University of North Carolina Wilmington

Infrastructure Standards for Installation

Standards as of 01/01/2019

Provided by ITS

IOS / NETWORK & COMMUNICATIONS

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**Overview**

The University of North Carolina Wilmington is constructing new buildings and renovating existing buildings both on and off main. This document defines voice and data cabling requirements for all future installations. The university recognizes that the integrity of the cabling systems and the use of proper installation techniques by qualified contractors, are essential for implementing a dependable network. Bandwidth requirements and fault tolerance is an important aspect of the structured solution and taken into consideration with the infrastructure design.

**Purpose**

The university will implement an end-to-end manufacturer’s solution that has resulted in the approval of three manufacturers:

1. CommScope SYSTIMAX® Solutions GigaSPEED XL Category 6 Structured Cabling System and Corning Cable Systems LANscape solution
2. CommScope SYSTIMAX® Solutions GigaSPEED X10D Category 6A Structured Cabling System with x91B reduced diameter cable and Corning Cable Systems LANscape solution (Access Solutions)
3. CommScope NETCONNECT/Uniprise® CAT 6 CS37 cabling system and the Corning Cable Systems LANscape
4. CommScope NETCONNECT/Uniprise® CAT 6A CS47 cabling system and the Corning Cable Systems LANscape (Access Solutions)
5. Belden System 3600 (for horizontal cabling), Belden System 10GXS (for wireless access point cabling). Belden System 3600 and/or 10GXS cabling shall use Belden’s REVConnect modular termination system, in appropriate category, supporting either jacks or plugs. Belden System 3600 and/or 10GXS cable shall be of Bonded-Pairs construction. Optical fiber system shall be Corning Cable Systems LANscape optical media with Belden’s Enterprise X (ECX) optical fiber patch panels.

This specification is to ensure that UNCW meets with a standards compliant end-to-end cabling solution with guaranteed “Channel” performance. This solution will allow UNCW to maximize productivity and value by minimizing down time and operational expenses, thus warranting our investment for 20 Years, while still providing for a future path to evolving technologies. Each of these solutions requires the contractor to provide Manufacturer certification:

1. CommScope SYSTIMAX Category 6 and Category 6A solutions require the contractor to be a current PartnerPRO network member; installers, supervisors, designers to have a current valid certification.
2. CommScope NETCONNECT/Uniprise Category 6 and Category 6Asolutions require contractor to be a current PartnerPRO network member; installers, supervisors, designers to have a current valid certification.
3. Belden solution requires the contractor to be a Belden Partner Alliance (PA) program member.
4. Corning solution requires the installers to be a current EWP.

**Solution Description**

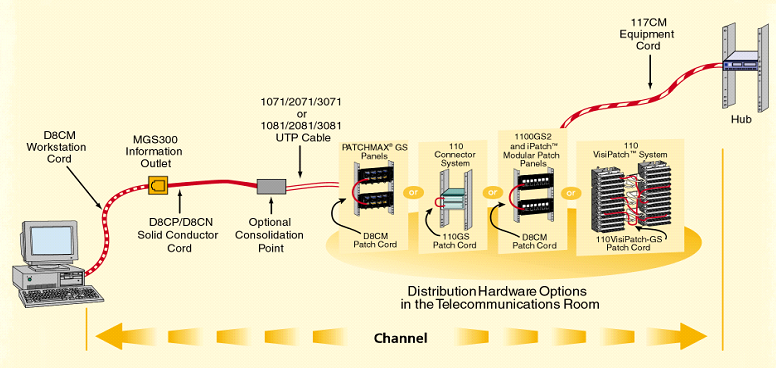
The SCS Solution shall utilize a network of fiber optic and unshielded twisted pair, riser, ty and station cables. Cables and terminations located as shown and in the quantities indicated on the drawings. Fiber cables shall terminate on wall- or rack-mounted fiber patch panels located in all demarcation and termination points shown on the drawings. All cables shall terminate in an alphanumeric sequence at all termination locations. All standard copper cable terminations shall comply with, and be tested to latest revision of TIA-568-C family of standards for Category 6 and/or beyond Category 6 installations. Horizontal cabling for wireless access points (WAPs) shall comply with, and be tested to latest revision of TIA-568-C family of standards for Category 6A and/or beyond Category 6 installations. Available and unused pairs between the Equipment Room (ER) and Telecommunications Room(s) (TR) shall terminate and identified as spare at each location. Station cables shall terminate on three or four gang wall plates equipped as shown on the drawings. All copper terminations will be T-568B wiring.

 **Diagram 1 - Structured Cabling Solution**

**Channel Performance Specifications**

The SCS solution for standard cable drops shall support a useable end-to-end system bandwidth of not less than 400 MHz. This requires substantial performance margin in all key electrical parameters beyond Category 6. Useable end-to-end system bandwidth is indicated by the maximum frequency at which a positive Power Sum Attenuation-to-Crosstalk Ratio may be obtained at both the Near (PSACRN) and Far ends (PSACRF) of a 100-meter cabling channel. This channel shall have the capability of four or six connections without failing to meet Category 6 specifications.

The required cabling system described is a “Beyond Category 6” structured cabling solution.



The SCS solution for wireless access points (WAPs) shall support a useable end-to-end system bandwidth of not less than 500 MHz. This requires substantial performance margin in all key electrical parameters beyond Category 6A. Useable end-to-end system bandwidth is indicated by the maximum frequency at which a positive Power Sum Attenuation-to-Crosstalk Ratio may be obtained at both the Near (PSACRN) and Far ends (PSACRF) of a 100-meter cabling channel. This channel shall have the capability of four or six connections without failing to meet Category 6A specifications.

The required cabling system described is a “Beyond Category 6A” structured cabling solution.

**Installation Specifics**

The installation contractor shall be responsible for installing, terminating, testing, and labeling the cabling system in accordance with TIA and BICSI installation guidelines for intra and inter building. The contractor will also provide UNCW with a dedicated project manager for the life of the project who is responsible for planning the installation schedule and act as the interface with UNCW employees. Weekly update meetings will be required. The contractor will also provide UNCW with the certified installation warranty certificate at the completion of the project. This will insure that UNCW will be able to maintain a warranty on their installed communication systems.

A single manufacturer shall provide all unshielded twisted pair (UTP) end-to-end Channel (as defined by latest revision of TIA-568-C family of wiring standards) configurations. The horizontal cabling to station outlets shall consist of UTP, riser rated (CMR) cable at a minimum.

Each standard data cable shall be ‘Beyond’ Category 6 rated to a minimum of 400 megahertz and shall be third party verified to comply with or exceed TIA Category 6 requirements.

