



THE UNIVERSITY OF
ALABAMA IN HUNTSVILLE®

Network | Telecommunications | Systems

Design & Construction Guidelines

UAH Office of Information Technology

Design & Construction Guidelines

Network and telecommunications infrastructure on University of Alabama in Huntsville (UAH) property is managed by the Office of Information Technology (OIT). This document provides guidelines and standards for contractors designing or installing new low-voltage cabling systems and related infrastructure. Unless otherwise stated, these requirements apply to all UAH properties and buildings.

The Designer of Record (DOR) is responsible for coordinating these requirements with applicable manufacturer requirements, industry standards, and project-specific conditions. Where requirements conflict, the most stringent standard will apply.

General Guidelines

1. General Terms and Conditions

- 1.1. All designs for telecommunication additions or changes must be coordinated with, and reviewed by, OIT. This includes Change Orders that occur during construction.
- 1.2. The Contractor must meet all qualifications as set forth in the Contractor Qualifications portion of the Detailed Contract Requirements section below.
- 1.3. These requirements are general in nature and may be modified to meet specific project needs. Any deviation must be approved in writing by the OIT Project Manager or their delegate.

2. Design and Construction Drawings

- 2.1. All design and construction drawings must include a communications riser diagram illustrating all components of the building communications distribution system. Appropriate notes must be provided to describe conduit sizes and any special instructions for the Contractor. In addition, electrical drawings for each floor must illustrate the floor distribution system components and communications outlet locations.
- 2.2. Prior to the 60% drawing review stage, the Contractor must provide OIT an initial wifi access point layout for review and refinement. If that's not possible, the Contractor must provide CAD files showing reflected ceiling plans and all electrical auxiliary plans. OIT will then provide the design for the wifi access point layout and submit it to the designer so that it may be incorporated into the final design. If OIT is providing the initial wifi access point layout, the following information is required to ensure the design has sufficient coverage:



- 2.2.1. Ceiling Heights of Offices, Classrooms and Corridors.
 - 2.2.2. Occupancy for Classrooms, Conference Rooms, and Warehouse space
 - 2.2.3. Type of coverage needed by area:
 - 2.2.3.1. High Density- Wireless used for testing or wireless device needed to perform job duties
 - 2.2.3.2. Normal Usage -Casual browsing on phone
 - 2.2.3.3. Low Density -wireless not used frequently
 - 2.2.3.4. Any dense seating areas used by students?
 - 2.2.3.5. Specialty Equipment used in areas: Scanners, IoT devices, Classroom cameras, wireless microphones. Presentation Pointers. Please note the area and device type.
 - 2.2.4. Indicate whether furniture in areas is movable or fixed.
 - 2.2.5. Indicate type of wall materials and areas used
 - 2.2.5.1. Dry wall
 - 2.2.5.2. Sound proofing materials (and what variety)
 - 2.2.5.3. Iron
 - 2.2.5.4. Cinderblock or brick
 - 2.2.5.5. Poured concrete
 - 2.2.6. Need for outdoor wireless.
3. Product Specifications and Standards. The Contractor must:
- 3.1. Furnish all materials, equipment, labor, supervision, tooling, miscellaneous mounting hardware, and consumables for fiber optic and copper data cabling work.
 - 3.2. Perform all work in accordance with ANSI/TIA and BICSI standards.
 - 3.3. Ensure that all materials, equipment, and systems are compatible with UAH's existing telecommunications infrastructure and with the product standards specified in this document.
 - 3.4. Plan for and accommodate technology specified by OIT for the project, coordinating the design as required elsewhere in this document.
 - 3.5. Obtain all permits and comply with local government regulations.

- 3.6. Show the proposed total cost in all quotes.
- 3.7. Provide quotes that are guaranteed for the remaining term of the awarded bid.
- 4. Installation Guidelines
 - 4.1. Conduit and Pull Box Systems. The Contractor must:
 - 4.1.1. Use only 4" conduits for new installations.
 - 4.1.2. Install (3) continuous three-inch 3-Cell MaxCell Fabric Inner-ducts that extend approximately six inches beyond each end of the conduit.
 - 4.1.3. Keep all conduits free of any debris, and remove any debris that may enter conduits during work.
 - 4.1.4. Trim all conduit penetrations to access enclosures.
 - 4.1.5. Install duct plugs/bushings/gaskets at building/hand-hole entries.
 - 4.1.6. Bore and trench at a minimum depth of 48".
 - 4.1.7. Bury three inch 3" or wider warning tape one (1) foot below the surface above a buried conduit between pull boxes.
 - 4.1.8. Use Quazite brand access enclosures.
 - 4.1.9. Only use approved pull box and construction locations
 - 4.1.10. Use underground boring methods below roadways, parking lots, sidewalks, or other paved/surfaced areas.
 - 4.1.11. Accompany all buried conduit with a 10awg, blue-jacket tracer wire for location.
 - 4.2. Fiber Optic Cable Installation and Termination. The Contractor must:
 - 4.2.1. Adhere to manufacturer guidelines for tension and bend radius when pulling fiber.
 - 4.2.2. Install only Corning CCH-04U fiber housings.
 - 4.2.3. Install only CCH-CS cassettes of the appropriate type and number.
 - 4.2.4. Install dust covers on all interconnect inserts.
 - 4.2.5. Install only loose tube indoor/outdoor riser-rated gel-free cable (e.g. Corning Freedom cable)
 - 4.2.6. Install fiber optic cable only along the conduit pathway approved by the OIT Project Manager or their delegate.

