SECTION 270000 - COMMUNICATIONS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes products and execution requirements pertaining to Division 27 systems. Copper and fiber backbone and horizontal cabling along with support systems are covered under this document.

B. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities for all cabling products shall be provided as required to complete cabling to all work stations as shown on floor plans.

C. The same manufacturer's product shall be utilized throughout the entire project for all copper and fiber optic cabling.

D. Substitutions: No substituted products shall be installed except with written approval by Owner.

1.2 DATA AND VOICE COMMUNICATIONS CONTRACT WORK

A. General:

1. Furnish all labor, materials, tools, equipment and services for the installation in accordance with general provisions of specifications and the Contract Drawings.
2. Report percentage of work completed on a monthly basis.
3. Completely coordinate with work of all other trades.
4. Provide all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation, whether or not specifically indicated in the Contract Documents.
5. Provide all floor penetrations, floor sleeves, conduit raceways, wall penetrations, etc. not shown on the electrical plans but needed for the routing of cabling provided herein.
6. Provide labor for work area patch cord installation at designated workstations.
7. Provide labor for equipment patch cord installation at patch panel to Ethernet switch port.
8. Provide labor for voice patch cord installation at horizontal patch panel to voice cross-connect patch panel in TR and TC.
9. Provide labor for testing horizontal and backbone cabling.
10. Provide firestopping. **Specified Technology, Inc. referred to as STI**
11. Provide labor for Wireless LAN Access Point, Antennas and Power Injector installation and system testing.
12. Provide Telecommunications grounding and bonding.

B. Provide complete installation for Structured Telecommunications Cabling System including but not limited to:

1. Category 5e UTP horizontal cables.
2. Category 3 multipair backbone cables.
3. Multimode optical fiber backbone cables.
4. Work area telecommunication outlets.
5. Wall mounted voice outlets.
6. Equipment mounting racks and rack enclosures.
7. Category 5e modular patch panels.
8. Optical fiber patch panels.
9. Optical fiber **(SC)** connectors.

10. Data and Voice Category 5e patch cords
11. Optical fiber patch cords.

12. Wire management panels.
13. Sound, Paging, Telephone interface cabling.
14. Field testing.
15. Patch cord installation.
16. Conduit floor sleeves, conduit and supports required for installation of all cabling.
17. Wireless LAN installation.
18. Firestopping.

C. Purchasing
1. Purchase all materials from **{Distributor}**
2. Provide complete price breakdown of materials and handling fees.

1.3 SUBMITTALS

A. Submittals shall be complete and at one time. Partial submittals will not be considered.

B. Material lists, schedule of values, lists of subcontractors, and proof of Contractor qualifications shall be provided to Engineer upon request and shall follow the guidelines as stated in the General Requirements (Division 1 of the specification).

C. Performance bonds, payment bonds, and insurance certifications shall be submitted by the Contractor prior to execution of the contract.

D. Show drawings shall be submitted. All communication system shop drawings shall include:
1. Manufacturer's data (specifications, "cut sheets").
2. Wiring diagrams for all installed cabling.
3. Equipment rack/cabinet layouts.
4. Proposed labeling schemes and labeling method.
5. List of cabling distances (typical and maximum) for all structured cabling
6. Submit copies of certifications for all technicians and the project manager who will support this project.
7. The certifications shall include:
   a. Structured Cabling and termination equipment installation certifications for copper and optical fiber connectivity and cabling.
   b. Approved manufacturer classes satisfactorily completed.
8. Contractor shall submit a test plan that defines the tests required to ensure that the system meets technical, operational, and performance specifications 45 days prior to proposed test date.
9. Work shall not proceed without the Owner's approval of the submitted items.

E. Drawings & Inspection of Site:
1. Communications floor plan drawings are to scale and typically are not dimensioned. The Contractor shall not scale drawings for equipment placement and clearances. Dimensions given on drawings shall always take precedence over scaled drawings.
2. Any existing wires, utilities, or equipment shown on the drawings are shown for general information and to the best knowledge of the Engineer. The Contractor shall field verify all existing wires, utilities, or equipment.
3. The Contractor shall field verify distances and equipment placements coordinating locations with other trades, construction managers, and general Contractor prior to installation.
4. The Contractor shall review all site conditions prior to submitting a bid on this project. Any obvious discrepancies between the site conditions and bidding documents shall be

brought to the attention of the Engineer at the time of bidding so clarification can be made by addendum.

5. Change order requests for additional costs related to the contractors misunderstanding related to the amount of work involved and lack of knowledge related to the site conditions will not be allowed.

F. Test Reports: Submit copies of complete reports of all testing performed to the General Contractor, with copies to the Architect's Electrical Engineer two weeks prior to job completion.

