

University of Houston Master Specification

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SECTION 27 0500 –Communications General Provisions

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect" or "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's Supplemental General Conditions and Special Conditions for Construction.
 - 3. The University of Houston's *Network Infrastructure Design Guidelines* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).
 - 4. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This document identifies the design and specification requirements for a complete and functional communications cable plant to be performed for University of Houston. The purpose of the communications cable plant as specified herein is to support the voice, data, AV connectivity and various other low voltage signaling and control devices.
- B. Comply with the requirements of the Contract Documents and coordinate the Work of Division 27 sections with the Work of all other sections.
- C. All work associated with Network Facilities (NFs) shall comply with the National Electrical Code (NEC), state and local building codes. The guidelines developed by ANSI/TIA/EIA and BICSI shall be followed in both design and construction.
- D. The Architect may at any time, by written order, make changes within the general scope of any contract resulting from this proposal document. If such changes expand, reduce, change or modify the scope of work, the price for the change shall be increased or decreased at the unit prices set forth in the Unit Pricing Section, and the amount shall be deducted from, or added to, the sale price of the system to the Owner. Do not add costs to the project without prior written approval from the Architect. If the change will increase the price by an amount that cannot be

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determined solely from the prices set forth in the Unit Pricing Section, the change also requires prior written approval from the Owner.

Revise subparagraph(s) below to suit Project.

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [Project site] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the Preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

1. <Insert activity>.

1.4 AGENCIES, REFERENCE STANDARDS AND CODES

A. Agencies

1. ANSI American National Standards Institute
2. BICSI Building Industry Consulting Service International
3. EIA Electronic Industries Association
4. FCC Federal Communications Commission
5. FOTP Fiber Optic Testing Procedures
6. IEEE Institute of Electrical and Electronic Engineers, Inc.
7. NBC National Building Code
8. NFPA National Fire Protection Agency
9. NEC National Electrical Code
10. TIA Telecommunications Industry Association
11. UL Underwriters Laboratories
12. TAC State of Texas Department of Information Resources:
[http://info.sos.state.tx.us/pls/pub/readtac\\$ext.ViewTAC?tac_view=4&ti=1&pt=10&ch=208](http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=1&pt=10&ch=208)
13. UH Manual of Administrative Policies and Procedures (MAPP)

B. Codes and Standards (Latest issue and addenda, if more recent than edition shown)

1. ADA Standards for Accessible Design 28 CFR Part 36
2. American Society for Testing Materials (ASTM)*
3. ANSI/TIA-568.1-D - Commercial Building Telecommunications Infrastructure Standard (through Addendum 1, March 6, 2018)
4. ANSI/TIA-568.2-D - Balanced Twisted-Pair Telecommunications Cabling and Components Standard (through Addendum 1, April 9, 2019)
5. ANSI/TIA-568.3-D - Optical Fiber Cabling And Components Standard (through Addendum 1, January 17, 2019)
6. ANSI/TIA-568.4-D - Broadband Coaxial Cabling and Components Standard (June 27, 2017)
7. ANSI/TIA-569-E - Telecommunications Pathways and Spaces (May 23, 2019)
8. ANSI/TIA-606-C - Administration Standard for Telecommunications Infrastructure (June 19, 2017)

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9. ANSI/TIA-607-D - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (July 29, 2019)
10. ANSI/TIA-526-7-A - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 edition 2: Fiber-Optic Communications Subsystem Test Procedures - Part 4-2: Installed Cable Plant - Single-Mode Attenuation and Optical Return Loss Measurement (July 29, 2015)
11. ANSI/TIA-526-14-C - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; Modification of IEC 61280-4-1 edition 2, Fiber-Optic Communications Subsystem Test Procedures- Part 4-1: Installed Cable Plant-Multimode Attenuation Measurement (April 2015)
12. ANSI/TIA -758-B - Customer-Owned Outside Plant Telecommunications Infrastructure Standard (March 27, 2012)
13. BICSI TDM, Cabling Installation, LAN Design, and Customer-Owned Outside Plant Manuals-Latest Editions
14. Chapter 208- State of Texas Communications Wiring Standard
15. International Standards Organization/International Electrotechnical Commission (ISO/IEC) IS 11801, 2000*
16. National Electric Code (NEC), Latest Issue
17. National Electrical Manufacturers Association (NEMA)*
18. OSHA - U.S. Department of Labor Occupational Safety & Health Administration
19. UL - Underwriters Laboratories (UL) Cable Certification and Follow Up Program*
20. UH Information Technology *Network Infrastructure Design Standards*
21. UH MAPP - Manual of Administrative Policies and Procedures

C. Acronyms and Abbreviations

1. ADA Americans with Disabilities Act
2. AKA also known as
3. ANSI American National Standards Institute
4. ASTM American Society for Testing and Materials
5. AWG American Wire Gauge
6. BDF Building Distribution Frame (also known as BICSI Entrance Facility)
7. BICSI Building Industry Consulting Services International
8. CFCI Contractor Furnished Contractor Installed
9. CO-OSP customer owned outside plant
10. EIA Electronic Industries Alliance
11. EMI electromagnetic interference
12. FCC Federal Communications Commission
13. Gb/s gigabits per second
14. HC horizontal cross-connect
15. HVAC heating, ventilation, and air conditioning
16. IEEE Institute of Electrical and Electronics Engineers
17. IDF Intermediate Distribution Frame
18. ISO International Organization for Standardization
19. LAN local area network
20. LF lateral fiber
21. Mb/s megabits per second

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| | | |
|-----|-------|---|
| 22. | MC | main cross-connect |
| 23. | MDF | Main Distribution Frame (also known as BICSI Entrance Room) |
| 24. | MF | metro fiber |
| 25. | NEMA | National Electrical Manufacturers Association |
| 26. | NESCO | National Electrical Safety Code |
| 27. | NF | Network Facility (broad term for MDF, BDF or IDF; also known as Telecommunications Room, TR, Equipment Room, or ER) |
| 28. | NFPA | National Fire Protection Association |
| 29. | NVR | network video recorder |
| 30. | OFCI | Owner Furnished Contractor Installed |
| 31. | OFOI | Owner Furnished Owner Installed |
| 32. | PM | Project Manager |
| 33. | RCDD | Registered Communications Distribution Designer |
| 34. | RFP | Request for Proposal |
| 35. | RFO | Request for Offer |
| 36. | TBB | telecommunications bonding backbone |
| 37. | TGB | telecommunications grounding busbar |
| 38. | TIA | Telecommunications Industry Association |
| 39. | TMGB | telecommunications main grounding busbar |
| 40. | TE | telecommunications enclosure |
| 41. | UIT | University Information Technology |
| 42. | UITNS | University Information Technology Network Services |
| 43. | UL | Underwriters Laboratories |
| 44. | UTP | unshielded twisted-pair |
| 45. | WAN | wide area network |
| 46. | WAP | wireless access point |
| 47. | Wi-Fi | wireless telecommunications defined by IEEE 802.11 |

1.5 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. The Network Cabling Contractor, here after referred to as “Cabling Contractor,” shall provide all materials, components, tools and labor necessary for the complete installation of all communications work required in the contract documents and specified herein.
- B. The Electrical Contractor, here after referred to as “Electrical Contractor,” shall provide materials, components, tools and labor to complete a communications cabling pathway, electrical power distribution and communications building grounding system as set forth in the Structured Cabling System specifications and electrical specifications and Technical and Electrical drawings.
- C. Work furnished and installed by the Cabling Contractor as specified in Division 27 and as shown in Electrical and Technical Drawings includes:
 - 1. The overhead cable runway system (basket trays) within the new ER;
 - 2. Identification for Communications Systems;
 - 3. Communications Equipment Room Fittings;
 - 4. Communications Backbone Cabling;

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5. Communications Horizontal Cabling;
 6. Patch Cords, Station Cords, and Cross-Connect Wire;
 7. Bonding conductors from all cable tray, sleeves and conduits;
 8. Coordination with OFOI Communications Services;
 9. Coordination with OFOI Data Communications Equipment;
 10. Coordination with OFOI Voice Communications Equipment;
 11. Coordination with OFCI Communications Services;
 12. Coordination with OFCI Data Communications Equipment;
 13. Coordination with OFCI Voice Communications Equipment;
- D. Work under this Division not in contract (NIC) that will be Owner Furnished/Owner Installed (OFOI) includes:
1. Communications services (e.g., ISP connectivity);
 2. Voice communications equipment (end user devices);
 3. Phone cords at the work area;
- E. Work furnished and installed by the Electrical Contractor as specified in Division 27 and as shown in Electrical and Technical Drawings includes:
1. The conduits and back boxes for the work area telecommunications outlets.
 2. Installation of the TMGB in the new MDF/BDF;
 3. Installation of the TBB from the new MDF/BDF to the new IDFs;
 4. Installation of the Bonding Conductor for Telecommunications (BCT) that bonds the TMGB to the electrical power ground compliant with ANSI J STD-607 A Standards;
 5. Electrical circuits in the telecom rooms.
- F. Work furnished and installed by others as described in other Divisions of the *Master Specification*.
1. Network Facility walls shall be covered, floor to ceiling, with rigidly fixed ¾-inch fire rated plywood, void free, and capable of supporting attached connecting hardware. Cover plywood with two coats of fire retardant paint per *27 1100 Network Facility Fittings*.
 2. Fire walls shall be marked for easy identification.
 3. Security systems and access control.
 4. Fire sprinkler systems.
 5. HVAC.

1.6 WORK RESULTS — DESCRIPTION OF PROJECT

[Designer to list the elements that constitute the completed work results in Part 1 of each relevant Section.](#)

- A. Work results are listed in Part 1 of each Section in Division 27.
- B. Network Connectivity for Other Trades:
1. Audio/Visual – Provide network connectivity as required for A/V elements. Refer to AV drawings and specifications for details.
 2. Electronic Safety and Security – Provide copper and fiber cabling and termination hardware as required facilitating voice and data network connectivity for IP cameras,

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Emergency Call Towers, Access Control Panels, etc. Refer to Security drawings and specifications for details.

3. Fire Alarm – Provide copper/ fiber connectivity as required for Fire Alarm Panels.
4. Building Management System – Provide network connectivity as required facilitating operation of BMS/DDC.
5. Elevator Equipment Room – Provide copper connectivity to elevator equipment room(s). Coordinate with elevator equipment provider.

C. Project Meetings

1. If necessary, invite UITNS to meetings in the FP&C Project Programming/Feasibility Study phase.
2. In the FP&C Schematic Design (SD) phase, the FP&C Project Manager (PM) shall open a work order for UITNS, and invite the UIT PM to design meetings in this phase.
3. In the FP&C Design Development (DD) phase, the FP&C PM shall invite the UIT PM to design meetings in this phase. Adhere to the requirements of *Network Infrastructure Design Standards* in drawings produced in this phase. The version of that document in effect at the beginning of this phase is locked in for the project, with the exception of approved manufacturers and products purchased directly by UITNS.
4. In the FP&C Construction Document (CD) phase, the FP&C PM shall invite the UIT PM to design meetings in this phase. Adhere to the requirements of *Network Infrastructure Design Standards* in drawings produced in this phase.
5. Cabling Contractor shall attend preconstruction meetings with Project Team.
6. Cabling Contractor shall provide representation on Project Team Meeting as specified in *Division 01* and by the Contractor as required.
7. Cabling Contractor shall provide representation on the Commissioning Team as required for implementation of the Commissioning Plan.

D. Preconstruction Evaluation

1. Examination of buildings and site shall be the responsibility of the Cabling Contractor. Examine conditions for compliance with Communications design specifications. Validate Communications section is in accordance with related Contract Documents and the specified Owner's operational needs.

E. Construction Documentation

1. Cabling Contractor shall coordinate requirements with general provisions specified in *Division 1 - Construction Progress Documentation*.
2. Cabling Contractor shall provide weekly progress report including synopsis of previous week's completed tasks, list of ongoing work, and updated schedule addressing milestones. Also include items for Owner coordination.
3. Cabling Contractor shall provide weekly report of inspection by project RCDD to confirm Cabling Contractor's work is compliant with industry and manufacturer standards.

1.7 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

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- B. Submit shop drawings, product data, and samples promptly enough and in appropriate sequence to cause no delay in the work or in the activities of separate contractors.
- C. Append information for new installations to existing documentation so that a complete, consolidated inventory of all installations and work completed by the contractor is maintained.

1.8 PROPOSAL SUBMITTALS

A. Cabling Contractor Certification:

1. Cabling Contractor shall be a licensed Panduit Certified Integrator (PCI) Design and Installation Company, or a CommScope ACT (Authorized Connectivity Training) capable of issuing a numbered registration certificate for the entire cable system, or both depending on the products used for the project. Include a copy of the PCI Company and ACT certificate or verification by Panduit and/or CommScope records with the Cabling Contractor bid; expired certificates and/or certificates issued under Panduit or CommScope past certification programs are unacceptable. Include proof of certification in the proposal.
2. Submit written proof that the Cabling Contractor is certified by the manufacturer of the products and adheres to the engineering, installation and testing procedures and utilizes the authorized manufacturer components and distribution channels in provisioning this Project.
3. Cabling Contractor shall be a member of Building Industry Consulting Services International (BICSI).
4. 100 percent of on-site personnel shall have either a CommScope or Panduit Certification in effect through, the bidding process, installation, testing, documentation, and acceptance. Documentation of all on-site personnel shall be provided post recommendation of selected Cabling Contractor in order to receive final UITNS approval.
5. 100 percent of on-site installation personnel shall have BICSI certification in effect through the bidding process, installation, testing, documentation and acceptance. Documentation of all on-site personnel shall be provided post recommendation of selected Cabling Contractor in order to receive final UITNS approval.
6. Cabling Contractor shall have a minimum of one (1) Registered Communications Distribution Designer (RCDD) on staff, with Panduit approved Certification plus RCDD equivalent, submitted and approved by Panduit or CommScope prior to project award. Submit a resume and copy of certifications for Cabling Contractor's RCDD.
7. The RCDD shall provide approval on the design, installation, and documentation of communications system along with ensuring all Panduit Integrity System or CommScope Warranty documentation and requirements are met and submitted to Panduit or CommScope upon completion of the project. Documentation of all on-site personnel shall be provided before final UITNS approval is granted.
8. Cabling Contractor shall not subcontract installation of voice/data/video cabling, termination or testing without the written consent of UITNS and with Panduit's or CommScope's review and confirmation to UITNS of proposed subcontractor's current and valid Panduit PCI and CommScope ACT certified status.
9. Cabling Contractor shall have worked satisfactorily for a minimum of five (5) years on systems of this type and size.

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10. Design and Installation Certificates: Signed by local cable manufacturer's representative certifying that design is acceptable with cable manufacturer's Design Engineer(s) and Cabling Contractor is authorized by manufacturer to install registered (warranty) cabling system.
 11. Submit a minimum of three (3) representative educational facilities cabling projects (higher education facilities are preferred) as references, including the school's name, location, Architect or Engineer, cost of the cabling project and the contact person at the school district, including phone number.
 12. Upon request by UITNS, furnish a list of references with specific information regarding type of project and involvement in providing of equipment and systems.
- B. A list of technical product education (training) completed by the Cabling Contractor's project personnel.
1. All members of the installation team shall be certified by the Manufacturer as having completed the necessary training to complete their part of the installation. Submit resumes of the entire team and completed training courses and copies of BICSI Installer as well as CommScope or Panduit training course certificates.
 2. Submit cable tester manufacturer or a third-party certification for copper and fiber cable test technicians.
- C. Warranty
1. Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of not less than fifteen (15) years from date of acceptance by UITNS, or 20 years in the case of CommScope.
- D. Price Quotation Information -

Include price quote that includes labor and material (and pre-cutover add/deduct unit pricing and post-cutover add/deduct unit pricing, as appropriate) for each item to be used in the installation. See example item description below.

1. Itemized Unit Pricing for Labor and Material;
2. Itemized Add/Deduct Unit Pricing for Labor and Material for Pre-Cutover (200' average length) FOUR (4) CAT 6 Drops;
3. Itemized Add/Deduct Unit Pricing for Labor and Material for Post-Cutover (200' average length) FOUR (4) CAT 6 Drops.

1.9 ACTION SUBMITTALS

- A. Additional action Submittals are listed separately in each Section of Division 27.
- B. In the FP&C Schematic Design (SD) phase, the FP&C PM shall submit a complete set of drawings (including civil, landscape, structural, architectural, mechanical, electrical, plumbing, fire protection, telecommunications, audio visual and security) to the UIT PM for comment and written approval by UIT before proceeding to the Design Development (DD) phase.

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- C. In the FP&C Design Development (DD) phase, the FP&C PM shall submit a revised, complete set of drawings (including civil, landscape, structural, architectural, mechanical, electrical, plumbing, fire protection, telecommunications, audio visual and security) to the UIT PM for comment and written approval by UIT before proceeding to the Construction Document (CD) phase.
- D. In the FP&C Construction Document (CD) phase, the FP&C PM shall submit a revised, complete set of drawings (including civil, landscape, structural, architectural, mechanical, electrical, plumbing, fire protection, telecommunications, audio visual and security) to the UIT PM for final comment and written approval by UIT before proceeding to the Bidding phase.
- E. Test Reports with related Test Result Documentation.
 - 1. Submitted test results and other submittals that are non-compliant shall be reviewed and returned to the Cabling Contractor with comments.
 - 2. Re-submitted test results and other submittals that are non-compliant shall be reviewed and returned to the Cabling Contractor with comments.
 - 3. Subsequent reviews of test results and other submittals shall be performed jointly by the Cabling Contractor and the Communications Consultant and Cabling Contractor shall pay Communications Consultant's published hourly rate during third review and thereafter.