Each cable for wireless access points (WAPs) shall be a “Beyond” Category 6A cable rated to a minimum of 500 MHz. Each cable for WAPs shall be third party verified to comply with or exceed Category 6A requirements, and shall carry be capable of supporting 100W Power-Over-Ethernet over 100 meters.

References for the project and standards shall be as required to include:

1. TIA-568-C.2 (or latest revision)
2. TIA-569-D (or latest revision)
3. TIA-606-B (or latest revision)
4. TIA-607-C (or latest revision)
5. NETA ATS (or latest revision)
6. NFPA 70 (or latest revision)
7. UL 969 (or latest revision)
8. ISO/IEC 11801 (or latest revision)
9. BICSI TDMM (or latest revision)
10. BICSI CO-OSP (or latest revision)
11. STS-1000 (or latest revision)
12. Standards of Installation of Infrastructure Network Communications at UNCW

Number of Drops per Room

*Faculty/Staff Offices, Class Rooms, Conference Rooms*

Will have a minimum of four (4), beyond Category 6 rated and one (1) - coax terminated on a video coupler insert or campus wide access outlet as determined on the print. Additional drops installed as requested. Each horizontal UTP cable shall terminate on one RJ-45 jack at the workstation. The termination method on the rear of the jack shall be Insulation Displacement Contact (IDC) type connectors. The pin assignments shall conform to TIA-568- B standard T568B. Rooms less than 100 square feet will have one (1) standard information outlet and rooms 100 square feet or more will have two (2) information outlets. An information outlet is two (2) voice and two (2) data.

Each information outlet will have a minimum of two (2) voice and two (2) data outlets.

***Wall phone locations***

Wall telephone outlets shall use Suttle 063187 or approved functional equivalent. The wall phone jack will be stainless steel and have mounting lugs with screw down termination. The mounting position will provide enough room for a standard wall phone w/ADA jack beside it.

***Data Projectors***

Each data projector will have a minimum of three cat 6 or beyond data cables installed.

***A/V Equipment Racks***

Each rack will have a minimum of five cat 6 or beyond data cables.

***TR Inter-connects***  Will have a minimum of three (3), Cat 6 for each Closet. Also an additional cross-connect for every twenty-four (24) installed Cat 6 jacks beyond the first twenty-four (24) connections.

***Print Machines*** Will have a minimum of one (1) dedicated Cat 6 for each device.

***Vending Machines*** Will have a minimum of one (1) dedicated Cat 6 for each device.

***Irrigation Clocks*** Will have a minimum on one (1) dedicated Cat 6 with in line protection installed (Ditek or equivalent). The installation will determine the cable used to meet code.

***Water Meter(s)***

Each water meter will have a minimum of one (1) dedicated cat 6 to each location. Installation of one voice line will be required in addition to the data line.

***JACE (HVAC) Communications*** Each JACE location will have a Standard drop on One (1) voice and two (2) data. The standard drop is within two feet of the JACE location.

***Freezer Location*** Will have one (1) standard drop for each location.

***Television Location and Monitor Locations*** Will have two (2) data outlets and one (1) standard RG-6 Coax cable installed.

***Intercom Cabling*** Each Intercom unit will have one (1) dedicated data cable from the data rack in the Communications room.

Wireless Access Point Outlets

***Conference and Auditorium***

16 to 25 seat- 2 outlets

25 to 30 seat- 3 outlets

30 to 50 seat-4 outlets

50 to 75 seat-5 outlets

75 to 100 seat- 6 outlets

***Work rooms*** – 2 outlets

***Hallways*** – every 100 feet

***Main Electrical rooms***- one per room

***Primary Mechanical rooms***- one per room

Wireless access points shall terminate on a dedicated 6A patch panel that matches the structured cabling solution being installed.

Cable Installation

Cabling Termination practices: The installer will observe the cabling practices described in the TIA-568-C family of standards. Standard industry practices guided by the latest revisions of BICSI TDMM and BICSI installation manuals are required for cable installation, handling, grooming, etc. Installation of cabling is in a manner that will protect the cable from damage during install, facilitate cable management and identification and provide a neat and groomed appearance. The horizontal cables shall be bundled in the ER/TR ladder tray using Velcro cable ties. Plastic ty-wraps are unacceptable. During the installation, nicks, abrasions, burning, and scuffing of cable are unacceptable and will be prevented. Replacement of damaged cables are at the contractor’s expense regardless of whether the cable passes Category 6 Level III testing standards.

***Cross-connect fields*** 110 or GigaBIX IDC connecting clips or blocks for every installed cable pair at the rack and WAO.

***Horizontal station cable***

Should have twelve inches of spare cable at the station outlet and 10 feet of spare at each rack

Category 5e power sum cables and fiber riser cable between the ER/TR

Outside plant Category 3: Eight feet spare at each protector block.

Fiber terminating into the building: as per industry best practices, last 15 feet of fiber cable to be cut off and discarded after pulling, still leaving 20 feet of spare at each rack.

###### **Network Data Connections**

Manufacturer certification is required for installers. Information outlet terminations will be to manufacturer’s specifications. The installer is responsible for end-to-end termination of all the cabling.

All data cable is blue in color unless changed by environmental standards.

Network and Communications – Telephony

All voice cable shall be Category 6 or beyond Category 6 rated. Telecommunication’s voice cable is white jacketed. Manufacturer certification is required for installers. Information outlet terminations will be to manufacturer’s specifications. The installer is responsible for end-to-end termination of all the cabling***.***

***Telephone Trunk Cables***

Cables of 25 pair and up are 24 AWG, LSPR Power Sum (Category 5e) solid conductor cables. These high pair-count cables terminate on 110-style 360 pair for the Systimax system, the Belden termination solution or the NECTONNECT Category 5e solution. The punch-down order is the traditional USOC color code order for Multi-pair telephone cables Punched on 110 blocks with insulation displacement connectors installed. All terminations will be on a dedicated voice rack.

Jacks (inserts, all installations)

Category 6 jack data jacks are yellow in color

Category 6 jack telecommunications voice jacks are white in color

When specifying Belden copper systems, jacks and modular plugs shall be from Belden’s REVConnect product family.

CATV video couplet kits are white in color.

Work Area Outlet (WAO) faceplate is white with a minimum of four ports with label insert top and bottom.

*Campus Copper Voice Backbone*

The connection for each building on campus is with a PE-89 rated outdoor copper cable consisting of a minimum of 25 pairs. Termination shall be consistent with the units used for the voice backbone. Terminations will be on protector blocks with 110 in/110 out. Each pair on the protector block use 4c1s 5 pin solid-state protector modules. The underground or inter-building cable installation, termination, and testing by the voice /data contractor.