1.4 QUALITY ASSURANCE

A. Installation Standards: Cable installation shall comply with the following:
1. NEC® 2005: National Electric Code®, 2005.
2. ANSI/TIA/EIA-568-B.1-2001. Commercial Building Telecommunications Cabling Standard. Part 1: General Requirements (Approved April 2001).
3. ANSI/TIA/EIA-568-B.1-1: Addendum 1 – Minimum 4-Pair UTP ScTP Patch Cable Bend Radius (July 2001).
4. ANSI/TIA/EIA-568-B.1-2: Addendum 2. – Grounding and Bonding Specifications for Screened Balanced Twisted-Pair Horizontal Cabling.
5. ANSI/TIA/EIA-568-B.1-3: Supportable Distances and Channel Attenuation for Optical Fiber Applications by Fiber Type (July 2003).
6. ANSI/TIA/EIA-568-B.1-4: Recognition of Category 6 and 850nm Laser-Optimized 50/125µm Multimode Optical Fiber Cabling (July 2003).
7. ANSI/TIA/EIA-568-B.2-2001: Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling (Approved April 2001)
8. ANSI/TIA/EIA-568-B.2-1: Addendum 1 – Transmit Performance Specifications for 4-Pair 100 Ohm Category 6 (June 2002).
9. ANSI/TIA/EIA-568-B.2-2: Addendum 2 (December 2001).
10. ANSI/TIA/EIA -568-B.2-3: Addendum 3 – Additional Considerations for Insertion Loss and Return Loss Pass/Fail Determination (March 2002).
11. ANSI/TIA/EIA -568-B.2-4: Addendum 4 – Solderless Connection Reliability Requirements for Copper Connecting Hardware (March 2002).
12. ANSI/TIA/EIA -568-B.2-5: Addendum 5 – Corrections to TIA/EIA-568-B.2 (January 2003).
13. ANSI/TIA/EIA-568-B.3-2000: Commercial Building Telecommunications Cabling Standard, Part 3: Optical Fiber Cabling Components Standards (Approved March 2000).
14. ANSI/TIA/EIA-568-B.3-1: Transmission Performance Specifications for 50/125µm Optical Cables (April 2002).
15. TIA-569-B: Commercial Building Standard for Telecommunications Pathways and Spaces (October 2004).
16. ANSI/TIA/EIA-606-A. The Administration Standard for the Telecommunications infrastructure of Commercial Building (May 2002).
17. ANSI/TIA/EIA-J-STD-607-A. Commercial Building Grounding and Bonding Requirements for Telecommunications (October 2002).
18. ANSI/EIA/TIA-758 – Customer Owned Outside Plant Telecommunications Cabling Standard (August 2004).
19. ANSI/TIA/EIA-526-14-A-1998 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant-OFSTP-14A.
20. TIA-598-C – Optical Fiber Cable Color Coding (January 2005).

B. Materials:
1. All materials shall be UL or ETL listed and verified and shall be marked as such.

2. Products shall be regularly catalogued items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications with any optional items required for proper installation unless otherwise noted.

3. Material shall be delivered to the site in the original packing.
4. Approved Products
    1. 4-pair UTP Cable: Superior Essex Cobra Enhanced Category 5e Cable
    2. Optical Fiber Cable: Superior Essex
    3. UTP Connector: Leviton Network Solutions
    4. Fiber Optic Cabinets: Leviton Network Solutions
    5. Fiber Optic connectors/splices/couplers: Leviton Network Solutions
    6. Rack and Cabinet: B-Line
    7. Patch Panel: Leviton Networks Solutions
    8. UTP Patch Cords: Leviton Networks Solutions

D. Installer Qualifications:

1. The Contractor shall have experience in the installation and testing of similar systems as specified herein and shall have completed at least five projects of similar size and scope within the last 24 months. The Contractor shall provide references upon request (including the project name, address, date of implementation, client name, title, telephone number, and project description."
2. The Contractor bidding on communication systems specified herein shall be certified by either BICSI or Superior Essex to install, service, and warranty the specified product prior to the time of bid and throughout the duration of the installation; or, the bidding Contractor shall utilize a sub-Contractor(s) certified by Superior Essex to install, service, and warranty the specified product. Manufacturer certifications shall not be project specific and should be valid for any and all projects completed by Contractor.
3. The Contractor must maintain a state Contractor's license as required by the state.
4. The Contractor installing the structured cabling is required to have a RCDD functioning as project manager (No Exceptions). The Contractor's RCDD/project manager shall complete at a minimum the following tasks.
    a. Review and submit Contractor's shop drawings.
    b. Conduct weekly site visits to review the installation and progress of the structured cabling during the communications installation phase of the project.
    c. Review and sign completed punchlist items.
    d. Review and submit Contractor's as-built documentation.
5. The Contractor shall provide copies of certificates for proof of manufacturer's training, manufacturer's certified installer and number, authorized distributor in the shop drawing submittal and at the request of the engineer to verify compliance with specification prior to recommendations for awarding bid. This certification must be completed six months prior to bidding project.

E. Approved Installers: Note: Each installer shall list name of project manager and field installer

Name:
Address:
Phone:
Contact:

Name:
Address:
Phone:
Contact:

Name:

Address:
Phone:
Contact:

1.5 MAINTENANCE

A. All materials used on this project shall be new. Used and refurbished equipment is not permitted. Provide equipment to site in original packaging whenever practical.

B. The Contractor is responsible for scheduling all deliveries and providing proper receipt, handling, and storage of all materials. Protect all equipment from physical damages (dents, scratches, dust, water, paint, chemicals, and temperature extremes) and vandalism, or theft. The Contractor shall replace any damaged or stolen equipment. The Contractor is responsible for all equipment until final project acceptance by Owner.

