecommunications Main Grounding Busbar (TMGB) to the Telecommunications Grounding Busbar (TGB).

ZZ. **TE:** Telecommunications Enclosure - A case or housing for telecommunications cable terminations and cross-connect cabling.
AAA. **TGB:** Telecommunications Grounding Bus Bar - A common point of connection for telecommunications system and equipment bonding to ground, and located in the telecommunications room or equipment room.

BBB. **TMGB:** Telecommunications Main Grounding Bus Bar - A bus bar placed in a convenient and accessible location and bonded, by means of the bonding conductor for telecommunications, to the building service equipment (power) ground.

CCC. **TO:** Telecommunications Outlet - A device placed at the user workstation for termination of horizontal media and for connectivity of network equipment. Also referred to as WAO (Work Area Outlet).

DDD. **TR:** Telecommunications Room – An enclosed space designed for housing telecommunications equipment, cable terminations, and cross-connects. The room is the recognized cross-connect between the Backbone and Horizontal Systems. Also frequently referred to as IDF (legacy term).

EEE. **Transition Splice:** A planned splice point, at the building entrance, used to transition from non-rated outdoor to indoor-rated cable designs.

FFF. **WAO:** Work Area Outlet - A device placed at the user workstation for termination of horizontal media and for connectivity of network equipment. Also referred to as TO (Tele-communications Outlet).

GGG. **ZDA:** Zone Distribution Area – A space in the Data Center where a zone outlet or consolidation point is located.

1.11 **ACRONYMNS & ABBREVIATIONS**

A. **ACR:** Attenuation-to-Crosstalk Ration

B. **ADA:** Americans with Disabilities Act

C. **AFF:** Above Finished Floor

D. **ANSI:** American National Standards Institute

E. **APC:** Angle Physical Connector

F. **ASTM:** American Society for Testing & Materials (ASTM International)

G. **AWG:** American Wire Gauge

H. **BCT:** Bonding Conductor for Telecommunications

I. **BER:** Building Entrance Room

J. **BET:** Building Entrance Terminal

K. **BICSI:** Building Industry Consulting Service International, Inc.

L. **BTU:** British Thermal Unit

M. **CATV:** Community Antenna Television (Cable Television)

N. **CBN:** Common Bonding Network

O. **CD:** Campus Distributor

P. **dB:** Decibel

Q. **dBmV:** Decibel MilliVolt
R. EDA: Equipment Distribution Area
S. EF: Entrance Facility
T. EIA: Electronic Industries Association
U. ELFEXT: Equal Level Far-End Crosstalk
V. EMC: Electromagnetic Compatibility
W. EMI: Electromagnetic Interference
X. EMT: Electrical Metallic Tubing
Y. ER: Equipment Room
Z. FCC: Federal Communications Commission
AA. FD: Floor Distributor
BB. FEXT: Far-End Crosstalk
CC. FOMM: Fiber Optic Multimode
DD. FOSM: Fiber Optic Single Mode
EE. FOTP: Fiber Optic Test Procedure
FF. Freq: Frequency
GG. GE: Grounding Equalizer (replacing TBBIBC)
HH. Gnd: Ground
II. HB: Hand Box
JJ. HC: Horizontal Cross-Connect
KK. HDA: Horizontal Distribution Area
LL. HH: Hand Hole
MM. HVAC: Heating, Ventilation, and Air Conditioning
NN. Hz: Hertz
OO. ICC: Intermediate Cross-Connect
PP. IDC: Insulation Displacement Connector
QQ. IDF: Intermediate Distribution Frame
RR. IEEE: Institute of Electrical and Electronics Engineers
SS. ISO: International Standards Organization
TT. ISP: Inside Cable Plant
UU. IT: Information Technology
<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>VV.</td>
<td>LAN: Local Area Network</td>
</tr>
<tr>
<td>WW.</td>
<td>LC: Lucent Connector</td>
</tr>
<tr>
<td>XX.</td>
<td>Mbps: Megabits per second</td>
</tr>
<tr>
<td>YY.</td>
<td>MC: Main Cross-Connect</td>
</tr>
<tr>
<td>ZZ.</td>
<td>MDA: Main Distribution Area</td>
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<tr>
<td>AAA.</td>
<td>MDF: Main Distribution Frame</td>
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<tr>
<td>BBB.</td>
<td>MH: Maintenance Hole</td>
</tr>
<tr>
<td>CCC.</td>
<td>MHz: Megahertz</td>
</tr>
<tr>
<td>DDD.</td>
<td>MM: Multimode</td>
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<tr>
<td>EEE.</td>
<td>MTP: Multi-Fiber Termination Push-On</td>
</tr>
<tr>
<td>FFF.</td>
<td>NEC: National Electrical Code, NFPA 70</td>
</tr>
<tr>
<td>GGG.</td>
<td>NESC: National Electric Safety Code</td>
</tr>
<tr>
<td>HHH.</td>
<td>NFPA: National Fire Protection Association</td>
</tr>
<tr>
<td>III.</td>
<td>NRTL: Nationally Recognized Testing Laboratory</td>
</tr>
<tr>
<td>JJJ.</td>
<td>OLTS: Optical Loss Test Set</td>
</tr>
<tr>
<td>KKK.</td>
<td>OSHA: Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>LLL.</td>
<td>OSP: Outside Plant</td>
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<tr>
<td>MMM.</td>
<td>OTDR: Optical Time Domain Reflectometer</td>
</tr>
<tr>
<td>NNN.</td>
<td>PR: Pair</td>
</tr>
<tr>
<td>OOO.</td>
<td>RCDD: Registered Communications Distribution Designer</td>
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<tr>
<td>PPP.</td>
<td>RFI: Radio Frequency Interference</td>
</tr>
<tr>
<td>QQQ.</td>
<td>RH: Relative Humidity</td>
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<tr>
<td>RRR.</td>
<td>SC: Subscriber Connector</td>
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<tr>
<td>SSS.</td>
<td>SE: Service Entrance</td>
</tr>
<tr>
<td>TTT.</td>
<td>SM: Single Mode</td>
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<tr>
<td>UUU.</td>
<td>TBB: Telecommunication Bonding Backbone</td>
</tr>
<tr>
<td>VVV.</td>
<td>TBBBC: Telecommunications Bonding Backbone Interconnecting Bonding Conductor</td>
</tr>
<tr>
<td>WWW.</td>
<td>TGB: Telecommunications Grounding Bus bar</td>
</tr>
<tr>
<td>XXX.</td>
<td>TIA: Telecommunications Industry Association</td>
</tr>
<tr>
<td>YYY.</td>
<td>TMGB: Telecommunications Main Grounding Bus Bar</td>
</tr>
</tbody>
</table>
ZZZ.  TO:  Telecommunications Outlet

AAAA.  TR:  Telecommunications Room

BBBB.  UMKC:  University of Missouri - Kansas City

CCCC.  UL:  Underwriters Laboratory

DDDD.  UPS:  Uninterruptible Power Supply

EEEE.  UTP:  Unshielded Twisted Pair

FFFF.  WAO:  Work Area Outlet

GGGG.  WAP:  Wireless Access Point

HHHH.  ZDA:  Zone Distribution Area
PART 2 - PRODUCTS

2.1 REFERENCE BRANDS AND PART NUMBERS – BASIS OF DESIGN

A. Reference brands and part numbers listed within Division 27 represent the Basis-of-Design and are as required by the University of Missouri - Kansas City (UMKC). Alternates may be proposed but shall meet or exceed specifications for the items listed. Acceptance shall be at the sole discretion of UMKC Networking & Telecommunications.

B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.

C. Prior to submitting bids, the Contractor shall call to the attention of the Architect and Technology Consultant any materials or apparatus that the bidder believes to be inadequate and to any necessary items of work omitted.

D. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Part Number</th>
<th>Description</th>
<th>Section Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M Fire Protection Products</td>
<td>CP25, CP25WB</td>
<td>Fire Barrier Caulking</td>
<td>270500</td>
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<tr>
<td>Dow Corning</td>
<td>2000</td>
<td>Firestop Sealant</td>
<td>270500</td>
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<tr>
<td>Hilti Construction Chemicals</td>
<td>CS240</td>
<td>Firestop Sealant</td>
<td>270500</td>
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<td>RectorSeal Corporation</td>
<td>950/1000</td>
<td>Metacaulk Intumescent Firestop Sealant</td>
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<td>3M Fire Protection Products</td>
<td>FS-195</td>
<td>Fire Barrier Wrap Strip</td>
<td>270500</td>
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<tr>
<td>Dow Corning</td>
<td>2002</td>
<td>Firestop Intumescent Wrap Strip</td>
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<td>Hilti Construction Chemicals</td>
<td>CS2420</td>
<td>Intumescent Wrap</td>
<td>270500</td>
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<td>3M Fire Protection Products</td>
<td>MPS-2 Plus</td>
<td>Moldable Putty Stix</td>
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<tr>
<td>RectorSeal Corporation</td>
<td>66335, 66340, 66345</td>
<td>Metacaulk Putty Pads and Sticks</td>
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<td>Arlington</td>
<td>EMT400</td>
<td>Insulated Plastic Bushings</td>
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<td>Manufacturer</td>
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<td>Description</td>
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<td>Contractor Selected</td>
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<td>Plywood Backboards</td>
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<td><strong>Grounding and Bonding for Communications</strong></td>
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<td>Newton Instrument Company</td>
<td>3056</td>
<td>¼&quot; x 4&quot; x 20&quot; Insulated Copper Ground Bar</td>
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<td>Newton Instrument Company</td>
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<td>Thomas and Betts</td>
<td>54816BE</td>
<td>Two Hole Compression Lug, Long Barrel, Blue</td>
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<tr>
<td>Thomas and Betts</td>
<td>54905BE</td>
<td>One Hole Compression Lug, Long Barrel, Blue</td>
<td>27 05 26</td>
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<td><strong>Pathways for Communications</strong></td>
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<td>Cable Management Solutions</td>
<td>CM301-6-X</td>
<td>Snake Canyon Full Width Basket Straight Section 23&quot; wide x 6&quot; deep x 24&quot; long</td>
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<td>Cable Management Solutions</td>
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<td>Snake Canyon Turning Component 23&quot; wide x 6&quot; deep x 24&quot; long</td>
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<td>CM301-TO</td>
<td>Snake Canyon Cable Drop Out 22” x 7”</td>
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<td>Cable Management Solutions</td>
<td>CM301-TRCB</td>
<td>Snake Canyon Pedestal Mount Bridge 25” x 3-1/4”</td>
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<td>Cable Management Solutions</td>
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<td>Snake Canyon Bridge Support 29-1/2” x 1” or 53-1/2” x 1”</td>
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<td>Cable Management Solutions</td>
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</tbody>
</table>

**Identification for Communications Systems** 27 05 53

- U.G. Products Co., Inc. 100W White Plastic Tag, 2” x 2-1/2” 27 05 53
- Brady PSL-514-619 Machine Printed Label 27 05 53
- Brady WML-1223-292 Machine Printed Label 27 05 53
- Brady CL-111-619 Machine Printed Label 27 05 53
- Brady PSL-1833-619-BK Machine Printed Label 27 05 53
- Contractor Selected Miscellaneous Hardware 27 05 53

**Communications Cabinets, Racks, Frames, and Enclosures** 27 11 16

- Belden XDR-8419-310 84” Relay Rack, #10-32 Tapped, 3” Channel 27 11 16
- Belden XDR-9619-310W 96” Relay Rack, #10-32 Tapped, 3” Channel 27 11 16
- Ortronics OR60400025 Cable Support Bracket Kit 27 11 16
- CPI 10610-019 Horizontal Rack Busbar 27 11 16
- Wiremold G20-C3 Power Strip 27 11 16
- CPI 11294-719 19” Deep Low Profile Shelf, Black 27 11 16
- Panduit PZRFCE4U Raised Floor Enclosure, 22.62” high x 22.62” wide x 5” deep 27 11 16
- Panduit PZRFC Raised Floor Enclosure Cover 27 11 16
- CPI A0622-RF 2U + 2U Raised Floor Enclosure, 25-1/2” wide x 25-1/2 long x 4-3/4” deep 27 11 16
- Contractor Selected Miscellaneous Hardware 27 11 16

**Communications Termination Blocks and Patch Panels** 27 11 19
<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Part Number</th>
<th>Description</th>
<th>Section Reference</th>
</tr>
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<tbody>
<tr>
<td>Belden-IBDN</td>
<td>AX104141</td>
<td>10GX KeyConnect Patch Panel, 24-port,1U, Titanium</td>
<td>27 11 19</td>
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<tr>
<td>Belden-IBDN</td>
<td>AX104142</td>
<td>10GX KeyConnect Patch Panel, 48-port,2U,Titanium</td>
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<tr>
<td>Belden-IBDN</td>
<td>AX100041</td>
<td>12/24-Port Fiber Express Panel, 1U Rack Mount, Black</td>
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<tr>
<td>Belden-IBDN</td>
<td>AX100116</td>
<td>48/96-Port Fiber Express Panel, 4U Rack Mount, Black</td>
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<td>Belden-IBDN</td>
<td>AX101729</td>
<td>6 Duplex LC MM Fiber Adapter Strips (12Fibers)</td>
<td>27 11 19</td>
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<tr>
<td>Belden-IBDN</td>
<td>AX101741</td>
<td>12 Duplex LC MM Fiber Adapter Strip (24Fibers)</td>
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<tr>
<td>Belden-IBDN</td>
<td>AX101731</td>
<td>6 Duplex LC SM Fiber Adapter Strip (12 Fibers)</td>
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<td>Belden-IBDN</td>
<td>AX101743</td>
<td>12 Duplex LC SM Fiber Adapter Strip (24 Fibers)</td>
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<tr>
<td>Belden-IBDN</td>
<td>A0340836</td>
<td>300-pair BIX Mount (QMBIX12E)</td>
<td>27 11 19</td>
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<td>Belden-IBDN</td>
<td>AX101472</td>
<td>GigaBIX Mount 12-Connector</td>
<td>27 11 19</td>
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<td>A0270164</td>
<td>250-pair BIX Mount (QMBIX10A)</td>
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<td>A0266828</td>
<td>5-pair BIX Connecting Block (QCBIX1A)</td>
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<td>Belden-IBDN</td>
<td>AX101448</td>
<td>GigaBIX Connector 25-pair</td>
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<td>Belden-IBDN</td>
<td>A0393146</td>
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**Communications Cable Management and Runway** 27 11 23

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**Communications Copper Backbone Cabling**  

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**Communications Optical Fiber Backbone Cabling**

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<p>| Belden-IBDN | B9E240 | Industrial Armored (Aluminum Interlock), Tight Buffer, UL OFCP/CSA FT6, Multimode OM4, 50 μm, 6 fibers | 27 13 23 |
| Belden-IBDN | B9E241 | Industrial Armored (Aluminum Interlock), Tight Buffer, UL OFCP/CSA FT6, Multimode OM4, 50 μm, 12 fibers | 27 13 23 |
| Belden-IBDN | B9E242 | Industrial Armored (Aluminum Interlock), Tight Buffer, UL OFCP/CSA FT6, Multimode OM4, 50 μm, 24 fibers (Singlejacket) | 27 13 23 |
| Pyramid | PLM100T | Indoor Corrugated Innerduct, Plenum Rated | 27 13 23 |
| Carlon | 14108R | Indoor Corrugated Innerduct, Non-Plenum Rated | 27 13 23 |
| Contractor Selected | | Miscellaneous Hardware | 27 13 23 |</p>
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PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Contractor shall provide conversion and integration of existing in-service communications infrastructure into new and existing spaces in close coordination with UMKC Networking & Telecommunications. Accommodate all UMKC requirements for after-hours scheduling and planned service outages.

B. Remove and dispose of communications cabling, and other physical support elements, such as racks and panels, as required by construction phasing.

C. UMKC shall not be responsible for delays in work because of shutdowns due to unsafe working practices by Contractors. Delays enforced by the Safety Office caused by unforeseen environmental conditions in the work area may be out of Contractor's control. Contractors shall contact the UMKC primary project manager immediately if delays are incurred for safety reasons.

D. UMKC facilities represent administrative, research, and educational facilities. As such, activities in all buildings are critical to the objectives of UMKC. These objectives shall not be interrupted by the Contractor's work activities. The active information transport system and cabling associated with specific work beyond the construction area shall not be disrupted at any time. Unusual circumstances (e.g. voice cutovers) can occur and shall be declared and scheduled with as much notice as possible. Service disruptions, if needed, shall be at the convenience and schedule of UMKC.

E. Security at UMKC is controlled by the UMKC Police Department. Police officers have final authority over access and security at work areas.

F. Contractor shall clean work areas each day and remove debris properly and legally from UMKC property. Materials and supplies stored for use in the project shall be neatly stacked outside the circulation areas. All exits and paths shall be cleaned so as to prevent dirt from being tracked into UMKC facilities.

G. Contractor shall ensure that all building fixtures have been reinstalled to their original condition at the conclusion of the final shift of the day.

H. Contractors may require parking spaces to be cordoned off in advance of work to access maintenance holes, hand holes, hand boxes, utility poles and/or underground spaces and pathways. Contractors shall contact UMKC Campus Facilities Management to arrange for this.

I. It shall be the responsibility of the Contractor to secure any parking permits prior to the first day of work on-site.

J. Work outside of normal UMKC operating hours and days shall be coordinated with UMKC Campus Facilities Management.

3.2 DIMENSIONS AND DEFINITE LOCATIONS

A. The Project Drawings depicting work show approximate locations. The exact location of equipment and devices shall be established in the field in accordance with instructions from the owner. Consideration shall be given to construction features, equipment of other trades, and requirements of the equipment proper.

B. The Contractor shall refer to shop drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection locations.

C. Unless specifically stated to the contrary, no drawing by scale shall be used as a dimension to work by. Dimensions noted on the drawings are subject, in each case, to measurements of adjacent or previously completed work and all such measurements necessary shall be taken before undertaking any work dependent upon them.
3.3 PROGRESSIVE AND FINAL CLEANING

A. Rubbish resulting from work shall be removed and disposed of on a daily basis.

B. Contractor shall clean wall, floor, and ceiling surfaces, furniture, equipment, casework, etc. made dirty by construction work.

C. Telecommunications Rooms (TR) and entrance facilities shall be free of rubbish for the duration of the project. Floor shall be swept at project completion.

D. Where painted surfaces of equipment have been damaged or rusted during construction, Contractor shall prepare surface(s) and paint to match final finish.

E. Aesthetics of existing architecture and finishes shall be maintained to owner's satisfaction.

F. Unless otherwise specified, new conduit, raceway, fittings, supports, and enclosures shall be finished to match color of wall/ceiling surface on which mounted where exposed to public's view and as determined by owner.

G. Existing conduit and raceway that is used under the project and which is marked-up by Contractor shall be finished to match color of wall/ceiling surface on which mounted where exposed to public's view and as requested by owner.

H. Contractor shall thoroughly clean all assemblies within all EF, MC, and TR spaces before they are turned over to UMKC Networking & Telecommunications for operation. Cleaning shall include, but not be limited to, all cable runway, racks and wire managers (inside and out), copper and optical fiber panels (inside and out). Should the MC or TR be completed prior to the balance of the floor space that it serves, racks, cabinets, and wall frames shall be covered with plastic sheeting to repel dust and other contaminants to which they will be subjected.

3.4 WARRANTY

A. The contractors shall adhere to all warranty requirements for all installations.

B. The contractor shall submit, in the bid documents, any additional contractor-specific warranties or guarantees to be offered on the project.

C. The contractor shall supply any and all necessary documentation needed to process and record the warranty(s) and to verify the installation solution.

D. Warranty of Fitness for a Particular Purpose
   1. Contractor shall warrant recognition and understanding of all UMKC requirements and intended uses for the Division 27 systems, warrant the response to the bidding process, and warrant the equipment and all other products and services to satisfy all requirements identified in the contract documents as fit for the intended use unless specifically identified, in writing, in the bid response.

E. Warranty of Title
   1. Contractor shall warrant the title to the equipment and software license rights to be free and clear of all liens, encumbrances, or agreements. Contractor further warrants and represents that in the event of any claim at any time; contractor shall pay, satisfy, or make provision for the payment and satisfaction of any claim of any nature with respect to UMKC shipping of any equipment.
F. **System Warranty**

1. The entire installation shall be warranted for two (2) years from the date of final acceptance for all components, parts, assemblies, and workmanship, and shall include a twenty (20) year application assurance warranty as a manufacturer registered system installation. During the warranty period, and for non-conformities of which contractor has notice, contractor shall take all necessary and appropriate action; free of charge, to correct any non-conformity with the warranties contained in the manufacturer agreement. During the warranty period, contractor shall provide to UMKC, free of costs and charges, all support necessary to ensure that the cabling system meets the requirements specified in this document and performance guarantees provided by the contractors. During the warranty period, contractors shall furnish, or cause to be furnished, all maintenance, service, parts and replacements necessary to maintain the cabling system in good working condition, at no cost to UMKC.

2. All deficiencies shall be corrected within a period of forty-eight (48) hours.

G. The contractor shall supply a full manufacturer’s application assurance warranty for all new installations, to include approved termination hardware and cabling media from the proposed manufacturer’s list of approved materials. Services to be provided by this contractor to UMKC during the warranty period shall include, without limitation, the following.