1.10 INFORMATIONAL SUBMITTALS

- A. Follow Division 1 and this Article.
- B. Within thirty days of award of the contract
 - 1. General
 - a. Bill of materials, noting items with long lead time
 - b. Optical loss budget calculations for each optical fiber run
 - c. Project schedule, including all major work components that materially affect any other work on the project
 - 2. Shop Drawings
 - a. Backbone (riser) diagrams
 - b. System block diagram, indicating interconnection between system components and subsystems
 - c. Interface requirements, including connector types and pin-outs, to external systems and systems or components not supplied by the contractor
 - d. Fabrication drawings for custom-built equipment
 - 3. Product Data — catalog cut sheets and information for
 - a. Wire, cable, and optical fiber
 - b. Outlets, jacks, faceplates, and connectors
 - c. All metallic and nonmetallic raceways, including surface raceways, outlet boxes, and fittings
 - d. Terminal blocks and patch panels
 - e. Enclosures, racks, and equipment housings

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- f. Over-voltage protectors
 - g. Splice housings
 - 4. Samples
 - a. Material samples of all items proposed as a substitution for or variation from authorized manufacturers and products set forth in each Section of Division 27.
- C. At least ten business days prior to obtaining approval for cutover to any portion of the new cable plant system
 - 1. Drawings: As-built documentation, AutoCAD 2000 or newer (DWG).
- D. At the conclusion of the project
 - 1. Final approved shop drawings. **Laminate one set of shop drawings and place them in the related NFs.**
 - 2. Plan drawings indicating location and identification of work area outlets, nodes, NFs, plan and elevation of Network Facilities, cable pathway details, and backbone cable type and locations and cable ID numbers
 - 3. Cable inventory data for all copper and fiber and termination hardware (prior to cutover to new cable plant if applicable). Submit data in Microsoft Excel format, listing products furnished, including:
 - a. Manufacturer's name and part numbers.
 - b. Cable numbers utilizing the Owner's cable numbering standard.
 - c. Network Facility termination detail sheets
 - d. Location and riser assignments.
 - e. Cross-connect schedules including entrance point, main cross-connects, intermediate cross-connects and horizontal cross-connects.
 - f. Labeling and administration documentation
 - g. Warranty documents for equipment
 - h. Copper certification test result (readable reports and test equipment native format)
 - i. Optical fiber power meter/light source, OTDR test results.
 - 4. Location table and spreadsheet with location detail for each wall jack:
 - a. jack numbers
 - b. room number
 - c. wall orientation (North, South, East, or West, or Power Pole if applicable)
 - d. landmark orientation and distance
 - 5. Manufacturer Certificates: Within 10 days of completion of the project, Cabling Contractor shall deliver letter signed by local Structured Cabling Components representatives and Cabling Contractor's RCDD stating that installed cabling system complies with all requirements specified in manufacturer's installation guidelines and that there were no accidents, improper installation, mishandling, misuse, damage while in transit, unauthorized alteration, unauthorized repair, failure to follow instructions, or misuse with the structured cabling system that could adversely impact warranty.

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6. Manufacturer's warranty to the Owner. This shall include, but is not limited to: Owner's name and project name and address. (Within three weeks of substantial completion.)
7. Within 10 days of completion of the project, Cabling Contractor shall deliver letter signed by local SCS Manufacturers representative and Cabling Contractor's RCDD stating that installed cabling system complies with all requirements specified in installation guidelines and that there were no accidents, improper installation, mishandling, misuse, damage while in transit, unauthorized alteration, unauthorized repair, failure to follow instructions, or misuse with the structured cabling system that could adversely impact warranty.
8. Within 21 days of completion of a project the Cabling Contractor and/or the manufacturer's local representative shall provide owner The Structured Cabling Performance Warranty signed by the manufacturer. The warranty shall list the owner and name of the Facility including location as the holder of the warranty.

E. EQUIPMENT RELOCATION AND SYSTEM STARTUP

Designer to provide a detailed summary of all work to be performed; examples below.

1. Upon notice of construction completion, UITNS shall be responsible for system startup services for the new Network Facility. The Cabling Contractor shall be responsible for ensuring the new equipment rooms, cabinets, floors and walls are clean and ready for equipment installation. On behalf of the Owner, the Cabling Contractor shall be responsible for coordinating with the GC and other trades to keep the NFs clean and dust free at all times.
2. It shall be the responsibility of the Cabling Contractor to develop and implement a full migration project schedule detailing the responsibilities of assigned personnel, along with contingency plans, and submit it to the Owner, or their designated representative, for approval.
3. During the transition period, Cabling Contractor shall have the necessary supervisory, technical, and other personnel available throughout technology relocations and cutover of the telephone, networking, and video systems. This is to ensure that technicians are on site to observe the operation and maintenance of the equipment, and to resolve any cabling related issues during system start-up.
4. Cabling Contractor shall ensure all amenities are present prior to equipment relocation. Cabling Contractor shall immediately contact the GC and the UITNS PM if a required service such as HVAC, electrical, backup power, etc., is not present.
5. Cabling Contractor shall accomplish a smooth and successful transition of operations and services to the new Network Facility. The transition includes the coordination, migration, testing, and problem resolution with the system vendors and UITNS.

F. SEQUENCING AND SCHEDULING

Designer to provide a detailed summary of all work to be performed; examples below.

1. An initial planning meeting shall be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project. Within two (2) weeks of the initial meeting, the Cabling Contractor shall provide a written report

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- and project schedule to clearly document the events and responsibilities associated with the project. Include the UITNS Project Manager in this meeting.
2. Cabling Contractor shall be responsible for the development and implementation of a complete project schedule detailing the responsibilities of assigned personnel and submit it to the GC and UITNS for approval.
- G. **QUALITY ASSURANCE - CABLING CONTRACTOR QUALIFICATIONS** (Designer to provide a detailed summary of all work to be performed; examples below.)
1. Follow Division 1 and this Section.
 2. Voice/Data
 - a. The installation company shall have a full-time RCDD on staff during all phases of the installation including testing and documentation. RCDD documentation shall be included in all responses to RFP/RFO.
 - b. The Installer shall have either CommScope or Panduit Certification in effect throughout installation, testing, documentation and acceptance.
 - c. All active on-site personnel shall be manufacturer certified for the system to be installed (e.g., Panduit, CommScope). The Cabling Contractor’s project manager or lead technician shall be BICSI certified to facilitate on-site installation practices and to provide inspections of on-going work.
 - d. Personnel who are untrained, lacking certification, or otherwise unqualified are not allowed to perform any portion of the communications infrastructure installation.
 - e. All personnel shall be permanent employees of the Cabling Contractor or approved sub-contractors.
 3. General
 - a. Material shall be new, and conform to grade, quality, and standards specified. Materials of the same type shall be a product of the same manufacturer throughout.
 - b. Subcontractors shall assume all rights and obligations toward the contractor that the contractor assumes toward the University of Houston and UITNS.
 - c. Coordinate Quality Assurance inspections with UITNS Project Managers.

PART 2 - PRODUCTS

2.1 PARTS AND MANUFACTURERS

- A. The following Sections of Division 27 provide approved product and schedules for this project.

[Designer delete sections that are not applicable to this project.](#)

1. 27 0526 Bonding and Grounding For Communications System
2. 27 0528 Pathways For Communications Systems
3. 27 0543 Underground Duct And Raceways
4. 27 0553 Identification For Communications Systems
5. 27 1100 Network Facility Fittings
6. 27 1300 Communications Backbone Cabling
7. 27 1500 Communications Horizontal Cabling

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- 8. 27 1619 Patch Cords, Station Cords And Cross-Contact Wire
- 9. 27 2000 Data Communications Equipment
- 10. 27 3000 Voice Communications Equipment

B. Refer to *Section 01 2500 Substitution Procedures* for variations from approved manufacturers or parts. **Obtain written approval from UITNS before requesting a substitution for work covered by *Division 27 Communications*.**

2.2 PRODUCT WARRANTY

- A. An extended manufacturer Product Warranty and System Assurance Warranty for the wiring system shall be provided (15 years for Panduit, 20 years for CommScope).
- B. The warranty covers all cables installed, tested and registered in a structured cabling system for the covered period. A structured cabling system is defined as a cabling infrastructure, designed and installed to current ANSI/TIA/EIA-568-B series standards.
- C. The Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of ANSI/TIA/EIA 568B and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of ANSI/TIA/EIA 568B and ISO/IEC IS 11801 for cabling links/channels, that the installation exceeds the loss and bandwidth requirements of ANSI/TIA/EIA 568B and ISO/IEC IS 11801 for fiber links/channels. The warranty shall apply to all passive SCS components.
- D. Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of not less than twenty (20) years from date of acceptance by University IT Network Services (UITNS).
- E. Warrant installation against all product defects, and that all approved cabling components meet or exceed the requirements of TIA/EIA-568B and ISO/IEC 11801 for a period of 20 years.
- F. The Extended Product Warranty and the System Assurance shall cover the replacement or repair of defective products and labor for the replacement or repair of such defective products.
- G. Within 10 days of completion of the project, Cabling Contractor shall deliver letter signed by local SCS Manufacturers representative and Cabling Contractor's RCDD stating that installed cabling system complies with all requirements specified in installation guidelines and that there were no accidents, improper installation, mishandling, misuse, damage while in transit, unauthorized alteration, unauthorized repair, failure to follow instructions, or misuse with the structured cabling system that could adversely impact warranty.
- H. Within 21 days of completion of a project the Cabling Contractor and/or the manufacturer's local representative shall provide owner The Structured Cabling Performance Warranty signed by the manufacturer. The warranty shall list the owner, name of the facility including location as the holder of the warranty.
- I. The Owner shall not be responsible for any aspect of ensuring the warranty is issued or updated. It shall be the Contractor's responsibility in conjunction with the Manufacturer.

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- J. During the warranty period, Owner may engage any manufacturer approved cabling contractor to perform future moves, adds and changes to the system. Owner approved contractors shall be responsible for updating any required documentation. Owner shall not be responsible for any aspect of updating and maintaining the warranty.
- K. The Labor, Material and Performance Warranty shall cover the testing and replacement of all structured cabling components. The structured cabling system shall be a complete certified system. The system and all components shall be performance matched and guaranteed by the manufacturer.
- L. Person / Entity Covered
 - 1. This warranty is for the sole benefit of Owner and any successor in interest to the site in which such Registered SCS was originally installed.
 - 2. All communications work and materials not included in the SCS components shall be warranted by the Cabling Contractor that performed the work for a minimum of three years from the date of substantial completion.

2.3 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Storage and Handling Requirements: Follow Division 1 Requirements.
- B. Temporary Storage: Coordinate with UITNS as necessary for temporary secure storage of equipment and materials during project timeframes.

2.4 PRODUCT QUALITY

- A. All materials and equipment provided shall be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufactures of such products. All materials shall be typical commercial designs that comply with the requirements specified. All materials and equipment shall be readily available through manufacturers and/or distributors. All equipment shall be supplied complete with any optional items required for proper installation.
- B. In the event of a breach of the representations and warranties contained herein, the Cabling Contractor, at their own expense, shall take all measures necessary to correct and make the cabling system work in compliance with the applicable manufacturer written technical recommendations and standards.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

- A. Existing Site Conditions
 - 1. Cable pathways and runs to individual outlets are not shown in their entirety but shall be provided as if shown in their entirety. The Cabling Contractor shall coordinate with other trades to determine exact routing.

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B. Environmental Limitations

1. Due to the critical nature of the environment, the Cabling Contractor shall use extra effort to provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation. Cabling Contractor shall remove all rubbish from job site daily at his or her own expense.
2. Environmental Requirements are usually covered in the General Requirements (Division 1) sections.

C. Use of Site: Coordinate the requirements in this Section with those in Division 1.

1. Proceed with work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the University of Houston including University IT Network Services (UITNS).
2. Cabling Contractors shall adhere to the University of Houston's Contractor Badge program and shall wear assigned contractor's badge on person in a clearly visible location following the Contractor Badge program standards as administered and provided by Facilities Planning & Construction.
3. Access to buildings where work is to be performed shall be directed by University IT Network Services (UITNS).
4. Cabling Contractors shall provide proper safeguards with personnel or appropriate safety barricades when pulling cables in any University of Houston building or related off-site areas.

D. Continuity of Services

1. Make advance arrangements with the University representative to avoid interference with or interruption of existing building services. Arrange the work to minimize down time.
2. Should services be inadvertently interrupted, immediately furnish labor (including overtime), material, and equipment necessary for prompt restoration of interrupted service.

3.2 EXAMINATION

- A. Examination of buildings and site shall be the responsibility of the Cabling Contractor. Examine conditions for compliance with requirements of other sections in which related work is specified and determine if conditions affecting performance of the work of this Section are satisfactory. Do not proceed with work of this Section until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Verify liquid-carrying pipes are not installed in or above voice and data system Network Facilities.
- C. Verify fire-rated backboards are properly installed and painted following Section 06105. Notify the UITNS Project Manager immediately and prior to installation in the event that the backboards are not installed or painted properly.
- D. Verify conduit, raceways, and boxes are properly installed.

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- E. Prior to starting the installation, the assigned installation supervisor shall participate in a walk-through of the project site with the UITNS Project Manager to review the installation documentation, verify that all construction necessary for the installation has been completed, and verify all installation methods and cable routes.
- F. The Cabling Contractor shall provide a complete cabling infrastructure according to the written specifications and drawings. If the scope of work to be performed by the Cabling Contractor changes, it shall be in writing. Cabling Contractor shall respond to these changes with a complete material list, including pricing, labor, and taxes in writing per Division 1 requirements. Cabling Contractor shall not proceed with additional scope of work without signed approval by the Contractor.

3.3 PREPARATION

A. Protection of Surroundings

- 1. Repair: Patching and repair of facilities, finishes, and equipment. Any damage to building or site caused by Cabling Contractor, including grass, paving, curbs etc., shall be restored at Cabling Contractor's expense to match condition prior to damage. If necessary and requested by the Contractor, Cabling Contractor shall provide professional services to clean or repair scratched/soiled finishes at their own expense.
- 2. Cabling Contractor shall keep all foods and liquids (water, drinks, etc.) in designated break areas.
- 3. The Cabling Contractor shall obtain the Architect's and Engineer's written permission via the Contractor before proceeding with any work necessitating cutting into or through any part of building structures such as girders, beams, concrete or tile floors, partition and/or ceilings.
- 4. If it becomes necessary to cut through any wall, floor, or ceiling to install any work under this Section of the Contract or to repair any defects that may appear up to the expiration of the guarantee period, such cutting shall be done by the Cabling Contractor under the supervision of the Contractor.
- 5. Patching of all openings cut by the Cabling Contractor, or repairing of any damage to the work of other trades caused by cutting or by the failure of any part of the work installed under this Contract, shall be performed by the appropriate trade but shall be paid for by the Cabling Contractor.
- 6. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect/Engineer. Impact-type equipment shall not be used except where specifically approved by the Architect/Engineer.
- 7. All openings shall be restored to "as-new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.
- 8. Refer to Division 1 for additional information.

B. DEMOLITION/REMOVAL

- 1. Unless indicated otherwise, all items that must be removed due to interference with work of this contract remain the property of the Owner, and are to be salvaged solely at the

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Owner's discretion. Obtain written approval from the Contractor before salvaging any material other than Cabling Contractor's waste material.

3.4 FIRESTOPPING

- A. The Cabling Contractor is required to properly firestop any penetrations through fire barriers utilized for the placement of telecom cabling in keeping with the firestopping provisions in Division 07. Provide fire resistant intumescent materials to restore fire ratings to wall, floor, or ceiling penetrations according to local and national codes.
1. Coordinate with trades constructing floors, walls, or other partitions of building construction to specify the size and shape of each opening to be constructed and device or system approved for use in each instance.
 2. Coordinate each firestop selection with adjacent work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, firestop systems work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.
 3. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.
 4. Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of firestopping. Remove combustible installation aids after firestopping material has cured.
 5. Additional requirements for existing penetrations are:
 - a. Existing raceways, cable trays, and cabling whether they are contained in the preceding structures or penetrate any existing building construction shall be firestopped to the extent necessary to fill cavities that exist between existing building construction and existing communications penetrations or conduit sleeve, and between existing conduits and existing conduit sleeve.
 - b. Assemblies consisting of individual steel-hat type restricting collars filled with intumescent type materials that completely surround communications penetration shall be used for nonmetallic raceways and cabling.
 6. If required by inspecting authorities:
 - a. Expose and remove firestopping to the extent directed by the inspecting authority to permit his or her inspection.
 - b. Reinstall new firestopping and restore work where removed for inspection.
- B. Verify the hourly rating of the barrier.
- C. Verify that cabling and other penetrating elements and supporting devices have been completely installed and temporary lines and cables have been removed.
- D. Select the UL Listing to match or exceed the barrier.
- E. Adhere to cable loads and fill procedure in the Listing.
- F. Seek pre-approval from the Authority Having Jurisdiction (Inspector).

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- G. When installing the System, be sure not to exceed the listed limitations.
- H. After installation, place information labels and take digital photographs of both sides of each firestopped penetration in the System for future reference.
- I. All openings shall be restored to “as-new” condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.
- J. Provide fire resistant materials to restore fire ratings to all wall, floor, or ceiling penetrations used in the distribution and installation for communications cabling system. Coordinate firestopping procedures and materials with Contractor and Master Specification Division 07.
- K. Solutions and shop drawings/submittals for firestop materials and systems shall be presented to the Contractor for written approval of materials prior to purchase and installation.
- L. Materials shall be installed per manufacturer instructions, be UL listed for intended use, and meet NEC codes for firestopping measures.
- M. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and remain resilient and pliable to allow for the removal and/or addition of communications cables without the necessity of drilling holes in the material.
- N. The firestopping material shall maintain/establish the fire rated integrity of the wall/barrier that has been penetrated.
- O. Cabling Contractor shall coordinate with Electrical Contractor and ensure Communications Pathway firestopping is properly identified and labeled. Cabling Contractor shall laminate and permanently affix to each side of a fire wall/floor penetration, the following information:
 - 1. Installing Cabling Contractor's name, address and phone number.
 - 2. Alpha-numeric unique identifier (floor/penetration - A1)
 - 3. Name of manufacturer of firestop system.
 - 4. Part & model numbers of system and all components.
 - 5. Phone numbers of manufacturer's corporate headquarters in U.S. and local distributor's name and phone number.

