

(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 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Horizontal communications cabling materials and installation methods
- B. Copper connectivity equipment.
- C. Horizontal cable testing methods.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Division 27 Sections include:
 - 1. 27 05 00 Common Work Results for Communications
- C. University of Houston Information Technology Telecommunication Infrastructure Standards (latest ed.)

1.3 SUMMARY

- A. This Section specifies the requirements for Communications Horizontal Cabling for the University of Houston [Project Name]. [Insert Project description.].
- B. All voice and data horizontal cables shall consist of plenum-rated, solid copper, 24 AWG, 100 balanced twisted-pair (UTP) Category 6 cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA-568B.2.
- C. Horizontal cabling shall be terminated in the ER/TRs on 48-port, 8-pin modular insulation displacement connector (IDC) meeting Category 6 performance standards, and pinned to T 568B standards. Category 6 patch panels shall be mounted in an approved 19 inch relay rack. 100 percent of the horizontal cabling shall be terminated on patch panels in the telecommunications room.
- D. The maximum horizontal distance shall be 295 feet.
- E. All information outlets will be flush-type mounted into conduits and boxes. Typical outlets will be used in the offices and consist of two voice and two data cables with 568B outlet configurations.
- F. Each horizontal cable must be tested with documentation provided.
- G. Contractor shall keep updated redline drawings and provide as-built documentation in both print and electronic formats.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cable
 - 1. Twisted Pair
 - a. CommScope - 6504 – Cable Jacket Color shall be Blue.
 - 2. Coaxial
 - a. CommScope – 2275 V
- B. Angled Patch Panels

1. Panduit – UICMPA48BL
 2. CommScope – M2000A-48
- C. Faceplates
1. Panduit – CFPE4IW
 2. CommScope – UNF-MFM-4P-WH
- D. Telecommunication 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 – Color: Red– CJ688 TP RD
 - b. Wireless Outlet – Color: Yellow – CJ688 TP YL
 - c. Security Camera/Intrusion Alarm Outlet – Color: Purple-CJ688 TP
 - d. EMECS Systems- Color: Green – CJ688 TP GN
 - e. Blank – CMBIW-X
 2. CommScope
 - a. Telecommunications Outlet – Color: Red – UNJ600-RD
 - b. Wireless Outlet – Color: Yellow – UNJ600-YL
 - c. Security Camera/Intrusion Alarm Outlet – Color: Purple
 - d. EMECS Systems- Color: Green
 - e. Blank – UNDC-WH

PART 3 - EXECUTION

3.1 GENERAL

- A. Follow manufacturer's installation guidelines and UH Information Technology Telecommunication Infrastructure Standards.
- B. All voice and data cabling and terminations and termination hardware shall be TIA/EIA wiring configuration T568B.
- C. All voice and data cabling shall be continuous from the nearest telecommunications room to the telecommunications outlet. Splicing of cable is not allowed.
- D. The length of each individual run of horizontal cable from the administration subsystem (Telecommunications Room) to the Telecommunication Outlet shall not exceed 295 ft.
- E. The 4 pair UTP cable shall be Underwriter's Laboratories (UL) listed type CMP.
- F. Strict attention shall be paid to the manufacturer's guidelines on bend radii and maximum pulling tension 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 (25 lbf).
- G. 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" 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 telecommunications room to the telecommunications outlet/connector in the work area. The maximum horizontal distance shall be 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, should 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 telecommunications room shall not exceed 10 m (33 ft).
3. Cable and components shall be visually inspected for proper installation. Cable stress, such as that caused by tension in suspended cable runs and tightly cinched bundles, shall be minimized. Plenum rated Velcro ties used to bundle cables should be applied loosely to allow the Velcro tie to slide around the cable bundle. The vector ties should not be cinched 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 shall be four times the cable diameter.
 6. Copper cable splicing or bridge tapping is unacceptable.
 7. Cables should 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. The connecting hardware manufacturer's instructions for cable sheath strip-back shall be followed. When terminating Category 6 and higher cables, the cable pair twists shall be maintained to within 13 mm (0.5 in) from the point of termination. For best performance when terminating cable on connecting hardware, the cable pair twists should be maintained as close as possible to the point of termination.
 8. The Cable Contractor shall install 4-pair Category 6 plenum rated UTP cables from the appropriate TR to each outlet location as indicated on the telecommunications drawings.

3.2 SITE QUALITY CONTROL

A. Site Testing and Inspection Agency Qualifications

1. Every cabling link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA/EIA-568-B.2-1 "Transmission Performance Specifications for 4-pair, 100 Ohm, Category 6 Cabling". This document will be referred to as the "TIA Cat 6 Standard."
2. The installed twisted-pair horizontal links shall be tested from the patch panel in the telecommunications room to the telecommunication wall outlet in the work area against the "Permanent Link" performance limits specification as defined in the TIA CAT 6 Standard.
3. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).
4. The test equipment shall comply with the accuracy requirements for level III field testers as defined in ANSI/TIA/EIA 568B.2-1. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table B.2 of Annex B of in ANSI/TIA/EIA 568B.2-1. (Table B.3 in this TIA document specifies the accuracy requirements for the Channel configuration.)
5. The test plug shall fall within the values specified in E.3.2.2 Modular test plug NEXT loss requirements of the in ANSI/TIA/EIA 568B.2-1.
6. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
7. The tester interface adapters must be of high quality and the cable shall 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 Cable Contractor shall 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 shall not be of twisted-pair construction.
8. One hundred percent of the 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. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with the Test Result Documentation as listed below.

B. Site Testing, Inspection and Acceptance

1. 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*.
2. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked 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.
3. A representative of the design team shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing commences.
4. At the conclusion of field testing, at a time scheduled by the owner's representative, the owner's representative will select a random sample (up to 10%) of the installed links in each wiring closet. The Cable Contractor, under supervision of the owner's representative, shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in Test Result Documentation as listed below.
5. The results obtained shall be compared to the data originally provided by the Cable Contractor. If any (one or more) of the sample test reports displays a fail or fail* result, the Cable Contractor shall resolve any conditions causing the failed test and under supervision of the owner's representative shall repeat 100% of the testing and the cost shall be borne by the Cable Contractor.

C. Performance Test Parameters

1. The test parameters for CAT 6 are defined in TIA CAT 6 standard, which refers to the ANSI/TIA/EIA-568-B.2 standard. The test of each link shall 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.
 - a. Wire Map
 - b. Length
 - c. Insertion Loss (Attenuation)
 - d. NEXT Loss
 - e. PSNEXT Loss
 - f. ELFEXT Loss, pair-to-pair
 - g. PSELFEXT Loss
 - h. Return Loss
 - i. ACR (Attenuation to crosstalk ratio)
 - j. PSACR
 - k. Propagation Delay
 - l. Delay Skew [as defined in TIA/EIA-568-B.1; Section 11.2.4.11]

D. Test Result Documentation

1. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.
2. The test results records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. 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.

Superior protection in this regard is offered by testers that transfer the numeric measurement data from the tester to the PC in a non-printable format.

3. The database for the completed job shall be stored and delivered on CD-ROM including the software tools required to view, inspect, and print any selection of test reports.
4. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:
 - a. The identification of the link in accordance with the naming convention defined in the overall system documentation.
 - b. The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number.
 - c. The date and time the test results were saved in the memory of the tester.
5. General Information to be provided in the electronic data base with the test results information for each link:
 - 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.
6. 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.
 - 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.

E. As-built drawings

1. Provide three (3) copies of E and three (3) copies of C size prints along with CAD files in .dwg or .dgn formats 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: Contract must kept 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.

END OF SECTION 27 15 00