1. **Remedial Maintenance**
   a. Contractor shall provide service on UMKC’s site as necessary including, but not limited to, fault isolation, diagnosis, and repair.

2. **Maintenance Records**
   a. Contractor shall maintain, at the jobsite, a current record of the cabling system configuration, including maintenance history and all adds, moves, and changes.

3. **Replacement Parts**
   a. Contractor shall provide and install replacement parts, including new components, to replace faulty cabling system components.

4. **Field Change Orders**
   a. Contractor shall provide and install field change orders with UMKC approval. All change order requests shall be processed by the General Contractor or Construction Manager.

5. **Post-System Warranty Maintenance Service**
   a. **Option of Maintenance Service**
      1) UMKC shall reserve the right to elect or cancel at any time any maintenance service to be provided by the Contractor.
   b. **Warranty of On-Site Response**
      1) Regardless of the cause of the problem, contractor shall ensure that parts, equipment, and materials are available to remedy the problems and its personnel are ready to begin work (such action being deemed a “response”) within the contract time periods for the applicable warranty period or maintenance period.

6. **Warranty of Security**
   a. Contractor shall warrant that its personnel, including all subcontracts, shall at all times comply with all UMKC security regulations of which contractor has been informed by UMKC. Contractor also warrants that it has obtained all necessary licenses and permits required by federal, state and local government.

3.5 **SAFETY REQUIREMENTS**

A. All contract work shall be performed in accordance with the policies, procedures, and standards established by the UMKC Safety Department.

B. UMKC safety officers have final authority over working conditions, required permits, and required equipment and its proper use. Contractors shall be responsible to coordinate their activities with the Safety Office.

C. In construction areas, all Contractor personnel shall wear personnel protection devices, as deemed appropriate by the General Contractor or Construction Manager and as required by OSHA for the work location and work operation being performed. Devices shall included, but not be limited to hardhats, work boots, safety eye protection, reflective vests, etc.

D. All exposed holes, pits, pipes, etc., either inside or outside UMKC facilities, shall be barricaded or plated and adequately secured when Contractor personnel are not present. All ladders, hanging wires, pipes, and other items protruding at a pedestrian level travel way must be removed or secured following the final shift of the day.
E. During breaks or when only a portion of work has been completed, tools shall not be left exposed where others may risk injury or attempt to use them. Windows and doors shall not be left unsecured or propped open during breaks. At the completion of the final shift each day, doors, windows, or other openings shall be adequately secured.

F. Contractors shall provide the most stringent traffic control as specified by the State of Missouri, signage, etc. as needed to maintain a safe working environment. All work area access, road closures, parking spaces closures, and work outside of normal UMKC operating hours and days shall be coordinated by Contractors as far in advance as possible with the UMKC Police Department. The UMKC Police Department shall determine if closures of roads or spaces are possible at proposed dates and times. Work at any location may be restricted by day or time, depending on the location of the area, the need for road closures/traffic control, and/or concurrent events in the area or on campus. Contractors should contact The UMKC Police Department well in advance to determine scheduling of access to work areas.

G. When driving on UMKC property, Contractor personnel shall observe all traffic safety regulations and pay particular attention to pedestrians. All loose material and debris on vehicles shall be adequately secured and tied down.

3.6 PERSONNEL IDENTIFICATION

A. All Contractor personnel working on the project shall carry a valid company identification card and shall wear clothing that identifies their company name. This requirement shall be in effect throughout the duration of the project.

B. Contractor personnel may be required to wear UMKC issued identification badges when performing work on UMKC facilities. If required, the Contractor shall provide names and social security numbers of all personnel assigned to the project so that badges may be prepared. Upon completion of the project, UMKC issued badges shall be returned to the UMKC Police Department.

END OF SECTION 270000
SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, Division 07, and Division 08 Specification Sections, apply to this Section.

B. Drawings and provisions of the Contract including Division 26 Electrical.

C. Section 270526 – Grounding and Bonding for Communications

D. Section 270528 – Pathways for Communications

E. Section 270553 – Identification for Communications Systems

F. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures

G. Section 271119 – Communications Termination Blocks and Patch Panels

H. Section 271123 – Communications Cable Management and Cable Runway

I. Section 271313 – Communications Copper Backbone Cabling

J. Section 271323 – Communications Optical Fiber Backbone Cabling

K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling

L. Section 271543 – Communications Faceplates and Connectors

M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire

N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODE AND STANDARDS

A. Refer to Section 270000 – Communications General

B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 SUMMARY

A. This Section includes:
   1. Hangers and Supports for Communications Systems
   2. Conduits and Back Boxes for Communications Systems
   3. Cable Trays for Communications Systems
   4. Surface Raceways for Communications Systems
   5. Cable Routing, Separation, and Distance
   6. Communications Room Provisions
   7. Common Installation Requirements
   8. Fire stopping

B. All references to Division 26, contained herein, are the responsibility of the Electrical Contractor.
1.4 DEFINITIONS

A. Refer to Section 270000 – Communications General

1.5 ACRONYMS & ABBREVIATIONS

A. Refer to Section 270000 – Communications General

1.6 COORDINATION WITH OTHER TRades

A. Coordinate layout of work with other trades. Make minor adjustments in location required for coordination. Locations of structural systems, heating work and plumbing lines shall take preference over locations of conduit lines where conflict occurs. Structural systems, heating work, and plumbing lines shall not interfere with or otherwise impede the routing of communication cabling with cable tray, raceways, or other pathways dedicated to communications. All potential issues shall be brought to the attention of the General Contractor or Construction Manager immediately, before proceeding with installation.

B. Other than minor adjustments shall be submitted to the General Contractor or Construction Manager for approval before proceeding with the work.

C. Coordinate locations, arrangement, mounting, and support of all communications provisions with Division 26.
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So that connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

D. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 and Division 26

F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08.

G. The location of TO(s) and WAO(s) shown on the Drawings is approximate, and the General Contractor or Construction Manager shall have the right to relocate any TO(s) or WAO(s) before they are installed without additional cost.

1.7 REFERENCES


E. Underwriters Laboratories (UL) - UL1479.

F. Published Fire-Rated Assemblies: Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E814 under their designation of UL1479 and publishes the results in their “Fire Resistance Directory” that is updated annually with a mid-year supplement.

1.8 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. Fire Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

D. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

E. For firestopping exposed to view, provided products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84

1.9 SUBMITTALS

A. Refer to Section 270000 – Communications General

B. Product Data Sheets

C. Certification by fire stopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

D. Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item.

E. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating item.

F. Where Project conditions require modification of qualified testing and inspecting agency’s illustration to suit a particular through-penetration firestop condition, submit illustration approved by fire stopping manufacturer’s fire protection engineer with modifications marked.

G. Qualification data for firms and persons specified in Paragraph 1.6 to demonstrate their capabilities and experience

1.10 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under Paragraph 1.4:

B. Fire stopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
C. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:

D. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.

E. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, ICBO Evaluation Report or by another qualified testing and inspecting agency.

F. Information on drawings referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Owner’s and Engineer’s prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.

G. Installer Qualifications: Engage an experienced Installer who has completed fire stopping that is similar in material, design, and extent to that indicated for Project and that has performed successfully.

H. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.

I. Provide fire stopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F. Appendix A, Section 1, “Polarized Light Microscopy.”

J. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

K. Pre-installation Conference: Conduct conference at Project site to inform those making penetrations of fire stopping practices to ensure maintaining penetration hole sizes to comply with the firestop system requirements.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire stopping products to Project site in original, unopened containers or packages with intact and legible manufacturer’s labels identifying project and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency’s classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job site.

C. Store and handle fire stopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

D. Comply with recommended procedures, precautions or remedies described in Material Safety Data Sheets as applicable.

E. Do not use damaged or expired materials.

1.12 ENVIRONMENTAL REQUIREMENTS

A. Do not install fire stopping when ambient or substrate temperatures are outside limits permitted by fire stopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Maintain this minimum temperature before, during, and for 3 days after installation of materials.

C. Ventilate fire stopping per fire stopping manufacturers’ instructions by natural means or, where this is inadequate, forced air circulation.

D. During installation, provide masking and drop cloths to prevent fire stopping materials from contaminating any adjacent surfaces.

E. Do not use materials that contain flammable solvents
1.13 SEQUENCING
A. Sequence Work to permit fire stopping materials to be installed after adjacent and surrounding work is complete.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
A. Hangers and Supports
   1. Cooper B-Line
   2. Erico/Caddy
   3. Panduit Corporation
B. Fire stopping Products
   1. 3M Fire Protection Products
   2. Dow Corning
   3. Hilti Construction Chemicals, Inc.
   4. The RectorSeal Corporation

2.2 REFERENCE PART NUMBERS
A. Refer to Section 270000 Communications General, Part 2 - Products
B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified

2.3 HANGERS AND SUPPORTS
A. Product selection shall be subject to Part 3 installation requirements.

2.4 CONDUITS AND BACK BOXES
A. Refer to Division 26.

2.5 CABLE TRAYS – BUILDING
A. Refer to Division 26.

2.6 CABLE TRAYS – COMMUNICATIONS SPACES
A. Refer to Section 271123 – Communications Cable Management and Cable Runway
2.7 SURFACE RACEWAYS
A. Refer to Division 26.

2.8 SLEEVES FOR RACEWAYS AND CABLES
A. Refer to Division 26.

2.9 SLEEVE SEALS
A. Refer to Division 26.

2.10 GROUT
A. Refer to Division 26.

2.11 PLYWOOD
A. All walls must be covered with ½” Grade A-C plywood, sanded smooth and painted with fire-resistant paint (not fire retardant plywood unless required by local fire codes).
B. The plywood should be mounted vertically starting at 2” AFF, and secured to the walls using flush-mounted fasteners designed and listed to secure wood to the specific wall/stud material.
C. All plywood must be mounted in contact with one another with no gaps between sheets. All fasteners must be flush with the surface of the plywood.

2.12 CONDUIT CHASE PIPES
A. Conduit Chase Pipes shall be provided within TR spaces in any case where ceiling tile has been provided and must be breached.
   1. All conduits must include pull strings or mule tape.
B. Electrical Metallic Tubing (EMT) and Fittings
   1. 4” trade size
      a. Manufactured to ANSI C80.3 (EMT Zinc Coated)
      b. UL Standard 797 (EMT – Steel)
   C. Refer to Division 26.
D. 4” Conduit shall be used to tie the EF to the TR’s, ER’s, and MC.
   1. All conduits must include pull strings or mule tape.

2.13 FIRE STOPPING
A. Provide fire stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the fire stopping under conditions of application and service, as demonstrated by fire stopping manufacturer based on testing and field experience.
B. Provide components for each fire stopping system that are needed to install fill materials and to comply with Paragraph 1.4. Use only components specified by the fire stopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
C. Permanent forming/damming/backing materials including the following:
   1. Semi-refractory fiber (mineral wool) insulation.
2. Ceramic fiber.
3. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
4. Fire-rated formboard.
5. Joint fillers for joint sealants.

D. Temporary forming materials
E. Substrate primers.
F. Collars.
G. Steel sleeves.

PART 3 - EXECUTION

3.1 FIELD CONDITIONS

A. Examine all elements intended for Communications. Check pathways, raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, installation hazards or impediments, and other conditions affecting installation. Verify that all work required in the field is adequately described in the plans. Proceed with installation only after unsatisfactory conditions and discrepancies have been brought to the attention of the General Contractor or Construction Manager and corrected.

B. Unless otherwise noted, the footages for cabling and materials shown on the Project Drawings are based upon available plant records, architectural drawings, or the Engineer's route and pathway assumptions. The Contractor shall be required to perform field surveys and measurements, prior to ordering materials.

3.2 HANGERS AND SUPPORTS

A. Communications cabling shall be contained within a combination of open spaces, enclosed conduits, raceways, and cable trays. These pathways are designed to provide the capacity to properly install high performance communications cabling for present and future applications.

B. Where cabling is installed within conduit, cable trays, and raceways, pathways shall be furnished and installed by Division 26.

C. Where conduit, cable trays, or raceways are not provided, Division 27 shall furnish and install independent supports so that no cable rests directly on ceiling tile, mechanical ductwork, or other supporting structures.

D. Cables shall be neatly routed and bundled above the suspended ceiling structure in bundles limited to a quantity of cables as per manufacturer Specifications and installation practices for Category 6a UTP or F/UTP as applicable to the media being installed. High performance sling-type supports shall be used for adds/moves/changes or low cable count pathways. High performance J-Hook supports shall also be used.

E. Suspended ceiling support wires shall not be used for cabling support. Cables shall not be laid directly on ceiling tiles or rails. Cables placed in hangers in the ceiling area shall be routed high and away from all other electrical and mechanical systems so as to avoid contact with light fixtures, ventilation ducts, sprinkler system or plumbing piping, motors or any other electrical devices.

F. The maximum separation between support points for all cabling shall be five (5) feet

G. All cable pathway support elements shall be certified by the manufacturer for a high performance twisted pair installation, when applicable. In all cases, support products shall be approved for the support of Category 6a (10 Gigabit) or higher cables, including optical fiber.
3.3 CONDUITS AND BACK BOXES
   A. Refer to Division 26

3.4 CABLE TRAYS – BUILDING
   A. Refer to Division 26

3.5 CABLE TRAYS – COMMUNICATIONS SPACES
   A. Refer to Section 271123 and 271844 – Communications Cable Management and Cable Runway

3.6 SURFACE RACEWAYS
   A. Refer to Division 26

3.7 SLEEVES FOR RACEWAYS AND CABLES
   A. Refer to Division 26

3.8 SLEEVE SEALS
   A. Refer to Division 26

3.9 GROUT
   A. Refer to Division 26

3.10 COMMON INSTALLATION REQUIREMENTS
   A. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall mounting items.
   B. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
   C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
   D. Right of Way: Give to piping systems installed at a required slope.
   E. The Contractor shall contact UMKC before commencement of work and shall coordinate with UMKC personnel and all other trades. Commencement of work shall be coordinated through the General Contractor or Construction Manager.

3.11 CABLE ROUTING, SEPARATION, AND DISTANCE
   A. Whenever possible, primary cable routing paths shall follow the logical structure of the building. When a
wall must be breached, provide sleeved openings. Cabling shall enter and exit these areas at 90° angles. Route all cables and cable raceways parallel to or perpendicular to building structure. No diagonal runs shall be permitted, unless noted otherwise.

B. To reduce or eliminate the field effect of EMI on data signaling, cable runs shall be kept a minimum distance from EMI sources. Refer to ANSI/NECA/BICSI-568-2006 Standard for Installing Commercial Building Telecommunications Cabling.

1. Minimum separation distance from possible sources of EMI:
   a. 5 inches (125mm) from power lines of 2 KVA or less.
   b. 12 inches (305mm) from lighting fixtures.
   c. Minimum separation distance from possible sources of EMI exceeding 5KVA:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Min. Separation Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unshielded power lines or electrical equipment in proximity to open or non-metal pathways.</td>
<td>24 in. (610 mm)</td>
</tr>
<tr>
<td>Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.</td>
<td>12 in. (300 mm)</td>
</tr>
<tr>
<td>Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway.</td>
<td>6 in. (150 mm)</td>
</tr>
<tr>
<td>Electrical motors and transformers.</td>
<td>47 in. (1200 mm)</td>
</tr>
</tbody>
</table>

C. Communications cabling shall not be run in parallel with any high voltage electrical wiring.

D. The maximum length of horizontal communications cables shall be limited to 90 meters from the TO (Telecommunications Outlet) to the point of termination within the TR.

E. All cabling shall be installed as single continuous homerun pulls from Connector Block to Patch Panel. No inline connectors or splices in any form shall be permitted.

F. Cable routing from the Cable Runway onto the distribution frame shall be neatly organized and supported by cable support brackets, clips, loops, radius drops, spools, etc., as required to minimize tension and stress on the connector block terminations.

3.12 COMMUNICATIONS ROOM PROVISIONS

A. PLYWOOD BACKBOARDS

1. Furnish and install plywood backboards on all useable walls where indicated on Project Drawings.
2. Plywood shall be AC Grade or better, void-free.
3. Mount plywood to cover entire area on which Cable Runway, equipment, terminating hardware, and cable management rings may be mounted.
4. Securely fasten plywood to wall framing members. Use flush hardware and supports to mount plywood. Ensure that the strength and placement of the hardware are sufficient to handle the total anticipated load (static and dynamic) and mounting of equipment.
5. All Plywood surfaces shall be painted with 2 coats of fire retardant paint of light gray color or color matching room color.

B. CONDUIT CHASE PIPES

1. Furnish and install 4” EMT conduit “Chase Pipes” within the TR and other information transport system spaces where communications cabling must pass through suspended ceiling tiles in route to point of cabling termination.
2. Chase Pipes shall be securely mounted to the wall above Cable Runway segments using slotted unistrut and 4” pipe clamps. Reamed and bush pipes at both ends prior to cabling rough-in.
3. Chase Pipes shall be used to tie the EF to the TR's,ER's and MC.

3.13 FIRE STOPPING

COMMON WORK RESULTS FOR COMMUNICATIONS  270500 - 9
A. Refer to Division 07, Section “Penetration Fire stopping”.
B. Refer to Division 26
C. Verify that openings are ready to receive the Work of this Section.

D. All conduits, sleeves, and penetrations of fire-rated walls, into which communications cables are pulled or reserved for communications cables, shall be sealed with an approved fire-retardant method and materials in accordance with UL (Underwriters Laboratory Inc.) Fire Resistance Directory.
E. All openings provided shall be fire stopped after cabling has been installed whether filled, partially filled, or un-used.

F. Preparation

1. Surface Cleaning: Clean out openings and joints immediately prior to installing fire stopping to comply with recommendations of fire stopping manufacturer and the following requirements:
   a. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of fire stopping.
   b. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with fire stopping. Remove loose particles remaining from cleaning operation.
   c. Remove laitance and form release agents from concrete.

2. Priming: Prime substrates where recommended by fire stopping manufacturer using that manufacturer’s recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3. Masking Tape: Use masking tape to prevent fire stopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire stopping materials. Remove tape as soon as it is possible to do so without disturbing fire stopping’s seal with substrates.

4. Do not reuse the existing fire stopping materials that do not meet all requirements of Section 07270. In particular remove and dispose of the existing putty within the annulus of conduit sleeves through walls and floors where the putty was manufactured by Rectorseal Corporation and dated prior to 50697. This is typical of most locations where the putty is encountered. If uncertain contact Owner for approximate date of installation of putty.

G. Installing Through-Penetration Firestops

2. General: Comply with the System Performance Requirements (Paragraph 1.4) and the through-penetration firestop manufacturer’s installation instructions and drawings pertaining to products and applications indicated.
3. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
4. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
5. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
6. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
7. For fill materials that will remain exposed after completing Work, finished to produce smooth, uniform surfaces that are flush with adjoining finishes.

H. Field Quality Control

1. Where deficiencies are found, repair or replace fire stopping so that it complies with requirements.
2. Keep areas of work accessible until inspection by applicable code authorities.
3. Perform under this Section, patching and repairing of fire stopping caused by cutting or penetrating by other trades.

I. Adjusting and Cleaning

1. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
2. Neatly cut and trim materials as required.
3. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

J. PROTECTION OF FINISHED WORK

1. Protect firestopping during and after curing period from contact with contaminating substances or form damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 270500
SECTION 270526 – GROUNDING AND BONDING FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section
B. Section 270000 – Communications General
C. Section 270500 – Common Work Results for Communications
D. Section 270528 – Pathways for Communications
E. Section 270553 – Identification for Communications Systems
F. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures
G. Section 271119 – Communications Termination Blocks and Patch Panels
H. Section 271123 – Communications Cable Management and Cable Runway
I. Section 271313 – Communications Copper Backbone Cabling
J. Section 271323 – Communications Optical Fiber Backbone Cabling
K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling
L. Section 271543 – Communications Faceplates and Connectors
M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire
N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODE AND STANDARDS
A. Refer to Section 270000 – Communications General
B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 SUMMARY
A. This Section includes solid grounding of technology systems and equipment. It includes basic requirements for grounding for protection of life, equipment circuits and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.
B. Comply with the ANSI/TIA/EIA Standard 607, “Grounding and Bonding Requirements” and the NEC.
1.4 SUBMITTALS
   A. Refer to Section 270000 – Communications General.
   B. Submit product data for the following:
      1. TMGB busbar
      2. TGB busbar
      3. Equipment rack busbars
      4. Two hole and one hole lugs
      5. No. 3/0 AWG and No. 6 AWG conductors
   C. Field-testing organization certificates, signed by the Contractor, certifying that the organization performing field tests complies with the requirements specified in Quality Assurance below.
   D. Report of field tests and observations certified by the testing organization.