3.5 CONSTRUCTION WASTE MANAGEMENT

- A. Cabling Contractor shall remove all excess material and debris from the site upon completion of work each day and in a manner approved by the Contractor's Project Manager. See *Section 01 7419 Construction Waste Management and Disposal*.

3.6 LABELING

- A. Confirm administrative labeling scheme of cabling and its numerical positions on the termination hardware. Refer to *27 0553 Identification of Communications Systems*.

3.7 CLOSEOUT ACTIVITIES

- A. Acceptance shall be subject to substantial completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation as described herein. Refer to 01 7700 Closeout Procedures for additional detail.
1. All Proposal Submittals and Project Record Submittals.
 2. Training to Owner's representative on methods to add and remove firestop barriers, add and remove isolation conduit seals and, when necessary, add and remove IP 67 rated outlets.
 3. Maintenance manuals specified in Division 1 to GC and Owner regarding structured cabling system, firestopping and conduit sealing methods and manufacturer's recommended maintenance instructions.
 4. Cabling Contractor shall complete all punch list items within thirty (30) days of notification by GC.
 5. Cabling Contractor shall wipe down all equipment, racks, cabinets, and sweep and mop NF floors prior to Substantial Completion. The Project is not considered complete until cleaning has been done.
 6. Cabling Contractor shall complete Closeout Checklist listing status of all submittals, maintenance manuals, Owner training, and punch list items and deliver per Division 1.

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SECTION 27 0526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect" or "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction*.
 - 3. The University of Houston *Network Infrastructure Design Guidelines* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding electrodes and conductors.
 - 2. Equipment grounding conductors.
 - 3. Bonding for communications equipment.
 - 4. Communications system grounding.
 - 5. Electrical equipment and raceway grounding and bonding.
 - 6. Control equipment grounding.
- B. Work covered by this Section consists of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of grounding and bonding infrastructure for non-electrical power as described on the Drawings and/or required by these specifications.
- C. **This section pertains only to communications equipment installations. For electrical systems, refer to 26 0526 Grounding and Bonding for Electrical Systems.**

Revise subparagraph(s) below to suit Project.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. B3-13(2018) — Soft or Annealed Copper Wire
 - 2. B8-11(2017) — Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
 - 3. B33-10(2020)e1 — Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
- B. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 142-2007 Recommended Practice for Grounding of Industrial and Commercial Power Systems
 - 2. 1100-2005 Recommended Practice for Powering and Grounding Electronic Equipment
- C. Underwriters' Laboratories (UL):
 - 1. 83 Thermoplastic Insulated Wire and Cables
 - 2. 96 Lightning Protection Components
 - 3. 96A System Installation
 - 4. 467 Grounding and Bonding Equipment
- D. National Fire Protection Association (NFPA):
 - 1. 780 Lightning Protection Code
 - 2. 70 National Electrical Code (NEC)
 - a. NEC Article No. 250 - Grounding
- E. American National Standards Institute/Telecommunications Industry Association/Electronic Industries Alliance (ANSI/TIA/EIA):
 - 1. J-STD-607-A Commercial Building Grounding and Bonding Requirements.
 - 2. Telcordia – Network Equipment Building Systems (NEBS) GR-1275.
- F. Building Industry Consulting Services International (BICSI):
 - 1. Telecommunications Distribution Methods Manual
 - 2. Customer Owned Outside Plant Design Manual
- G. Local, county, state and federal regulations and codes in effect as of date of “notice to proceed” shall be complied with.

1.4 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [Project site] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

- 1. <Insert activity>.

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1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.6 ACTION SUBMITTALS

- A. None.

1.7 INFORMATIONAL SUBMITTALS

- A. Shop drawings
- B. Product data
- C. As-built plans showing locations of infrastructure
- D. Qualification data for installers
- E. Qualification data for testing agency (if applicable)
- F. Field quality control reports in native format

PART 2 - PRODUCTS

2.1 PARTS AND MANUFACTURERS

- A. Refer to *Section 01 2500 Substitution Procedures* for variations from approved manufacturers or parts. **Obtain written approval from UITNS before requesting a substitution for work covered by *Division 27 Communications*.**

B. GROUNDING BUSBARS

1. Chatsworth

- a. Telecommunications Main Grounding Busbar (TMGB) - #10622-012 ground busbar with #10622-000 busbar insulators or equivalent
- b. Telecommunications Grounding Busbar (TGB) - #10622-012 ground busbar with #10622-000 busbar insulators or equivalent

C. GROUNDING JOINTS AND SPLICES

1. Grounding conductor joints/splices: mechanical type, copper alloy, with a minimum of two bolts and a separate section for each conductor

- a. Burndy
 - 1) QPX
- b. OZ/Gedney

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- 1) XTP
- 2) PMX
- c. Penn-Union
 - 1) VX
- 2. Grounding conductor joints/splices: copper compression type with two (2) indents
 - a. Burndy
 - b. T&B
 - c. Blackburn
- 3. Grounding conductor terminations (lugs): single barrel, mechanical screw type, copper alloy with machined contact surfaces
 - a. OZ
 - 1) SL
 - b. T&B
 - c. Burndy
- 4. Grounding conductor terminations (lugs): copper compression type with two (2) indents
 - a. Burndy
 - b. T&B
 - c. Blackburn

D. BONDING CONDUCTORS

- 1. Cable Tray Bonding Conductor: green #8 AWG insulated bonding jumper (12 inch max) with appropriate lugs or manufactured braided copper grounding jumper
 - a. B-Line
 - 1) #CAM-GJ
 - b. T&B
 - 1) #BD12
 - c. OZ/Gedney
 - 1) type "FB"
 - d. Mono-Systems
- 2. Equipment Frame Bonding Conductor: green #8 AWG insulated bonding jumper
- 3. Telecommunications Bonding Backbone (TBB)
 - a. Green insulated copper conductor, minimum size of No. 6 AWG
 - 1) Match the insulation fire rating to that of its pathway
 - 2) Size the TBB at 2 kcmil per linear foot of conductor length up to a maximum size of 3/0 AWG.

| | |
|-----------------|----------------|
| TBB length (ft) | TBB Size (AWG) |
|-----------------|----------------|

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| | |
|-------|-----|
| <13 | 6 |
| 14-20 | 4 |
| 21-26 | 3 |
| 27-33 | 2 |
| 34-41 | 1 |
| 42-52 | 1/0 |
| 53-66 | 2/0 |
| > 66 | 3/0 |

- 4. Bonding Conductor (BC)
 - a. Green insulated copper bonding conductor
 - 1) Minimum size is the same size as the TBB

PART 3 - EXECUTION

3.1 TELECOMMUNICATIONS INSTALLATION

A. Grounding — General

- 1. Bond and ground equipment racks, cable trays, housings, messenger cables, raceways and rack-mounted conduit.
- 2. Connect cabinets, racks, cable trays and frames to single-point ground that is connected to building ground system or NF grounding bar using #6 AWG green insulated copper grounding conductor.

B. Bonding — General

- 1. Use low-impedance bonding to assure electrical continuity between bonded elements.
- 2. Mechanically fasten all conduits that terminate to cable trays, wire ways and racks. When connected to a cable tray or rack, connect conduits with ground bushings, wire bonded to the tray or rack, and grounded to the main building grounding system or NF grounding bar using #6 AWG copper.

C. Installation of the TMGB

- 1. Install the TMGB at the bottom of plywood backboard near the outside plant entrance conduits in the MDF.
- 2. Install the TMGB so that the BC for telecommunications is as short and straight as possible.
- 3. Use continuous 3/4-inch conduit for the conductor.

D. Installation of the TGB

- 1. Install the TGB at the bottom of plywood backboard near the copper riser terminations in each IDF.
- 2. Install the TGB so that the TBB for telecommunications is as short and straight as possible.

E. Installation of the TBB

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1. Install Green insulated copper grounding conductor from the TMGB to each TGB.
- F. Installation of Grounding Conductor Joints/Splices
1. Install mechanical type, copper alloy, with a minimum of two bolts and a separate section for each conductor or copper compression type with two (2) indents.
 2. Install manufactured insulating cover or heavy tape insulation over joints/splices.
- G. Grounding of Cable Tray
1. Install grounding at each cable tray joint.
 2. Install grounding from side of cable tray down to TMGB or TGB. Drill and tap side of cable tray (for appropriate size bolt, ¼ inch x 20 min.), making sure that bolt does not extend into wire management part of tray.
- H. Grounding of Equipment Frame
1. Install grounding for the Equipment Frame.
- I. Grounding for Inter-building Copper Cable
1. For building entrance protection for copper cabling, use a 2-foot fuse link between outside plant cable plant splice and the protector module
 - a. IDC-type input and output terminals
 - b. 100 pair-pair capacity
 - c. Female mounting base, equipped with 230 volt, solid state protector modules
 - d. Provide enough protector modules to completely populate all building entrance terminals.
 2. Bond the shield of all inter-building backbone cables to the ground lug on the primary protector panel.
 3. Bond the protector panel to the TMGB.
 4. Bond the shield of all intra-building backbone cables to the TMGB.
- J. Lightning Protection
1. Furnish and install a building entrance terminal with a two (2) foot fuse link between the outside cable plant splice and the protector module, IDC-type input and output terminals, 100-pair capacity and female mounting base, equipped with 230-volt, solid-state protector modules. Provide sufficient protector modules to completely populate all building entrance terminals.
 2. Furnish and install lightning arrestors rated for 1 Gbps on copper cabling that exits a building and feeds outdoor APS, cameras or other network equipment.

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SECTION 27 0528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect" or "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's Supplemental General Conditions and Special Conditions for Construction.
 - 3. The University of Houston's *Network Infrastructure Design Standards* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior communications pathways and supports.
 - 2. Outlets and conduit runs.
 - 3. Risers in Network Facilities (NFs).
 - 4. Grounding and bonding of pathways.
 - 5. Pathway firestopping requirements.

Revise subparagraph(s) below to suit Project.

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [Project site] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the Preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

- 1. <Insert activity>.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.5 ACTION SUBMITTALS

- A. Provide Shop Drawings showing tray routing. Obtain University Information Technology Network Services (UITNS) approval before installation proceeds.
- B. Present solutions and Shop Drawings/submittals for firestop materials and systems to the Contractor for written approval of materials prior to purchase and installation.

1.6 INFORMATIONAL SUBMITTALS

- A. Provide As-built plans showing locations of network infrastructure.

PART 2 - PRODUCTS

2.1 PARTS AND MANUFACTURERS

- A. Refer to *Section 01 2500 Substitution Procedures* for variations from approved manufacturers or parts. **Obtain written approval from UITNS before requesting a substitution for work covered by *Division 27 Communications*.**
- B. Pathways
 - 1. Panduit
 - a. J-Hooks: J-Pro
- C. Comfort Cradles
 - 1. Tomarco/Stiffy
 - a. 2-inch FIG205-122UH
 - b. 3.5-inch FIG205-8UH
 - c. 2-inch FIG201-2UH
 - d. 3.5-inch FIG201-3UG
- D. Cable Tray
 - 1. Cablofil
 - a. 12-inch x 2-inch CF54 /300 EZ
 - b. 12-inch X 4-inch CF105 / 300 EZ
- E. Fiber Optic Innerduct

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1. White or orange, plenum rated, UL Listed, flexible optical fiber/communications raceway, recognized per NEC Articles 770 and 800 for plenum areas for optical fiber and telecommunications cables.

F. Trapeze Support Kits

1. Cooper B-Line
 - a. 9G-55XX-22SH

G. Wall-mounted Brackets

1. Cooper B-Line
 - a. B409

H. Powered Fiber Cable Systems

1. CommScope
 - a. Powered Fiber Cable Indoor/Outdoor : PFC-S04L12
 - b. Powered Fiber Cable Outdoor : PFC-S04O12
 - c. Power Express Distribution Shelf w/Alarm Module: PFP-PX-S1
 - d. Power Express Distribution Module, Supports up to 8 Devices: PFP-PX-8M
 - e. Power Express Blank Slot Panel: PFP-PX-SF
 - f. SPS Rectifier Power Distribution Shelf: PFP-SPS-S1
 - g. 1600W SPS Power Rectifier Module: PFP-SPS-1600M
 - h. SPS Rectifier Controller Display: PFP-SPS-C1
 - i. SPS Rectifier Blank Slot Panel: PFP-SPS-SF
 - j. 60W, 2 Port, PoE Extender: PFU-P-C-O-060-02

2.2 CONDUITS AND FITTINGS

- A. For each communications outlet, provide a complete assembly of conduit, tubing or duct with fittings including, but not necessarily limited to, connectors, nipples, couplings, locknuts, bushings, expansion fittings and other components and accessories as needed to form a complete system of the type indicated.
- B. The minimum conduit size for telecommunications outlets shall be 1 inch.
- C. All sleeves shall be reamed and grommets placed prior to cable installation to prevent cable damage.

2.3 WALL AND CEILING OUTLET BOXES

- A. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with the outlet boxes being used and meeting the requirements of each individual situation.

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2.4 PULL / JUNCTION BOXES

- A. Provide pull boxes rated NEMA- 1 for telecommunications conduits in interior locations. For damp or wet locations such as plumbing chases or outdoors, provide pull boxes rated NEMA-3R.

2.5 PLENUM RATED FIBER OPTIC INNERDUCT

- A. Provide all fittings to form a complete, integrated raceway system.
- B. Install all fiber in 1 ¼-inch corrugated, non-metallic plenum-rated innerduct when not installed in conduit or in utility tunnel tray.
 - 1. Provide UL Listed innerduct with flame propagation compliant with UL 2024.
 - 2. Only manufacturer's fittings, transition adapters, terminators and fixed bends are to be used.
- C. Fabrication
 - 1. Sequentially mark footage as specified in *Section 27 0553 Identification for Communications Systems*.

2.6 CABLE TRAY SECTIONS AND COMPONENTS

- A. General: Provide metal cable trays of types, classes and sizes indicated, with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces, in compliance with applicable standards and with the following additional construction features.
- B. Provide cable trays with a minimum 4-inch usable load depth, or as noted on the Drawings.
- C. Straight tray sections shall have side rails fabricated as I-Beams. Supply straight sections in standard 12-foot lengths, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on Drawings.
- D. Tray widths shall be 12 inches or as shown on Drawings.
- E. All fittings shall have a minimum radius of 24 inches.
- F. Provide bolted type splice plates for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Make splice plate construction in such a way that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray.
- G. Cable Tray Supports: Construct supports from 12 gauge steel formed shape channel members 1 ⅝ inch by 1 ⅝ inch with Trapeze Support Kits (9G-55XX-22SH) as manufactured by Cooper B-Line, Inc. Support cable trays installed adjacent to walls on wall-mounted brackets B409 as manufactured by Cooper B-Line, Inc.
- H. Support trapeze hangers supported by ½-inch (minimum) diameter rods.

- I. Barrier Strips: Place as indicated on Drawings and fasten into the tray with self-drilling screws.
- J. Accessories: Furnish special accessories as required to protect, support, and install a cable tray system. Accessories consist of but are not limited to section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install pull boxes in conduits at intervals no greater than 100 feet. Install a pull box in conduit runs whenever there are two 90° sweeps, or a total of 180° of sweeps in a conduit run. A pull box may not be used to change the direction of a conduit run. Any deviations from these criteria must have prior approval from UITNS.
- B. Mount wall outlets in a minimum 4-inch x 4-inch x 2 ½-inch double gang outlet box with a single gang mud-ring. Stub gang boxes for outlets into the ceiling void via one 1-inch conduit with pull string.
- C. Size communications pathways in accordance with the requirements of BICSI and the NEC where conduit, pull boxes, cable tray and other raceway sizes are not specifically shown on Drawings. The minimum conduit size shall be 1 inch.
- D. Bond all metallic telecommunications conduits entering the NF or the Building Distribution Frame (BDF) together and to the TMGB with a #6 AWG ground cable.
- E. Locate conduits entering the NF so as to allow for the greatest flexibility in the routing and racking of cables.
- F. Provide 4-inch conduits between NFs.
- G. Terminate conduits or conduit sleeves entering through the floor of the NF, 2 inches above the finished floor. Position the outer diameter of the conduit within 4 inches of room walls.
- H. Conduit runs shall not exceed 100 feet or have more than two 90-degree bends without the use of a properly sized junction box. Insulated throat compression fittings shall be used for communications conduit runs, with termination points having plastic or grounding bushings installed.
- I. Minimum radius for conduit bends:
 - 1. Internal diameter of less than 2 inches – 6 times the internal diameter.
 - 2. Internal diameter of more than 2 inches – 10 times the internal diameter.
- J. Install conduits in the most direct route possible from the NF to the work area.
- K. Do not run conduits next to hot water lines, steam pipes, or other utilities that may present a safety hazard or cause degradation of system performance.