1.6 WARRANTY

A. Extended and Special Manufactures Warranties and/or Service Agreements will be required as described below for the following systems or system components. The Superior Essex Campus Warranty provides an extended warranty that combines product, labor, and applications assurance directly to the end-user.
   1. Cobra Category 5e Cabling, Connectivity Hardware, and Patch Cables shall be covered by a **Lifetime** NextLAN product, labor, and application assurance warranty. The application assurance portion shall provide coverage for the cabling system to support the applications that are designed for the specifications outlined in TIA/EIA 568-B.1. These applications include, but are not limited to 10BASE-T, 100BASE-T, 1000BASE-T, and 155 Mb/s ATM.
   2. Intrabuilding and Interbuilding copper and optical fiber backbone cables may be eligible for a 20-year (minimum) product, labor, and application assurance warranty.
   3. The application assurance warranty shall be structured in a manner that the Contractor providing corrective services will be reimbursed by the warranty provider when the manufacturer's warranty requirements have been met. The Contractor shall register the cabling system with Superior Essex to obtain the warranty for the Owner and include the approved warranty certificate in the final as-built records. The Owner will be responsible for adhering to the warranty stipulations if they should desire to continue receiving warranty coverage.

B. Telecommunication Contractor must submit the following to Superior Essex
   1. Warranty Registration Form
   2. Test results in electronic for both the copper and fiber optic systems. (Note: Hard copies will not be accepted.)

C. Once the submitted materials are reviewed, the Telecommunications Contractor will be notified in writing of acceptance or rejection. If the project is accepted, the Contractor will receive a copy of the signed Warranty Registration Form and a warranty certificate for the Owner.

D. Telecommunication Contractor shall forward the signed Warranty Registration Form and warranty certificate to the Owner.

PART 2 – PRODUCTS

2.1 OPEN CABLE SUPPORT SYSTEM

A. Provide B-Line Part No. BCH21 wide base J-hooks cable supports for cable bundles up to 40 cables. Provide Leviton Velcro Hook and Loop Wrap Part No. 43115-015 for cable bundles greater than 40 cables.

B. Provide open cable supports for each system to comply with Part 3.

2.2 LOCAL AREA NETWORK (LAN) INFRASTRUCTURE

A. Category 5e Horizontal Cable:
1. Superior Essex Cobra® Cable
a. UL listed CMP or CMR as required by installation location

B. Category 3, Voice Intrabuilding Backbone:
1. Quantities and pair count for all copper backbone cabling shall be provided as required to complete cabling system as shown on the drawing schematic diagrams.
a. UL listed CMP or CMR as required by installation location
2. Superior Essex Part No.

	Part Number	Pair count	Jacket Color
CMR	18-475-33	25	Gray
	18-579-33	50	Gray
	18-789-33	100	Gray
	18-D99-33	150	Gray
	18-A99-33	200	Gray
	18-B99-33	300	Gray
	18-C99-33	400	Gray
CMP	18-475-36	25	Gray
	18-475-46	25	White
	18-579-36	50	Gray
	18-799-36	100	Gray
	18-A99-36	200	Gray
	18-B99-36	300	Gray
	18-C99-36	400	Gray

3. All pairs of copper backbone cables shall be terminated at both ends on termination blocks.

C. Optical Fiber Backbone Cable:
1. Superior Essex TeraGain® 10G-300
a. UL listed OFNP or OFNR as required by installation location; aqua jacket
b. Cable shall be reinforced with Aramid yarn, and contain no metallic elements.
c. Optical fiber cable shall have an attenuation value not to exceed 3.5 dB per kilometer at 850 nm and 1.5 dB per kilometer at 1300 nm. Bandwidth shall be at least 1500 MHz per kilometer at 850 nm and 500 MHz per kilometer at 1300 nm.

D. Communication Outlets: Where indicated on drawings, data and voice jacks shall share a common outlet.
1. Category 5e Modules: Provide 8 position – 8 conductor non-keyed modules wired in accordance with EIA/TIA T568B PIN configuration standard to terminate Category 5e UTP cables as specified herein.
a. Category 5e module, color: electric ivory: Leviton Part No.: 5G110-RI5

2. Flush Mounted Outlets:
   a. 6-Port Faceplate, color: electric ivory: Leviton Part No.: 42080-6IS
   b. Category 5e module, color: electric ivory: Leviton Part No.: 5G110-RI5
   c. Blank modules as needed, color: electric ivory: Leviton Part No.: 41084-BIB (10 pack)