1.5 QUALITY ASSURANCE
   A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings of types and rating required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground rods and plate electrodes, whose products have been in satisfactory use in similar service for not less than 3 years.
   B. Installer: Qualified with at least 3 years of successful installation experience on projects with technology ground work similar to that required for this project.
   C. Listing and labeling: Provide products specified in this Section that are listed and labeled. The terms “listed” and “labeled” shall be defined as they are in the National Electric Code, Article 100.
   D. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.
   E. Field-testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated.
   G. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical and electronic grounding.
   H. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical and electronic grounding.

1.6 BONDING & GROUNDING INFRASTRUCTURE
   A. IC (Interconnecting Bonding Conductor) (referred to in TIA/EIA-607 at the Bonding Conductor for Telecommunications): The copper conductor that bonds the TMGB to the service equipment (power) ground.
   B. TMGB (Telecommunications Main Grounding Busbar): A copper ground reference busbar, typically installed in the entrance facility or entrance room, and is bonded to the service equipment (power) ground by the Interconnecting Bonding Conductor.
C. TGB (Telecommunications Grounding Busbar): A copper ground reference busbar, typically installed in telecommunication closets (TR) and is bonded to the TMGB by the TBB. The TGB references metallic entities in the TR space to ground.

D. TBB (Telecommunications Bonding Backbone): An insulated copper conductor extending from the TMGB to each TGB.

E. EK (Equipment Bonding Conductor): An insulated copper conductor that bonds metallic items and equipment to the TMGB and TGB

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Subject to compliance with requirements, provide products by the following:

1. Burndy Corp.
2. Crouse-Hinds Co.
3. Electrical Components Division; Gould Inc.
5. ILSCO
6. Newton Instrument Company
7. Panduit Corporation
8. Thomas and Betts Corp.

2.2 REFERENCE PART NUMBERS

A. Refer to Section 270000 Communications General, Part 2 - Products

B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.

C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 COMPONENTS

A. Telecommunication Main Grounding Busbar (TMGB): 1/4" x 4" x 20" insulated copper ground bar.

B. Telecommunication Grounding Busbar (TGB): 1/4" x 4" x 10" insulated copper ground bar.

C. Equipment Rack Busbars: 1/4" x 1" x 19" rack ground bar detail, for equipment rack applications.

D. Other Ground Reference Busbars: 1/4" x 1" x 12" insulated copper bar, for miscellaneous applications.

E. Bare annealed copper bars of rectangular cross section. All bus bars shall be two-hole lug type.

2.4 CONDUCTORS

A. Bonding Conductors: All bonding conductors shall be green insulated copper with min 98% conductivity. Exception is use of flat, braided, aluminum ground straps utilized for bonding sections of aluminum cable tray.
B. Unless otherwise specified, size the conductors as required by NEC.

C. Unless otherwise specified, the IC (Interconnecting Bonding Conductor) (referred to in TIA/EIA-607 at the Bonding Conductor for Telecommunications) shall be black insulated copper, No. 3/0 AWG with green tape applied.

D. Unless otherwise specified, the TBB (Telecommunications Bonding Backbone) shall be black insulated, copper, No. 3/0 AWG with green tape applied.

E. Unless otherwise specified, the EK (Equipment Bonding Conductor) shall be green insulated copper, No. 6 AWG.

F. Grounding Electrode Conductor: Stranded cable.

G. Bare Copper Conductors:
   1. Conform to the following:

H. Coordinate with Division 26 Sections.

2.5 MISCELLANEOUS CONDUCTORS


2.6 CONNECTOR PRODUCTS

A. Listed and labeled as grounding connectors for materials used and approved by a nationally recognized testing laboratory.

B. Two hole compression lugs: Long Barrel Type color code blue, high conductivity wrought copper, electro tin plated, or approved equal.

C. One hole compression lugs: Long Barrel One Hole Lugs color code blue, high conductivity wrought copper, electro tin plated, or approved equal

D. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by manufacturers for indicated applications.

E. Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials and bonding straps, as recommended accessories by manufacturers.

F. Pressure Connectors: High-conductivity-plated units.

G. Bolted Clamps: Heavy-duty units listed for the application.

H. Copper Compression HTAP & Clear Cover

I. Cabinet-Mounted Front-to-Rail Jumper

J. Paint-piercing Bonding Screw

K. Paint-piercing Grounding Washer
L. Two-Hole ESD Kits
M. Thread-Forming Screws

PART 3 - EXECUTION

3.1 INSPECTION
A. Installer must examine areas and conditions under which technology grounding connections are to be made and notify the Technology Consultant in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 PREPARATION
A. Site and materials preparation for testing is the responsibility of Contractor.

3.3 INSTALLATION
A. In the Telecommunications Rooms, Equipment Rooms, and Entrance Facilities provide all local bonding as specified on the drawings and in the specifications.
B. Ground electrical systems and equipment as required by code, utility, local ordinances, and requirements herein.
C. Cable connections and joints shall be provided per ANSI/TIA/EIA-607.
D. Bonding conductors should be continuous and routed in a direct route to point of termination.
E. All insulated ground bars must be isolated from the structural support by a 2” minimum separation, using manufacturer’s recommended insulating stand-offs and hardware.
F. Clean ground bars prior to terminating conductors.
G. Label all telecommunications bonding conductors as close as possible to their termination point.
H. Bond the TMGB to the service equipment (power) ground, typically located in the electrical entrance facility, utilizing the most direct route possible to minimize conductor length.
I. Bond all TGBs to the TMGB using conductor size specified.
J. Whenever two or more TBBs are used in a multi-story building, they shall be bonded together on the top floor, and at every third floor, at a minimum, using the bonding conductor size specified. Refer to drawings.
K. Bond the following to the TMGB when present:
   1. Telecommunication panelboards: Alternating Current Equipment Ground Bus (ACEG), if equipped, or its enclosure.
   2. Building structural steel, if exposed (steel rebar of reinforced concrete are not required to be bonded).
   3. Metallic equipment racks
   4. Cable Shields.
5. All metal raceways and cable trays for telecommunications cabling extending from the same room or space where the TMGB is located.
6. Others as identified on the Drawings.

L. Bond the following to the TGB when present:
1. Telecommunication panelboards: ACEG, if equipped, or its enclosure.
2. TGBs within the same space
3. TBBs terminated on the same floor to other TGBs
4. Metallic equipment racks
5. Cable Shields.
6. All metal raceways and cable trays for telecommunications cabling extending from the same room or space where the TGB is located.
7. Others as identified on the Drawings.

M. Conductors
1. Within each communications space EF, MC, TR, Data Center, Demarc Room, and any other information transport systems distribution space, the Contractor shall provide and install an individual homrun of green insulated stranded 6AWG copper ground wire directly from the TGB or TMGB to each and every assembly as follows:
   a. Rack or Cabinet
   b. Cable Runway Assembly
   c. BET (Building Entrance Terminal)
   d. Wall and Rack Mounted Frame
   e. Owner-furnished Network Electronics Unit, if directed
   f. Shielded Patch Panel
   g. Primary Protector
   h. Secondary Protector
2. Route conductors on short direct paths that have minimum resistive and inductive impedance as follows:
   a. Bonding conductors shall be routed with minimum bends or changes in direction
   b. Bonding connections shall be made directly to the points being bonded.
   c. Do not bend the grounding conductor wires into tight angles. Changes in direction shall be of the widest radius possible.
   d. Unnecessary connections or splices in bonding conductors shall be avoided. When absolutely necessary, use an approved connection and position it in an accessible location.

N. Connections
1. IC and TBB conductors shall be terminated at the TMGB and TGB with two-hole compression lugs.
2. EK bonding conductors shall be terminated with one-hole compression lugs.
3. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
4. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer to in order of galvanic series.
5. Make connections with clean bare metal at points of contact.
6. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.
7. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer’s published torque tightening values for connectors and bolts. Where manufacturer’s torqueing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

3.4 TESTING PROCEDURES AND GUIDELINES

A. Tests to be Performed
1. The following tests shall be performed. Multiple steps are necessary for each test. Refer to the "Testing" Section.
   a. Grounding Reference System Continuity Test.
   b. NOTE: The continuity of each equipment bonding conductor (EK) is NOT part of this procedure.
2. The ground reference system to be testing is shown on the Ground Reference System Schematic on the Drawings for each building. See the building Drawings

B. Test Equipment

1. Biddle Instruments, Megger DET2/2 Ground Tester or later approved model. The figure below depicts the DET2/2 equipment and connections.

C. Testing Guidelines

1. The following testing guidelines apply to all test procedures and shall be followed to promote efficient and accurate testing.
   a. Be sure all connections are tight. Loose connections will drastically affect the test results.
   b. The test lead shall be No. 14 AWG, stranded, insulated, copper conductor. The test lead shall be long enough to reach all TGBs from the TMGB. One test lead shall be used for all tests.
   c. NOTE: The test lead may be spooled however, the Biddle meter may produce inaccurate or erratic resistance measurements if the quantity of cable on the spool is too great. If the meter behaves erratically first try performing the test in the "low current" setting. If the behavior persists, the test lead should be un-spooled.
   d. The Current shall be set to "HIGH".
   e. The Filter shall be set to "ON".
   f. The Frequency shall be set to "150 Hz".
   g. Connect terminals C2 and P2 by a jumper wire (if not connected by the manufacturer).
   h. Connect Terminals P1 and C1 by a jumper wire (if not connected by the manufacturer).
   i. Once the test lead is attached to the meter it should not be removed as identified in the specific test procedure.

3.5 TESTING

A. Reference Test

1. The reference test procedure is necessary to calibrate the test setup. The reference test procedure shall be performed prior to performing any test.
2. The reference value shall be recorded and subtracted from all other measurements. If the length of the test lead is changed, new reference data must be taken and recorded. Refer to the test Documentation.
B. Reference Test Procedure:

1. Connect one end of the test lead to Terminal C1 and the other end to Terminal C2.
2. Perform the Biddle Meter Resistance Test.
3. Record test lead resistance on the data sheet.
4. Disconnect the test lead from Terminal C1 ONLY. The test lead should remain connected to Terminal C2 if possible throughout the tests.

C. Ground Reference System Continuity Test

1. The ground reference system shall be tested to validate the continuity and integrity of the interconnection of the TMGB, TGB, TBB, IC, and building’s grounding electrode.

D. Ground Reference System Continuity Test Procedure

1. Refer to the figure below.

2. Remove all equipment bonding conductors (EKxxx) from the TMGB and the TGBs. THE IC SHALL REMAIN ATTACHED TO THE TMGB. Panelboard and building steel bonds shall be removed. The TBB conductor (interconnecting the TMGB and TGBs) shall remain attached at all busbars.
3. Move the meter and test lead to the first TGB to be tested. Route the test lead to the TMGB and connect the test lead to the TMGB. The other end of the test lead should still be connected to Terminal C2 from the Reference Test. Connect a short test lead (typically from the manufacturer) from Terminal C1 to the TGB to be tested.
4. Perform the Biddle Meter Resistance Test.
5. Record the resistance on the data sheet.
6. Attach the equipment bonding conductor from the panelboard (if the panelboard is located within the room) to the TGB and repeat the test. Record the resistance on the data sheet. The reading may be slightly less than the first reading.
7. Attach the equipment bonding conductor from the building steel (if applicable) and repeat the test. Record the resistance on the data sheet. The reading may be slightly less than the previous reading.
8. This completes the grounding system continuity test for this TGB. Leave the building steel and panelboard ground connected to this TGB. Repeat the test for all other TGBs.
9. The test results should be in the order of a few 10ths of an ohm (approximately 0.10 to 0.90). The measured value should decrease when the panelboard and building steel grounds are added.

3.6 WIRE AND CABLE DOCUMENTATION

1. The Test Results Data Sheet shall be completed and submitted to the Owner prior to substantial completion of the Project.
2. The Test Results Data Sheet shall be used to record submit all test data. All information shall be typed on the sheet.
3. Provide the Owner with a Test Results Data Sheet for each TGB. Make copies of the form as necessary.

**TEST RESULTS DATA SHEET**

<table>
<thead>
<tr>
<th>Project Name: ___________________________</th>
<th>Crew Members: ___________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Date: ______________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Tester used: ____________________________</td>
<td>Current (High \ Low)</td>
</tr>
<tr>
<td>Serial Number: __________________________</td>
<td>Filter (on \ Off)</td>
</tr>
<tr>
<td></td>
<td>Frequency (Hz)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>TGB Identification: ____________________</td>
<td></td>
</tr>
<tr>
<td>Reference Test Resistance: __________________</td>
<td>W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ground Reference System Continuity Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGB</td>
</tr>
<tr>
<td>Reference (Difference)</td>
</tr>
<tr>
<td>Ω</td>
</tr>
</tbody>
</table>

3.7 WIRE AND CABLE IDENTIFICATION

A. Furnish and install labels as identified in Specification Section 270553 Identification for Communication Systems.

END OF SECTION 270526
SECTION 270528 – PATHWAYS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Section 270000 – Communications General

C. Section 270500 – Common Work Results for Communications

D. Section 270526 – Grounding and Bonding for Communications

E. Section 270553 – Identification for Communications Systems

F. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures

G. Section 271119 – Communications Termination Blocks and Patch Panels

H. Section 271123 – Communications Cable Management and Cable Runway

I. Section 271313 – Communications Copper Backbone Cabling

J. Section 271323 – Communications Optical Fiber Backbone Cabling

K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling

L. Section 271543 – Communications Faceplates and Connectors

M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire

N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General

B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

C. NFPA 70 – National Electrical Code.


F. NEMA VE 2-2000 – Cable Tray Installation Guidelines.

G. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes.
H. NEMA VE 1-1998 - Metallic Cable Tray Systems

1.3 DEFINITIONS

A. Refer to Section 270000 – Communications General

1.4 ACRONYMS & ABBREVIATIONS

A. Refer to Section 270000 – Communications General

1.5 SYSTEM DESCRIPTION

A. This Section includes secure support from the building structure for technology items by means of cable tray, hangers, supports, anchors, sleeves, inserts, seals and associated fastenings.

B. All support shall utilize threaded fasteners for all technology/attachments.
  1. Exception:
  2. Spring steel fasteners may be used in lieu of threaded fasteners only for ¾” raceways above suspended ceilings.

C. Types of supports, anchors, sleeves and seals specified in this section include the following:

D. Cable basket
  1. Clevis hangers
  2. Riser clamps
  3. C-clamps
  4. I-beam clamps
  5. Conduit straps
  6. Round steel rods
  7. Lead expansion anchors
  8. Toggle belts
  9. Floor seals

E. Supports, anchors, sleeves and seals furnished as part of factory-fabricated equipment, are specified as part of that equipment assembly or as specified in Division 26.

F. Wire basket support systems are defined to include, but are not limited to straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports and accessories.

G. Ladder style cable tray systems are separately defined within Section 271123 Communications Cable Management and Cable Runway.

H. The work covered under this section consists of furnishing all necessary coordination, labor, supervision, materials, equipment, tests and services required to install complete cable basket systems within all areas, as indicated within project Drawings.

1.6 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings requires, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Contractor Qualifications: Firm shall have at least 3 years of successful installation experience with projects utilizing electronic/electrical supporting device work similar to that required for this project.
C. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of supporting devices.

D. MSS Compliance: Comply with applicable MSS standard requirements pertaining to fabrication and installation practices for pipe hangers and supports.

E. UL Compliance: Provide components that are UL listed and labeled.

F. FS Compliance: Comply with Federal Specification FF-S-760 pertaining to retaining straps for conduit, pipe and cable.

G. Components shall be listed and labeled by ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

H. Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 392).

I. Comply with NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance” pertaining to installation of cable tray systems.

J. Installer: Qualified with at least 3 years of successful installation experience on projects with technology raceway work similar to that required for this project

K. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

1.7 SUBMITTALS

A. Refer to Section 270000 – Communications General

B. Submit the following in accordance with Conditions of Contract and Supplementary Conditions Specifications Sections.

1. Product Data: Submit manufacturer’s data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve and seal.

2. Where multiple products are shown on one cut sheet, circle product to be used.

3. Shop Drawings: Submit dimensioned drawings of fabricated products, indicating details of fabrication and materials.

4. Submit drawings of cable tray (wire basket) and accessories including connector assemblies, clamp assemblies, brackets, splice plates, splice bars, waterfalls, grounding clamps and hold down plates showing accurately scaled components. Show layout, support and installation details.

5. Submit manufacturer’s data on cable tray (wire basket) support system including, but not limited to, types, materials, finishes, dimensions, colors and inside depths.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Cable Management Solutions, Inc. – Series 301 (Snake Canyon)

B. CPI (Chatsworth Products Inc.) – On-Trac Wire Mesh Cable Tray System

C. Cooper/B-Line - FlexTray

D. Legrand - Cablofil
2.2 REFERENCE PART NUMBERS

A. Refer to Section 270000 Communications General, Part 2 - Products

B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.

C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 SECTIONS AND COMPONENTS

A. Provide cable tray (wire basket) of types and sizes indicated; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

B. Material and finish specifications for each metal cable tray type are as follows:

1. Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be electro-plated zinc in accordance with ASTM B633.

2. Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be coated after the wire basket runway has been fabricated in accordance with ASTM A123 (CSA Type 1). All hot-dip galvanized sections must be returned to the point of manufacture after coating for inspection and removal of all icicles and excess zinc. Failure to do so may result in damage to cables and/or injury to installers.

3. Electro-Galvanized Zinc: Support accessories and miscellaneous hardware shall be coated in accordance with ASTM B633 SC3. All threaded components shall be coated in accordance with ASTM B633 SC1.

2.4 CABLE TRAY AND SUPPORT SYSTEMS

A. Wire basket shall be made of high strength steel wires and formed into a standard 2 inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along wire basket sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

B. Wire basket cable tray shall conform to the following nominal criteria.

1. Straight sections shall be furnished in standard lengths.

2. Wire basket shall have a 6 inch usable loading depth by the width identified on the drawings.

3. All fittings shall be field formed as needed.

4. The installation and all fittings of all raceways shall allow Category 6a cable and fiber optic cable to be pulled in and through in such a manner as to not exceed the pulling tension or minimum bending radius.

5. All splicing assemblies shall be the bolted type using flange locknuts.

6. Cable tray supports shall be center support hangers, trapeze hangers or wall brackets and shall be supported by 1/4 inch or 3/8 inch diameter rods.

7. Special accessories shall be furnished as required to protect, support and install all cable tray support systems.

C. Reference: Section 270000 Communications General, Part 2 – Products.
3.1 GENERAL

A. Examine all elements intended for Communications. Check pathways, raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, installation hazards or impediments, and other conditions affecting installation. Verify that all work required in the field is adequately described in the plans. Proceed with installation only after unsatisfactory conditions and discrepancies have been brought to the attention of the General Contractor or Construction Manager and corrected.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver cable tray (wire basket) support systems and components carefully to avoid breakage, bending and scoring finishes. Do not install damaged equipment.

B. Store cable tray (wire basket) and accessories in original cartons and in clean dry space; protect from weather and construction traffic.

3.3 INSTALLATION

A. Install cable tray (wire basket) where indicated; in accordance with recognized industry practices (NEMA VE-2 2000), ensure that the cable tray equipment complies with requirements of the NEC, and all general installation practices.

B. Coordinate cable tray (wire basket) with other electrical and mechanical work as necessary to properly interface installation of raceway with other work.

C. Provide sufficient space encompassing cable tray (wire basket) to permit access for installing and maintaining cables.

D. Install all raceways parallel to the wall or ceiling lines unless otherwise noted. Support basket cable raceways every 4’ minimum and at 6” from ends or boxes.

E. Ground the raceway per NEC Article 250, 392 and ANSI/TIA/EIA-607.

F. Route raceways in a manner to avoid steam, water, or other liquid piping.

G. Fish or blow through every run of conduit before plastering to guard against obstructions or omissions and plug ends carefully with tight fitting wood plugs or bush caps to avoid filling with plaster, dust, etc. and to avoid the possibility of condensation.

H. Leave nylon or steel fish wire in all raceways where permanent wiring is not being installed under this contract.

I. Install conduit making the total cross-sectional area of each raceway of sufficient size to permit ready installation or withdrawal of the cables required therein.

J. Route cable tray (wire basket) a minimum of 5” clearance from fluorescent light fixtures, 12” clearance from electrically operated equipment and all wiring at 120 or more volts and 4 ft. from transformers or large motors.

K. All technology conduits are to be provided with nylon bushings to allow for cable pulling without damage.  
   1. All conduits must include pull strings or mule tape.

L. For cable support, provide strain relief a minimum of every 10’ in vertical conduits runs. Provide the proposed method and products as a product submittal.

M. In areas without suspended ceilings, install cable tray (wire basket) raceways 6” below the lowest obstruction unless otherwise directed.
3.4 TESTING

A. Test pull-out resistance of one of each type, size and anchorage material for the following fastener types:
   1. Expansion anchors.
   2. Toggle bolts.

B. Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain and submit the Structural Engineer’s signed approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.

C. Test cable tray (wire basket) support systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance.

D. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the “worst case” loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1.