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- L. Seal all in-use and spare conduits entering the NF or BDF to prevent the intrusion of water, gases and rodents during the construction project. Within five days of releasing the conduit for the installation of cable, the Contractor shall ensure all conduits to be clean and dry.
- M. All conduits and cables that penetrate fire-rated walls or floors shall be firestopped.
- N. The primary horizontal cable support system shall be conduit to cable tray, installed as shown in Technical Drawings. Place supports so that the support spans do not exceed maximum span indicated on Drawings. Cable tray shall be properly grounded. Wall penetrations shall transition to properly firestopped 1-inch – 4-inch sleeves, then back to cable tray.
- O. Outlets having one single cable shall have a single gang box that stubs up into the ceiling void via one (1) 1-inch conduit with pull string. Use of flexible conduit is prohibited.
- P. Outlets having two or more cables shall have a double gang box with a single gang reducer that stubs up into the ceiling void via one (1) 1-inch conduit with pull string.
- Q. Neatly dress cables along common paths with Velcro tie wraps, with voice cables separated from data cables. Do not exceed the maximum number of cables per bundle specified by the manufacturer. Add separate parallel J-hook pathway when cable count requires it.
- R. J-hooks shall be installed 4 to 5 feet apart. Avoid uniform spacing to minimize problems with signal degradation.
- S. Use methods approved by the manufacturer to support J-hooks from decking or building structure.
- T. Lay out cable pathway runs in advance to determine space requirement along pathways, and to ensure non-interference from other trade installations.
- U. Do not support communications pathway from, or lay on, ceiling suspension system or use electrical, plumbing or other pipes for support. Communications pathway supports shall be permanently anchored to building structure or joist.
- V. Provide attachment hardware and anchors designed for the structure to which attached, and that are suitably sized to carry the weight of the pathway and cables to be supported. Confirm installation procedures for cable support system with the Architect before implementation.
- W. Ream conduits to eliminate sharp edges. Terminate metallic conduit with an insulated bushing. Initial sealing of the sleeve penetration shall be completed by the sleeve installer. Refer to ANSI/TIA/EIA-606 and *Section 27 0553 Identification for Communications Systems* for administration of the pathway system.
- X. The inside of the cable tray or wireway shall be free of burrs, sharp edges or projections that can damage cable insulation. For abrasive supports (e.g., threaded rod), protect the portion within the tray with a smooth, non-scratching covering so that cable can be pulled without physical damage.

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- Y. When a wireway passes through a partition or wall, it must be an unbroken length.
- Z. Do not exceed the fill requirements when installing telecommunications cables.
- AA. Properly firestop openings in fire-rated walls, floors and ceilings.
- BB. Install barriers between power and telecommunications cables per electrical code.
- CC. Do not use cable trays and wireways as walkways or ladders unless specifically designed and installed for that purpose.
- DD. Locate supports where practicable so that connections between sections of the tray fall between the support point and the quarter section of the span. Support centers shall be in accordance with the load and span for the applicable class as specified in the NEC. A support shall be placed within 600 mm (2 feet) on each side of any connection to a fitting. Support wireways on 1500 mm (5 feet) centers unless designed for greater lengths.
- EE. Provide and maintain a minimum of 12-inch headroom above a cable tray. Ensure that other building components (e.g., air conditioning ducts) do not restrict access to trays or wireways.

3.2 MINIMUM CLEARANCES

- A. Communications pathway minimum clearances:
 - 1. Minimum of 1 foot parallel, 3 inches crossover from power cables and conduits.
 - 2. Minimum of 6 inches above ceiling tiles.
 - 3. Minimum of 24 inches from hot flues, steam pipes, hot water pipes and other hot surfaces.
 - 4. Minimum of 3 feet separation from electrical panel boards.
 - 5. Minimum of 5 inches from lighting fixtures.
 - 6. Minimum of 6 feet separation from electrical motors and transformers.
 - 7. Minimum of 2 inches from exposed all-thread rods.

3.3 FIRESTOPPING

- A. Provide fire-resistant materials to restore fire ratings to all wall, floor or ceiling penetrations used in the distribution and installation for communications cabling system.
- B. Comply with requirements as stated in *Division 07 Penetration Firestopping*.

END OF SECTION 27 0528

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SECTION 27 0543 – UNDERGROUND DUCT AND RACEWAYS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect" or "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction*.
 - 3. The University of Houston's *Network Infrastructure Design Standards* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. Section Includes:

Revise subparagraph(s) below to suit Project.

- 1. Cutting and Patching Asphalt and Concrete.
 - 2. Trenching and Excavation
 - 3. Underground Conduit Systems.
 - 4. Cable Routing Hardware.
 - 5. Horizontal Directional Drilling – Also commonly referred to as Directional Boring or Guided Horizontal Boring.
- B. Work covered by this Section consists of providing all services, labor, materials, tools, and equipment required for the complete and proper installation of exterior telecommunications pathways as called for in these Specifications and related Drawings.
- C. Detailed summary of work (*Designer to provide a detailed summary of all work to be performed.*)
 - 1. Incoming Service Duct-bank: **[Description]**
 - 2. Primary Duct-bank: **[Description]**
 - 3. Feeder Duct-bank: **[Description]**
 - 4. Innerduct: **[Description]**

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1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at **[Project site]** <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the Preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

- 1. <Insert activity>.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.5 ACTION SUBMITTALS

- A. Before installation begins:
 - 1. Provide notification, in writing, of conditions detrimental to proper completion of the Work or conditions deviating from Drawings.
 - 2. Provide Shop Drawings of all core drilling locations for coordination with Architect and Owner prior to drilling.
 - 3. Obtain University Information Technology Network Services (UITNS) approval before installation proceeds.

1.6 INFORMATIONAL SUBMITTALS

- A. AS-BUILT DRAWINGS
 - 1. Submit drawings with notations reflecting any variations from the Specifications and Drawings, including As-built conduit routing.
 - 2. Provide Excel spreadsheet with GPS coordinates of all handholds and manholes.

1.7 QUALITY ASSURANCE

- A. Perform all installation work for the new exterior telecommunications pathways in a neat and workmanlike manner.
- B. Materials and work specified herein shall comply with the applicable requirements as stated in *Section 27 0500 Communications General Provisions*.
- C. For horizontal directional drilling, the Contractor shall follow all procedural precautions necessary to ensure that the essential aspects of proper directional bore installation are adequately controlled.

PART 2 - PRODUCTS

The paragraph and subparagraphs in this Article demonstrate the line spacing format for subparagraphs not subordinate to the preceding subparagraph.

2.1 PARTS AND MANUFACTURERS

- A. Refer to *Section 01 2500 Substitution Procedures* for variations from approved manufacturers or parts. **Obtain written approval from UITNS before requesting a substitution for work covered by *Division 27 Communications*.**

B. TRENCH/BACKFILL MATERIALS

Refer to *Division 31 Trenching, Backfilling, and Compaction* for requirements.

C. CONDUIT SYSTEM

1. Non-Metallic Conduit:
 - a. PVC plastic pipe: ASTM D1785, Schedule 40, Type PVC 1120.
 - b. Tone Tape: Arnco DL WP12LC Tone Tape, or equivalent.
2. Electrical Metallic Tubing (EMT): Electro-galvanized steel tubing $\frac{3}{4}$ inch and larger diameter per project requirements.
 - a. Conduit joint couplings and connectors - steel double set screw indenter fittings.
 - b. Metal bushings for $\frac{3}{4}$ -inch and 1-inch conduit.
 - c. Insulated metallic bushings for 1-1/4 inch and larger conduit.
 - d. Insulated metallic bushings with grounding lugs as required.
 - e. Conduit sweeps - minimum 10 times the conduit inside diameter.
 - f. Include required conduit straps and hangers, heavy-duty malleable iron or steel. Perforated pipe strap and wire hangers are not permitted.
3. Inside Pull-Boxes: Refer to *Section 27 0528 Pathways for Communications Systems* for inside pull-boxes for conduit entering building.
4. Outside Pull-Boxes: Minimum 14 gauge galvanized steel with weatherproof locking cover and hardware for surface mounting as required for Project. Dimensions as required for Project.
5. Test mandrel: shall be $\frac{1}{4}$ inch smaller than inside conduit diameter and minimum 12 inches long.
6. Pull-rope: $\frac{1}{4}$ -inch Nylon pull rope.
7. Core Drill Seals for Outside Building Walls: Link-Seal waterproof assembly or equal. Manufactured by PSI/Thunderline/Link-Seal.
8. Conduit Caulking Compound: Choose compounds for sealing conduit ducts that have putty-like consistency workable with hands, at temperatures as low as 35 degrees Fahrenheit, do not slump at a temperature of 300 degrees Fahrenheit, and do not harden materially when exposed to air. Compounds shall readily caulk or adhere to clean surfaces

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of plastic conduit, metallic conduits, or conduit coatings; concrete, masonry; any cable sheaths, jackets, covers or insulation material and common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect on the hands of workers or upon materials.

9. Underground Plastic Line marker: Manufacturer's standard permanent, continuous-printed polyethylene film tape with metallic core, intended for direct burial service; not less than 3 inches wide x 4 mils thick. Provide orange tape with black text reading, "CAUTION FIBER OPTIC CABLE BELOW".
10. Ground Wire: Bare Copper # 6
11. Tracer Box: NEMA-3 4-inch x 4-inch weatherproof box
12. Spacers for 4-inch Conduit: Carlon S289NJN Intermediate Spacer and S288NJN Base Spacer.
13. Precast Concrete Vault:
 - a. General: Provide precast concrete communications vault as detailed on the Drawings and as required for installation of new duct-bank systems and connection to existing duct-bank systems at locations shown on the Drawings. Provide 4-foot x 8-foot x 6-foot deep precast.
 - b. Design: Vaults shall be steel reinforced and the complete vault assembly designed for H-20-44 bridge loading. Clearly indicate in submittals all dimensions and reinforcing steel.
 - c. Concrete: Construct vaults using concrete with a 4500 psi 28-day strength. Concrete mix shall be designed in accordance with ASTM standards.
 - d. Reinforcing Steel: Use intermediate or hard grade billet steel conforming to ASTM A15, deformed in accordance with ASTM A305.
 - e. Vaults: Vault and pull box covers for all non-traffic areas shall be made of ductile iron cover; covers in parking and traffic areas shall be cast iron and rated for heavy vehicular traffic. Mount covers in a 30-inch Type "B" or "WRM" frame. Dowel the frame and neck into the vault to prevent movement away from the opening. Mark voice and data communications vaults and pull box covers with the text "TELECOMMUNICATIONS".
 - f. Conduit Entry: For plastic conduits, include a bell end inside the vault or pull box, mounted flush and grouted to seal openings. Provide precast fiber type terminators for each duct-bank entry.
 - g. Grounding: A #4/0 bare copper ground wire shall penetrate the side wall in the bottom section of each vault and pull box and extend 48 inches inside and outside of the vault pull box.
 - h. Accessories: Provide knockouts, cable racks, sumps, steps, joint seals and other accessories shown on the Drawings or as required for a complete installation.
14. Duct Plug 4-inch: General Machine Products (GMP) 6668R16
15. End Bell 4-inch: Carlon E297N
16. Multi-cell Fabric Mesh Duct:

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- a. Manufacturer: MaxCell.
- b. Use only manufacturer's fittings, transition adapters, terminators, accessories and installation kits.

D. CABLE ROUTING HARDWARE

- 1. Cable Rack with Support Hardware as required (or comparable):
 - a. 18-Hole: Condux 08380200, Chance C203-1126
 - b. Other sizes as required: Condux, Chance
- 2. Cable Rack Steps/Hooks:
 - a. 4-inch: Condux 08380600, Chance C203-1131
 - b. Other sizes as required: Condux, Chance
- 3. "S" Rack Supports: Condux, Chance
- 4. Step Lock Wedge: Panduit CHW-C20

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which the new exterior telecommunications pathways are to be installed.
- B. Verify field measurements and pathway routing conditions are as shown on Drawings.
- C. If discrepancies or problems are found, notify Architect, and wait for direction. Beginning of telecommunications pathway installation indicates Contractor acceptance of existing conditions.

3.2 EXCAVATING, TRENCHING AND BACKFILLING:

- A. General: The Work hereunder includes excavation and backfill as necessary to install the voice and data communications work. Coordinate voice and data communications work with other work in the same area, including excavating and backfilling, dewatering, floor protection provisions, other temporary facilities, other underground services (existing and new), landscape, paving, structural foundations and floor slabs on grade. Coordinate with weather conditions and provide temporary facilities needed for protection and proper performance of excavating and backfilling.
- B. Standards: Comply with the applicable provisions of *Division 31 Trenching, Backfilling, and Compaction*. Refer instances of uncertain applicability to the Architect/Engineer for resolution before proceeding with the Work.
- C. Refer to Owner before cutting or drilling any surface.
- D. All utilities are to be located by Contractor and exposed, if necessary, prior to construction.

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- E. Before excavation, notify UITNS PM of work to be done so that service interruptions in existing fiber pathways can be prevented. A UIT employee must be present during excavation.
- F. Voice and data communications duct-banks shall be independent and not shared with any other systems.
- G. Accurately excavate the bottom of the trench to provide firm, uniform bearing for the bottom of raceways and duct-banks. Where mud or unstable soil is encountered in bottom of trench, remove it to firm bearing and backfill the trench with bedding sand to proper grade and tamp to provide uniform firm support.
- H. Accurately grade the bottom of trenches to provide proper fall and uniform bearing and support for each section of the conduit on undisturbed soil or 2 inches of sand fill at every point along its entire length. In general, grading for voice and data communications duct-banks and conduits shall be from building to vault, and from a high point between vaults to each vault.
- I. Exercise care not to excavate below required depth, leaving a flat bed of undisturbed earth, firm and secure, before laying conduit. In the event rock is encountered, excavate 6 inches below required depth and backfill to required depth with bedding sand, and compact to minimum 95% compaction.
- J. Control all grading in the vicinity of excavation to prevent surface ground water from flowing into the excavations. Remove any water accumulated in the excavations by pumping or other acceptable method. During excavation, stack material suitable for backfilling in an orderly manner, a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be removed from the site and properly disposed of.
- K. If any unknown and/or uncharted utilities are encountered during excavation, promptly notify Architect/Engineer and wait for instructions before proceeding.
- L. If unknown utilities are encountered and work is continued without contacting the Architect/Engineer for instructions, and damage is caused to said utilities, the Contractor shall repair such damage, at his own expense, to the satisfaction of the Owner or utility company concerned.
- M. Do not backfill trenches until all required tests have been made by the Contractor and approved by the Architect/Engineer.
- N. Backfill shall be cement stabilized sand up to 6 inches above the top of conduit or duct-bank. Backfill up to grade shall be in maximum 6-inch lifts with minimum 95% compaction of lifts. *Refer to Division 31 Trenching, Backfilling, and Compaction* for additional requirements.
- O. Opening and Re-closing Pavement, Landscape Areas and Lawns: Where excavation requires the opening of existing walks, street, drives, other existing pavement or lawns, such surfaces shall be cut as required to install new conduit and to make new connections to existing conduits. The sizes of the cut shall be held to a minimum, consistent with the work to be accomplished. After installation of the new work is completed and the excavation has been backfilled and flooded,

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the area shall be patched or replaced, using materials to match those cut out or removed. Patches shall thoroughly bond with the original surfaces, be level with them.

- P. Excavation in Vicinity of Trees: The Contractor shall comply with applicable requirements as stated in *Division 31 Site Preparation*, and on the tree protection Drawings.
- Q. Perform all trenching and backfill for new underground conduit system placement as shown on the Drawings.
- R. Perform pavement marking as required.

3.3 CONDUIT SYSTEM PLACEMENT

- A. Place new conduit system including maintenance holes as shown on the Drawings.
- B. Maintain 12-inch clearance from all utilities. Conduit is to be encased in concrete slurry (flow fill) where proper distance cannot be obtained.
- C. Cross telecommunications conduit ducts below gas piping.
- D. Thoroughly clean all conduits before laying or using.
- E. During construction, plug the ends of the conduits to prevent water washing mud into the conduits, vaults or buildings. Take particular care to keep the conduits clean of concrete, dirt or any other substance during the construction.
- F. New and reopened trenches under asphalt roadways and parking lots shall have concrete cap or be encased in concrete as required.
- G. Support multiple conduits on preformed nonmetallic separators to provide not less than 1-inch spacing between exterior surfaces of conduit (Type 5). Space separators close enough to prevent sagging of conduits or breaking of couplings and watertight seals.
- H. Place moistened pea-sized gravel and sand mixture in the trench for 20 feet on each side of the vaults (Type 4).
- I. Multi-cell Fabric Mesh Duct:
 - 1. Install all fabric mesh duct per manufacturer's requirements.
 - 2. Populate all fabric mesh duct with a measured pull tape.
- J. Securely anchor conduits in place with nylon tie-downs to prevent movement during the placement of concrete slurry (flow fill), moistened pea-sized gravel and sand mixture, and other backfill materials. Wire tie-downs are prohibited.
- K. Conduit Joint Couplings:
 - 1. Install PVC non-metallic fittings with solvent applied couplings.
 - 2. Use an approved transition coupling to connect metal to plastic (PVC) conduits.

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- L. Couplings may be threaded and/or glued to provide watertight seal at conduit junctions.
- M. Seal all conduit junctions and fittings watertight prior to pour of concrete slurry (flow fill). Make conduit couplings in accordance with the manufacturer's recommendation for the particular type of conduit and coupling selected and as approved.
- N. Unless otherwise noted on Drawings, a minimum 24-inch depth of cover is required above the top of all conduits.
- O. Provide communications drain box in conduit 6 feet from building outside wall penetrations as shown in Drawings. Perforate conduit inside drain box to allow water and gas to escape.
- P. Transition to PVC coated Galvanized Rigid Conduit (GRC) at 5 feet from building outside wall penetrations.
- Q. For all offsets and sweep bends, provide fiberglass or PVC coated GRC.
- R. All conduit bends are to be minimum 3-foot radius or larger as noted on Drawings.
- S. Bury underground plastic line marker 12 inches above the telecommunications conduit.
- T. Cast into concrete a #6 bare copper ground wire directly above the telecommunications conduit and extend 4 inches into each vault space. Extend 6 inches of tracer wire into tracer box on outside wall of building directly above conduit entry point.
- U. Provide plastic conduit bell ends at each PVC conduit termination and for all conduit entering vaults.
- V. Avoid boring under concrete sidewalks. Remove and replace sidewalks as necessary.
- W. Extend the new conduit through the wall into the building, tunnel, or crawl space a minimum of 4 inches.
- X. Building, tunnel and vault core drills shall be sealed around conduits with approved waterproof plugging compound.
 - 1. Seal openings around conduits that pass through inside building wall core drills with UL listed foamed silicone elastomeric compound.
 - 2. Seal openings around conduits that pass through outside building walls with a complete Link-Seal assembly for a waterproof seal. Slope conduit away from building.
 - 3. Seal openings around conduits that pass through vault walls with foundation foam on the interior of the core and silicone sealer on the inside and outside of the core for a waterproof seal.
- Y. Place Maintenance Holes (MH) with the long dimension in line with the main conduit run. The conduit shall enter opposite ends of the MH on the short sides. Do not use the MH as a 90 degree bend in cable installations.
- Z. Ream and bush the ends of the metallic conduit:

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1. Insulated metallic bushings for 1 ¼-inch conduit and larger
2. Insulated metallic bushings with grounding lugs for conduit entering Network Facilities (NFs).