- 4.2.7. Comply with TIA/EIA 526, TIA/EIA 568.3, TIA/EIA 569, and TIA/EIA568-B.1 standards.
- 4.2.8. Label all outside plant cabling at every transition point i.e. pull box, vault, riser, closet, etc..
- 4.2.9. Ensure exposed fiber is routed neatly without unnecessary strain on the cable and bind cables every 48" – 60".
- 4.2.10. Ensure conduit has no more than two 90-degree bends when utilizing fiber.
- 4.2.11. Provide adequate service loop (20 feet for general outdoor Quazite boxes, 50 feet for splice point Quazite boxes) in or near the closet allowing for equipment relocation within the closet.
- 4.3. Copper/Horizontal Cabling. The Contractor must:
 - 4.3.1. Use TIA/EIA-568 T568A pin assignments.
 - 4.3.2. Cable Categories:
 - 4.3.2.1. All horizontal cabling not used for wifi access points must be **Category 6** (250MHz-10G) cable with specified jack.
 - 4.3.2.2. All horizontal cabling for wifi access points must be **Category 6A** (500MHz-10G) cable with specified jack.
 - 4.3.3. Install six-port faceplates for each gang box with blank fillers in unused ports.
 - 4.3.4. NOT install surface-mount "biscuit" jacks without written approval from the OIT Project Manager or their delegate.
 - 4.3.5. NOT splice copper cables under any circumstances.
 - 4.3.6. Comply with TIA/EIA 569 standards.
 - 4.3.7. Install data connectors on the left and voice on the right of the faceplates where possible.
- 4.4. Horizontal Data Interconnect. The Contractor must:
 - 4.4.1. Provide and install factory-manufactured orange CAT6 bootless patch cables between patch panels and network equipment.
 - 4.4.2. Provide cable administration drawings (port maps) and documentation in an appropriate format to the OIT Project Manager and/or their delegate.
- 4.5. Patch Paneling Labeling. The Contractor must:

- 4.5.1. Affix identifying labels in the top left area of each panel, numbered in sequence from top to bottom.
- 4.5.2. Install all new patch panels such that they will not exceed eighty (80) percent of their terminated port capacity. For example, the Contractor must not terminate more than 38 cables onto a newly-installed 48-port patch panel.
- 4.5.3. Properly label all patch panel ports.
- 4.6. Cabling System Testing. The Contractor must:
 - 4.6.1. Test 100% of installed cables.
 - 4.6.2. Provide documentation describing the test equipment, methodology, and results to the OIT Project Manager and/or their delegate.
- 4.7. Grounding and Bonding
 - 4.7.1. The Contractor must install appropriate grounding/earthing in compliance with ANSI/TIA/EIA-606 and ANSI/TIA/EIA-607 for all new racks, metallic backboards, cable sheaths, metallic strength members, splice cases, and cable trays.
- 4.8. MDF/IDF Requirements for New Construction and Renovated Structures. The Contractor must:
 - 4.8.1. Provide dedicated, supplemental air conditioning beyond normal building for all data closets.
 - 4.8.2. Provide and install Eaton brand Lithium UPS units for new data closets for compatibility with existing monitoring appliances and coordinate device selection with the OIT Project Manager to ensure adequate sizing.
 - 4.8.3. Place MDF/IDF closet power receptacles on circuits that receive generator power in the event of a loss of commercial power to the building, in buildings equipped with a generator.
 - 4.8.4. Provide at least two "quad" sets of NEMA 5-20 receptacles NOT fed from generator power in each closet, with each "quad" fed from a dedicated branch circuit.
 - 4.8.5. Install MDF/IDF racks ONLY in a layout approved, in writing, by the OIT Project Manager or their delegate.
 - 4.8.6. NOT co-locate MDF/IDF closets with any other equipment, resources, servers, materials, or storage. MDF/IDF closets are dedicated strictly for central IT datacomm distribution. UAH campus security and safety equipment may be

co-located in MDF/IDF closets only with express written approval from OIT, Facilities and Operations, and Risk Management teams.

- 4.8.7. Construct MDF/IDF rooms as fire-rated spaces: rated walls extended slab-to-slab, rated self-closing doors, and firestopping of all barrier penetrations to maintain the rating, in accordance with the adopted building code, NFPA 75/76, and TIA-569. Provide fire-retardant-treated plywood backboards.

5. Warranty, Services, and Post-Installation Maintenance. The Contractor must:

- 5.1. Provide a warranty against defects in materials and workmanship for a minimum of 20 years. UAH prefers a lifetime warranty.
- 5.2. Provide all labor and materials necessary to correct system failure and return equipment to a functional state when performing repairs in response to a warranty claim.

6. Inspections

- 6.1. UAH Office of Information Technology's (OIT's) Network Team will request a manufacturer inspection during or after installation.
- 6.2. Final inspection will be performed by UAH OIT staff for install validation
- 6.3. UAH's OIT Network Team may perform spot testing to validate test documentation.
- 6.4. System acceptance will be granted after all documentation is received and final inspection is performed. OIT's Network Team will provide a recommendation to the architect.