END OF SECTION 270528
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section
B. Section 270000 – Communications General
C. Section 270500 – Common Work Results for Communications
D. Section 270526 – Grounding and Bonding for Communications
E. Section 270528 – Pathways for Communications
F. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures
G. Section 271119 – Communications Termination Blocks and Patch Panels
H. Section 271123 – Communications Cable Management and Cable Runway
I. Section 271313 – Communications Copper Backbone Cabling
J. Section 271323 – Communications Optical Fiber Backbone Cabling
K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling
L. Section 271543 – Communications Faceplates and Connectors
M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire
N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General
B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 SCOPE OF WORK

A. Provide, or furnish, or install all materials and equipment and provide all labels required as shown on the drawings, schedules and specified in all Sections of Division 27.
B. It is the intent of the specifications, drawings and schedules that all labels be legible and provided in locations which are readily visible.
C. Only those items affected by the installation of the Project shall be labeled unless otherwise indicated.
D. Comply with the EIA/TIA Standard 606, “The Administration Standard for the Telecommunications Infrastructure OF Commercial Buildings”.

E. This Section includes requirements for identification of components including, but not limited to, the following:
   1. Identification labeling for cables and conductors; the labeling system shall designate the cables origin and destination and a unique identifier for the cables within the system.
   2. Equipment labels including racks, cabinets, ground bars, and panels; racks and patch panels shall be labeled to identify the location within the cable system infrastructure.
   3. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
   4. Operational signs.

F. The Contractor shall submit, for confirmation and approval by the Owner and Technology Consultant, all details of the labeling system for the cable installation in accordance with details included with this document. The Owner will confirm the exact verbiage of the labeling scheme with the successful contractor.

G. All label printing shall be machine generated using indelible ink ribbons or cartridges. Self-laminating labels shall be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

1.4 SUBMITTALS
   A. Refer to Section 270000 – Communications General and General Provisions of the Contract
   B. Product Data Sheets for the Labeling Machine to be used

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
   A. Belden/CBT-IBDN
   B. Panduit
   C. Brady
   D. U.G. Products Company

2.2 REFERENCE PART NUMBERS
   A. Refer to Section 270000 Communications General, Part 2 - Products
   B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
   C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified
PART 3 - EXECUTION

3.1 GENERAL

A. Unless otherwise indicated, the exact location of labels shall be established in the field in accordance with instructions from the Owner. Consideration shall be given to construction features, label placement as affected by other work by other Crafts, and label placement to provide maximum benefit and minimum obstruction of physical equipment and hardware features.

B. Contractor shall keep a detailed up-to-date record of the label information and placement of all labels installed as specified herein.

C. Contractor shall fill-in the label information in the form (17111A.xls) provided by the Owner. The information requested is typically that which can only be provided after installation.

D. The Contractor shall furnish and install manufacturer’s standard products of categories and types required for each application.

E. Lettering and Graphics: Coordinate names, abbreviations, colors and other designations used in technology identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by standards.

F. The Contractor shall clean all surfaces prior to the attachment of labels. Follow the manufacturer’s recommendations for cleaning and affixing labels.

G. Sequence of work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

H. Apply cable/conductor identification on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used on shop drawings, contract documents, and similar previously established identification for project’s technology work.

3.2 SPACES

A. Entrance Facility (EF)

1. The Entrance Facility for both copper and fiber terminations. No work is required by the Contractor. Room label shall be provided by Others.

B. Telecommunications Room (TR)

1. No work is required by the Contractor. Room label shall be provided by Others.

3.3 CABLING

A. Copper Cabling

1. Item: Campus Copper cable (CC)

   a. CC is outside plant multi-pair copper cable.
   b. Label Location: On the cable at both ends, visible, near the hardware on which the cable is terminated.
   c. Label Information: Cable identifier is the letters CC followed by the cable number (5 numeric characters), and the Cable Count (5 numeric characters), both the beginning and end count. The cable identifier is unique to Campus. The cable identifier is shown on the Drawings.
d. Method: White plastic tag with the printed Brady label affixed to the lower portion of the tag. The tag shall be fastened to the cable with a nylon cable tie.
e. Tag part number: U.G. Products Co. Inc., white plastic, 2” x 2-1/2”, No.100W
f. Brady label part number: PSL-514-619
g. Format: All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. Two line format with the cable identifier on the top line and the Node Pair Count below. Center text - use dash as delimiter.
h. Example: CC00001 08251-08350

2. Item: Copper tie Cable
   
a. The Copper tie Cable is the multi-pair cable that extends between the existing MDF and the new frame in the Entrance Facility. The Copper tie Cable is an interior cable. The cable is either hard-punched onto the existing protectors or terminated on new frames at both ends. The cable will be considered a Building Copper cable and shall be assigned the Node Pair Count of the MDF.
b. Label Location: On the cable at both ends, near the hardware on which the cable is terminated.
c. Label Information: Refer to the labeling detail at the end of this section. The cable labeling is unique to each cable throughout the campus.
d. Method: White plastic tag with the printed Brady label affixed to the lower portion of the tag. The tag shall be fastened to the cable with a nylon cable tie.
e. Tag part number: U.G. Products Co. Inc., white plastic, 2” x 2-1/2”, No.100W
f. Brady label part number: PSL-514-619
g. Format: All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. One line format with the Cable identifier first and the Cable Count last

3. Item: Building Copper cable (BC)
   
a. BC is interior multi-pair copper backbone cable extending from the Main Cross connect (MC) to the Telecommunications Room (TR) or Intermediate Cross connect (ICC).
b. Label Location: On the cable at both ends, near the hardware on which the cable is terminated.
c. Label Information: Refer to the labeling detail at the end of this section. The cable labeling is unique to each cable throughout the campus.
d. Method: White plastic tag with the printed Brady label affixed to the lower portion of the tag. The tag shall be fastened to the cable with a nylon cable tie.
e. Tag part number: U.G. Products Co. Inc., white plastic, 2” x 2-1/2”, No.100W
f. Brady label part number: PSL-514-619
g. Format: All capital letters. Font should be as large as possible to fill the label holder space with the information. The font should be Helvetica or equal and bold. One line format with the Cable identifier first and the Cable Count last.
h. Example: 82CB1C-0001-0200

B. Fiber Cabling
   
1. Item: Building Fiber cable (BF)
   
a. BF is interior fiber backbone cable extending from the Main Cross connect (MC) to the Telecommunications Room (TR) or Intermediate Cross connect (ICC).
b. Label Location: On the jacket or sheath of the cable at both ends (before the fan-out or breakout point). Place the label near the cable entrance into the termination hardware and exterior to the termination hardware.
c. Label Information: Refer to the labeling detail at the end of this section. The cable labeling is unique to each cable throughout the campus.
e. Brady label part number: WML-1223-292
f. Format: All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. One line format with the Cable identifier first and the Cable Count last.
3.4 TERMINATION HARDWARE

A. See Drawings for example of frame layout and labeling.

B. Copper Termination Hardware

1. Item: Outlet faceplate
   a. The outlet faceplate is typically the BELDEN/CDT-IBDN MDVO faceplate.
   b. Label Location: Refer to outlet configuration drawings.
   c. Label Information: Refer to the labeling detail at the end of this section.
   d. Method: Print the information on an adhesive label and affix the label as shown on outlet configuration drawings. Machine printed Brady Labels.
   e. Brady label part number: CL-111-619
   f. Format: Font should be sized to fill the area of the strip. The font should be Helvetica or equal and bold, one line format.
   g. Example: 82D1E-A01

2. Item: Multi-pair Copper Backbone Cables on Wiring Blocks
   a. The Campus Copper and Building Copper Backbone cables are terminated on BIX Blocks.
   b. Label Location: Between the labeling holding tabs mounted in the center of each 50 pair termination field of the BIX Mounts.
   c. Label Information: Cable Count in 5 pair increments.
   d. Method: Color coded plastic strips from BELDEN/CDT-IBDN. Use Brady software program to print the information on the strip or manufacturer's preprinted labels.
   e. Format: Font should be sized to be readable and to fit all information required without overlap of text. The font should be Helvetica or equal, one line format.
   f. Example: (Riser Count) 00301 00305 00306 00310 00311 00315 00316 00320 00321 00325

3. Item: Station Cables on BIX Blocks
   a. The voice station cables are terminated on the BIX Blocks.
   b. Label Location: Between the labeling holding tabs mounted in the center of each 50 pair termination field of the BIX Mounts.
   c. Label Information: Refer to Drawings. Each strip labels 12 jack positions.
   d. Method: Blue colored plastic strips from BELDEN/CDT-IBDN. Use Brady's software program to print the information on the strip.
   e. Format: Font should be sized to fill the vertical space on the strip. The font should be Helvetica or equal and bold, one line format, centered over each 4-pair group.
   f. Example: Refer to Drawings

4. Item: Patch Panel (for data station cables)
   a. The data station cables are terminated on the BIX patch panels.
   b. Label Location: Label the patch panel on end of each patch panel mounted in an equipment rack. The adhesive label affixes to the face of the patch panel.
   c. Label Information: Refer to Drawings. Refer to the labeling detail at the end of this section.
   e. Brady label part number: PSL-1833-619-BK.
   f. Format: Font should be sized to fill the vertical space on the strip. The font should be Helvetica or equal and bold, one line format.
   g. Example: 82D1E-A

Fiber Termination Hardware

5. Item: Fiber Panel enclosures
   a. The optical fiber cables are terminated on BIX Rack Mount Patch Panels
b. Label Location: On the lower center outside of the enclosure and on the inside frame, lower center.

c. Label Information: Refer to Drawings. Refer to the labeling detail at the end of this section.


e. Brady label part number: PSL-1833-619-BK

f. Format: Font should be sized to fill the label space with the information. The font should be Helvetica or equal and bold, one line format.

g. Example: 82SB1C-A

C. Fiber Terminations

1. Item: Building Fiber terminations

a. The connector layout within each enclosure may vary. In general the columns of fiber connectors are grouped in units of six connectors. Columns count from left to right. Terminations positions within a column count from top to bottom. The connector adapters are both simplex SC and ST.

b. Label Location: At the rack mounted fiber termination units they are factory labeled inside the front the enclosure on the panels. Refer to Outlet Configuration drawings for locations on outlets.

c. Label Information: Refer to Drawings. Refer to the labeling detail at the end of this section.

d. Method: Factory labeled at fiber termination units. At workstation outlets, Print the information on an adhesive label and affix the label as shown on outlet configuration drawings. Machine printed Brady Labels.

e. Brady label part number: CL-111-619

f. Format: Font should be sized to fill the label space with the information without overlap of the next column. The font should be Helvetica or equal and bold, one line format.

g. Example: Refer to Labeling Detail and Outlet Configuration Drawings.

Designates The Floor Of The Originating
EF, MC, TC, or ICC

Designates The Cable Type

Designates The Building Number

MH = Multi-Mode Horizontal Fiber
SH = Single-Mode Horizontal Fiber
MB = Multi-Mode Backbone Fiber
SB = Single-Mode Backbone Fiber
CB = Copper Backbone
D = Copper Data Horizontal
V = Copper Voice Horizontal
CV = Campus Video

For Voice, Designates The Cable Termination
Space On The BIX Connector Block, i.e.
001, 002, 003 etc.

For Copper Backbone, Designates The Cable
Count i.e. 08251-08350

82CV1E-A001

N = North
L = East
S = South
W = West
C = Central

PATCH PANEL, CABLE, & OUTLET LABELING DETAIL

3.5 EQUIPMENT AND EQUIPMENT RACKS

A. Item: Equipment Racks

1. The equipment racks are typically 19” wall-mount

or free-standing racks.

2. Label Location: On the cross bar at the top of the rack, on both sides of free-standing racks.
3. Label Information: The Equipment Rack identifier is the letter R followed by the rack number (2 numeric characters). The Equipment Rack label information is shown on the drawing details. The Equipment Rack identifier is unique to the room.

4. Method: Machine printed Brady Labels
5. Brady Label part number: PSL-514-619
6. Format: All capital letters. The font should be sized to fill the label space with the information. The font should be Helvetica or equal and bold, one line format.
7. Example: R01

3.6 GROUNDING AND BONDING

A. Item: Telecommunications Main Grounding Busbar (TMGB)
1. Label Location: On the left side of the busbar on the busbar wall standoff.
2. Label Information: The letters TMGB. The TMGB is unique to the building. The identifier information is identified on the grounding drawings.
3. Method: White plastic tag with the printed Brady label affixed to the tag. The tag shall be fastened to the busbar wall standoff with a nylon cable tie facing out for readability.
4. Tag part number: U.G. Products Co. Inc., white plastic, 2" x 2-1/2", No.100W
5. Brady label part number: PSL-514-619
6. Format: All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold, one line format.
7. Example: TMGB

B. Item: Telecommunications Grounding Busbar (TGB)
1. Label Location: On the left side of the busbar on the busbar wall standoff.
2. Label Information: Refer to the labeling detail at the end of this section. The identifier information is identified on the grounding drawings.
3. Method: White plastic tag with the printed Brady label affixed to the tag. The tag shall be fastened to the busbar wall standoff with a nylon cable tie facing out for readability.
4. Tag part number: U.G. Products Co. Inc., white plastic, 2" x 2-1/2", No.100W
5. Brady label part number: PSL-514-619
6. Format: All capital letters. Font should be as large as possible to fill the label holder space with the information. The font should be Helvetica or equal and bold, one line format.
7. Example: 82TGB-TR1E

C. Item: Telecommunications Bonding Backbone (TBB)
1. The Telecommunications Bonding Backbone (TBB) bonds the TMGB to the TGB. There may be multiple TBBs. The quantity of TBBs depends on the methods used to interconnect the TGBs.
2. Label Location: On the conductor at each end and at each break in the insulation (for connection to another conductor or a busbar). The label shall be placed near the end of the insulation.
3. Label Information: Refer to the labeling detail at the end of this section. The identifier information is identified on the grounding drawings.
4. Method: Machine printed Brady Labels
5. Brady Label part number: WML-1223-292
6. Format: All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold, one line format.
7. Example: 2TBB-MC02

D. Item: Interconnecting Bonding Conductor (IC)
1. Referred to in TIA/EIA-607 as the Bonding Conductor for Telecommunications.
2. The Interconnecting Bonding Conductor bonds the Service Entrance to the TMGB. Typically there is only one IC.
3. Label Location: On the conductor at each end. The label shall be placed near the end of the conductor at the connection to the Service Entrance and the TMGB.
4. Label Information: The letters IC followed by the sequence number (1 numeric character). The sequence number shall be unique to the building. The identifier information is identified on the grounding drawings.
5. Method: Machine printed Brady Labels
6. Brady Label part number: WML-1223-292
7. Format: All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold, one line format.
8. Example: IC1

E. Item: Equipment bonding conductor (EK)

1. The Equipment bonding conductor (EK) bonds the TMGB and TGB to other metallic items, including electronic equipment.
2. Label Location: On the conductor at each end and at each break in the insulation (for connection to another conductor or a busbar). The label shall be placed near the end busbar or the break in the insulation whichever applies.
3. Label Information: The letters EK followed by the sequence number (3 numerical characters). The sequence number shall be unique to the Telecommunications Room and entrance facility. The contractor shall assign the numbers as necessary to accomplish the installation.
4. Method: Machine printed Brady Labels
5. Brady Label part number: WML-1223-292
6. Format: All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold, one line format.
7. Example: EK001

Designates An MC or TC for TGB.
Designates TBB or TGB.
Designates The Building Number

82TBB-MC02

Designates The Originating MC or TC for TBB.
Designates The Assigned TBB Cable #, or The TC Identification.

TBB = Telecommunications Bonding Backbone.
TGB = Telecommunications Grounding Busbar.

0# = Assigned TBB Cable Number
GN = TC Ground North
GC = TC Ground Central
1E = TC First Floor East
4S = TC Fourth Floor South

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**TGB & TBB LABELING DETAIL**

3.7 OPERATIONAL SIGNS

A. Provide instructional signs with approved legend where instructions or explanations are needed for system or equipment operation.

END OF SECTION 270553
SECTION 271116 – COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Section 270000 – Communications General

C. Section 270500 – Common Work Results for Communications

D. Section 270526 – Grounding and Bonding for Communications

E. Section 270528 – Pathways for Communications

F. Section 270553 – Identification for Communications Systems

G. Section 271119 – Communications Termination Blocks and Patch Panels

H. Section 271123 – Communications Cable Management and Cable Runway

I. Section 271313 – Communications Copper Backbone Cabling

J. Section 271323 – Communications Optical Fiber Backbone Cabling

K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling

L. Section 271543 – Communications Faceplates and Connectors

M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire

N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General

B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 DEFINITIONS

A. Refer to Section 270000 – Communications General

1.4 ACRONYMS & ABBREVIATIONS

A. Refer to Section 270000 – Communications General

1.5 SYSTEM DESCRIPTION

A. The predominant type of rack to be furnished and installed in support of UMKC information transport systems shall be as follows:
1. Single Upright, Two-Post Open Frame Universal “Relay Rack” Style

B. Open frame equipment racks, 19 inches wide x 84 or 96 inches high, shall be furnished and installed such that rear access is available for installation and maintenance. Racks shall be bolted to the floor. The tops of the racks shall be securely braced to rigid Cable Runway and bracketed to the wall. All hardware shall be provided for protection within seismic zones, where applicable.

C. Occasionally, under specific direction of UMKC Networking & Telecommunications, racks may be wall mounted as well as floor supported. Use of wall/floor racks must be approved in writing and in each instance. Refer to criteria contained herein.

D. Contractors shall observe minimum clearance requirements as follows, unless otherwise directed by UMKC Networking & Telecommunications or the Technology Consultant.

E. Racks shall be mounted to allow a minimum of 36” access space in both front and rear.
   1. The sides of a rack or group of racks situated against a wall shall have a minimum of 6” clearance from rack to the adjacent wall, with 12” preferred where TR allows. Clearance for the access “walk around” end shall be 24” at minimum and 36” where code clearance is required.

F. Raised Access Floor Enclosures shall be provided to support a flexible zoned cabling distribution system based upon standard modular patch panel mountings.

1.6 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike 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.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

1.7 SUBMITTALS

A. Refer to Section 270000 – Communications General

B. Product Data Sheets

C. Bill of Materials

1.8 MATERIALS FOR USE BY OWNER

A. Furnish materials to UMKC Networking & Telecommunications as described below:
   1. All rack screws in excess of those required to install panels and devices shown in Project Drawings. Refer to Part 2 Products.
   2. All panels in excess of those required to install panels and devices shown in Project Drawings. Refer to Part 2 Products.

B. Throughout installation, materials shall be securely stored at the project site. When called for by the Owner, materials shall be delivered by the Contractor who shall obtain a signature of acceptance and delivery from UMKC Networking & Telecommunications.
PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
A. Belden/CDT-IBDN
B. CPI (Chatsworth Products Incorporated)
C. Panduit Corporation

2.2 REFERENCE PART NUMBERS
A. Refer to Section 270000 Communications General, Part 2 - Products
B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 OPEN FRAME EQUIPMENT RACKS – SINGLE UPRIGHT, 2-POST
A. Racks shall be manufactured from 16GA steel base and 12GA steel uprights.
B. Equipment mounting channels shall be 3" deep and punched on the front flange with the EIA-310-D universal hole pattern to provide forty-five (45) rack-mount spaces for equipment in an 84" high frame and fifty-two (52) rack-mount spaces for equipment in a 96" high frame.
C. Equipment-mounting channels shall be spaced to allow attachment of 19" EIA rack-mount equipment. Attachment points shall be tapped with 10-32 holes. The rack shall include assembly and equipment-mounting hardware. Each rack shall include fifty (50) each combination pan head, pilot point mounting screws.
D. The assembled rack shall measure 7' (84") or 8' (96") high x 19" wide. The sides (webs) of the equipment-mounting channels shall be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
E. Racks shall be rated for 500 lb. of equipment.
F. Finish shall be black in color.
G. Furnish and install all necessary hardware for mounting equipment racks. Racks shall be securely mounted at both top and bottom. If this is not possible for any reason, UMKC Networking & Telecommunications shall be notified immediately.
H. Furnish and install all necessary hardware for mounting, grounding, and bonding of equipment in equipment racks as per the Panduit Structured Ground™ System. Refer to Section 27 05 00 – Common Work Results for Communications.

2.4 RAISED FLOOR ENCLOSURES
A. Enclosure shall require the removal of only one floor tile and drop through a single tile opening without disassembly to install. Mounting brackets shall be of a one-piece design without any loose hardware for easy attachment to raised floor pedestals.
B. Enclosure shall be properly grounded and bonded to the raised floor system when installed without the need of additional jumpers or other components.

C. Enclosure shall meet UL2043 requirements for use in a plenum space, be available in multiple sizes, and be configurable for both field-terminated and pre-terminated connectivity.

D. Enclosure and cable openings shall have the capacity to support forty-eight (48) Category 6 cables per rack space.

E. Enclosure shall have flexible cable ingress/egress grommets that allow for quick and easy moves, adds, and changes, while still maintaining a plenum rating.

F. Enclosure shall be capable of being secured and protected from unauthorized access with a lockable cover.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine all elements intended for Communications. Check pathways, raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, installation hazards or impediments, and other conditions affecting installation. Verify that all work required in the field is adequately described in the plans. Proceed with installation only after unsatisfactory conditions and discrepancies have been brought to the attention of the General Contractor or Construction Manager and corrected.