3. Surface Mount Outlets: (Cashwraps)
   a. Provide surface mount outlet box in color electric ivory: Leviton Part No.: 42777-1IA
   b. 6-Port Faceplate, color: electric ivory: Leviton Part No.: 42080-6IS
4. Wireless LAN Outlets
   a. Provide two-port surface mounted interface box in color electric ivory: Leviton Part No.:41089-2IP
5. 4-Port Modular Furniture Outlets: 2 Piece
   a. Faceplate with Bezel Adapter, color: electric ivory: Leviton Part No.: 49910-SI4
   b. Category 5e module, color: electric ivory: Leviton Part No.: 5G110-RI5
   c. Blank modules as needed, color: electric ivory: Leviton Part No.: 41084-BIB (10 pack)
6. Phone Outlets:
   a. Faceplate kit with Category 5e module.
      1) Leviton Part No. 5G110-RI5
7. Column Outlets
   a. Where indicated on drawings, provide 6-port flush face plate in color black to match column: Leviton Part No.: 42080-6ES
   b. Category 5e module, color: black: Leviton Part No.: 5G110-RE5
   c. Blank modules as needed, color: black: Leviton Part No.: 41084-BEB (10 pack)
8. Security Cover Outlets
   a. Where indicated on drawings, provide surface mounted security cover outlet
      1) Leviton Part No. 41290-SMI
      2) 2 Port QuickPort Adaptor Part No. 41295-HDI
      3) Category 5e module, Leviton Part No.: 5G110-RI5
      4) Blank modules as needed, Leviton Part No.: 41084-BIB
   b. Paint cover to match mounting surface. Confirm color with Architect prior to applying finish
9. Flush Floorbox Outlets:
   a. Tracjack Device Bezel: Walker # MAB6TJ.
   b. RJ-45 Cat 5e module: Leviton Part No.: 5G110-RW5
   c. Blank modules as needed: Leviton Part No.: 41084-BWB (10 pack)
   d. Mount in floorbox flange.
10. Identification: Provide colored CAT-5e RJ-45 connector module at the communications outlet and patch panel as follows:
    a. Red: Leviton Part No.: 5G1100RR5 for all LAN data locations.
    b. Purple: Leviton Part No.: 5G110-RP5 for all POS data locations.
    c. Blue: Leviton Part No.: 5G110-RB5 for all digital voice cross-connects at the patch panels in the MC and HC and digital voice locations at the communications outlet.
    d. Gray: Leviton Part No.: 5G110-RG5 for all analog voice locations at the communications outlet and analog voice cross-connects at the patch panels in the MC and HC.
    e. White: Leviton Part No.: 5G110-RW5 for voice cross-connects at the MC between the HC voice backbone patch panels.

E. Equipment Mounting Racks: Equip as detailed on the Drawings and as follows:
1. Racks for Patch Panels and Multi-Port Switches:
   a. Provide racks as indicated on Drawings for rack mounted connecting hardware and Owner furnished equipment. Racks shall be assembled at 19” wide x 84” tall.
      1) B-Line Part No. SB506084XUFB

2. Racks for Servers, Monitors, and Keyboards:
   a. Provide racks as indicated on Drawings for Owner-furnished servers and related equipment. Racks shall be four post aluminum frame assembled at 19 inches wide x 7'-0" tall. Racks shall have adjustable steel EIA rails and shall be supplied with 50 #12-24 cage nuts and screws.
      1) B-Line Part No. SB8361908430FB
3. Racks for PBX:
   a. Provide racks as indicated on Drawings for Owner-furnished PBX equipment. Racks shall be four post aluminum frame assembled at 19 inches wide x 7'-0" tall. Racks shall have adjustable steel EIA rails and shall be supplied with 50 #12-24 cage nuts and screws.
      1) B-Line Part No. SB8361908430FB
4. Racks for Security Video:
   a. Provide security video racks as indicated on Drawings. Racks shall be tapped front and rear rails with dimensions 84"H x19"Wx30"D and shall provide 45 vertical rack units for mounting equipment.
      1) B-Line Part No. SB8301908430FB (quantity = 2)
   b. Equip racks with the following accessories (quantities per rack)
      1) Leviton 4505 Series Rack Mount PDU Part No. 4505-20F (Quantity = 2)
      2) Leviton rack mounted horizontal cable management bar Part No. 49005-CMB (Quantity = 26)
      3) Velcro Cable Strap mounted vertically for cable management, B-Line Part No. SB7275/8x6 (Quantity = 5)
      4) Screws, black, package of 50, B-Line Part No. SB58604BZ. (Quantity = 2)
   5. Cabinets: B-Line E2 Zone 4 Rated Cabinet or Access Cabinet System.
   a. Low profile optical fiber pivoting cabinet with phosphor bronze sleeve 3-SC duplex adapter panels. Leviton Part No.: 5P130-00N. Load with 5F100-3BC
   b. Vertical cable management channels. B-Line Part No.: SB86083D084FB
   c. Horizontal feed-through wire management panels. B-Line Part No.: SB87019S2FB
   d. 48-port, GigaMax Category 5e high density patch panels. Leviton Part No.: 5G596-U48
   e. Rack mount 16 position, power strip.
   f. 100 CFM fan kits with guard.
   g. Grounding lug.
   h. Leviton Velcro Hook and Loop Wrap Part No. 43115-015
   i. Vented Equipment Shelf
6. Provide rack mounted cable management channels as shown on the drawings.
   a. Vertical cable management panel:
      1) B-Line Part No.: SB86083D084FB
   b. Horizontal cable management panel: B-Line Part No.: SB87019S2FB
   c. Optical Fiber cable management panel: Leviton Part No.: 49252-P02
7. Shelves: Provide rack mounted shelves as indicated on Drawings.
   a. Equipment Shelf:
      1) 19-inch rack, B-Line Part No. SB747S1915AFB
   b. CPU Shelf:
      1) 19-inch rack, B-Line Part No. E2SH4P1930FB
   c. Keyboard/Monitor Shelf:
      1) 19-inch, B-Line Part No. SB741S19AFB
   d. Vented Equipment Self:
      1) B-Line Part No. SB747V1915AFB

8. Concrete Floor Mounting Kit: B-Line Part No. SB588A to secure racks to concrete floor.
   a. Provide one for each rack in the MC and one for each HC enclosure.
9. Distribution Rack Grounding: furnish ground terminal block for each rack. Racks shall be grounded using stranded #6 AWG green insulated copper conductor. Furnish all required

bonding material and hardware, and bond to building grounding electrode subsystem at building electrical service entrance.