7. Submittals

- 7.1. Warranty information for new cable installs.
- 7.2. Detailed pricing breakdown distinguishing and describing all costs.
- 7.3. Proof of certification for test equipment used.
- 7.4. OTDR calibration history.

Detailed Contract Requirements

8. Introduction and Scope

- 8.1. The University of Alabama in Huntsville (hereinafter referred to as the "Customer" or "UAH" requests proposals from qualified contractors (hereinafter referred to as "Contractor") who desire to provide service as outlined herein.



8.2. UAH requirements from the Contractor awarded this contract are as follows:

- 8.2.1. UAH will only consider proposals from qualified data contractors that meet all qualifications set forth in the Contractor Qualifications section of this document.
- 8.2.2. The Contractor will furnish all materials, equipment, labor, supervision, tooling miscellaneous mounting hardware and consumables for each cabling system installed and will completely test, and turnover for acceptance to the Customer structured cabling systems described herein.

9. General Terms and Conditions

9.1. Contractor Qualifications

- 9.1.1. The Customer will consider proposals from qualified Contractors who are capable of meeting the terms and conditions stated herein. The Contractor must be ordinarily engaged in the business of providing data and phone-structured cable installations and have sufficient experience and financial resources to provide the services specified in this proposal. Qualified Contractors must be currently engaged in data and phone cable installations in the Huntsville and North Alabama area and have operated and provided these services to the area for a minimum of five (5) years.
- 9.1.2. There will be a pre-bid meeting of all contractors intending to bid on this project. Time and place of the meeting will be announced at the time this specification is released for bids.
- 9.1.3. There will be a mandatory meeting between the selected Contractor and UAH's OIT Network Services staff within three days after the contract is awarded.
- 9.1.4. Contractors must be Corning NPI certified and in good standing with Corning Cable Systems. Contractor employees who install fiber optic cables must meet Corning's stringent requirements for technical experience. Work will not be subcontracted.
- 9.1.5. The Contractor must be a current Leviton Network Solutions Certified Installer and must remain in good standing with Leviton for the duration of the project. The Contractor must provide documentation demonstrating that the installing firm and assigned technicians are qualified to install, test, certify, and submit Leviton Category 6/6A structured cabling systems for the manufacturer's current extended system warranty. All structured cabling work must be performed by the certified Contractor's own forces. Subcontracting of structured cabling work is prohibited unless specifically approved in writing by OIT.

- 9.1.6. The Contractor must submit a current resume of their staff RCSS and at least three customer references with its proposal. Customers must be comparable in size to UAH and operate in the Huntsville/North Alabama area. Information provided must include a contact name, address and phone number(s), the size of the operations served, data and phone cabling installation services utilized, and any other pertinent information used to help determine the Contractor's experience. The top three (3) Contractors may be required to submit financial statements and a credit report authorization allowing UAH to evaluate the Contractor's financial condition and ability to meet the contract responsibilities. UAH reserves the right to request additional information to determine the responsibility of the apparent successful Contractor relative to its ability to comply with the terms and conditions of this Request for Proposals.
- 9.1.7. Preference will be given to Contractors with demonstrated experience in data center construction and renovation activities including electrical, UPS/transfer switch, fire suppression and VoIP design/installation.
- 9.1.8. The Contractor must own a fiber optic fusion splicer and maintain calibration services as per the manufacturer. UAH may require this service in the event that fiber cables are in need of repair.

10. Product Specifications and Standards

- 10.1. The Contractor will furnish all materials, equipment, labor, supervision, tooling, miscellaneous mounting hardware and consumables for each cabling system installed and will completely test, and turnover for acceptance to UAH's OIT Network Team, the structured cabling systems described herein.
- 10.2. UAH relies on telecommunication standard groups such as ANSI/TIA and BICSI along with manufacturer's representatives to ensure that UAH obtains the best possible installation. UAH reserves the right to refer to these telecommunications standards along with best practices or resolution of installation disputes not listed in this specification. If this document or any of the documents listed are in conflict, then the more stringent requirement must apply. All documents listed are believed to be the most current releases of the documents. It is the Contractor's responsibility to determine and adhere to the most recent release of the telecommunications standards:
 - 10.2.1. ANSI/TIA/EIA-568B.1-3. "Commercial Building Telecommunications Cabling Standard Part 1."
 - 10.2.2. ANSI/TIA/EIA-568B. 2-5. "Commercial Building Standards for Telecommunications Cabling Standard Part 2."