3.2 EQUIPMENT INSTALLATION

A. Open Frame Equipment Racks – Single Upright, 2-Post

1. Assemble racks according to manufacturer’s instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
2. All racks shall be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below. (Use CPI #40604-003 for concrete slab floors or #40607-001 wood floors. Raised floor support kits are also available.)
3. All Racks shall be individually (home-run) grounded to the TGB using appropriate hardware provided by the electrical contractor. The ground shall meet local code requirements and shall be approved by the Authority Having Jurisdiction (AHJ). Refer to Section 27 05 00 – Common Work Results for Communications.
4. Racks shall have additional bracing as required for by building codes and the recommendations of a licensed structural Engineer for seismic.
5. Cable Runway shall be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach Cable Runway. Use appropriate hardware from the Cable Runway manufacturer. Refer to Section 27 11 23 – Communications Cable Management & Cable Runway.
6. Communications Cable Management shall be attached to the sides of the rack to deliver cables to the rack. The rack should not be drilled to attach cable management. Use appropriate hardware from the cable management manufacturer. Refer to Section 27 11 23 – Communications Cable Management & Cable Runway.
7. The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

B. Raised Floor Enclosures

1. Assemble enclosures according to manufacturer’s instructions.
2. Installation locations shall be selected to ensure that there are no obstacles to interfere with the installation.
3. Four (4) support brackets shall be mounted under the enclosure by placing one on each pedestal
mount bracket by attaching the U-bolt and nut around the pedestal. Refer to manufacturer instructions for adjustment to various pedestal sizes. Use a magnetic ruler to measure the correct mounting location for each support bracket. The brackets must be mounted at a position so that the gasket will form a seal with the floor tile.

4. Install four (4) CoolBoot assemblies inside enclosure and then insert the enclosure in the desired floor tile.

5. Install pedestal mount bracket assemblies according to manufacturer instructions. Enclosure shall be mounted to the pedestal mounting brackets using the supplied 1/4" x 20 bonding bolts.

END OF SECTION 271116
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Section 270000 – Communications General

C. Section 270500 – Common Work Results for Communications

D. Section 270526 – Grounding and Bonding for Communications

E. Section 270528 – Pathways for Communications

F. Section 270553 – Identification for Communications Systems

G. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures

H. Section 271123 – Communications Cable Management and Cable Runway

I. Section 271313 – Communications Copper Backbone Cabling

J. Section 271323 – Communications Optical Fiber Backbone Cabling

K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling

L. Section 271543 – Communications Faceplates and Connectors

M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire

N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General

B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 SUMMARY

A. This Section includes:

1. Panels for Backbone Cabling Systems
2. Panels for Horizontal Cabling Systems
3. Termination Blocks for Voice BDF (Building Distribution Frames)

1.4 DEFINITIONS

A. Refer to Section 270000 – Communications General
1.5 ACRONYMS & ABBREVIATIONS
A. Refer to Section 270000 – Communications General

1.6 SUBMITTALS
A. Refer to Section 270000 – Communications General
B. Product Data Sheets
C. Specification Sheets for Test Equipment
D. Bill of Materials
E. Contracting Firm Qualifications and Certifications
F. Installation Team Qualifications by Individual
G. Current Manufacturer Certifications

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
A. Belden/CDT-IBDN

2.2 REFERENCE PART NUMBERS
A. Refer to Section 270000 Communications General, Part 2 - Products
B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 DISTRIBUTION PANELS FOR OPTICAL FIBER BACKBONE CABLING
A. Optical Fiber Distribution Panels shall be rack mount enclosures with front and rear removable doors, removable top, large front-mounted fiber guides, and integrated hinged optical jumper manager. “12/24-Port” panels shall accept up to four (4) connector panels, supporting a maximum of twenty-four (24) “SC” or “ST” style couplings in 1U rack space. “48/72-Port” panels shall accept up to twelve (12) connector panels, supporting a maximum of seventy-two (72) “SC” or “ST” style couplings in 4U rack space.
B. Each panel shall include a full complement of blank adapter panels, labels, cable storage accessories, and optical fiber cable routing accessory kit.
C. Optical Fiber Distribution Panels shall include “LC” style coupler panels and connectors as required for the complement of multimode optical fiber elements and “ST” style coupler panels and connectors as required for the complement of single mode optical fiber elements, indicated on Project Drawings.
D. Multimode Connector Panels shall be color coded according to the optical fiber type for which they are
applied. Laser-optimized 50/125μm multimode shall be aqua.

E. Single Mode Connector Panels shall be color coded according to the optical fiber type for which they are applied. 8.3/125μm single mode shall be blue.

2.4 PATCH PANELS FOR COPPER HORIZONTAL CABLING

A. MC, TR, and other information transport distribution spaces:
   1. Provide High Density 24- and 48-Port Category 6a UTP Patch Panels with insulation displacement connecting blocks for termination of all horizontal channels. Insulation displacement connecting blocks shall be based linear BIX style technology.
   2. Patch Panels shall contain 8-position RJ-45 UTP ports that meet or exceed transmission performance of Category 6a for the horizontal channel.
   3. Patch Panels shall terminate four (4) pairs of Category 6a UTP horizontal cabling per jack.

B. All ports installed for Category 6a UTP shall be black in color.

2.5 TERMINATION BLOCKS FOR COPPER BACKBONE/RISER CABLES

A. Termination blocks shall be BIX-style, wall mounted with legs in increments of 250- and 300-pair per unit, including both the wiring block and connecting blocks for field termination.

B. Blocks shall meeting Category 6a specifications as verified by an independent testing laboratory, at minimum and shall support termination of 22-24AWG solid conductors.

C. Blocks shall contain color-coded tips on the base wiring block and well as on the connector blocks and shall incorporate back openings for cable feed-through.

D. Termination blocks shall be used at the voice backbone cabling origination point within the MC and TR as shown in the Project Drawings.

E. Furnish and install wall-mounted backboard channels and troughs..

PART 3 - EXECUTION

3.1 INSTALLATION

A. All Patch Panels, Distribution Panels, and Blocks shall be securely mounted in the rack or on the wall with a minimum of four (4) rack screws located in the four corners of each panel/block.

B. All Panels shall be arranged in sequential order from top to bottom and left to right within racks and shall be labeled in alphanumeric order according to the UMKC-approved labeling scheme.

C. Panels for shielded cabling, where applicable, shall be bonded and grounded to rack frames within which they are installed and terminated directly to the TGB (Telecommunications Grounding Busbar) within each TR space.

3.2 WIRE AND CABLE IDENTIFICATION

A. Furnish and install labels as identified in Specification Section 270553 Identification for Communication Systems.

END OF SECTION 271119
SECTION 271123 – COMMUNICATIONS CABLE MANAGEMENT AND CABLE RUNWAY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Section 270000 – Communications General

C. Section 270500 – Common Work Results for Communications

D. Section 270526 – Grounding and Bonding for Communications

E. Section 270528 – Pathways for Communications

F. Section 270553 – Identification for Communications Systems

G. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures

H. Section 271119 – Communications Termination Blocks and Patch Panels

I. Section 271313 – Communications Copper Backbone Cabling

J. Section 271323 – Communications Optical Fiber Backbone Cabling

K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling

L. Section 271543 – Communications Faceplates and Connectors

M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire

N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General

B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 DEFINITIONS

A. Refer to Section 270000 – Communications General

1.4 ACRONYMS & ABBREVIATIONS

A. Refer to Section 270000 – Communications General
1.5 SYSTEM DESCRIPTION

A. Vertical Cable Management sections, 84"H, shall be bolted-in between all Open Frame Racks. Width of Vertical Cable Management sections shall be as indicated on Project Drawings.

B. Horizontal Cable Managers shall be bolted-in between Patch Panels. Location of Horizontal Managers shall be as indicated on Project Drawings.

C. The work covered under this section consists of furnishing all necessary coordination, labor, supervision, materials, equipment, tests and services required to install complete Cable Runway systems within all EF, MC, TR, and ICC spaces, as indicated within Project Drawings.

1.6 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike 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.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

1.7 SUBMITTALS

A. Refer to Section 270000 – Communications General

B. Product Data Sheets

C. Bill of Materials

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Belden/CDT-IBDN

B. CPI (Chatsworth Products, Inc.)

2.2 REFERENCE PART NUMBERS

A. Refer to Section 270000 Communications General, Part 2 - Products

B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.

C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.
2.3 CABLE MANAGEMENT

A. Vertical Cable Management for Racks/Frames

1. Every Rack/Frame shall have a minimum of one Vertical Cable Manager furnished and installed between racks and at the end of multiple rack line-ups. The Vertical Cable Manager shall create a space for storing and organizing cables along the side of each Rack/Frame.
2. Vertical Cable Manager width shall be sized as indicated on Project Drawings.
3. Vertical Cable Manager shall match the height of the Rack/Frame to which it shall be attached.
4. Vertical Cable Manager shall bolt to the side of Racks/Frames using factory-provided hardware and mounting provisions. The manufacturer of the Vertical Cable Manager shall be by the same manufacturer as the Racks/Frames. Refer to Section 17 11 16 – Communications Cabinets, Racks, Frames, & Enclosures.
5. The Vertical Cable Manager shall be a double-sided H-shaped trough. The front and rear metal edges in between the latches shall be covered by plastic edge protectors to protect cables. The double-sided trough shall provide independent front and rear cable pathways and shall have multiple evenly spaced edge protected front-to-rear cable pass-through holes for cables in the center divider.
6. Reference: Section 270000 Communications General, Part 2 – Products.

B. Horizontal Cable Management for Racks/Frames

1. Furnish and install Horizontal Cable Managers 19" W x 3" H (2RU) where specifically indicated on Project Drawings.
2. Manager shall be black in color.

2.4 CABLE RUNWAY AND ACCESSORIES

A. Cable Runway shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.

B. Cable Runway (side stringers) shall be 9’-11½” long. Cross members shall be welded in between stringers on 12” centers beginning 5-3/4” from one end so that there are 10 cross members per Cable Runway. There shall be 10-1/2” of open space in between each cross member.

C. Finish shall be epoxy-polyester hybrid powder coat (paint) black in color.

D. Furnish and install 6 inch width, 12 inch width, and 18 inch width ladder style cable runway sections in each TR and information transport systems space as indicated on Project Drawings. Cable Runway shall be securely mounted to top of equipment racks using all necessary hardware as shown in Project Drawings.

E. Cable Runway shall be black in color. Include J-Bolts and associated mounting hardware.

F. Cable Runway Radius Drops shall be mounted to stringer and cross members using clevis pins, where cabling must turn down into tops of vertical cable managers. Drops shall be black in color.

G. Channel Mounting Plates shall be 3”. Plates shall be black in color. Include associated mounting hardware.

H. Wall Mounting Angles shall be black in color. Include J-Bolts and associated mounting hardware.

I. Vertical Wall Brackets.

J. Cable Runway Foot.

K. Butt Splice Kits.
L. Triangular Support Brackets shall be black in color.

M. Runway/Enclosure Junction Kits shall be black in color.

N. Cable Runway Elevation Kit shall be used to transition between racks of unequal heights. Kits shall be black in color.

O. Cable Retaining Posts shall be installed to create a cable trough effect using ladder style tray. Posts shall be black in color.

P. Cable Runway Pathway Dividers shall be installed to separately route backbone cabling away from horizontal cabling bundles where entering the TR and routed to destination racks(s).

Q. Protective End Caps shall be black in color.

R. Furnish and install all hardware as required to form a complete system, whether or not specifically listed herein. Examples of required miscellaneous hardware include, but are not limited to threaded rod, threaded rod cover, beam clamps, lock nuts, runway and ceiling support brackets, slip-on support brackets, vertical wall brackets, etc.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine all elements intended for Communications. Check pathways, raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, installation hazards or impediments, and other conditions affecting installation. Verify that all work required in the field is adequately described in the plans. Proceed with installation only after unsatisfactory conditions and discrepancies have been brought to the attention of the General Contractor or Construction Manager and corrected.

3.2 EQUIPMENT INSTALLATION

A. VERTICAL CABLE MANAGEMENT

1. Vertical Cable Managers shall be attached to the side of the Rack/Frame using the manufacturer’s installation instructions and included hardware. No holes shall be drilled in Racks/Frames in order to install mismatched managers.

2. When a single Vertical Cable Manager is used in between two Racks/Frames, attach the Vertical Cable Manager to both Racks/Frames.

3. When more than one (1) Vertical Cable Manager is used on a Rack/Frame or group of Racks/ Frames, use the same make, style and size of Vertical Cable Manager on the Rack/Frame or in between Racks/ Frames.

4. The color of the Racks/ Frames and Vertical Cable Managers shall match.

B. HORIZONTAL CABLE MANAGEMENT

1. All Managers shall be securely mounted in the rack with a minimum of four (4) rack screws located in the four corners of each panel.

C. CABLE RUNWAY

1. Cable Runway shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.

2. Cable Runway shall be supported every 5 feet on center with 5/8 inch diameter threaded rod, or applicable support brackets or racks. Exposed portion of threaded rod shall be protected with tubular cover throughout the portion of the rod exposed to cabling within the maximum fill area.
3. Cable Runway shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

4. Cable Runway splices shall be made in mid-span, not over a support, using the manufacturer's recommended splice hardware.

5. Cable Runway shall be supported every 5' or less in accordance with TIA-569-B. Cable Runway shall be supported within 2' of every splice and within 2' on both/all sides of every intersection. Support Cable Runway within 2' on both sides of every change in elevation. Support Cable Runway every 2' when attached vertically to a wall.

6. Heavy-duty splices are recommended for Cable Runway in excess of 18" width (18" wide Cable Runway). Heavy-duty splices are required for any splice formed in the vertical orientation including changes in elevation formed using vertical-to-horizontal 90° turns or horizontal-to-vertical 90° turns. Use heavy-duty splices to secure all overhead turns to the overhead horizontal pathway(s).

7. When the pathway is overhead, Cable Runway shall be installed with a minimum clearance of 12" above the Cable Runway. Leave a minimum of 12" in between Cable Runway and ceiling/building truss structure. Leave a minimum of 3" in between Cable Runway and the tops of equipment racks and/or cabinets. Multiple tiers of Cable Runway shall be installed with a minimum clearance of 12" in between each tier of Cable Runway. When located above an acoustical drop ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the Cable Runway.

8. When installed under a raised floor, Cable Runway shall be installed with a minimum 3" clearance between the top of the Cable Runway and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3" clearance between Cable Runways wherever Cable Runways cross.

9. Within each TR, Cable Runway should be bonded together, electrically continuous, and bonded to the TMGB and TGB, unless otherwise specifically noted in the Project Drawings. Cable Runway and turns shall be bonded across each splice with a bonding kit. Cable Runway shall be bonded to the TMGB and TGB using an approved ground lug on the Cable Runway and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the Cable Runway where bonding/ground lugs contact the Cable Runway so that the lug shall contact bare metal. Use antioxidant joint compound in between the bare metal on the Cable Runway and ground lug. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual Cable Runway sections and turns and through the bond to the TMGB and TGB.

10. The combined weight of cables within the Cable Runway shall not exceed the stated load capacity of the Cable Runway as stated in the manufacturer’s product specifications or load/design tables.

11. Straps shall not be required when Cable Runway is equipped with cable retaining posts.

12. Add 8" high cable retaining posts to the open sides of Cable Runway as indicated in Project Drawings. Cable fill within any Cable Runway should not exceed 6" in height.

13. When a single Cable Runway supports different types of cable media, the cable media shall be separated within the pathway by cable spools that attach to the cross members on the Cable Runway.

14. Use a radius drop to guide cables wherever cable exits overhead Cable Runway to access a rack, cabinet or wall-mounted rack, cabinet or termination field. Furnish and install a moveable cross member also to attach and align the radius drop in between the welded cross members of a Cable Runway.

15. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.

16. Use auxiliary support brackets that attach to the side stringer of the Cable Runway to support interconnect cabling (patch cords, equipment cords, jumper cords) that is routed between racks using the Cable Runway. Auxiliary support brackets can be used to support other conductors that should be physically separated from cables within the Cable Runway as defined by local code or the authority having jurisdiction (AHJ).

17. Whenever possible, maintain a 2' separation between Cable Runway used for communications cables and pathways for other utilities or building services.

18. The installer shall furnish and apply touch-up paint color-matched to the finish on the Cable Runway and shall correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component shall be replaced with a new component finished from the factory. If a component is
physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the Cable Runway system.

19. Install Cable Runway level and straight unless specifically notes on Project Drawings.

20. Furnish and install seismic protection products for all Cable Runway hardware assemblies.

21. Alternate spacing ladder arrangements shall be made for all Cable Runway runs above and parallel to TR rack rows so that space above entry point into vertical wire managers remains clear and precise alignment of cable runway radius drops can be assured.

22. Ladder type runway shall be capable of carrying a uniformly distributed load of 135 lbs./ft. on a five foot support span with a safety factor of 1.5 when supported as a simple span. Load and safety factors specified are applicable to both side rails and rung capacities.

END OF SECTION 271123
SECTION 271313 – COMMUNICATIONS COPPER BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Section 270000 – Communications General

C. Section 270500 – Common Work Results for Communications

D. Section 270526 – Grounding and Bonding for Communications

E. Section 270528 – Pathways for Communications

F. Section 270553 – Identification for Communications Systems

G. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures

H. Section 271119 – Communications Termination Blocks and Patch Panels

I. Section 271123 – Communications Cable Management and Cable Runway

J. Section 271323 – Communications Optical Fiber Backbone Cabling

K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling

L. Section 271543 – Communications Faceplates and Connectors

M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire

N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General

B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 SYSTEM DESCRIPTION

A. The copper backbone hierarchy employed by UMKC (University of Missouri - Kansas City) – Networking & Telecommunications includes Interbuilding, Intrabuilding, and Service Provider cabling systems.

B. Interbuilding copper cabling systems, where applied, represent the primary copper riser/distribution system originating at the PBX Room or voice services “hub” serving the UMKC Campus. The end destination of each interbuilding backbone link is a termination point within the EF (Entrance Facility).

C. Intrabuilding copper cabling systems represent the primary copper riser/distribution system, originating within the EF and MC (Main Cross-Connect), that serve TR (Telecommunications Room) or ICC (Intermediate Cross-Connect) facilities located on the same floors and those above or below. Each floor shall have at least one (1) TR and larger buildings shall have more than one (1). Intrabuilding cabling systems may also contain optical fiber identified as part of the horizontal cabling.
D. Service Provider cabling systems are not-in-contract, but will require pathways that are furnished and installed by Division 26.

E. Refer to Project Drawings, “Technology Building Riser” for specific requirements of each building site.

1.4 DEFINITIONS

A. Refer to Section 270000 – Communications General

1.5 ACRONYMS & ABBREVIATIONS

A. Refer to Section 270000 – Communications General

1.6 SUBMITTALS

A. Refer to Section 270000 – Communications General
B. Product Data Sheets
C. Specification Sheets for Test Equipment
D. Bill of Materials
E. Contracting Firm Qualifications and Certifications
F. Installation Team Qualifications by Individual
G. Current Manufacturer Certifications

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Belden/CDT-IBDN/CDT

2.2 REFERENCE PART NUMBERS

A. Refer to Section 270000 Communications General, Part 2 - Products
B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 COPPER BACKBONE CABLING – INTRABUILDING

A. Multi-pair copper backbone cables from the MC shall be home-run routed directly to the TR(s).
B. ISP Copper Backbone Cabling shall be Category 5e rated, multi-pair 24 AWG riser or plenum-rated as required. Cabling shall consist of solid-copper conductors tested to meet Category 5e performance. Cabling shall be UL® tested and listed as CMR or CMP as required for the environment into which it is to be placed. The cable shall be available in 25 pair increments.
C. Where pair capacity is not specified in Project Drawings, multi-pair cabling shall be sized to provide two (2) pairs per 4-pair TO (Telecommunications Outlet) to be installed with a minimum pair count of 25.

D. Cables shall be gray in color.

2.4 COPPER BACKBONE CABLING – INTERBUILDING (OSP)
   A. Shall be Owner Furnished and Installed.

2.5 COPPER BACKBONE SPLICING - INTERBUILDING ONLY (OSP)
   A. Shall be Owner Furnished and Installed.

PART 3 - EXECUTION

3.1 FIELD CONDITIONS
   A. Examine all elements intended for Communications. Check pathways, raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, installation hazards or impediments, and other conditions affecting installation. Verify that all work required in the field is adequately described in the plans. Proceed with installation only after unsatisfactory conditions and discrepancies have been brought to the attention of the General Contractor or Construction Manager and corrected.

   B. Unless otherwise noted, the footages for cabling and materials shown on the Project Drawings are based upon available plant records, architectural drawings, or the engineer’s route and pathway assumptions. The Contractor shall be required to perform field surveys and measurements, prior to ordering materials.

   C. Unless otherwise stated, where installation requirements identified in Reference Standards conflict with the manufacturer’s recommendations, the more restrictive shall be apply.

   D. Bring to the attention of the Owner and Engineer conflicts between manufacturer’s instructions and Contract Documents.