AA. After conduit duct installation has been completed and concrete has set, pull “D” test mandrel through all new conduit ducts to verify duct integrity and ensure smooth interior surfaces free from burrs or obstructions that might damage cable sheaths.

BB. Following mandrel testing, draw cylindrical wire brush with stiff bristles through each conduit to clean the conduit and remove any concrete, dirt or other obstructions.

CC. Stub out conduits into NFs, and cabinets only enough to attach connector and bushings with grounding lugs, except conduits shall rise a minimum of 6 inches above the finished floor.

DD. Install new pull rope in all new conduit and extend three feet into each building space.

EE. Plug ends of the new conduit with watertight rubber conduit plugs, conduit caulking compound or conduit caps to ensure foreign matter does not enter the buildings.

3.4 CABLE ROUTING HARDWARE

A. Place new cable routing hardware in the tunnels and in crawl spaces beneath the building as required and as shown on the Drawings.

B. Perform installation of routing hardware including anchoring and supports, grounding and bonding as specified in *Section 27 0526 Grounding and Bonding for Communications Systems*.

C. Place new ladder, pulling-in irons, cable racks, “S” rack supports, and steps in new and existing vaults as required for backbone cable routing.

3.5 HORIZONTAL DIRECTIONAL DRILLING

A. Notify Owner at least 48 hours in advance of starting horizontal directional drilling work. Do not begin the directional drilling until Owner is present at the job site and agrees that proper preparations have been made.

B. No work can commence until Traffic Control and Construction Permits are in place.

C. Site Preparation

1. Prior to any alterations to work site, mark the entry and exit points.
2. Make no alterations to the work site beyond what is required for operations.
3. Confine all activities to designated work areas.

D. Drill Path Survey

1. Accurately survey the entire drill path with entry and exit stakes placed in the appropriate locations within the areas indicated on Drawings.

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- 2. If a magnetic guidance system is being used, the drill path shall be surveyed for any surface geomagnetic variations or anomalies.
- E. Following drilling operations, the equipment shall be de-mobilized and the worksite restored to its original condition.

3.6 SAFETY

- A. Adhere to all applicable state, federal and local safety regulations and conduct all operations in a safe manner.
- B. The Contractor shall comply with UH Environmental Health & Life Safety procedures as stated in <https://uh.edu/ehts/about/manuals/>.

END OF SECTION 27 0543

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SECTION 27 0553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect" or "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's Supplemental General Conditions and Special Conditions for Construction.
 - 3. The University of Houston's *Network Infrastructure Design Standards* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. Section Includes:

Revise subparagraph(s) below to suit Project.

- 1. Documentation practices and requirements for Communications Systems
 - 2. Required submittals
 - 3. Approved manufacturers and parts
 - 4. Detailed label requirements with examples
- B. This section defines the requirements for labeling telecommunications infrastructure as described on the Drawings and/or required by these Specifications.

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [Project site] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the Preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

- 1. <Insert activity>.

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1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.5 ACTION SUBMITTALS

- A. None.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule:
 - 1. Outlets: Scaled drawings indicating location and proposed designation.
 - 2. Backbone Cabling: Riser diagram showing each Network Facility, backbone cable, and proposed backbone cable designation.
 - 3. Racks: Scaled drawings indicating location and proposed designation.
- D. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.
- E. Maintain telecommunications infrastructure records in a computer spreadsheet or database. PDF is not acceptable. Prepare a record for each backbone cable. The record shall show the cable name, describe the origin point, and destination point of the cable. The cable record shall record what services and/or connections are assigned to each cable pair or strand.
- F. Provide a complete and accurate set of As-built Drawings. In the As-built Drawings, record the identifiers for major infrastructure components including the pathways, spaces and wiring portions of the infrastructure, which may have separate drawings if warranted by the complexity of the installation or the scale of the Drawings.

1.7 QUALITY ASSURANCE

- A. Identification and administration work described in this section shall comply with the latest applicable requirements as outlined in *Section 27 0500 Communications General Provisions*.

1.8 TELECOMMUNICATIONS ADMINISTRATION

- A. All UH facilities shall apply and maintain a system for documenting and administering the telecommunications infrastructure.
- B. UH maintains a campus-wide labeling scheme for voice and data outlets and patch panels.

PART 2 - PRODUCTS

The paragraph and subparagraphs in this Article demonstrate the line spacing format for subparagraphs not subordinate to the preceding subparagraph.

2.1 PARTS AND MANUFACTURERS

- A. Refer to *Section 01 2500 Substitution Procedures* for variations from approved manufacturers or parts. **Obtain written approval from University Information Technology Network Services (UITNS) before requesting a substitution for work covered by *Division 27 Communications*.**
- B. Network Facility Copper, Fiber, and Coax Backbone Cable Labels
 - 1. Panduit #LS7-75NL-1
 - 2. Brady #WML-1231-292
- C. Network Facility Copper, Fiber, and Coax Horizontal Cable Labels
 - 1. Panduit #LS7-75NL-1
 - 2. Brady #WML-317-292
- D. Work Area Copper, Fiber, and Coax Riser Cable Labels
 - 1. Panduit #LS7-75NL-1
 - 2. Brady #WML-317-292
- E. Patch Panel Labels
 - 1. Panduit #LS7-38-1
 - 2. Brady #CL-111-619
 - 3. P Touch TZe-231

PART 3 - EXECUTION

3.1 LABEL CHARACTERISTICS, STANDARDS AND CONVENTIONS

- A. Labels shall meet the legibility, defacement, exposure and adhesion requirements of UL 969 *Standard for Marking and Labeling Systems*.
- B. The labeling scheme shall meet or exceed the requirements of ANSI/TIA-606-C.
- C. Label materials shall meet all applicable fire codes.
- D. Labels shall be resistant to environmental factors (such as moisture, heat and ultraviolet light) and have a life span equal to or greater than that of the labeled item.
- E. All labels shall be preprinted or generated by a computer or mechanical device. Handwritten labels are not acceptable, except as described in the instructions for labeling faceplates.
- F. Outside plant labels shall remain waterproof even when submerged.

- G. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used, and must be used in the manner intended by the manufacturer.

3.2 LABELING PROCEDURES

- A. To be consistent with applicable standards and industry practices, labeling and color coding shall be applied to all telecommunications infrastructure components. A label shall carry a unique identifier that denotes a specific component. Color coding shall allow personnel to quickly identify how the component is used in the overall telecommunications infrastructure of the facility. Infrastructure to be labeled includes:
 - 1. Copper and fiber optic outside plant cable, risers, horizontal (station) and patch cables.
 - 2. Racks, cabinets and patch panels.
- B. Visibility and durability
 - 1. Select size, color and contrast of all labels that will assure that the identifiers are easily read.
 - 2. Labels should be visible during the installation and normal maintenance of the infrastructure.
 - 3. Where insert-type labels are used, provide a clear plastic cover over the label.
 - 4. For labels applied directly to a cable, apply a clear vinyl wrapping over the label and around the cable to permanently affix the label.

3.3 LABEL INFORMATION CONTENT

- A. Fiber Optic Cable: Outside Plant (OSP)
 - 1. At each end
 - a. Far-end building number and name (or standard abbreviation, if insufficient space)
 - b. Single-mode or Multimode
 - c. Strand count
 - 2. At points where cable enters/exits tunnel or conduit (place label within 12 – 36 inches of tunnel or conduit, or nearest point that is clearly visible)
 - a. Building number and name at both ends (with the network uplink end first)
 - b. Strand count
 - 3. Along the length at 100-foot intervals, or nearest point that is clearly visible
 - a. Building number and name at both ends (with the network uplink end first)
 - b. Strand count
- B. Fiber Optic Termination Panels: OSP
 - 1. At each end
 - a. Far-end building number and name

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- b. Single-mode or Multimode
 - c. Strand count
2. Additional instructions
- a. Use both machine printed labels AND manufacturer's color coding on ferrules to denote single-mode fiber or multimode fiber
 - 1) Yellow = Single-mode
 - 2) Orange = Multimode
 - b. On each separate 6 or 12-strand panel insert, place a factory label with the panel number
 - c. On each strand's termination, place a factory label, or installer-applied machine-printed label with the strand number for that cable
 - d. If there is a factory supplied label for the door or cover, use it to record cable numbers and strand number
- C. Fiber Optic Cable: Risers
1. At each end (Entrance Facility and its interconnecting equipment or Intermediate Distribution Frame (IDF))
- a. Far-end Entrance Facility, equipment or IDF room number
 - b. Single-mode or Multimode
 - c. Strand count
- Note: Sometimes a small building or facility may be fed from a primary building and treated as equipment to the primary building. In such cases, label the riser cable (may require an OSP-rated cable) as described here.
- D. Fiber Optic Termination Panels: Risers
1. At each end
- a. Far-end Entrance Facility, equipment or IDF room number
 - b. Single-mode or Multimode
 - c. Strand count
2. Additional instructions
- a. On each separate 6- or 12-strand panel insert, place a factory label with the panel number
 - b. On each strand's termination, place a factory label, or installer-applied machine-printed label with the strand number for that cable
- E. Copper Cable: OSP or Feeder
1. At each end
- a. Far-end building number and name
 - b. Pair count
2. At points where cable enters/exits the tunnel or conduit (place label within 12 – 36 inches of tunnel or conduit, or nearest point that is clearly visible)

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- a. Building number and name at both ends (with the network uplink end first)
 - b. Pair count
 - 3. Along the length at 100-foot intervals (or nearest point that is clearly visible), and at every turn in a location
 - a. Building number and name at both ends (with the network uplink end first)
 - b. Pair count
 - 4. Protector block at each end
 - a. Cable number (supplied by UITNS)
 - b. Far-end building number and name
 - c. Pair count
- F. Copper Cable: Risers
 - 1. At each end (Entrance Facility and its interconnecting equipment or IDF)
 - a. Far-end Entrance Facility, equipment or IDF room number
 - b. Pair count
- G. Copper Termination Panels: Risers
 - 1. At each end
 - a. Far-end Entrance Facility, equipment or IDF room number
 - 2. At the point where individual pairs are terminated
 - a. Label every fifth pair point
- H. Horizontal (Station) Cable — Fiber Optic or Copper
 - 1. At each end (behind the faceplate and on the patch panel)
 - a. Far-end equipment or IDF room number
 - b. Cable number (shall match the number on the patch panel and faceplate)
 - 2. On the faceplate
 - a. Mark with an ultra-fine tip, black, permanent Sharpie®, then cover with a machine printed label
 - b. Room number: upper left corner of the plate
 - c. Cable number: directly below (preferred) or next to the jack
 - d. If fiber optic, also specify Single-mode or Multimode
 - 3. At the equipment or IDF patch panel
 - a. Cable number
 - b. Room number: below the cable number

Note: In the Network Facilities (NFs), after the first panel has been filled (1-48), label additional panels in continuous sequence (49-96, etc.).
- I. Patch Cables — Fiber Optic or Copper

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1. At each end
 - a. Source and destination

J. Wireless Access Points (WAPs) and Associated Jacks

1. WAP
 - a. Label each WAP in a visible area on the device, to be readable from the ground with no magnification
 - b. IDF number
 - c. MAC address (last 6 digits)
 - d. AP number

EXAMPLE: NF-300 C4:99:46 AP-48

2. Jack
 - a. Label WAP jacks on the ceiling grid
 - b. IDF number
 - c. Jack number

K. Cameras

1. To be labeled with these elements, separated by hyphens:
 - a. IDF number
 - b. Patch panel id
 - c. Number of the nearest room/door

EXAMPLE: 109-B19-113

2. Onscreen labeling
 - a. Room name and/or number or object viewed (shall match camera schedule and schematics)

L. Network Video Recorders (NVRs)

1. Label on the inside of the front cover panel
 - a. The host name = building number-building name-NVR series number as a single word. Example: 405 ERP NVR 1
 - b. The host IP address.
2. Configuration requirements
 - a. Do not change the default admin login credentials until final testing and acceptance by UITNS and Campus Safety are completed.
 - b. Host name (see above)
 - c. DNS Server addresses = 172.21.12.1 and 172.21.12.17
3. Enable time sync to ns1.uh.edu

M. Circuit Breaker Panels and Electrical Outlets

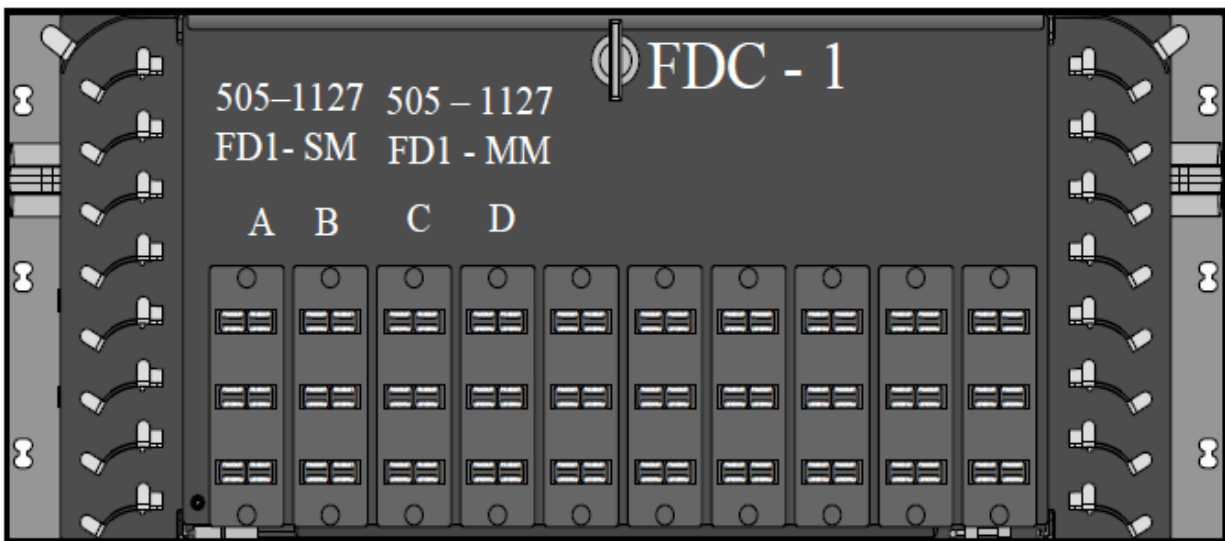
1. All telecommunications circuits are to be clearly labeled on circuit breaker panels and the circuit id number to be on the face plate of the outlet in the NFs.

3.4 EXAMPLES

A. Fiber Labeling (see Fiber Labeling Illustration and example, below)

1. There shall be three areas labeled on each fiber panel:
 - a. Above the individual columns on label panel
 - b. Above the letters on each column
 - 1) First line: Destination building number - Destination NF room number
 - 2) Second line: Destination fiber distribution cabinet - fiber type
2. On each line in each column, individual labels for each fiber port
 - a. Destination panel - Destination fiber port - Destination color

Fiber Labeling Illustration



Typical Fiber Colors and Pair Designation

| | | | |
|----------|-----------|-----------|-----------|
| Blue: Bl | Orange: O | Red: R | Black: B |
| Green: G | Brown: Br | Yellow: Y | Violet: V |
| Slate: S | White: W | Cyan: C | Rose: Ro |

Fiber Labeling Example

| |
|----------|
| 505-1127 |
| A |
| A1-BI |
| A2-O |
| A3-G |

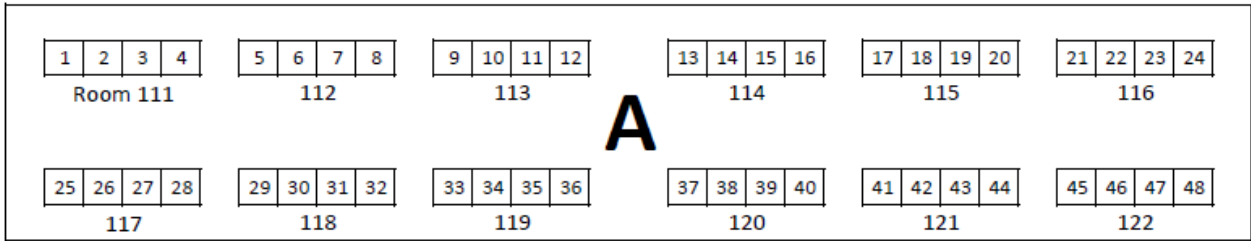
Label the front of each fiber optic distribution box with FD-sequence number.