- 10.2.3. ANSI/TIA/EIA-569-B. "Commercial Building Standards for Telecommunications Pathways and Spaces," CSA T530.
- 10.2.4. ANSI/TIA/EIA-606. "Administration Standard for Telecommunications Infrastructure of Commercial Buildings," CSA T528.
- 10.2.5. ANSI/TIA/EIA-607. "Commercial Building Grounding/Bonding Requirements."
- 10.2.6. ANSI/TIA/EIA-758-1. "Customer-Owned Outside Plant Telecommunications Cabling Standard."
- 10.2.7. ANSI/NFPA 70 National Electrical Code, CSA C22.1
- 10.2.8. BICSI Telecommunications Distribution Methods Manual, current edition.
- 10.2.9. Local and municipal codes and regulations.
- 10.2.10. The Contractor is expected to comply with any TIA-EIA and BICSI standards for this installation even when not directly listed in this or other documents provided by UAH.
- 10.2.11. Products specified by part number in this document are done so based on owner preference, compatibility with existing systems, or advanced planning for proposed technology.
- 10.2.12. The Contractor must meet with UAH OIT within three (3) business days after notice of award to review and clarify the project specifications and OIT structured cabling requirements. In addition, the project electrical Contractor must attend at least one pre-installation meeting with OIT prior to the installation of raceways, electrical boxes, cable tray, or other infrastructure related to OIT structured cabling. These meetings must be coordinated by the UAH Construction Project Manager and the OIT Project Manager.
- 10.2.13. Regulations and Permits – The Contractor is responsible for all permits. The Contractor is responsible for complying with local government regulations.
- 10.2.14. Proposed cost must be shown for materials, labor, and installation total. The proposing Contractor must not leave out any costs.
- 10.2.15. All quotes must be guaranteed for the remaining term of the awarded bid.

11. Conduit and Pull Box Systems

- 11.1. New/external fiber optic conduit systems will consist of 4" conduits (4.02"–4.13" ID) with three (3), three inch (3") 3-Cell MaxCell Fabric Innerducts, duct plugs/bushings/gaskets (building/hand-hole entries), termination/inflation bags (i.e. internal building applications via Maxcell Part# MXCRTBVL100 "Wolf Bags") and locating wires (inter-building).

Construction is expected to conform to these specifications unless written permission is obtained from UAH OIT Network Services staff.

- 11.2. All conduits will be blown out with compressed air or brushed out to remove dirt, water, and other residue prior to cable and inner duct installation. Inner ducts will be cut to allow approximately six inches (6") of excess material to extend beyond the end of the conduit.
- 11.3. Inner ducts used as part of construction will be contiguous sections end to end. Adequately secure and reconnect excess inner duct pull-ropes or locating wires for future use.
- 11.4. Conduit penetrations to access enclosures will be trimmed to within three inches (3") of the enclosure walls and resealed with concrete.
- 11.5. All entries to buildings or hand holes will use MaxCell Fabric Innerducts terminated using MaxCell Split-Termination Plugs, Bushings, and Gaskets specifically designed for use in four-inch (4.02"-4.13" ID) conduits. All plugs will be water-tight and/or up to 20 psi sealed, reusable, and non-corrosive.
- 11.6. Boring and trenching will be to a minimum depth of 48". Where a depth of 48 inches cannot be obtained, extra protection, such as concrete encasements or steel conduits will be used.
- 11.7. Warning tape with a minimum width of three inches (3") will be buried 12 inches below the finished grade the buried conduit between pull boxes. As a minimum, the tape must be marked "WARNING OPTICAL CABLE" (preferably ULCC orange).
- 11.8. Placement of hand holes will be to grade and maintenance slack will be placed horizontally and taped to prevent unraveling (i.e. figure eight) in the hole.
- 11.9. Conduit access enclosures will be Quazite brand unless otherwise approved by UAH's OIT Network Team, measure at least 48"x30" with open bottoms and twelve-inch (12") minimum depth of crushed limestone base. Pull box lids will have a weight test load specification of 16,000 lbs. or greater.
- 11.10. Final conduit, pull box, and construction locations must be approved prior to construction by UAH's OIT Network Team and Facilities and Operations. UAH's OIT Network Team must be notified of construction dates at least forty-eight (48) hours prior to activity. The UAH Help Desk phone number is 256-824-3333. The Contractor should reference the **specific** project and ask to be connected to the OIT Networks Team.
- 11.11. Telecommunications conduit extensions must use underground boring methods below roadways, parking lots, sidewalks, hardscapes, and other paved or surfaced areas. Construction is expected to conform to this specification unless written permission is obtained from UAH's OIT and Facilities and Operations.

11.12. All buried conduit must be accompanied by a 10awg, blue-jacket tracer wire for location.

12. Fiber Optic Cable Installation and Termination

- 12.1. Unless otherwise specified in a work order, all fiber cable is to be protected with inner duct. Each new four-inch (4") conduit will be installed containing three (3) 3-cell MaxCell Fabric Innerducts. After installation, inner ducts are to be permanently labeled as containing fiber optic cable. A locator wire will be installed in all new conduit.
- 12.2. Tension on any fiber cable must never exceed the manufacturer's recommendation while the cable is being pulled through a tray or conduit. Pulling by hand is preferred. If a power winch or mechanical advantage device is used, a tension meter must be used to confirm that maximum tension is not exceeded. Alternatively, a mechanical fuse rated at the manufacturer's recommended value may be included in the linkage. A swivel at the cable end must be used to prevent torsion. While under tension, a minimum bend radius of 15 times the cable's outside diameter must be maintained, using pulleys and sheaves as needed. Cable that is at rest or not under tension must not have a bend radius less than 10 times the outside diameter.
- 12.3. Unless specified, all fiber optic parts must be Corning branded. 4U fiber housings will be Corning CCH-04U (new design) with the appropriate number and type of CCH-CS cassettes. Small Form Factor LC connectors will be installed in a consecutive numbering sequence in rack mount interconnect hardware. Fiber LC connectors will be compatible with Plenum laser-optimized and SMF28E or better fibers. Corning Premium Solution housings may be used for compatibility with some existing installations if written approval is received from UAH's OIT Network Team.
- 12.4. The fiber count for fiber optic cables will vary with each project. All Fiber optic cables used will be loose tube indoor/outdoor riser rated SM in one gel-free cable such as Corning Freedom cable. SM cable must be SMF28E or better. Exception situations are only with written approval from UAH's OIT Network Team.
- 12.5. All LC interconnect inserts will have dust covers installed.
- 12.6. Bidder must comply with respective TIA/EIA 526 standards and recommendations for single and multimode power loss measurements, and TIA/EIA 568B.3 optical fiber components and loss criteria in testing and measurement procedures (i.e. cabled fiber attenuations maximum: Multimode: 850 nm: 3.0dB/kilometer; 1300nm: 1.5 dB/Kilometer; Single mode: 1310nm: 0.4dB/kilometer; 1550 nm: 0.3dB/kilometer; SM/MM Connector Insertion Loss: 0.75 dB per connector pair; etc....)
- 12.7. Fiber optic cable installation will comply with manufacturer Standard Recommended Procedures (SRPs) including pulling tensions, working bend radii, transition points, etc.