10. Power Protection Strips:
    a. Leviton Part No.: P1040-10S or P1041-10S. Provide as indicated on Drawings.
11. Cable Runway: B-Line Part No. SB17U24BFB (black 15" W). Equip each rack with a ladder style cable runway installed between the backboard and the equipment rack. Securely attach to backboard and rack in accordance with manufacturer's written instructions.
12. Wall Angle Support Kit: B-Line Part No.: SB211315FB
13. Cable Management Straps: Leviton Part No.: 43112-012

F. Category 5e Modular Patch Panels:
1. Leviton Part No.: 5G596-U48 High-Density 48-port Category 5e patch panel; units are modular to 110 printed circuit board style patch panels. Furnish quantities and port configurations required to terminate UTP horizontal cables indicated on the Drawings for the MC and HCs.
2. Leviton Part No.: 5G596-U24 High-Density 24-port Category 5e patch panel; units are modular to 110 printed circuit board style patch panels. Furnish quantities and port configurations required to terminate cables indicated on the Drawings for the MC and HCs.

G. Optical Fiber Patch Panels: Provide rack mounted modular enclosure units complete with connector couplings mounted in SC adapter panels for interconnection of optical fiber cables as specified herein. Units shall be sized to terminate all optical fibers indicated on the Drawings in the MC.
1. In the MC provide:
    a. Rack mount fiber enclosure: Leviton Part No.: 5R430-00N
    b. Duplex SC Adapter Panels with designation strips: Leviton Part No.: 5F100-6BC
    c. Blank adapter panels: Leviton Part No.: 5F100-BLK

H. Optical Fiber Connectors: Leviton Part No.: 49991-MSC; keyed, ceramic tipped, FastCAM, SC multimode connector, for termination at optical fiber patch panels in the MC and HCs.

I. Leviton Category 5e Non-Keyed Slim Line Patch Cords: Quantities and lengths as scheduled in PART
1. Shall be delivered to Owner, minus those installed.
2. Leviton Part No.5D460-xxt xx = length, t = color

J. 110 Series Wiring Blocks:
1. Provide wiring blocks constructed of fire retardant molded plastic with color-coded horizontal index strips that secure and organize 25-pairs each. The wiring blocks shall accommodate 22 through 26 AWG cable size conductors and shall be suitable for installation on terminal backboards as shown on the drawings. Provide 110-blocks as shown on drawings. Use five (5) C-4 clips and one (1) C-5 clip on station 110-blocks for terminating.
2. At the MC provide 110 series connecting hardware and wire management for horizontal cabling interconnects and cross-connects.
    a. Provide 300 pair block with legs, Leviton Part No.: 41AW2-300
    b. Provide 110 jumper trough with legs, Leviton Part No.: 41A10-HCM
    c. Provide 4-pair 110C connecting blocks, Leviton Part No.: 49104-IDC (10 pack)
    d. Provide 5-pair 110C connecting blocks, Leviton Part No.: 49105-IDC (10 pack)

    e. Provide designation kit with stripholders for horizontal cabling, Leviton Part No.: 41LBL-00W

f. Provide red 110 color coded designation strips for labeling of horizontal cabling on 110 blocks, Leviton Part No.: 41LBL-00R

K. Leviton Optical Fiber Patch Cables (Delivered to the Owner): For connection of optical fiber equipment to optical fiber cross connects and interconnects. Quantities and lengths as scheduled in PART 1.

L. Optical fiber cable marker shall be self-laminating, write-on, rigid, non-adhesive, tag measuring 3.50" x 2.00", and installed by utilizing specified cable tie, legend shall be black in color on yellow in color background, nomenclature shall state: "CAUTION: FIBER OPTIC CABLE, TYPE, and COUNT."

1. Acceptable manufacturer is Panduit:
   a. Panduit Part No.: PST-FO (5 tags/pkg.)
   b. Cable tie shall be dome-top, barb type with stainless steel locking barb, material shall be Nylon 6.6 with a maximum width of .141".
      1) Acceptable manufacturer is Panduit: Part No. BT1.51-C (6.1" length)
      2) Acceptable manufacturer is Panduit: Part No. BT21-C (8.0" length)

PART 3 – EXECUTION

3.1 INSTALLATION: GENERAL

A. Open Cable Support installation:

1. This Contractor shall furnish and install all supports for cables specified in this section.
2. Cable supports shall be spaced randomly, but no further than 4'-0" apart.
3. Provide all additional cable management products, sleeves or conduit raceways as required to protect exposed cabling and complete the installation of cables in a neat manner.
4. All floor penetrations shall be at columns, exterior walls or in equipment rooms.
5. Cables shall be supported at height of bottom flange of structural beams using a rigid support method (i.e. threaded rod, beam clamps, etc.).
6. Do not support cables from ductwork, sprinkler piping, water piping, waste piping, conduit, ceiling wire, or other system supports.
7. Provide independent support system for each low voltage cabling system.
8. Use saddle type fabric supports for major pathways and J-hooks or saddle supports for minor pathways. Do not exceed recommended fill capacity of supports.

