

University of Houston Master Specification

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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