

University of Houston Master Specification

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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]

END OF SECTION 27 1500