EXAMPLE:

| |
|-----|
| FD1 |
|-----|

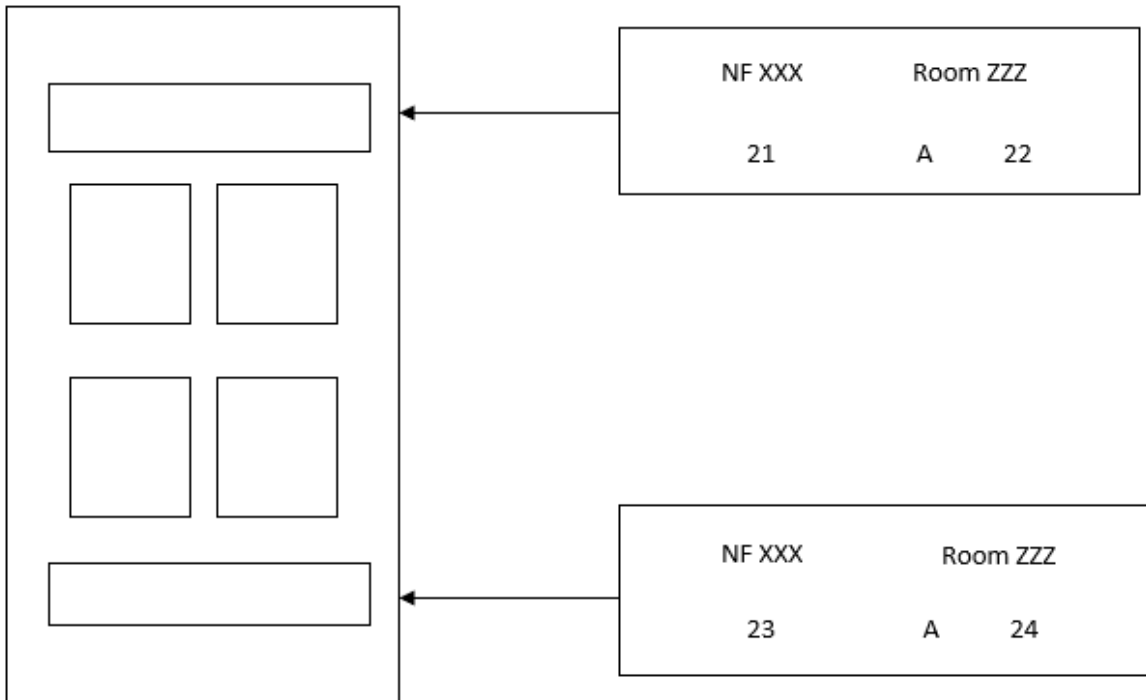
- B. Copper Labeling (see Copper Labeling Illustration, below)
 - 1. Each patch panel will have an alphanumeric designation
 - 2. Jack: each jack number on the patch panel will be determined by room number along with the panel and port designation as shown.

Copper Labeling Illustration



- C. Office Faceplates (see Office Faceplate Labeling Illustration, below)
 - 1. First line: NF room number and the room number of the communications outlet
 - 2. Second line: first jack number followed by the panel letter followed by the second jack number

Office Faceplate Labeling Illustration



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D. Patch Cords

1. Panel number — Jack number — Switch number — Port number
2. Label each end of the cable

Patch Cord Example

A23-SW1- P11-17

E. Racks

1. Label the top of each rack with the rack number

Rack Example

Rack 1

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SECTION 27 1100 – NETWORK FACILITY FITTINGS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect" or "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 2. The University of Houston’s Supplemental General Conditions and Special Conditions for Construction.
 3. The University of Houston’s *Network Infrastructure Design Guidelines* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. Section Includes:

Revise subparagraph(s) below to suit Project.

1. Fittings for Network Facilities (NFs)
2. Installation and layout details

- B. This section covers parts, manufacturers and installation practices for equipment in NFs.

Revise subparagraph(s) below to suit Project.

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [Project site] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

1. <Insert activity>.

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1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.5 ACTION SUBMITTALS

- A. Obtain UITNS approval before installation proceeds after each of these submittals
- B. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- C. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
- D. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer,]** qualified layout technician, installation supervisor, and field inspector.

PART 2 - PRODUCTS

2.1 PARTS AND MANUFACTURERS

- A. Refer to *Section 01 2500 Substitution Procedures* for variations from approved manufacturers or parts. **Obtain written approval from UITNS before requesting a substitution for work covered by *Division 27 Communications*.**

The paragraph and subparagraphs in this Article demonstrate the line spacing format for subparagraphs not subordinate to the preceding subparagraph.

- B. Equipment Racks - Heavy duty aluminum 7' floor mounted racks with cable management channels on both sides and mounting rails for 19 inch equipment are required.
 - 1. Chatsworth Products Inc.
 - a. Relay Rack: 55053-703
 - b. Vertical Cable Manager: 30162-703
 - c. Grounding Bar: 13622-012
 - 2. CommScope

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C. Fiber Optic Enclosures

1. Corning
 - a. 1U: CCH-01U
 - b. 2U: CCH-02U (use in IDFs)
 - c. 3U: CCH-03U
 - d. 4U: CCH-04U (use in BDFs)
2. CommScope
 - a. 1U: SD-1U
 - b. 2U: SD-2U (use in IDFs)
 - c. 3U: SD-4U (holds 6 panels; use in BDFs)
 - d. 4U: SD-4U

D. Vertical Cable Management

1. Panduit Products
 - a. 6 in. Wide 7FT Double Sided Black W/Doors: PR2VD06
 - b. 8 in. Wide 7FT Double Sided Black W/ Doors: PR2VD08
 - c. 10 in. Wide 7FT Double Sided Black W/ Doors: PR2VD10
 - d. 12 in. Wide 7FT Double Sided Black W/ Doors: PR2VD12
2. CommScope
 - a. 6 in. Wide 7FT Double Sided Black W/ Doors: VCM-DS-84-6B 760072785
 - b. 8 in. Wide 7FT Double Sided Black W/ Doors: VCM-DS-84-8B 760089359
 - c. 10 in. Wide 7FT Double Sided Black W/ Doors: VCM-DS-84-10B 760089367
 - d. 12 in. Wide 7FT Double Sided Black W/ Doors: VCM-DS-84-12B 760089375

E. Horizontal Cable Management

1. Panduit Products
 - a. 1U: NCMHF1
 - b. 2U: NCMHF2
2. Uniprise
 - a. 1U: 1375162-1
 - b. 2U: 1375162-2

F. Basket Cable Tray

1. Cablofil
 - a. 12 inch x 2 inch - CF54 / 300 EZ
 - b. 12 inch X 4 inch - CF105 / 300 EZ

G. Paint

1. Flame Control Coatings, LLC
 - a. NO. 20-20A - Fire Hazard Classification, ASTM E-84 (NFPA 255) Class "A"

H. Uninterruptible Power Supply (UPS)

1. Tripp Lite
 - a. SMART1500LCD
 - b. SMART5000XFMRXL

I. Power Distribution Unit

1. Tripp Lite
 - a. PDU1215
 - b. PDU1220

J. Rack-mount Monitor Shelf

1. Tripp Lite
 - a. B020-008-17 Console KVM Switch w/LCD

K. Firestopping Materials

1. EZ-Path

2.2 RELAY RACKS

- A. Use equipment racks that are capable of accepting 19 inch equipment, self-supporting and manufactured from high-strength aluminum with two top brackets included for additional strength.
- B. Use racks with black finish color. Drill and tap mounting holes each side at 5/8 inch - 5/8 inch - 1/2 inch patterns compatible with EIA 1-1/4 inch- 5/8 inch alternating patterns.
- C. Include base flanges with mounting holes drilled through for securing the rack to the floor. Make each mounting hole at least 5/8 inch in diameter.
- D. Where the rack is to be mounted to VCT flooring or bare concrete, use an insulating pad, and take care that anchors used to secure the rack to the floor do not come in contact with any reinforcing steel embedded in the concrete slab.
- E. In the NFs, reserve space at the top of each rack for fiber enclosures: for BDFs, a minimum of eight Units (8U), and for IDFs, a minimum of six Units (6U).

2.3 CABLE MANAGEMENT

- A. Vertical cable management is to be double-sided and narrow or wide depending upon application requirements. Use manager sections with a black finish. Include lockable latching sections and protective edge guards.
- B. Use horizontal cable management capable of attachment to a 19 inch rack, maximum 6 inch deep and maximum 2.8 inch high. Use managers with a black finish.

2.4 CABLE RUNWAY

- A. Subject to compliance with these specifications, cable runway is to be as manufactured by Legrand Cablofil. Cable runway (basket tray) is required within the NFs to provide a suitable pathway to route all cabling into and out of termination equipment, mounted in equipment racks or on backboards attached to walls, and pathway spaces beyond the NF.
- B. Ladder racks: Provide UL classified cable runway and components. Such products are to be UL classified as to its suitability as an equipment-grounding conductor. Ladder racks and components are to have rounded edges and smooth surfaces in compliance with applicable standards, and with the following additional construction features:
 - 1. Dimension: Make the side rail cross sectional area greater than 0.20 square inches, with a height of 1-1/2 inches.
 - 2. Material and Finish: All ladder racks and components are to be made of tubular steel and finished with flat black powder coat paint or gold chem film over zinc plating.
 - 3. Construction: Ladder rack is a prefabricated metal structure consisting of two longitudinal side rails connected by individual transverse members. Ladder rack is to be constructed of 1-1/2 inch x 3/8 inch x .065 inch rectangular steel tubing. Make each cross member a single, continuous, rectangular tube 1/2 inch x 1 foot x .065 inch with radiused corners. Weld cross members to stringers at 9-inch intervals with ends finished to protect installers and cables.
 - 4. Ladder rack width is 12 inches except as otherwise shown on the Telecommunications Drawings.
 - 5. Space cross members every 9 inches at a minimum.
- C. UL Classified Rack Butt-Splice Kit: Consists of 4 splice plates, U-shaped. Overall, 5 inch by 5/8 inch by 11/16 inch thick. Provided with 7/16 inch by 3/8 inch cutout for insertion of trimmed head bolt. Bolt measures 3/8 inch diameter by 2-1/2 inch long provided with hex nut and lock washer.
- D. UL Classified Rack Junction Splice Kit: L-shaped splice angles. Overall, 2 inch x 2 inch by 1-1/2 inch, 3/16 inch thick. Secured to cable runway by 3/8 inch diameter by 1-1/2 inch hex bolts, nuts and lock washers.
- E. UL Classified 90 Degree Rack Splice Kit: Outside Clamp - Overall, 5-3/4 inch x 3/4 inch by 5/8 inch, minimum 0.10 thick. Provided with 7/16 inch by 7/16 inch cutout for insertion of trimmed head bolt. Bolt measures 3/8 inch diameter by 3-1/4 inch long. Provided with hex nut and lock washer. Inside Edge Clamp - Overall, 2-9/16 inch x 15/16 inch x 5/8 inch, minimum 0.10 thick. Provided with 7/16 inch x 7/16 inch cutout for insertion of trimmed head bolt.
- F. UL Classified 45 Degree Rack Splice Kit: Outside Clamp - Overall, 4-7/16 inch x 5/8 inch x 3/4 inch, minimum 0.10 inch thick. Provided with 7/16 inch x 7/16 inch cutout for insertion of trimmed head bolt. Bolt measures 3/8 inch diameter by 2-11/16 inch long provided with hex nut and lock washer. Inside Edge Clamp - Overall, 2-9/16 inch x 15/16 inch x 5/8 inch minimum 0.10 inch thick. Provided with 7/16 inch x 7/16 inch cutout for insertion of trimmed head bolts.

PART 3 - EXECUTION

3.1 GENERAL

A. NF

1. Do not install IT network equipment in the NFs until they are completely built, cleaned and secured with the UITNS-approved key.
2. Interior walls: Cover interior walls floor to ceiling with fire-rated ¾ inch plywood painted with two coats of a neutral color fire retardant paint. Leave the fire rated stamp visible. Have the Fire Marshall's Office inspect and approve before painting.
3. Cabling within Racks and Enclosures: provide adequate length of cabling. Train conductors to termination terminal points that follow manufactures installation procedures for maintaining cable performance specifications. Provide lacing/mounting bars to restrain cables, to prevent straining connections, and to stop bending cables to smaller radii than minimums recommended by manufacturer.
4. Equipment Racks: Provide 19-inch wide x 7-foot – 0-inch tall, floor-mounted equipment racks, installed per Technical Drawings, with number of vertical rack sections as required to allow space for termination of all fiber and data/voice cabling plus mounting space for multi-port concentrators (Hub/Switches) required to cross-connect all data jacks.
5. Locate/space racks and enclosures according to EIA/TIA guidelines for front and around access.
6. Vertical wire management: double-sided vertical rack cabling sections. Reference Technical Drawings
7. Entrance: Arrange and coordinate locations of distribution frames, patch panels, cross-connections in NFs and racks to optimize space requirements of any service provider requirements, telephone system and LAN equipment.
8. Provide cable runway in equipment room above all racks and up to runway/conduits/sleeves entering room from corridors to form a complete runway system connecting all hardware installations. Attach grounding lugs to each rack/cable raceway, conduit, etc. Refer to Technical Drawings for details.
9. Install trays overhead along the equipment rows, leading to the cross-connects. Coordinate tray locations with lighting, air-handling systems, and fire extinguishing systems so that fully loaded trays do not obstruct or impede their operation. NEC Article 392 provides requirements for cable trays.
10. Provide horizontal cable runways. Equip each 19-inch rack with overhead basket style cable runway installed between the wall and horizontal/equipment racks. Refer to COMMUNICATIONS Technical Drawings for proposed locations and sizing of each runway. Securely attach to wall studs with support brackets (and racks if applicable), in accordance with manufacturer written instructions.
11. Install a grounding bar that measures 12 inches long by 2 inches wide by ¼ inch holes that accepts 2-hole lug connectors. Connect the bar to the main building ground using #2 or greater copper wire.
12. Provide ground lug for each 19-inch rack. Racks shall be grounded to wall mounted ground bus bar using #6 AWG stranded, green jacketed, insulated copper conductor. Furnish all required bonding material and hardware, and bond to building grounding electrode

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subsystem TMGB in ER. If crimp connectors are used to bond the #6 AWG wire, follow NEC bonding procedures/specifications.

13. Use an inert dielectric material to separate dissimilar metals apt to corrode through electrolysis under the environmental operating conditions specified.

END OF SECTION 27 1100

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SECTION 27 1300 – COMMUNICATIONS BACKBONE CABLING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect" or "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 2. The University of Houston's Supplemental General Conditions and Special Conditions for Construction.
 3. The University of Houston *Network Infrastructure Design Guidelines* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. Section Includes:
 1. Coordination with other trades and parts of the contract.
 2. Submittals (Action and Informational).
 3. Quality Assurance.
 4. Parts and Manufacturers.
 5. Installation and Testing.
- B. The building backbone riser system connects Network Facilities to each other, to the Main Service Entrance Room and to the Equipment Room. UH specifies separate cable systems to provide data, video and voice needs. The backbone riser system consists of plenum-rated, multi-pair twisted pair copper cables, coaxial, and single mode fiber cables along with associated termination systems. This section covers labor, equipment, supplies, materials and testing involved in installing, terminating and labeling copper and fiber backbone infrastructure as described on the drawings or required by these Specifications.

Revise subparagraph(s) below to suit Project.

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [Project site] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the preinstallation meetings.

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Copy subparagraph below and edit for each activity required for preconstruction conference.

1. <Insert activity>.

1.4 COORDINATION

- A. New cable plant requiring connection to, or disconnection from, the University of Houston campus networks is to be performed by personnel designated by UITNS. Campus networks include telephone, local and wide area, video, cable television, and fiber optic networks.
- B. Contractor shall coordinate the work specified in this Section with the work in other parts of the Contract documents.
- C. Plans in general are diagrammatic. It is the full responsibility of the Contractor to be familiar with the location of equipment involved under the work of other trades to eliminate conflicts between the fiber and copper cable installation and the work of other trades.
- D. Direct all questions and issues with regard to coordination to the Owner.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.6 ACTION SUBMITTALS

- A. Submit Cable Pulling Plan, as follows:
 1. Indicate the installed backbone conduit layout in schematic format, including junction boxes and distances between junction boxes.
 2. Indicate contents of each conduit.
 3. Indicate the cable pulling calculations, conduit fill ratios and actual cable runs and tensions.
 4. Cable Pulling Plan is to be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submittal.
 5. Installation of cabling cannot commence before written approval of the pulling plan and calculations by UITNS.
- B. Submit preliminary fiber test results to the UITNS Project Manager post-installation before being put into service to provide for correction of any non-conformities or inconsistencies so as to avoid disruptions to the active network.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit installation plan, and keep up-to-date throughout the project, indicating:
 1. Equipment and personnel
 2. Materials and staging area
 3. Start and completion dates
 4. Locations, including floor, room and building
 5. Installation plan is to be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.

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- B. Submit a copper cable pulling plan for all multi-pair copper cables with a pair count of 25 pairs or greater, that includes, but is not limited to, the following:
 - 1. Each cable run and route.
 - 2. Date and duration of the pull.
 - 3. Pulling methodology and equipment setups.
 - 4. Pulling tension calculations for each pull in the run.
 - 5. Safety issues and precautions to be taken.

- C. Cable Splicing Submittals
 - 1. Fiber fusion splicing method and procedures.
 - 2. Schedules of copper and fiber cables to be spliced.
 - 3. Copper splicing method and procedures.
 - 4. Certification documents for all splicing personnel.
 - 5. Cut sheets of accurate locations of fiber and copper splice closures.

- D. Shop Drawing Submittals to include:
 - 1. Room penetration plan / drawing
 - 2. Communications extension pathway plan / drawing
 - 3. Riser conduit anchoring plan / drawing
 - 4. Conduit chase plan / drawing
 - 5. Communications pathway plan / drawing
 - 6. Junction box, gutter and pull box labeling plan / drawing
 - 7. Cabinet / rack elevation drawing
 - 8. Floor plan drawing for all NF rooms
 - 9. Wall elevation drawings for all NF rooms

- E. Manufacturer's data, including part numbers, cut sheets and detailed descriptions, for all proposed equipment.

- F. Submit cable inventory data for all fiber, copper, and coaxial cabling and termination equipment. Submit data in Microsoft Excel format (current version), listing products furnished, including:
 - 1. Manufacturer's name.
 - 2. Manufacturer's part numbers and com code numbers.
 - 3. Cable numbers as described in 27 0553 Identification for Communications Systems.
 - 4. Location and riser assignments.
 - 5. Installed lengths for all fibers.
 - 6. This requirement applies to copper cable, fiber optic cable, and all termination equipment.

- G. Record Drawings: Furnish CAD drawings of completed work including cable numbers. Refer to item Section 27 0553 - Identification for labeling conventions. Contractor's on-site Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) supervisor must review, approve and stamp all shop drawings, coordination drawings and record drawings.