Campus Fiber-Optic Data Backbone

*From the MDF to the IDF(s)*

The data cables used between the MDF to the IDF(s) will be a fiber-optic cable consisting of a minimum twelve single-mode fibers. The number and type of fiber and quantities required are according to the existing and future network requirements. The existing cables are Siecor or Corning Cable Systems fiber optic cable and terminated with LC connectors mounted in Corning Cable Systems LANscape or Belden Enterprise X (ECX) rack-mounted hardware in the top position of the data rack. All twelve strand fibers must terminate in twelve port interconnect panels.

*Between Buildings*

Existing buildings use Corning Cable systems duct/aerial hybrid loose-tube fiber-optic cable. Existing hardware is the Corning Cable systems landscape rack-mounted hardware. The University, according to the existing and future network requirements will specify the number and type of fibers.

UNCW is a splice free fiber optic campus. Fiber optic cable splicing is unacceptable for any fiber optic cabling: outside plant or Intra-building.

Outside plant, fiber will terminate in Data rack fiber patch panels in each MDF.

Backbone fiber will terminate in each MDF and TR in a data rack fiber patch panel, either Corning Cable Systems LANScape or Belden Enterprise X (ECX).

This backbone cable shall consist of a minimum of 24 single-mode fibers.

The cable termination is with LC connectors and rack-mounted hardware.

The minimum count is 24 single mode fibers.

Communications Room/Equipment Room

The ER/TR(s) for each building provide for a transition between the horizontal and backbone pathways, and provide space for Network communications components including cable terminations (horizontal and backbone), active and passive equipment, cross-connections cabling, and hardware, and any other materials or equipment associated with the building Network communications, dataand technology systems.All Communications Rooms shall have direct access to the hallway or other such corridor. Network communications rooms are dedicated space. Building services such as Electrical (i.e. Electrical Distribution Panels or Transformers) poses a threat of damage or EMI interference that makes them completely unacceptable for Network Communications Equipment and wiring. Supporting codes are in the TIA-568B-C and TIA-569 wiring standard unequivocally against Multi-Use Communications rooms. In existing buildings, due to age of the building and design criteria at that, time space shared with other trades exists until the building’s renovation or space is available.

1. Network communications doors should not open into network communications Rooms.
2. Network communications Rooms shall not contain any type of sink or storage for Custodial or any other such supplies.
3. Network rooms MDFs, IDFs: - do not allow storage of any kind (i.e. Books, Furniture, A/C Filters, Light Bulbs, AV Equip. etc….).
4. Floors in Network Communications Rooms shall be sealed concrete or tile. Carpeted floors are totally unacceptable for Network Communications rooms due to the associated static electricity they create posing a threat of damage to sensitive Network Electronics.
5. A minimum space of 10 ft. X 10 ft. X 8 ft. H is required for all Network Communications Rooms or as required by TIA~~-~~569-A designs considerations. Square foot size: 10,000: 10 ft. X 11 ft.; 8,000 sq. ft.: 9 ft. X 10 ft. and 5,000 sq. ft.: 7 ft. X 10 ft.
6. All walls of the Network communications room are covered in ¾” non- fire rated plywood horizontally, be void free and finished on one side; mounted 4 inches above finish floor (AFF) the total perimeter of the room. The Non-fire rated plywood has at least two coats of fire resistant white paint. The paint applied is on all six sides with a minimum of two coats. The final paint finish shall be clear of footprints, markings, etc. and be a smooth finished product. NO exceptions. The plywood will be mounted eight (8) foot vertically and four (4) foot wide around the entire communications room.
7. All Network Communications locations shall be equipped with a grounding bus bar. A solid copper grounding bus bar ¼-inch thick x4 inches high with compression fittings and standoff brackets with insulators will be required on the Network communications backboard.
8. Bus bar connection is to a backbone of insulated, solid copper (minimum #6 AWG, with 3/0 recommended). This backbone is to the main grounding bus bar in the electrical entrance facility that bonds back to the building’s grounding system. This point should be at an electric panel per NEC 2005 standards. Chatsworth grounding bar 10622-010 or equivalent. The grounding bar location is mounted above the horizontal cable tray in the TR.
9. Each telecom Room connection to the MCC has a minimum of eight LSPR Power Sum Cables (Category 5e). Cables that installed outdoors will be PE-89 type and terminated on 110 in/ 110 out building protectors at each end. Each building entrance protector will be fully loaded with C4B1S (PTC) solid-state protector modules. The pair counts used for this backbone will vary by project due to connection requirements.
10. Each rack will also house a minimum of one (1) rack-mounted surge suppressor or UPS as specified on the print.
11. TIA-569-D Standards usage for lighting, HVAC, perimeters and dust design are required.
12. Fire Alarm panel installation in the TR or the ER not permitted.
13. Electrical outlets mounted at eighty-two (82) inches above AFF to top of outlet.
14. All electrical outlets are on the emergency generator. If the building does not have an emergency generator circuit prepping for future installed is required.
15. Installation of electrical conduits, refrigerant pipes, water pipes, HVAC ducting or piping, elevator alarms or pump alarms cannot penetrate through the communication or ER rooms.
16. Dedicated duplex 20 amp 110 VAC outlets on separate circuits are required. Convenience outlet mounting is at six foot. Intervals around the perimeter.
17. One- L6-20P outlet is required. Outlet is mounted at eight-two (82) inches AFF.
18. To improve visibility all walls are white in color.
19. HVAC: 24 hours/day, 365 days a year, 64 degrees to 75 degrees Fahrenheit, 30 to 55% humidity, positive pressure.
20. Lighting: Typically, 8.5 ft. high providing 50 ft. candles @ three feet above the floor.
21. Dust: less than 100 micrograms/cubic meter/24-hour period.
22. Audio Visual (AV) Cabling: AV cabling shall not use the communications rooms: MDF, IDF, and Entrance Facility as a pathway due to legal and auditing problems. The AV cable for riser pathways needs its own dedicated pathway. AV equipment storage is not allowed.
23. Intercom units: The single data line for each intercom unit is a standard data cable and terminate in the communications room data rack. Network Communications maintain the cable. AV maintains the power supply and must be located in a dedicated area separate from the communications rooms.
24. Sleeves and Pathways for Communications, data, and fiber optic cabling is dedicated and not to be used by other trades. Each trade is responsible for providing a dedicated pathway that meets code. Ty-wrapping or attaching to communications pathways or supports is not allowed.
25. Racks are two post open frame with three (3) inch deep channel, seven (7) feet in height, nineteen (19) inches wide and have a total of forty-five (45) RU’s. Vertical cable management will be a minimum of six (6) inches wide and six (6) inches deep, double sided with covers. Each rack will have a vertical cable manager per side. If two (2) racks are side by side the total Vertical cable manager’s width will be twelve (12) inches wide.