B. Cable Installation:

1. All communications cabling that has become abandoned as part of new renovation projects, previous renovation projects, or temporary communication cables used during the construction process shall be completely removed. Abandoned communication cables that may have future use can remain in place if labeled clear at both end and at regular intervals of the cable run. Refer to NEC Article 800.52 for more information regarding the removal of abandoned communication cables.
2. All cables shall be bundled using plenum rated ties 5'-0" on center (at mid-span).
3. All cabling shall be installed in accordance with manufacturers' written bend radius and pulling tensions. General industry guidelines recommend the following bend radius and pulling tensions:
   1. Tensile loading on a single 4-pair copper UTP cable shall not exceed 25 lbf.
   2. Bend radius of a single 4-pair copper UTP cable shall not exceed 4 times the diameter of the cable.
   3. Bend radius of multi-pair copper UTP and optical fiber cable shall not exceed 10 times the diameter of the cable.
4. All conduits and conduit sleeves shall have bushings or grommets shall be installed prior

to the installation of communications cables to avoid damage and abrasions to cable sheathing and insulation. If bushings have are installed by the electrical Contractor, the communications cabling contract shall furnish and install bushings prior to pulling communications cabling.

5. Horizontal cable length for 4-pair copper UTP cables shall not exceed 295 feet. Prior to bidding and installation, the contactor shall review the drawings and verify no cable run exceeds 295 feet and notify the communications designer of cable runs that may exceed 295 feet.
6. Splices are not permitted in any voice or data cable unless other specified or show on drawings.
7. Avoid placing copper cables near sources of extreme heat (i.e. boilers, radiators, heat coils).
8. Maintain cable twists for all UTP cables. For terminations cable sheathing shall be stripping back no more than ½" back from termination point for all Category 5e and Category 6 cables.
9. All cables shall be supported by cable tray, cable runway, or J-hooks. When large quantities of cables leave trays or runways, cables shall be supported by drop-outs or cable support hardware manufactured specifically for the purpose of supporting cables. J-hooks shall be installed a minimum of every 5 feet and cabling shall maintain minimal deflection and strain (less than 12" deflection). Cables shall not be supported from ceiling grid wires. Cables shall not run above iron joists.
10. All cables shall be separated and bundled into like groups by cable sheathing colors.
11. Service loops shall be provided at both ends of installed horizontal and backbone cabling. A 12" service loop shall be installed in the ceiling space near workstation outlets (excessive cable shall not be coiled in outlet boxes). A 10' service loop shall be provided in communication rooms and shall be installed to allow for future equipment rack/cabinet relocations without the need to re-terminate patch panels; the 10' service loop shall be neatly bundled and secured in ceiling space with large D-rings or place in cable trays.
12. Any cabling installing in equipment rooms shall be neatly placed in cabling trays, cabling runways, or horizontal and vertical rack/cabinet cable managers. When tray, runways, or cable managers are not specified, cable shall be neatly installed with D-rings. Cables shall always be installed vertically/horizontally or at right angles to structure.
13. Nylon plastic cable ties may be used to secure permanently installed horizontal and backbone cabling; any cable ties installed in plenum ceiling spaces shall be rated for use in plenum spaces. Cable ties shall never be secured too tight whereby potentially changing the cable geometry.
14. Separation: Maintain the following distances between cables, other system cables and other building systems:
    a. One (1) foot from fluorescent lights.
    b. Four (4) feet from motors and transformers
    c. Three (3) feet from hot water piping or other mechanical equipment.
    d. One (1) foot from electrical conduits, other systems cables or other electrical equipment.
15. All low voltage cables shall be run parallel or at right angles to building structural framework. Do not run cables diagonally across ceiling space without written authorization by the Architect's Electrical Engineer.
16. Fire seal around all cables running through rated floors and walls.
17. Velcro straps shall be utilized in the TR and inside TC enclosures for all cable bundling. Tie wraps shall be prohibited in the telecommunication rooms.
18. Leave spare pull string with every outlet installed.

3.2 INSTALLATION: COMMUNICATIONS INFRASTRUCTURE

A. Category 5e Horizontal Cables:

1. Maximum cable lengths to be 295 feet (90 m) including service loop. Provide all necessary installation materials, tools and equipment to perform insulation displacement type terminations at all communications outlets, patch panels and 110 punch-down blocks.
2. Terminate each 4-pair cable from a work area outlet module labeled VaM-110-X or VM-110-X on the 300-pair terminal block designated for analog services (CO dial tone). Each 4-pair cable shall have all pairs terminated under the corresponding C-4 clip. See attached 'Full-Line Store 110-Block Terminations' listing and detail drawing of the 300-pair 110-Termination Block in the construction drawings.
3. Support and secure cables at patch panels using rear cable management bracket supplied with panel.
4. Install stuffer caps on each workstation outlet and patch panel port after cable has been terminated on 110 IDC.

B. Optical Fiber Cable:

1. Provide one twelve-strand multimode optical fiber cable from the TR to each TC.
2. All optical fiber installations shall be installed using open cabling methods. Limit cable-bending radius to 20 times the cable diameter during installation, and 10 times the diameter after installation. Provide all required tools, materials, consumables, and equipment necessary for field mounting of SC connectors. Label each end of each cable as to source and destination. Terminate optical fibers in consistent, consecutive manner at each end. Label Optical Fiber raceway cable with yellow "Caution - Optical Fiber Cable" tags every 10 feet. Leave 10 feet of slack at each fiber termination point. Neatly coil slack optical fiber cable on top of rack above optical fiber patch panel enclosure at each rack location.
3. Optical fiber cable terminations shall utilize enclosures and components in quantities consistent with the required fiber counts at each end of each segment. During optical fiber connector termination, visually inspect all terminations with a 400-power microscope. Follow all of the connector manufacturer's recommendations. Unacceptable flaws in the terminations will include, but not limited to, scratches, full or partial cracks, bubbles, pits, epoxy residual, dirt, dust, oil, moisture, grinding and sanding debris. The acceptable termination will show a connector tip that is free of all imperfections in 100% of the core and 80% of the cladding. All unacceptable connectors shall be inspected after rework.
4. During installation of optical fiber cable do not allow pulling tension to exceed cable manufacturer's specification for the cable being installed. Only the strength member of the cable shall be subjected to the pulling tension.
5. Clean all optical fiber connector tips prior to inserting them into matting receptacles or bulkheads.