- 12.8. Conduit access enclosures will be Quazite brand, unless otherwise approved by UAH, measure at least 48"x30" with open bottoms and a twelve-inch (12") minimum depth of crushed limestone base. Pull box lids will have a weight test load specification of 16,000 lbs. or greater. The area around the hand hole must be filled to grade such that no damage or groundwater interference to the hand hole exists.
- 12.9. Outside plant cables will have printed labeled tags affixed to the cable/inner duct at every transition of a vault, hand hole, riser closet, or major pull box. Machine-printed tags will include a non-flexible composite tag with format, "(location one) – (location two) – (sequence number)." For example, cable number (1) from Bevell Center (BC) room 237 to Bevell Center (BC) room 147 would be labeled as "BC237-BC147-1."
- 12.10. All cables installed by the Contractor will be properly contained in conduit, cable tray, raceway, or Maxcell-3-inch (3") three (3) cell Fabric inner ducts (conduit). Where none of these support media are available, the individual cables will be supported by cable harnesses, neatly run, properly dressed, supported and secured with the appropriate cable ties or Velcro to the under-slab or metal structure at intervals not exceeding TIA or manufacturer's standards. Cable tray is preferred wherever possible. In the event that the use or installation of cable tray is infeasible, j-hooks may be used with the written approval of OIT. If j-hooks are used, the cables will be supported by j-hooks on the walls or ceilings, every forty-eight inches (48") or to respective cable "standards."
- 12.11. All cables will be handled, installed, and supported in accordance with the manufacturer's guidelines. During the laying of the cable, the installer will take care not to overstress the cable. After the cable is installed, the installer will make sure that all parts of the cable are supported properly throughout their length and will be stress-free at both ends.
- 12.12. All exposed cabling is to be installed and routed in a neat and professional manner. All exposed cable bundles must be bound at a minimum of every forty-eight (48") – sixty (60") inches (unless corresponding cabling standards specify more conservative parameters). All cable binding used will be hand-tightened only to a point where the sheath is neither kinked or deformed. Cable installations in guest areas will be concealed or covered in a manner aesthetically acceptable to UAH. Exceptions require written approval received from UAH's OIT Network Team.
- 12.13. No section of conduit must be longer than thirty (30m) (100ft) or contain more than two ninety (90) degree bends between pull points or pull boxes. (TIA/EIA-569, 4.4.2.1). Note: Cabling/conduit standards that require more conservative parameters must always be utilized.
- 12.14. Conduit bend radius must be at least six (6) times the internal diameter. When the conduit size is greater than 50mm (2 inches), the inside radius must be at least ten (10)

- times the internal diameter of the conduit. For fiber optic cable, the inside radius of a bend must always be at least ten (10) times the internal diameter of the conduit.
- 12.15. Horizontal fill ratios for conduit, cable trays, raceways, and ducts will conform to standards and manufacturer's recommendations.
 - 12.16. Minimum clearance between cables and power sources will be according to TIA/EIA 568-B.1 standards.
 - 12.17. Cabling within Wiring Closets and Enclosures: Provide cable of adequate service loop length (20 feet) to allow for equipment relocation within the closet. Use lacing bars to restrain cables, provide connection strain relief, and prevent bending cables to smaller radii than the minimums recommended by the manufacturer.
13. Copper/Horizontal Cabling
- 13.1. Unless otherwise specified, the wiring scheme for these projects will be T568A.
 - 13.2. All copper cabling used must comply with Leviton Category 6 (250MHz-650 MHz-10G) and Leviton Category 6A (500MHz MHz-10G). Cable and connectivity products must be tested and perform to Leviton Category 6 and Category 6A Permanent Link specifications.
 - 13.3. Cat 6 cable will be installed in each data communications location where required. The color scheme will be as follows:
 - 13.3.1. Data cable must have an orange-colored jacket
 - 13.3.2. Wireless Access Point (WAP) cable must have a white-colored jacket
 - 13.3.3. Security Camera cable must have a purple-colored jacket
 - 13.4. All copper cabling used must be Leviton-approved to ensure the finished product will be eligible for the Leviton warranty.
 - 13.5. A Leviton Cat6 Patch Panel with pluggable jacks will be utilized (Leviton Part# 49255-H48 or modern equivalent). The color scheme will be as follows:
 - 13.5.1. Data connectors will be orange in color (Leviton Part# 61110-RO6)
 - 13.5.2. WAP connectors will be white in color (Leviton Part# 61110-RW6)
 - 13.5.3. Security Camera connectors will be purple in color (Leviton Part# 61110-RP6)
 - 13.6. If office faceplates are required: install a six-port faceplate for each single gang box or a dual six-port faceplate for each double gang box. Faceplates will have designation windows and the appropriate number of color-matched blanks to fill all voids in each communication outlet. The color scheme will be as follows:

- 13.6.1. Data connectors will be orange in color (Leviton Part# 61110-RO6)
- 13.6.2. WAP connectors will be white in color (Leviton Part# 61110-RW6)
- 13.6.3. Security Camera connectors will be purple in color (Leviton Part# 61110-RP6)
- 13.7. Biscuit jack housings are not allowed unless otherwise approved by UAH's Network Services or specified (Ref. Wi-Fi below) in this bid. Wi-Fi Access Point installation mounts above the ceiling or in external NEMA boxes may require "biscuit jack" housings. The color scheme must follow the standards set forth in this document.
- 13.8. All cabling will be continuous without splices from the room/office outlets to the telecommunications room patch panels or punch-down blocks.
- 13.9. All cables installed by the Contractor will be properly contained in conduit, cable tray, raceway, or duct. Where none of these support media are available, the individual cables will be supported by cable harnesses, neatly run, properly dressed, supported, and secured with the appropriate cable ties or Velcro to the under-slab or metal structure at intervals not exceeding TIA or manufacturer's standards. Cable tray is preferred wherever possible. In the event that the use or installation of cable tray is infeasible, j-hooks may be used with the written approval of OIT. If j-hooks are used, the cables will be supported by j-hooks on the walls or ceilings, every forty-eight inches (48") or to respective cable "standards."
- 13.10. All cables will be handled, installed, and supported in accordance with the manufacturer's guidelines. During the laying of the cable, the installer will take care not to overstress the cable. After the cable is installed, the installer will make sure that all parts of the cable are supported properly throughout their length and will be stress-free at both ends.
- 13.11. Appropriate attention will be given to the handling of cables to ensure that the bend radius conforms to the manufacturer's requirements. At no time will the cable's static or dynamic bending radius be less than four (4) times the cable diameter unless corresponding manufacturer or structured cabling standards specify otherwise. Installation details for this bid will always follow more conservative parameters.
- 13.12. All exposed cabling is to be installed and routed in a neat and professional manner. All exposed cable bundles must be bound at a minimum of every forty-eight – sixty inches (48-60") unless corresponding cabling standards specify more conservative parameters. Cable bindings will be cinched by hand tightening, and to the point prior to squeezing the cable sheath or outer covering. Cable installations in guest areas will be concealed or covered in a manner aesthetically acceptable to UAH. Exceptions require written approval received from UAH's OIT Network Team.
- 13.13. No section of conduit must be longer than thirty (30m) or 100 ft., contain more than two ninety (90) degree bends between pull points or pull boxes (TIA/EIA-569, 4.4.2.1). Note:

- Cabling/conduit standards that require more conservative parameters must always be utilized.
- 13.14. Conduit bend radius must be at least six (6) times the internal diameter. When the conduit size is greater than 50mm (2 inches), the inside radius must be at least ten (10) times the internal diameter of the conduit. For fiber optic cable, the inside radius of a bend must always be at least ten (10) times the internal diameter of the conduit.
 - 13.15. Horizontal fill ratios for conduit, cable trays, raceways, and ducts will conform to standards and manufacturer's recommendations.
 - 13.16. Minimum clearance between cables and power sources will be according to TIA/EIA 568-B.1 standards.
 - 13.17. All telecommunications faceplate outlets/connectors will be securely mounted with screws. Exceptions require written approval from UAH's OIT.
 - 13.18. Wiring within Wiring Closets and Enclosures: Provide conductors of adequate service loop length to allow for equipment relocation within the closet. Train conductors to terminal points. Use lacing bars to restrain cables, provide connection strain relief, and prevent bending cables to smaller radii than minimums recommended by the manufacturer.
 - 13.19. Separation of Wires: Comply with TIA/EIA-569-A rules for separating unshielded copper voice and data communication cabling from potential EMI sources, including electrical power lines and equipment.
 - 13.20. Where possible, data connectors will be left justified within the faceplates (left side column) and voice connectors will be right justified within the faceplate.
14. Horizontal Data Interconnect
- 14.1. The horizontal interconnect for data cables must consist of corresponding patch cords from the horizontal Category 6 termination panels to the network equipment within the same or adjacent racks and station cables from the office data jack to computer equipment.
 - 14.2. Station cables for connections from the jacks to data equipment such as printers, PCs, servers, and other devices must be furnished. Station cables must be orange, bootless, and twelve (12) feet long. All station cables will be factory-manufactured and tested.
 - 14.3. Furnish data patch cables for telecommunication room patch fields that comply with Leviton pre-terminated Category 6 TIA/EIA-568-A. All patch cords will be factory-manufactured and tested. All data copper patch cables must be bootless and orange in color.