Patch Cords

The qualified contractor will provide all patch cords for the project. The following criteria apply:

1. Patch cords are included in the project and provided by the voice/data contractor for the rack end and the work area outlet(s).
2. Patch cords must be manufactured by the selected end-to-end system manufacturer and must be of correct grade to maintain the beyond Category 6 or beyond Category 6A channel rating.
3. Installation of the patch cords will be by the contractor after review with Network communications.
4. Patch cords for the work area outlet will be 50% 15 feet, 50% 20 feet. Unless otherwise designated by the Network communications department. The quantity for the Work area outlets will be for all Network communications data outlets throughout the facility.
5. Patch cords for each data cable in the data rack(s) of all communications rooms. At the rack end, the patch cords will be 40% 2 feet, 40% 3 feet, and 20% 4 feet.
6. Category 6A patch cords provided by contractor for each wireless access point. The length is a minimum of 5 feet and the quantity is for each wireless access point. The patch cord for the rack end will be included in the data cable quantity.
7. Patch cords will be from one supplier and match the end-to-end solution installed for the project.
8. Patch cords submittals are included for review and include lengths and quantities.

Cable Pathways

Pathways constructed from J-hooks maybe hung from Ceiling Wire installed with powder-actuated devices. J-Hooks will not be attached to independent grid wire or to the existing drop ceiling grid wiring. The added weight to the ceiling grid system can cause distortion in the grid system. Cable tray usage is for horizontal pathways with options including channel tray, ladder tray, solid bottom, and ventilated. Cable tray with conduit from the wall, stubbed within 6 inches of the cable tray and bonded is the preferred method. Conduits will have a 200 lbs. minimum pull string installed regardless of the length of the conduit. The horizontal cable between the ER/TR and the station outlets may have different support methods.

Proper Use of J-Hooks

Ceiling support shall not exceed manufacturer specification for Category 6 compliance. The maximum span distance will not exceed 5 feet intervals with a maximum of 12 inches of sag between supports. There shall be a minimum distance of 3 inches between the cable support distance and ceiling grid. Cable pathways design is to avoid EMI and RFI Interference. Common causes of this interference are fluorescent lighting fixtures, air handling motors, and many kinds of electrical controls including starters, lighting contractors, and power distribution panels. All cable runs must be at least two feet away from all fluorescent lights and EMF sources. Never run parallel with electrical conduits or strap to them. Every cable, whether an individual or grouped together, shall be supported. Wherever possible, group cables together in pathways. Never cinch plastic cable ties overly tight. If it deforms the outer cable jacket, it is too tight. The ties should be trimmed of any excess length and be snug. Cable splicing is not permitted and violation corrections will be at the contractor’s expense.

Unsuitable Conduit

During cable pulling, flexible conduit tends to:

* + Creep
  + Shift
  + Cause sheath damage to the cable

Flexible conduit usage is only in situations where it is the only practical alternative.

NOTE: If flexible conduit is used, its size increases by one trade size relative to the size of a rigid conduit.

**IMPORTANT**: Flexible conduit (e.g., metal flex conduit) usage in buildings not recommended.

Acceptable conduit runs

Achieve the best direct route (e.g., usually parallel to building lines) with no bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes. Contain no continuous sections longer than 30.5 m (100 ft.). Conduit bonding is to ground on one or both ends in accordance with national or local requirements. Conduit type selection is to withstand the environment and meet code for installation. NOTE: For runs that total more than 30.5 m (100 ft.) in length, pull points or pull boxes installed so that no segment between points/boxes exceeds the 30.5 m (100 ft.) limit. Total conduit runs kept to 45.8 m (150 ft.) or less (including the sections through pull boxes).

**Identification and Labeling**

The contractor with the following criteria will provide labels. Each end of all Category 6 cable labeled at approximately 3 to 6 inches from the Network Data/voice jack, CATV, and with a printed cable label. The contractor with consultation will provide labeling for the faceplate and block terminations from the Information Technology Network Group. All labeling will comply with the TIA-606A standard. The ER/TR labeling nomenclature will match that of the station outlet (SO) identifier as shown in the following information.

1. Rack- mounted 110-block labeling: Each 110-block position (each 4-pair connector clip) will be labeled as follows: Standard SOs/ wall phones outlets FVXX- where FVXX is the SO identifier where the Category 6 or beyond Category 6 cable on that connector clipterminates.
2. Modular patch panel labeling: Each panel has labeling. Each modular jack panel position shall be XXX where XXX matches the SO identifier. The patch panel shall have a label placed on the upper left hand corner of the panel face identifying the panel. All labels for the labeling printed using a computer, printer or Brother p-touch labeler with the TZ tape or equivalent. LABELS SHALL NOT BE HAND WRITTEN. Labels shall be different colors as detailed for identification per the 606B standard. The contractors shall meet with UNCW Telecom personnel, verify the numbering schemes, and label coloring.
3. The general numbering sequence shall conform to a sequential numbering pattern common to all floors of the facility. All cable numbering is sequentially from room to room as closely as possible. The final numbering scheme agreement is between the selected vendor and the building owner, UNCW prior to the start of the physical installation.
4. Station outlet labeling consists of two components: top faceplate label and a bottom faceplate label. The label will consist of a five-character identifier with the format f-y-xxx. F= the floor number of the building, y is D for data or V for voice and xxx is a unique identifier between o and 999 for any station outlet on that floor served by the same ER/TR. Faceplate labels for wall phones will consist of 4-character identifier with the format f-v-xxx. F= the floor number, V = is for voice, xx is a unique identifier between 0 and 99.
5. TIA-606 Administration standards for the Network Communications Infrastructure of Commercial Buildings is an incorporated reference. Compliance and shall be maintained.
6. Each cable record must indicate the cable type by manufacturer and manufacturer’s designation and document every pair/conductor in the cable. Cable identifier linkage is to all pathways in which it runs.
7. Each piece of termination hardware such as a patch panel or wiring block must be unique named and labeled.
8. Termination position on cross-connect must be identified by type, the pair conductor terminated and a user code.
9. Each element in the route, identification labels should be completed and attached. Labels should meet the requirements of UL969 Standard for Marking and Labeling Systems.
10. A final report should record system configuration, unique identifier, fiber labels, pathways, as-built details, and as-built drawings.
11. Loss Measurements and OTDR traces shall also be included. With the records.
12. Color coding to match 606 requirements.
13. Cable numbering shall follow the example:

D=DATA, V=VOICE

5=NETWORK COMMUNICATIONS ROOM NUMBER

2=FLOOR NUMBER

013=13TH CABLE TO BE INSTALLED

CABLE D.5.2.013

1. Wireless access point labeling: label the grid work at the outlet location with a printed label. Provide WAP in front of the horizontal cable label at the rack end. A green dot on the grid work is for easy location identification.

