

(NOTE TO DESIGNER: These Specifications are basic minimum criteria to be met in preparing the final specifications for this section, which is the responsibility of the Designer.)

SECTION 27 13 00
COMMUNICATIONS BACKBONE CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

- A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing in performing the following operations recognized as necessary for the installation, termination, and labeling of copper and fiber backbone infrastructure as described on the Drawings and/or required by these Specifications.
- B. Products
- C. Installation Requirements
- D. The building backbone riser system connects Telecommunication Rooms 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.

1.3 RELATED SECTIONS

- A. 27 05 00 Common Work Results for Communications
- B. 27 05 53 Identification for Communication Systems

1.4 COORDINATION

- A. New cable plant requiring connection to, or disconnection from, the University of Houston campus networks shall be performed by personnel designated by Information Technology Network Operations. 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.
- B. 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.
- C. All questions and issues with regard to coordination shall be directed to the Owner.

1.4 SUBMITTALS

- A. Manufacturer's data, including part numbers, cut sheets and detailed descriptions, for all proposed equipment.
- B. Cable inventory data shall be submitted for all fiber, copper, and coaxial cabling and termination equipment. Submit data electronically on CD-Rom disc in "Microsoft Excel 2007" format, listing products furnished, including:

1. Manufacturer's name.
 2. Manufacturer's part numbers and com code numbers.
 3. Cable numbers utilizing the UH Information Technology Network Operations' cable numbering standard.
 4. Location and riser assignments.
 5. This requirement applies to copper cable, fiber optic cable, and all termination equipment.
- C. Record Drawings: Furnish CAD drawings of completed work including cable numbers. Refer to item Section 27 05 53 for labeling conventions. Contractor's on-site Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) supervisor shall review, approve and stamp all shop drawings, coordination drawings and record drawings.
- D. Cable Testing Reports.
1. Submit Testing Plan prior to beginning cable testing.
 2. Submit certified test reports of Contractor-performed tests in accordance with this document.
 3. Electronic and hardcopy versions of test reports shall be submitted together and clearly identified with cable identification.
 4. Test reports shall be reviewed, approved and stamped by the Contractor's on-site RCDD.
- E. Product data for all termination and test equipment to be used by Contractor to perform work.
1. Equipment shall be calibrated with traceability to National Institute of Standards and Technology (NIST) requirements.
 2. Contractor shall include 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 shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.
- F. 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 shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submittal.
 5. Installation of cabling shall not commence prior to approval of the pulling plan and calculations by the Architect/Engineer.
- G. The Contractor shall submit installation plan 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 shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.
- H. The Contractor shall 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.

- I. 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, showing accurately scaled components, of fiber and copper splice closures, accessories, clamps, brackets, hangers, splice connectors, splice joint assemblies and fittings.
- J. Shop Drawing Submittals to include:
 - 1. Room penetration plan / drawing
 - 2. Communication extension pathway plan / drawing
 - 3. Riser conduit anchoring plan / drawing
 - 4. Conduit chase plan / drawing
 - 5. Communication pathway plan / drawing
 - 6. Junction box, gutter and pull box labeling plan / drawing
 - 7. Cabinet / rack elevation drawing
 - 8. Floor plan drawing for all ER / TR rooms
 - 9. Wall elevation drawings for all ER / TR rooms
- K. All submittals for substitutions or modifications shall be made to the ITNO for approval prior to start of work.

1.5 QUALITY ASSURANCE

- A. Verification: 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: 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 COPPER CABLE

- A. Substitutions for products specified are not permitted without express written approval of Information Technology Network Operations.
- B. Solid Copper Backbone/Tie Copper Cable: 24 AWG, UTP, Category 3, OSP Backbone Cables with an overall metallic shield. Manufacturer: Berk-Tek - Part Number: 10032113
- C. Voice backbone cables installed in underground conduits or the tunnel shall be gel-filled PIC cable to a termination point within the ER. The backbone cable shall then be cross-connected to the protector blocks.
- D. All splice cases used in the multi pair voice backbone shall be waterproof.
- E. Building entrance protection for copper cabling shall be installed utilizing a two (2) foot fuse link between outside plant cable plant splice and the protector module with IDC-type input and output terminals, 100 pair-pair capacity and female mounting base, equipped with 230 volt solid state protector modules. Sufficient protector modules shall be provided to completely populate all building entrance terminals.

- F. The shield of all inter-building backbone cables must be bonded to the ground lug on the primary protector panel. The protector panel must be bonded to the Telecommunications Main Grounding Busbar. The shield of all intra-building backbone cables must be bonded to the Telecommunications Main Grounding Busbar.
- G. Voice backbone cables shall have a minimum 10-foot service loop when terminated in the ER and TR, and at any splice points in telecommunications manholes.

2.2 PROTECTOR PANELS

- A. Entrance Terminals - CIRCA 188OECA1-100G
- B. Protector Modules – CIRCA Gas Protector Unit – 3BIE

2.3 COPPER TERMINATION HARDWARE

- A. Main Cross Connect (MC)
 - 1. 5 Pair – Panduit P110KB1005
 - 2. 5 Pair – CommScope UNK-110-WB-5M-100PR
 - 3. 4 Pair – Panduit P110KB1004
 - 4. 4 Pair – CommScope UNK-110-WB-4M-100PR
- B. Entrance Facility (EF)
 - 1. 5 Pair – Panduit P110KB1005
 - 2. 5 Pair – CommScope UNK-110-WB-5M-100PR
 - 3. 4 Pair – Panduit P110KB1004
 - 4. 4 Pair – CommScope UNK-110-WB-4M-100PR
- C. 48 Port Angled Patch Panels, filled and terminated with appropriate number of black RJ-45 jacks.
 - 1. Panduit – UICMPPA48BL
 - 2. CommScope – M2000A-48