14.4. Cable Administration Drawings: Show building floor plans with cable administration point labeling. Identify labeling convention in drawing legend and show example labels for telecommunication rooms, cable backbones, entrance cables, terminal hardware and positions, terminating connectors, grounding buses and pathways. Follow convention of TIA/EIA-606. Furnish two copies of electronic and printed "as-built" documentation at project completion. Electronic file documents will be AutoCAD 2004 (for as-built) and Microsoft Excel/Word testing and measurement.

14.4.1. Documentation format must include the following information: Cable schedule will cross reference room number and telecommunication room, patch panel, and port numbers of all building data connectors. For example, room 114 has two data connections whose data closet patch panel/port terminations are telecommunications room 217 on patch panel one (1), connectors three (3) and four (4):

Served Room Number	Termination/Faceplate ID
114	217-P1-03
	217-P1-04

15. Patch Panel Labeling

15.1. Rack-mounted data patch panels will be numerically sequenced and labeled from top to bottom. For example, in a patch field of four RJ45 Cat6 (250 MHz-650 MHz-10G) GigaMax panels, the top panel will be numbered one and the bottom numbered four (designated by the numbers 1, 2, 3, etc.). Identifying labels will be attached in the top left area of each panel.

15.2. Data connections will be ordered sequentially within each patch panel by floor and room number sequence. Patch panels will not exceed 80 percent of their terminated port capacity to allow growth within floor and room sequence areas.

15.3. Each patch panel jack location will be labeled in the designated panel port description area above each connector and will indicate the corresponding room number or drawing location reference. Port label description will be machine generated; no hand labels will be accepted.

15.4. Note: References to labels or labeling refer to machine/computer-generated adhesive-backed labels printed and attached to identifying areas. Label and print size must be proportional in size to the respective areas identified.

16. Cabling System Testing



- 16.1. Testing of cabling must be performed prior to the system cutover, 100 percent of the UTP horizontal and riser pairs must be tested, including tests for opens, shorts, polarity reversals, transposition, and presence of AC voltage. 100 percent of fibers from newly installed fiber optic cable must be tested using a stabilized light source and will include bidirectional OTDR testing. The installed structured cable must be tested to the appropriate TIA/EIA or manufacturing standards from (a) the work area outlet to the Telecommunications Room and (b) from the Telecommunications Room to the work area outlet.
 - 16.2. Testing of the pre-terminated fiber cabling will follow guidelines set by manufacturing specification for DB losses on pre-terminated cabling; test must include bidirectional OTDR measurements given to UAH's OIT at the conclusion of this project.
 - 16.3. Testing documentation: Two copies of electronic and printed "as-built" documentation are to be provided within two weeks of project completion. All documentation will be indexed, printed, and bound. Electronic copies of drawings will be provided that are readable and editable using AutoCAD 2004. Port maps will be provided that are readable and editable using Microsoft Excel. All deviations from these requirements must be explicitly approved by UAH's OIT group.
 - 16.4. Test equipment and results: name, manufacturer, model number and last calibration date will specify test equipment used. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. Test results will include test performed, equipment settings, and expected and actual test results achieved. When repairs and re-tests are performed, the problem found and corrective action taken must be noted, and both the failed and passed test data must be shown in the printed test results.
17. Grounding and Bonding
 - 17.1. All Contractor installed new racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the MDF must be grounded to the respective TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. All wires used for telecommunications grounding purposes must be identified and labeled in accordance with ANSI/TIA/EIA-606 "Administration Standards for Telecommunications Infrastructure of Commercial Buildings," and ANSI/TIA/EIA-607 "Commercial Building Grounding/Bonding Requirements."
18. MDF/IDF Requirements for New Construction and Renovated Structures
 - 18.1. All MDF/IDF closets in new construction projects must be outfitted with supplemental air conditioning separate from the building A/C.

18.2. Uninterruptible Power Supply (UPS):

18.2.1. All MDF/IDF closets in new construction projects must include installation of a stand-alone Eaton Lithium UPS (non-rack mounted) that utilizes a NEMA L6-20R receptacle and can be connected to the network for management.

18.2.2. Use the following Eaton model numbers as a guide for selection. The selected UPS product must be fit for the location and required capacity, and must be of equal or greater capability: 5P1000RC, 9PX1500RT-L, 9PX2000RT-L, 9PX2200GRT-L, 9PX3000GRT-L, 9PX3000RT-L, 9PXM8S16K

18.3. ALL MDF/IDF closets in must include 2 APC PDUs and must be similar to APC model AP7911B.

18.4. If a building generator is available, all MDF/IDF closet power must be on a generator circuit.

18.5. Rack layout in new MDF/IDF closets must be discussed with, and be approved by, UAH's OIT Network Team.

18.6. MDF/IDF Quantity and Sizing

18.6.1. MDF/IDF Quantity

18.6.1.1. Each building must contain one (1) Main Distribution Frame (MDF) for the purpose of terminating external datacomm connections for distribution IDFs throughout the building.

18.6.1.2. Each building must contain one or more Intermediate Distribution Frames (IDF) per floor, the quantity and location of which must be designed to stay within horizontal cabling distance and serving area limits.