- H. As-built Drawings: Provide CADD files in .dwg, .dgn, or .pdf formats showing floor plans with room numbers and actual backbone cabling and pathway locations and labeling. The deliverable is required within 5 business days of final cable testing. Record GPS locations of all manhole/pull boxes.

- I. Cable Testing Reports.
 - 1. Submit Testing Plan prior to beginning cable testing.
 - 2. Observe testing requirements detailed in PART 3 – EXECUTION in this document.
 - 3. Submit certified test reports of Contractor-performed tests in accordance with this document.

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- 4. Submit test reports together, clearly marked with cable identification.
- 5. Test reports must be reviewed, approved and stamped by the Contractor's on-site RCDD.

- J. Product data for all termination and test equipment to be used by Contractor to perform work.
 - 1. Calibrate equipment with traceability to National Institute of Standards and Technology (NIST) requirements.
 - 2. Include a copy of calibration and certification that equipment calibration meets NIST standards and has been calibrated at least once in the previous calendar year.
 - 3. Test equipment data must be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.

1.8 QUALITY ASSURANCE

- A. Verification
 - 1. The Owner shall maintain inspection personnel on the job site. It is incumbent upon the Contractor to verify that the installation and material used has been inspected before it is enclosed within building features, or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected.

- B. Equipment
 - 1. The Contractor is to use equipment and rigs designed for pulling, placement and termination of multi-pair copper cable; including reel trucks, mechanical mules, sheaves, shoes, anchors etc., and equipment for drilling masonry, installing anchors, etc., to install support and cable management hardware.

PART 2 - PRODUCTS

2.1 PARTS AND MANUFACTURERS

- A. Refer to *Section 01 2500 Substitution Procedures* for variations from approved manufacturers or parts. Obtain written approval from UITNS before requesting a substitution for work covered by *Division 27 Communications*.

- B. Backbone Cables
 - 1. Berk-Tek
 - a. Part Number: 10032113 - Solid Copper Backbone/Tie Copper Cable: 24 AWG, UTP, Category 3, OSP Backbone Cables with an overall metallic shield.

- C. Protector Panels.
 - 1. Circa Enterprises
 - a. Entrance Terminals: 188OECA1-100G
 - b. Protector Modules: Gas Protector Unit - 3BIE

- D. Copper Termination Hardware (Cat 3, legacy applications) – Main Cross Connect (MC)
 - 1. Panduit
 - a. 5 Pair: P110KB1005
 - b. 4 Pair: P110KB1004
 - 2. CommScope
 - a. 5 Pair: UNK-110-WB-5M-100PR

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- b. 4 Pair: UNK-110-WB-4M-100PR

- E. Copper Termination Hardware (Cat 3, legacy applications) – Building Distribution Frame (BDF)
 - 1. Panduit
 - a. 5 Pair: P110KB1005
 - b. 4 Pair: P110KB1004
 - 2. CommScope
 - a. 5 Pair: UNK-110-WB-5M-100PR
 - b. 4 Pair: UNK-110-WB-4M-100PR

- F. Angled Patch Panels (Cat 3, legacy applications) – Equipment and IDF – 48-port, filled and terminated with appropriate number of black RJ-45 jacks.
 - 1. Panduit - UICMPPA48BL
 - 2. CommScope - 760207308

- G. Copper Termination Hardware (Cat 6) – Main Cross Connect (MC)
 - 1. Panduit
 - a. 5 Pair: P110KB1005
 - b. 4 Pair: P110KB1004
 - 2. CommScope
 - a. 5 Pair: UNK-110-WB-5M-100PR
 - b. 4 Pair: UNK-110-WB-4M-100PR

- H. Copper Termination Hardware (Cat 6) – Building Distribution Frame (BDF)
 - 1. Panduit
 - a. 5 Pair: P110KB1005
 - b. 4 Pair: P110KB1004
 - 2. CommScope
 - a. 5 Pair: UNK-110-WB-5M-100PR
 - b. 4 Pair: UNK-110-WB-4M-100PR

- I. Angled Patch Panels (Cat 6) – Equipment and IDF – 48-port, filled and terminated with appropriate number of black RJ-45 jacks.
 - 1. Panduit - UICMPPA48BL
 - 2. CommScope - 760207308

- J. Fabric Inner-duct
 - 1. MaxCell

- K. Metallic Tone Tape
 - 1. Arnco
 - a. DL WP12LC Tone Tape

- L. Outside Plant Fiber Optic Cable
 - 1. CommScope
 - a. 48-strand 9/125-micron single-mode outside plant rated fiber optic cable
 - b. 12-strand 62.5/125-micron multimode outside plant rated fiber optic cable (MM OSP cable used only for fire alarm system on the main campus; all other applications, including UH Technology Bridge fire alarm system, use SM OSP cable)

- M. Inside Plant Fiber Optic Cable

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1. CommScope
 - a. 12-strand Plenum-rated 9/125-micron single-mode fiber optic cable
 - b. 6-strand Plenum-rated 62.5/125-micron multimode fiber optic cable

- N. Fiber Termination Hardware
 1. Rack-mounted Fiber Distribution Units
 - a. CommScope
 - 1) For ER: #RFE-FXD-EMT-BK/4U
 - 2) For NFs: #RFE-SLG-EMT/2U
 2. ST fiber connectors

- O. Firestopping Materials
 1. EZ-Path

PART 3 - EXECUTION

3.1 CABLE INSTALLATION – OUTSIDE PLANT

- A. Communications conduits must be the top tier utility within the ductbank with a minimum of 18-inch separation from high voltage cabling.

- B. All fiber optic cable with loose tube construction installed underground must be gel filled or constructed of appropriate waterproofing compounds.

- C. Fiber optic cable installed in manholes between buildings must have a minimum of two (2) complete loops of at least 50 feet in each manhole.

- D. A copper tracer line should be run with all fiber that is in a non-metallic conduit. In each conduit, install a pull cord having a metallic member (tone tape) with a minimum test rating of 200 lbs pulling strength. Secure all pull cords shall be secured to prevent accidental removal.

- E. Fiber optic cables must always have minimum 20-foot service loop at the terminating ends and all approved splice points. Place service loops with large bend radii neatly bundled on walls or on the attached to the bottom side of ladder trays in 'figure-8' configuration.

- F. Splicing of fiber optic cable is not allowed between buildings.

- G. Install cable runs in one continuous length from bulkhead connector to bulkhead connector without splices; including service loops, and repairs unless required by standard, otherwise written approval must be received from UITNS Management.

- H. Place all newly installed fiber optic cable inside fiber optic innerduct with one-inch ID when not in conduit or utility tunnel cable tray. Splice innerduct according to manufacturer approved methods. A pull string must be run in addition to the cable in order to provide access for future growth.

- I. When splicing into the Metro fiber ring, all fiber cable installations are to be 100 percent terminated except as directed by UITNS. Install plastic dust caps on all unused fiber terminations.

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- J. Install, at a minimum, 48-strand, single-mode fiber of size 9/125 micron. Final strand counts are to be approved by UITNS.
- K. Single-mode cable attenuation at 1310nm must not exceed 1 dB plus .0008 dB per foot, end to end.
- L. The average/maximum fiber splice loss is 0.05/0.3 dB for single-mode fusion splices and 0.10/0.3 dB for mechanical splices.
- M. Submit the cable pulling plan to the Owner prior to commencement of the operation.
- N. Pull the fiber in inner-duct inside the manhole to prevent damage to the cable. No splicing is allowed in fiber cables between buildings.
- O. Splice all inner-duct according to manufacturer approved methods.
- P. The route of multi-pair copper cable installation is as described herein or as shown on the Drawings.
- Q. Two fiber optic cables must be included in each elevator umbilical.
- R. Ensure that the cables are pulled into the ducts in a manner observing the bend radii and tension restrictions of the cable.
- S. Use appropriate shoes, guides, wheels and lubricants to prevent damage to the cable jacket and sheath during installation.
- T. Install shield bond connectors to the shields of all cables terminated at the Protector Panels.
- U. Voice backbone cables installed in underground conduits or the tunnel must be gel-filled PIC cable to a termination point within the ER. The backbone cable must then be cross-connected to the protector blocks.
- V. Apply an appropriate amount of damming compound over the end of filled copper cables in indoor or dry environments to prevent seepage of cable filling compounds where encapsulant shall not be used.
- W. Prior to closure assembly in dry or indoor installations, all exposed cable pairs must have the filling compound thoroughly cleaned off the cable insulation using appropriate cleaning solvents.
- X. All splice cases used in the multi pair voice backbone must be waterproof.
- Y. Test all spliced pairs and clear all splice-related faults prior to sealing the closure
- Z. Voice backbone cables must have a minimum 10-foot service loop when terminated in the NF, and at any splice points in telecommunications manholes.

3.2 BACKBONE CABLE TESTING

- A. Complete end-to-end test results for all copper UTP and fiber optic lines installed is required.
- B. All fiber optic cable must be visually inspected and optically tested on the reel upon delivery to the installation site. Using Optical Loss Test Sets (OLTS) or an Optical Time Domain Reflectometer (OTDR), an

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access jumper with like fiber, a pigtail, and a mechanical splice, all fibers shall be tested for continuity and attenuation. Testing for continuity and attenuation on the reel must confirm factory specifications to ensure that the fiber optic cable was not damaged during shipment. The test results must match the results of the factory-attached tag on the reel, or the fiber shall not be used. Reel data sheet must be provided showing test results.

- C. After installation, provide end-to-end (bi-directional) test measurements for single-mode and multimode fibers (2 wavelengths per test are required). Test results must be submitted for review as part of the installation inspection requirements. Test results must be presented in paper form and electronic form, and must contain the names and signatures of the technicians performing the tests.
- D. Testing must be performed on all fibers in the completed end-to-end system, following the technical criteria and formulae in the applicable section of ANSI/TIA-568-x-D. Note however, that all UH fiber must be tested, rated and guaranteed for Ethernet GigaSPEED 1000B-X performance. Additionally, all fiber optic cable links must pass all installation and performance tests both recommended and mandated by the cable manufacturer.
- E. The fiber optic cable shall withstand water penetration when tested with a one-meter static head or equivalent continuous pressure applied at one end of a one-meter length of filled cable for one hour. No water shall leak through the open cable end. Testing shall be done in accordance with FOTP-82, "Fluid Penetration Test for Filled Fiber Optic Cable."
- F. Use cable with tensile strength of greater than or equal to 2700N (Newtons) short term and 600N long term without exhibiting an average increase in attenuation greater 0.20 dB (multi-mode) and 0.10 dB (single-mode). Make the minimum bend radius for cables less than or equal to 20 times the outside diameter under installation tensile load and 10 times the outside diameter under long term tensile load.
- G. All multi-pair copper cable pairs installed must be tested to ANSI/TIA-568-x-D, Category 3 or Category 6 equivalent performance specifications using level IIe or higher field testers. In addition, provide loop resistance measurements in ohms and dB loss at 1KHz, 8KHz, and 256KHz.
 - 1. Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct any reversed or grounded pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.
 - 2. If copper cables contain more than the number of bad pairs shown in the table below, or if outer sheath damage is cause of bad pairs, remove and replace the entire cable.

MAXIMUM PERMISSIBLE BAD PAIRS IN CAT 3 CABLING

| CABLE SIZE | MAXIMUM BAD PAIRS |
|------------|-------------------|
| <100 | 1 |
| 101 to 300 | 1 – 3 |
| 301 to 600 | 3 – 6 |
| >601 | 6 |

- H. The Owner is to be notified at least 24 hours prior to testing to allow observation at the Owner's discretion. If the Owner confirms his intention to observe, agree with the Owner upon a reasonable starting time. Should the Owner not be present at the scheduled commencement time, the Contractor may begin testing as scheduled.
- I. All pairs in backbone copper cables are to be tested for continuity and wire-map.

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- J. Format: Submit test results in two (2) formats: first, original file(s) downloaded from tester; second, data in Excel format with the following fields: NF RM # / RM # of drop / Port # / all relevant test information in as many fields as necessary.
- K. Take care when recording the information in the tester, with reference to above format criteria, that proper consistency with port identification is required.
- L. Delivery: Test Results shall be electronically submitted to the UITNS department. UITNS shall provide contact information after contract is awarded and before project completion.
- M. All test results are to be recorded and turned over to the Owner for checking within 10 business days of cable installation.

3.3 CABLE AND TERMINATION PANEL LABELING

- A. Label the installed cables in accordance with 27 0553 Identification for Communications Systems.

3.4 CABLE SUPPORT

- A. Provide cable supports and clamps to attach cables to backboards and walls.
 - 1. Attach horizontal and vertical backbone cables at 2-foot intervals using Owner approved supports such as D-rings or jumper troughs utilized for wire management.
- B. Attach cables to manhole racks using Owner approved methods.

3.5 AS-BUILT DRAWINGS

- A. Red Line Drawings: Contractor shall keep one E-size set of floor plans on site during work hours with installation progress marked and backbone cable labels noted. Contractor may be asked to produce these drawings for examination during construction meetings or field inspections.

END OF SECTION 27 1300

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SECTION 27 1500 – COMMUNICATIONS HORIZONTAL CABLING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect" or "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 2. The University of Houston's Supplemental General Conditions and Special Conditions for Construction.
 3. The University of Houston *Network Infrastructure Design Guidelines* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. Section Includes:

Revise subparagraph(s) below to suit Project.

1. Manufacturers and parts.
2. Required meetings and submittals.
3. Installation.
4. Testing, performance and acceptance.
5. Project documentation.

- B. This section describes horizontal communications cabling materials and installation methods, copper connectivity equipment and horizontal cable testing methods.

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [Project site] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

1. <Insert activity>.

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1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.5 ACTION SUBMITTALS

- A. To request IP addresses, submit the University Information Technology Network Services (UITNS) IP address form to the assigned UIT Project Manager as early as possible.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. System Labeling Schedules that are part of the cabling and asset identification system of the software.
 - 2. Cabling administration drawings and printouts.
- C. Test Result Documentation
 - 1. Native-format data from testers is required for all test results.
 - 2. The test results information for each link is to be recorded in the memory of the field tester upon completion of the test.
 - 3. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test and that these results cannot be modified at a later time.
 - 4. General Information to be provided with the test results information for each link includes:
 - a. The identification of the customer site as specified by the end-user.
 - b. The identification of the link in accordance with the naming convention defined in the overall system documentation.
 - c. The overall Pass/Fail evaluation of the link-under-test.
 - d. The name of the standard selected to execute the stored test results.
 - e. The cable type and the value of NVP used for length calculations.
 - f. The date and time the test results were saved in the memory of the tester.
 - g. The brand name, model and serial number of the tester.
 - h. The identification of the tester interface.
 - i. The revision of the tester software and the revision of the test standards database in the tester.
 - j. The test results information must contain information on each of the required test parameters.
 - 5. The detailed test results data to be provided in the electronic database for each tested link must contain the following information:
 - a. For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. In this case, the PC-resident database program must be able to process the stored results to display and print a color graph of the measured parameters. The PC-resident software must also provide a summary numeric format in which some critical information is provided numerically as defined by the summary results (minimum numeric test results documentation) as outlined above for each of the test parameters.

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- 1) Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.1 m (1ft) and the test limit value.
- 2) Propagation delay: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value.
- 3) Delay Skew: Identify the pair with the largest value for delay skew, the value calculated in nanoseconds (ns) and the test limit value.
- 4) Attenuation: Minimum test results for the worst pair.
- 5) Return Loss: Minimum test results for the worst pair as measured from each end of the link.
- 6) NEXT, ELFEXT, ACR: Minimum test results documentation as explained in Section I.B for the worst pair combination as measured from each end of the link.
- 7) PSNEXT, PSELFEXT, and PSACR: Minimum test results documentation for the worst pair as measured from each end of the link.

D. As-built drawings

- 1. Provide CAD files in .dwg or .dgn formats or PDF files showing floor plans with room numbers and actual outlet locations and labeling. The deliverable is required within 5 business days of final cable testing.
- 2. Red Line Drawings: Contractor must keep one (1) E size set of floor plans on site during work hours with installation progress marked and outlet labels noted. Contractor may be asked to produce these drawings for examination during construction meetings or field inspections.
- 3. For Wi-Fi network infrastructure, provide the final WAP location map (PDF) and spreadsheet (MS Excel) with WAP location information that includes the MAC address, room number, IDF number and switch port number (see example below).

Sample of Excel File with WAP information

| AP Name | AP Model | MAC Address | Room # | IDF # | Switch Port # |
|--------------|----------|-------------------|--------|---------|---------------|
| 563-0100N-HW | AP320i | 00:0c:e6:08:18:f4 | 100N | IDF 105 | 1/0/11 |
| 563-0107B-CT | AP320i | 00:0c:e6:07:91:1f | 107B | IDF 105 | 1/0/15 |
| 563-00102-HW | AP320i | 00:0c:e6:07:8f:65 | 102 | IDF 105 | 1/0/17 |

PART 2 - PRODUCTS

2.1 PARTS AND MANUFACTURERS

A. GENERAL GUIDELINES

- 1. Do not mix manufactures for closely related parts (for example, do not use different manufacturers for faceplates and blank inserts since they may not be compatible).
- 2. Refer to *Section 01 2500 Substitution Procedures* for variations from approved manufacturers or parts. Obtain written approval from UITNS before requesting a substitution for work covered by *Division 27 Communications*.