Example: WAP D.5.2.013

Fiber Labeling

1. The interconnect panel will be labeled on the front glass of the enclosure and include:
   1. Size and type of the fiber.
   2. The far end or “TO” will be shown
   3. The building the fibers termination point location is.
   4. The Enclosure will be identified.
   5. The interconnect panel will be identified.
2. Panel A 12 SM to (bldg. abbreviation) Enclosure (A thru Z identified on enclosure) to Panel A thru Z identified on enclosure)
3. EX. Panel A 12 SM to TSC Enclosure D Panel G.

**Testing, Documentation and Warranty**

Copper category 5e and/or 6 channels shall be tested as appropriate, with only PASSing values accepted, using a TIA-568-compliant Cat 6 Time-Domain Reflectometer. Copper category 6A channels shall be tested, with only PASSing values accepted, using a TIA-568-compliant Augmented Cat 6 (Cat 6A) Time-Domain Reflectometer.

Horizontal Cable Testing

1. Channel testing: Each equipment Network communications room patch cord, patch panel, horizontal cable, RJ 45 jack, Station patch cord will be tested end- to- end for compliance with category 6 level III parameters as stated in the TIA- 568 family of standards. Only certified cat 6-cable testing allowed on each all beyond cat 6 cables. The Test equipment used for horizontal category six cable tests complies with the industry standard Category 6 cable testers level III and comply with TIA test procedures. Each link shall be tested to TIA-568-C pinout, with only PASS results accepted. The contractor, at no charge to UNCW, shall bring any pairs not meeting the requirements of the standard into compliance and complete end-to-end test results documentation to UNCW. The test results will require 2-cd copies.

Fiber Optic Testing

Each 62.5 OR 50/125-micron fiber will be tested patch panel to patch panel at the 850 and 1300 nm wavelength in both directions using a light meter. Each single mode fiber will be tested patch panel to patch panel at the 1310 and 1550 nm wavelength both directions using a light meter. The maximum total attenuation for any single fiber between patch panels will not exceed 3.0 db.

* Power meter tests: For building risers, power meter tests are required.
* Provide a power test and OTDR test for length, attenuation, and micro bends for each individual fiber. Documentation will include the power test and OTDR results.
* Test results included for inclusion into the documentation package.
* Link attenuation does not include any active devices or passive devices other than cable connectors and splices.
* A final report shall be complied that records system configuration, fiber labels, cable routes, and as-bilts details and as-built drawings.

Computer Generated Report

All cables/connectors shall be tested provide test equipment generated print out for each cable/connector, indicating that the channel end-to-end solution has passed or failed. Test results: Provide two cd copies.

All testing must meet manufacturer’s warranty requirements.

Manufacturer Warranty

Contractor shall provide a minimum Twenty (20) year cabling Extended Product Warranty and Application Assurance. The warranty will support any performance claims the manufacturer makes over and above the Cat. Six standards stated herein. A Warranty statement from the Manufacturer stating the period of the warranty for all the products specified for the project and the name and address of the authorized manufacturers agent who will honor the warranty claims.

Extended Product Warranty

The Extended Product Warranty will cover product defects for all passive manufactured channel components. Passive components are those exhibiting no gain or contributing no energy. Manufacturer warrants, from the date a Registration Certificate passes to the end-user, the following:

1. That the passive products that comprise the registered Channel solution will be free from manufacturing defects in material or workmanship under normal and proper use;
2. That all channel approved passive cabling products that comprise the registered channel solution exceed the specification of TIA 568 and exceed ISO/IEC 11801 standards and will be equal to or exceed to the performance specifications of the associated Communication product data sheet in effect at the time the Registration Certificate is issued;
3. That the installation will exceed the insertion and return loss, attenuation and near end cross talk (NEXT) requirements of TIA 568-B and the ISO/IEC 11801 standards for cabling links/channel configurations specified in these standards.
4. That each channel is comprised exclusively of a single manufacturer solution and is capable of delivering 1.2 Gbps (Cat 5e), 3.6 Gbps (Cat 6) or 10 Gbps (Cat 6A) to the workstations or WAPs in accordance with applications standards.
5. This extended Product Warranty is applicable to the channel cabling solution products only on the original site of installation. Under the Extended Product Warranty, Manufacturer will either repair or replace the defective product itself at Manufacturers’ cost. The U.S.A., Manufacturer will pay an Authorized cable installation Reseller for the cost of labor to repair or replace any such defective product on behalf of Manufacturer.
6. Corning Cable Systems LANscape solutions “landscape extended warranty” a 25-year guarantee on complete fiber optic cabling solutions. The telecom contractor shall be an authorized Corning Cabling Systems extended warranty (NPI) installer.

Application Assurance

Application Assurance covers failure of the channel SCS to operate the applications, that the Solution is to support, as well as additional application(s) included in the numbered list. Manufacturer warrants that the registered channel SCS solution will be free from failures which prevent operation of the specific applications for which the original channel SCS was designed. The Application Assurance Program also covers the following additional applications:

1. Those identified in the current (at the time of installation) channel SCS Performance Specifications; and
2. In accordance with application standards specifications, any applications introduced in the future by recognized standards or user forums that use TIA/EIA 568 or ISO/IEC 11801 components and link/channel specifications for cabling.
3. The contractor’s certifications are current for the manufacturer’s solution installation. The contractor shall provide standards compliant, warranted, end-to-end channel solution for structured cabling solutions.

Additional Warranty

Contractor shall state any additional Contractor supplied warranty. This contractor warrants the Network communications cabling infrastructure system to be free of defects in the materials and workmanship for the period of one year after the date of final payment. The effective date of this warranty applies to all components of these systems regardless of any equipment manufacturer’s warranties, which may expire at an earlier date. Any system malfunctions or any previously undiscovered non- compliance with the plans and specifications during the warranty period are repaired at no cost to the Owner are brought into compliance.