3.2 COPPER CABLE INSTALLATION
   A. The Contractor shall field survey and review with the Owner and Engineer similar installations on campus that contain the same type of materials that are used for this Project to gain the desired routing and layout, installation techniques, and finished-look prior to start of construction and as often as necessary during the construction process.

   B. Install all cables through primary and secondary pathways. Unless otherwise specified, installation methods and techniques shall satisfy ANSI/EIA/TIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces.

   C. Where cables are supported from building structure they shall be adequately supported such that the cable will not be damaged by normal building use.

   D. Cables shall not be installed or routed in any manner that violates the manufacturer’s specifications. Manufacturer’s minimum bend radius for static (post installation) cables is 10 times the cable diameter. Manufacturer’s minimum bend radius for cables under strain (pulling tension) is 20 times the cable diameter.
E. Unless otherwise specified, terminate cables in accordance with ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Cabling Standard, observing the industry standards for terminating color-coded cables for premises and campus environments.

F. Do not install damaged or defective cable. Installation of damaged cable will not be accepted. Unless otherwise allowed by the Owner, damaged cable shall be removed and new cable installed at the expense of the Contractor. Damage includes physical damage to the cable and damage that may affect performance. THE OWNER WILL NOT ACCEPT CABLE OF ANY TYPE UNTIL AFTER IT IS INSTALLED AND PASSES A PHYSICAL INSPECTION AND ALL PERFORMANCE TESTS.

G. Cable Support along Primary Pathway

1. Primary pathways include major pathways for cable routed floor-to-floor, through corridors, and pathways that carry cables feeding multiple areas which are likely to be used to support growth in those areas. Primary pathways carry cable to secondary pathways.
2. Where cable tray cannot be installed to be continuous, provide support and strain relief for cables using mechanical fasteners such as J-hooks, conduit, C-channel, and other necessary devices to support cables around discontinuity. In exposed areas support cables as indicated on Drawings.
3. Where a telecommunication raceway, cable tray, or cable rack is provided, all telecommunication cables shall utilize the system except:
   a. emergency system wiring
   b. fire alarm systems
4. Cables shall be routed to avoid cable crossover between cable continuing vertically floor-to-floor and cable routed horizontally.
5. Cable installation and cable routes shall be planned and cables shall be installed such that the capacity of the conduit, sleeves, and cable tray is used most efficiently.
6. Bundle and route cables throughout the building to maintain neat, uniform, and combed bundles. Where cable is exposed in vertical runs, such as utility shafts, provide reusable cable straps to neatly contain cable bundles.
7. Use common vertical sleeve(s) for routing of all copper intra-building backbone/riser cables. Provide strain relief for cables routed vertically using mechanical fasteners such as conduit, C-channel, reusable cable straps, other necessary devices (such as Erica/Caddy #CAT600WM) to support cables.
8. Secure all intra-building backbone cables to the MC and TR walls to prevent movement of the cable. D-rings shall be acceptable for this purpose.
9. Secure the cables to the Cable Runway to prevent movement of the cable and use the horizontal Cable Runway to route the cable to the point of termination.
10. Staples may NEVER be used to secure cables.
11. Furnish a fifteen (15) foot service loop within all MC and TR locations.
12. All cabling shall be continuous and without splices, except to attach to BETs.

H. Cable Support Along Secondary Pathway

1. Secondary pathways extend from the primary pathway to the communication outlet box. Secondary pathways carry cable from the primary pathway to the communication outlet box.
2. Cable shall be routed parallel and perpendicular to walls and floor from the primary pathway to the outlet box. WHERE MULTIPLE ROUTES ARE POSSIBLE ROUTE CABLE ALONG THE SHORTEST ROUTE TO MINIMIZE CABLE LENGTH AS PRACTICAL.
3. Attaching or otherwise draping cables to ceiling wire grid, pipes by other trades, lighting fixtures, etc. shall not be permitted.
   a. Do not use suspended ceiling support hangers (wires) to support station cables.
   b. Do not support cable from other mechanical, electrical, or plumbing, systems.
   c. Staples may NEVER be used to attached or support cables.
   d. Station cables shall be supported such that they do not rest on the suspended ceiling system.
4. Cables and cable pathways shall be supported from the building structure. Superstructure designed and intended to support multiple utilities may be used as a superstructure for communications cables if the superstructure can physically support the additional load and if the support mechanism for the cable works for supporting the cable from the superstructure.
5. J-Hooks and other independent cable supports shall be located on 48” to 60” centers to adequately support and distribute the cable weight.
6. The Contractor shall be responsible for determining the route and quantity of J-Hooks and other independent cable supports within the overhead ceiling space wherein cable tray or other support systems have not been provided by Division 26.
7. Where J-Hooks and independent cable supports are used, runs shall follow walls and building supporting structures; diagonal runs shall not be acceptable.
8. Place cables without exceeding cable manufacturer’s recommended pulling tensions.
9. Pull cables simultaneously if more than one is being pulled in the same raceway.
10. Use pulling compound or lubricant only if necessary. Use compounds that will not damage conductor or insulation.
11. Use pulling means, including fish tape, cable, rope, and basket weave or cable grips, that will not damage cabling or raceways.

3.3 CROSS-CONNECT JUMPERS
A. Coordinate installation of jumpers with Owner prior to starting work.
B. Provide 2” minimum and 4” maximum service loop in each cross-connect jumper for voice and data circuits at each end.
C. Cross-connect jumpers shall be uniform in shape.
D. Plan and route cross-connect jumpers for voice circuits and data circuits through the jumper rings on the frames such that they are not intermixed haphazardly. Keep voice and data cross-connect jumpers segregated as possible.

3.4 CABLE MANAGEMENT AND ROUTING AT DISTRIBUTION FRAMES
A. Cabling shall be arranged on the patch panels in sequential numerical order by cable number.
B. Cabling shall be arranged on the termination blocks in sequential numerical order by cable pair.
C. At distribution frames route cables along the backboard vertically and horizontally to avoid diagonal routing. Where the termination location is unspecified, neatly coil enough cable slack in each closet to reach the farthest corner of the backboard routing vertically and horizontally.
D. Plan cable layout, routing, and cable management on the backboard such that:
   1. Cable cross-over is minimal.
   2. Cables are kept as short as practicable.
   3. Station cables and equipment cables are neatly shaped, combed, and bundled vertically and horizontally.

3.5 COPPER CABLE SPLICES
A. Splices in backbone cables shall be made using mechanical tools, modules, and connectors of the same manufacturer which are specifically designed for the type and size of cable being spliced.
B. All splices shall be performed in a splice closure specifically designed for the number of cables, size of cables, quantity of conductors, and environment of the splice.
C. Metallic shields of telecommunications cables shall be bonded together within the closure of all splices.
D. All cables entering a splice case shall be supported independent of the splice case to a supporting structure and such that the splice case is accessible for re-entry.
E. Splicing of cables containing energized circuits shall be coordinated with Owner

3.6 CABLE REMOVAL
A. All copper riser cable and termination hardware that is replaced with new shall be removed.
B. Existing twisted pair communications cable and hardware in the project area that has been abandoned in place prior to this Project shall be removed.

C. Conduit and enclosures shall remain. Blank covers shall be provided for abandoned junction boxes.

D. All penetrations and sleeves affected by removal of cable shall be fire-stopped after removal of cable to maintain required fire rating.

E. Existing termination hardware within the existing telecommunications spaces and communications enclosures shall be removed from service after cutover.

F. Existing distribution frame hardware and cabling shall be removed after active services are transferred to new cabling system as verified at frame.

3.7 FIRE STOPPING

A. Fire stopping shall be installed after all cabling under contract has been installed. Refer to Specification Section 270500 Common Work Results for Communications

3.8 UTP TESTING AND DOCUMENTATION PROCEDURES

A. New cable pairs shall be end-to-end tested as follows.

1. DC loop resistance
2. Wire map
3. Continuity to remote end
4. Shorts between two or more conductors
5. Crossed pairs
6. Reversed pairs
7. Split pairs

B. Testers may require a BIX-style adapter at the TR location.

C. All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated in the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing. Autotest settings, provided in the field tester for testing the installed cabling, shall be set to the manufacturer default parameters for the type and characteristics of the cable to be tested.

D. Tests shall be performed with connectors and termination completed and in-place.

E. Any cable or component not satisfactorily passing the tests as described or failing to meet quality installation standards as described in this specification, shall be repaired and/or replaced at the Contractor's expense.

F. The Contractor shall prepare complete cable test reports for all installed cables for review and approval of UMKC Networking & Telecommunications prior to acceptance of the cabling system.

3.9 WIRE AND CABLE IDENTIFICATION

A. Furnish and install labels as identified in Specification Section 270553 Identification for Communication Systems.

END OF SECTION 271313
SECTION 271323 – COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section
B. Section 270000 – Communications General
C. Section 270500 – Common Work Results for Communications
D. Section 270526 – Grounding and Bonding for Communications
E. Section 270528 – Pathways for Communications
F. Section 270553 – Identification for Communications Systems
G. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures
H. Section 271119 – Communications Termination Blocks and Patch Panels
I. Section 271123 – Communications Cable Management and Cable Runway
J. Section 271313 – Communications Copper Backbone Cabling
K. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling
L. Section 271543 – Communications Faceplates and Connectors
M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire
N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General
B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 DEFINITIONS

A. Refer to Section 270000 – Communications General

1.4 ACRONYMS & ABBREVIATIONS

A. Refer to Section 270000 – Communications General

1.5 SYSTEM DESCRIPTION
A. The optical fiber hierarchy employed by UMKC (University of Missouri - Kansas City) – Networking & Telecommunications includes Interbuilding, Intrabuilding, and Service Provider cabling systems. These systems are designed based upon a “hierarchical star” configuration.

B. Interbuilding cabling systems provide the primary backbone link originating at primary data center facilities located on the UMKC Campus. The end destination of each interbuilding backbone link is a termination point within at least one (1) EF (Entrance Facility). Interbuilding cabling is not-in-contract and will be provided by the Owner.

C. Intrabuilding cabling systems are most often primary backbone links, originating within the EF (Entrance Facility) and MC (Main Cross-Connect), that serve TR (Telecommunications Room) or ICC (Intermediate Cross-Connect) facilities located on the same floors and those above or below. Each floor shall have at least one (1) TR and larger buildings shall have more than one (1). Intrabuilding cabling systems may also contain optical fiber identified as part of the horizontal cabling.

D. Service Provider cabling systems are not-in-contract, but will require pathways that are furnished and installed by Division 26.

E. Refer to Project Drawings, “Technology Building Riser” for specific requirements of each building site.

1.6 SUBMITTALS

A. Refer to Section 270000 – Communications General

B. Product Data Sheets

C. Specification Sheets for Test Equipment

D. Bill of Materials

E. Contracting Firm Qualifications and Certifications

F. Installation Team Qualifications by Individual

G. Current Manufacturer Certifications

H. 100% Test Results as detailed within PART 3 EXECUTION

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Belden-IBDN

B. Carlon

C. Pyramid

2.2 REFERENCE PART NUMBERS

A. Refer to Section 270000 Communications General, Part 2 - Products

B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 OPTICAL FIBER BACKBONE CABLING

A. New segments of multi-element optical fiber backbone cable shall meet the requirements of the National Electrical Code® (NEC)® Section 770. The cable shall be listed OFNR (OFCR) for riser (non-plenum) applications or OFNP (OFCP) for plenum applications, as required. The indoor backbone fiber shall be multi-mode and single mode, utilizing a tight buffered, air-core design with all-dielectric strength member construction.

B. Orange innerduct shall be required with all optical fiber cabling; indoor and outdoor. All conduit designated to contain interbuilding and outside plant (OSP) optical fiber shall also be filled with spare innerducts comprising the full capacity of that conduit. For example, a 4’ OSP conduit shall contain a minimum of (3) 1’ innerducts in all cases the cabling installation requires use of the conduit. Un-used conduits shall be left vacant except for pull strings or mule tape.

C. Minimum bend radius shall be no less than fifteen (15) times outside diameter under full tensile load and no less than ten (10) times outside diameter under no load.

D. New Multi-mode Optical Fiber segments shall meet the requirements of EIA/TIA-492AAAC “Detail Specification for 850-nm Laser-Optimized, 50μm Core Diameter/125μm Cladding Diameter Class 1a Graded-index Multimode Optical Fibers.”


F. Color Coding

1. For indoor applications, the color of the outer jacket shall be aqua for cables containing 50/125 μm Laser Optimized Fiber.
2. For indoor applications, the color of the outer jacket shall be yellow for cables containing single mode fiber.
3. For outside plant applications, the jacket shall contain carbon black to provide ultraviolet light protection.
4. The optical fiber color coding shall be in accordance with EIA/TIA-598-B, "Optical Fiber Cable Color Coding."

G. Each optical fiber backbone cable shall consist of a minimum number of individual elements specified within the Project Drawings such as backbone/riser schematics but shall never be less than 12 strands of fiber.

1. Optical fiber cabling shall be available in 12-, 24-, 48- and 96- element configurations.

H. All optical fiber cables shall be shipped with OTDR results for each fiber. OTDR results shall show attenuation and bandwidth. The results shall be documented in such a manner that the information can be retained for future use.

I. Backbone (riser) cable in non-plenum air spaces shall be NEC Type OFNR as follows:

1. Tight buffered Fan-Out Riser Cable.

J. Backbone (riser) cable in plenum air spaces shall be NEC Type OFNP as follows:

1. Tight buffered Fan-Out Plenum Cable.

K. Campus Backbone (Underground & Building Entrance) shall be of loose tube design with water blocking technology NEC OFNR as follows:

1. Loose Tube Gel-Free Cable
L. Building entrance cables meeting the UL-1666OFNR specification may enter a building without requiring a transition splice, i.e. Loose Tube Gel-Free Cables.

2.4 OPTICAL FIBER CONNECTORS

A. All optical fiber cables shall be terminated with permanently installed connectors per EIA/TIA-45 S-21.

B. Optical fiber connections for multimode optical fiber shall utilize "LC" type connectors with zirconia ceramic ferrule and bend limiting strain relief.

C. Optical fiber connections for single mode optical fiber shall utilize "ST" type connectors with zirconia ceramic ferrule and bend limiting strain relief

D. The maximum optical attenuation for each rated connector pair shall not exceed 0.7 dB.

E. The connectors shall sustain a minimum of two-hundred (200) mating cycles without violating performance requirements as outlined in EIA/TIA 568B.3.

F. Connectors shall be color coded according to the optical fiber type for which they are applied. 9/125μm single mode shall be blue, and laser-optimized 50/125μm multimode shall be aqua.

2.5 INNERDUCT

A. Innerduct shall be riser or plenum rated, as required for the environment in which it is placed.

B. Innerduct shall be flexible, corrugated, and non-metallic.

C. Innerduct shall be 1-1/4" diameter.

D. Innerduct shall NOT be required where optical fiber cabling construction is specified with a jacketed interlocking armor.

PART 3 - PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Examine all elements intended for Communications. Check pathways, raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, installation hazards or impediments, and other conditions affecting installation. Verify that all work required in the field is adequately described in the plans. Proceed with installation only after unsatisfactory conditions and discrepancies have been brought to the attention of the General Contractor or Construction Manager and corrected.

B. Unless otherwise noted, the footages for cabling and materials shown on the Project Drawings are based upon available plant records, architectural drawings, or the engineer’s route and pathway assumptions. The Contractor shall be required to perform field surveys and measurements, prior to ordering materials.

C. Unless otherwise stated, where installation requirements identified in Reference Standards conflict with the manufacturer’s recommendations, the more restrictive shall be apply.

D. Bring to the attention of the Owner and Engineer conflicts between manufacturer's instructions and Contract Documents.
3.2 OPTICAL CABLE INSTALLATION

A. The Contractor shall field survey and review with the Owner and Engineer similar installations on campus that contain the same type of materials that are used for this Project to gain the desired routing and layout, installation techniques, and finished-look prior to start of construction and as often as necessary during the construction process.

B. Install all cables through primary and secondary pathways. Unless otherwise specified, installation methods and techniques shall satisfy ANSI/EIA/TIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces.

C. Where cables are supported from building structure they shall be adequately supported such that the cable will not be damaged by normal building use.

D. Cables shall not be installed or routed in any manner that violates the manufacturer's specifications. Manufacturer's minimum bend radius for static (post installation) cables is 10 times the cable diameter. Manufacturer's minimum bend radius for cables under strain (pulling tension) is 20 times the cable diameter.

E. Unless otherwise specified, terminate cables in accordance with ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Cabling Standard, observing the industry standards for terminating color-coded cables for premises and campus environments.

F. Do not install damaged or defective cable. Installation of damaged cable will not be accepted. Unless otherwise allowed by the Owner, damaged cable shall be removed and new cable installed at the expense of the Contractor. Damage includes physical damage to the cable and damage that may affect performance. THE OWNER WILL NOT ACCEPT CABLE OF ANY TYPE UNTIL AFTER IT IS INSTALLED AND PASSES A PHYSICAL INSPECTION AND ALL PERFORMANCE TESTS.

G. Cable Support along Primary Pathway

1. Primary pathways include major pathways for cable routed floor-to-floor, through corridors, and pathways that carry cables feeding multiple areas which are likely to be used to support growth in those areas. Primary pathways carry cable to secondary pathways.

2. Where cable tray cannot be installed to be continuous, provide support and strain relief for cables using mechanical fasteners such as J-hooks, conduit, C-channel, and other necessary devices to support cables around discontinuity. In exposed areas support cables as indicated on Drawings.

3. Where a telecommunication raceway, cable tray, or cable rack is provided, all telecommunication cables shall utilize the system except:
   a. emergency system wiring
   b. fire alarm systems

4. Cables shall be routed to avoid cable crossover between cable continuing vertically floor-to-floor and cable routed horizontally.

5. Cable installation and cable routes shall be planned and cables shall be installed such that the capacity of the conduit, sleeves, and cable tray is used most efficiently.

6. Bundle and route cables throughout the building to maintain neat, uniform, and combed bundles. Where cable is exposed in vertical runs, such as utility shafts, provide reusable cable straps to neatly contain cable bundles.

7. Provide strain relief for cables routed vertically using mechanical fasteners such as conduit, C-channel, reusable cable straps, other necessary devices to support cables.

8. Use common vertical sleeve(s) for routing of all optical intra-building backbone/riser cables. Provide strain relief for cables routed vertically using mechanical fasteners such as conduit, C-channel, reusable cable straps, other necessary devices (such as Erico/Caddy #CAT600WM) to support cables.

9. Secure all intra-building backbone cables to the MC and TR walls to prevent movement of the cable. D-rings shall be acceptable for this purpose.

10. Secure the cables to the Cable Runway to prevent movement of the cable and use the horizontal Cable Runway to route the cable to the point of termination.

11. Furnish a fifteen (15) foot service loop within all MC and TR locations.
3.3 CABLE MANAGEMENT AND ROUTING AT DISTRIBUTION FRAMES
A. Cabling shall be arranged on the patch panels in sequential numerical order by cable number.
B. Cabling shall be arranged on the termination blocks in sequential numerical order by cable pair.
C. At distribution frames route cables along the backboard vertically and horizontally to avoid diagonal routing. Where the termination location is unspecified, neatly coil enough cable slack in each closet to reach the farthest corner of the backboard routing vertically and horizontally.
D. Plan cable layout, routing, and cable management on the backboard such that:
   1. Cable cross-over is minimal.
   2. Cables are kept as short as practicable.
   3. Station cables and equipment cables are neatly shaped, combed, and bundled vertically and horizontally.

3.4 OPTICAL CABLE SPLICES
A. All splices shall be performed in a splice closure specifically designed for the number of cables, size of cables, quantity of conductors, and environment of the splice.
B. Metallic shields (such as protective armor) of telecommunications cables shall be bonded together within the closure of all splices.
C. All cables entering a splice case shall be supported independent of the splice case to a supporting structure and such that the splice case is accessible for re-entry.

3.5 CABLE REMOVAL
A. All optical cable and termination hardware that is replaced with new shall be removed.
B. Conduit and enclosures shall remain. Blank covers shall be provided for abandoned junction boxes.
C. All penetrations and sleeves affected by removal of cable shall be fire-stopped after removal of cable to maintain required fire rating.
D. Existing termination hardware within the existing telecommunications spaces and communications enclosures shall be removed from service after cutover.
E. Existing distribution frame hardware and cabling shall be removed after active services are transferred to new cabling system as verified at frame.

3.6 OPTICAL CABLE INSTALLATION AND ROUTING
A. The optical fiber cable shall be installed after complete installation of the innerduct if innerduct is specified.
B. All optical fiber cable shall be home-run. Cables shall not be spliced.
C. The cable shall be installed in accordance with the manufacturer's specifications for installation and loading. The short and long term cable loading values shall not be violated.
D. The manufacturer's minimum bending radius under both loaded and unloaded conditions shall not be violated. Cable wrinkling shall be avoided.
E. Cable and inner duct routes shall be defined prior to installation such that the cable lengths are accurate, such that securing cable in place will not result in shortage of cable, and such that desired routing paths are not compromised because of inaccurate planning and coordination.