18.6.2. MDFs and IDFs must be sized appropriately to accommodate the rack space needed for the environment. The Contractor must coordinate with OIT to determine the necessary space. At a minimum, room sizes must follow BICSI recommendations:

Serving Area	Minimum Room Size
≤ 5000 sq ft	10' x 8'
5000 sq ft to 8000 sq ft	10' x 9'
8000 sq ft to 10,000 sq ft	10' x 11'

18.7. Fire-Rated Construction and Firestopping. The Contractor must:

- 18.7.1. Construct each MDF/IDF as a fire-rated space separated from the remainder of the building. At a minimum, the room envelope (walls, floor, and ceiling/roof assembly) must provide a fire-resistance rating of not less than one (1) hour, built as fire barriers in accordance with the currently adopted International Building Code. Where NFPA 75, NFPA 76, the adjacent occupancy, or the Authority Having Jurisdiction requires a higher rating (commonly two hours), the more stringent requirement applies.
- 18.7.2. Extend all rated walls full height, slab-to-slab, so the rated barrier remains continuous above any suspended ceiling.
- 18.7.3. Provide fire-rated door and frame assemblies matching the rating of the surrounding wall, equipped with self-closing and positive-latching hardware.
- 18.7.4. Firestop every penetration of a rated barrier (cables, conduits, sleeves, inner ducts, cable tray, and bus) with a through-penetration firestop system tested to ASTM E814 / UL 1479, meeting or exceeding both the F and T ratings of the penetrated assembly. Any sleeve or penetration disturbed during the work must be re-firestopped before turnover.
- 18.7.5. Provide a minimum of three (3) four-inch (4") firestopped backbone sleeves through the floor adjacent to the plywood termination field, located near the door, consistent with TIA-569.
- 18.7.6. Provide fire-retardant-treated plywood backboards bearing the manufacturer's fire-rating stamp. Where backboards are painted, the rating stamp must remain legible.
- 18.7.7. Maintain the MDF/IDF as a dedicated, non-combustible space. Combustible storage and non-IT materials are prohibited, consistent with the co-location restriction cited in this document.
- 18.7.8. Provide clean-agent fire suppression for each MDF/IDF, designed and installed in accordance with NFPA 2001 and the applicable provisions of NFPA 75 and NFPA 76. Water-based suppression (wet-pipe, dry-pipe, or pre-action sprinkler systems) is prohibited within MDF/IDF and datacenter spaces. Coordinate the suppression system, along with fire detection and any required room sealing or integrity provisions, with Facilities and Operations, Risk Management, and the OIT Project Manager or their delegate
- 18.7.9. Submit firestop system documentation (UL system numbers and locations) as part of the closeout submittals.

18.8. Accessibility and Security

- 18.8.1. MDF/IDF locations must be accessible from the nearest hallway and must not be nested within other rooms.
- 18.8.2. MDF/IDF locations must be secured with electric strikes and offer badge reader access, utilizing the campus's current access control system. The Contractor must coordinate with Facilities and Operations and Risk Management teams as needed to facilitate this installation as specified.

19. Warranty, Service and Post-Installation Maintenance

- 19.1. The Leviton certified Contractor must obtain, from the manufacturer, a warranty of the cabling system against defects in workmanship for a period NO LESS Than twenty (20) years from the date of system acceptance. A lifetime warranty is preferable. The warranty must cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty must be provided at no additional cost to UAH.
- 19.2. The Corning NPI Contractor must obtain, from the manufacturer, a warranty of the cabling system against defects in workmanship for a period of NO LESS THAN twenty (20) years from the date of system acceptance. A lifetime warranty is preferable. The warranty must cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty must be provided at no additional cost to UAH.

20. Inspections

- 20.1. UAH will request an inspection from the manufacturer's representatives during and/or after the installation to confirm manufacturer's standards have been met. The Contractor will repair, fix, or replace, at the Contractor's cost, all items that do not meet the manufacturer's standards.
- 20.2. OIT's Network Team will perform a final inspection to validate that all horizontal and backbone cables have been installed as defined in the drawing package, and that the installation meets the aesthetic expectations of UAH.
- 20.3. OIT reserves the right to spot test a representative sample of the cabling system to validate and confirm test results supplied by the Contractor. If significant discrepancies are found, the Contractor will be notified for resolution. The Contractor will be responsible for repair, replacement, or re-termination of any component that fails testing.

- 20.4. Completion of final inspections, receipt of the tests, as-built documentation (port maps), and successful performance of the system for a two-week period will constitute acceptance of the system.
- 21. Submittals. The Contractor must:
 - 21.1. Submit warranty information with quotes for review for all new cable installations.
 - 21.2. Provide port maps for all copper data drops showing which telecommunications room, patch panel, and port each drop terminates to, the served room number and faceplate/outlet ID, and the drop type (data, WAP, or security camera), cross-referenced per the labeling conventions specified in this document.
 - 21.3. Submit all documentation to support any warranty in accordance with manufacturer requirements, and apply for said warranty on behalf of UAH. The warranty will cover the components and labor associated with the repair/replacement of any failed link, within the warranty period that is a valid warranty claim.
 - 21.4. Provide a detailed pricing breakdown of their quote on a separate page as well as distinguish and describe all costs.
 - 21.5. Provide proof of Leviton Network Solutions Certified Installer certification and Corning NPI certification.
 - 21.6. Provide a full OTDR calibration report.