Self-Install Warranty: The beyond cat 6 structured cabling manufacturers shall issue The University of North Carolina at Wilmington a Self-Install Warranty for all future moves, adds and changes that are warrantied under this contract document ‘Extended product warranty and application assurance program for an end-to –end channel solution’.

Inspection

The Project Manager and/or the SCS System Manager shall perform on-going inspections during construction. All work performed is in a high-quality manner. In addition, the overall appearance shall be clean, neat and orderly. These items need to meet compliance:

1. Is the design documentation complete- Are all the cables properly labeled, from end-to-end?
2. Have all terminated cables been properly tested in accordance with the specifications. Testing includes for the specific category as well as tested for opens, shorts, polarity reversals, transposition and presence of AC and/or DC voltage?
3. Is the cable type suitable for its pathway? Are the cables bundled in parallel?
4. The manufacturer’s pathway Guidelines are used. Is all cable penetrations installed properly and fire stopped according to code?
5. Have the Contractors avoided excessive cable bending?
6. The potential for EMI and RFI sources been considered?
7. Is Cable Fill Ratio Correct?
8. Are hanging supports within 1.5 meters (5 feet)?
9. Does hanging cable exhibit some sag?
10. Are Network communications room terminations compatible with applications equipment?
11. The patch Panel instructions are followed?
12. Jacket removal point.
13. Termination positions.
14. All pair terminations tight with minimal pair distortions.
15. Twists maintained up to Index Strip.
16. The Modular Panel instructions been followed?

* Cable dressing first
* Jackets remain up to the Connecting Block
* All pair terminations tight and undistorted
* Twists maintained up to the Connecting Block

1. Connectors are correct side- up in the Jack Panels without cables wrapped or twisted around the Mounting Collars.
2. Are the correct outlet connectors used (T568B)?
3. That the jacket maintained right up to the manufacture specifications.
4. Are identification markings uniform, permanent and readable?

Damages

The contractor is responsible for all damages to portions of the building caused by it, its employees or subcontractors including but not limited to the following:

1. All damage to any [portion of the building caused by the movement of tools, materials or equipment.
2. All damage to any component of the construction of spaces “turned over” to the contractor.
3. All damage to the electrical distribution system and/or other space “turned over” to the contractor.
4. All damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.
5. Other damage to the materials, tools and/or equipment of UNCW, its consultants, General Contractor, subcontractors, Architect, other contractors, agents and leases.

Recorded Documents

Prepare record documents in accordance with the requirements in Division 27 Section “PROJECT CLOSEOUT”. In addition to requirements specified in Division I, indicate installed conditions:

1. Backbone and horizontal cabling, station outlets, layout of ER and TR, all labeling of all cabling, connectors, equipment, conduits, cable trays, etc.
2. Equipment locations (exposed and concealed), dimensioned form prominent building lines.
3. Approved substitutions, contract Modifications, and actual equipment and materials installed.

Documentation

The cabling contractor shall provide the following documentation to the owner within 2 weeks following the completion of the installation:

1. Marked up floor plans identifying as-built cable routing for all horizontal backbone cabling. Submitted in electronic format (AutoCAD) and hard copy print out.
2. Marked up floor plans with station outlet identifier listed adjacent to each station outlet. Submitted in electronic format (AutoCAD) and hard copy print out. In addition, the contractor will provide full size laminated prints or framed prints installed by the contractor in each ER and each TR. All required full size drawings installed as required in each TR and ER to reference all station outlets served by a specific ER or TR.
3. Test results for each jack in each station outlet compiled in a binder with the tests listed in numerical order grouped by ER/TR. Provide two CD copies.
4. Tests results for all horizontal and backbone UTP, Co-Ax and fiber cables complied in a binder with the tests grouped by the backbone cable. Provide two 8-1/2 x 11 hardcopies in notebooks and 2 CD copies.
5. A scaled plan of each building showing the placement of each individual item of equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.

Quality Assurance

Installers Qualifications: Contractor with a minimum of five years documented successful installation experience on projects utilizing cabling infrastructure work similar to that required for this project. The contractor shall be an experienced firm regularly engaged in the layout and the installation of cabling infrastructure systems. The contractor must be able to show evidence that he has successfully completed projects of similar size and scope in the last 12 months. The contractor shall be a manufacturer certified Business Partner, CVA, or for the TE solution the installers, supervisors, registered certifier, and designers to have a current valid certification card.

1. The Network Communications project manager must have experience in this type of project and he/she expected to provide technical support.
2. The Network Communications project manager shall attend the monthly progress meetings held by the state and additional meetings as scheduled or required.
3. BICSI registration must be current and the installer and technicians must be in good standing.
4. During the shop drawing process, provide copies of all manufacturer and BICSI certifications, the contractor shall meet the following criteria: 15% of work force shall be BICSI certified ‘Technician level or better (RCDD). 15% of work force shall be BICSI certified Installer level 2 or higher; 15% of work force shall be BICSI certified installer level 1 or of equivalent experience/training.
5. Contractor employees will wear visible ID badges on the job site with current picture and company name at all times.

**General Requirements**

1. Work under this section shall include providing all labor, materials, equipment, and services necessary for and reasonably incidental to the proper completion of all Network communications work as shown on the drawings and herein specified. Work shall also include, but not be limited to the furnishings, unloading, handling, distribution, setting, supporting, and installation of all required components.
2. Refer to electrical drawings for each buildings equipment room, Telecom room (TR) and station outlet location.
3. Refer to the Network communications riser diagrams and diagram drawings for the following:
4. Outlet elevation: showing all components required for the installation and mounting of the outlet. The faceplate of a typical quad station outlet and all outlet configurations used.
5. Outlet pathway elevation: shows the details of how the cables routing from the horizontal pathway to the outlet. Conduit size is at a minimum ¾ inch stubbed out to within six inches of the cable tray and bonded to the cable tray. In a typical cable tray, voice and data will be located on one side of the cable with the A/V cabling located on the opposite side.
6. Grounding and bonding drawing: Shows the five major components for the grounding of the Network communications infrastructure throughout the building. The five components shown are the Bonding conductor, the Network communications main grounding bus bar, the Network communications grounding bus bar, the Network communications bonding backbone, Network communications bonding backbone interconnecting bonding conductor. All grounding and bonding shall meet the TIA/EIA –607 standards and the NEC code.
7. Campus Wide Drawings: Show all details for each individual campus wide access door interior and exterior. Drawings are not to scale. Refer to architectural and structural drawings for building construction and dimensions and to roof finish schedule on architectural drawings for the materials, finish and construction method of walls, floor and ceiling in order to insure proper rough in and installation of work.