F. A service loop of 10 feet (minimum) shall be provided at both ends of the cable unless otherwise indicated on the drawings. The location of the service loop shall be placed such that the cable can be extended without interference of other systems such as mechanical systems, electrical piping, plumbing, racking, etc. The direction of the loop (i.e., clockwise or counter-clockwise) shall be such that the cable enters the rack and distribution hardware with minimal bends. The service loop shall be stored out-of-way and fastened to prevent possible damage.

3.7 OPTICAL FIBER TERMINATION

A. General Optical Fiber Termination

1. All Single-mode fiber shall be fusion spliced, fiber to fiber or fiber to factory made jumper with ST connectors. All Single-mode fiber will have ST connectors.
2. Backbone (multimode) optical fiber cables shall be directly terminated with LC composite/ceramic connectors using LC connectors. All Single-mode fiber will be fusion spliced to jumpers.
3. Cable and fiber protection, installation, and termination shall be according to the connector manufacturer’s recommended practices and shall use the manufacturers, kits, processes, cleaners, solvents, fasteners, and other mechanisms necessary for a complete termination unless otherwise indicated herein.
4. Unless otherwise indicated, all cable routing, management, preparation, protection, installation, and storage shall be according to the hardware manufacturer’s recommended practices and shall use the manufacturers, kits, processes, cable and fiber management hardware, fasteners, and other mechanisms necessary for a complete installation.
5. The multimode fibers shall be terminated with a connector that is beige in color and shall be inserted into the adapter that is beige in color. The single-mode fibers shall be terminated with a connector that is blue in color and inserted into the adapter that is blue in color.
6. Cable and fiber terminations shall be labeled. Contractor shall provide information per Owner furnished cable recording documents.
7. Cable termination shall incorporate industry standard color coding and positioning within the enclosures. Refer to Paragraph 3.8.4 for adapter orientations.
8. The connector panels that contain the LC adapters shall accommodate six adapters (six fibers). See paragraph 3.8.4 for orientation of the adapters for desired polarity.

B. Optical Fiber Termination With in Rack Mount Patch Panels

1. Coordinate with Owner and Engineer to field review the installation of enclosures and hardware to gain desired installation techniques and placement practices before their installation throughout campus buildings.
2. Install the Patch Panels as shown on the drawings. Unless otherwise shown, all enclosures shall be installed tight to each other in the equipment racks.
3. The Patch Panels shall be installed with connector panels in low density configuration.

C. Optical Fiber Termination Adapter Orientation

1. Specific orientation of the adapters is necessary to maintain the correct polarity of the transmit and receive signals throughout the campus. Polarity is achieved by physical key slot orientation of adapters in the fiber distribution enclosures. The adapter orientation that shall be applied will be included with the fiber cable recording documents from the Owner and Engineer. The key-slot-up or key-slot-down orientation as it relates to the A/B and B/A designation is shown below.
2. Physical orientation of the adapters shall be achieved by removing and rotating the adapter within the connector panel to the proper key-slot-up or key-slot-down.
3. Owner will furnish adapter orientation information in the following tabular form. Refer to the Table below.
3.8 FIRESTopping

A. Fire stopping shall be installed after all cabling under contract has been installed. Refer to Specification Section 270500 Common Work Results for Communications

3.9 OPTICAL FIBER TESTING AND DOCUMENTATION

PROCEDURES A. End-to-End Attenuation Testing per Segment

1. The following common guidelines apply to all test procedures and shall be followed to promote efficient and accurate testing:
   a. Test jumpers shall be of the same fiber, fiber core size and connector type as the cable being tested.
   b. Power meter and the light source shall be set to the same wavelength.
   c. All system optical connectors, sleeves, and jumpers shall be properly cleaned prior to measurement.

2. The optical power loss in the optical fiber shall be measured for each segment of optical fiber cable by performing end-to-end attenuation testing of cable segments.

3. End-to-End Attenuation Test Requirements:
   a. Testing shall be performed on all optical fibers in all cables. b. Each cable shall be tested end to end.
   c. All testing shall be performed after the optical fiber cable is installed in its final resting place, after all buffer tubes, pigtails, and fiber strands are routed and secured in their final resting place, and after all optical fiber strands are terminated with connectors and inserted into the adapters in the connector panels within the enclosures.
   d. All measurements and recordings shall be performed with the optical source at the entrance facility.

4. Multimode Optical Fiber - End-to-End Attenuation Test Procedure:
   a. Perform the test at both 850 nm and 1300 nm.
   b. Testing shall be performed in one direction.
   c. Tests shall be performed with an optical source and optical power meter.
   d. The test procedure that shall be used is ANSI/EIA/TIA-526-14A-Test Method B, Optical Power Loss Measured of Installed Multimode Fiber Cable
   e. Identify unsolvable discrepancies to the Owner and Engineer.

5. Single Mode Optical Fiber - End-to-End Attenuation Test Procedure:
   a. Perform the test at both 1310 nm and 1550 nm. b. Testing shall be performed in one direction.
   c. Tests shall be performed with a optical source and optical power meter.
   d. The test procedure that shall be used is ANSI/EIA/TIA-526-7-Test Method A.1, Optical Power Loss Measured of Installed Single-mode Fiber Cable
   e. Identify unsolvable discrepancies to the Owner and Engineer.

6. End-to-End Attenuation Test Result Analysis:
   a. In the field with the test gear in place, compare the test result with the expected optical power loss from the Owner-furnished table. Trouble-shoot and correct for results that are outside the expected range and when the results prove inconsistent and retest. This is an iterative process.
b. Notify the Owner and Engineer of test results that are out of range for reasons other than installation practices.

7. End-to-End Attenuation Test Documentation:
   a. The Test Documentation requirements are the minimum requirements. Other details of presentation and recording methods will be discussed with the Owner and Engineer. Gain approval from Owner and Engineer of the test documentation format and content prior to campus-wide testing. Coordinate with Owner and Engineer to get representative sample of the documentation format and content for review.
   b. Provide the Owner with both a printed copy and the electronic files on disk of the test results.
   c. The Contractor shall provide the test data in a complete, consistent, and tabular format. All results shall be printed from a laser printer.
   d. The report shall include the information shown in Appendix A. The report shall be formatted as shown in Appendix A unless otherwise approved by the Owner and Engineer. The information shown is the minimum that shall be included in the report. Reports generated by the optical test equipment are acceptable if approved by the Owner and Engineer.
   e. Provide the printed results paper-clipped together in numerical order by building fiber cable number. The tab label shall indicate ONLY the cable number on a laser printed label.

B. Signature Traces (Single Mode Optical Fiber Only)
   1. The signature trace shall not be required under this Contract.

3.10 WIRE AND CABLE IDENTIFICATION

A. Furnish and install labels as identified in Specification Section 270553 Identification for Communication Systems.

END OF SECTION 271323
SECTION 271513 – COMMUNICATIONS COPPER/OPTICAL FIBER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Section 270000 – Communications General

C. Section 270500 – Common Work Results for Communications

D. Section 270526 – Grounding and Bonding for Communications

E. Section 270528 – Pathways for Communications

F. Section 270553 – Identification for Communications Systems

G. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures

H. Section 271119 – Communications Termination Blocks and Patch Panels

I. Section 271123 – Communications Cable Management and Cable Runway

J. Section 271313 – Communications Copper Backbone Cabling

K. Section 271323 – Communications Optical Fiber Backbone Cabling

L. Section 271543 – Communications Faceplates and Connectors

M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire

N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General

B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 SYSTEM DESCRIPTION

A. Communications Copper Horizontal Cabling shall be furnished, installed, tested, labeled, and documented from each MC (Main Cross-Connect) or TR (Telecommunication Closet) to all WAOs (Work Area Outlets), TO (Telecommunications Outlets), and EO (Equipment Outlets) ready for connection of file servers, personal computer stations, telephones, medical equipment, wireless access points, video control interfaces, monitoring interfaces, printers, modems, and all other equipment as designated by UMKC (University of Missouri - Kansas City) Networking & Telecommunications.

B. Category 6a Communications Copper Horizontal Cabling shall be sourced from, and certified by, the following approved termination hardware manufacturer(s) per project site.

1. BELDEN/CDT-IBDN
1.4 DEFINITIONS

A. Refer to Section 270000 – Communications General

1.5 ACRONYMS & ABBREVIATIONS

A. Refer to Section 270000 – Communications General

1.6 SUBMITTALS

A. Refer to Section 270000 – Communications General

B. Product Data Sheets

C. Specification Sheets for Test Equipment
   1. Hand-held testing equipment manufacturer, model, and software version.
   2. Injector equipment manufacturer, model, and software version.

D. Bill of Materials

E. Contracting Firm Qualifications and Certifications

F. Current Manufacturer Certifications

G. 100% Test Results as detailed within PART 3 EXECUTION

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Cables from approved list as maintained by the termination hardware manufacturer for the solution proposed:

   1. BELDEN/CDT-IBDN

2.2 REFERENCE PART NUMBERS

A. Refer to Section 270000 Communications General, Part 2 - Products

B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.

C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 COPPER HORIZONTAL CABLING

A. The Horizontal System is the portion of the telecommunications cabling system that extends from the TO (Telecommunications Outlet) connector to the HC (Horizontal Cross-connect), located in the MC (Main Cross-Connect) or TR (Telecommunications Room)). It consists of the telecommunications outlet/connector, horizontal cables, optional CP (Consolidation Point) if indicated in the Project Drawings,
and that portion of cross-connect in the MC/TR serving the horizontal cabling. Each floor of a building should be served by a distinct Horizontal System, unless otherwise directed by the UMKC Networking & Telecommunications.

1. Horizontal cabling shall be TIA 568.C.2 Class E performance rated Category 6a. All cables shall be imprinted by the manufacturer as Category 6a, at minimum.
2. All cabling shall consist of four (4) unshielded twisted pairs; non-bonded solid bare copper conductors, color-coded per the band strip color coding conventional standard as follows:
   a. Pair #1 - White/Blue-Blue
   b. Pair #2 - White/Orange-Orange
   c. Pair #3 - White/Green-Green
   d. Pair #4 - White/Brown-Brown
3. All Horizontal system cables shall CMP. These markings shall also include the name of the cable manufacturer and the category performance rating.
4. Cable jacket shall be sequentially marked at 2-foot intervals.
5. Horizontal cabling shall be white in color.
6. Physical Characteristics
   a. Gauge: 23 AWG
   b. Cable Diameter: .247"
   c. Nominal Weight: 34 lbs./kft.
   d. Max. Install Tension: 45 lbs.
   e. Min. Bend Radius: 1.5"
   f. Operating Temperature: -20° to +75°C
7. Performance Characteristics
   a. Mutual Capacitance: 15.4pF/ft. nom., 330pF/100m max.
   b. DC Resistance: 6.6 ohms/100m
   c. Skew: 25ns/100m
   e. Cabling shall exhibit the following minimum performance characteristics at the following frequencies:

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<th>Parameter</th>
<th>100MHz (dB)</th>
<th>200MHz (dB)</th>
<th>250MHz (dB)</th>
<th>400MHz (dB)</th>
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<td>33.9</td>
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<td>Min. PSACRF</td>
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<tr>
<td>Min. Return Loss</td>
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<td>9.0</td>
<td>8.0</td>
<td>6.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Category 6a Minimum Cable Performance Standards

B. Contractor shall provide the Owner with an estimate of the quantities of the required BELDEN/CDT-IBDN materials.

C. Communications cables shall be type and size (number of pairs) identified for the installation of the various communications systems.

D. Communications cables shall be UL Listed and Approved for intended use. All cable shall be of Type specified by the NEC for use in plenum, non-plenum, and riser spaces.

E. Communications cables installed in cable trays or racks shall be APPROVED for use in such and shall be of fire-resistive construction.

F. Communications cable suitable for use in ducts, plenum, and other space used for environmental air shall be UL Listed as being smoke resistant, shall be Teflon-coated and shall be classified as type CMP communications cable.

G. Communications cable suitable for use in vertical shafts shall be UL Listed for use in such space and shall be classified as type CMR communications cable
**2.4 OPTICAL FIBER HORIZONTAL CABLING**

A. New segments of multi-element optical fiber backbone cable shall meet the requirements of the National Electrical Code® (NEC®) Section 770. The cable shall be listed OFNR (OFCR) for riser (non-plenum) applications or OFNP (OFCP) for plenum applications, as required. The indoor backbone fiber shall be multi-mode and single mode, utilizing a tight buffered, air-core design with all-dielectric strength member construction.

B. Minimum bend radius shall be no less than fifteen (15) times outside diameter under full tensile load and no less than ten (10) times outside diameter under no load.

C. New Multi-mode Optical Fiber segments shall meet the requirements of EIA/TIA-492AAAC “Detail Specification for 850-nm Laser-Optimized, 50μm Core Diameter/125μm Cladding Diameter Class 1a Graded-index Multimode Optical Fibers.”

D. Color Coding
   1. For indoor applications, the color of the outer jacket shall be aqua for cables containing 50/125 μm Laser Optimized Fiber.
   2. For indoor applications, the color of the outer jacket shall be yellow for cables containing single mode fiber.

E. Each optical fiber backbone cable shall consist of a minimum number of individual elements specified within the Project Drawings such as backbone/riser schematics.

F. Optical fiber cabling shall be available in 2-element configuration.

G. All optical fiber cables shall be shipped with OTDR results for each fiber. OTDR results shall show attenuation and bandwidth. The results shall be documented in such a manner that the information can be retained for future use.

H. Backbone (riser) cable in non-plenum air spaces shall be NEC Type OFNR as follows:
   1. Tight buffered Fan-Out Riser Cable.

I. Backbone (riser) cable in plenum air spaces shall be NEC Type OFNP as follows:
   1. Tight buffered Fan-Out Plenum Cable.

**2.5 OPTICAL FIBER CONNECTORS**

A. All optical fiber cables shall be terminated with permanently installed connectors per EIA/TIA-45 S-21.

B. Optical fiber connections for multimode optical fiber shall utilize “LC” type connectors with zirconia ceramic ferrule and bend limiting strain relief.

C. Optical fiber connections for single mode optical fiber shall utilize “ST” type connectors with zirconia ceramic ferrule and bend limiting strain relief

D. The maximum optical attenuation for each rated connector pair shall not exceed 0.7 dB.

E. The connectors shall sustain a minimum of two-hundred (200) mating cycles without violating performance requirements as outlined in EIA/TIA 568B.3.

F. Connectors shall be color coded according to the optical fiber type for which they are applied. 9/125μm single mode shall be blue, and laser-optimized 50/125μm multimode shall be aqua
PART 3 - EXECUTION

3.1 FIELD CONDITIONS

A. Examine all elements intended for Communications. Check pathways, raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, installation hazards or impediments, and other conditions affecting installation. Verify that all work required in the field is adequately described in the plans. Proceed with installation only after unsatisfactory conditions and discrepancies have been brought to the attention of the General Contractor or Construction Manager and corrected.

B. Unless otherwise noted, the footages for cabling and materials shown on the Project Drawings are based upon available plant records, architectural drawings, or the engineer's route and pathway assumptions. The Contractor shall be required to perform field surveys and measurements, prior to ordering materials.

C. Unless otherwise stated, where installation requirements identified in Reference Standards conflict with the manufacturer's recommendations, the more restrictive shall be apply.

D. Bring to the attention of the Owner and Engineer conflicts between manufacturer's instructions and Contract Documents.

3.2 CABLE INSTALLATION

A. The Contractor shall field survey and review with the Owner and Engineer similar installations on campus that contain the same type of materials that are used for this Project to gain the desired routing and layout, installation techniques, and finished-look prior to start of construction and as often as necessary during the construction process.

B. Install all cables through primary and secondary pathways. Unless otherwise specified, installation methods and techniques shall satisfy ANSI/EIA/TIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces.

C. Where cables are supported from building structure they shall be adequately supported such that the cable will not be damaged by normal building use.

D. Horizontal station cables shall be home-run from the communication outlet box at the work area to the distribution frame serving the area as shown on the Drawings. Horizontal copper cabling runs shall be placed in one continuous end-to-end length between the MC or TR and the WAO, TO, or EO without splices of any kind.

E. Cables shall not be installed or routed in any manner that violates the manufacturer's specifications. Manufacturer's minimum bend radius for static (post installation) cables is 10 times the cable diameter. Manufacturer’s minimum bend radius for cables under strain (pulling tension) is 20 times the cable diameter.

F. Unless otherwise specified, terminate cables in accordance with ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Cabling Standard, observing the industry standards for terminating color-coded cables for premises and campus environments.

G. Do not install damaged or defective cable. Installation of damaged cable will not be accepted. Unless otherwise allowed by the Owner, damaged cable shall be removed and new cable installed at the expense of the Contractor. Damage includes physical damage to the cable and damage that may affect performance. THE OWNER WILL NOT ACCEPT CABLE OF ANY TYPE UNTIL AFTER IT IS INSTALLED AND PASSES A PHYSICAL INSPECTION AND ALL PERFORMANCE TESTS.

H. Cable Support along Primary Pathway

1. Primary pathways include major pathways for cable routed floor-to-floor, through corridors, and pathways that carry cables feeding multiple areas which are likely to be used to support growth in those areas. Primary pathways carry cable to secondary pathways.

2. Where cable tray cannot be installed to be continuous, provide support and strain relief for cables
using mechanical fasteners such as J-hooks, conduit, C-channel, and other necessary devices to support cables around discontinuity. In exposed areas support cables as indicated on Drawings.

3. Where a telecommunication raceway, cable tray, or cable rack is provided, all telecommunication cables shall utilize the system except:
   a. emergency system wiring  
   b. fire alarm systems

4. Cables shall be routed to avoid cable crossover between cable continuing vertically floor-to-floor and cable routed horizontally.

5. Cable installation and cable routes shall be planned and cables shall be installed such that the capacity of the conduit, sleeves, and cable tray is used most efficiently.

6. Bundle and route cables throughout the building to maintain neat, uniform, and combed bundles. Where cable is exposed in vertical runs, such as utility shafts, provide reusable cable straps to neatly contain cable bundles.

7. Provide strain relief for cables routed vertically using mechanical fasteners such as conduit, C-channel, reusable cable straps, other necessary devices to support cables.

8. Cables may NOT be stapled or permanently held or fastened at any point along primary pathway.

I. **Cable Support Along Secondary Pathway**

1. Secondary pathways extend from the primary pathway to the communication outlet box. Secondary pathways carry cable from the primary pathway to the communication outlet box.

2. Cable shall be routed parallel and perpendicular to walls and floor from the primary pathway to the outlet box. WHERE MULTIPLE ROUTES ARE POSSIBLE ROUTE CABLE ALONG THE SHORTEST ROUTE TO MINIMIZE CABLE LENGTH AS PRACTICABLE.

3. Attaching or otherwise draping cables to ceiling wire grid, pipes by other trades, lighting fixtures, etc. shall not be permitted.
   a. Do not use suspended ceiling support hangers (wires) to support station cables.
   b. Do not support cable from other mechanical, electrical, or plumbing, systems.
   c. Station cables shall be supported such that they do not rest on the suspended ceiling system.

4. Cables and cable pathways shall be supported from the building structure. Superstructure designed and intended to support multiple utilities may be used as a superstructure for communications cables if the superstructure can physically support the additional load and if the support mechanism for the cable works for supporting the cable from the superstructure.

5. J-Hooks and other independent cable supports shall be located on 48” to 60” centers to adequately support and distribute the cable weight.

6. The Contractor shall be responsible for determining the route and quantity of J-Hooks and other independent cable supports within the overhead ceiling space wherein cable tray or other support systems have not been provided by Division 26. .

7. Where J-Hooks and independent cable supports are used, runs shall follow walls and building supporting structures; diagonal runs shall not be acceptable.

8. Place cables without exceeding cable manufacturer’s recommended pulling tensions.

9. Pull cables simultaneously if more than one is being pulled in the same raceway.

10. Use pulling compound or lubricant only if necessary. Use compounds that will not damage conductor or insulation.

11. Use pulling means, including fish tape, cable, rope, and basket weave or cable grips that will not damage cabling or raceways.

12. Cables may NOT be stapled or permanently held or fastened at any point along secondary pathway.

3.3 **CABLE BUNDLING HARDWARE**

A. Cable bundling hardware shall be rated for the environment and application in which used. Applications include, but are not limited to, general purpose, outdoor, chemical resistant, flame retardant, high temperature, and vibration.

B. Provide reusable cable management straps for bundling and securing horizontal station cables and equipment jumper cables within entrance facilities and telecommunication closets. Do not use nylon cable ties.

C. Provide reusable cable management straps for bundling and securing horizontal station cables at primary vertical pathways. Do not use nylon cable ties.

D. Do NOT strap horizontal station cable to cable tray and ladder rack.
3.4 CROSS-CONNECT JUMPERS

A. Coordinate installation of jumpers with Owner prior to starting work.

B. Provide 2” minimum and 4” maximum service loop in each cross-connect jumper for voice and data circuits at each end.

C. Cross-connect jumpers shall be uniform in shape.

D. Plan and route cross-connect jumpers for voice circuits and data circuits through the jumper rings on the frames such that they are not intermixed haphazardly. Keep voice and data cross-connect jumpers segregated as possible.