B. Cable – Twisted Pair

- 1. CommScope
 - a. CS34P BLU Category 6 U/UTP Cable, plenum rated, 4 pair count

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- 2. Panduit
 - a. PUP6504BU-UY (blue jacket)

- C. Cable – Coaxial (NO LONGER USED FOR NEW CONSTRUCTION PROJECTS)
 - 1. CommScope
 - a. 2275 V

- D. Cable Fiber (Distribution)
 - 1. Corning
 - a. Single-mode: 012ED8-31331-20
 - b. Multi-mode: 012KD8-31330-20
 - 2. CommScope
 - a. Single-mode: P-012-DS-8W-FSUYL
 - b. Multi-mode: P-012-DS-6F-FSUOR

- E. Cable Fiber (OSP)
 - 1. Corning
 - a. 24F, single-mode- 024EUC-T4101D20
 - b. 48F, single-mode- 048EUC-T4101D20
 - c. 96F, single-mode- 096EUC-T4101D20
 - d. 144F, single-mode- 144EUC-T4101D20
 - 2. CommScope
 - a. 24F, single-mode- 024EUC-T4101D20 D 024-LA-8W-F12ns
 - b. 48F, single-mode- 048EUC-T4101D20 D 048-LA-8W-F12NS
 - c. 96F, single-mode- 096EUC-T4101D20 D 096-LA-8W-F12-NS
 - d. 144F, single-mode- 144EUC-T4101D20 D 144-LA-8W-F12ns

- F. Angled Patch Panels
 - 1. Panduit
 - a. UICMPPA48BL
 - 2. CommScope
 - a. M2000A-48

- G. Faceplates
 - 1. Panduit
 - a. CFPE4IW
 - 2. CommScope
 - a. UNF-MFM-4P-WH

- H. Telecommunications Outlets: 8-pin modular Category 6, un-keyed, pinned T568B standards to be fully terminated. Single-gang mounting plate with four (4) openings which shall include one or more of the following devices:
 - 1. Panduit
 - a. Telecommunications Outlet, Red: CJ688TPRD
 - b. Wireless Outlet, Yellow: CJ688TPYL
 - c. Security Camera/Intrusion Alarm Outlet/Door Locks, Violet: CJ688TPVL?
 - d. EMECS Systems, Green: CJ688TPGR
 - e. Blank: CMBIW-X
 - 2. CommScope
 - a. Telecommunications Outlet, Red: UNJ600-RD
 - b. Wireless Outlet, Yellow: – UNJ600-YL

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- c. Security Camera/Intrusion Alarm Outlet/Door Locks, Violet: UNJ600-VL?
 - d. EMECS Systems, Green: UNJ600-GR
 - e. Blank – 1-1116412-3
- I. Wireless Access Points (WAPs)
 - 1. Aruba
 - a. Consult the assigned UITNS Project Manager for the approved WAP model at the time of product selection.
- J. Telephone Equipment
 - 1. For a list of supported Skype for Business phones/handsets, please go to <http://www.uh.edu/infotech/services/skype/phones/index.php>.
- K. Firestopping Materials
 - 1. EZ-Path

PART 3 - EXECUTION

3.1 GENERAL

- A. Never attach cable to the ceiling grid support system.
- B. Terminate horizontal cabling in the TRs on 48-port, 8-pin modular insulation displacement connector (IDC) meeting Category 6 performance standards, and pinned to T 568B standards. Mount Category 6 patch panels in an approved 19-inch relay rack. Terminate all horizontal cabling on patch panels in the Network Facility.
 - 1. Use Category 6E and Category 6A jacks.
 - 2. The exposed front of each jack must be the correct color to represent the connection's purpose as follows:
 - a. Red General purpose, office and lab connection - other than Category 6A
 - b. Blue General purpose, office and lab connection - Category 6A
 - c. Yellow Wireless Access Point connection
 - d. Violet Security camera, security device, lighting controller, door lock or Code Blue phone
 - e. Green EMECS system connection
 - f. White AV
- C. Follow manufacturer's installation guidelines and *Network Infrastructure Design Standards*.
- D. All voice and data cabling shall be continuous from the nearest Network Facility to the telecommunications outlet. Splicing of cable is not allowed.
- E. Pay strict attention to the manufacturer's guidelines on bend radii, maximum pulling tension and vertical rise during installation. Notice that the recommended minimum bend radius for a cable during installation is typically greater than the recommended bend radius after the cable is installed. This is to minimize tension and deformation as the cables pass around corners during installation. The maximum pull-force guideline for 4-pair horizontal balanced twisted pair cables is 110 N.
- F. Lubricants may be used to facilitate pulling of cables but the lubricant shall not be harmful to the cable, the raceway, or personnel. J-Type Polywater is preferred.

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- G. Fiber patch cables secured by strap or other fasteners shall not be pulled so tightly that the outside cable sheathing is indented or crushed.

- H. Terminated fiber strands will be installed in rack-mounted optical fiber distribution shelves. Install all optical fiber in inner-duct up to the point the cable enters a terminating enclosure.

- I. UTP Cabling:
 - 1. Provide a minimum of 3-foot service loop (for re-termination) for horizontal cables. Locate service loop where horizontal cable run transitions to cable tray. Place at least 12 inches of service loop in outlet box.
 - 2. The horizontal distance is the cable length from the mechanical termination of the media at the horizontal cross-connect in the Network Facility to the telecommunications outlet/connector in the work area. The maximum horizontal distance is 295 ft, independent of media type. The length of the cross-connect jumpers and patch cords in the cross-connect facilities, including horizontal cross-connects, jumpers, and patch cords that connect horizontal cabling with equipment or backbone cabling, shall not exceed 5 m (16 ft) in length. For each horizontal channel, the total length allowed for cords in the work area plus patch cords or jumpers plus equipment cables or cords in the Network Facility cannot exceed 10 m (33 ft).
 - 3. Visually inspect cable and components for proper installation. Minimize cable stress, such as that caused by tension in suspended cable runs and tightly cinched bundles. Apply plenum rated Velcro ties used to bundle cables loosely to allow the Velcro tie to slide around the cable bundle. Do not cinch the ties so tightly as to deform the cable sheath. Cable placement should not deform the cable sheath.
 - 4. Minimum bend radius: The minimum bend radius for cable will vary depending on the condition of the cable during installation (tensile load) and after installation when the cable is at rest (no-load).
 - 5. The minimum bend radius, under no-load conditions, for 4-pair unshielded twisted-pair (UTP) cable is four times the cable diameter.
 - 6. Copper cable splicing or bridge tapping is unacceptable.
 - 7. Cables shall be terminated with connecting hardware of the same category or higher. To maintain the cable geometry, remove the cable sheath only as much as necessary to terminate the cable pairs on the connecting hardware. Follow the connecting hardware manufacturer's instructions for cable sheath strip-back. When terminating Category 6 and higher cables, keep the cable pair twists within 13 mm (0.5 in) from the point of termination. For best performance when terminating cable on connecting hardware, keep the cable pair twists as close as possible to the point of termination.
 - 8. The Cabling Contractor will install 4-pair Category 6 plenum rated UTP cables from the appropriate TR to each outlet location as indicated on the telecommunications drawings.

- J. Wireless Access Points (WAPs)
 - 1. Run two Category 6E cables and install two jacks at each WAP location to accommodate future needs.
 - 2. Mount WAP in a visible and accessible location, preferably below the ceiling or on the walls. For maintenance purposes, WAP shall be mounted in a space no higher than 10-feet high, avoiding objects like air conditioning units, vents, sprinkler systems, or anything that will interfere with the performance of WAP.
 - 3. If a WAP must be mounted in a non-standard location (e.g. exposed or recessed ceilings) contact UITNS for alternative mounting solutions.
 - 4. Label WAPs and their associated jacks as described in Master Specification 27 0553 Identification for Communications Systems.

3.2 SITE QUALITY CONTROL

A. Site Testing and Inspection Agency Qualifications

1. Every cabling link in the installation is to be tested in accordance with the field test specifications defined in ANSI/TIA-568.2-D — “Balanced Twisted-Pair Telecommunications Cabling and Components”. This document will be referred to as the “TIA Cat 6 Standard.”
2. The installed twisted-pair horizontal links are to be tested from the patch panel in the Network Facility to the telecommunications wall outlet in the work area against the “Permanent Link” performance limits specification as defined in the TIA CAT 6 Standard.
3. The test equipment must comply with the accuracy requirements for level III field testers as defined in the TIA CAT 6 Standard. The tester including the appropriate interface adapter must meet the specified accuracy requirements.
4. The test plug must fall within the values specified in the modular test plug NEXT loss requirements of the TIA CAT 6 Standard.
5. The tester must be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
6. The tester interface adapters must be of high quality and the cable should not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The Cabling Contractor is to provide proof that the interface has been calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable must not be of twisted-pair construction.
7. All installed cabling links must be tested and must pass the requirements of the standards in this section. Any failing link must be diagnosed and corrected. Follow the corrective action with a new test to prove that the corrected link meets the performance requirements. Provide the final and passing result of the tests for all links in accordance with the Test Result Documentation as listed above in Informational Submittals.

B. Site Testing, Inspection and Acceptance

1. If horizontal cable contains bad conductors or damaged outer jacketing, remove and replace cable.
2. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.
3. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. Mark the test result of a parameter with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks.
4. A representative of the design team must be invited to witness field testing. Notify the representative of the start date of the testing phase five business days before testing begins.
5. At the conclusion of field testing, at a time scheduled by the UITNS PM, the UITNS PM will select a random sample (up to 10%) of the installed links in each wiring closet. The Cabling Contractor, under supervision of the UITNS PM, is to test these randomly selected links and the results are to be stored in accordance with the prescriptions in Test Result Documentation as listed in 1.5 Informational Submittals.
6. The results obtained are to be compared to the data originally provided by the Cabling Contractor. If any (one or more) of the sample test reports displays a fail or fail* result, the Cabling Contractor must resolve any conditions causing the failed test and, under supervision of the UITNS PM, repeat all testing. The cost shall be borne by the Cabling Contractor.

- C. The test parameters for CAT 6 are defined in TIA CAT 6 standard. The test of each link is to contain all of the following parameters as detailed below. In order to pass the test all measurements (at each frequency in the range from 1 MHz through 250 MHz) must meet or exceed the limit value determined in the above-mentioned standard.
1. Wire Map
 - a. Length
 - b. Insertion Loss (Attenuation)
 - c. NEXT Loss
 - d. PSNEXT Loss
 - e. ELFEXT Loss, pair-to-pair
 - f. PSELFEXT Loss
 - g. Return Loss
 - h. ACR (Attenuation to crosstalk ratio)
 - i. PSACR
 - j. Propagation Delay
 - k. Delay Skew [as defined in TIA/EIA-568-B.1; Section 11.2.4.11]

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SECTION 27 1619 – PATCH CORDS, STATION CORDS AND CROSS-CONNECT CABLES

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect" or "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction*.
 3. The University of Houston *Network Infrastructure Design Standards* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. Section Includes:
 1. Coordination with other trades and parts of the contract.
 2. Submittals (Action and Informational).
 3. Quality Assurance.
 4. Parts and Manufacturers.
 5. Installation and Testing.
- B. This section covers the cables used to provide connections to horizontal cables that transport signal between network distribution equipment and between such equipment and end-user hardware.

Revise subparagraph(s) below to suit Project.

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [Project site] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

1. <Insert activity>.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.5 ACTION SUBMITTALS

- A. None.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PARTS AND MANUFACTURERS

- A. Refer to *Section 01 2500 Substitution Procedures* for variations from approved manufacturers or parts. **Obtain written approval from UITNS before requesting a substitution for work covered by *Division 27 Communications*.**

- B. Copper Cables

- 1. Panduit

- a. 3-foot UTPSP3
 - b. 5-foot UTPSP5
 - c. 7-foot UTPSP7
 - d. 10-foot UTPSP10
 - e. 14-foot UTPSP14
 - f. 20-foot UTPSP20
 - g. Colors: Above part numbers are off white. Append the following to part numbers to designate color.
 - 1) BL = Black
 - 2) BU = Blue
 - 3) RD = Red
 - 4) YL = Yellow
 - 5) VL = Violet
 - 6) OR = Orange

- 2. CommScope

- a. 3-foot UNC6-xx-3F
 - b. 5-foot UNC6-xx-5F
 - c. 7-foot UNC6-xx-7F

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- d. 10-foot UNC6-xx-10F
- e. 14-foot UNC6-xx-15F
- f. 20-foot UNC6-xx-20F
- g. xx = Color Designation. Replace xx in part numbers to designate color as follows:
 - 1) BK = Black
 - 2) BL = Blue
 - 3) RD = Red
 - 4) YL = Yellow
 - 5) VL = Violet
 - 6) OR = Orange

C. Fiber Optic Cables

- 1. CommScope or Corning
 - a. Single-mode: Fiber Optic Patch Cords with LC connectors – yellow
 - b. Multimode: Fiber Optic Patch Cords with ST connectors – orange

PART 3 - EXECUTION

3.1 General Installation

- A. Cabling Contractor shall fully cooperate and coordinate with Owner's Voice and Data Communications Equipment providers as required to ensure proper integration and connectivity between systems.
- B. Cabling Contractor shall furnish and install all patch cords in conjunction with Owner's Voice and Data Communications Equipment providers.
- C. Cabling Contractor shall provide adequate technician support when Owner's Voice and Data Communications Equipment providers are planning and installing new voice and data equipment installation and connectivity.
- D. Field terminated patch cables are strictly prohibited.
- E. Label copper and fiber optic patch cables as described in *27 0553 Identification for Communications Systems*.

3.2 Copper Cable

- A. Furnish and install two Category 6 copper patch cables (one 5 feet in length and one 7 feet in length) for each horizontal cable installed.
- B. Take care to protect the minimum bend radius of 4 times the cable diameter on all copper patch cables.

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- C. Assure that, at minimum, every horizontal cabling permanent link in the installation meets or exceeds performance characteristics of the field test specifications defined in ANSI/TIA-568.2-D *Balanced Twisted-Pair Telecommunications Cabling and Components Standard*.
- D. Copper Patch Cable Color:
 - 1. Blue General purpose, office or lab connection
 - 2. Yellow Wireless access point connection
 - 3. Violet Security camera, Security device, door lock or Code Blue phone
 - 4. Green EMECS system connection
 - 5. White AV
- E. Connect all wireless (WAP) jacks to a gigabit port with Power over Ethernet (802.at) on a dedicated HPE switch for wireless devices.

3.3 Fiber Optic Cable

- A. Provide one duplex LC Fiber optic patch cable for every fiber optic strand terminated.
- B. Patch cables are to be of like type and connector to the terminated fiber optic cable type.
- C. Length is to be determined at installation and recorded in submittal documents. Make the cable length adequate to reach owner provided electronic equipment mounted in lower section of relay rack.
- D. Fiber Optic Patch Cable Color:
 - 1. Yellow: Single-mode
 - 2. Orange: Multi-mode

END OF SECTION 27 1619

SECTION 27 2000 – DATA COMMUNICATIONS EQUIPMENT

PART 1 - GENERAL

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term “Architect” or “Engineer.” Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston’s Supplemental General Conditions and Special Conditions for Construction.
 - 3. The University of Houston’s *Network Infrastructure Design Standards* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. This Section specifies the requirements for the Data Communications Equipment for the University of Houston [**Project Name**] [**Insert Project description**].
- B. Data Communications Equipment Includes:
 - 1. Customer owned routers, servers, Ethernet switches, personal computers, printers, wireless access points, etc. required to connect the Academic Wing to the rest of the campus, the internet and the public switched telephone network (PSTN).
 - 2. Data Communications Equipment will be Owner Furnished Contractor Installed (OFCl).

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [**Project site**] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the Preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

- 1. <Insert activity>.

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1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.5 ACTION SUBMITTALS

- A. None.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor must furnish labeled floor plan and Excel run sheet to University Information Technology Network Services (UITNS) two weeks prior to occupancy.

PART 2 - PRODUCTS

The paragraph and subparagraphs in this Article demonstrate the line spacing format for subparagraphs not subordinate to the preceding subparagraph.

- 2.1 Not Applicable.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Contractor shall fully cooperate and coordinate with UITNS as required to ensure proper integration and connectivity between systems.
- B. Contractor shall furnish and install all patch cords in conjunction with UITNS' Work.
- C. Contractor shall provide adequate technical support to UITNS during planning, installation and connectivity of new voice and data equipment.
- D. Contractor shall provide adequate technician support first business day after data equipment installation and connectivity.

END OF SECTION 27 2000

SECTION 27 3000 – VOICE COMMUNICATIONS EQUIPMENT

PART 1 - GENERAL

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term “Architect” or “Engineer.” Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

1.1 RELATED DOCUMENTS

- A. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston’s Supplemental General Conditions and Special Conditions for Construction.
 - 3. The University of Houston’s *Network Infrastructure Design Standards* (available at <https://uh.edu/infotech/services/computing/networks/network-infra-standards/>).

1.2 SUMMARY

- A. This section specifies the requirements for the Voice Communications Equipment for the University of Houston [**Project Name**] [**Insert Project description**].
- B. Voice Communications Equipment includes:
 - 1. Customer owned phones, faxes, etc. required to connect the [**Project Name**] to the rest of the campus and the public switched telephone network (PSTN).
 - 2. Voice Communications Equipment will be Owner Furnished Contractor Installed (OFCI).

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at [**Project site**] <Insert location>. The Contractor and the Facilities Project Manager lead the meeting. The UIT Project Manager must be invited to the Preinstallation meetings.

Copy subparagraph below and edit for each activity required for preconstruction conference.

- 1. <Insert activity>.

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<Insert Project Name>
<Insert U of H Proj #>

<Insert Issue Name>
<Insert Issue Date>

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Follow the *Submittal Administrative Requirements* as stated in *Section 01 3300 Submittal Procedures*. For submittals to UIT, use electronic format only.

1.5 ACTION SUBMITTALS

- A. None.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor must furnish labeled floor plan and Excel run sheet to University Information Technology Network Services (UITNS) two weeks prior to occupancy.

PART 2 - PRODUCTS

The paragraph and subparagraphs in this Article demonstrate the line spacing format for subparagraphs not subordinate to the preceding subparagraph.

- 2.1 Not Applicable.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Contractor shall fully coordinate with UITNS as required to ensure proper integration and connectivity between systems.
- B. Contractor shall furnish and install all patch cords in conjunction with UITNS.
- C. Contractor shall provide adequate technician support during planning, installation and connectivity of new voice and data equipment by UITNS.
- D. Contractor shall provide adequate technician support first business day after Voice equipment installation and connectivity.

END OF SECTION 27 3000