C. INSTALLATION - VOICE COMMUNICATIONS SYSTEM

1. Install Category 3, multi-pair voice backbone cables utilizing an independent open cabling pathway from the horizontal cabling and optical fiber cabling.
2. Terminate Category 3, multi-pair cables at the designated patch panels indicated on the drawings for the TC and TRs. Contractor shall terminate each successive cable pair on Pair 1 (Pins 4 and 5) of each 8P-8C module.
3. For each voice cross-connect, provide the appropriate color icon at each patch panel port at the TCs and TR.
4. Provide all cross-connects in the MC from the horizontal station patch panel or the voice riser panels to the PBX patch panel. The PBX vendor shall provide PBX patch panels.
5. Complete all cross-connects for analog central office facilities and alarm lines to 110-termination block. Use white/red and red/white cross-connect wire.

6. Cross-connects shall be completed as per construction schedule.
7. The PBX System specifies a 4-pair, 24 AWG cable for each attendant console. Category 5e horizontal cabling shall be terminated on the 110-blocks in the MC Room.

D. RACKS AND ENCLOSURES:
1. Freestanding equipment racks and enclosures shall be protected free of all dust, debris and other environmental elements during construction until substantial completion walk-through.
2. Each rack, enclosure shall have a dedicated #6 AWG ground wire to a grounding busbar or building ground as defined by NEC.
3. Secure racks and enclosures to floor using rack installation kit.

3.3 INSTALLATION OF WIRELESS LAN SYSTEM

A. Meru Networks Access Point/Antenna (Owner Provided) Installation
1. Install all Access Points/Antennas at locations shown on the Contract (Construction) Drawings.
2. Install Access Points in accordance with manufacturer's instructions.
3. Access Point configuration completed by Owner.

B. Category 5e UTP cable installation
1. Sales Floor Access Point Locations
   a. Install one category 5e UTP cable from the serving TR/TC and terminate with a category 5e plug.
   b. A 50-foot service loop shall be coiled in the ceiling space above the Access Point without exceeding the manufacturer’s bend radius.
2. Stock Room Access Point Locations
   a. Install one category 5e UTP cable from the serving MR/TC and terminate with a category 5e module.
   b. Install the module in a Surface Mount Interface Box mounted adjacent to the Access Point.
   c. A 50-foot service loop shall be coiled in the ceiling space above the Access Point without exceeding the manufacturer’s bend radius.

3.5 LABELING

A. General:
1. All labels shall be permanent, machine generated labels produced by a labeling machine. Labels shall be a permanent polyester material clear in color with label lettering black in color.
   A.) DYMO Rhino Labels only.
2. Labeling information will be reviewed at Pre-Install Meeting, and the Owner shall approve the labeling scheme prior to the installation of any cabling.
3. Surfaces shall be cleaned before attaching labels. All labels shall be attached firmly and vertically plumb on equipment, faceplates, patch panels termination blocks, etc.
4. All labeling of cables, equipment, and components shall be included in as-built documentation, floor plan drawings, and schematic deigns.

B. Cabling
1. All structured cables (horizontal and backbone) shall be labeled at both ends within 6" of cable termination point. Where voice backbone cables extend behind termination blocks, cable labels shall be placed at a location on the cable where the labels are visible from the front of the termination blocks.
2. Labels shall have an adhesive backing and shall wrap completely around the circumference of the cable jacket. Label and lettering sizes shall be of appropriate size in regards to cable diameter.

C. Labeling of Equipment Racks, Termination Hardware, and Faceplates
1. All communications equipment racks, cabinets, fiber enclosures, and termination hardware shall be clearly labeled at the top, left-hand corner of the equipment.
2. Equipment Racks and Cabinets shall have ¾" to 1" high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character in sequence for each rack/cabinet. (i.e. TR2-A represents the first rack/cabinet in Telecommunications room #2)
3. Fiber Enclosures shall have 3/8" to ½" high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character of the rack/cabinet and the enclosure number (i.e. TR1-B-1 represents the first enclosures, second rack/cabinet in Telecommunications Room #1). Additionally, each strand of fiber shall be identified with the termination location of the opposite end and the fiber position number on the outside (or inside) front cover and top, left-hand corner of the enclosure under the enclosure label.
4. Modular Patch Panels shall have 3/8" to ½" high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character of the rack/cabinet and the patch panel number (i.e. TR3-C-2) represents the second patch panel, third rack/cabinet in Telecommunications Room #3). Patch panels shall be labeled with sequential numbering starting with "01" for topmost patch panel and moving downward towards the bottom of the rack. Additionally, each jack position on the patch panel shall be identified with the jack position number (i.e. a 48-port patch panel shall have number 1 through 48 silk screen printed on the patch panel or shall have labeling strips with numbers 1 through 48 machine printed above/below corresponding jack position).
5. Voice Termination Blocks shall be labeled similar to patch panels and fiber enclosures when installed in equipment racks and cabinets. Voice backbone cable pairs shall be labeled starting with V001 starting at the main communications room and continuing sequentially through all communications rooms. Horizontal voice cables (station cables) terminated shall be labeled similar to data patch panels.
6. Voice and Data Outlets shall have 3/16" high lettering with the labeling method as indicated. Voice and data outlets shall be identified with the telcommunications room where cables are terminated, the rack/cabinet number, the patch panel number, and the jack position number (i.e. TR3-C-2-28 represents the outlet is located on the second patch panel in the third rack/cabinet in Telecommunications Room #3 and is jack position #28). The Contractor shall terminate all cabling in a sequential method.