Additional Standards and Codes

1. Work to conform with any city, State law, regulation, code, ordnance, and ruling or Fire Underwriters requirement applicable to this class of work.
2. Contractor will comply with the stricter requirement when a conflict occurs.
3. The following guidelines and standards will apply wherever applicable

* TIA-568-C Commercial Building Standards for Telecommunications
* TIA- 569-D Commercial Building standards for Pathways and Spaces
* TIA-606-B Administration (Labeling)
* TIA- 607-C Grounding and bonding of premises cable
* BICSI TDMM Telecommunications Distribution Methods Manual
* BICSI CO-OSP Customer-owned Outside Plant Design Manual
* ANSI/NECA/BICSI 568-2001

Renovations

The Voice, data, CATV, and AV must be coordinated through Network Communications. A certified contractor for the building solution-SYSTIMAX, NETCONNCET/Uniprise or Belden, does voice, data, CATV, and AV cabling that is in the renovation. Work under this section shall include providing all labor, materials, equipment, and services necessary for and reasonably incidental to the proper completion of all Network communications work as shown on the drawings and herein specified. Work shall also include, but not be limited to the furnishings, unloading, handling, distribution, setting, supporting, and installation of all required components. The contractor will install as-bilts updating all changes in each TR and ER. Electronic copies of the as built will be provided to UNCW project management CAD department. Requirements for projects listed in the standards apply to all renovations involving voice, data, CATV, and AV.

Manholes and Duct banks

1. Seal all ducts at terminations or all conduit entry points with expandable reusable conduit plugs capable of withstanding 15-psi minimum hydro static pressure in manholes and buildings.
2. All duct banks will have a trace wire installed and a 1250-pound tensile test ½ “wide marking cord equivalent to NEPTCO Inc. or MULETAPE part # 1250P.
3. All conduits pulled as full as possible without damage to the cable.
4. All cables secured to the wall of the vault.
5. All cables clearly labeled using stamped aluminum.
6. The labeling for the cables will show destination, origination, cable size and pair count.
7. Cables labeled in all ER, MDF’s, and IDF’s.
8. Three 11/4-inch ID inner ducts placed in a minimum of one 4-inch conduit leading to every building.
9. The entrance conduit into each building, which contains the inner ducts, shall be equipped with a hole plug designed to seal around each individual inner duct.
10. Each inner duct sealed to prevent leakage into the building.
11. Manhole diagrams and duct bank diagrams shown on the Network communications drawings.
12. Each cable will have a slack loop in each manhole. The slack loop will be one full circle inside the manhole.
13. The distance between manholes should not exceed 450 feet.
14. Manhole lids will be equivalent to a U.S.F. FABRICATION, INC. APD 300.
15. Install conduits with gradual, sweeping elbows and offsets. Hard 90s are not acceptable.
16. Provide non-metallic cable rack on each wall in the manhole with a minimum of three arms each wall.
17. All duct banks inspected and approved prior to the placement of any concrete.
18. Duct bank poured with 3,000-psi concrete and encased all sides with a minimum of three inches.
19. After the duct line is completed, a standard flexible mandrel used for cleaning followed by a brush with stiff bristles. Mandrels shall be at least 12 inches long and have a diameter ¼ inch less than the inside diameter of the duct being cleaned.
20. A minimum of 2- 4-inch conduits schedule 40 PVC and is required for all Network communications duct banks. Schedule 80 PVC conduit is required for installation under roads and heavy traffic areas.

Joint Trench Required Separations

When a joint-trench method is used, the following vertical or horizontal separations for Network communications facilities and other facilities are used.

Vertical/horizontal separations

Adjacent Structure Minimum Separation

Power or other foreign conduit

* + 76 mm (3 in) of concrete, or
  + 101 mm (4 in) of masonry, or
  + 305 mm (12 in) of well-tamped earth.
  + Pipes (gas, oil, water)
  + 152 mm (6 inch) when crossing
  + 305 mm (12 in) when parallel.
  + Street railways 10 mm (3.3 ft.) below top rail.

**NOTES**: Place cable in rigid PVC conduit for a distance of 3 m (10 ft.) on either side of the pipeline crossing. If multiple pipelines exist, then extend conduit 3 m (10 ft.) from the outside pipes. Place rigid steel conduit for a minimum distance of 7.6 m (25 ft.) on either size of the center of the track (e.g., rails) crossing. If there are multiple tracks, the conduit should extend out 7.6 m (25 ft.) on either side

Of the center of the outside tracks.

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Confined space Entry Procedures

The purpose of this safe work practice is to provide a procedure when working around an ‘open’ manhole or preparing to enter a manhole for routine maintenance or inspection. A manhole structure is a confined space that presents possible fall hazards where there is a potential for toxic gases to be present. Therefore, ALL personnel assigned to enter Network Communications manholes shall follow the procedures in this work practice.

Required Safety Equipment and Procedures

All personnel working around open manholes and preparing to enter the manhole shall use the following safety equipment:

1. Approved gas detector (properly calibrated)
2. Fresh air blower;
3. Safety harness, rope, and tripod safety system; and
4. Approved hardhat.

All Network Communications manholes designed for entrance and inspection maintenance on a regular basis use the following procedures before entering the confined space:

1. Atmospheric Testing: Before allowing any personnel inside the confined space, test the space for all three atmospheric conditions, oxygen content, flammable or explosive gases and hydrogen sulfide.
2. Oxygen contentmust be at least 19.5% in the confined space, measured at all levels (bottom, middle, and top). The safe oxygen level is between 19.5% and 21%. Do not enter the confined space if the oxygen level is below 19.5% or above 21%.Due to the extreme danger of suffocation in confined spaces, constant and continuous oxygen monitoring is required throughout each work period. Oxygen content above 23% can cause explosions or vigorous burning of flammable materials, including hair or clothing.
3. After you have determined oxygen content, use the detector to measure flammability at all levels of the confined space (bottom, middle, and top).Flammability measured in terms of the Lower Flammable Limit (LFL) or Lower Explosive Limit (LEL). This is the smallest concentration of a combustible gas in air that will explode when it contacts a spark or open flame.
4. Finally, test the atmosphere for any toxic concentrations of vapors. Toxicity measured in terms of the Threshold Limit Value (TLV). Use the detector to measuretoxicity at all levels of the confined space (bottom, middle, and top). Since toxic concentrations may be lighter or heavier than air, they can be present at the top or the bottom of the confined space. Note**:** The confined space tested at three levels for each atmospheric condition. Each level tested for a minimum of 60 seconds. The gas detector itself lowered into the confined space atmosphere with a safety line or the detector with an aspirator pump. Consult the detector operating procedures manual if you have any operating questions.
5. Ventilation**:** A fresh air ventilation system shall be set up and in operation before and duringall inspection and maintenance procedures.
6. After the air ventilation system has been in operation and the confined space has been tested and determined to be safe for entry, the operator shall be equipped with:
7. A safety harness and lifeline, attached to the tripod safety retrieval system.
8. An approved, properly calibrated gas detector that is in operation the entire time the employee is in the confined space. This is necessary due to the possibility of a rapid change in the confined space atmosphere.
9. An approved hard hat.
10. If permanent ladder steps are not in the confined space, use an aluminum ladder in good operating condition to enter the confined space. Any employee who descends into a man hole/sewer will have safety harness, rope, and tripod safety system attached to the employee.
11. At least one person stationed above ground for support purposes whenever a confined space is ready for entrance. .
12. Emergency Action Plan-- No person shall enter a confined space (manhole, to retrieve someone who is unconscious without having additional trained personnel above ground to assist. The person entering the confined space for rescue purposes must be equipped with the required rescue equipment and follow the specific rescue procedure.
13. A qualified person shall inspect all safety devices and instruct all involved employees on proper confined space safety procedures. All defective safety devices reported to the supervisor immediately. It shall be the supervisor’s responsibilityto insure that crews assigned to enter
14. Confined spaces have the required safety devices in their possession. The supervisor must assure the assigned employee has the required safety devices in their possession. The supervisor must assure the assigned employee trained to operate all safety equipment and understands all safety procedures.

General Manhole Safe Work Practices

1. Use caution when working around manholes.
2. Do not smoke, light open flames, or produce sparks in the immediate vicinity of open manholes.
3. Before removing manhole or entrance covers, test the atmosphere inside the manhole by using remote sampling probe or aspirators. If the lower explosive limit is above 10% inside the manhole, do not remove the cover.
4. Use picks, hooks to open manhole covers.
5. Lift manhole covers and heavy hatches with the legs. Never lift with the back muscles.
6. Lay removed manhole and heavy hatch covers flat on the ground several feet away from the opening.
7. With the manhole or entrance covers removal, the opening requires a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and protect each employee working in the space from foreign objects entering the space.
8. Use barricades and/or warning devices to direct traffic around open manholes.
9. Follow Public Services Department directions for Confined Space Entry Programand all safety procedures before entering and during entry into any manhole.
10. Have at least two persons present before entering a manhole: One person to enter the manhole and one person in the clear to observe in the event of an emergency. One of the persons must be a “qualified person” as defined by the Public Services Department’s Confined Space Entry Program This person bears the responsibility of completing the Confined Space Entry Permit. Never enter a manhole unattended.
11. Wear protective clothing and nonslip, non-sparking shoes in a manhole.
12. Test each individual manhole step carefully. Be sure to check ladder for overall structural soundness and ability to support weight before using.
13. Use ladders to access manholes whenever the structural soundness and support ability of the manhole steps/stairs are in question.
14. Take proper safety precautions when using ladders in a manhole.
15. Use a safety harness and life line when entering a vertical entry manhole, unless the lifeline creates an entanglement hazard.
16. Watch out for slippery footing in a manhole.
17. Do not hand carry tools and/or equipment while climbing up or down steps or a ladder into a manhole.
18. Raise or lower tools and/or equipment into a manhole using a rope, sling, or bucket.
19. Use only explosion-proof portable lighting and non-sparking tools in a manhole.
20. Avoid using electrical tools in or near water. Never stand in water when using electrical tools.
21. Constant ventilation is required when performing “hot-work” within a manhole, if the above safe works, practices is not accomplishable, or if there is a positive reading

Fire Stopping

1. This Section includes requirements for the furnishing and installing of fire rated wiring devices.
2. Furnish and install all fire rated wiring devices and associated hardware as shown on the Contract Drawings and as hereinafter specified.
3. All devices shall be heavy-duty specification grade with an in tumescent insert material allowing for 0 to 100-percent visual fill of conductors.
4. The same manufacturer shall supply all furnished fire rated devices and associated hardware.
5. Fire rated wiring devices shall bear the UL Classification marking.
6. Device testing in accordance with ASTM E 814 (ANSI/UL1479).

Fire rated wiring devices

1. Cables passing through fire-rated floors or walls shall pass through fire-rated wiring devices which contain an in tumescent insert material that adjusts automatically to cable additions or subtractions.
2. The device shall have an F Rating equal to the rating of the barrier in which the device installation is applied.
3. Wiring devices shall be capable of allowing a 0 to 100-percent visual fill of cables.
4. Wire devices shall be of a sufficient size to accommodate the quantity and size of data cables required.
5. Wire devices provided with steel wall plates for single or multiple devices allowing them for joined.
6. Manufacturers’ accepted for fire rated devices include Specified Technologies INC., Hilti, and 3M.

Installation

1. Wiring device installation is in locations where drawings indicate on the blue print, and are arranged singly or ganged at the height specified.
2. Install the devices in strict accordance with the approved shop drawings and the equipment manufacturer’s recommendations.
3. Apply the factory supplied gasketing material prior to the installation of the wall plates.
4. Secure wall plates to devices per the equipment manufacturer’s recommendations.
5. Buildings at UNC-W wiring is according to the established campus –wide wiring standards since the early 1990’s. The fire safety considerations of the pathway systems shall comply with all applicable fire safety and electrical codes. In general, the N.C. Department of Insurance determines the compliance of these systems with codes, and reserves the right to inspect and approve/disapprove their installation. If the pathway system is a metallic, enclosed system non-plenum cabling installation within unless otherwise noted. All wireway and conduit penetrations of rated walls and floors shall be fire stopped per applicable UL assembly. Plenum cable installed as required per the guidelines on an individual building basis. UNC-W adheres to the BICSI, NEC, and ANSI/TIA/EIA-569-A guidelines for fire stopping.

Cleaning

1. After the installation is complete contractor shall clean all systems.
2. Vacuum debris from system component, enclosures, junction boxes and pull boxes prior to testing and again prior to completion.
3. Thoroughly clean equipment of stains, paint spots, dirt and dust. Remove temporary labels not used for instruction or operation.

Codes, Permits, and Fees

1. Comply with all applicable laws, ordinances, rules, regulations, codes, or rulings of governmental units having jurisdiction as well as standards of the National Fire Protection association and serving utility requirements.
2. Obtain and pay for all permits, fees, inspections, utility connections and extensions and the like associated with work in each section of this division.
3. Comply with SCO for inspections as required.

End of Standards for Installation