3.5 CABLE MANAGEMENT AND ROUTING AT DISTRIBUTION FRAMES

A. Cabling shall be arranged on the patch panels in sequential numerical order by cable number.

B. Cabling shall be arranged on the termination blocks in sequential numerical order by cable pair.

C. At distribution frames route cables along the backboard vertically and horizontally to avoid diagonal routing. Where the termination location is unspecified, neatly coil enough cable slack in each closet to reach the farthest corner of the backboard routing vertically and horizontally.

D. Plan cable layout, routing, and cable management on the backboard such that:

   1. Cable cross-over is minimal.
   2. Cables are kept as short as practicable.
   3. Station cables and equipment cables are neatly shaped, combed, and bundled vertically and horizontally.

3.6 COPPER CABLE SPLICES

A. Horizontal station cables shall not be spliced.

3.7 CABLE REMOVAL

A. All horizontal station cable and termination hardware that is replaced with new shall be removed.

B. Existing twisted pair communications cable and hardware in the project area that has been abandoned in place prior to this Project shall be removed.

C. Conduit and enclosures shall remain. Blank covers shall be provided for abandoned outlet boxes.

D. All penetrations and sleeves affected by removal of cable shall be fire-stopped after removal of cable to maintain required fire rating.

E. Existing termination hardware within the existing telecommunications spaces and communications enclosures shall be removed from service after cutover.

F. Existing distribution frame hardware and cabling shall be removed after active services are transferred to new cabling system as verified at frame.

3.8 WIRE AND CABLE IDENTIFICATION

A. Furnish and install labels as identified in Specification Section 270553 Identification for Communication Systems.
3.9 FIRE STOPPING

A. Fire stopping shall be installed after all cabling under contract has been installed. Refer to Specification Section 270500 Common Work Results for Communications

3.10 UTP TESTING AND DOCUMENTATION PROCEDURES

A. General

1. This Section includes link and channel testing methods, procedures and minimum transmission requirements for the installed unshielded twisted pair (UTP) Category 6a rated cable systems installed under this Project.
2. The purpose of the testing is to ensure proper installation of the UTP telecommunications cabling system.
3. Unless otherwise specified herein, all testing definitions, parameters, methods, and practices shall comply with the Performance Standards identified in Specification Section 270000 Communications General.
4. Unless otherwise indicated, a field link test shall be performed on new horizontal cables installed under the Project and on existing horizontal cables that are re-terminated, rerouted, and where the termination is disturbed to perform work under the project.
5. Unless otherwise indicated, a field channel test shall be performed ONLY on those outlet locations receiving data service. The outlets to receive data service are identified on the Owner-provided cutover cable records. The channel test for locations receiving data service is ADDITIONAL TO the link test for the location.
6. Two week (14 days) prior to scheduled cutover date the Owner shall receive from the Contractor printed copper station cable performance test results. Cutover shall not commence unless test results are submitted.

B. Link Definition for the Project

1. A link consists of up to 90 meters (295 feet) of horizontal cabling, a connection at each end, up to 2 meters of test equipment lead from the main unit of the hand-held tester to the local connection, and up to 2 meters of test equipment lead from the remote unit to the remote connection. A total length of up to 94 meters (308 feet).
2. The connection to the equipment at each end of the link is not included in the link definition.

C. Channel Definition for the Project

1. A channel consists of up to 90 meters (295 feet) of horizontal cabling, a connection at each end, up to 7 meters for the cross-connect and equipment cable, and up to 3 meters for the work area equipment cable. A total length of up to 100 meters (328 feet)
2. The connection to equipment at each end of the channel is not included in the channel definition.

D. Field Tests to be Performed:

1. The following field tests shall be performed for both the link and the channel for category-6a performance:
   a. Wire Map
   b. Length
   c. Attenuation
   d. Near-end Crosstalk (NEXT) Loss

E. Test Equipment:

1. Test equipment shall be equipped with the most current software upgrades to meet applicable testing standards. Calibration of the testing instruments shall be current as per the manufacturer’s requirements. Test cords, adapters, and connectors shall be maintained in good order. Test instruments must be identified on the applicable summary test forms as to make, model, software generic, and calibration date.
2. This Contractor may be required to field demonstrate the calibration and testing procedures to UMKC Networking & Telecommunications. UMKC Networking & Telecommunications shall confirm the demonstration requirement prior to start of field test operations
3. Unless pre-approved by UMKC Networking & Telecommunications, all copper certification testing shall be performed using test equipment as follows:

F. Test Equipment Setup and Test Parameters:
1. Autotest: Use the “Cat6 Link Full” and “Cat6 Channel Full” Autotests from the Autotest List to perform the required link and channel tests. Customize the Autotest as necessary to satisfy testing requirements and parameters.
2. Cable Type: Select the cable type being tested. Cable Type may vary. Always change the NVP as identified herein for the type of cable being tested.
3. NVP: The Nominal Velocity of Propagation (NVP) shall be determined by field measuring a 150-foot piece of cable according to the manufacturer’s instructions. The cable shall be unspooled and physically measured with a tape measure. Do not use footage markings on the cable to determine 150 feet. The cable shall be terminated on both ends with an 8-pin modular jack. The PentaScanner+ calculates the NVP based on the cable’s shortest wire pair. The NVP shall be printed on the test report.
4. Frequency Range: The frequency range for category 6A tests shall be 1 MHz to 500 MHz. The category 6A Permanent Link and category 6A Channel Autotest default frequency range is 1 MHz - 500 MHz.
5. Cable Pairs: Test all cable pairs. Select all pairs for TEST and all pairs for Pass/Fail criteria for Autotest.
6. Length Units: Cable length test results shall be in feet.
7. Date Style. The date style shall show month, day, and year. Date shall be the date the test is conducted.
8. Language: The language shall be English.

G. Test Procedure
1. The Contractor shall provide 48-hours’ notice to the UMKC Networking & Telecommunications Engineer prior to commencement of cable testing. The Engineer shall, at his discretion, be present to observe any and all cable test procedures. Cable testing procedures shall be acceptable to the Engineer.
2. Testing shall be performed with the tester at the distribution frame and the injector at the work area outlet.
3. All tests shall be performed with connectors and termination completed and in-place.
4. Test leads and test hardware have limited life-cycles. Inspect and replace the test leads as necessary.
5. Use only test leads specified by the test equipment manufacturer.
6. Strictly follow the test equipment manufacturer's instructions for equipment setup, initialization, and calibration.
7. Any and all cables or components not satisfactorily passing the tests as described or failing to meet quality installation standards as described in this specification, shall be repaired and/or replaced at the Contractor's expense.

H. Test Documentation
1. The Test Documentation requirements are the minimum requirements. Other details of presentation and recording methods will be discussed with the Owner and Engineer. Gain approval from Owner and Engineer of the test documentation format and content prior to full-scale testing. Coordinate with Owner and Engineer to get representative sample of the documentation format and content for review.
2. Provide the Owner with both a printed copy and the electronic files on disk of the test results.
3. The test report shall include the information shown in the Appendix-A sample, unless otherwise approved by the Owner and Engineer. The italicized information on the report is example information and is variable. Customize the information for the particular installation.
4. Printed copy shall include the following header fields on each test report shall contain the appropriate information. These are minimum requirements:
   a. Circuit ID
   b. Test Result
   c. Owner
   d. Serial Number
   e. Injector Serial Number
   f. Software Version
   g. Date
   h. Cable Type
   i. NVP
The information in each user definable header field on each test report shall contain the information as follows:

- **Circuit ID:** Indicate the outlet location number and jack number under test
- **Owner:** Indicate the owner of the test equipment
- **Date:** Indicate the date of the test
- **Cable Type:** Indicate the cable type being tested
- **NVP:** Indicate the field measured NVP
- **Building:** Indicate the building where the cable is being tested
- **Closet:** Indicate the closet identifier where the cable is terminated

The minimum test result information on each report shall include the data for the tests identified in "Field Tests Performed".

The Contractor shall provide the test data in a complete and consistent format. All results shall be printed from a laser printer.

Provide the printed results contained in 3" three-ring notebook binders. The test results shall be three-hole punched and numerically ordered by outlet location number within the notebook. Provide separate notebooks for Channel Test results and Link Test results. Multiple volumes may be necessary. Separate all FAIL test results in each notebook from the PASS test results. Provide a separator tab labeled "Fail Results" in front of the sheets of FAIL test results. Provide a separator tab labeled "Pass Results" in front of the sheets of PASS test results.

The cover of the notebook shall read (italicized information is variable):

- "PROJECT NAME"
- "Building Name (BLDG. No. x)"
- "UTP Test Results"
- "Volume No." X
- "Date" (month and year)

The contractor shall verify that a report for each jack in the Project is contained in the notebooks.

The electronic copy of the test results shall be on 3.5" floppy disks. The disks shall be double sided, high density, and IBM formatted.

Disks shall be labeled. The label shall read:

- "PROJECT NAME"
- "Building Name (BLDG. No. x)"
- "UTP Test Results on Disk"
- "Disk No." X of X
- "Date" (month and year)

The files on disk shall be in Comma Separated Variable (CSV) file format.
SECTION 271543 – COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section
B. Section 270000 – Communications General
C. Section 270500 – Common Work Results for Communications
D. Section 270526 – Grounding and Bonding for Communications
E. Section 270528 – Pathways for Communications
F. Section 270553 – Identification for Communications Systems
G. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures
H. Section 271119 – Communications Termination Blocks and Patch Panels
I. Section 271123 – Communications Cable Management and Cable Runway
J. Section 271313 – Communications Copper Backbone Cabling
K. Section 271323 – Communications Optical Fiber Backbone Cabling
L. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling
M. Section 271619 – Communications Patch Cords, Station Cords, and Cross-Connect Wire
N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS
A. Refer to Section 270000 – Communications General
B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 SUMMARY
A. This Section includes:
   1. Faceplates and Housings for Work Area Outlets (WAO), Telecommunications Outlets (TO), and Equipment Outlets (EO).
   2. Modular Jacks and Outlets for termination of data and voice cabling at WAOs, TOs, and EOs.

1.4 DEFINITIONS
A. Refer to Section 270000 – Communications General
1.5 ACRONYMS & ABBREVIATIONS
   A. Refer to Section 270000 – Communications General

1.6 SUBMITTALS
   A. Refer to Section 270000 – Communications General
   B. Product Data Sheets
   C. Specification Sheets for Test Equipment
   D. Bill of Materials
   E. Contracting Firm Qualifications and Certifications
   F. Installation Team Qualifications by Individual
   G. Current Manufacturer Certifications
   H. 100% Test Results as detailed within PART 3 - EXECUTION

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
   A. Belden/CDT-IBDN

2.2 REFERENCE PART NUMBERS
   A. Refer to Section 270000 Communications General, Part 2 - Products
   B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
   C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 FACEPLATES
   A. Furnish and install single gang modular cover plates with one (1) modular outlet opening for "Voice-Only" or “Data-Only” as indicated on Project Drawings.
   B. Furnish and install single gang modular cover plates with two (2), three (3), and four (4) modular outlet openings for "Voice" and “Data” as indicated on Project Drawings.
   C. Modular cover plates shall be plastic or stainless steel as required to match electrical plates supplied by Division 26 unless otherwise directed by UMKC - Networking & Telecommunications. Plastic modular furniture cover plates shall match the furniture’s kick plate color when possible. Confirm all colors with Networking & Telecommunications prior to ordering materials.
   D. Furnish and install 106-style modular mounting frames where required to adapt to surface raceway as may be provided by Division 26.
E. Furnish and install blank inserts for all un-used openings. Blank inserts shall be International White in color unless otherwise directed by UMKC - Networking & Telecommunications.

2.4 MODULAR CONNECTORS (JACKS/OUTLETS)
A. Furnish and install Modular Connectors consisting of RJ45 8-position modular jacks, meeting or exceeding transmission performance of Category 6a.
B. Modular Connectors shall be mounted in modular cover plates.
C. Modular Connectors shall be UL listed and comply with EIA/TIA 568BA.
D. All modular jacks shall be blue in color where purposed for “data” and red in color where purposed for “voice”, unless otherwise directed by UMKC - Networking & Telecommunications. Confirm all colors with Networking & Telecommunications prior to ordering materials.
E. Furnish and install keystone style jacks as may be required to be compatible with special assemblies such as poke-thru assemblies provided by Division 26.
F. Apply Blank Inserts to all un-used openings. Blank inserts shall be International White in color.

2.5 MODULAR JACK/OUTLET PLATE FOR WALL TELEPHONES
A. Flush mounted modular RJ11 jack/plate to fit into a single gang 3-1/2 inch deep box.
B. RJ11 modular jack shall be 6-position.
C. The RJ11 jack shall be mounted in a stainless steel faceplate designed for the modular mounting of wall telephones.

2.6 MULTIMEDIA OUTLET BOX
A. Furnish and install 6-port box, International White in color.
B. Equip with RJ45 modular connectors.

2.7 MULTI-USER OUTLET BOX
A. Furnish and install 24-port box, International White in color.
B. Equip with RJ45 modular connectors.

2.8 SURFACE MOUNT BOXES
A. Furnish and install single port surface mount box where Telecommunications Outlets are to be provided for Wireless Access Points (WAPs) and for IP-based Camera locations.

PART 3 - EXECUTION

3.1 COORDINATION
A. Confirm colors and identification schemes for cabling, faceplates, and Data/Voice Modular Copper Jacks and Connectors with Architect/Engineer and Owner’s Networking & Telecommunications Staff prior to placing material orders. The Architect/Engineer must approve requested changes, not in compliance with Drawings and Specifications.

B. Conduit, in-wall boxes, and floor boxes shall be provided by the Division 26 Contractor. The Division 27 Contractor shall be responsible to coordinate with Division 26 to confirm that proper box sizes shall be provided.

C. Surface Raceway, where indicated, shall be provided by the Division 26 Contractor. The Division 27 Contractor shall be responsible to coordinate with the Division 26 Contractor to confirm that proper box styles and sizes are be provided.

3.2 INSTALLATION

A. Install products in accordance with manufacturer’s written instructions and in full compliance with the National Electrical Code and other state and local requirements.

B. Quantity of horizontal station cables to install to each outlet location is keyed to outlet symbol on Drawings.

B. For horizontal station cables terminate each 4-pair cable component with new 4-pair, 8 position, 8 conductor, T568A pin/pair assignment designation, UTP modular jack. Install new faceplate and label each outlet.

D. Install 2-position faceplates unless otherwise specified herein or indicated on the Drawings.

E. All Faceplates shall be installed flush to the wall surface without any gap and shall be cleaned and leveled prior to final acceptance.

F. All Faceplates shall be labeled using machine generated type in alphanumeric order according to the UMKC labeling scheme to be published by bulletin prior to installation. Bulletin shall not result in additional cost to the project under any circumstances.

G. Damaged system component replacement shall be the responsibility of Contractor.

3.3 CERTIFICATION TESTING

A. Refer to Specification Section 271513 Communications Copper Horizontal Cabling, Part 3 – Execution.

3.4 WIRE AND CABLE IDENTIFICATION

A. Furnish and install labels as identified in Specification Section 270553 Identification for Communication Systems.

END OF SECTION 271543
SECTION 271619 – COMMUNICATIONS PATCH CORDS, STATION CORDS, AND CROSS-CONNECT WIRES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Section 270000 – Communications General

C. Section 270500 – Common Work Results for Communications

D. Section 270526 – Grounding and Bonding for Communications

E. Section 270528 – Pathways for Communications

F. Section 270553 – Identification for Communications Systems

G. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures

H. Section 271119 – Communications Termination Blocks and Patch Panels

I. Section 271123 – Communications Cable Management and Cable Runway

J. Section 271313 – Communications Copper Backbone Cabling

K. Section 271323 – Communications Optical Fiber Backbone Cabling

L. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling

M. Section 271543 – Communications Faceplates and Connectors

N. Section 273223 – Voice Communications Elevator Telephones

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General

B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 SUMMARY

A. This Section includes:
   1. Patch Cables for Backbone Cabling Systems
   2. Patch Cables for Horizontal Cabling Systems

1.4 DEFINITIONS

A. Refer to Section 270000 – Communications General
1.5 ACRONYMS & ABBREVIATIONS
   A. Refer to Section 270000 – Communications General

1.6 SUBMITTALS
   A. Refer to Section 270000 – Communications General
   B. Product Data Sheets
   C. Bill of Materials

1.7 MATERIALS FOR USE BY OWNER
   A. Furnish materials as described in Part 2 Products.
   B. Throughout the project lifecycle, all cords and jumper assemblies shall be securely stored at the Division 27 Contractor’s office facility. When called for by the Owner, materials shall be delivered by the Division 27 Contractor who shall obtain a signature of acceptance and delivery from the Owner.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS A.
   Belden-IBDN

2.2 REFERENCE PART NUMBERS
   A. Refer to Section 270000 Communications General, Part 2 - Products
   B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
   C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 COPPER PATCH/STATION CORDS – MC and TR – WAO, TO, and EO
   A. Category 6a, 23 AWG 8-conductor stranded copper patch cords with RJ45 plugs.
      1. Provide 100% of total port count Category 6a “data” patch cords required for patching at the TR (Telecommunications Room) locations. Budget length mix according to 5’ & 7’ as needed to evenly dress rack design shown in Project Drawings.
      2. Provide 100% of total port count Category 6a “data” patch cords for each modular cover plate at user end. Each patch cord shall be used for connecting to workstations and shall not be less than 9’ in length.
      3. Patch cables for “data” shall be blue in color.
   
   B. Patch cords shall be factory terminated.
   C. All patch cords shall be configured with straight through pinning with T568B pin-pair configuration.
   D. Patch cords shall not degrade the required channel performance characteristics as specified in EIA/TIA 568B.2.
E. Copper patch cords shall be supplied as a part of the manufacturer solution proposed.

PART 3 - EXECUTION

A. All Patch Cables shall be provided by the contractor.
B. The contractor shall provide one 15’ patch cord for every jack installed at the user interface.
C. The contractor shall provide one patch cord for every cable terminated in the ER/TR. (lengths to be determined by location in relation to termination and active equipment 4’, 7’, 10’, 15 are approved)

END OF SECTION 271619
SECTION 273223 – VOICE COMMUNICATIONS ELEVATOR TELEPHONES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Section 270000 – Communications General

C. Section 270500 – Common Work Results for Communications

D. Section 270526 – Grounding and Bonding for Communications

E. Section 270528 – Pathways for Communications

F. Section 270553 – Identification for Communications Systems

G. Section 271116 – Communications Cabinets, Racks, Frames, and Enclosures

H. Section 271119 – Communications Termination Blocks and Patch Panels

I. Section 271123 – Communications Cable Management and Cable Runway

J. Section 271313 – Communications Copper Backbone Cabling

K. Section 271323 – Communications Optical Fiber Backbone Cabling

L. Section 271513 – Communications Copper/Optical Fiber Horizontal Cabling

M. Section 271543 – Communications Faceplates and Connectors

1.2 CODES AND STANDARDS

A. Refer to Section 270000 – Communications General

B. Refer to Division 1 – Reference Standards and General Conditions of the Contract

1.3 SUMMARY

A. This Section includes:
   1. Elevator Telephones

1.4 DEFINITIONS

A. Refer to Section 270000 – Communications General
1.5 ACRONYMS & ABBREVIATIONS
   A. Refer to Section 270000 – Communications General

1.6 SUBMITTALS
   A. Refer to Section 270000 – Communications General
   B. Product Data Sheets
   C. Bill of Materials

1.7 MATERIALS FOR USE BY OWNER
   A. Furnish materials as described in Part 2 Products.
   C. Throughout the project lifecycle, all elevator telephones shall be securely stored at the Contractor’s office facility until installed in elevators.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURERS
   A. All IP elevator telephones approved and certified by their manufacture to work directly with Cisco Unified Communications Manager 9.1 or above.
   B. All analog elevator telephones approved and certified by their manufacture to work with Cisco Unified Communications Manager 9.1 or above through Cisco Systems VG350 analog to IP gateway product.

2.2 REFERENCE PART NUMBERS
   A. Refer to Section 270000 Communications General, Part 2 - Products
   B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
   C. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

2.3 ELEVATOR TELEPHONE PROGRAMMING, SETUP, INSTALLATION, CONFIGURATION AND OPERATION
   A. All phases of elevator programming, setup, installation, configuration and operations must work with Cisco Unified Communications Manager 9.1 or above.
      1. If an IP elevator phone is provided it must work on standard Ethernet cabling with Power over Ethernet directly connecting over the Universities network with Cisco Unified Communications Manager 9.1 or above.
      2. If an analog elevator phone is provided it must work with Cisco Unified Communications Manager 9.1 or above connecting through Cisco’s VG350 analog to IP gateway product.

PART 3 - EXECUTION

A. All elevator phones shall be provided by the contractor.
B. The contractor shall install all elevator phones.
C. The contractor shall do all programming, setup and configuration needed to make the elevator phones fully functional and operating in the owner environment.
D. Elevator telephone numbers will be provided by owner.

E. Owner will do all programming or settings requested by contractor on Cisco Communications Manager or analog gateways.
   1. Contractor will make all programming or settings changes on elevator phones.

END OF SECTION 273223