2.4 OUTSIDE PLANT FIBER OPTIC CABLE

- A. 48-strand 9/125 micron single-mode outside plant rated fiber optic cable: CommScope
- B. 12-strands 62.5/125 micron multi-mode outside plant rated fiber optic cable (MM OSP cable used only for fire alarm system): CommScope
- C. All fiber optic cable with loose tube construction installed underground shall be gel filled or be constructed of appropriate waterproofing compounds.
- D. A minimum of two (2) complete fiber optic loops in each manhole shall be installed in manholes between buildings.
- E. No splicing is allowed in fiber optic cables between buildings.
- F. Cable runs shall be installed 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 ITNO Management.
- G. All newly installed fiber optic cable shall be placed inside fiber optic innerduct when not in conduit or utility tunnel cable tray. A pull string must be run in addition to the cable in order to provide access for future growth.
- H. Fiber optic cables shall 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.

2.5 INSIDE PLANT FIBER OPTIC CABLE

- A. 12-strands Plenum-rated 9/125 micron Singlemode fiber optic cable: Manufacturer - CommScope
- B. 6-strands Plenum-rated 62.5/125 micron Multimode fiber optic cable: CommScope

2.6 FIBER TERMINATION HARDWARE

- A. Rack-mounted Fiber Distribution Units for ER: CommScope #RFE-FXD-EMT-BK/4U
- B. Rack-mounted Fiber Distribution Units for TRs: CommScope #RFE-SLG-EMT/2U
- C. ST fiber connectors

2.7 FIBER PATCH CABLES

- A. Fiber Optic Patch Cords with ST connectors for both SM and MM Cable: Panduit
 - 1. Yellow for single-mode
 - 2. Orange for multi-mode
- B. One duplex patch cable for every fiber optic strand terminated.
- B. Patch cables to be of like type and connector to fiber cable.
- C. Length shall be adequate to reach owner provided electronic equipment mounted in lower section of relay rack.

PART 3 – EXECUTION

3.1 CABLE INSTALLATION – OUTSIDE PLANT

- A. Fiber optic cable installed in manholes between buildings shall be a minimum of two (2) complete loops in each manhole.
- B. Splicing of fiber optic cable is not allowed between buildings.
- C. All fiber shall be installed in innerduct. Innerduct shall be spliced according to manufacturer approved methods.
- D. At a minimum, 48-strand, single-mode fiber of size 9/125 micron shall be installed. Final strand counts to be approved by ITNO. Single-mode fiber size shall be 9/125 micron. All Single-mode cables are not to exceed 1 dB plus .0008 dB per foot end to end attenuation at 1310nm.
- E. The average/maximum fiber splice loss for single-mode fusion splices shall be 0.05/0.3 dB and 0.10/0.3 dB for mechanical splices.
- F. Contractor shall submit the cable pulling plan to the Owner prior to commencement of the operation.
- G. The fiber shall be pulled in inner-duct inside the manhole to prevent damage to the cable. No splicing is allowed in fiber cables between buildings.
- H. All inner-duct shall be spliced according to manufacturer approved methods.
- I. The route of multi-pair copper cable installation is as described herein or as shown on the Drawings.
- J. The Contractor shall ensure the cables are pulled into the ducts in a manner observing the bend radii and tension restrictions of the cable.
- K. The Contractor shall use appropriate shoes, guides, wheels and lubricants to prevent damage to the cable jacket and sheath during installation.
- L. Install shield bond connectors to the shields of all cables terminated at the Protector Panels.
- M. The Contractor shall 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.

- N. Prior to closure assembly in dry or indoor installations, all exposed cable pairs shall have the filling compound thoroughly cleaned off the cable insulation using appropriate cleaning solvents.
- O. All pairs spliced shall be tested and all splice-related faults cleared prior to sealing the closure assembly.

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 an Optical Time Domain Reflectometer (OTDR), an 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. End to end (bi-directional) test measurements shall be provided for singlemode 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 shall be in paper form and electronic form, and must contain the names and signatures of the technicians performing the tests.
- D. Testing shall be performed on 100% of the fibers in the completed end-to-end system. ANSI/TIA/EIA-568-A, Annex H, provides the technical criteria and formulae to be used in fiber optic testing. 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. All multi-pair copper cable pairs installed shall be tested to TIA/EIA 568A, Category 3 or Category 6 equivalent performance specifications. In addition, provide loop resistance measurements in ohms and dB loss at 1KHz, 8KHz, and 256KHz.
- F. 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, a reasonable starting time shall be agreed upon. Should the Owner not be present at the scheduled commencement time, the Contractor may begin testing as scheduled.
- G. 100% of all pairs in backbone copper cables shall be tested for continuity and wire-map.
- H. Format: Test Results must be submitted in two (2) formats. First, must be original file(s) down loaded from tester. Second, the file must be cohesively placed in Excel format with the following fields: ER/TR RM # / RM # of drop / Port # / all relevant test information in as many fields as necessary.
- I. Care, with reference to above format criteria, should be taken when recording the information in the tester, proper consistency with port identification is required.
- J. As- Built drawings must be submitted with .dgn or .dwg file extensions.
- K. Delivery: Test Results may be electronically submitted to the ITNO Department. Contact information shall be provided after contract is awarded and before project completion
- L. All test results are to be recorded and turned over to the Owner for checking.

3.2 CABLE AND TERMINATION PANEL LABELING

- A. Label the installed cables in accordance with Section 27 05 53

3.3 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

3.3 AS-BUILT DRAWINGS

- A. Provide three (3) copies of E and three (3) copies of C size prints along with CADD files in .dwg or .dgn 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.
- B. Red Line Drawings: Contract must kept one (1) 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