3.6 TESTING

A. Test procedures shall be as described by the TIA/EIA-568-B: Commercial Building Telecommunications Cabling Standard, Parts 2 and 3 and TIA/EIA-526-14-A-1998 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant-OFSTP-14A.

B. Permanent Link Testing shall be completed on all horizontal (station) cables.

C. Submit test reports to the General Contractor 2 weeks prior to Store Turnover. Test reports shall be provided electronically in an Adobe Acrobat (PDF) format.

D. Category 5e Cable Testing:
1. All wiring shall be certified to meet or exceed the specifications as set forth in TIA/EIA-568B for Category 5e requirements for permanent link.
2. Field Testing shall include the following parameters for each pair of each cable installed:
   a. Store number and name.
   b. Test equipment manufacturer and model number.
   c. Cable I.D. The test sheets will be in numerical order by cable ID.
   d. Date of test.
   e. Wire map (pin to pin connectivity and polarity check) i.e. near 12345678, far 12345678.
   f. Length (in feet).
   g. Insertion Loss.
   h. Near End Crosstalk (NEXT).
   i. Power Sum Near End Crosstalk (PSNEXT).
   j. Equal-Level Far End Crosstalk (ELFEXT).
   k. Power Sum Equal-Level Far End Crosstalk (PSELFEXT).
   l. Return Loss.
   m. Delay Skew.
   n. Attenuation to Crosstalk ratio (ACR).
   o. DC Resistance per 100M/328 feet.
   p. Impedance.
   q. Capacitance.
3. Record test results for each cable and turn over to the General Contractor two weeks prior to Store Turnover. Correct malfunctions when detected, and re-test to demonstrate compliance. Note: Test equipment Fluke DTX1200 or 1800 Type III cable Tester.

E. Voice Backbone Testing:
1. All wiring shall be certified to meet or exceed the specifications as set forth in TIA/EIA-568B for Category 3 requirements for permanent link. Certifications shall include the following parameters for each pair of each cable installed:
   a. Store number and name.
   b. Cable I.D. The test sheets will be in numerical order by cable ID.
   c. Date of test.
   d. Wire map (pin to pin connectivity and polarity check) i.e. near 12345678-far 12345678.
   e. Length (in feet).
   f. Impedance.
   g. Attenuation.
   h. DC Resistance per 100M/328 feet.
2. Record test results for each cable and turn over to the General Contractor two weeks prior to Store Turnover. Correct malfunctions when detected, and re-test to demonstrate compliance.

F. Optical Fiber Testing:
1. Preinstallation Testing:
   a. Test each conductor of every optical fiber cable on the reel with a light source and a power meter. Obtain the cable manufacturer power meter test results for each real used on the project. Using the attached Optical Fiber Test Form record the readings and the manufacturer's reel number. Prior to completion of project, turn over the completed optical fiber test form, optical fiber cable reel ID tags and optical fiber cable manufacturer's test results.
2. Acceptance Testing:
   a. After terminating optical fiber cables, one of the individual fibers of each cable segment shall be tested using an OTDR to determine the actual length.

b. Multimode optical fiber attenuation shall be tested on all individual fibers of each cable segment using an LED light source and power meter to determine the actual loss. These tests shall be performed at the 850nm and 1300nm windows in both directions. Test set up and performance shall be in accordance with ANSI/TIA/EIA-526-14A, Method B.

c. A reference power measurement shall be obtained by connecting one end of test jumper 1 to the light source and the other end to the power meter. After recording the reference power measurement, test jumper 1 shall be disconnected from the power meter without disturbing the light source and attached to the cable plant. The power meter shall be moved to the far end of the cable plant and attached to the cable plant with test jumper 2.

3. Readings must not be higher than the "Optimal Attenuation Loss." The OAL will be calculated using the manufacturer's factory certified test results, (db/km) converted to the actual installed lengths plus the manufacturer's best published attenuation losses for the connector and/or splice installed on this project. (0.30+/-0.30 for Connectors and 0.10 for splices). The construction manager shall use the OAL for comparison with the end to end power loss test results prior to acceptance.
4. Test Results: Must be completed and turned over to the General Contractor prior to active equipment installation. Specific due dates for optical fiber will be established at pre-install meeting.

3.6 CLEANUP

A. The communications Contractor shall clean up all debris related to D27 work on a regular basis leaving the job site in a clean, safe condition. Protect all equipment from damage during construction. Equipment not protected shall be replaced at the Contractor's expense.

END OF SECTION